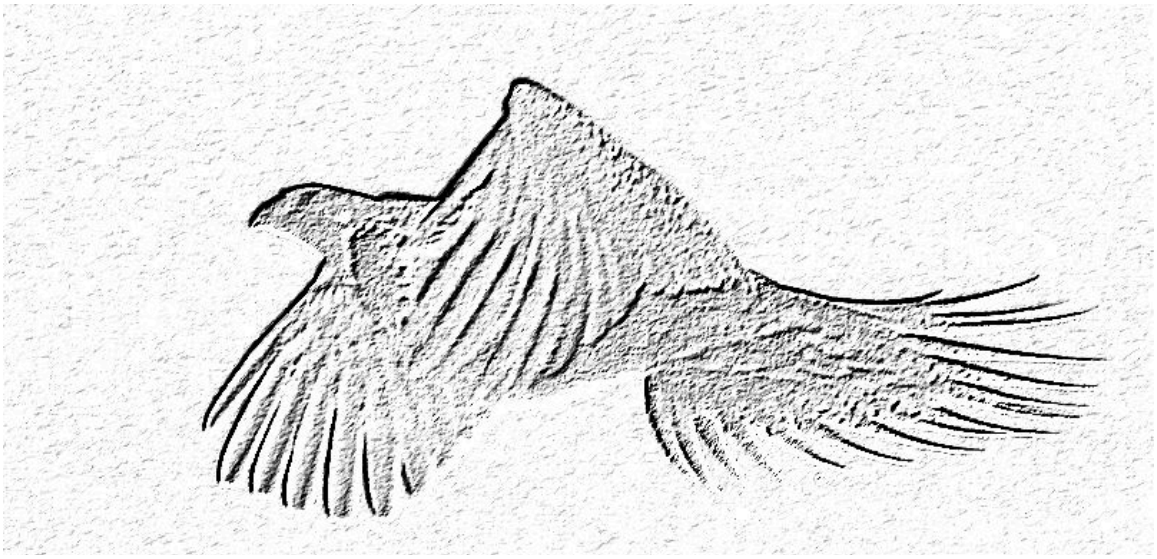
2012
GREATER SAGE-GROUSE
JOB COMPLETION REPORT



June 1, 2012 – May 31, 2013

Wyoming Game and Fish Department
Cheyenne, WY

Table of Contents

Page

Statewide
Sage-Grouse
Job Completion Report
2012

June 2012-May 2013

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Wyoming Sage-Grouse Job Completion Report

Conservation Plan Area: **Statewide Summary**
Period Covered: **6/1/2012– 5/31/2013**
Prepared by: **Tom Christiansen – Sage-grouse Program Coordinator**

INTRODUCTION

Sage-grouse data collection and research efforts across Wyoming began to increase in the early 1990s due to the increasing concerns for sage-grouse populations and their habitats (Heath et al. 1996, 1997). Monitoring results suggest sage-grouse populations in the Wyoming were at their lowest levels ever recorded in the mid-1990s. From 1996-2006 however, the average size of leks increased to levels not seen since the 1970s. Since 2006, average lek size has declined though not to levels recorded in the mid-1990s.

In March 2010 the U.S. Fish and Wildlife Service (Service) issued a decision of "warranted but precluded" for listing Greater Sage-grouse as threatened or endangered under the Endangered Species Act. This means the bird has become a "candidate" for listing but is precluded from immediate listing due to higher priorities. This status is reviewed annually by the Service.

Governor Matt Mead issued an Executive Order in 2011 which reiterated and clarified the intent of Wyoming's Core Area Strategy (CAS) originally developed under former Governor Freudenthal's administration with the assistance of the Governor's Sage-Grouse Implementation Team (SGIT) and the local sage-grouse working groups (LWGs). The CAS addresses the threats (habitat loss and fragmentation and insufficient regulatory mechanisms) specifically identified by the Service in their 2010 listing decision. The Core Areas are shown in Figure 1.

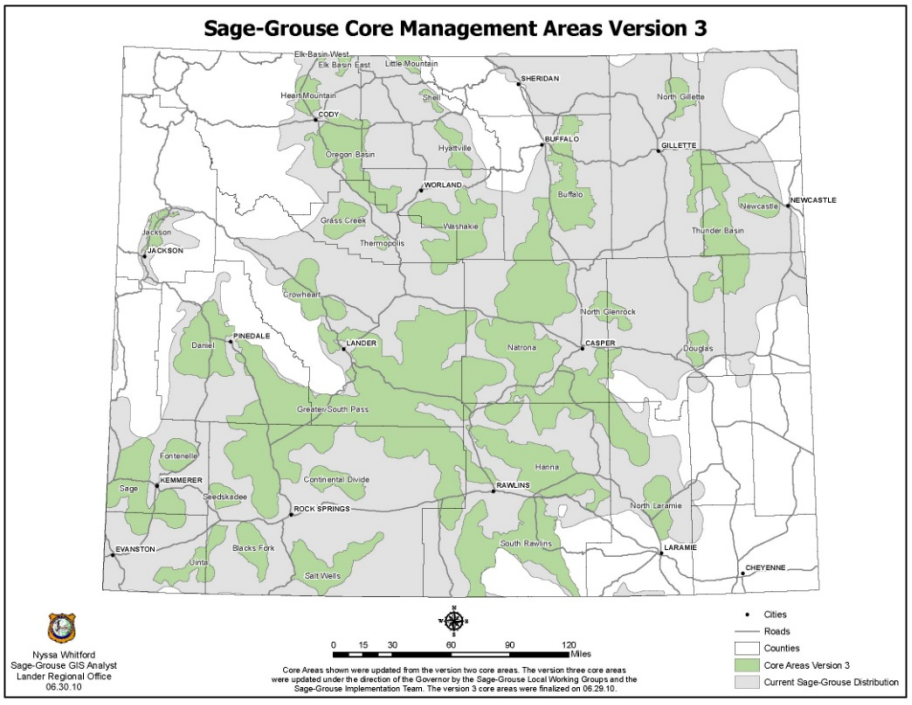


Figure 1. Wyoming Core Areas (version 3).

The 2012 Legislature approved the 2013-2014 biennium General Fund budget which again includes funding for the sage-grouse program. Allocation of over $1 million of these funds to local projects began in mid-2012 and will continue through mid-2014.

Prior to 2004, Job Completion Reports (JCRs) for greater sage-grouse in Wyoming were completed at the WGFD Regional or management area level. In 2003, the WGF Commission approved the Wyoming Greater Sage-Grouse Conservation Plan (State Plan) and a Sage-Grouse Program Coordinator position was created within the WGFD. The State Plan directed local conservation planning efforts to commence. In order to support the conservation planning efforts, JCRs across the State changed from reporting by Wyoming Game & Fish Dept. regional boundaries to those of the eight planning area boundaries (Figure 2). The 2004 JCR reviewed and summarized prior years' data in order to provide a historical perspective since that document was the first statewide JCR in memory. Additionally, Patterson (1952) provides an invaluable reference for sage-grouse, not only in Wyoming, but across the range of the species. Knick and Connelly (2011), provide state of the art information on the ecology and conservation of Greater Sage-grouse.

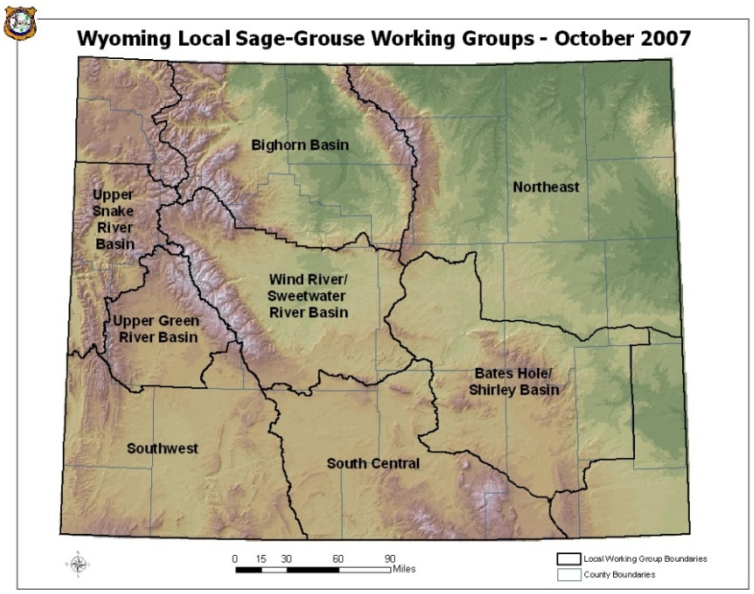


Figure 2. Wyoming Local sage-grouse working group boundaries.

BACKGROUND

The greater sage-grouse is the largest species of grouse in North America and is second in size only to the wild turkey among all North American game birds. It is appropriately named due to its year-round dependence on sagebrush for both food and cover. Insects and forbs also play an important role in the diet during spring and summer and are critical to the survival of chicks. In general, the sage-grouse is a mobile species, capable of movements greater than 50 km between seasonal ranges. Radio telemetry studies conducted in Wyoming have demonstrated that most sage-grouse populations in the state are migratory to varying extent. Despite this mobility, sage-grouse appear to display substantial amounts of fidelity to seasonal ranges. Sage-grouse populations are characterized by relatively low productivity and high survival. This strategy is contrary to other game birds such as pheasants that exhibit high productivity and low annual

survival. These differences in life history strategy have consequences for harvest and habitat management.

Greater sage-grouse once occupied parts of 12 states within the western United States and 3 Canadian provinces (Figure 3). Populations of greater sage-grouse have undergone long-term population declines. The sagebrush habitats on which sage-grouse depend have experienced extensive alteration and loss. Consequently, concerns rose for the conservation and management of greater sage-grouse and their habitats resulting in petitions to list greater sage-grouse under the Endangered Species Act (see following ESA Status section). Due to the significance of this species in Wyoming, meaningful data collection, analysis and management is necessary whether or not the species is a federally listed species.

Sage-grouse are relatively common throughout Wyoming, especially southwest and central Wyoming, because sage-grouse habitat remains relatively intact compared to other states (Figures 3 and 4). However, available data sets and anecdotal accounts indicate long-term declines in Wyoming sage-grouse populations over the last six decades.

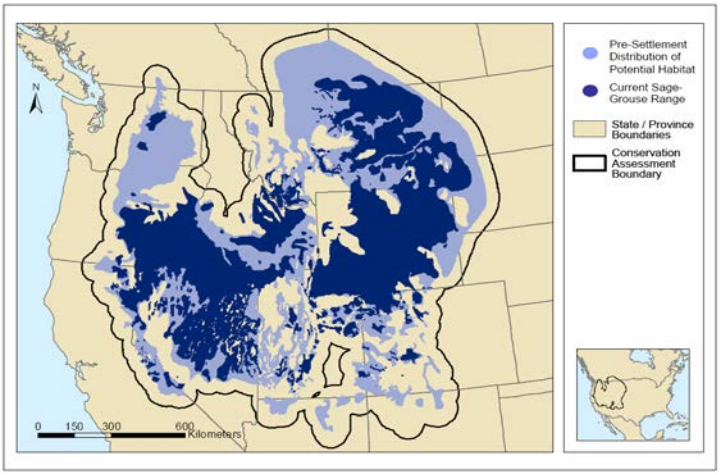


Figure 3. Current distribution of sage-grouse and pre-settlement distribution of potential habitat in North America (Schroeder 2004). For reference, Gunnison sage-grouse in SE Utah and SW Colorado are shown.

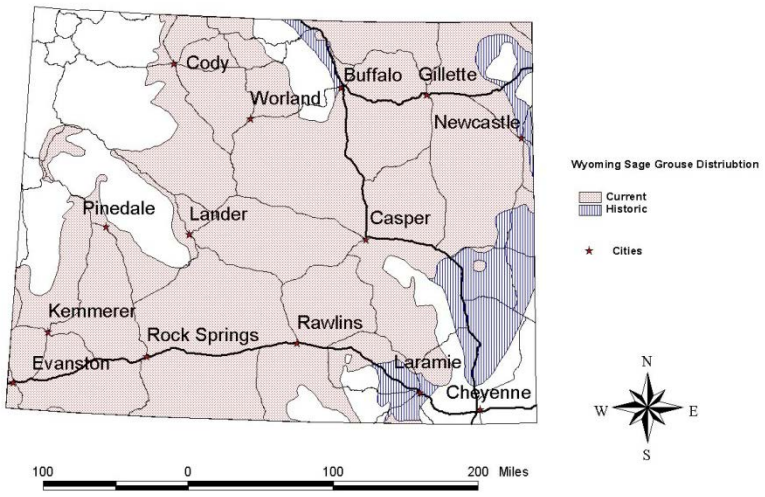


Figure 4. Sage-grouse distribution in Wyoming.

Past management of sage-grouse in Wyoming has included:

- Population monitoring via lek counts and surveys, harvest statistics, and data derived from wing collections from harvested birds. Lek counts and surveys have been conducted in Wyoming since 1949.

- The protection of lek sites and nesting habitat on BLM lands by restricting activities within ¼ mile of a sage-grouse lek and restricting the timing of activities within a 2-mile radius of leks. The Core Area Strategy (CAS – described below) has expanded and strengthened these protections in core areas.

- The authorization and enforcement of hunting regulations.

- Habitat manipulations, including water development.

- Conducting and/or permitting applied research.

Endangered Species Act Status

In March 2010 the U.S. Fish and Wildlife Service (Service) issued a decision of "warranted but precluded" for listing Greater Sage-grouse as threatened or endangered under the Endangered Species Act. This means the bird has become a "candidate" for listing but is precluded from immediate listing due to higher priorities. This status is reviewed annually by the Service. The Department's reply to the Service's annual data call to assist in their annual review is on file in the WGFD Habitat Protection Program's office in Cheyenne.

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

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

METHODS

Methods for collecting sage-grouse data are described in the sage-grouse chapter of the WGFD Handbook of Biological Techniques (Christiansen 2007), which is largely based on Connelly et al (2003). The sage-grouse chapter of the handbook was updated in 2012 and will be available for use in the next reporting period.

RESULTS

Lek monitoring

While lek counts and surveys have been conducted in Wyoming since 1948, the most consistent data were not collected until the mid-1990s. The number of leks checked in Wyoming has increased markedly since 1949. However, data from the 1950s through the 1970s is

unfortunately sparse and by most accounts this is the period when the most dramatic declines of grouse numbers occurred. Some lek survey/count data were collected during this period as the historical reports contain summary tables but the observation data for most individual leks are missing making comparisons to current information difficult. Concurrent with increased monitoring effort over time, the number of grouse (males) also increased (Figure 5). The increased number of grouse counted was not necessarily a reflection of a population increase; rather it was resultant of increased monitoring efforts.

The average number of males counted/lek decreased through the 1980s and early 90s to an all time low in 1995, but then recovered to a level similar to the late 1970s in 2006 (Figure 6). Again, fluctuations in the number of grouse observed on leks are largely due to survey effort not to changes in grouse numbers exclusively, but certainly the number of male grouse counted on leks exhibited recovery between 1995 and 2006 as the average size of leks increased and is generally interpreted to reflect an increasing population. The same cannot be said for the most recent three- to seven-year period (Figures 7 and 8) during which the average number of cocks observed on leks declined, though not to levels documented in the mid-1990s. Thus, there has been a long-term decline, a mid-term increase and short-term decline in the statewide sage-grouse population. The mid- and short-term trends in statewide populations are believed to be largely weather related. In the late 1990s, and again in 2004-05, timely precipitation resulted in improved habitat conditions allowing greater numbers of sage-grouse to hatch and survive. Drought conditions from 2000-2003 and again later in that decade are believed to have caused lower grouse survival leading to population declines. These trends are valid at the statewide scale. Trends are more varied at the local scale. Sub-populations more heavily influenced by anthropogenic impacts (sub-divisions, intensive energy development, large-scale conversion of habitat from sagebrush to grassland or agriculture, Interstate highways, etc.) have experienced declining populations or extirpation. Figures 9 and 10 illustrate sage-grouse density changes between 2005-07 and 2011-13 based on peak male lek counts and surveys.

Recent analyses suggest grouse populations are cyclic (Fedy and Doherty 2010, Fedy and Aldridge 2011). While weather and climate undoubtedly influence sage-grouse population cycles such influences have not been quantified and factors other than weather (predation, parasites) may also play a role. It is important to acknowledge and control for the cyclic nature of sage-grouse when conducting impact studies and monitoring grouse response to management.

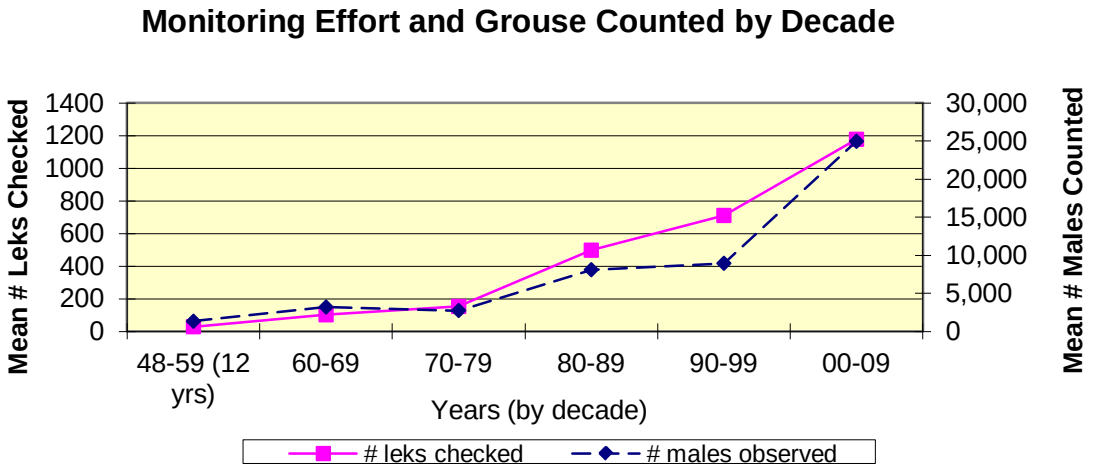


Figure 5. Mean annual numbers of leks checked (monitoring effort) and male grouse counted in Wyoming 1948-2009 by decade.

A new sage-grouse database was developed in 2012 in order to improve efficiency, reduce errors, and better facilitate data analysis. Changes were made to the manner in which lek data are calculated and reported in Table 1. The new version is based solely on "occupied" leks. The past version suggested that was the case in the title of Table 1, but when unoccupied leks were monitored those data were also included in the Table. The result of this change is that the number of "known occupied" leks is now more accurate, but reflects fewer leks than in the previous version. Similarly, the new version calculates average male lek attendance using only monitoring observations where one or more male grouse were observed strutting. The old version included a count of "0" males for leks where activity was confirmed by the presence of sign but no birds were observed. Together, these two changes result in somewhat higher, but more accurate, average male attendance for active leks than previously reported. The changes do not result in any change in population trend based on average male lek attendance. Interpreted population increases and decreases over time remain the same so no revisions to past reports are required.

Since only "occupied" leks are being reported on Table 1, it is important to consider trends in the numbers of active versus inactive leks in addition to the average size of active leks. During a period of population decline, the size of active leks typically declines and the number of inactive leks increases. The converse is typically true of an increasing population. Therefore the magnitude of both increases and decreases is usually greater than what is indicated by the average lek size alone.

Average female lek attendance is no longer being reported since our data collection techniques is not designed to accurately capture these data and is therefore not a useful figure in assessing population trend.

Lek monitoring data for the 2012 breeding season are summarized in Tables 1 a-b. Male attendance at all leks visited (counts and surveys) averaged 16.7 males per lek during spring 2013, a 16% decrease below the 19.9 males/lek observed in 2012 and a more meaningful 60% decline from the 44.7 males/lek observed in 2006. For the 10-year period (2004-2013), average male lek attendance ranged from 16.7 males/lek in 2013, the lowest average males per lek since 1997, to 44.7 males/lek in 2006, which was the highest average males per lek figure recorded since 1978. It is important to note that the number of leks sampled increased substantially over the 10-year period and the same leks were not checked from year to year. However leks that were checked consistently over the same period demonstrated the same trends except in some local areas as described in the local JCRs.

Small changes in the statistics reported between annual JCRs are due to revisions and/or the submission of data not previously available for entry into the database (late submission of data, discovery of historical data from outside sources, etc). These changes have not been significant on a statewide scale and interpretation of these data has not changed.

While a statistically valid method for estimating population size for sage-grouse does not yet exist, monitoring male attendance on leks provides a reasonable index of relative change in abundance in response to prevailing environmental conditions over time. However, lek data must be interpreted with caution for several reasons: 1) the survey effort and the number of leks surveyed/counted has varied over time, 2) not all leks have been located, 3) sage-grouse populations cycle, 4) the effects of unlocated or unmonitored leks that have become inactive cannot be quantified or qualified, and 5) lek locations may change over time. Both the number

of leks and the number of males attending these leks must be quantified in order to estimate population size.

Three independent analyses have assessed changes in long-term sage-grouse populations at rangewide, statewide, population and sub-population levels in recent years (Connelly et al. 2004, WAFWA 2008, Garton et al. 2011). The trends reflected by these analyses are generally consistent with each other and with that shown in Figure 6. These or similar methods of analysis should be incorporated into Wyoming's JCRs as they mitigate some of the limitations of using only average males/lek to determine population trend.

Table 1. Lek Attendance Summary

a. Leks Checked

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek (2)
2004	1391	1139	82	20244	24.4
2005	1478	1250	85	35493	35.5
2006	1550	1352	87	44657	41.7
2007	1616	1434	89	43571	39.1
2008	1675	1402	84	35601	32.8
2009	1704	1452	85	30617	28.4
2010	1737	1482	85	25759	23.5
2011	1773	1495	84	21448	20.5
2012	1811	1558	86	21333	19.9
2013	1816	1575	87	17953	16.7

b. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2004	837	179	375	1016	82.4	17.6
2005	1004	127	347	1131	88.8	11.2
2006	1085	159	306	1244	87.2	12.8
2007	1136	190	290	1326	85.7	14.3
2008	1103	220	352	1323	83.4	16.6
2009	1099	256	349	1355	81.1	18.9
2010	1118	274	345	1392	80.3	19.7
2011	1087	304	382	1391	78.1	21.9
2012	1131	320	360	1451	77.9	22.1
2013	1105	445	266	1550	71.3	28.7

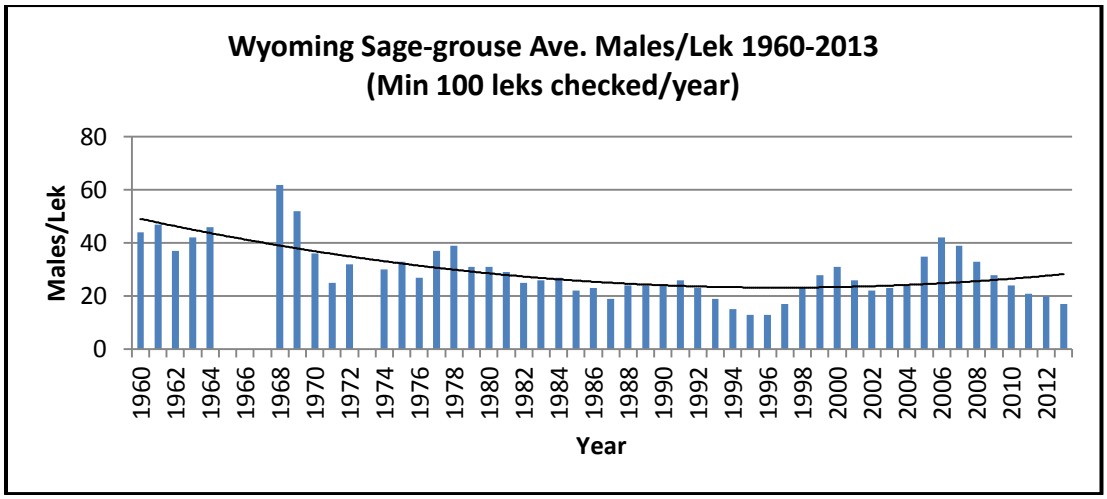


Figure 6. Average number of males per lek counted in Wyoming from 1960-2013 with a minimum of 100 leks checked each year.

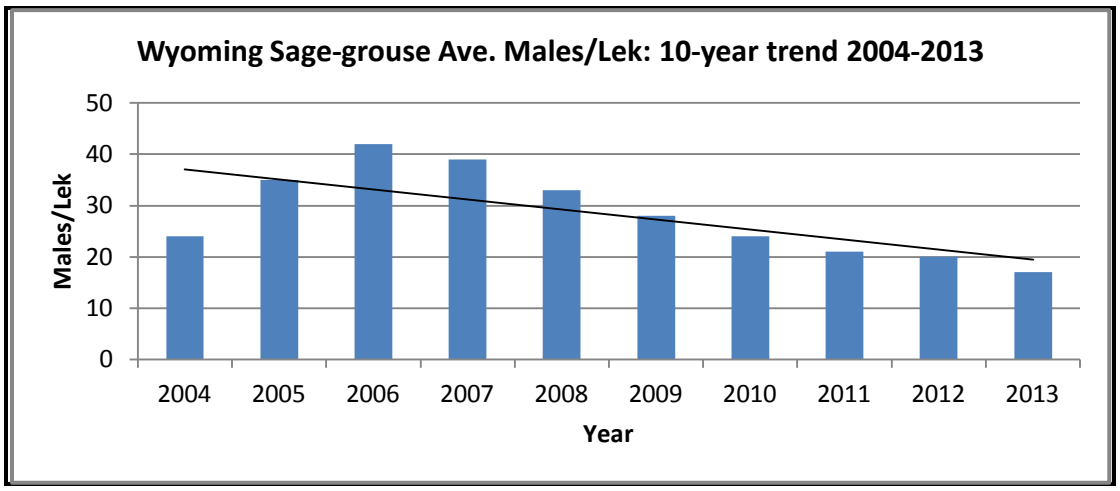


Figure 7. Average number of males per lek observed on leks in Wyoming from 2004-2013 with trend line.

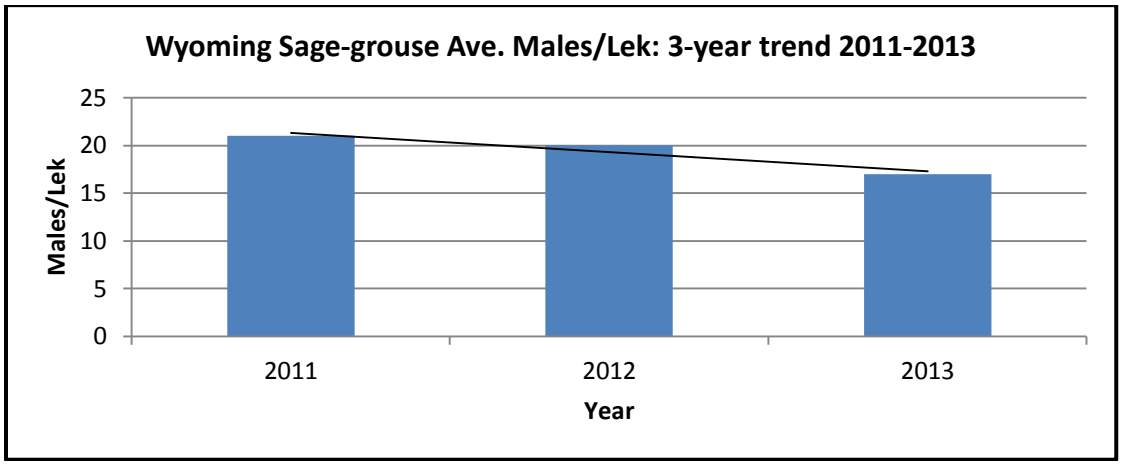
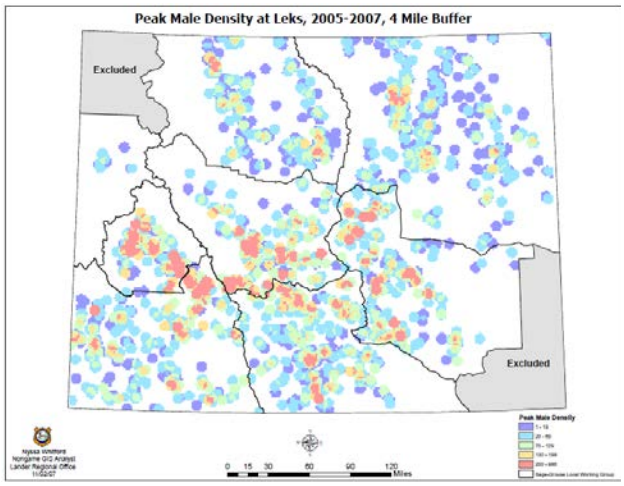
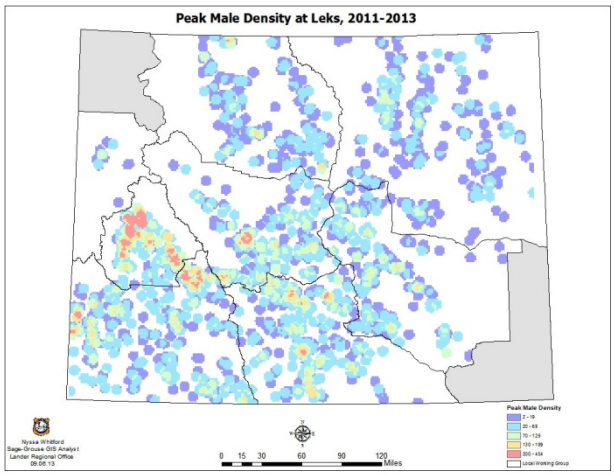


Figure 8. Average number of males per lek observed on leks in Wyoming from 2011-2013 with trend line.



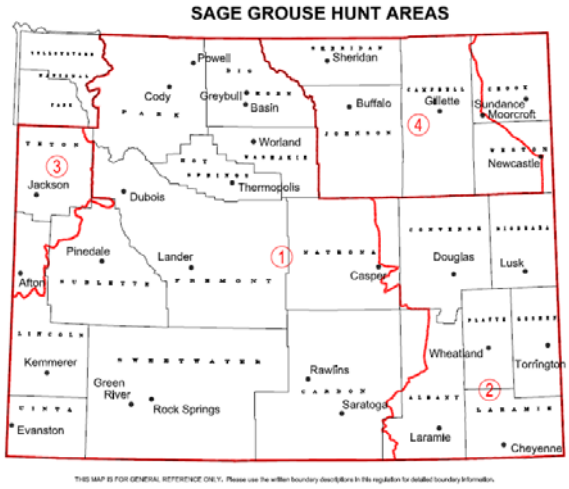


Figures 9 and 10. Relative sage-grouse density comparing 2005-2007 and 2011-2013 based on peak male lek counts and surveys.

Hunting season and harvest

As a result of concerns about the issue of hunting and its impact to sage-grouse a white paper was prepared in 2008 then revised in 2010 (Christiansen 2010), presented to the WGF Commission and distributed through the WGF web page. The science and public policy basis for managing sage-grouse harvest in Wyoming are covered in detail within that document. Similarly, the Western Association of Fish and Wildlife Agency directors adopted a policy statement on the topic in the summer of 2010 (Attachment D in Christiansen 2010).

No major changes were made to the 2012 hunting season (Figure 11, Table 2) compared to 2011.



Area	Season Dates	Daily/Poss. Limits	Falconry
1	Sept. 15-Sept. 30	2/4	Sept. 1-Mar. 1
2, 3	Closed	Closed	Closed
4	Sept. 15-Sept. 17	2/4	Sept. 1-Mar. 1

Figure 11 and Table 2. 2012 sage-grouse hunting season map and regulations.

Hunting seasons in Wyoming are shown in Table 3a. Due to concerns over low populations the statewide hunting season was shortened to nine days and the daily bag limit decreased to two sage-grouse in 2002 and has remained very conservative since that time. Two areas, eastern Wyoming and the Snake River Drainage in northwest Wyoming are closed to sage-grouse hunting (Figure 11).

Delaying and shortening the season and decreasing the bag limit dramatically decreased the numbers of sage-grouse hunters and their harvest in 2002 and 2003. Hunters were also sensitive to the plight of grouse populations and did not take the opportunity to hunt sage-grouse as much as they had in the past. But since 2004, hunter numbers and harvest have rebounded as a result of generally increased sage-grouse numbers. Hunter numbers increased and harvest declined modestly between 2011 (4,568 hunters/10,290 birds) and 2012 (4,700 hunters/9,869 birds). The 2012 harvest data were near the 10-year averages. The steady decline in the number of birds harvested since 2006 is correlated with the declining population indicated by lek attendance trends, although not to the same magnitude.

Table 3. Sage Grouse Hunting Seasons and Harvest Data

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	4835	2355	5705	0.8	2.1	2.4
2004	11783	5436	13229	0.9	2.2	2.4
2005	13178	5230	12175	1.1	2.5	2.3
2006	12920	5412	11981	1.1	2.4	2.2
2007	10378	5180	10699	1.0	2.0	2.1
2008	10302	4745	10065	1.0	2.2	2.1
2009	11162	4732	10812	1.0	2.4	2.3
2010	11057	4732	11434	1.0	2.3	2.4
2011	10290	4568	11186	0.9	2.3	2.4
2012	9869	4700	11342	0.9	2.1	2.4
Avg	10,577	4,709	10,863	1.0	2.2	2.3

The number of sage-grouse wings collected from hunters decreased by 19% in 2012, which is a greater proportional decline than the 4% decrease in estimated harvest between 2011 and 2012. In 2012, 1,964 wings were recorded (Table 4), which is about 20% of the estimated harvest. This is equal to the 10-year average of 20% and the changes between years are minor.

The 2012 chick:hen ratio (based on harvested wing analysis) was 0.8 chicks per hen (Table 4 and Figure 12). This level of productivity is typically associated with a declining population. This is consistent with the 2013 lek data (all lek checks), which indicated a 16% decrease in the average numbers of males on leks (Table 5). When average males per lek were increasing from 1997-2000 and 2005-2006, the proceeding years' chick:hen ratio averaged 2.1. Conversely, when the chick:hen ratio dropped to 1.1:1 in 2000, .8:1 in 2007, 1.1:1 in 2009 and .9:1 in 2010 the average males:lek decreased 20%,16%, 21% and 13% respectively. Relatively small changes in average males/lek observed in 2002 (+3%) and 2003 (+4%) were proceeded by chick:hen ratios of 1.6:1and 1.5:1 respectively, although similar chick:hen ratios resulted in declines of about 15% in both 2002 and 2008. The 57% increase in average males/lek observed in 2005 was preceded by a statewide chick:hen ratio of 2.4:1 in 2004. In general it appears that chick:hen ratios of about 1.5:1 result in relatively stable lek counts the following spring, while chick:hen ratios of 1.8:1 or greater result in increased lek counts and ratios below 1.2:1 result in declines. Additional data are required to strengthen the statistical strength of these analyses.

Prior to 1997, wing analysis results may be questioned in some parts of the state since most personnel were not well trained in techniques.

Table 4. Composition of Harvest by Wing Analysis

Year	Sample Size	Percent Adult		Percent Yearling		Percent Young		Chicks/ Hens
		Male	Female	Male	Female	Male	Female	
2003	1606	13.0	27.6	1.7	6.5	21.9	29.2	1.5
2004	2268	9.6	22.0	1.3	4.0	30.6	32.5	2.4
2005	2841	13.0	21.8	3.4	6.4	24.3	31.1	2.0
2006	2101	19.5	27.9	4.0	6.7	17.7	24.2	1.2
2007	2232	19.8	37.1	3.4	5.3	15.6	18.8	0.8
2008	2154	14.4	25.8	4.6	6.7	20.3	28.0	1.5
2009	2550	14.1	29.1	5.9	8.3	17.1	25.6	1.1
2010	2169	10.1	39.8	2.6	5.9	11.2	16.6	0.9
2011	2425	8.9	31.2	4.0	5.6	21.3	29.0	1.4
2012	1964	13.2	36.6	4.5	9.1	15.5	21.1	0.8

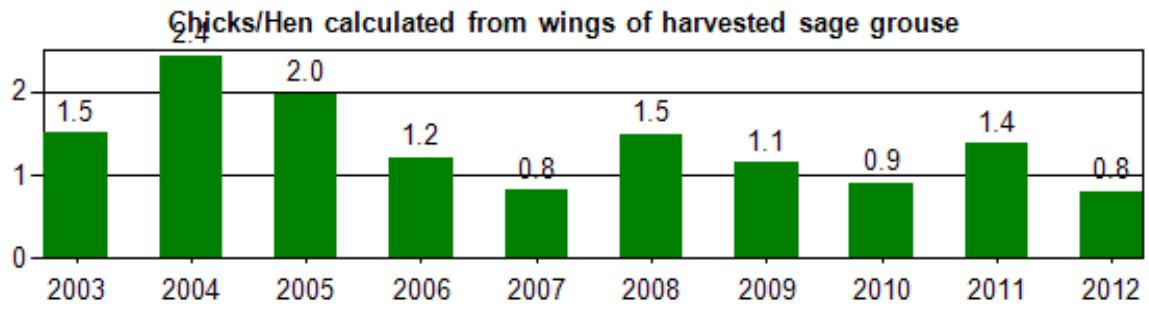


Figure 12. Chicks/Hen 2002-2011 based on wings from harvested grouse.

Year	Chicks:Hen (based on wings from harvested birds)	Change in male lek attendance the following spring
1997	1.9	+36%
1998	2.4	+21%
1999	1.8	+13%
2000	1.1	-20%
2001	1.6	-15%
2002	1.6	+3%
2003	1.5	+4%
2004	2.4	+57%
2005	2.0	+17%
2006	1.2	-5%
2007	0.8	-16%
2008	1.5	-16%
2009	1.1	-21%
2010	0.9	-13%
2011	1.4	-7%
2012	0.8	-16%

Table 5. Potential influence of chick production, based on wings from harvested birds, on population trend as measured by male lek attendance.

As a result of continued bio-political concerns for sage-grouse population declines in northeast Wyoming, the Department proposed closing the hunting season in Area 4 in 2012. However, the proposal was met with valid opposition from various conservation and hunting groups and individuals from both within and outside the state, and the proposal was not implemented by the WGF Commission. This exercise should be used to inform future management when calls to close hunting seasons are put forth.

Weather and Habitat

Sage-grouse nest success and chick survival have been linked to habitat condition, specifically shrub height and cover, live and residual (remaining from the previous year) grass height and cover, and forb cover. The shrubs (primarily sagebrush) and grasses provide screening cover from predators and weather while the forbs provide food in the form of the plant material itself and in insects that use the forbs for habitat. Spring precipitation is an important determinant of the quantity and quality of these vegetation characteristics. Residual grass height and cover depends on the previous year's growing conditions and grazing pressure while live grass and forb cover are largely dependent on the current year's precipitation.

Weather and climate have been linked to sage-grouse population trends (Heath et al. 1997). Most of the Local Conservation Planning Area JCRs include sections on weather and sage-grouse relationships. In general spring precipitation is positively linked to chick:hen ratios, which are in turn, linked to the following year's lek counts of males. However, periods of prolonged cold, wet weather may have adverse effects on hatching success, plant and insect phenology and production and chick survival. Untimely late snow storms in May and early June of both 2009 and 2010 likely contributed to reduced nesting success and chick survival. Efforts to quantify/qualify these effects in a predicable fashion over meaningful scales have largely failed.

Calendar year 2012 was the hottest, driest year documented in Wyoming since record keeping began 118 years ago (NOAA 2012). The lack of spring moisture in 2012 meant little production of important food plants and insects, therefore lower chick survival and more birds than usual were likely forced to move to either higher elevation or irrigated meadows and steam courses..

Habitat and seasonal range mapping.

While we believe that most of the currently occupied leks in Wyoming have been documented, other seasonal habitats such as nesting/early brood-rearing and winter concentration areas have not been identified. Efforts to map seasonal ranges for sage-grouse will continue by utilizing winter observation flights and the on-going land cover mapping efforts of the USGS, BLM, WGF, the Wyoming Geographic Information Science Center (WYGISC) of the University of Wyoming and others.

CONSERVATION STRATEGIES

Governor's Core Area Strategy (CAS) and Executive Order

In an unprecedented move to coordinate sage grouse conservation efforts across the State of Wyoming, then Governor Dave Freudenthal utilized the recommendations from his Sage-Grouse Implementation Team (SGIT) and released an Executive Order in August 2008 that directed state agencies to work to maintain and enhance greater sage grouse habitat in Wyoming. These actions constituted Wyoming's Core Area Strategy (CAS). Following the release of the new "warranted but precluded" listing decision by the Service in 2010, the Governor reconvened the SGIT to revise and update the CAS. Following the updates prepared during the spring and summer of 2010 by the Implementation Team, with the assistance of the local sage-grouse working groups, Governor Freudenthal issued a new Executive Order August 2010 to replace that from 2008. Then, newly elected Governor Matt Mead issued an Executive Order on June 2, 2011 which reiterated and further clarified the intent of the CAS (which was attached to the 2011-12 statewide JCR and also available at http://wgfd.wyo.gov/web2011/wildlife-1000817.aspx) . A list of the projects reviewed for consistency with the CAS is maintained by the WGFD Habitat Protection Program in Cheyenne.

The Core Area Strategy addresses the threats (habitat loss and fragmentation and insufficient regulatory mechanisms) specifically identified by the Service in their 2010 listing decision. In a June 2011 letter to Governor Mead, the Service said, "In summary, the Service believes the Greater Sage-grouse Core Area Protection provides an excellent model for meaningful conservation of sage-grouse if fully supported and implemented. We believe that when fully realized, this effort could ameliorate many threats to the Greater sage-grouse in Wyoming."

The Core Area Strategy is being implemented across the state under the guidance of a state/federal interagency team of specialists which meets on a regular basis to discuss issues related to implementation of the strategy. A key component of the strategy's implementation is the Density and Disturbance Calculation Tool (DDCT). This tool was developed by agency GIS specialists as an interactive, on-line application through the University of Wyoming's Geographic Information and Science Center. Training sessions are provided to industry and agency staff required to use the DDCT.

The Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) are working to adopt Wyoming's Core Area Strategy into their land management decision processes in Wyoming. A new WY-BLM sage-grouse instruction memorandum was issued in early 2012 (WY-BLM IM 2012-19). BLM Resource Management Plans (RMPs) and USFS Forest Plans across the state are being amended to incorporate Wyoming's Core Area Strategy and new BLM national sage-grouse policy (BLM-IM-2012-043 and 044).

Conservation Planning

In 2000, the WGFD formed a citizen/agency working group for the purpose of developing a statewide strategy for conservation of sage-grouse in Wyoming. The working group completed its task and in 2003 The Wyoming Greater Sage-Grouse Conservation Plan (WGFD 2003) was approved by the Wyoming Game and Fish Commission. The State Plan was largely reliant on implementation by local working groups. The state's eight LWGs all submitted final conservation plans between 2006 and 2008. In 2012, the local working groups began the process of updating their plans with current information to make them consistent with the Wyoming Core Area Strategy, address the Service's 2010 listing decision and incorporate new science. This effort should be complete by the end of 2013.

From 2005-2011, Local Working Groups were allocated approximately $3.7 million to support implementation of local sage-grouse conservation projects. The source of this funding was the State of Wyoming General Fund as requested by Governor Freudenthal and approved by the legislature. One hundred thirty-three (133) projects were implemented (Attachment A), most of which included multiple cost-sharing partners. Projects include habitat treatments/restoration, improved range management infrastructure and grazing management plans, applied research, inventories, monitoring and public outreach.

The 2012 Legislature approved the 2013-2014 biennium General Fund budget which included another $1.2 million for local projects. Allocation of these funds began in mid-2012 and the 24 individual projects approved during the reporting period are also listed in Attachment A.

Natural Resources Conservation Service (NRCS) Sage-Grouse Initiative (SGI)

The NRCS has implemented its Sage-Grouse Initiative (SGI) across Wyoming and 10 other sage-grouse states. Details of this initiative can be obtained from the NRCS Wyoming State Office or from the Sage-Grouse Initiative website http://www.sagegrouseinitiative.com .

Statewide USFWS Candidate Conservation Agreement with Assurances (CCAA)

A mechanism to achieve the goals of the statewide sage-grouse conservation effort is development of statewide agreements (Candidate Conservation Agreements with Assurances (CCAA), Candidate Conservation Agreements (CCA), Memoranda of Agreement (MOA) and incentives to insure management actions on private and public lands will continue in a manner that is ecologically, economically, and culturally sustainable. These agreements provide a means for conserving species through proactive conservation measures that reduce the potential for additional regulatory requirements that result when species become listed as threatened or endangered. Currently, a CCAA and a CCA are being developed cooperatively by local, state, and federal resource agencies that will provide assurances or reduce the potential for additional regulatory requirements for Wyoming ranch operations in the event that the sage grouse is listed

under ESA. Individual ranches will be able to participate in conservation practices appropriate to their ranch. The Service released the draft CCAA for public comment in early 2013.

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 (FS), the Natural Resources Conservation Service (NRCS), BLM and USFWS. The primary outcome of the meeting was the creation of a Sage-Grouse Task Force (Task Force) chaired by Governors Mead (WY) and Hickenlooper (CO) and the Director of the BLM. The Task Force was directed to develop recommendations on how to best move forward with a coordinated, multi-state, range-wide effort to conserve the sage-grouse, including the identification of conservation objectives to ensure the long-term viability of the species.

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

In summary, the report prepared by the COT (U.S. Fish and Wildlife Service 2013) listed energy development, infrastructure, improper livestock and/or wildlife grazing practices and recreation as broadscale 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.

In the Powder River Basin (NE LWG area plus a small section of Montana), the report listed energy development, infrastructure, improper livestock and/or wildlife grazing practices, weeds and annual grasses, mining and recreation as broadscale threats to sage-grouse with localized threats being sagebrush elimination, fire, conifer encroachment, and urbanization. The report estimated a 16.5% probability of the subpopulation of breeding birds being below 500 by 2037 and an 86.2% probability of the subpopulation of breeding birds declining below 500 by 2107. This relatively high probability of continued population declines is a major management concern, though not a new one.

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. These objectives and measures are largely consistent with the Wyoming CAS (described above).

OTHER ISSUES

West Nile Virus

West Nile virus (WNv) was first confirmed in sage-grouse in 2003 in the northern Powder River Basin and is now considered a potential threat to sage-grouse populations. Research efforts have resulted in several published papers and theses that describe the disease and its potential impact to sage-grouse populations (Walker and Naugle 2011 and references therein).

Monitoring efforts in 2012 again included: 1) intensive monitoring of radio-collared sage-grouse during the late summer on study sites across Wyoming, 2) WGF field personnel were directed to collect late summer sage-grouse mortalities and submit them for testing, and 3) press releases were distributed requesting the general public, especially landowners, to report late summer sage-grouse mortalities.

Results of the monitoring efforts in 2012 suggest WNv activity and mortality was minor in Wyoming as only two WNv sage-grouse mortalities were documented. However, both birds were radio telemetered. Had these birds not been telemetered, they would not likely have been found. One case came from Carbon County, the other from Big Horn County. The Wyoming Department of Health received few reports of human West Nile virus infection. While the summer of 2012 was the warmest on record in Wyoming (NOAA 2012), which was favorable for mosquitoes and WNv, it was also the driest (NOAA 2012), which was unfavorable for mosquitoes and WNv.

Energy Development

The issue of energy development and its effects to sage-grouse and sagebrush habitats continues to be a major one in many portions of the state. The topic is of major interest in Local Working Group efforts and the JCRs for the local conservation areas contain additional detail on the issue. Research efforts continue to focus on this issue and during this reporting period five peer-reviewed manuscripts based on Wyoming research were released (Blickley et al. 2012, Dzialak et al. 2013, Fedy et al. 2012, Hess and Beck 2012 and Taylor et al. 2012). A related paper on mitigation (Northrup and Wittemyer 2013) was also published.

On-going research examining energy development impacts to sage-grouse and sage-grouse habitat includes research on the effects of wind energy development in eastern Carbon County. A master's thesis (LeBeau 2012) resulted from this research and peer-reviewed publications based on this thesis are pending.

The results of these research efforts inform and guide management actions where energy development occurs in sage-grouse habitat (Wyoming Game and Fish Department 2010 and

Bureau of Land Management 2012). The Wyoming Core Area Strategy is reliant on research efforts.

RESEARCH AND PUBLICATIONS

See Attachment B for a compilation of current sage-grouse research being conducted in Wyoming. This information was compiled by Dr. Jeff Beck at the University of Wyoming. Attachment C is a listing of Wyoming-based research reports and peer-reviewed publications to date.

MANAGEMENT RECOMMENDATIONS

1) Implement Governor Mead's Sage-Grouse Executive Order and Core Area Strategy.

2) Continue to update and implement local conservation plans in all 8 planning areas.

3) Continue to refine and de-bug the new sage-grouse database and Job Completion Report software to an intranet application.

4) Continue to map lek perimeters and integrate these data into the WGF lek database. Priority for this effort should be based on the lek size of lek and impending development actions that may impact leks.

5) Personnel monitoring leks should review and consistently follow established lek monitoring protocol each year.

6) Map seasonal habitats (nesting/early brood rearing, winter concentration areas) for sage-grouse using data from the on-going land cover mapping project and sage-grouse observations.

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Attachment A: Wyoming Sage-Grouse Projects Supported with 2005-2014 General Fund Budgets							
Project Name	**Budget Biennium**	**Local Working Group**	**Total Cost**	**SG $**	**Project Description**	**Partners**	**Status**
1 - Martin Ranch Range Improvement - phase I (see also # 21)	2005-06	Bates Hole/ Shirley Basin	$43,290 (multiyear)	$19,501 requested/approved, $19,633.44 spent	Fence construction to implement 3 pasture rotation grazing system and mosaic prescribed fire in Mountain Big Sagebrush to improve forage including forbs and insects.	Martin Ranch, NRCS	Complete
2 - 7E Ranch Grazing Mgt	2005-06	Bates Hole/ Shirley Basin	$94,590 (multiyear)	$44,990 requested/approved, $44,990 spent	Fence construction and water development to implement a 4-pasture rest-rotation grazing system.	NRCS, 7E Ranch, BLM	Complete
3 - PW Spring Restoration	2005-06	Big Horn Basin	$20,000	$10,000 requested/approved, $8,150 spent	Spring development and protection.	BLM, Spring Gulch Cattle Co.	Complete
4 - Heart Mtn SG Habitat Enhancements	2005-06	Big Horn Basin	$105,000	$38,000 requested/approved, $32,226.15 spent	Spring protection and small mosaic sagebrush treatments with mowing and prescribed fire.	NRCS, TNC, WGFD, Russell Boardman, NW Community College, Park Co. Weed/Pest, Meadowlark Audubon, Buffalo Bill Historical Center.	Complete
5 - YU Bench SG Habitat Enhancements	2005-06	Big Horn Basin	$26,000	$15,000 requested/approved; $14,493 spent	Mosaic sagebrush mowing and fenced forb seedings.	BLM, Sportsmen for Fish & Wildlife.	Complete
6 - Jackson Hole Plant Species Composition & Structure	2005-06	Upper Snake River Basin	$65,450	$26,250 requested/approved/spent	GIS sage-grouse winter habitat inventory and monitoring.	USGS, USFWS, WGFD	Complete
7 - DeSmet Conservation District Community-Based Approach to Restore Sagebrush (also see #31 & 72)	2005-06	Northeast	$1,097,054 (multiyear)	$90,000 requested/approved/spent	Habitat restoration, development/implementation of grazing and CBM BMPs, habitat mapping, landowner outreach.	NRCS, WGFD, Eyas Foundation, Anadarko Petroleum, Lance Oil & Gas, DeSmet Cons. District, BLM, USFWS, numerous private landowners.	Complete

8 - University of MT SG and Energy Development: Planning Tools	2005-06	Northeast	$860,000 (multiyear)	$35,000 requested/approved; $34,993.40 spent	Research to develop conservation planning tools (i.e. maps), determine energy development impacts, and determine West Nile virus impacts to sage grouse.	BLM, DOE, WGFD, National F & W Foundation, PAW, Univ of MT, Wolf Creek Charitable Foundation, Western Gas Resources, Budweiser Foundation.	Complete
9 - Sixteen Mile-Atlantic Rim Water Developments	2005-06	South-Central	$40,000	$20,000 requested/approved; $19,996.85 spent	Spring development and protection.	Blake Sheep Co., Espy Livestock Co., RMEF, Bow Hunters of WY, BLM, Saratoga, Encampment, Rawlins Conservation Dist., Cowboy 3-Shot SG Foundation, Anadarko Petroleum, Carbon Co. Road & Bridge.	Complete
10 - Seminoe Allotment Water Developments	2005-06	South-Central	$13,000	$6,500 requested/approved/spent	Spring development and protection.	Miller Est. Cattle Co., BLM	Complete
11 - Carbon County Seeding	2005-06	South-Central	$4,000	$2,000 requested/approved; $1,982.31 spent	Forb seedings in wet areas along low volume county roads.	Carbon Co. Road & Bridge	Complete
12 - SG & Sagebrush Conservation I&E	2005-06	Southwest	$2,600	$2,600 requested/approved; $2,597.00 spent	Educational displays including taxidermy mounts and restaurant activity placemats for youth.	WGFD	Complete
13 - South LaBarge Weed Control	2005-06	Southwest	$15,000	$5,000 requested/approved/spent	Invasive/noxious weed control.	BLM, USFS, GR Basin Cooperative Weed Mgt Area.	Complete
14 - Rock Creek Prescribed Burn	2005-06	Southwest	$150,000	$20,000 requested; $6,200 approved/spent	Prescribed burning of aspen, mountain shrub and mountain big sagebrush to improve habitat conditions for all wildlife including sg.	BLM, RMEF, WGFD	Complete
15 - Winter Closure Signs (see also #63)	2005-06	Southwest	$4,000	$2,000 requested/approved; $1,674.75 spent	Improve effectiveness of existing public land big game and sage grouse winter range closures via new signing.	BLM, WGFD	Complete

16 - SG Seasonal Habitat and Demo Documentation	2005-06	Upper Green River Basin	$235,739	$49,739 requested/approved/spent	Research documenting pre-development/baseline seasonal distribution of sage grouse.	BLM, Shell/WY Community Foundation SG Fund, No. Am. Grouse Partnership.	Complete
17 - Examining Noise Effects from Energy Devel. (see also #46, 77 & 118)	2005-06	Upper Green & Wind River/ Sweetwater River	$149,320	$20,000 requested/approved/spent	Research examining the effects of noise resulting from energy exploration and development.	BLM, National F & W Foundation, Univ. Calif. Davis	Complete
18 - Enhanced GIS Data on Sagebrush Habitats	2005-06	Upper Green River Basin	$94,260	$10,000 requested/approved/spent	Collate and link all past and on-going research, mapping, and habitat treatments conducted in the Upper Green River Basin into a single, accessible GIS database.	Anonymous private donor, Tom Thorne SG Fund.	Complete
19 - Government Draw SG Habitat Improvement	2005-06	Wind River/ Sweetwater	$32,500	*0 * - With the purchase of the mower (below), WGF will conduct the mowing and therefore contracting will not be required.	Habitat treatments using mower and Lawson aerator. Proposal requested funding for contracting the equipment and labor.	BLM, Devon Energy Corp.	Complete
20 - John Deere CX20 Rotary Cutter	2005-06	Wind River/ Sweetwater	$22,149	$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
				~$425,000 approved			
21 - Martin Ranch Range Improvement phase II (continuation of project #1)	2007-08	Bates Hole/ Shirley Basin	$26,000	$14,000 requested/approved; $10,825.71 spent	Fence construction to implement 3 pasture rotation grazing system and mosaic prescribed fire .	Martin Ranch, NRCS	Complete
22 - 3-Man Ranch Upland Habitat Improvement	2007-08	Bates Hole/ Shirley Basin	$100,600	$13,944 requested/approved/spent	Water development and fencing to facilitate rest-rotation grazing system	3-Man Ranch, WGF LIP, WY Wildlife & Natural Resources Trust	Complete

23 - L3 Cattle Co. fence and spring development	2007-08	Bates Hole/ Shirley Basin	$21,190	$5,297.50 requested/approved; $5,193.88 spent	Water development and fencing to facilitate deferred-rotation grazing system	L3 Cattle Co, NRCS	Complete
24 - M&D Land Wildlife Inventory	2007-08	Bates Hole/ Shirley Basin	$54,172	$10,500 requested/approved; $10,302.54 spent	Wildlife surveys, range surveys & management consultation	NRCS	Complete
25 - Schnoor/Flat Top Big Sagebrush Restoration	2007-08	Bates Hole/ Shirley Basin	$161,550 (multiyear)	$18,305 requested/approved/spent	LWG $ to apply Plateau herbicide to cheatgrass infested areas. Other mechanical, chemical and RX fire to be used to restore big sage communities.	Mule Deer Foundation, Wy Gov's Big Game License Coalition, Wy Wildlife and Natural Resources Trust, WGFD, NRCS	Complete
26 - North Butte Guzzler	2007-08	Big Horn Basin	$140,000 (multiyear)	$12,000 requested/approved; $11,968.86 spent	One of 12 guzzlers to be installed over a period of 5 years	BLM, Water for Wildlife, Mule Deer Foundation, WGF	Complete
27 - Big Horn Basin Land Cover Mapping	2007-08	Big Horn Basin	$108,000	$30,000 requested/approved/spent	Refined land cover/habitat mapping based on Landsat images.	BLM, WGF, RMEF	Complete
28 - Bentonite Reclamation Trials	2007-08	Big Horn Basin	$35,000	$40,000 requested/approved; $39,986.60 spent	Experimentally establish portable irrigation systems to reclaim mined areas w/ sagebrush.	Wyo-Ben, M-I, Bentonite Performance Minerals, American Colloid, Black Hills Bentonite	Complete
29 - Emblem Bench/ Table Mtn Habitat Enhancement	2007-08	Big Horn Basin	$18,000	$2,500 requested/approved; $2,498.37 spent	Sagebrush mowing and grass/forb seeding.	BLM	Complete
30 - Jackson Hole Sage-Grouse Demographic Study (also see #75, 105 & 140)	2007-08	Upper Snake River Basin	$504,269 (multiyear)	$62,000 requested/approved/spent	Research to define population demographics and habitat use via VHF and GPS telemetry.	Beregia South, JH Conservation Alliance, Grand Teton NP	Complete
31 - Lake DeSmet CD Habitat Enhancement (also see #7 & 72)	2007-08	Northeast	$2.4 million (multiyear)	$85,000 requested; $27,400 approved/spent	Habitat restoration, development/implementation of grazing and CBM BMPs, habitat mapping, landowner outreach. Continuation of multi-year project.	Numerous federal agencies, oil & gas companies, private foundations, private businesses including landowners	Complete

32 - Thunder Basin Grassland land cover mapping	2007-08	Northeast	$250,000 (multiyear)	$45,000 requested/approved; $44,999.24 spent	Land cover/habitat mapping via analysis of remote sensing data.	USFS, BLM	Complete
33 - 4W Ranch habitat enhancement and monitoring	2007-08	Northeast	$32,400	$32,400 requested; $16,200 approved; $13,990 spent	Water development and ranch friendly sg monitoring system development.	4W Ranch	Complete
34 - Impacts of Energy Development on SG	2007-08	Northeast	$90,000	$30,000 requested/approved/spent	Research continuing to document impacts of CBNG development to sg.	BLM	Complete
35- Stratton research site - assessing grazing and prescribed fire effects (see also #68)	2007-08	South-Central	$116,000 (multiyear)	$72,000 requested; $57,000 approved/spent	Research to assess the effects of prescribed fire and grazing management to sg.	BLM, USGS, CSU	Complete
36- 16-Mile/Atlantic Rim water projects II (see also #9)	2007-08	South-Central	$30,000	$10,000 requested/approved; $7,310 spent	Continuation of project #9 above. Spring development and protection.	BLM, Blake Sheep Co./ Espy Livestock Co.	Complete
37 - Atlantic Rim SG study Phase 1	2007-08	South-Central	$90,000	$40,000 requested/approved; $36,895.70 spent	Define sg distribution to use as pre-treatment data within natural gas development area. See also #82 & 91.	BLM, Anadarko Petroleum, WGF	Complete
38 - Red Rim Water Development	2007-08	South-Central	$48,260	$10,000 requested/approved	Water development to facilitate use of the project area as a grassbank.	RMEF, WGF, Water for Wildlife	Complete
39 - Exclosure & Guzzler maintenance	2007-08	Southwest	$42,000	$20,000 requested/approved/spent	Monitoring and maintenance of 35 range exclosures and 11 guzzlers on BLM.	BLM	Complete
40 - Belle Butte Water Development	2007-08	Southwest	$132,000	$34,500 requested/approved/spent	Attach 7 wildlife guzzlers to new livestock watering pipeline.	BLM, numerous grazing permittees	Complete
41 - Hiawatha Aerial Surveys	2007-08	Southwest	$29,100	$10,000 requested/approved; $2,262 spent	Conduct aerial surveys to document grouse distribution esp. winter and leks.	BLM, Questar, WGF	Complete
42 - Red Canyon/ Elk Mtn Rx Burn	2007-08	Southwest	$300,000	$30,000 requested/approved/spent	Prescribed fire to improve upland plant communities.	BLM, RMEF, WGF	Complete

43 - Raven/SG study	2007-08	Upper Green River Basin	$336,250 (multiyear)	$55,000 requested/approved/spent	Raven ecology study to determine effects to sg.	Tom Thorne SG Fund, Animal Damage Mgt Board	Complete
44 - Lander Front Habitat Improvement	2007-08	Wind River/ Sweetwater River	$479,700 (multiyear)	$30,000 requested/approved/spent	Various habitat treatments over a large landscape. LWG $ to fund juniper removal.	RMEF, WGF, Mule Deer Foundation, private landowners	Complete
45 - RB Keith Ranch Wildlife Inventory (see also #97)	2007-08	Wind River/ Sweetwater River	$37,527	$11,500 requested; $6,250 approved/spent	Wildlife & range surveys to determine conservation needs.	NRCS, Keith Ranch	Complete
46 - Examining Noise Effects from Energy Devel. (see also #17, 77 & 118)	2007-08	Wind/ Sweetwater, Upper Green and Northeast	500,000+ (multiyear)	$78,028 requested; $71,615 approved/spent	Continuing research examining the effects of noise resulting from energy exploration and development	BLM, National F & W Foundation, Univ. Calif. Davis	Complete
47 - Water trough escape ramps, spring protection and fence markers (see also #99 and 128)	2007-08	Statewide	$192,000	$36,000 requested/approved/spent	Provide pre-fab wildlife escape ramps, fence collision deterents and spring protection fencing to private landowners throughout the state.	WY Natural Resources Trust, Landowners, WGF	Complete
48 - Twin Creek Monitoring Project	2007-08	Wind River/ Sweetwater River	$8,200	$6,400 requested/approved; $4,960 spent	Monitor vegetation response to grazing management incl. stocking rate, time/timing and longer recovery periods.	Twin Creek Ranch	Complete
49 - SG Seasonal Habitat and mitigation planning (continuation of project #16)	2007-08	Upper Green River Basin	$639,790	$25,311.50 requested/approved/spent	Research documenting pre-development/baseline seasonal distribution of sage grouse.	Tom Thorne SG Fund, BLM, North Am. Grouse Partnership	Complete
50 - Rawlins Winter Flights	2007-08	South-Central	$7,000	$7,000 requested/approved/spent	Document sg winter distribution during harsh winter	BLM, WGFD	Complete
51 - Hiawatha SG Habitat Mapping	2007-08	Southwest	$417,120 (multiyear)	$30,000 requested/approved, $29,634.35 spent	Develop high-resolution seasonal sg habitat maps to help determine energy development influence.	Questar, Colorado Division of Wildlife	Complete

52 - Peterson Spring Protection (see also #94)	2007-08	Southwest	$24,480	$17,280 requested, $8,500 approved, $8,194 spent	Develop and protect 3 springs to provide wildlife and livestock water but protect the source from livestock degradation	Owen Peterson	Complete
53 - SG Education and Community Outreach (see also #131)	2007-08	Bates Hole - Shirley Basin	$23,000	$13,000 requested/approved/spent	Develop and administer sage-grouse conservation educational programs in the Casper area.	Audubon Wyoming	Complete
54 - Western Natrona County Sage-Grouse Study	2007-08	Bates Hole - Shirley Basin	$133,822	$7,210 requested/approved/spent	Seasonal distribution and habitat use for land use planning along with parasite/disease assay	BLM, WGFD, University of Wyoming, Casper College	Complete
55 - M & D Land Company Water Development	2007-08	Bates Hole - Shirley Basin	$18,560	$7,425 requested/approved, $4,000 spent	Water development to facilitate grazing plan implementation (dry hole - unsuccessful)	M & D Land Co., NRCS	Complete
56 - Shook Ranch Range Improvement	2007-08	Bates Hole - Shirley Basin	$70,000	$10,000 requested/approved/spent	Prescribed fire in mountain big sage, developing and protecting water sources, installing a cross fence and implementing rotational grazing system	Shook Ranch, NRCS	Complete
57 - Hat-Six Ranch Riparian Buffer	2007-08	Bates Hole - Shirley Basin	$18,200	$11,600 requested/approved, $9,936.55 spent	Fencing riparian buffer to enhance riparian habitat, reduce erosion and improve brood-rearing use by sg.	Hat-Six Ranch, NRCS	Complete
58 - McCullough Peaks HMA Waters and Healthy Rangelands	2007-08	Big Horn Basin	$360,000 (multiyear)	$20,000 requested, $8,434 approved/spent	Develop rangeland water and fenced overflow green strips to improve grazing management and provide sg forage.	FOAL, BLM, Grazing permittee	Complete
59 - Big Horn Basin Habitat Treatment Research (also see #80)	2007-08	Big Horn Basin	$34,000	$34,000 requested/approved/spent	Research to quantify and qualify the effects of sagebrush treatments, especially mowing, to sage-grouse habitat	University of Wyoming	Complete

60 - Westslope Juniper Removal (See also #107, 134 and 135)	2007-08	Big Horn Basin	$27,000	$6,066 requested/approved/spent	Remove junipers encroaching on sagebrush habitat with chainsaws and/or Gyrotrac machines.	BLM	Complete
61 - Jonah Interagency Office Veg Baseline	2007-08	Upper Green River Basin	$400,000	$33,875 requested/approved/spent	Baseline inventory of vegetation within JIO focus areas to assist in natural gas development mitigation planning	JIO, Tom Thorne SG Fund, BLM/WLCI	Complete
62 - Raven Brochure	2007-08	Upper Green River Basin	$2,000	$2,000 requested/approved/spent	Postcard mailed to 5,000 Sublette Co. residents encouraging them to reduce sources of artificial food sources for ravens.	UGR LWG	Complete
63 - Winter Range Signs (see also #15)	2007-08	Upper Green River Basin & Southwest	$6,000	$3,000 requested/approved/spent	Improve effectiveness of existing public land big game and sage grouse winter range closures via new signing.	BLM, WGFD	Complete
64 - Lander SG Flights	2007-08	Wind River/ Sweetwater River	$6,000	$6,000 requested/approved, $3,795 spent	Flights to document sage-grouse winter distribution and lek locations	WGFD	Complete
65 - Mower Maintenance (see also #20)	2007-08	Wind River/ Sweetwater River	$2,750	$2,750 requested/approved, $2,729.39 spent	Maintain mower in order to conduct habitat projects, esp the Government Draw Project.	WGFD	Complete
66 - HWA Lysite Study	2007-08	Wind River/ Sweetwater River	$1,305,800	$30,000 requested, $24,900 approved/spent	Sage-grouse distribution and habitat use study to determine appropriate stipulations for natural gas development.	Hayden-Wing Assoc., Encana, ConocoPhillips, Noble, WRSR LWG, BLM	Complete
67 - NE Grazing Workshops (See also # 70 & 88.)	2007-08	Northeast	$7,000	$5,000 requested/approved, $4,975.42 spent	4 grazing/range mgt workshops to be held in Campbell, Crook and Weston Counties by Dr. Roy Roath.	WGFD, Campbell Co. Conservation District	Complete
			2007-2008 Total	**~1,000,000 approved**			

68 - Stratton Research site phase 2 (see also #35)	2009-10	South-Central	$83,300	$58,300 requested/approved/spent	Assess the effects of grazing timing within prescribed burns	USGS, BLM	Complete
69 - Horse Creek Weed Control	2009-10	Upper Green River Basin	$22,624	$10,264 requested; $5,000 approved	Chemical control of noxious weeds within a wildfire area	BLM, USFS, landowners	Complete
70 - Northeast Grazing Workshops 2 (see also # 67 & 88)	2009-10	Northeast	$7,000	$5,500 requested/approved/spent	3 grazing/range mgt workshops to be held in Johnson, Campbell and Weston Counties by Dr. Roy Roath	Campbell Co., Weston Co & Powder River Conservation Districts	Complete
71 - Determining characteristics of sage-grouse habitat relative to Ecological Site Descriptions	2009-10	Upper Green River Basin	$317,589	$99,822 requested/approved; $95,040 spent	Research project to determine characteristic of nesting and early brood-rearing habitat relative to NRCS Ecological Site Descriptions	Wyoming Wildlife Consultants LLC	On-going
72 - Lake DeSmet Project Phase III-IV (see #7 & 31)	2009-10	Northeast	$150,500	$47,300 requested/approved/spent	Habitat restoration, development/implementation of grazing and CBM BMPs, habitat mapping, landowner outreach. Continuation of multi-year project (#7 & 31).	Numerous federal agencies, oil & gas companies, private foundations, private businesses including landowners	Complete
73 - Cross Lazy 2 Conservation Easement	2009-10	Upper Green River Basin	$3,040,000	$100,000 requested/approved/spent	Conservation easement	Wyoming Wildlife and Natural Resources Trust, Doris Duke Charitable Trust, Tom Thorne Sage-Grouse Conservation Fund	Complete
74 - Weston-Niobrara Grouse Study	2009-10	Northeast	$150,000 (multiyear)	$60,000 requested/approved; $14,654 spent	Telemetry study to determine habitat use and movement on eastern fringe of sage-grouse range	Wyoming Game and Fish Dept., USFS, NRCS	Complete
75 - Jackson Hole Sage-Grouse Population Demographics (see #30, 105 & 140)	2009-10	Upper Snake River Basin	$461,731 (multiyear)	$100,000 requested/approved/spent	Telemetry study to determine habitat use, movement and population demographics in Jackson Hole	Jackson Hole Airport, Grand Teton National Park, Charles Engelhard Foundation	Complete

76 - Analyzing NRCS Ecological Site Description (ESD) as a tool for inventorying potential sg nesting habitat	2009-10	Northeast	$18,500	$14,000 requested/approved/spent	Research comparing known nesting sites to NRCS Ecological Site Descriptions.	Lake DeSmet Conservation District	Complete
77- Developing a program to predict noise energy development noise impacts to sage-grouse (see also #17, 46, 77 & 118)	2009-10	Wind River/ Sweetwater River; Northeast; Upper Green River Basin	$500,000+ (multiyear)	$51,205 requested/approved/spent	Utilize research results from projects #17 & 46 above to develop a computer program to predict energy development noise impacts to lekking sage-grouse	BLM, National Park Service, Tom Thorne Sage-Grouse Conservation Fund	Complete
78 - Field evaluation of larvivorous fish for mosquito management in the Powder River Basin	2009-10	Northeast	$31,730	$26,730 requested/approved/spent	Field test of Plains Killifish and/or Fathead Minnows to control West Nile virus vector mosquito larvae	Montana State University	Complete
79 - Big Horn Mountain Sage-Grouse Distribution Study	2009-10	Northeast	$36,000	$10,000 requested/approved; $2,600 spent	Telemetry study to determine potential linkage between populations on either side of the Big Horn Mountains	BLM	Complete
80 - Big Horn Basin Habitat Treatment research Phase II (see also # 59)	2009-10	Big Horn Basin	$134,959	$59,595 requested/approved/spent	Continuation of project #59	University of Wyoming	Complete
81 - Spellman Ranch Range Improvement	2009-10	Northeast	$48,350	$12,500 requested/approved/spent	Fencing, water development and consultation to improve range management	NRCS, WGFD, Spellman Ranch	Complete
82 - Identifying habitats for sage-grouse persistence within the Atlantic Rim coalbed	2009-10	South-Central	$448,090 (multiyear)	$56,590 requested/approved/spent	Telemetry study to determine habitat use in the context of energy development. Uses info from projects #37 & 91.	Anadarko Petroleum, BLM, University of Wyoming, WGFD	Complete

methane field							
83 - Shell Valley salt cedar & Russian olive control	2009-10	Big Horn Basin	$1,672,700 (multiyear)	$44,000 requested/approved; $41,000 spent	Mechanical and chemical treatment of salt cedar and Russian olive	South Big Horn Conservation Dist.,Big Horn County Weed & Pest, NRCS, WY Wildlife and Natural Resources Trust, BLM	Complete
84 - Simpson Ridge wind energy impacts study (see also #115)	2009-10	Bates Hole - Shirley Basin	$655,000	$22,750 requested/approved/spent	Research to determine impacts of wind energy development to sage-grouse	Horizon Wind Energy, Iberdrola Renewables, others pending	Complete
85 - Grazing Management Assistance	2009-10	Bates Hole - Shirley Basin	$5,000	$5,000 requested/approved; $4,600 spent	Small group or 1:1 grazing management assistance from Dr. Roy Roath to landowners	Natrona Conservation District, NRCS, WGFD	Complete
86 - Black Mountain Sagebrush Restoration (see also #106)	2009-10	Big Horn Basin	$107,000	$70,000 requested, $60,000 approved; need to confirm amount spent	Sagebrush transplants into wildfire area using technology developed by project #28. Also see project #105.	Wyoming Wildlife and Natural Resources Trust, WGFD, BLM	Complete
87 - South highway water project	2009-10	Big Horn Basin	$120,000	$24,000 requested, $20,000 approved/spent	Pipeline, storage and stock tanks to improve grazing management	Wyoming Wildlife and Natural Resources Trust, Washakie County Conservation District, Gooseberry Ranch, Mule Deer Foundation, Water for Wildlife	Complete
88 - Northeast Grazing Management Assistance (see also #67 and 70)	2009-10	Northeast	$25,600	$12,000 requested/approved/spent	Small group or 1:1 grazing management assistance from Dr. Roy Roath to landowners	Campbell Co. Cons. Dist., WGFD, NRCS	Complete

89 - Thunder Basin Grasslands core area habitat rehabilitation	2009-10	Northeast	$86,500	$25,400 requested, $17,500 approved/spent	Aerial application of Plateau herbicide to control cheatgrass and drilling of one water well	WGFD, Wyoming Water Development Commission, WY Wildlife and Natural Resources Trust, Powder River Coal/Rio Tinto America	Complete
90 - Multi-species habitat enhancement	2009-10	Northeast	$50,000	$10,000 requested/approved/spent	Improved riparian management via fence removal/replacement and upland water development	NRCS, HIP Investments Inc.	Complete
91 - Atlantic Rim Flights Phase II (see #37 and 82)	2009-10	South-Central	$484,022	$20,000 requested/approved/spent	Continuation of project #37; also in partnership with project #82	BLM, Anadarko Petroleum, Warren Resources, University of Wyoming	Complete
92 - Buck Draw Solar Well	2009-10	South-Central	$13,000	$6,500 requested, $3,000 approved, $2,880 spent	Convert existing generator powered well to solar power and replace tanks and pipelines	BLM, Bruce Thayer	Complete
93 - Red Mountain CRM seeding	2009-10	South-Central	$282,650 (multiyear)	$10,500 requested, $5,000 approved, 0 spent - project never materialized	Reseed sagebrush treatment areas with forb rich seed mix to improve diversity and sage-grouse habitat; remove encroaching conifers, wet meadow protection	BLM, WY Wildlife and Natural Resources Trust, USFWS Partners for Wildlife, WGFD, Laramie Rivers CD	Cancelled
94 - Petersen Ranch Project Phase II (see #52)	2009-10	Southwest	$19,500	$9,000 requested, $3,500 approved/spent	Spring protection and water development	Landowner	Complete
95 - Kelly Hayfields restoration (see also #114 and 141)	2009-10	Upper Snake River Basin	$120,945	$65,045 requested, $50,000 approved/spent	Restore native vegetation to abondoned smooth brome hayfields.	Grand Teton National Park	Complete
96 - Beaver Creek invasive vegetation control (another phase of #44)	2009-10	Wind River/ Sweetwater River	$290,388	$20,000 requested, $10,000 approved/spent	Mechanical and chemical treatment of juniper, salt cedar and Russian olive	Wyoming Wildlife and Natural Resources Trust, NRCS, WGFD, Mule Deer Foundation, BLM	Complete

97 - Keith Ranch Water Development and Grazing Mgt (see also #45)	2009-10	Wind River/ Sweetwater River	$165,266	$27,000 requested, $20,000 approved	Water development and grazing management plan development.	NRCS, Landowner	Complete
98 - Seasonal Habitat Mapping	2009-10	Statewide	$352,000 (multiyear)	$155,000 requested, $141,000 approved/spent	Use predictive habitat models to produce sage-grouse seasonal habitat maps	U.S. Fish & Wildlife Service, BLM, Various energy development companies	On-going
99 - Fence markers and spring protection fencing (see also #47 and 128)	2009-10	Statewide	$130,000	$64,800 requested/approved; $62,628 spent	Purchase fence markers and Steel Jack spring protection for statewide distribution	Niobrara Conservation District, numerous private landowners, BLM, The Nature Conservancy	On-going
	2009-2010 Total			**~$1,100,000 approved**			
100 - Cheatgrass mapping - Upper Green River Basin Phase I (see also #126)	2011-12	Upper Green River Basin	$71,390	$55,000 requested/approved/spent	Cheatgrass mapping and spot control	Sublette Co. Weed & Pest/GR Basin Coordinated Weed Mgt Association	Complete
101 - West Slope Bighorn Mtns Cheatgrass Control	2011-12	Big Horn Basin	$20,000	$10,000 requested/approved/spent	Cheatgrass control	BLM - Cody FO	Complete
102 - Albert Creek Grazing Mgt	2011-12	Southwest	$25,000	$12,500 requested/approved/spent	Grazing management and infrastructure	Horseshoe Spear Cattle Co., BLM, WGFD	Complete
103 - ACC Cheatgrass Control	2011-12	Big Horn Basin	$150,000 (multiyear)	$20,000 requested/approved, $17,100 spent	Cheatgrass control and effectiveness monitoring	Big Horn Co. Weed & Pest, American Colloid Co.	Complete
104 - Emergency Wildfire Restoration	2011-12	Northeast	$53,774	$33,250 requested/approved, $30,257 spent	Restoration of wildfire area in the Buffalo sage-grouse core area	Lake DeSmet Conservation District, private landowner, WGFD	Complete

105 - Jackson Hole SG Habitat and Movement Modeling (see also #30, 75 & 140)	2011-12	Upper Snake River Basin	$24,000	$16,000 requested, $8,000 approved/spent	Develop sage-grouse habitat selection and home-range models using data from prior work.	Craighead Beringia South	On-going
106 - Worland Black Mountain Cheatgrass Control and Sagebrush Restoration (see also #86)	2011-12	Big Horn Basin	$260,000	$105,000 requested, $96,000 approved/spent	Cheatgrass control and sagebrush seedling establishment and planting in wildfire area.	WGFD, BLM, Wildlife and Nat. Res. Trust	Complete
107 - Crooked Crk and Rome Hill Juniper Treatment (see also #60, 134 and 135)	2011-12	Big Horn Basin	$90,000	$22,500 requested/approved/spent	Mechanical juniper removal from sage-grouse habitat	BLM - Worland FO	Complete
108 - Grand Teton NP lek monitoring	2011-12	Upper Snake River Basin	$11,369	$4,032 requested/approved/spent	Hire technicians to conduct lek monitoring in Grand Teton National Park	Grand Teton National Park, WGFD	Complete
109 - Restoration of SG habitat on mined sites (see also #139)	2011-12	Big Horn Basin	$36,026	$21,053 requested/approved/spent	Research to test methods to improve sagebrush seedling vigor and survival for mineland reclamation	Michigan Technical University, MI SWACO, American Colloid, BLM	Compete
110 - Fence marking in SW Wyoming	2011-12	Southwest	$18,091	$10,000 requested/approved $8,948.12 spent	Volunteer construction and placement of fence markers to prevent/mitigate sage-grouse fence collisions	BLM, Utah's Hogle Zoo	Complete
111 - Impacts of Ravens on SG nests in southern WY	2011-12	South-Central & Southwest	not provided by applicant	$102,892 requested/approved; $100,664.20 spent	Research to determine raven impacts and raven control to sage-grouse	Utah State University	On-going
112 - Noxious weed control in Spring Crk/Big Ridge BTNF	2011-12	Upper Snake River Basin	$22,000	$7,500 requested, $3,883 approved; $3,869.39 spent	Noxious weed control on Bridger-Teton NF lands	Lincoln Co. Weed & Pest, Wildlife and Nat. Res. Trust, RMEF, USFS	Complete

113 - Improving SG habitat in the Cottonwood Crk drainage (see also #137)	2011-12	Big Horn Basin	$630,000 (multiyear)	$99,809 requested, $30,195 approved/spent	LWG $ to provide spring protection aspect of larger habitat restoration project	The Nature Conservancy, WYDEQ, Wildlife & Nat. Res. Trust, LU Ranch, Hot Springs Weed & Pest, Exxon Mobil, Marathon Oil, WGFD, Spring Gulch Cattle Co.	Complete
114 - Kelly Hayfields restoration Phase II (see also #95 & 141)	2011-12	Upper Snake River Basin	$140,181	$52,647 requested; $31,585 approved/spent	Restore native vegetation to abondoned smooth brome hayfields.	Grand Teton National Park, NRCS	Complete
115 - Impacts of wind energy development in SE Wyo (see also #84)	2011-12	Bates Hole/ Shirley Basin & South-Central	$1,320,798 (multiyear)	$110,000 requested, $85,000 approved/spent	Research to establish the short-term effects of wind development to sage-grouse	National Wind Coordinating Collaborative, Western Assoc. of Fish & Wildlife Agencies	Complete
116 - Sharpnose sagebrush treatment Unit 2	2011-12	Wind River/ Sweetwater	$53,700	$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
117 - Response of SG to sagebrush treatments	2011-12	Wind River/Sweetwater, South-Central, Southwest, Bates Hole/Shirley Basin	$539,800 (multiyear)	$189,800 requested/approved/spent	Research to determine sage-grouse demographic and habitat use response to sagebrush treatments	Univ. of Wyoming Coop Unit, WGFD	On-going

118 - Estimating noise impacts for habitat selection modeling (see also #17, 46 & 77)	2011-12	Wind River/Sweetwater, South-Central, Southwest, Bates Hole/Shirley Basin, Northeast, Upper Green River Basin	$69,415	$49,335 requested/approved/spent	Research to develop a noise model and determine noise exposure thresholds.	Univ. California-Davis	On-going
119 - Identifying restoration and land-use priorities	2011-12	Northeast	$207,376	$37,922 requested/approved/spent	Research using genetic techniques to map population connectivity	Univ. of Wyoming	On-going
120 - SG core areas as umbrella for non-game species	2011-12	Southwest & Wind River/Sweetwater	$249,724	$30,000 requested; $8,000 approved/spent	Research to determine the conservation effectiveness of sage-grouse core areas for non-game species	Univ. of Wyoming Coop Unit	On-going
121 - Thunder Basin Sagebrush Mapping	2011-12	Northeast	$350,000	$50,000 requested/approved/spent	Develop an accurate sagebrush map using 1' aerial photography	Thunder Basin Grasslands Prairie Ecosystem Assoc.	On-going
122 - Thunder Basin SG collaring	2011-12	Northeast	$100,000	$25,000 requested/approved/spent	Seasonal distribution and habitat use study	Thunder Basin Grasslands Prairie Ecosystem Assoc.	On-going
123 - Henderson Draw cheatgrass treatment	2011-12	Bates Hole/Shirley Basin	$78,000-$87,000	$50,000 requested/approved/spent	Cheatgrass control	BLM - Casper FO	Complete
124 - Seven Mile Gulch Exclosure	2011-12	Southwest	$29,800	$21,600 requested/approved	Spring and associated habitat protection fencing	Unita Development Co., WGFD, volunteers	Complete
125 - Buckhorn Flowing well fencing	2011-12	Southwest	$19,000	$5,000 requested/approved/spent	Flowing well and associated habitat protection fencing	WY Landscape Conservation Initiative, BLM	Complete
126 - Cheatgrass mapping & control - Sublette Co.	2011-12	Upper Green River Basin & Southwest	$92,719	$92,719 requested/approved/spent	Cheatgrass mapping and spot control	Sublette Co. Weed & Pest/GR Basin Coordinated Weed Mgt Association	Complete

Phase II (see also #100)							
127 - Sublette Co. raven control (see also #151)	2011-12	Upper Green River Basin	$15,000	$15,000 requested/approved/spent	Raven nest removal and habitat modification	Sublette Co. Conservation District	Complete
128 - Escape Ramp & spring protection fence materials (see also #47 and 99)	2011-12	Big Horn Basin, Wind River/ Sweetwater	$15,000	$15,000 requested/approved; $14,702.88 spent	Water trough escape ramps and spring protection fencing	Niobrara Conservation District, numerous private landowners, BLM	On-going
129 - Fence collision markers	2011-12	South-central, Upper Green River Basin, Southwest	$100,000	$42,000 requested/approved	Volunteer construction and placement of fence markers to prevent/mitigate sage-grouse fence collisions	Medicine Bow Conservation District, WGFD, private landowners, BLM	On-going
130 - Buffalo Internet lek monitoring database	2011-12	Northeast	$2,500	$2,500 requested/approved; $2,465 spent	Maintain real-time lek database for the Buffalo BLM FO to facilitate monitoring coordination between agencies and industry	BLM, WGFD, industry	Complete
131 - Audubon Community Naturalist (see also #53)	2011-12	Bates Hole/Shirley Basin	$178,500	$10,000 requested/approved/spent	Sagebrush ecosystem education program for schools	various foundations and grants	Complete
132- North Laramie Range cheatgrass control	2011-12	Bates Hole/Shirley Basin	$206,700	$26,000 requested/approved/spent	Cheatgrass control	Wildlife and Nat. Res. Trust, WGFD, Gov's Big Game Lic. Coalition	Complete
133 - Invasive Species Mapping and Control in BTNF & GTNP (see also #142)	2011-12	Upper Snake River Basin	$53,000	$12,000 requested, $6,500 approved/spent	Invasive/noxious weed mapping and control.	Teton Co. Weed & Pest, Grand Teton National Park, Nat'l Elk Refuge, Bridger-Teton NF, Jackson Hole Airport	Complete
	2011-12 Total			**~1,200,000 approved**			

134 - Shell Black Mtn Juniper Control (see also #60, 107 and 135)	2013-14	Big Horn Basin	$64,000	$32,000 requested, $30,000 approved	Mechanical juniper removal from sage-grouse habitat	BLM	Approved
135 - Rome Hill Juniper Control (see also #60, 107 & 134)	2013-14	Big Horn Basin	$216,000	$35,000 requested, $30,000 approved	Mechanical juniper removal from sage-grouse habitat	BLM	Approved
136 - UW Bentonite impacts research	2013-14	Big Horn Basin	$125,140	$24,244 requested, $11,000 approved	Research of bentonite mining impacts to sage-grouse	American Colloid Co.	Approved
137 - Improving habitat in the Cottonwood Crk drainage (see also #113)	2013-14	Big Horn Basin	$104,590	$50,090 requested, $25,000 approved	LWG $ to pay for mechanical conifer removal from sage-grouse habitat as part of a larger habitat restoration project	BLM, WY DEQ	Approved
138 - SG habitat use in the Big Horn Basin	2013-14	Big Horn Basin	$223,272	$25,000 requested, $22,000 approved	Determining sage-grouse habitat use and movements on the west side of the Big Horn Basin	WY ADMB, WY Private Lands Grazing Team, Breitburn Operating L.P., Legacy Reserves, Shoshone CD, Meeteetse CD, Big Horn Basin Pred Mgt Dists., National Wildlife Research Center, USDA/APHIS/Wildlife Services	Approved
139 - Mich Tech sagebrush reclamation research (see also #109)	2013-14	Big Horn Basin	$82,344	$26,124 requested, $20,000 approved	Research of enhanced sagebrush reclamation techniques on bentonite mined sites	Michigan Technical University, Wyoming Wildlife and Natural Resources Trust	Approved
140 - Jackson Hole SG Habitat and Movement Modeling (see also #30, 75	2013-14	Upper Snake River Basin	$24,000	$8,800 requested/approved	Finish sage-grouse habitat selection and home-range models using data from prior work.	Craighead Beringia South, Community Foundation Jackson Hole, private donors	Approved

and 105)							
141 - Kelly Hayfields restoration Phase 3 (see also #95 & 114)	2013-14	Upper Snake River Basin	$87,534	$30,000 requested; $28,200 approved	Restore native vegetation to abondoned smooth brome hayfields.	Grand Teton National Park, NRCS	Approved
142 - Invasive species control in Teton Co. (see also #133)	2013-14	Upper Snake River Basin	$46,728	$3,000 requested/approved	Invasive weed control in Teton County	Jackson Hole Weed Mgt Assoc.	Approved
143 - Raven/raptor density effects to lek count (see also #111)	2013-14	Southwest, South-Central	not provided by applicant	$100,000 requested; $70,000 approved	Research to determine impacts of raven control to sage-grouse	Utah State University	On-going
144 - Cheatgrass mapping and control in Sublette Co. phase III (see also #100 & 126)	2013-14	Upper Green River Basin, Southwest	$137,142	$62,142 requested/approved	Cheatgrass mapping and spot control	Sublette County Weed & Pest, Green River Basin Coordinated Weed Mgt Assoc.; WLCI	On-going
145 - Impacts of noise on sage-grouse (see also # 17, 46, 77 & 118)	2013-14	Wind River-Sweetwater River, Northeast, South-Central, Southwest	$63,388	$41,626 requested/approved	Continuing research examining the effects of noise resulting from energy exploration and development	University of California-Davis, BLM	On-going
146 - Response of SG to sagebrush treatments Phase II (see also #117)	2013-14	Wind River-Sweetwater River, South-Central, Southwest	$956,593 (multi-year)	$99,841 requested/approved	Continuing research to determine sage-grouse demographic and habitat use response to sagebrush treatments	University of Wyoming, Kelly Ornith. Research Fund, BLM, WY Reclamation & Restoration Center, WWNRT	On-going

147 – Impacts of wind energy development on sage-grouse (see also #84 and 115)	2013-14	Bates Hole-Shirley Basin, South-Central, Southwest	$1,023,250 (multi-year)	$105,000 requested/approved	Continuing research to determine sage-grouse demographic and habitat use response to wind energy development.	National Wind Coordinating Collab., Iberdrola Renewables, Pacificorp, EnXco, Wyoming Wildlife Foundation, UW, W.E.S.T. Inc., Wyoming Wildlife Consultants, LLC	On-going
148 - Beaver Hills Water Development	2013-14	South-Central	$341,000	$12,000 requested/approved	Spring development and protection and wildlife friendly fence conversion.	SERCD, IK Ranch, others pending approval	On-going
149 - Road attribute inventory in greater sage-grouse core habitat	2013-14	Wind River-Sweetwater River	$36,000	$50,000 requested, $36,000 approved	BLM contractor to inventory roads and associated attributes in the Twin Crk Travel Mgt Area	BLM Lander FO	On-going
150 - Sublette Windmil Conversions	2013-14	Upper Green River Basin	$71,757	$71,757 requested/approved	Convert existing windmills to solar pumping units to reduce raven nesting substrate	Sublette Co. Conservation District, landowners/permittees, BLM	On-going
151 - Sublette Raven Control and nest deterrents (see also #127)	2013-14	Upper Green River Basin	$15,000	$15,000 requested/approved	Raven nest removal and habitat modification	Sublette Co. Conservation District. Gas field operators, BLM, WGFD, USDA Wildlife Services	On-going
152 - Sagebrush ID in the Cato Wildfire - Buffalo Core SG habitat	2013-14	Northeast	$23,773	$17,794 requested/approved	Mapping of sagebrush restoration potential and inv. spp. control effectiveness in the Cato Wildfire area	DeSmet Conservation District, BLM, landowners, Johnson Co. Weed & Pest, NRCS	On-going
153 - Converting CBM wells to wildlife water	2013-14	Northeast	$72,716	$19,808.16 requested, $3,025 approved	Converting CBM wells to wildlife/livestock water sources	Campbell Co. Conservation District, landowners, BLM, NRCS	On-going
154 - Douglas Core Area Wildfire Restoration	2013-14	Northeast	$178,200	$40,000 requested, $30,000 approved	Wildfire restoration	Landowners, WGFD, others applied for	On-going

155 - Identifying priorities for land use and habitat restoration	2013-14	Northeast	$207,376 (multi-year)	$48,830 requested, $24,415 approved	Research to prioritize habitats for land use and habitat restoration	University of Wyoming, others pending	On-going
156 - CBM reclamation brochure for landowners	2013-14	Northeast	$9,422	$6,747 requested, $3,800 approved	Develop, print and distribute a brochure for landowners describing CBM reclamation practices	NRCS, Cambell Co. Conservation District, BLM, Landowners	On-going
157 - Fathead minnows for mosquito control research	2013-14	Northeast	$71,060	$71,060 requested, $23,700 approved	Research to determine efficacy of fathead minnows for mosquito control to address West Nile virus	University of Waterloo, Big Horn Environmental Consultants, landowners	On-going
	2013-14 as of 05/31/13				**$794,280 approved, $405,720 remaining as of 5/31/13**		

Attachment B:

GREATER SAGE-GROUSE RESEARCH CONDUCTED IN WYOMING IN 2012

Presented to Wyoming Game and Fish Department

Compiled by Dr. Jeff Beck, Department of Ecosystem Science and Management, University of Wyoming, Laramie, WY 82071

November 7, 2012

Research studies are listed alphabetically by principal contact or investigator. Please feel free to contact principal contacts or investigators with specific questions.

1. A SPATIALLY EXPLICIT INDIVIDUAL-BASED MODELING APPROACH TO EVALUATE THE CUMULATIVE EFFECTS OF WIND ENERGY DEVELOPMENT ON THE GREATER SAGE-GROUSE

Contact: Argonne National Laboratory (Dr. Kirk LaGory); Phone: (630) 252-3169; Email:

lagory@anl.gov

Argonne National Laboratory, Environmental Science Division, Drs. Kirk LaGory and Yuki

Hamada

In 2011, we completed development of a spatially explicit, proof-of-concept individual-based model to examine how wind energy development affects greater sage-grouse populations in Albany County, Wyoming. The model, based on published life history information, represents six major processes for seven age-sex classes of sage-grouse: seasonal movements, habitat selection, competition, body condition change, reproduction, and survivorship. The model estimates population size and distribution based on individual sage-grouse habitat selection and resultant reproduction and mortality rates that are based on habitat suitability. Scenario tests showed that the location and configuration of wind energy development are critically important to determining the effect of development on the population, and that indirect effects can be as significant as direct effects. The model has the potential to provide valuable information for planning, siting, and assessment of the cumulative impacts of extensive regional wind development on sage-grouse. In 2012, we conducted a series of validation tests and sensitivity analyses of key parameters. The model performed well in terms of predicting population size, population sex ratios, age distributions, and the number of active leks relative to observed values. In addition, results were relatively robust over the range of parameter values tested.

Funding provided by U.S. Department of Energy, Energy Efficiency and Renewable Energy, Wind and Water Program

2. GREATER SAGE-GROUSE MIGRATION ECOLOGY AND RESPONSE TO BENTONITE MINING IN THE BIGHORN BASIN, WYOMING

Contact: Dr. Jeff Beck; E-mail: jlbeck@uwyo.edu; Phone: (307) 766-6863

Aaron Pratt, Department of Ecosystem Science and Management, University of Wyoming
Jeffrey Beck, Department of Ecosystem Science and Management, University of Wyoming
Lyndon Bucher, American Colloid Company, Belle Fourche, South Dakota
Tom Easterly, Wyoming Game and Fish Department, Greybull, Wyoming

Wyoming contains 70% of the world's bentonite clay deposits, and mines in the Bighorn Basin produce >50% of Wyoming's annual supply. Bentonite is extracted by open-pit mining that leads to disturbance, fragmentation, and loss of sagebrush habitat. Plans call for mining to increase in sagebrush communities; therefore, our primary study objective is to monitor (for 3 years; 2011–2013) the demographic rates and habitat selection patterns of greater sage-grouse in an area with bentonite mining (Shell) compared to a reference area without mining (Hyattville). We are monitoring female survival, nest success, and brood survival with radio telemetry. For males, we are attaching bands to estimate survival using mark-recapture techniques. To help guide reclamation we are sampling vegetation in microhabitat plots at nests, early-brood locations, and at paired random locations. In the future we will evaluate habitat selection at the landscape scale and compare demographic rates of grouse relative to their exposure to mining. We will also experiment with using genetic markers in feathers collected from leks to estimate male survival using mark-recapture models. Our second study objective is describing the migration ecology of these populations using GPS-marked grouse. Observations indicate a wide variety of migratory behavior including differences between sex, proportion of each population that is migratory, timing, distance, duration, destination, and differences among seasons. We will compare the survival and reproductive success of grouse expressing different migration behaviors and model migration routes and habitat used. We are also experimenting with stable isotope signatures to identify migration behavior.

Greater sage-grouse sample sizes obtained in the eastern Bighorn Basin, Wyoming, 2011–2012.

Sample	Female		Male		Nest	Brood	Microhabitat Plots	
	VHF	GPS	Band	GPS			Nest	Brood
2011								
Shell	14	5	11	5	16	5	16	13
Hyattville	40	5	28	6	39	14	39	24
2012								
Shell	12	5	11	1	17	6	17	25
Hyattville	51	16	26	4	55	27	54	36

Funding is provided by the American Colloid Company. Additional funding has been granted by the Bighorn Basin Local Sage-Grouse Working Group and the Margaret and Sam Kelly Ornithological Research Fund.

3. WINTER HABITAT SELECTION BY GREATER SAGE-GROUSE INFLUENCED BY COALBED METHANE DEVELOPMENT IN SOUTH-CENTRAL WYOMING

Contact: Dr. Jeff Beck; E-mail: jlbeck@uwyo.edu; Phone: (307) 766-6863

Christopher P. Kirol[1], Smith, Kurt, T.[1], Jeffrey L. Beck[1], and Frank C. Blomquist[2]
[1]University of Wyoming, Department of Ecosystem Science and Management, 1000 East University Avenue, Laramie, WY 82071; [2]Bureau of Land Management, Rawlins Field Office, Rawlings, Wyoming 82301

We compared winter habitat selection patterns and survival for female greater sage-grouse (*Centrocercus urophasianus*) inhabiting a 6,093 km^2 study area with coalbed methane extraction in northwestern Colorado and south-central Wyoming and a 1,225 km^2 reference study area in south-central Wyoming. Our objectives were to: 1) develop winter habitat selection and survival models for sage-grouse, and 2) evaluate the relative influence of anthropogenic development on winter habitat selection and risk. We used 744 locations from 172 radio-marked female grouse obtained from 34 fixed-wing flights across 3 winters (2007-2008, 2008-2009, and 2009-2010) in binary logistic regression modeling to quantify selection by comparing grouse and available locations at 3 spatial scales. We used 12 landscape predictor variables including anthropogenic infrastructure, snow accumulation, topography, and vegetation. Grouse in our reference area selected habitat with a lower topographic ruggedness index within 2,448 m and with higher variability in shrub height and continuous Wyoming big sagebrush cover within 2,448 m. Grouse in the energy-development study area selected winter habitat with higher variability in shrub height and continuous shrub cover within 2,448 m, and in areas with less surface disturbance within 490 m. Survival was positively correlated with variability in big sagebrush cover within 490 m and negatively correlated with variability in shrub cover within 2,448 km. We did not find a correlation between anthropogenic variables and female winter survival. Displacement of sage-grouse in the energy extraction area may have masked our ability to identify anthropogenic variables influencing survival. Our results indicate the importance of conserving large sagebrush landscapes characterized by low-to-moderate relief and adequate shrub height and canopy cover for wintering sage-grouse within energy-disturbed landscapes.

Funding provided by the Bureau of Land Management.

4. RESPONSE OF GREATER SAGE-GROUSE TO TREATMENTS IN WYOMING BIG SAGEBRUSH

Contact: Dr. Jeff Beck; Email: jlbeck@uwyo.edu: Phone: (307) 766-6683
Smith, Kurt, T.[1], Jeffrey L. Beck[1], Anna D. Chalfoun[2], Stan Harter[3], and Sue Oberlie[4]

[1]University of Wyoming, Department of Ecosystem Science and Management, 1000 East University Avenue, Laramie, WY 82071

[2]University of Wyoming, Department of Zoology and Physiology, USGS Wyoming Cooperative Fish and Wildlife Research Unit, 1000 East University Avenue, Laramie, WY 82071; [3]Wyoming Game and Fish Department, Lander field office, 260 Buena Vista Drive, Lander, WY 82520; [4]Bureau of Land Management Wyoming, Lander field office, 1335 Main Street, Lander, WY 82520

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 grassy 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 sage-grouse response to habitat treatments have reported varied results and generally lack the spatial and temporal replication necessary for robust evaluation of demographic rates and fine-scale habitat use of sage-grouse in response to treatments. Our study, centered near Jeffrey City in Fremont County, Wyoming is designed as a Before-After Impact-Control study with 3 years of pre-treatment and 2 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 attached GPS transmitters in spring and summer 2012 to female grouse. Pre-treatment data will guide our selection of treatment sites with treatments implemented in fall 2013. In 2011 and 2012 we monitored survival at 81 nests and 31 broods. Identifying positive, negative, or neutral sage-grouse demographic and habitat use responses will aid in determining the efficacy of treatments in Wyoming big sagebrush intended to enhance habitat for sage-grouse and other vertebrate species associated with the sagebrush biome.

Funding Sources: Wyoming Game and Fish Department, Wyoming Sage-Grouse Conservation Fund; Bates Hole, Southwest, and Wind River/Sweetwater River Local Sage-grouse Work Groups; and Margaret and Sam Kelly Ornithological Research Fund

5. OCCURRENCE AND FITNESS INFORMED MODELING OF SAGE-GROUSE HABITAT IN JACKSON HOLE, WY

Contact: Bryan Bedrosian; E-mail: bryan@bswy.org; Phone: (307) 734-0581

Bryan Bedrosian, Craighead Beringia South

Trapper Haynam, Craighead Beringia South

Bob Crabtree, Yellowstone Ecological Research Center

The end goal of this project is to develop spatially explicit metrics of greater sage-grouse habitat response in Jackson Hole, WY. This research will relate sage-grouse survival and movement data to a suite of environmental variables. We are developing models for nesting, brood rearing, summer foraging, and winter foraging life history stages. Our response data were collected from 2007-2010. We have >70,000 GPS and VHF telemetry locations, from all life history stages, for ~25 male and ~75 female birds. We will utilize well established habitat selection modeling methodologies, such as a resource selection probability functions (logistic models) or generalized linear mixed-effects models. In this use-availability modeling framework, spatially explicit covariates thought to be important to sage-grouse (e.g., sagebrush canopy cover, herbaceous understory, past fire severity, raven occurrence) are fit to telemetry location data to give relative measures (parameter estimates) of apparent sage-grouse preference for particular covariate combinations. The estimated parameters can then be used to generate resource use probability surfaces (probability layers). Using a similar approach, and semi-parametric survival analysis, parameters will be estimated and then survival or risk surfaces can be generated. If a best supported model has biologically conclusive parameter estimates; survival or risk surfaces and resource selection surfaces will be used to calculate a habitat suitability surface. Methods for generating habitat suitability surfaces are still being considered. The final candidate model structures have not yet been decided upon, some covariates have yet to be synthesized, and covariate data arrays are still being populated.

6. EFFECTIVENESS OF SAGE-GROUSE CORE AREAS AS AN UMBRELLA FOR NON-GAME SAGEBRUSH SPECIES OF GREATEST CONSERVATION NEED

Contact: Dr. Anna Chalfoun; Email: achalfou@uwyo.edu: Phone: (307) 766-6966

Jason Carlisle[1], Anna Chalfoun[1], Martin Grenier[2], Andrea Orabona[2], Susan Patla[2], Zack Walker[2], Tom Christiansen[2], Kurt Smith[3], Jeffrey Beck[3]

[1]Wyoming Cooperative Fish & Wildlife Research Unit, Department of Zoology & Physiology, University of Wyoming; [2]Wyoming Game and Fish Department; [3]Department of Ecosystem Science and Management, University of Wyoming

We are seeking to understand how effective Wyoming's Greater Sage-grouse Core Population Areas are at conserving sagebrush-associated wildlife species of greatest conservation need (SGCN). More specifically, we hope to determine the spatial scales at which core areas are a suitable surrogate for SGCN management; and whether or not SGCN will be benefited by streamlining management actions to focus on meeting sage-grouse needs in core areas. In order to rigorously test these questions, we have begun implementing a four-part approach, focusing on differing scales: 1) quantify overlap statewide between sage-grouse core areas and focal SGCNs' predicted spatial distribution, 2) examine the occurrence and relative abundance of SGCN across gradients of sagebrush habitat and sage-grouse core areas, 3) evaluate the reproductive success of three sagebrush-obligate passerine SGCN (Brewer's sparrow, sage sparrow, sage thrasher) across gradients of sagebrush habitat and sage-grouse core areas, and 4) examine the responses of SGCN to sagebrush-reducing experimental habitat treatments designed to benefit greater sage-grouse. We are currently updating the preliminary findings reported last year for objective 1using a more rigorous overlap analysis. We successfully completed our first field season this past summer, collecting data near Jeffrey City, WY to address objectives 2-3. Following field seasons will continue to address objectives 2-3, and begin addressing objective 4.

Funding provided by Wyoming Game and Fish Department, Southwest Local Working Group, and Wind River / Sweetwater River Basin Local Working Group.

7. STATE-WIDE SEASONAL GREATER SAGE-GROUSE HABITAT MODELING FOR WYOMING

Contact: Dr. Brad Fedy; E-mail: bfedy@uwaterloo.ca; Phone: (519) 888-4567 ext. 32706

Principal Investigator
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Animal habitat selection is an important and expansive area of research in ecology. In particular, the study of habitat selection is critical in habitat prioritization efforts for species of conservation

concern. Wyoming is predicted to remain a stronghold for greater sage-grouse (*Centrocercus urophasianus*) populations and contains approximately 37% of remaining birds. We compiled species data from 14 unique radiotelemetry studies and habitat data from high-quality, biologically relevant, Geographic Information System (GIS) layers across Wyoming. We developed habitat selection models for greater sage-grouse across Wyoming for three distinct life stages: 1) nesting, 2) summer/late brood-rearing, and 3) winter. We developed patch and landscape models across four different extents, producing Statewide models and regional models for 3 different regions of Wyoming: 1) Southwest, 2) Central, and 3) Northeast. Habitat selection varied among regions and seasons yet, preferred habitat attributes generally matched the extensive literature on sage-grouse seasonal habitat requirements. We chose Resource Selection Function (RSF) thresholds for each model set that delineated important seasonal habitats for sage-grouse. Each model set showed good validation and discriminatory capabilities within our study site boundaries. We tested model performance in areas not used in the development of the model (i.e., novel areas). The associated manuscript was submitted for peer-review in August 2012.

8. STATE-WIDE GENETIC CONNECTIVITY FOR GREATER SAGE-GROUSE IN WYOMING

Contact: Dr. Brad Fedy; E-mail: bfedy@uwaterloo.ca; Phone: (519) 888-4567 ext. 32706

Principal Investigators
Dr. Brad Fedy, Department of Environment and Resource Studies, University of Waterloo, Waterloo, Ontario, Canada in collaboration with USGS Fort Collins Science Center.
Dr. Sara Oyler-McCance, U.S. Geological Survey, Fort Collins Science Center, Fort Collins, CO 80526, USA

Colorado Greater sage-grouse population connectivity has been identified as a priority management issue by multiple state and federal management agencies. We are currently working on a large-scale project to assess levels of population connectivity using genetic approaches. This project will assist in the delineation of related populations and describe possible sub-population boundaries that transcend all administrative boundaries. The research will also identify likely barriers to the movement of individuals among populations. The study will assist managers in understanding the relative importance of priority habitats and in accordance with policy, assist in the priority management of those habitats. One objective of the State's Game and Fish Agency is to maintain connectivity. To accomplish this, we must understand more about the genetic diversity and the likelihood and nature of impacts from any inbreeding that is identified and the association between the seasonal habitats of the species and the subpopulations that use them. We have completed the first stage of the project involving the collection of feather samples and the laboratory processing of the approximately 2000 feather samples from across Wyoming. This stage involved DNA isolation, the use of multiple molecular markers, and the development of the genetic data that will be used to quantify connectivity. The second stage of the project has begun will comprise the analysis of the genetic data compiled from the first stage and produce the management-relevant products previously mentioned.

9. IMPACTS OF RAVEN ABUNDANCE ON GREATER SAGE-GROUSE NESTING SUCCESS IN SOUTHWEST AND SOUTH-CENTRAL WYOMING

JONATHAN DINKINS, DR. MICHAEL CONOVER, and SCOTT MABRAY, Department of Wildland Resources, Utah State University, Logan, Utah, 84322-5230, USA

We have studied female sage-grouse habitat selection, nest success, and survival in relation to avian predators from 2008–2012. Research was conducted at 12 study sites, 16-km or 24-km diameter, in southern Wyoming. This research has been a collaborative effort among the BLM, University of Wyoming, Utah State University, and Wyoming Game and Fish Department. Between BLM, University of Wyoming, and Utah State University, 69–200 sage-grouse hens were monitored per year (Table 1). Sample sizes were smaller in 2012, because we did not capture sage-grouse in 2012; thus, we were monitoring sage-grouse hens from previous years that had functioning radio-collars. Raptor and corvid abundance was monitored by establishing point-count locations near sage-grouse nests and broods (100-200 m away from nests) and at random locations. Table 1 details the number of nests and random locations monitored for avian predators. Wildlife Services removed ravens around 5 study sites within these study areas yearly. We are currently completing analyzes on sage-grouse habitat selection, nesting success, and survival related to avian predators, anthropogenic features (proximity to oil and gas structures, power lines, and roads), landscape features (proximity to forested and riparian habitat and topographic ruggedness), and local vegetation parameters ($10m^2$ sagebrush, grass, litter, bare ground, and forb cover; and average sagebrush and grass heights at $10m^2$). These analyses will constitute five stand-alone research chapters in Jonathan Dinkins's dissertation and will be submitted to peer-reviewed scientific journals (1 chapter is in press, 1 chapter is in review, and 3 are in preparation for submission).

Table 1. Approximate number of sage-grouse monitored, nests found, and random locations. All sage-grouse nests and random locations had 3–8 avian point-counts conducted per breeding season.

Year	Sage-grouse Monitored	# Nests	# Random Avian Predator Point-Count Locations
2008	**170**	**53**	**164**
2009	**200**	**77**	**177**
2010	**170**	**85**	**160**
2011	**180**	**110**	**170**
2012	**69**	**32**	**185**

Study Funders
Anadarko Petroleum Corporation, Bureau of Land Management, Lincoln County Predator Management Board, Predatory Animal District of Sweetwater County, South-central Sage-grouse Local Working Group, Southwest Sage-grouse Local Working Group, Uinta County Predator Management Board, Wyoming Animal Damage Management Board, Wyoming Game and Fish Department, Wyoming Landscape Conservation Initiative

10. AN ANALYSIS OF ENERGY WILDLIFE CONSERVATION POLICY AND STRATEGIES FOR GREATER SAGE GROUSE AND MULE DEER IN WYOMING

Contact: R. Scott Gamo; E-mail: scott.gamo@wyo.gov; Phone: (307) 777-4509

R. Scott Gamo, Department of Ecosystem Science and Management, University of Wyoming, and Wyoming Game and Fish Department, Cheyenne
Jeffrey L. Beck, Department of Ecosystem Science and Management, University of Wyoming

We are evaluating the Wyoming Governor's Executive Order for Sage-Grouse (SGEO) to: 1) assess its effectiveness in maintaining sage-grouse populations in sage-grouse core population areas, and 2) understand better its indirect impact in providing habitat protections for wintering mule deer. Our approach to assess the effectiveness of the SGEO in maintaining sage-grouse populations is to use a Before-After-Control-Impact (BACI) design to evaluate sage-grouse lek counts statewide in core and non-core areas. Our objectives are two-fold: 1) test the effectiveness of the SGEO, and 2) evaluate the mechanisms affecting the effectiveness of this policy. We will compare the dynamics of male sage-grouse lek attendance inside core areas across time as well as compare these dynamics to sage-grouse occurring in non-core areas. In addition, we will evaluate differences in anthropogenic infrastructure between grouse populations in core and non-core areas. We will also use a BACI design to evaluate the influence of the sage-grouse core area policy on mule deer populations and habitat. Our objectives for this portion of our research include evaluating whether: 1) sage-grouse core population areas provide similar protections for mule deer, and 2) disturbance on mule deer winter range inside core areas differs from that on winter ranges outside of sage-grouse core areas. We anticipate our findings will provide important information for upcoming US Fish and Wildlife Service listing decisions for the greater sage-grouse as well as agency support of natural resource policy.

Funding: Provided by USFWS and Wyoming Game and Fish Department

11. A STUDY OF THE IMPACTS OF A WIND ENERGY DEVELOPMENT ON GREATER SAGE-GROUSE IN SOUTHEASTERN WYOMING

Contact: Dr. Matt Holloran; E-mail: matth@wyowildlife.com; Phone: (307) 399-6885

Gregory Johnson, Chad LeBeau, Ryan Nielson and Dr. Trent McDonald, Western EcoSystems Technology, Inc.; Dr. Matt Holloran and John Dahlke, Wyoming Wildlife Consultants, LLC; Dr. Jeffrey Beck, University of Wyoming Department of Ecosystem Science and Management.

In June 2008, the U.S. Department of Energy (DOE) set forth development of wind-generated electricity as a national energy priority. DOE estimated that the U.S. has ample wind resources to reach the goal of 20% of our nation's power supplied by wind energy by 2030, but one of the greatest hindrances to this accomplishment may be uncertainties regarding the potential impacts of wind energy developments to wildlife. The impacts of wind development to sage-grouse are currently unknown; however, potential effects to the species are enough to limit energy development in some sagebrush-dominated regions of the West, especially throughout much of central and western Wyoming. The overall goal of the research updated here is to establish the short-term effects of a wind energy development on female sage-grouse. We are studying sage-grouse inhabiting areas near the PacifiCorp Seven Mile Hill wind project located approximately 15 km west of Medicine Bow, WY. Research was initiated in April 2009; the National Wind Coordinating Collaborative joined the effort in 2011. Female sage-grouse equipped with VHF radio-transmitters are being radio-tracked to document seasonal habitats (e.g., nesting, brood-rearing, summer, winter) selected and population demographics (e.g., survival, nesting success, chick productivity). We radio-tracked 100 female sage-grouse in 2012, including 50 females captured from 3 leks located ≤1.4 km from a wind turbine and 50 females captured in a control area. Between April 1 and Sept 1, 2012 we collected 1223 locations of this radio-equipped sample. We additionally collected vegetation and soils data at 127 use and random plots, and have conducted avian predator (e.g., *Corvidae* and raptors) nest and point count surveys throughout the study area. We will compare sage-grouse using habitats near wind turbines to grouse using habitats away from wind turbines to assess population-level effects of the wind energy development. Vegetation and avian predator data will be used to generate covariates for inclusion in wind energy development impact modeling.

Funding provided by: National Fish and Wildlife Foundation funds administered by the Bureau of Land Management as directed by the National Wind Coordinating Collaborative Sage-grouse Committee (2011-2012); Agricultural Experiment Station at the University of Wyoming (2011); Wyoming Reclamation and Restoration Center at the University of Wyoming (2011); Bates Hole/Shirley Basin Local Sage-grouse Working Group (2011-2012); South Central Local Sage-grouse Working Group (2012); EnXco (2011-2012); Iberdrola Renewables (2011); and PacifiCorp (2011-2012).

12. SAGE-GROUSE MONITORING ON LOST CREEK *IN-SITU* URANIUM MINE

Contact: Dr. Matt Holloran; E-mail: matth@wyowildlife.com; Phone: (307) 399-6885
Eric Berg, LWR Consultants, Inc.; Matt Holloran and John Dahlke, Wyoming Wildlife Consultants, LLC.

In April 2010, Wyoming Wildlife Consultants, LLC and LWR Consultants, Inc. initiated a research project in south-central WY collecting pre-treatment (e.g., pre-development) data at a site with a proposed *in-situ* uranium mine. Sage-grouse lek and telemetry monitoring protocols designed to assess the effects of *in-situ* uranium mining activities on sage-grouse populations, seasonal habitat selection, and productivity within treatment (e.g., within 2 km of disturbance) and control areas are being implemented. The study is being conducted in south-central Wyoming approximately 20 miles north of Rawlins, WY and west of U.S. Highway 287. The objective of lek searches and lek counts is to track male breeding population size within treatment and control areas through the life of the Project. Lek counts and searches are being conducted following standard protocol. To determine the potential effects of mining activities on habitat selection and demographics, we are using standard telemetry techniques on approximately 50 radio-equipped females. A secondary objective of seasonal habitat selection information is to build models quantifying the amount of habitat that may conservatively be assumed to be functionally influenced by mining activities on a seasonal basis (e.g., spatially quantify the amount of suitable nesting, early brood-rearing, summering, and wintering habitats within given distances of proposed infrastructure). We are additionally conducting brood surveys to assess potential impacts of mining activities on sage-grouse juvenile recruitment. Field work for the telemetry portion of this study was completed August 2012.

Funding provided by Lost Creek ISR, LLC.

13. THE COSTS OF DRILLING ON FEDERAL AND PRIVATE LAND: EVIDENCE FROM THE WYOMING CHECKERBOARD

Eric Lewis, Department of Economics, University of Michigan

The purpose of this research is to identify how private and federal land affect drilling outcomes for oil and gas drilling. I am using data from the "checkerboard" region of Wyoming, where land is allocated to private and public ownership in a checkerboard pattern. Using data on historical and current wells, I find that public land was usually drilled on first followed by private land. This suggests that government policies made drilling on public land more profitable than if firms had drilled on private land.

One of the major costs oil and drilling firms cite is the cost of following protocols to preserve protected species. The sage grouse is a particularly important species in the area because it lives in the checkerboard region and has been a potential candidate for listing as an endangered species. To see how sage grouse presence affects drilling, I am comparing drilling outcomes in locations with leks with drilling outcomes in locations without leks. I have found that within the checkerboard, leks are evenly distributed between public and private land. Further research will examine whether the presence of leks decreases the probability of drilling, and, if so, whether the presence of leks differentially decreases the probability of drilling on public land or on private land.

Financial Support is provided by the National Science Foundation's Graduate Research Fellowship Program and the University of Michigan.

14. GREATER SAGE-GROUSE RADIO-TRACKING PROJECT, POWDER RIVER BASIN, WYOMING

Contact: Tom Maechtle; E-mail: tom@bighornec.com; phone: (307) 673-7571

Tom Maechtle, Andy Sutphin, Linette Sutphin, Chris Kirol, Big Horn Environmental Consultants, P.O. Box 207 Sheridan, Wyoming 82801

Big Horn Environmental Consultants (BHEC), with the support of Anadarko Petroleum Corporation began a sage-grouse radio-tracking project in the Powder River Basin of Wyoming in 2008. We captured and radio-marked sage-grouse hens Johnson County, Wyoming from 2008-2011. We maintained a sample size of up to 100 radio-marked hens. All hens were aged, blood samples obtained, and feathers were collected for genetics analysis and to test for WNv antibodies. Marked hens were monitored year-round with more intensive monitoring occurring during nesting, brood rearing and WNv seasons. Mortalities were sent to the Wyoming State Vet Lab in Laramie for necropsies. The primary objective for the study is to assess the response of sage-grouse to reduction of Coal Bed Natural Gas infrastructure (power lines, roads, human visitations, acres disturbed etc). BHEC completed the field portion of the Powder River Basin radio-tracking project in 2011. No sage-grouse were captured or monitored in the Powder River Basin in 2012. We are currently in the data analysis phase of the project. The accuracy of the results and interpretation of this analysis are largely dependent on the accuracy of the GIS layers and associated spatial variables (e.g., well density, distance to nearest well, and distance to nearest road) used in the analysis. We have found that much of these data in the Wyoming Oil and Gas Conservation Commission database such as well locations and roads were often not accurate with respect to the true ground locations, which requires us to manually reposition well locations, road corridors, and digitize new roads, and surface disturbance using NAIP color aerial imagery (U.S. Department of Agriculture 2010). Once the spatial analysis is complete our data set will be evaluated at Boise State University for statistical analysis.

Funding Provided by Anadarko Petroleum Corporation

15. EVALUATION OF THE RESPONSE OF GREATER SAGE-GROUSE TO WIND DEVELOPMENT ACTIVITIES ASSOCIATED WITH THE CHOKECHERRY AND SIERRA MADRE WIND ENERGY PROJECT, CARBON COUNTY, WYOMING

Josh Millspaugh and Chris Hansen, University of Missouri; Scott Gamo, Wyoming Game and Fish Department; Mark Rumble, U.S. Forest Service Rocky Mountain Research Station; Jon Kehmeier and Nate Wojcik, SWCA Environmental Consultants

Power Company of Wyoming (PCW) has proposed to construct the 1,000 turbine, 3,000 megawatt Chokecherry and Sierra Madre Wind Energy Project south of Rawlins, Wyoming. A before-after-control-impact (BACI) design is being used to evaluate the impacts of wind energy development on greater sage-grouse. The research area consists of 2 treatment areas where wind energy development will occur and 3 control areas without any wind energy development. Generally, the research effort will evaluate pre-construction habitat selection, population demographics, general movement and distribution patterns, and lek attendance trends. In spring 2010, 40 rump-mounted GPS PTTs were deployed on female sage-grouse; recovered PTTs were redeployed in fall 2010. In January 2011, the research team was awarded a contract from the National Wind Coordinating Collaborative to expand the research effort to include male and juvenile sage-grouse. In 2011, the number of tagged females was increased to 55 (11 in each study unit); 20 GPS PTTs and 50 rump-mounted VHF tags were fitted on males. In 2012, an additional 20 male GPS PTTs were deployed and recovered tags were redeployed. Our design calls for maintaining at least 50 GPS tagged females, 50 GPS tagged males, and 100 VHF tagged males and juveniles distributed evenly among the 5 study units. It is anticipated that 3 years of pre-construction data will be collected prior to the initiation of wind development activities.

Funded by Power Company of Wyoming, Wyoming Game and Fish Department, U.S. Forest Service Rocky Mountain Research Station, and National Wind Coordinating Collaborative

16. WHAT POTENTIAL MITIGATION AND RESTORATION SITES HAVE THE MOST POTENTIAL BENEFIT FOR SAGE-GROUSE?

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Beth A. Fitzpatrick and Melanie A. Murphy, Department of Ecosystem Sciences and Management, University of Wyoming, Laramie, Wyoming 82071

To meet the management objective of long-term landscape-level sustainability of sage-grouse populations, both occupancy of habitat and functional connectivity through the landscape are required. Avoiding or reclaiming sage-grouse lek sites may influence population networks and can be used for making decisions regarding sage-grouse management. In order to prioritize landscape-level restoration efforts and plan for future development, we are addressing the following objectives:

Objective 1: Predict site-level sage-grouse occurrence in relation to energy development.
Objective 2: Estimate functional connectivity of sage-grouse.
Objective 3: Predict occurrence & connectivity of sage-grouse in future landscape scenarios.

In 2012, we collected presence-absence data from approximately 78 sites (PRB = 31, BHB = 47) and genetic samples from approximately 68 leks (PRB = 28, BHB = 48, ~1150 samples). Vegetation surveys were conducted at 131 sites (PRB=26, BHB=105): 28 occupied leks (PRB=7, BHB = 21) and 103 random sites (PRB=35, BHB=68). These data will be used to create preliminary probability of lek occurrence and connectivity models.

We will collect additional occurrence data, genetic samples, and vegetation data in 2013. Our goal is ~ 300 leks and DNA samples from ~3,000 individuals over the duration of the project. Occurrence (Objective 1) and functional connectivity (Objective 2) of sage-grouse will be integrated in a network framework to identify spatially explicit sites important for sage-grouse population sustainability in the context of alternative development and restoration scenarios.

Funding by: Wyoming Reclamation and Restoration Center, Northeast Wyoming Sage-grouse Working Group, University of Wyoming

17. RESOURCE SELECTION AND LANDSCAPE-LEVEL CONSERVATION PLANNING FOR SAGE-GROUSE IN THE GREAT DIVIDE BASIN IN SOUTH-CENTRAL WYOMING

Contact: Chad Olson; E-mail: chad@haydenwing.com; Phone: (307) 742-5440

Chad V. Olson, Mathew R. Dzialak, Seth M. Harju, Jennifer E. Hess, James P. Mudd, and Jeffrey B. Winstead. Hayden-Wing Associates, LLC, Natural Resource Consultants, Laramie, Wyoming 82070

Prioritizing seasonal habitats for greater sage-grouse in landscapes undergoing energy development is critical for guiding future anthropogenic activities. Providing stakeholders with high-resolution modeling of critical habitats based on locally-collected data should improve front-end landscape conservation planning and thereby reduce potential impacts. In our study, we equipped female greater sage-grouse with solar-powered ARGOS/GPS transmitters in and around the Wamsutter Energy Field in south-central Wyoming. Our objectives are to: (1) quantify resource selection/avoidance, (2) generate high-resolution maps predicting probability of use for critical seasonal habitat at the landscape scale, and (3) investigate use of habitat enhancement sites and evaluate future treatment locations. The main study area extends from I-80 between Wamsutter and Creston Junction north to the Chain Lakes, and the Stewart Creek drainage northwest of Rawlins is being used as a reference area. To-date, we have recorded: >150,000 GPS bird locations, 119 nest locations, >15,000 brood locations, and three new or previously-undocumented leks. In 2012, the dry conditions clearly affected breeding; nest initiation was earlier (~9 days), no re-nesting was observed, nest success was lower (largely due to the lack of re-nesting), distance-from-nest was higher for broods during the early brood-rearing period, and brood success was lower. Interestingly, we documented several movements (>4 miles) to water by hens during late incubation. Hens were away from nests for $\leq$9 hrs during these extended incubation "breaks", but in all cases (n = 4), incubation resumed and the clutches ultimately hatched. Fieldwork and data analysis are ongoing.

Funding is provided by BP America Production Company.

Recent publications from this or related projects are downloadable from:
http://www.haydenwing.com/publications.html

18. MORTALITY, PREDATION, AND SPACE USE OF GREATER SAGE-GROUSE IN BIGHORN BASIN

Beth Orning, M.S. Candidate-Department of Wildland Resources, Utah State University, Logan, Utah, and Julie K. Young, Ph.D., USDA-WS, National Wildlife Research Center – Predator Research Facility and Department of Wildland Resources, Utah State University, Logan, Utah*

We are evaluating effects of predation on greater sage-grouse hen survival and nest success. Our objectives are to: (1) provide data on the types and impacts of predators on sage-grouse hens and their nests and (2) provide managers with additional information beyond habitat improvements that could enhance sage-grouse management. In 2011, we identified coyotes as the primary predator of sage-grouse and their nests. at two complexes within the Bighorn Basin Conservation Area. In 2012, we implemented an experimental design across three study sites to evaluate the impacts of coyotes. One site (Polecat Bench) received intensive coyote removal during nesting and brood rearing, a second site (Fifteen Mile) received moderate coyote removal in the form of existing management removal actions to increase game herds, and the third site (Oregon Basin) received no removals and served as the experimental control. Hen fate was measured via radio-telemetry. Nest fate was measured through hen monitoring and nest cameras. Predator occupancy and abundance was measured through scent stations, trail cameras, point counts, and scat transects. Survival, nest success, and abundance of predators were estimated using cox proportional hazard in Program R and nest survival, site occupancy and mark-recapture models in Program MARK. Initial analysis detected differences in survival across sites (Reg.Coef=-0.66, p= 0.21, 95%CI=0.19, 1.43). No effect was found on the *dsr* of nests (β=-0.56, 95%CI=-1.78, 0.65) or the proportion of successful nests (χ^2=3.07, df=2, p=0.22) between sites. Further analysis of treatment effects will be analyzed using ANOVA, MLE, and linear regression to model vegetation and predator density effects on survival and nest success response in sage-grouse.

Table 1. Summary of capture, nesting and survival data for sage-grouse hens at three lek complexes in Bighorn Basin (April 2011 – September 2012).

	Oregon Basin	15 Mile∫∫	Polecat Bench
# VHF Radio-collared	29	16	24
# Nests	25**	10	24**
Nest Success (> 1 egg hatched)	12**	6	7**
Nest Depredations	9**∫	4	13
Other Losses (abandon, hen mortality during incubation)	4	0	4*
Hen Mortalities	16	5	7
Fate Unknown	0	0	1
% Depredations (of failed nests)	67	100	76
% Mortality	55	31	29

* One nest abandoned may also have been partially depredated

** Includes second nest attempts
∫ Includes a partial depredation
∫∫ From 2012 only

Funding provided by Meeteetse Conservation District, USDA-Wildlife Services, USDA-WS-National Wildlife Research Center, Wyoming Animal Damage and Management Board, and Wyoming Game and Fish Department. Support from Jim Pehringer and NW District WS Specialists.

19. LINKING SAGE-GROUSE NEST VEGETATION STRUCTURE DATASETS TO ECOLOGICAL SITES

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Project 1: Linking metrics of vegetation structure in sagebrush steppe to ecological site descriptions. A. Hild , G. Paige, A. Wuenschel

Ecological sites (ES) document the management unit based on soil, climate landscape position and the associated vegetative community function. Because ES is an accepted management unit for many public land management agencies, it is a critical component of management to document and clarify the relationship of ES to wildlife habitat. This study expands on spatial analyses documented in 2011, to document and model spatial relationships in sagebrush steppe in the same habitat resource areas near Pinedale, Wyoming. We revisited a subset of the 60 nest sites again in the summers 2010 and 2011 to record vegetation along transects using line point, gap and shrub belt monitoring methods. Our objectives are to document and precisely capture vegetative cover, relate the measures to less labor-intensive field measures commonly included in agency field methods and examine the spatial relationships within vegetative components of ESs. Characteristics that differ among ecological sites have been documented to differ near greater sage grouse nesting sites, implying that ecological sites vary in habitat quality. We have also found differences in vegetation structure around nest sites. This portion of the research is currently being analyzed and summarized.

Project 2: Quantifying Structure of Sage Grouse Nest Habitat at multiple scales.

G. Paige, A. Hild and K. Afratakhti.

A companion project to Project 1 (above), we are using some of the same datasets to quantify and describe sage-grouse nest habitat at a range of scales, using both ground based measures and remote sensing techniques. We delineated plot areas encompassing transects and collected ground-based LiDAR data to document vegetation distributions and complement traditional monitoring methods. This study is investigating and quantifying the horizontal and vertical distribution of vegetation structure at a range of scales in greater sage-grouse nesting habitat. It will also investigate how both fine and broad scale characteristics influence sage-grouse nesting habitat at the broad scales. This portion of the research is currently underway. We are currently seeking funding to allow a second summer of data collection for this project. The student is funded via UW sources.

Presentations 2012:

Wuenschel, A.E., A.L. Hild, G.B.Paige, M.J. Holloran. 2012. Ecological sites: another way to look at sage-grouse habitat. Ecological Society of America. Portland, Oregon. August 2012.

Wuenschel, A.E., A.L. Hild, G.B.Paige. 2012. Shrub Patterns among Ecological Sites in Sage-Grouse Nesting Habitat. Wildand Shrub Symposium. Las Cruces, New Mexico. May 2012. (Poster)

Wuenschel, A.E., A.L. Hild, G.B.Paige. 2012. Understanding greater sage-grouse habitat within the context of ecological sites. Front Range Student Ecology Symposium, Fort Collins, Colorado. February 2012. (Poster)

Wuenschel, A.E., G.B. Paige, A.L. Hild, M.J. Holloran, and K. Afratakhti. 2012. Linking metrics of sage-grouse habitat suitability to ecological site descriptions. Society for Range Management, Spokane, Washington. February 2012.

Afratakhti., K., G.B. Paige, S.N. Miller, A.E. Wuenschel, M.J. Holloran. 2012. A fuzzy logic approach to analyze suitability of greater sage-grouse nesting habitat. Society for Range Management, Spokane, Washington. February 2012.

20. EXAMINING THE EFFECTS OF NOISE FROM ENERGY DEVELOPMENT ON THE BREEDING BIOLOGY OF THE GREATER SAGE-GROUSE (*CENTROCERCUS UROPHASIANUS*)

Principal Investigator:

Gail Patricelli, Associate Professor, Dept. Evolution and Ecology, University of California, Davis

Additional Investigators:

Jessica L. Blickley, Ph.D. Candidate, Graduate Group in Ecology, UC Davis

Dr. Stacie L. Hooper, Postdoctoral Researcher, Dept. Evolution and Ecology, UC Davis

The goal of this project is to investigate the effects of noise from natural gas development on sage-grouse reproductive behaviors. Sage-grouse are declining in areas of energy development and evidence suggests that noise is a cause of this decline. This project has three major objectives: 1) Descriptive- characterize sounds produced by energy development and by sage-grouse, 2) Experimental – play back recorded noise on sage-grouse leks to determine whether noise impacts sage-grouse breeding behavior, and 3) Predictive - model sound propagation across the landscape in sagebrush habitat. To fulfill these objectives, we monitored noise sources in Sublette and Campbell counties that are associated with energy development, including drilling rigs, compressor stations, roads, and generators. We also conducted a noise playback experiment on leks in our study site in Fremont County from 2006-2009; this noise playback resulted in immediate, drastic, and sustained declines in lek attendance by male sage-grouse relative to paired controls. Males that remained on experimental leks had elevated fecal stress hormones compared to males on control leks. Currently, we are investigating the impact of noise on other breeding behaviors. We adapted landscape-level noise modeling software (NMSimNord) and are using it, along with our measurements from noise sources, to map the "acoustic footprint" of natural gas development in the Pinedale Anticline from 1998-2005. The National Park Service has provided us with scripts that will allow us to overcome limits of processing time and power in modeling 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 relative to other factors.

This research has been funded by grants from: the Bureau of Land Management, the Wyoming Sage-grouse Conservation Fund (via the Sage-grouse Local Working Groups), the Tom Thorne Sage-Grouse Conservation Fund (via the Wyoming Community Foundation), the National Fish and Wildlife Foundation, the National Parks Service, the National Science Foundation and the University of California, Davis

21. THUNDER BASIN SAGE-GROUSE STUDY

Dave Pellatz, Thunder Basin Grasslands Prairie Ecosystem Association; Bill Vetter & Amanda Hohnhorst, ICF International; Gwyn McKee, Thunderbird Wildlife Consulting; Matt Holloran, WY Wildlife Consultants; Tim Byer, USDA-Forest Service; Tracy Pinter, BLM.

Thunder Basin Grasslands Prairie Ecosystem Association began a pilot study in 2011 to determine if a team of scientists dedicated to capture could successfully equip with radio-transmitters a sample of female sage-grouse large enough to warrant the pursuit of further research objectives. The pilot study was successful and collaring efforts continued in 2012. The project area encompasses portions of southern Campbell County, northern Converse County, western Weston County, and northwestern Niobrara County, Wyoming.

Two primary research objectives have been identified: 1) Determine sage-grouse seasonal use of sites treated to manage cheatgrass and how those treatments influence sage-grouse demographics, 2) Determine spatial arrangement (i.e., size and juxtaposition) of sagebrush patches required for sage-grouse selection and success. If funding is available, a secondary objective will be to determine managerially-effective spatial relationships of habitat types across a landscape being managed for "competing" wildlife species such as sage-grouse and mountain plovers.

Results from the 2011 and 2012 trapping confirm that females are difficult to locate and trap in the general area of study. Thirty-five grouse were being tracked in 2012, 26 from 2012 collaring efforts and 9 from 2011. Of these, seventeen were female. Tracking will continue through the winter and collars will be removed from the males next spring.

To augment data collection, motion activated cameras were installed at 18 leks overlapping portions of the collaring area. Data from these cameras allowed us to gain a better understanding of lek activity levels and disturbances and monitor impact on lek activity from collaring efforts.

Funding/In-Kind: Cloud Peak Energy, Peabody Energy, NE Wyoming Sage-grouse Working Group, Thunder Basin Grasslands Prairie Ecosystem Association, Bureau of Land Management, WY Wildlife Consultants, Wyoming Wildlife and Natural Resource Trust.

22. USE OF GENETIC DATA TO DETECT ISOLATION AND TIMING OF ISOLATION OF GREATER SAGE-GROUSE POPULATION IN NORTHWEST WYOMING

Sarah Schulwitz,[1] Bryan Bedrosian,[2] Jeff Johnson[1]

[1]*Department of Biological Sciences, University of North Texas;* [2]*Craighead Beringia South*

Recent range-wide, genetic-based studies on Greater Sage-Grouse (*Centrocercus urophasianus*) have identified multiple isolated populations with reduced genetic diversity. These studies, however, excluded a population within Teton National Park, located north of Jackson, WY, which is surrounded by potential natural dispersal barriers as well as recent anthropogenic habitat fragmentation. Using 16 microsatellite loci, we analyzed 300 Greater Sage-Grouse samples collected near Jackson, to the northeast of Jackson (Gros Ventre), in west-central (Pinedale) and east Wyoming (Powder River Basin), and in southeast Montana (Big Horn Basin) to determine levels of genetic diversity and the degree of connectivity of the Jackson population with surrounding populations. We found that significant population differentiation existed among Sage-Grouse populations with data suggesting that the Jackson population is isolated relative to the other sampled populations, particularly Pinedale, its closest neighboring large population. Additionally, the Gros Ventre and Jackson populations exhibited significantly reduced levels of genetic diversity relative to other sampled populations. Current work is aimed at determining the timing of divergence (i.e. historic or recent) of the Jackson population relative to surrounding populations in Wyoming. Sequence data at five nuclear introns and mitochondrial control region-I & II is currently being generated for a subset of individuals from Jackson, Gros Ventre, Pinedale and Powder River Basin. Single nucleotide polymorphisms (SNPs) will be identified at each locus and be subsequently used in coalescent-based analyses to determine approximate timing of Jackson Sage-Grouse isolation. These results will be necessary for making informed decisions for future management of the Jackson Greater Sage-Grouse population.

Funding for the Jackson connectivity project was obtained from Upper Snake River Basin Sage-Grouse Working Group, Wyoming Game & Fish Department, Craighead Beringia South, University of Wyoming, Grand Teton National Park, Jackson Hole Airport, US Forest Service and Bureau of Land Management. Funding for the Sage-grouse SNP project was obtained through University of Wyoming-National Park Service Research Center.

23. SAGEBRUSH SEEDLING ESTABLISHMENT USING COPPER TREATMENT, AND WATER RETENTION CRYSTALS ACROSS THREE SITE CONDITIONS

Catherine Tarasoff – School of Forest Resources and Environmental Science, Michigan Technological University. 1400 Townsend Drive, Houghton, MI. ctarasof@mtu.edu.

Our objective is to develop a protocol to improve seedling transplant survival and growth sagebrush on restored bentonite mines in the Big Horn Basin. Our results will be used to systematically create healthy, fertile islands within critical sage-grouse habitat.

We compared transplant survival and growth across three mined soil conditions:

1. Newly prepared with excellent soil (live cast)
2. Newly prepared with moderate soil (5-30 yr old stockpiled topsoil)
3. Failed restoration efforts

The treatments were:

1. Control – untreated containerized seedlings
2. Copper – seedlings treated with cupric carbonate
3. Untreated + crystals - untreated seedlings transplanted with water retention crystals
4. Copper + crystals - cupric carbonate treated seedlings transplantedwith water retention crystals

Seedlings were transplanted April 2011. Survival was very high across all soil types and treatments in September 2011, indicating very low transplant shock and summer drought stress. Most mortality occurred over the winter of 2011-12. June 2011, survival remained high on the excellent and moderate sites (60-100%) but variable (0-95%) on failed sites. June 2012, stem diameter and canopy volume were added to the assessment. Of the plants that survived, heights ranged from 15-20 cm (excellent and moderate) versus 3-10 cm (failed). Stem diameter and canopy volume reflect a similar trend. Therefore, site condition is the most important factor influencing plant survival and growth. However, as a cautionary note, we did record higher incidences of cheatgrass in June 2012 on the livecast soil (excellent) than the moderate (stockpiled) soil.

Project support has come from:
M-I Swaco
American Colloid
Wyoming Wildlife and Natural Resource Trust Fund
Big Horn Basin Sage-grouse Local Working

24. USING GPS SATELLITE TRANSMITTERS TO ESTIMATE SURVIVAL, DETECTABILITY ON LEKS, LEK ATTENDANCE, INTER-LEK MOVEMENTS, AND BREEDING-SEASON HABITAT USE OF MALE GREATER SAGE-GROUSE IN NORTHWESTERN COLORADO

Principal Investigator: Dr. Brett Walker, Avian Research Program, Colorado Parks and Wildlife, 711 Independent Ave., Grand Junction, CO 81505. Phone: 970-255-6125 (office), 970-778-0886 (cell). Email: brett.walker@state.co.us

Period Covered: June 11, 2011 – June 10, 2012

Despite untested assumptions, lek-count data are widely used to monitor populations of greater sage-grouse. Buffers around lek locations are also commonly used to identify and protect important sage-grouse areas. However, lek counts may not track actual changes in male abundance, and the effectiveness of lek buffers at reducing disturbance to breeding males and habitat has not been rigorously tested. Colorado Parks and Wildlife is color-banding and deploying solar GPS PTT transmitters on male greater sage-grouse and conducting double-observer counts and resighting at leks to obtain data on male survival, lek attendance, inter-lek movements, detectability, and diurnal and nocturnal habitat use around leks during the breeding season in the Hiawatha Regional Energy Development project area of NW Colorado and SW Wyoming. We captured and color-banded 42 non-juvenile (yearling or adult) males in fall-winter 2011-2012 and 25 juvenile males in late winter 2012. Of these 67 males, we deployed GPS transmitters on 47 (23 non-juveniles and 24 juveniles). Crews discovered 2 new leks in 2012 by checking clusters of previous early-morning locations of GPS males and confirmed strutting at 3 leks discovered in 2011. Crews conducted 90 standard counts at 26 leks, 131 mornings of resighting on 15 leks, and 58 unreconciled double-observer counts at 16 leks. Survival, lek attendance, and inter-lek movement data are still being analyzed. GPS transmitters documented round-trip seasonal movements of 34-58 km and one-way movements of 25-59 km. Problems with color-band retention were evident in spring 2012 and may preclude comparison of color-banded vs. GPS male survival.

Funding: Colorado Parks and Wildlife

Attachment C.
Wyoming Sage-Grouse Research Reports (through May 31, 2013)

The following list includes final research reports from WGF sage-grouse research or theses and dissertations from university research efforts. It does not include annual agency monitoring reports or popular press articles.

Bedrosian, B. and D Craighead. 2010. Jackson Hole sage grouse project completion report: 2007-2009. Craighead Beringia South. Kelly, Wyoming. Includes 4 appended reports:

A: Common raven activity in relation to land use in western Wyoming: Implications for greater sage grouse reproductive success.

B: Critical winter habitat characteristics of greater sage-grouse in a high altitude environment.

C: Sage grouse baseline survey and inventory at the Jackson Hole Airport.

D: Sage-grouse chick survival rates in Jackson Hole, Wyoming.

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Bui, T.D. 2009. The effects of nest and brood predation by common ravens (*Corvus corax*) on greater sage-grouse (*Centrocercus urophasianus*) in relation to land use in western Wyoming. Thesis. University of Washington, Seattle.

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Kuipers, J. L. 2004. Grazing system and linear corridor influences on Greater Sage-grouse habitat selection and productivity. Thesis. University of Wyoming, Laramie.

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Bates Hole/Shirley Basin
Local Working Group Area
Job Completion Report

Period Covered:
June 1, 2012 – May 31, 2013

Prepared by: **Justin Binfet**
Wyoming Game and Fish Department

January 14th, 2014

Sage Grouse Job Completion Report

Year: 2004 - 2013, Working Group: Bates Hole

1. Lek Attendance Summary (Occupied Leks) (1)

a. Leks Counted

Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek (2)
2004	163	52	32	1723	38.3
2005	186	59	32	3358	60.0
2006	195	63	32	3844	63.0
2007	205	56	27	2433	45.9
2008	211	62	29	2226	37.1
2009	212	60	28	1611	29.3
2010	215	109	51	2485	27.0
2011	218	103	47	1670	19.9
2012	219	79	36	1222	20.0
2013	220	78	35	969	16.4

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2004	163	72	44	1465	31.2
2005	186	100	54	2396	31.5
2006	195	116	59	3421	38.4
2007	205	110	54	2913	36.9
2008	211	103	49	2031	27.4
2009	212	100	47	1693	23.5
2010	215	65	30	861	17.6
2011	218	95	44	895	14.9
2012	219	89	41	779	13.0
2013	220	96	44	759	13.8

1) Occupied - Active during previous 10 years (see official definitions)

2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

3) Inactive - Confirmed no birds/sign present (see official definitions)

Sage Grouse Job Completion Report

Year: 2004 - 2013, Working Group: Bates Hole

1. Lek Attendance Summary (Occupied Leks) (1) Continued

c. Leks Checked

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek (2)
2004	163	124	76	3188	34.7
2005	186	159	85	5754	43.6
2006	195	179	92	7265	48.4
2007	205	166	81	5346	40.5
2008	211	165	78	4257	31.8
2009	212	160	75	3304	26.0
2010	215	174	81	3346	23.7
2011	218	198	91	2565	17.8
2012	219	168	77	2001	16.5
2013	220	174	79	1728	15.2

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2004	94	28	41	122	77.0	23.0
2005	136	9	41	145	93.8	6.2
2006	152	3	40	155	98.1	1.9
2007	134	8	63	142	94.4	5.6
2008	135	35	41	170	79.4	20.6
2009	130	33	49	163	79.8	20.2
2010	143	17	55	160	89.4	10.6
2011	159	46	13	205	77.6	22.4
2012	133	30	56	163	81.6	18.4
2013	120	68	32	188	63.8	36.2

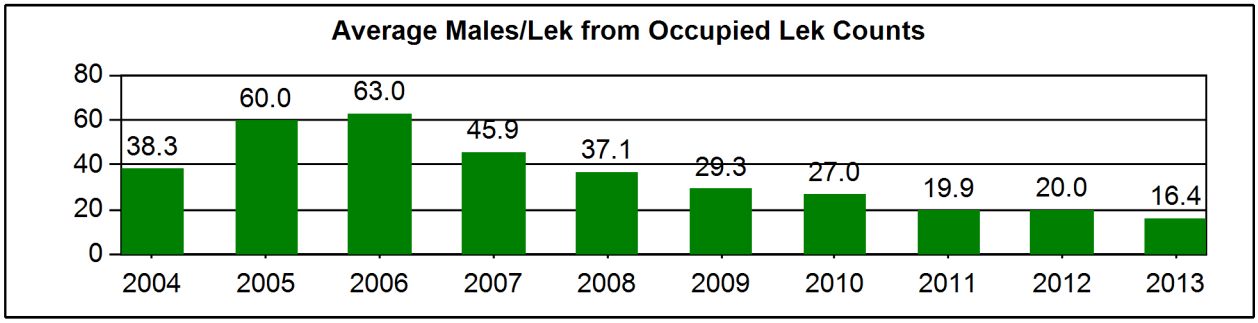
1) Occupied - Active during previous 10 years (see official definitions)

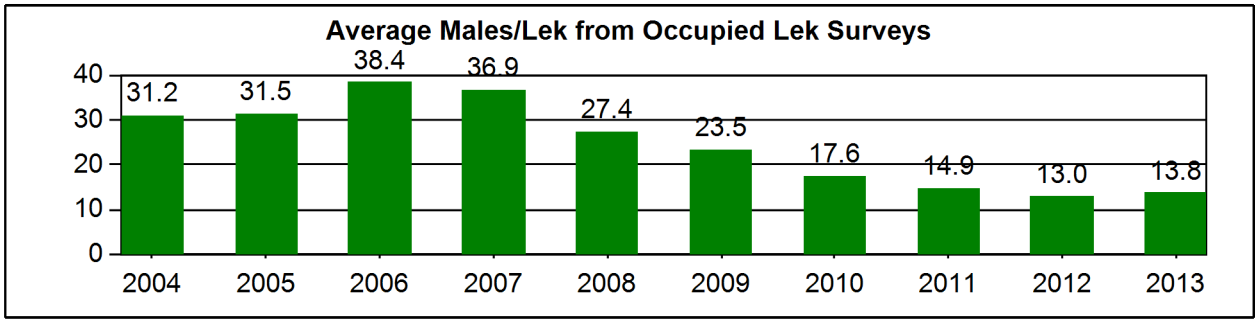
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

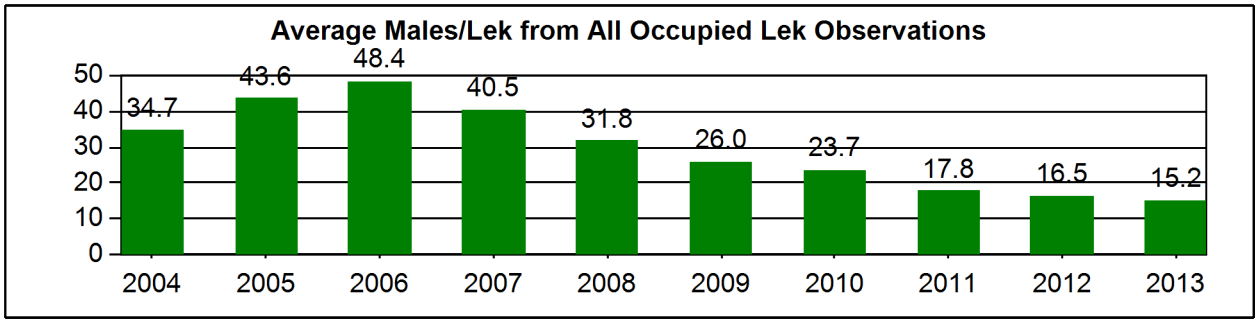
3) Inactive - Confirmed no birds/sign present (see official definitions)

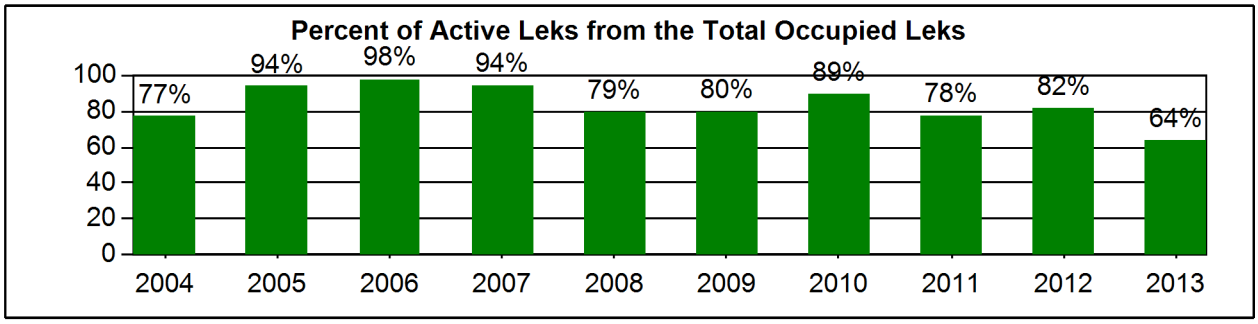
Sage Grouse Occupied Lek Attendance Summary

Year: 2004 - 2013, Working Group: Bates Hole



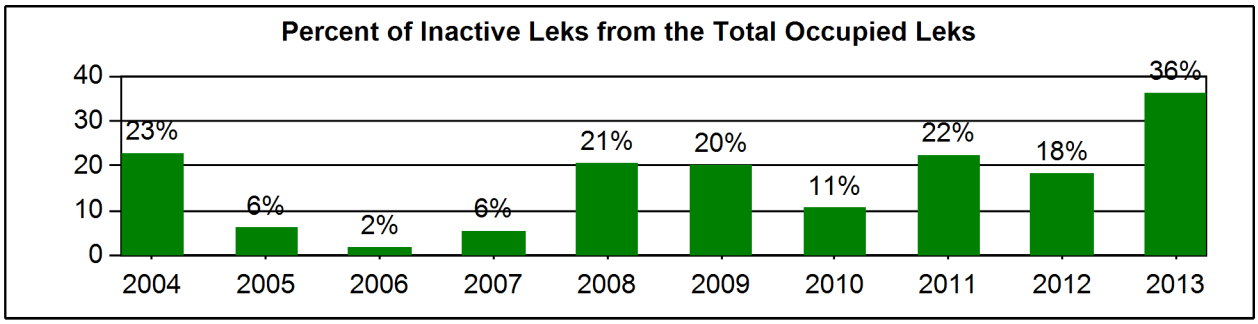






Sage Grouse Occupied Lek Attendance Summary

Year: 2004 - 2013, Working Group: Bates Hole



Sage Grouse Job Completion Report

Year: 2003 - 2012, Management Area: F

4. Sage Grouse Hunting Seasons and Harvest Data

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

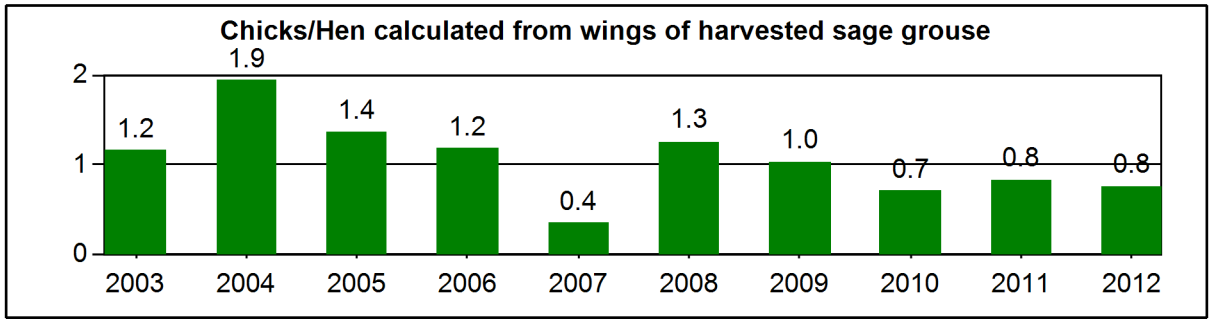
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2003	623	318	626	1.0	2.0	2.0
2004	1237	583	1071	1.2	2.1	1.8
2005	2304	925	1734	1.3	2.5	1.9
2006	1672	717	1169	1.4	2.3	1.6
2007	1365	655	1155	1.2	2.1	1.8
2008	1295	654	1161	1.1	2.0	1.8
2009	1026	532	956	1.1	1.9	1.8
2010	1027	480	1001	1.0	2.1	2.1
2011	1117	514	981	1.1	2.2	1.9
2012	688	415	852	0.8	1.7	2.1
Avg	1,235	579	1,071	1.1	2.1	1.9

Sage Grouse Job Completion Report

Year: 2003 - 2012, Management Area: F

5. Composition of Harvest by Wing Analysis

Year	Sample Size	Percent Adult		Percent Yearling		Percent Young		Chicks/ Hens
		Male	Female	Male	Female	Male	Female	
2003	214	20.6	24.3	2.8	11.2	19.6	21.5	1.2
2004	308	13.6	24.7	1.3	4.2	24.0	32.1	1.9
2005	372	17.5	25.8	3.0	7.8	21.5	24.5	1.4
2006	305	29.8	22.6	4.3	7.5	13.1	22.6	1.2
2007	546	19.4	53.5	4.2	2.9	8.4	11.5	0.4
2008	217	12.0	26.7	5.5	9.7	17.1	29.0	1.3
2009	314	12.7	26.1	9.2	12.1	17.8	22.0	1.0
2010	284	13.0	35.2	5.6	12.3	13.4	20.4	0.7
2011	224	17.9	34.8	4.9	7.1	15.6	19.6	0.8
2012	171	18.1	34.5	1.2	11.1	19.3	15.8	0.8



Introduction

Sage-grouse are found throughout the Bates Hole/Shirley Basin Local Working Group (BHSBLWG) area in the sagebrush/grassland habitats of Bates Hole, Shirley Basin, the South Fork of the Powder River Basin, foothills of the Laramie Range and Rattlesnake Hills, and in northern Platte/southern Niobrara Counties. Occupied habitat is fairly contiguous throughout much of Bates Hole and Shirley Basin. Habitats within the South Fork of the Powder River Basin are somewhat fragmented by changes in habitat type / sagebrush cover and oil and gas development. Occupied sage-grouse habitat in the Laramie Range is primarily limited to the west slope including portions of the Laramie Plains. Large contiguous blocks of sagebrush/grassland communities east of the Laramie Range have been largely eliminated. Occupied habitat within the BHSBLWG area is nearly evenly split between private and public ownership. Approximately 51% of the known leks are found on private land with the remaining 49% found on Forest Service, Bureau of Land Management, Bureau of Reclamation, and Wyoming State Trust lands.

Sage-grouse management data collected by the WGFD focuses on lek counts and surveys, harvest statistics, brood surveys, and analysis of wings collected from harvested birds. Lek counts and surveys have been conducted within the BHSBLWG area since the 1950s. Lek counts are conducted in April and early May as per WGFD protocol (WGFD 2007). Individual leks are counted 3 or more times at 7 – 10 day intervals. Lek counts are conducted to estimate population trend based on peak male attendance. Lek surveys are also conducted in the spring, but are typically conducted only one time per lek to determine general lek activity status (e.g., active, inactive, or unknown). More detailed lek definitions are attached to the Statewide JCR. Limited sage-grouse brood data is also collected during July and August. Brood counts provide some indication of chick production and survival, although their use is limited in estimating recruitment due to sampling design being neither systematic nor repeatable, with sample sizes typically being small. Where available, wing data from harvested sage-grouse provide a more reliable indicator of chick production and recruitment.

Past and current management of sage-grouse within the BHSBLWG area has focused mainly on the protection and/or enhancement of sagebrush habitats and protection of leks and nesting buffers from surface disturbing activities during the breeding/nesting season. Protection efforts have primarily occurred via controlled surface use or timing stipulations attached to state and federally permitted projects and through ongoing revision of BLM Resource Management Plans. Sage-grouse habitat protection has been increasingly important given the potential listing under the Endangered Species Act. As a result, the State of Wyoming adopted a core area management strategy through Governor's Sage Grouse Executive Order 2011-5. This strategy enhances protections to sage-grouse within delineated core areas, which were further refined in 2010 (version 3). Core areas have been delineated to encapsulate important sage-grouse habitats throughout Wyoming thereby increasing protections for the majority of sage-grouse occurring in the State. Protections applied to sage-grouse habitats outside of core areas are less stringent than those within core areas in an attempt to incentivize natural resource development outside of the best remaining sage-grouse habitats.

Most sage-grouse populations in Wyoming are hunted, though some portions of the state have been closed to sage-grouse hunting to protect small, isolated populations (i.e., in the southeast, northeast, and northwest portions of the state). A technical review of hunting seasons and harvest of sage-grouse in Wyoming was developed by the Wyoming Game and Fish Department (WGFD 2008). This document details the role of hunting seasons and public use of sage-grouse populations, potential impacts, and management actions taken by the Department to implement more conservative harvest

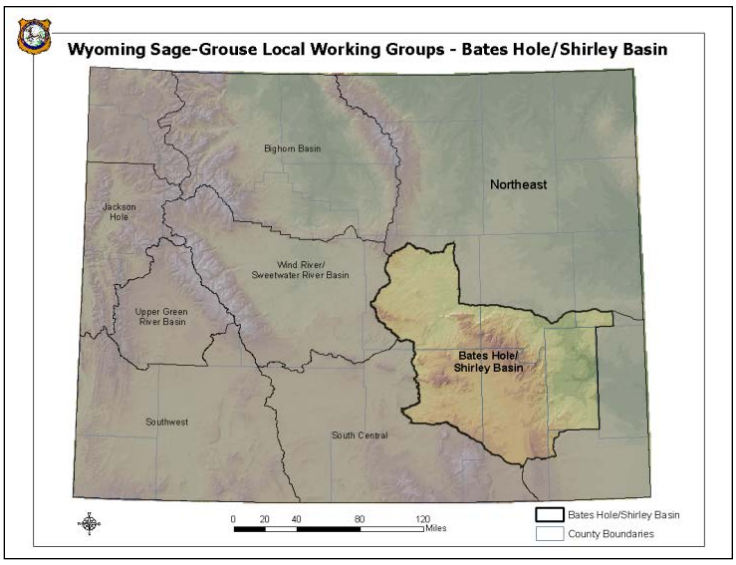
strategies dating back to the mid-1990's. Within sage-grouse populations having less than 100 males attending leks, hunting seasons should be closed to prevent additive mortality on small, isolated populations (BHSBLWG 2007). Hunting seasons have thus been closed in Niobrara, Platte, Goshen and Laramie Counties, and in the majority of Converse, Weston and Crook Counties. In addition, seasons were closed in the eastern portion of Natrona County including the Hat Six area southeast of Casper. Within these areas, sage-grouse populations occur in small, isolated patches of suitable habitat on the fringe of sage-grouse range. Within these small populations, harvest mortality is far more likely to be additive and potentially detrimental. Within the remaining portion of the BHSBLWG area where robust sage-grouse populations occur, conservative hunting seasons continue to occur each year.

Historically, sage-grouse hunting seasons opened in early September. Research investigating the impacts of hunting on sage-grouse populations indicated a late September opening date had a decreased impact on hen survival, and may increase recruitment compared to an early September season (Braun and Beck 1996, Heath et al. 1997, Connelly et al. 2000). This is due to successful hens with broods being typcially more widely distributed across the landscape in later September, which decreases harvest pressure on the most successful segment of the population. In early September, hunters tend to disproportionately focus harvest pressure on successful hens with broods as they are relatively easy to locate, especially near water sources. Sage-grouse seasons within most of the BHSBLWG area currently span two or three weekends, opening the third Saturday in September and closing September 30. From 1982 – 2001, bag and possession limits were 3 per day and 6 in possession. Since 2002, bag and possession limits have been reduced throughout the BHSBLWG area to 2 per day and 4 in possession.

Local Working Group Area

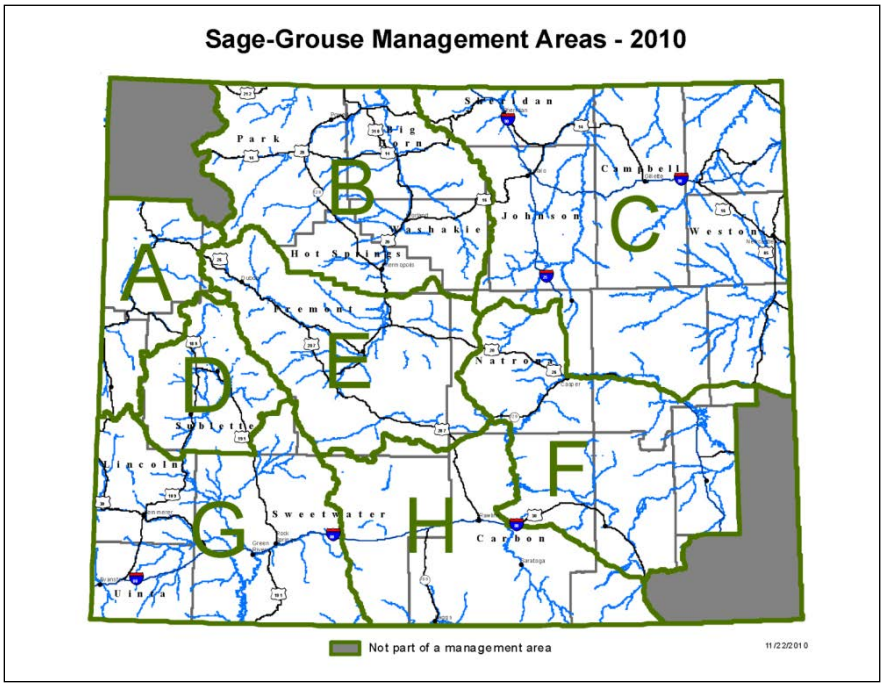
The BHSBLWG area includes Bates Hole, the Shirley Basin, the Rattlesnake Hills, the southern Bighorn Mountains, the Laramie Range, and isolated occupied habitats in southern Niobrara and Platte County (Figure 1). Political jurisdictions include Albany, Carbon, Converse, Laramie, Natrona, Niobrara, and Platte counties. This area is managed by the BLM (primarily the Casper and Rawlins Field Offices), the Bureau of Reclamation, the USDA Forest Service (Medicine Bow National Forest), the State of Wyoming, and private landowners. 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 within the BHSBLWG area include livestock grazing, wind energy development, oil and gas development, coal mining, and dry-land and irrigated crop production.

Figure 1. The Bates Hole/Shirley Basin Local Working Group Area.



The BHSBLWG area encompasses WGFD Small/Upland Game Management Area F (Figure 2). Management areas do not correspond to sage-grouse population boundaries. Rather, management areas are used for general data collection (including harvest) and reporting for all small and upland game species. Sage-grouse are well distributed throughout most of the BHSBLWG area. Sage-grouse are largely absent from most of Platte County, some of the Laramie Plains, and higher elevation timbered areas in the Laramie Range and Shirley Mountains.

Figure 2. The Bates Hole/Shirley Basin Local Working Group area and WGFD sage-grouse management areas.



Leks and Lek Complexes

A new sage-grouse database was developed in 2012 in order to improve efficiency, reduce errors, and better facilitate data analysis. Changes were made to the manner in which lek data are calculated and reported in Table 1. The new version is based solely on "occupied" leks. The past version suggested that was the case in the title of Table 1, but when unoccupied leks were monitored those data were also included in the Table. The result of this change is that the number of "known occupied" leks is now more accurate, but reflects fewer leks than in the previous version. Similarly, the new version calculates average male lek attendance using only monitoring observations where one or more male grouse were observed strutting. The old version included a count of "0" males for leks where activity was confirmed by the presence of sign but no birds were observed. Together, these two changes result in somewhat higher, but more accurate, average male attendance for active leks than previously reported. The changes do not result in any change in population trend based on average male lek attendance. Interpreted population increases and decreases over time remain the same so no revisions to past reports are required.

Sage-grouse, and therefore occupied leks, are well distributed throughout most of the BHSBLWG area (Figure 3). Much of the historic range in Platte County is no longer occupied due to large scale conversions of sagebrush grasslands to cultivated fields. The Wyoming Game and Fish Department summarizes lek monitoring data each year. As of spring 2013, there are 217 known occupied leks, 61 unoccupied leks, and 28 leks of an undetermined classification within the BHSBLWG area (Figure 4). Lek definitions are presented each year in the statewide Job Completion Report and as a standalone document available upon request (WGFD 2010). Undoubtedly, there are leks within the BHSBLWG area that have not yet been identified, while other un-discovered leks have been abandoned or destroyed. The majority of leks classified as "undetermined" lack sufficient data to make a valid status determination. In these cases, historic data indicates these leks were viable at one point, with the leks subsequently being either abandoned or moved. However, location data is either generic or suspect in many of these cases, further confounding the ability to determine the status of these leks.

Figure 3. Sage-grouse lek distribution and core areas within the BHSBLWG area, 2013.

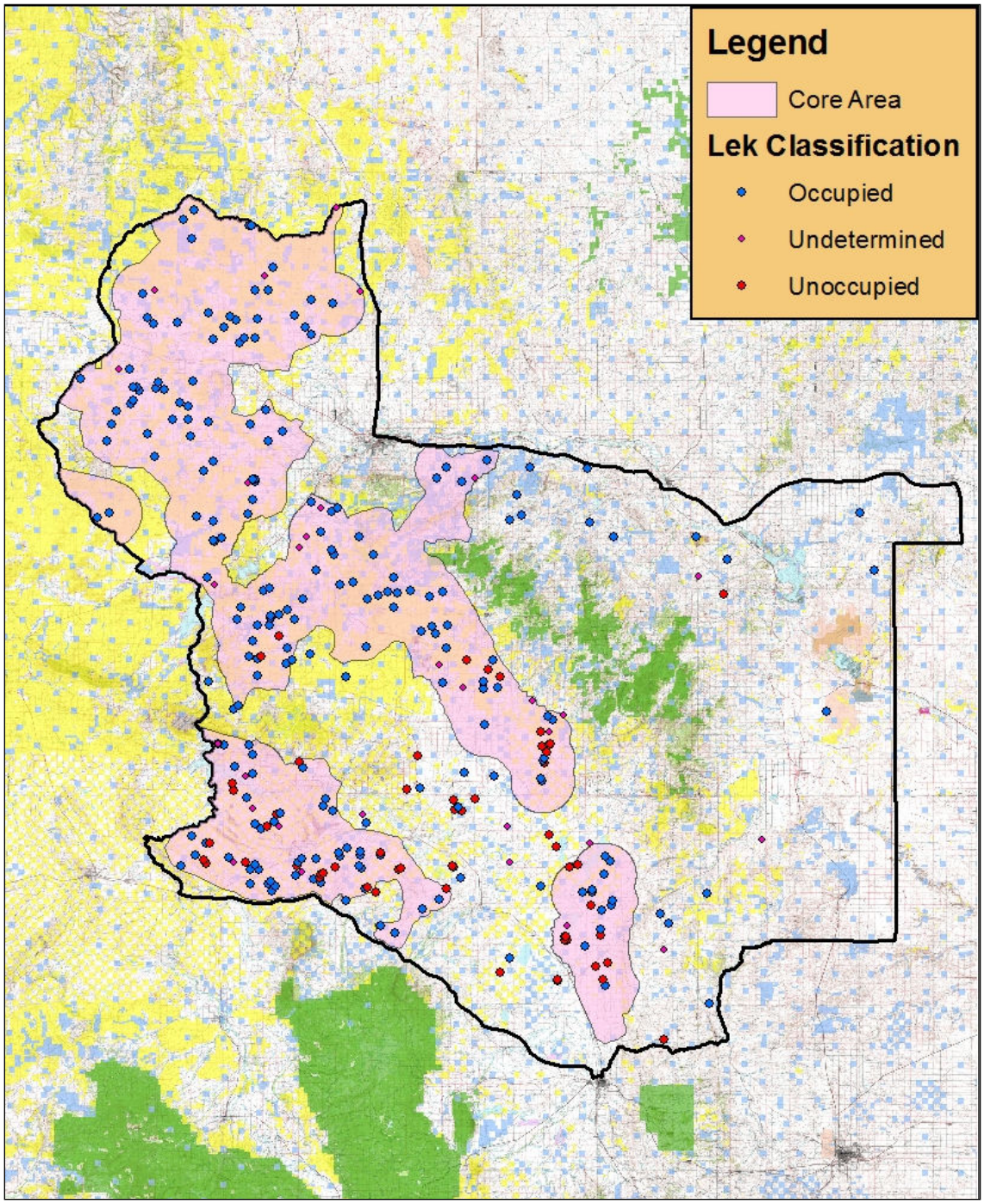


Figure 4. Sage-grouse lek demographics within the BHSBLWG area, 2013.

Sage Grouse Lek Characteristics

Working Group: Bates Hole

Region	Number	Percent
Casper	121	39.5
Lander	2	0.7
Laramie	183	59.8

Working Group	Number	Percent
Bates Hole	306	100.0

Classification	Number	Percent
Occupied	217	70.9
Undetermined	28	9.2
Unoccupied	61	19.9

BLM Office	Number	Percent
Casper	118	38.6
Lander	2	0.7
Newcastle	1	0.3
Rawlins	185	60.5

Biologist	Number	Percent
Casper	112	36.6
Douglas	9	2.9
Laramie	107	35.0
Rawlins	2	0.7
Saratoga	69	22.5
Wheatland	7	2.3

Warden	Number	Percent
	1	0.3
Cheyenne	2	0.7
Douglas	3	1.0
East Casper	36	11.8
East Rawlins	2	0.7
Elk Mountain	70	22.9
Glenrock	8	2.6
Lusk	1	0.3
Medicine Bow	67	21.9
North Laramie	39	12.7
West Casper	71	23.2
Wheatland	6	2.0

County	Number	Percent
Albany	73	23.9
Carbon	109	35.6
Converse	11	3.6
Laramie	3	1.0
Natrona	103	33.7
Niobrara	1	0.3
Platte	6	2.0

Land Status	Number	Percent
BLM	112	36.6
BLM/Private	2	0.7
BOR	1	0.3
Not Determined	2	0.7
Private	162	52.9
State	26	8.5
USF&WS	1	0.3

Management Area	Number	Percent
F	306	100.0

Lek Status	Number	Percent
Unknown	306	100.0

Lek counts and lek surveys have been conducted within the area since the late 1950's, although historically on only a small number of leks. Since 1998, lek monitoring effort has expanded significantly, resulting in relatively consistent data sets over the last 16 years, enabling meaningful comparisons of current sage-grouse data to a running 10-year average. In 2013, personnel checked 174 known occupied and undetermined leks in the BHSBLWG area. A total of 78 leks were counted

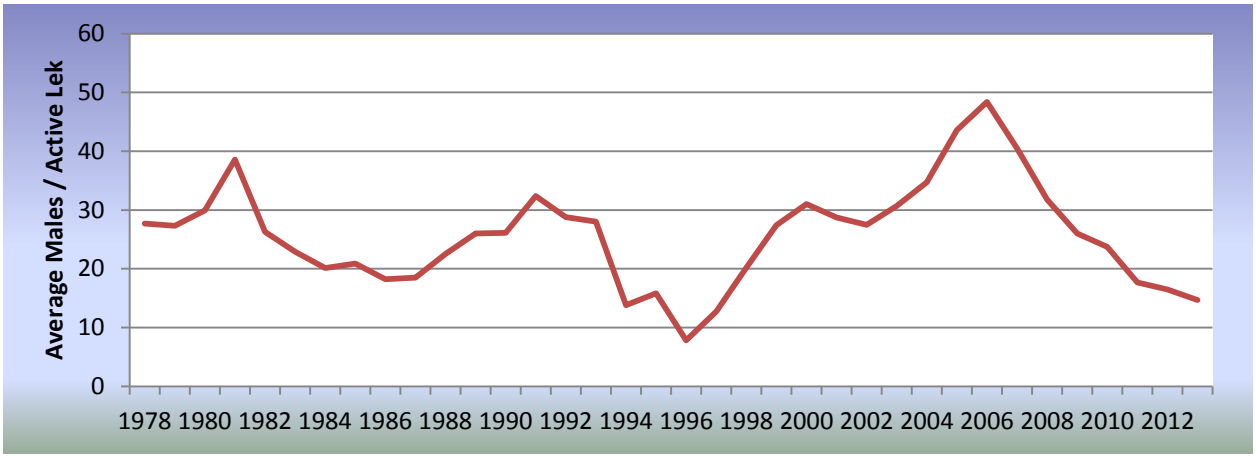
while 96 leks were surveyed in 2013. Of the leks checked where annual status was confirmed, 120 were active and 68 were inactive. This equates to 36% of leks with confirmed annual status being inactive. A total of 32 leks were of unknown status. This marked a significant increase in the number of inactive leks in 2013, as only 30 (19%) of 162 leks with confirmed status were determined to be inactive in 2012. Undoubtedly, the substantial population decline realized within the BHSBLWG area since 2006 has resulted in many smaller leks becoming inactive (see Population Trend discussion). It is important to consider trends in the numbers of active versus inactive leks in addition to the average size of active leks. During a period of population decline, the size of active leks typically declines and the number of inactive leks increases. The converse is typically true of an increasing population. Therefore the magnitude of both increases and decreases is usually greater than what is indicated by the average lek size alone. Average female lek attendance is not reported since our data collection technique is not designed to accurately capture these data and is therefore not useful in assessing population trend.

Population Trend

Monitoring male attendance on leks provides a reasonable index of sage-grouse population trend over time. Nevertheless, these data must be interpreted with caution for several reasons: 1) the survey effort and the number of leks surveyed/counted has varied over time, 2) it is assumed that not all leks in the area have been located, 3) sage-grouse populations exhibit cyclic patterns (Fedy and Doherty 2010), 4) the effects of unlocated or unmonitored leks that have become inactive cannot be quantified or qualified, and 5) lek sites may change over time. Both the number of leks and the number of males attending these leks must be quantified in order to estimate population size. Fluctuations in the number of grouse observed on leks over time are not exclusively a function of changing grouse numbers. These data also reflect changes in lek survey effort due to weather conditions dictating access to monitor leks. Over the last 10 years, the average number of males observed per ***count*** lek increased from the early 2000's to a zenith of 63 in 2006, but has since declined to 16 in 2013. Male lek attendance has declined considerably from 2006 through 2013 as chick production and recruitment has been very poor over this time frame (see productivity discussion). The average number of males observed per ***count*** lek in 2013 is 58% below the previous 10-year average of 37.6, and was the lowest average recorded since intensive lek monitoring began in 1998. Following a period of substantial growth through 2006, sage-grouse populations have since declined by 75% based on the mean maximum number of males observed per counted lek.

Average peak male lek attendance obtained through surveys are strongly correlated with those obtained via lek counts in years when sample sizes exceed 50 leks (Fedy and Aldridge 2011). Since 1978, a minimum of 50 leks have been checked within the BHSBCA in all but 4 years (1992-1995) to determine annual population trend. The average number of males observed per active surveyed lek has fluctuated substantially over the last 35 years within the BHSBCA (Figure 6). After a precipitous decline in the mid-1990's, sage-grouse populations increased substantially to a zenith in 2006, but have since declined dramatically through 2013. The average number of males observed per *active* lek in 2013 (14.7) was the lowest recorded since 1996-1997, and was 44% below the long-term average (since 1978) of 26.3.

Figure 6. Mean number of peak males per ***active lek checked*** within the BHSBLWG area, 1978 – 2013.



*Less than 50 leks were checked each year from 1992–1995 (average of 33 leks checked each of those years).

Within the BHSBLWG area, 56 leks have been abandoned since the 1960's. The timing in which these leks were abandoned is usually difficult to determine due to gaps in data collection. Reasons for abandonment are unknown for many historic leks. It is unclear whether these leks have been abandoned due to natural sage-grouse population fluctuations over time or from anthropogenic disturbances such as natural resource development or poor grazing practices. Since 1998, many abandoned leks have been monitored, with no indication these leks have begun to be reoccupied. However, some of these leks may have never been legitimate leks, with one-time observations being recorded as leks. In addition, many of these leks have generic location-data, which further calls into question the veracity of the original lek designations. In cases where actual leks have been abandoned, such generic location-data makes (re)locating these leks much more difficult. Regardless, these leks should be maintained within the database until sufficient data has been collected to remove them as per WGFD lek monitoring protocol. Monitoring of abandoned/unoccupied leks has increased in recent years.

Productivity

Classifying wings based on sex and age from harvested sage-grouse provides a reasonable indicator of annual sage-grouse chick productivity. The sex and age composition of wings obtained from harvested birds is likely proportional to sex and age ratios available in the population. During fall hunting seasons, sage-grouse occur in mixed groups comprised of hens and chicks. Since hunting seasons open in late September, both barren and successful (with brood rearing) hens are typically found together. Therefore, harvest pressure is assumed to be equal across adult hens and chicks (of both sexes) as hunters do not typically differentiate between the two. Sampling bias is therefore assumed to be minimal (excluding mature males, which are typically under-harvested in proportion to the population due to some hunter selectivity) when calculating the chick:hen ratio. Summer brood surveys are also conducted, but do not provide as reliable an indicator of chick productivity given they are not conducted in a systematic and repeatable manner. In addition, many observations of sage-grouse occur along riparian areas during summer brood surveys, which may under-represent the number of barren hens occurring on uplands, thus biasing the actual chick:hen ratio. Therefore, brood survey data will not be discussed here.

Based on wing data, chick productivity was estimated to be 0.8 chicks per hen in 2012. Over the last 10 years, wing-barrel estimated productivity has fluctuated between 0.4 and 1.9 chicks per hen. In general, chick/hen ratios of about 1.5:1 result in relatively stable lek counts the following spring, while chick/hen ratios of 1.8:1 or greater result in subsequent increased lek attendance and ratios below 1.2:1 result in decline (WGFD 2007). The 2012 ratio marked the eighth consecutive year of moderate to poor chick production/survival (below 1.5 chicks/hen), resulting in population decrease. Such population decrease has been detected in the aforementioned lek attendance data. It is unknown whether the declining number of chicks observed in the harvest in recent years is due to poor nest success or chick survival, increased predation, deteriorating habitat conditions, or any combination thereof. The poor chick production/survival observed since 2007 may also be attributed to the colder and wetter springs prevailing since 2007, which may have led to increased nest abandonment/failure or poor early brood survival. Cold wet weather can be especially detrimental to sage-grouse hatchlings and juveniles during the first few weeks of life.

Harvest

Hunter and harvest statistics provide insight into trends in wildlife populations. Typical of upland game bird populations, there is usually a direct correlation between sage-grouse population levels and hunter effort and harvest. As sage-grouse numbers decrease, hunter harvest generally declines. Conversely, when populations increase, sage-grouse hunting effort and harvest generally increases. Harvest data specific to the BHSBLWG area was obtainable starting in 1982. Prior to 1982, harvest data was recorded by county and not by management areas. Since 1982, overall sage-grouse harvest has declined considerably within the BHSBLWG area. Harvest peaked in 1983 at 14,180 birds and subsequently declined to an historic low of 688 in 2012 (Figure 7). Over the last 10 years within the BHSBLWG area, trends observed in harvest data generally mirror those observed in male lek attendance from the spring (Figure 8). Over the same time frame, sage-grouse harvest declined considerably from 2000 – 2002, increased through 2005, and has generally declined over the last 7 years as sage-grouse populations have declined.

Figure 7. Total sage-grouse harvested per year within the BHSBLWG area, 1983 – 2012.

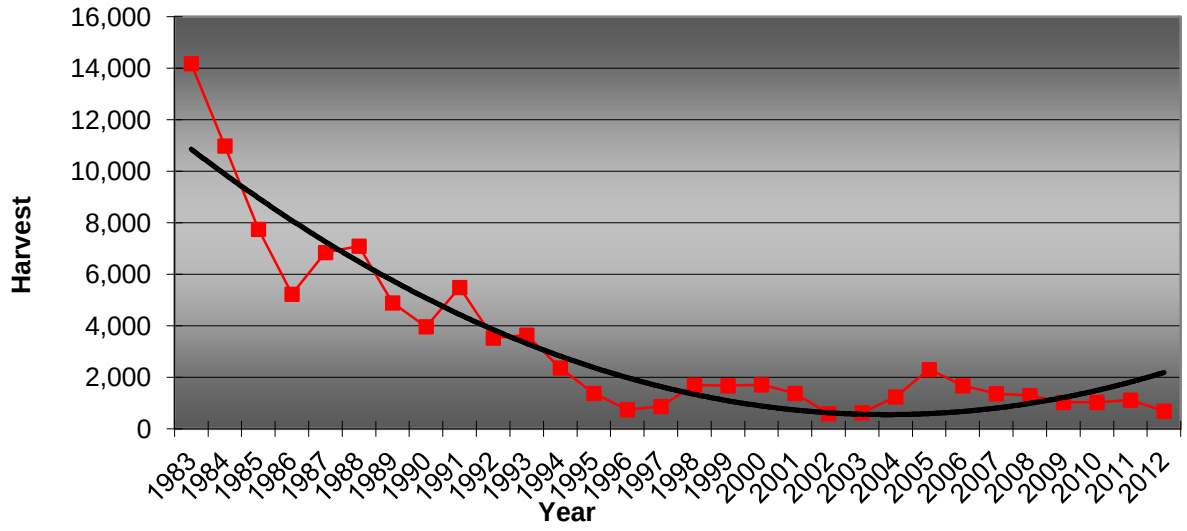
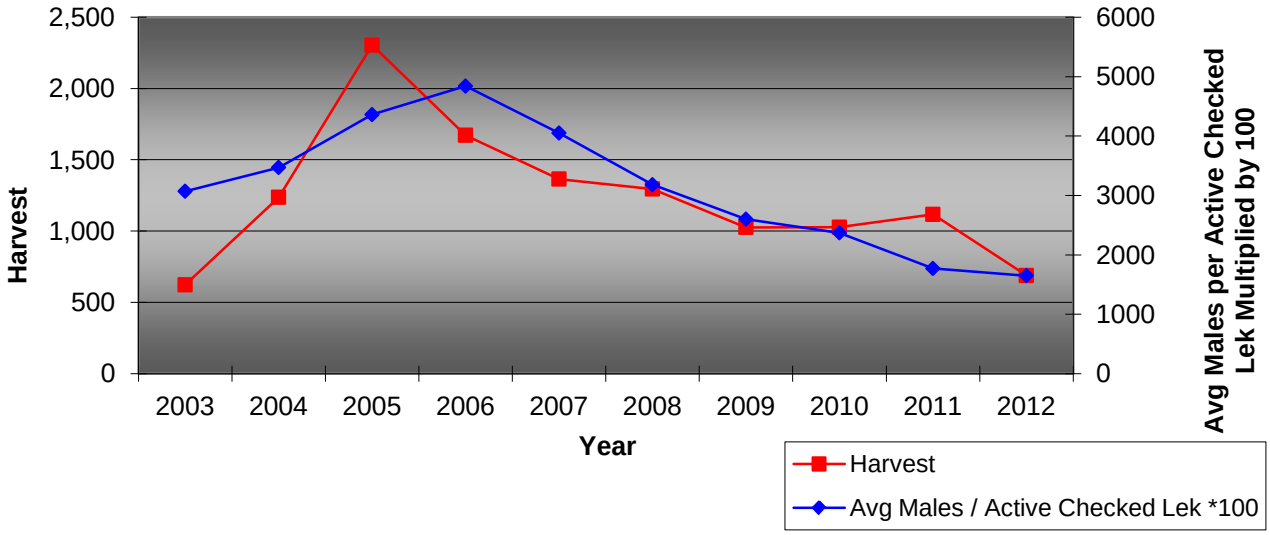


Figure 8. Total sage-grouse harvested per year and the average number of males per active lek checked within the BHSBLWG area, 2003 – 2012.



Hunter participation and harvest declined dramatically in Wyoming when the Wyoming Game and Fish Commission reduced the bag limit and shortened the hunting season in 2002 (WGFD 2008). A similar reduction occurred in 1995 when the season was moved later into September. This decline occurred in spite of a concurrent population increase (based on males/lek), demonstrating the effects increasingly conservative hunting seasons have had on hunter participation in recent years. Managers are unable to quantify population response to changes in harvest levels within the BHSBLWG area. Research suggests harvest pressure can be an additive source of mortality within small isolated sage-grouse populations, but is generally compensatory at levels under 11% of the preseason population (Braun and Beck 1985, Connelly et al. 2000, Sedinger et al. 2010).

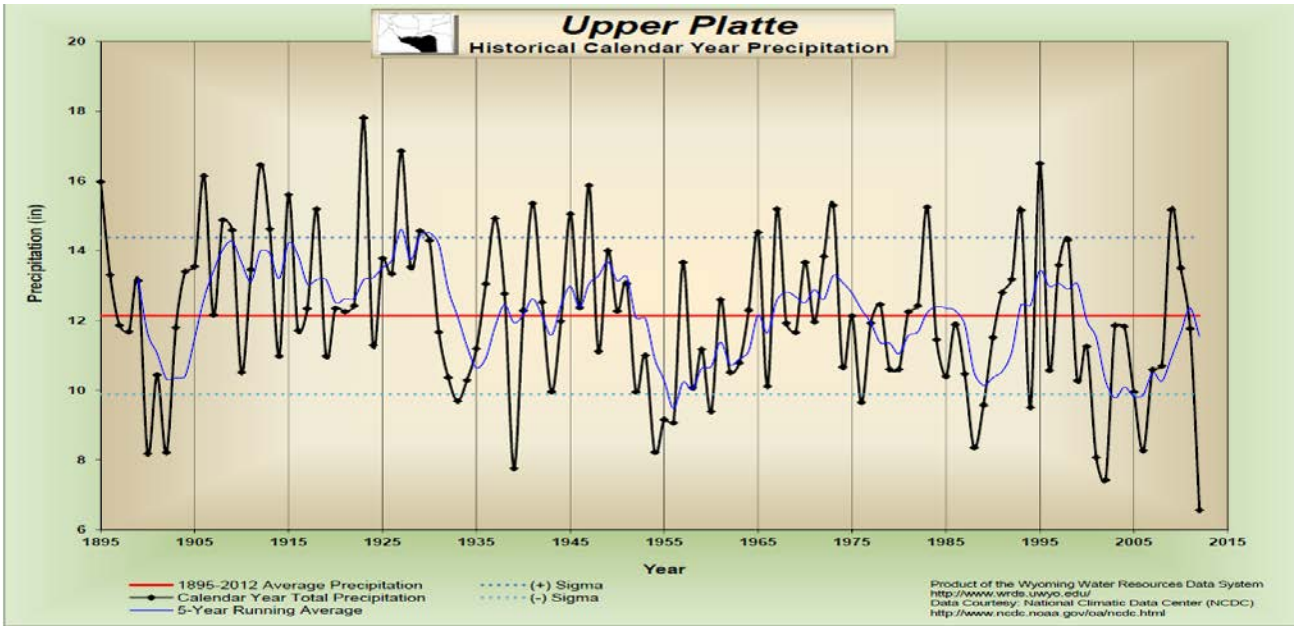
Habitat

There is little doubt sage-grouse habitat quality has declined over the past several decades throughout the BHSBLWG area. Increased human-caused disturbance (i.e., oil/gas, coal, uranium, and wind energy development), improper grazing by livestock and wildlife, sagebrush eradication programs, and long-term drought have all combined to negatively impact sage-grouse and their habitats. As the level of concern for sage-grouse and sagebrush ecosystems has risen, various habitat improvement projects have been planned and/or implemented throughout the BHSBLWG area. However, there is much debate among wildlife managers, habitat biologists, researchers, and rangeland specialists as to the efficacy of various forms of habitat treatments within sagebrush ecosystems. Given the long timeline required to reestablish sagebrush following treatment and the difficulty in measuring sage-grouse population level response to such treatments, habitat treatments designed to improve sagebrush ecosystem function should be conducted with extreme caution, especially in xeric sagebrush stands or in habitats containing isolated sage-grouse populations. Habitat treatments designed to improve sagebrush community health funded through the Governor's Sage-grouse Conservation Fund are detailed in Appendix I. Funding for all projects detailed in Appendix I was allocated via the BHSBLWG.

Weather

Based on the data obtained from the Wyoming State Climate Office, the Upper North Platte climatic division experienced the driest conditions on record during the 2012 growing season (Figure 9). This resulted in extremely poor sagebrush leader growth and herbaceous vegetation production in 2012. Because the spring of 2011 received excellent precipitation, some residual grass for 2012 nesting cover was present although there was little to no grass growth during the spring of 2012. In addition, forb production was extremely poor in 2012, which was likely detrimental to sage-grouse from an herbaceous and insect foraging standpoint. Despite warm dry conditions prevailing during the peak hatching period, such conditions may have caused elevated nest failure and abandonment and/or poor survival of newly hatched chicks during the early brood rearing phase. This may have been the primary driver behind yet another year of poor chick recruitment observed in the wing barrel data. It is unknown whether the population fluctuations over the last 10 years (increase through 2006 followed by subsequent decline) are a function of prevailing weather conditions or due to the cyclical nature of sage-grouse populations. The winter and early spring months of 2013 prior to the breeding season were near normal for temperatures and precipitation. In addition, the summer and fall of 2013 was far wetter than normal with excellent shrub and herbaceous vegetation production which should benefit sage-grouse entering the 2014 breeding season.

Figure 9. 2012 Water Year for the Upper North Platte drainage, Wyoming Climate Division 5 (http://www.wrds.uwyo.edu/sco/data/divisional_precip/divisional_precip.html)



Special Studies

Western EcoSystems Technology, Inc. has provided progress reports to Horizon Wind Energy for The Greater Sage-Grouse Telemetry Study for the Simpson Ridge Wind Energy Project, Carbon County, Wyoming. This report was not provided within this document, but may be available upon request from the project proponent. In summary, the consulting firm was hired to conduct a long-term research project to evaluate the impacts to sage-grouse from wind energy development within a defined core area. A technical committee was assembled to define research methodology and objectives. The committee included representation from state and federal agencies as well as reputable sage-grouse researchers. This research was partially funded from local sage-grouse working group funds. Field

work was initiated in 2009 and will continue through 2014 or 2015 contingent upon funding. In addition, a master's thesis was completed summarizing male lek attendance, seasonal habitat selection, and survival within this study area (LeBeau 2012). Male lek attendance was analyzed from 2008 – 2012, while radio-marked birds were monitored for seasonal habitat selection and survival in 2009 and 2010. The following was copied verbatim from the abstract of the thesis:

> "Greater sage-grouse did not avoid wind turbines during the nesting and brood-rearing periods, but did select for habitats closer to turbines during the summer season. Greater sage-grouse nest and brood survival decreased in habitats in close proximity to wind turbines, whereas female survival appeared not to be affected by wind turbines. Peak male lek attendance within both study areas experienced significant declines from 1 year pre development to 4 years post development; however, this decline was not attributed to the presence of the wind energy facility.
>
> The results from my study are the first examining the short-term impacts to greater sage-grouse populations from wind energy development. Greater sage-grouse were not avoiding the wind energy development two years following construction and operation of the wind energy facility. This is likely related to high site fidelity inherent in sage-grouse. In addition, more suitable habitat may exist closer to turbines at Seven Mile Hill, which may also be driving selection. Fitness parameters including nest and brood survival were reduced in habitats of close proximity to wind turbines and may be the result of increased predation and edge effects associated with the wind energy facility. Lastly, wind energy infrastructure appears not to be affecting male lek attendance 4 years post development; however, time lags are characteristic in greater sage-grouse populations, which may result in impacts not being quantified until 2–10 years following development. Future wind energy developments should identify greater sage-grouse nest and brood-rearing habitats prior to project development to account for the decreased survival in habitats of close proximity to wind turbines. More than 2 years of occurrence data and more than 4 years of male lek attendance data may be necessary to account for the strong site fidelity and time lags present in greater sage-grouse populations."

Diseases

Two confirmed cases of West Nile virus in sage-grouse were documented in Wyoming in 2012. One of these was in Carbon County within the BHSBLWG area, with the other being in Big Horn County. Both were radio-marked sage-grouse within ongoing research projects. Only seven human cases were reported in Wyoming in 2012, among the lowest numbers reported in Wyoming since the virus arrived in the state a decade ago. While record-breaking hot temperatures (NOAA 2012) were favorable for West Nile viremia, the concurrent record-breaking lack of moisture (NOAA 2012) likely inhibited the life cycle of the *Culex tarsalis* mosquito. Normal monitoring efforts were in place. These consisted of requesting researchers with telemetered birds to monitor for mortality in late summer and attempt to recover and submit carcasses of dead birds to the Wyoming State Vet Lab for necropsy. WGFD field personnel, other agency personnel and the public (via press release), especially hay farmers, were also asked to report dead sage-grouse in a timely fashion. The extent of WNV infection and its effects on sage-grouse populations throughout the BHSBLWG area in recent years is unknown, but potentially significant. However, no data exists to indicate recent declines in the BHSBLWG area sage-grouse population can be specifically attributed to WNV.

Recommendations

1. Continue efforts to document seasonal habitat use throughout the BHSBLWG area, with emphasis on nesting, early-brood rearing, and winter habitats.

2. The BHSBLWG should continue to solicit conservation projects that will benefit sage-grouse. These include but are not limited to projects designed to enhance sagebrush understory herbaceous vegetation production, riparian corridor protection, wind energy related research, water development, livestock grazing management planning, etc.

3. Ensure monitoring of all count leks is conducted properly and consistently as per WGFD protocol on an annual basis (WGFD 2010). In addition, maximize overall lek monitoring efforts (including lek surveys) each year to ensure lek sample sizes are significant enough to adequately detect population change.

4. If possible, attempt to survey all leks each year while maintaining counts on all designated count leks. Encourage the public, volunteers, and especially landowners to report lek activity and assist with lek surveys and counts. Continue to monitor inactive or unoccupied leks to adjust classification status as appropriate.

5. Continue to update and refine UTM coordinates (using NAD83) of leks and map lek perimeters where needed.

6. Continue to inventory abandoned leks to see if any are appropriate for removal from the database based on appropriate criteria. Most abandoned leks within the BHSBLWG area occur within the Laramie WGFD Region.

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Appendix I. Conservation Projects within the BHSBLWG area funded since inception through the Wyoming Governor's Sage-grouse Conservation Fund.

Project Name	Budget Biennium	Conservation Funding	Project Description	Partners	Status
Martin Ranch Range Improvement (Phase I)	2005-06	$19,501 requested/ approved; $19,633 spent	Fence construction to implement 3 pasture rotation grazing system and mosaic prescribed fire in mountain big sagebrush to improve forage including forbs and insects	Martin Ranch, NRCS	Complete
7E Ranch Grazing Mgt	2005-06	$44,990 requested/ approved; $44,990 spent	Fence construction and water development to implement a 4-pasture rest-rotation grazing system	NRCS, 7E Ranch, BLM	Complete
SG Education and Community Outreach	2007-08	$13,000 requested/ approved/spent	Develop and administer sage-grouse conservation educational programs in the Casper area	Audubon Wyoming	Complete
Western Natrona County Sage-Grouse Study	2007-08	$7,210 requested/ approved/spent	Seasonal distribution and habitat use for land use planning along with parasite/disease assay	BLM, WGFD, University of Wyoming, Casper College	Complete
M&D Land Company Water Development	2007-08	$7,425 requested/ approved; $4,000 spent	Water development to facilitate grazing plan implementation (dry hole - unsuccessful)	M&D Land Co., NRCS	Complete
Shook Ranch Range Improvement	2007-08	$10,000 requested/ approved/spent	Prescribed fire in mountain big sage, developing and protecting water sources, installing a cross fence and implementing rotational grazing system	Shook Ranch, NRCS	Complete
Hat-Six Ranch Riparian Buffer	2007-08	$11,600 requested/ approved; $9,936 spent	Fencing riparian buffer to enhance riparian habitat, reduce erosion and improve brood-rearing use by sage-grouse	Hat-Six Ranch, NRCS	Complete
Martin Ranch Range Improvement (Phase II)	2007-08	$14,000 requested/ approved; $10,825 spent	Fence construction to implement 3 pasture rotation grazing system and mosaic prescribed fire	Martin Ranch, NRCS	Complete

3-Man Ranch Upland Habitat Improvement	2007-08	$13,944 requested/ approved/spent	Water development and fencing to facilitate rest-rotation grazing system	3-Man Ranch, WGF LIP, WWNRT	Complete
L3 Cattle Co. fence and spring development	2007-08	$5,297 requested/ approved; $5,194 spent	Water development and fencing to facilitate deferred-rotation grazing system	L3 Cattle Co, NRCS	Complete
M&D Land Wildlife Inventory	2007-08	$10,500 requested/ approved; $10,302 spent	Wildlife surveys, range surveys & management consultation	NRCS	Complete
Schnoor/Flat Top Big Sagebrush Restoration	2007-08	$18,305 requested/ approved/spent	LWG $ to apply Plateau herbicide to cheatgrass infested areas. Other mechanical, chemical and RX fire to be used to restore big sage communities.	Mule Deer Foundation, WY Gov's Big Game License Coalition, WWNRT, WGFD, NRCS	Complete
Water trough escape ramps, spring protection and fence markers*	2007-08	$36,000 requested/ approved/spent	Provide pre-fab wildlife escape ramps, fence collision deterents and spring protection fencing to private landowners throughout the state.	WWNRT, Landowners, WGFD	Complete
Impacts of wind energy development in SE WY*	2009-10	$22,750 requested/ approved/spent	Research to determine impacts of wind energy development to sage-grouse	Horizon Wind Energy, Iberdrola Renewables	Complete
Grazing Management Assistance	2009-10	$5,000 requested/ approved; $4,600 spent	Small group or 1:1 grazing management assistance from Dr. Roy Roath to landowners	Natrona Conservation District, NRCS, WGFD	Complete
Seasonal Habitat Mapping*	2009-10	$155,000 requested/ approved; $141,000 spent	Use predictive habitat models to produce sage-grouse seasonal habitat maps	U.S. Fish & Wildlife Service, BLM, Various energy companies	On-going
Fence markers and spring protection fencing*	2009-10	$64,800 requested/ approved; $62,628 spent	Purchase fence markers and Steel Jack spring protection for statewide distribution	Niobrara Conservation District, numerous private landowners, BLM, TNC	On-going

Impacts of wind energy development in SE WY*	2011-12	$110,000 requested; $85,000 approved/ spent	Research to establish the short-term effects of wind development to sage-grouse	National Wind Coordinating Collaborative, Western Assoc. of Fish & Wildlife Agencies	Complete
Henderson Draw cheatgrass treatment	2011-12	$50,000 requested/ approved/spent	Cheatgrass control	BLM - Casper F.O.	Complete
Audubon Community Naturalist (see also #53)	2011-12	$10,000 requested/ approved/spent	Sagebrush ecosystem education program for schools	various foundations and grants	Complete
North Laramie Range cheatgrass control	2011-12	$26,000 requested/ approved/spent	Cheatgrass control	WWNRT, WGFD, Gov's Big Game Lic. Coalition	Complete
Response of sage-grouse to sagebrush treatment*	2011-12	$189,800 requested/ approved/spent	Research to determine sage-grouse demographic and habitat use response to sagebrush treatments	Univ. of Wyoming Coop Unit, WGFD	Complete
Estimating noise impacts for habitat selection modeling*	2011-12	$49,335 requested/ approved/spent	Research to develop a noise model and determine noise exposure thresholds	Univ. California-Davis	Complete
Audubon Community Naturalist (see also #53)	2013-14	$10,000 requested/ approved/spent	Sagebrush ecosystem education program for schools	various foundations and grants	On-going
North Natrona cheatgrass treatment	2013-14	$60,000 requested/ approved/spent	Cheatgrass control northwest of Casper in the Natrona Core Area	BLM - Casper F.O.	On-going
Impacts of wind energy development in SE WY*	2013-14	$50,000 requested/ approved/spent	Research to establish the short-term effects of wind development to sage-grouse	National Wind Coordinating Collaborative, Western Assoc. of Fish & Wildlife Agencies	On-going

* Other local working groups collaborated on funding these projects with Sage-grouse Conservation Funds

Big Horn Basin
Sage-Grouse
Job Completion Report
2012

June 2012-May 2013

Tom Easterly
Wyoming Game & Fish Dept.
Cody Region

Cody Region Annual Report

Species: **Sage-grouse**
Region: **Cody**
Management area: **B**

Period covered: **6/1/2012 – 5/31/2013**
Local Working Group: **Big Horn Basin**
Prepared by: **Tom Easterly**

INTRODUCTION

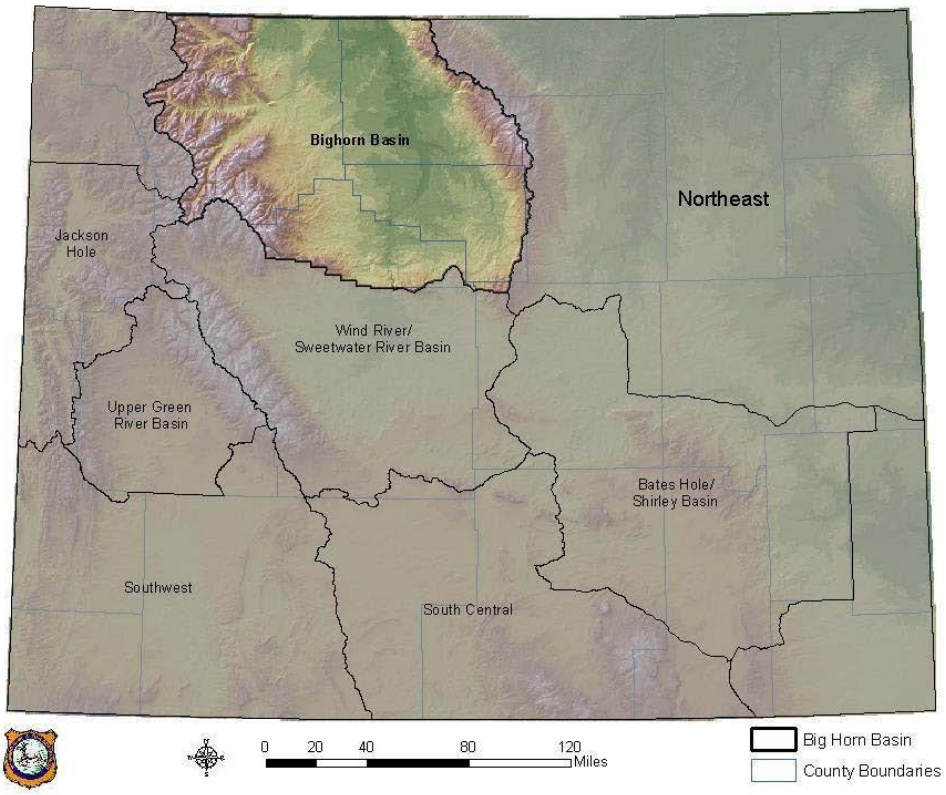
During the late 1990s, concerns increased over degradation and fragmentation of sagebrush ecosystems and declines in greater sage-grouse (*Centrocerucus urophasianus*, hereafter referred to as sage-grouse) populations. Wyoming Game & Fish Department (WGFD) increased monitoring efforts for sage-grouse across the state. An internal working group was established in 1997. A state-wide citizens working group consisting of representatives from government agencies (state and federal), agriculture, extractive industries, environmental groups, hunting groups, and Native American tribal interests was formed in 2000. This citizens' group produced the **Wyoming Greater Sage-grouse Conservation Plan,** which was approved and adopted by the WGF Commission in 2003. The Plan called for creation of local working groups (LWG) to formulate strategies on a local level to address sage-grouse conservation; eight local working groups were formed (Fig. 1).

Similar to the state-wide working group, the Big Horn Basin LWG (BHBLWG), in north-central Wyoming (Fig. 1), consisted of representatives from agriculture, mining, oil/gas production, conservation and hunting interests, a citizen at-large, local (county) government, local Conservation Districts, Bureau of Land Management (BLM), Natural Resources Conservation Service (NRCS), and WGFD. BHBLWG produced the **Sage-grouse Conservation Plan for the Big Horn Basin, Wyoming** in 2007. This plan is available under "Final Local Conservation Plans" at: http://wgfd.wyo.gov/web2011/wildlife-1000817.aspx. A draft version of the five-year (2007-2013) update of that plan is also available at the same web site. The final update will be available by April 2014.

Between 1999 and 2003, seven petitions were filed to list the greater sage-grouse for protection under the Endangered Species Act. On March 5, 2010, after judicial and other extended reviews of its decisions, the U.S. Fish and Wildlife Service (USFWS) re-issued its decision of "warranted but precluded" for listing greater sage-grouse as threatened or endangered under the Endangered Species Act. Thus, sage-grouse became a "candidate" for listing but are precluded from immediate listing due to higher priorities. This status is to be reviewed by the USFWS again in 2015.

This annual report summarizes conservation efforts and data collected on sage-grouse in the Bighorn Basin during the 2012 biological year (1 June 2012–31 May 2013), including the 2013 breeding season (lek surveys).

Figure 1. State of Wyoming sage-grouse conservation areas, highlighting the Bighorn Basin conservation area.



STUDY AREA

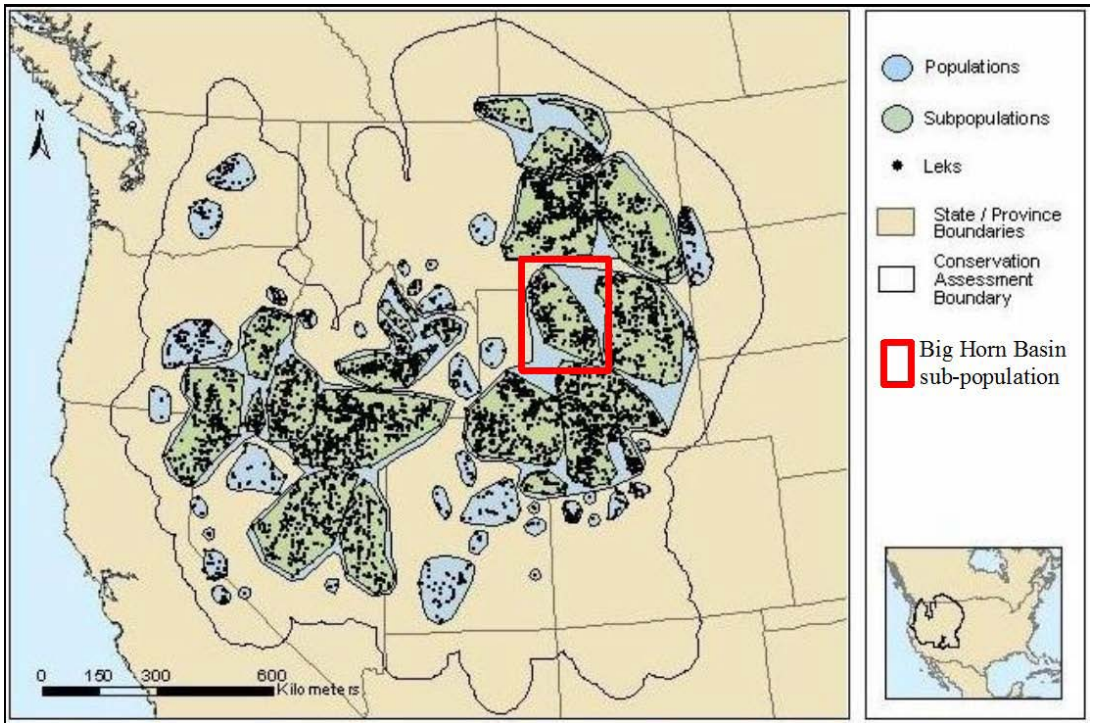
The Bighorn Basin Conservation Area (Basin) encompasses over 12,300 square miles and is subdivided into various ownership patterns and political jurisdictions. The Basin is mostly public land managed by the BLM (40%), Forest Service (25%), State "school lands" (5%), or other government agencies (>1%; Bureau of Reclamation, National Park Service, Department of Defense). Over 3,100 square miles of the Basin are private land (25%). Counties within the Basin include Big Horn, Hot Springs, Park, and Washakie. WGFD divided the state into management areas for data collection and reporting of small and upland game species. In 2010, new management areas were created for sage-grouse management that correspond with conservation areas (as mapped in Fig. 1); the Bighorn Basin is Area B. Primary land uses in the Basin include: livestock grazing, farming, oil and gas development, bentonite mining, urban and suburban developments, recreation and wildlife habitat.

Habitats within the Basin are diverse and vary depending upon such factors as soil type, annual precipitation and elevation. Major habitat types within the Basin include: sagebrush/grassland, salt desert shrub, agricultural crops and pasture lands, cottonwood-riparian corridors, mixed mountain shrub, and at higher elevations mixed conifer forests with interspersed aspen stands.

Connelly et al. (2004) recognized sage-grouse in the Big Horn Basin as a distinct sub-population (Fig 2). Mountain ranges to the east and west restrict most sage-grouse movement due to

unsuitable habitat types. Grouse movements in the north and southeast portions of the Basin have not been well documented. There are several leks on both sides of the Wyoming-Montana state line, and movement between states is likely. Suitable habitat on Copper Mountain, the Owl Creek Mountains and the southern Bighorn Mountains serve as travel corridors to other areas where sage-grouse populations occur (e.g., the South Fork of the Powder River Basin).

Figure 2. Discrete populations and subpopulations of sage-grouse in western North America, highlighting (red rectangle) the Big Horn Basin sub-population. (Adapted from Connelly et. al. 2004).



There were 294 known sage-grouse leks in the conservation area; 134 of which were known to be active in 2013 (Table 1). Thirty-five lek sites were unoccupied (abandoned or destroyed). Leks classified as "Unknown" (annual status) need additional observations before being reclassified as occupied or unoccupied (management status). Two new strutting sites were located during the 2013 breeding season. Another potential lek site was only visited once and will need additional monitoring next spring. A majority of leks (68%) occur on BLM managed land and 23% of known leks occur on private land (Table 1). There are probably other leks within the Basin that have not been discovered.

METHODS

Since 1998, data on numbers of sage-grouse attending leks were collected in two ways: lek surveys or lek counts. Lek surveys were defined as at least one visit to a lek during the breeding season (mid March-mid May) to determine if the lek was active. Lek counts consisted of three or more visits to a lek (separated by about 7-10 days) during the peak of strutting activity (early April-early May) to document the maximum number of males in attendance. Some leks in the Basin have been surveyed since the late 1950's-early 1960s.

Table 1. Classification of leks in the Big Horn Basin based on activity, ownership and various geopolitical boundaries, 2013.

Management status	Number	Percent
Occupied	252	85.7
Undetermined	3	1.0
Unoccupied	39	13.3

Annual Status	Number	Percent
Active	134	45.6
Inactive	3	1.0
Unknown	157	53.4

Biologist	Number	Percent
Cody	78	26.5
Greybull	50	17.0
Worland	166	56.5

County	Number	Percent
Big Horn	47	16.0
Hot Springs	50	17.0
Park	98	33.3
Washakie	99	33.7

Land Status	Number	Percent
BLM	199	67.7
BOR	1	0.3
Private	69	23.5
State	23	7.8
Undetermined	2	0.6

Warden	Number	Percent
Greybull	30	10.2
Lovell	17	5.8
Meeteetse	36	12.2
North Cody	22	7.5
Powell	16	5.4
South Cody	18	6.1
Ten Sleep	47	16.0
Thermopolis	42	14.3
Worland	66	22.4

BLM Office	Number	Percent
Cody	105	35.7
Worland	189	64.3

Brood surveys were conducted during July and August. No consistent methodology has been established for brood surveys, but usually consisted of an observer walking or driving in areas thought to be occupied by sage-grouse. Data on the number of chicks, adult hens, and adult males were collected. Locations (UTM coordinates) and habitat type were also recorded to help delineate brood rearing areas.

Harvest information was obtained through a mail questionnaire of bird hunters. Hunters were requested to provide data on number of birds harvested, days hunted, and areas hunted. Data obtained through hunter surveys had been compiled by county prior to 1982. From 1982 to 2009, data were compiled and reported by small and upland game management area. The Bighorn Basin was divided into nine management areas. Beginning in 2010, sage-grouse management areas were consolidated to correspond with conservation areas (Fig. 1). The entire Bighorn Basin is sage-grouse Management Area B.

Surveys were conducted during December through early February to delineate winter distribution and identify important habitats. Winter surveys consisted of driving or flying across areas that contain sufficient sagebrush above snow to provide cover and forage. Observers recorded location, grouse numbers, habitat type, aspect, slope, and approximate snow depth.

RESULTS AND DISCUSSION

Lek monitoring. In 2012, a revision was made to the manner in which lek data were calculated and reported. Average male lek attendance is now calculated using only monitoring observations where one or more male grouse were observed strutting (active leks). Additionally, leks documented as active because fresh sign (i.e., droppings, feathers, tracks) was found but no males were observed (zero males) were also not included in the calculations of average number of males per lek. Changes resulted in somewhat higher, but more accurate, average male attendance for active leks than previously reported. The revisions did not result in any change in population trend based on average male lek attendance.

In spring 2013, 80% of occupied leks in the Bighorn Basin were checked, resulting in an average of 9.5 males per lek. Forty-two leks were observed following count protocols (2003-12 average=71 leks) and 147 leks were surveyed (at least one visit; 2003-12 average=95). Long-term data sets indicate similar trends in data collected from both counts and surveys (Fedy and Aldridge 2011; Fig. 3). Count leks are typically larger and attended more consistently, while survey leks usually have fewer males. Since observers visit survey leks less frequently, it is likely that "peak" male attendance was not documented at those sites.

The average number of male sage-grouse observed at leks in the Bighorn Basin declined for the fourth consecutive year (Table 2, Fig. 3). Declines in average male attendance at leks observed during the past few years may be natural fluctuations in sage-grouse population cycles. Sage-grouse populations, in the Basin and elsewhere, cycle on an approximate 7 to 10-year interval (Fig. 4). During the previous low in the population cycle (2002), an average of 12 males per lek were observed at Bighorn Basin leks. The lowest level observed was 9.4 males/lek in 1995 and highest male attendance was 26.1 males/lek in 2006.

Since only active leks are being used to calculate the average number of males per lek, it became important to also consider trends in the numbers of active versus inactive leks. During a period of population decline, the size of active leks typically declines and the number of inactive leks increases. The converse is typically true of an increasing population. Therefore, the magnitude of changes in overall sage-grouse numbers may be greater than what is suggested by the average males per lek alone.

Contrary to what was expected during a population decline (an increase in number of inactive leks), the number of leks in the Bighorn Basin documented as inactive has slightly declined despite declines in average number of males observed per lek since 2006. Graphs of percent active and inactive leks presented in Figure 3 were calculated on number of leks of known status each year (Table 2d), giving the impression that most (85-98%) leks were active. Percentages of active and inactive leks (annual status) presented in Figure 5 were calculated based on the number of leks known to be occupied (management status). Since the annual status of many leks was not known, a lower percent of leks were classified as active. The number of unknown status leks increased mainly because field personnel are not visiting "survey" leks enough to identify annual status.

Figure 3. Average number of male sage-grouse observed per lek in the Big Horn Basin Conservation Area by counts, surveys and all observations, 2003-13.

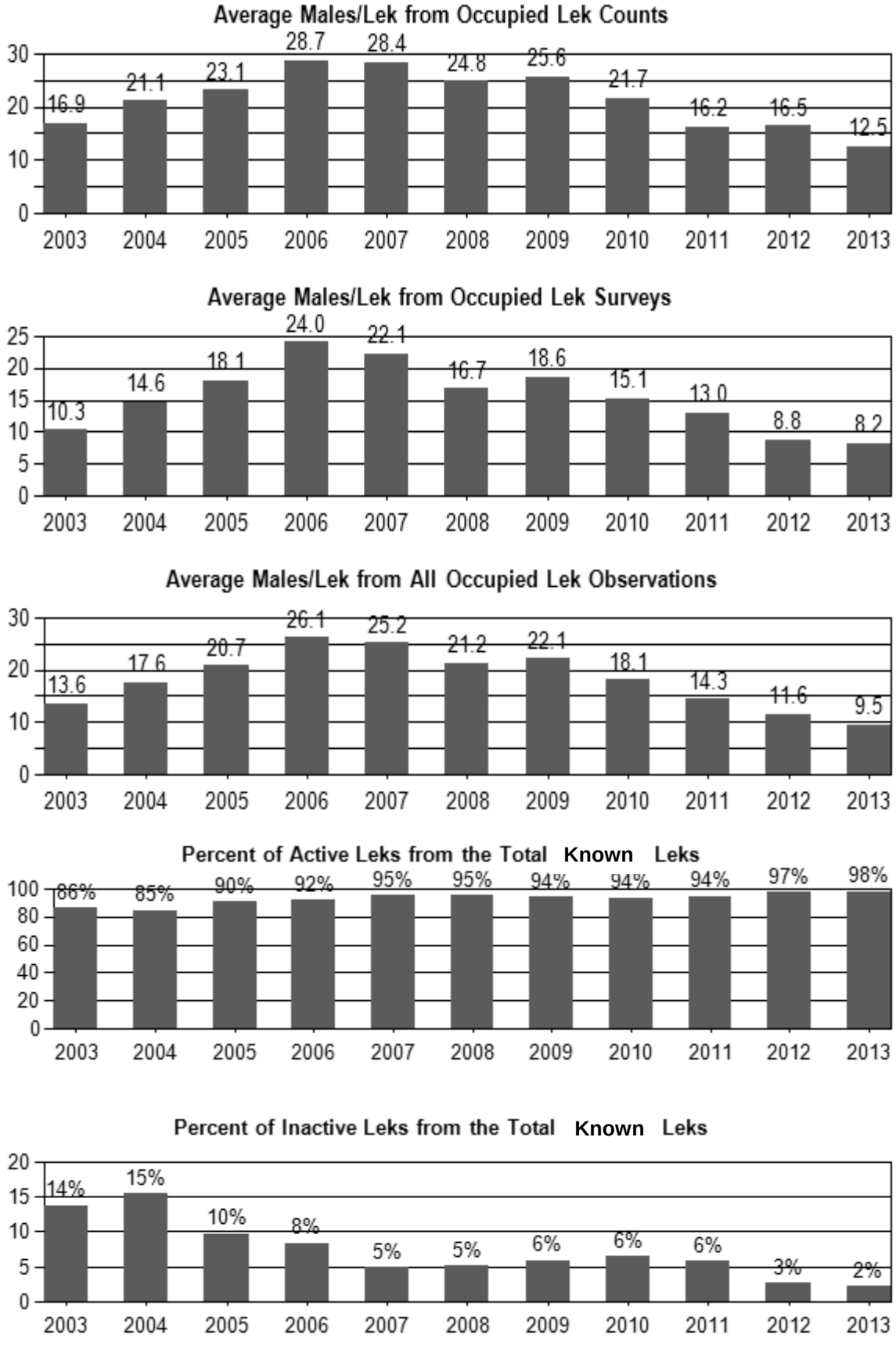


Table 2 (a-d). Lek attendance summary of occupied leks[1] in the Big Horn Basin, 2003-2013.

a. Leks Counted

Year	Occupied	# Counted	% Counted	Peak Males	Avg Males/ Active Lek[2]
2003	191	66	35	1047	16.9
2004	194	61	31	1140	21.1
2005	193	85	44	1757	23.1
2006	203	64	32	1694	28.7
2007	205	72	35	1901	28.4
2008	218	96	44	2083	24.8
2009	219	74	34	1717	25.6
2010	223	74	33	1495	21.7
2011	230	64	28	905	16.2
2012	233	53	23	823	16.5
2013	237	42	18	501	12.5

b. Leks Surveyed

Year	Occupied	# Surveyed	% Surveyed	Peak Males	Avg Males/ Active Lek[2]
2003	191	80	42	651	10.3
2004	194	83	43	966	14.6
2005	193	79	41	1230	18.1
2006	203	97	48	1753	24.0
2007	205	82	40	1550	22.1
2008	218	79	36	1121	16.7
2009	219	95	43	1244	18.6
2010	223	108	48	1242	15.1
2011	230	119	52	988	13.0
2012	233	126	54	771	8.8
2013	237	147	62	750	8.2

c. Leks Checked

Year	Occupied	# Checked	% Checked	Peak Males	Avg Males/ Active Lek[2]
2003	191	146	76	1698	13.6
2004	194	144	74	2106	17.6
2005	193	164	85	2987	20.7
2006	203	161	79	3447	26.1
2007	205	154	75	3451	25.2
2008	218	175	80	3204	21.2
2009	219	169	77	2961	22.1
2010	223	182	82	2737	18.1
2011	230	183	80	1893	14.3
2012	233	179	77	1594	11.6
2013	237	189	80	1251	9.5

Table 2. Continued.

d. Lek Status

Year	Active	Inactive[3]	Unknown	Known Status	% Active	% Inactive
2003	119	19	53	138	86.2	13.8
2004	115	21	58	136	84.6	15.4
2005	140	15	38	155	90.3	9.7
2006	131	12	60	143	91.6	8.4
2007	136	7	62	143	95.1	4.9
2008	148	8	62	156	94.9	5.1
2009	128	8	83	136	94.1	5.9
2010	144	10	69	154	93.5	6.5
2011	129	8	93	137	94.2	5.8
2012	146	4	83	150	97.3	2.7
2013	134	3	100	137	97.8	2.2

[1] Occupied = Active during previous 10 years (see official definitions).

[2] "Avg Males/Active Lek" includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

[3] Inactive = Confirmed no birds or sign present (see official definitions).

Figure 4 . Trends in average male attendance at leks in the Bighorn Basin and state-wide, 1980-2013.

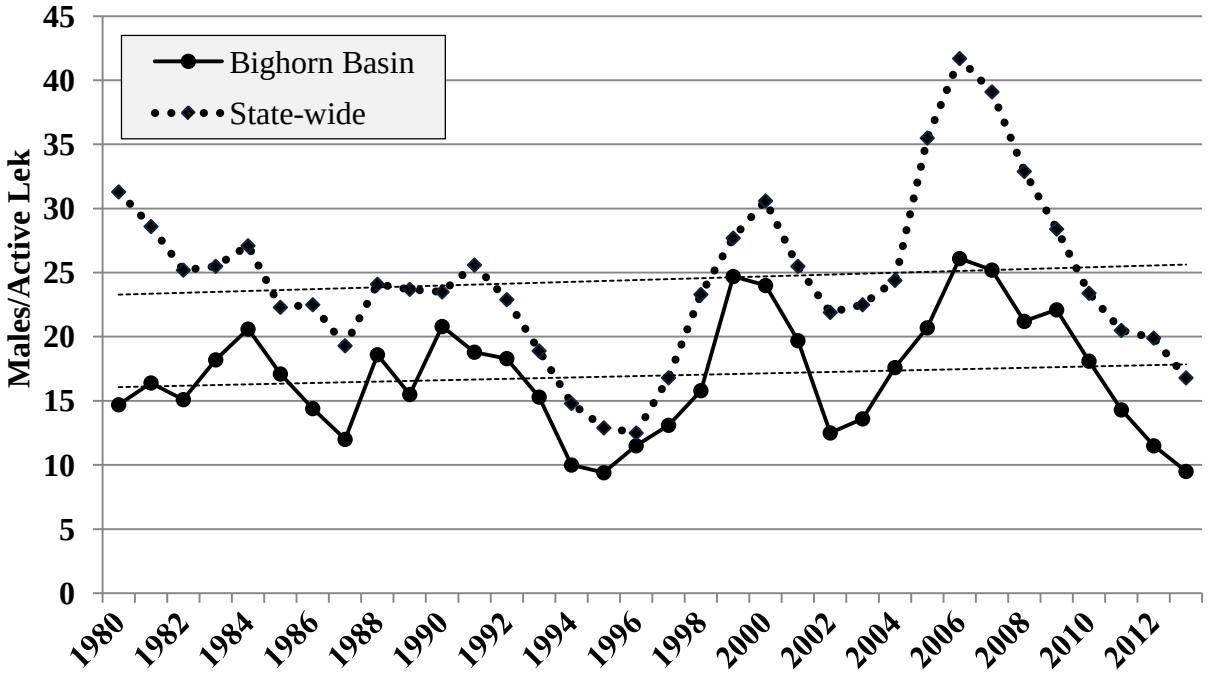
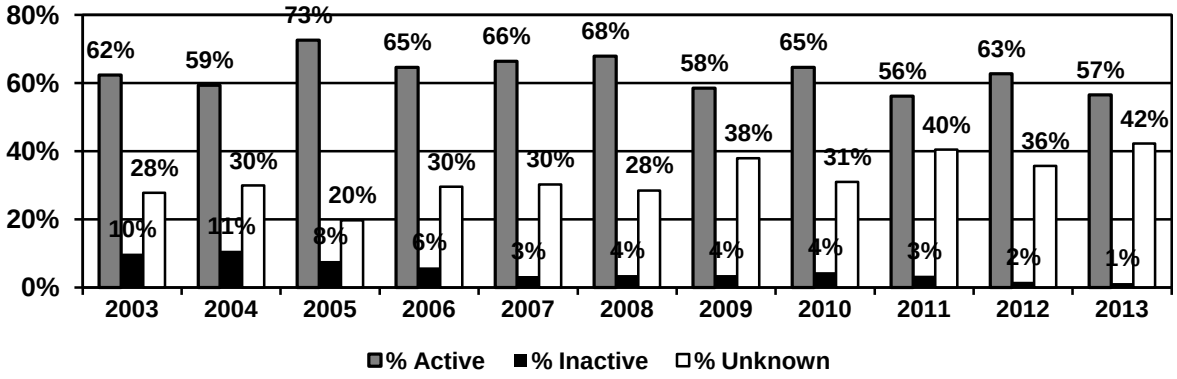


Figure 5. Trends in active and inactive leks in the Bighorn Basin Conservation Area based upon total number of leks known to be occupied, 2003-13.



Production surveys. Surveys for sage-grouse are conducted during July and August each year to document brood sizes and brood-rearing habitats. Most survey work is done in conjunction with other activities and no survey routes have been established. All sage-grouse observations by WGFD personnel were entered into the Department's Wildlife Observation System. WGFD personnel coded only 23 hours (including travel time to and from possible brood-rearing areas) to sage-grouse (species code CT) brood surveys (activity code 512) in 2012. Only six observations of sage-grouse hens or broods were documented (Table 3); five other observations of sage-grouse were made that contained only males and/or undocumented adults. A direct connection between effort (time spent surveying for broods) and number of broods observed was discussed in previous annual reports. Sample sizes (number of groups observed) in 2011 and 2012 were too small to make valid statements on chick production (chicks/brood or chicks/hen).

Analysis of wings from harvested grouse was used to estimate chick production in other portions of Wyoming. An insufficient number of wings have been collected from around the Bighorn Basin in past years, thus this technique was discontinued here.

Table 3. Brood survey data collected by Wyoming Game & Fish Department personnel in the Bighorn Basin, 2001-12.

Year	Groups observed	Broods	Chicks	Hens	Chicks/ brood	Chicks/ hen
2001	22	14	51	24	3.6	2.1
2002	12	10	35	16	3.5	2.2
2003	22	24	103	30	4.3	3.4
2004	14	17	71	73	4.2	1.0
2005	27	23	123	41	5.3	3.0
2006	23	24	99	38	4.1	2.6
2007	57	56	191	99	3.4	1.9
2008	24	18	88	29	4.6	3.0
2009	24	26	104	33	4.0	3.2
2010	23	17	64	17	3.8	3.8
2011	10	0	0	18	0	0
2012	6	8	26	8	3.3	3.3
2001-11 average	23	21	84	38	4.1	2.2

Hunting season and harvest. Beginning in 1995, the opening day of sage-grouse season was moved from 1 September to the third Saturday in September. Research suggested that hens and broods were more dispersed and less vulnerable to hunting with the later opening date. Between 1982-94, hunting seasons averaged 25 days long (range 16-31 days) and between 1995-2001 the season was open for approximately 15 days. Due to concerns over low populations, in 2002 the hunting season was again shortened and the daily bag limit decreased from three to two sage-grouse. Between 2002-12, hunting seasons for sage-grouse averaged 11 days long.

Moving and shortening the season and decreasing the bag limit decreased the number of sage-grouse harvested and the number of hunters in the Basin (Fig. 6). Average (1982-1994) annual harvest in the Basin was 3,756 sage-grouse taken by 1,300 hunters during 3,118 hunter days (2.8 birds/hunter, 2.4 days/hunter). Following changes to the hunting season opening date (1995-2001), an average of 549 hunters took 1,056 sage-grouse during 1,567 days of hunting (1.9 birds/hunter, 2.8 days/hunter). Since the last changes to the hunting seasons (2002-2011), hunters averaged 0.7 birds/hunter and 2.4 days/hunter. In 2012, 290 hunters in the Bighorn Basin harvested 457 sage-grouse (1.6 birds/hunter); spending 609 hunter-days afield (2.1 days/hunter) during the 16-day hunting season.

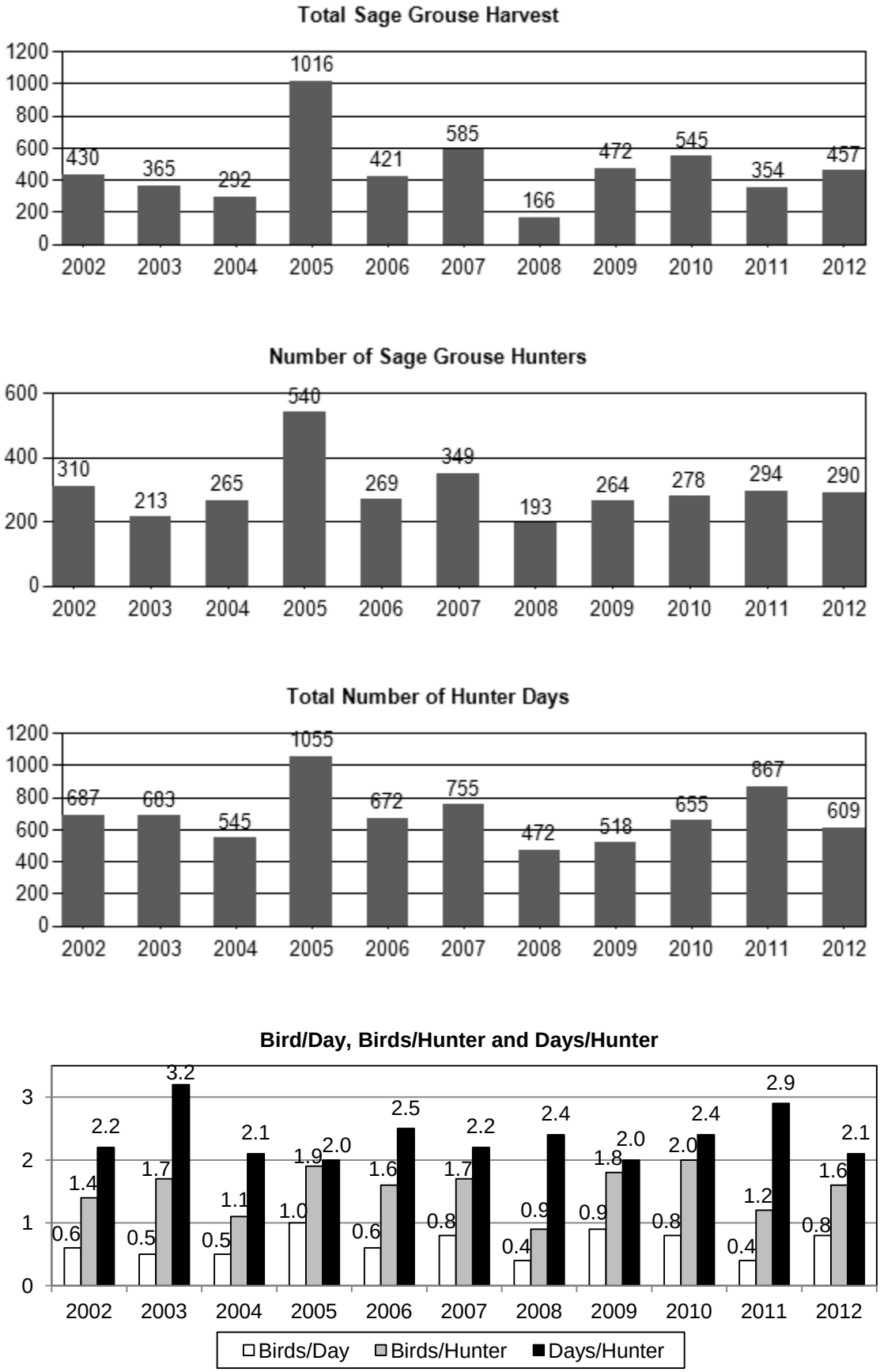
CONSERVATION PLANNING

The BHBLWG was formed in September 2004, to develop and facilitate implementation of a local conservation plan for the benefit of sage-grouse and, whenever feasible, other species that use sagebrush habitats. The BHBLWG's mission statement is, "*Through the efforts of local concerned citizens, recommend management actions that are based on the best science to enhance sagebrush habitats and ultimately sage-grouse populations within the Big Horn Basin*."

The Sage-grouse Conservation Plan (Plan) for the Basin identified several factors that may influence sage-grouse populations in the Basin. A brief description of each factor and potential impacts to grouse or their habitats were discussed. Impacts of each factor were addressed in the Conservation Strategy section of the Plan. Goals and objectives were formulated to address: 1) habitats, 2) populations, 3) research and 4) education. Strategies and commitments in the Plan were designed to improve sage-grouse habitats and populations in the Basin. Specific actions, recommended management practices and commitments to achieve goals and objectives were presented. The Plan can be viewed at the WGFD website: http://wgfd.wyo.gov/web2011/Departments/wildlife/pdfs/SG_BHBConservationPlan0000684 .

The LWG is writing a five-year (2007-13) update to the plan. The update will highlight on-the-ground projects that occurred in the Basin and summarize state-wide and nation-wide policy and programs designed to conserve sage-grouse and sagebrush habitats. Updates from all working groups will be submitted to USFWS prior to their review of the status of sage-grouse in 2015.

Figure 6. Sage-grouse hunting statistics for Bighorn Basin (Management Area B), 2002-12.



RESEARCH

Research on sage-grouse in the Bighorn Basin has been limited. One project evaluated the relative influence of prescribed burning and mowing treatments on quality of sage-grouse nesting and early brood-rearing habitats (Hess 2010, Hess and Beck 2012a). Hess and Beck (2012b) also used lek data in the Bighorn Basin from 1980 to 2009 to evaluate factors that may have influenced the probability of sage-grouse lek abandonment. Their objective was to examine lek abandonment based on landscape characteristics that explain differences between occupied and unoccupied leks. Their analysis used landscape predictor variables obtained from geographic coverages at 5 scales (1.0-, 3.2-, 4.0-, 5.0-, and 6.4-km radii around leks) to evaluate how these disturbances influenced lek abandonment. Coverages included anthropogenic characteristics (agricultural development, oil and gas development, prescribed burned treatments, and roads) and environmental characteristics (vegetation attributes and wildfire). Abandoned (unoccupied) leks had more variability of shrub height in a 1.0-km radius, a higher percentage of wildfire in a 1.0-km radius, and more oil and gas wells in a 1.0-km radius compared to occupied leks. They suggested that presence of oil/gas wells was most influential predictor of lek abandonment in their model. They recommended that conservation efforts should be focused on minimizing well development and implementing wildfire suppression tactics near active sage-grouse leks (Hess and Beck 2012b).

In 2010, two research projects on sage-grouse were begun in the Basin. One is researching possible affects of bentonite mining on sage-grouse (Pratt and Beck 2012). That project will continue for another field season (2014). The second project was designed to document levels of predation on adult hens, nests and broods at several sites on the west side of the Big Horn Basin (Orning and Young 2012, 2012a). The first phase of the predation project was completed and will be available as a master's thesis. A second phase of the predation project will focus on impacts of ravens.

CONCLUSIONS

Despite being at a low in the population cycle, sage-grouse populations in the Basin remain stable. Sage-grouse in the Basin face threats, but are not in danger of foreseeable extripation. On-going conservation efforts are intended to mitigate some anthropogenic impacts. Research and efforts to monitor status and trends of sage-grouse populations and habitats should continue. Data should be used to direct future management efforts across the Big Horn Basin.

RECOMMENDATIONS

More effort is needed to collect data on sage-grouse in the Bighorn Basin. Only one visit to "survey leks" is often inadequate to determine if a lek is active or inactive. Observers need to return to leks that had no birds present on the initial visit later in the breeding season to look for signs of use. Since no wings are collected from grouse harvested in the Basin, there is no estimate of production. Brood surveys could provide data on production of young if a large number of grouse were surveyed. More hours should be allocated to brood surveys during July and August. Personnel from outside the WGFD could be used to conduct brood surveys such as is done with lek surveys. Collecting wings from harvested grouse could be attempted again.

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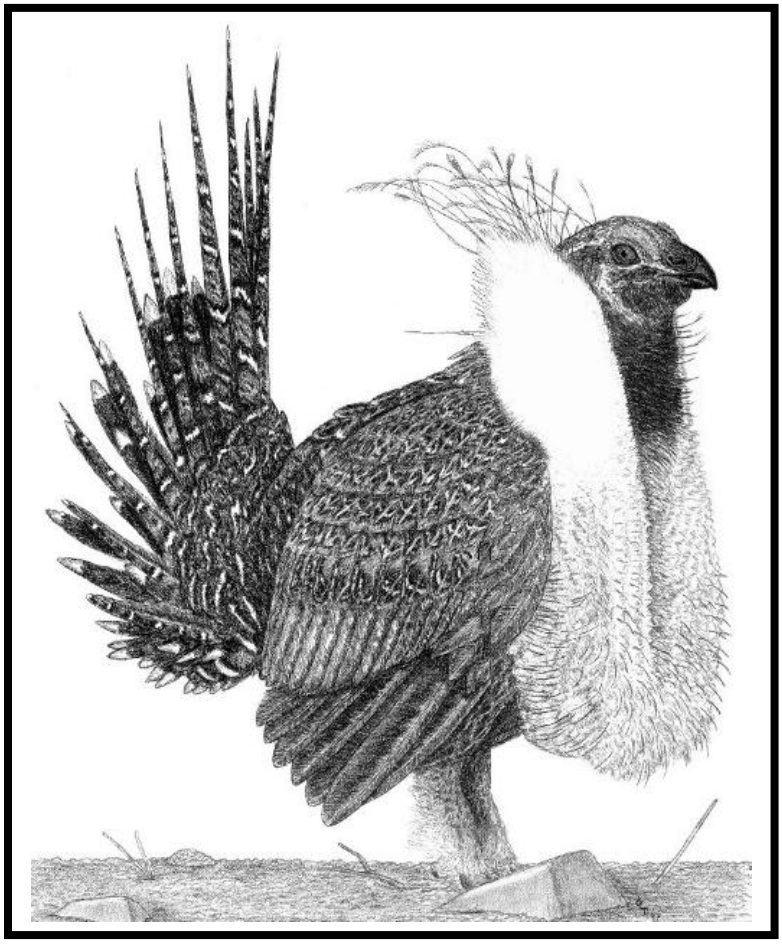
Northeast Wyoming Local Working Group

2012 ANNUAL SAGE-GROUSE COMPLETION REPORT



Prepared By:

Dan Thiele
District Wildlife Biologist, Buffalo
Wyoming Game and Fish Department

Sage Grouse Job Completion Report

Year: 2004 - 2013, Working Group: Northeast

1. Lek Attendance Summary (Occupied Leks) (1)

a. Leks Counted

Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek (2)
2004	290	127	44	1022	12.8
2005	338	102	30	1489	19.1
2006	374	85	23	1793	28.0
2007	397	108	27	2036	26.1
2008	411	125	30	1900	20.2
2009	414	149	36	1135	10.8
2010	413	180	44	1561	13.7
2011	420	174	41	1125	11.7
2012	422	243	58	1861	12.9
2013	412	107	26	694	10.5

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2004	290	132	46	741	9.5
2005	338	180	53	2099	16.3
2006	374	234	63	3306	19.3
2007	397	258	65	3444	20.3
2008	411	243	59	2218	15.8
2009	414	223	54	1346	11.8
2010	413	176	43	618	7.8
2011	420	193	46	635	8.0
2012	422	149	35	462	9.8
2013	412	247	60	909	8.5

1) Occupied - Active during previous 10 years (see official definitions)

2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

3) Inactive - Confirmed no birds/sign present (see official definitions)

Sage Grouse Job Completion Report

Year: 2004 - 2013, Working Group: Northeast

1. Lek Attendance Summary (Occupied Leks) (1) Continued

c. Leks Checked

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek (2)
2004	290	259	89	1763	11.2
2005	338	282	83	3588	17.3
2006	374	319	85	5099	21.7
2007	397	366	92	5480	22.1
2008	411	368	90	4118	17.6
2009	414	372	90	2481	11.3
2010	413	356	86	2179	11.3
2011	420	367	87	1760	10.1
2012	422	392	93	2323	12.2
2013	412	354	86	1603	9.3

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2004	158	63	69	221	71.5	28.5
2005	211	35	92	246	85.8	14.2
2006	237	31	106	268	88.4	11.6
2007	250	83	64	333	75.1	24.9
2008	235	96	80	331	71.0	29.0
2009	221	100	93	321	68.8	31.2
2010	199	135	79	334	59.6	40.4
2011	183	147	90	330	55.5	44.5
2012	197	139	86	336	58.6	41.4
2013	176	171	65	347	50.7	49.3

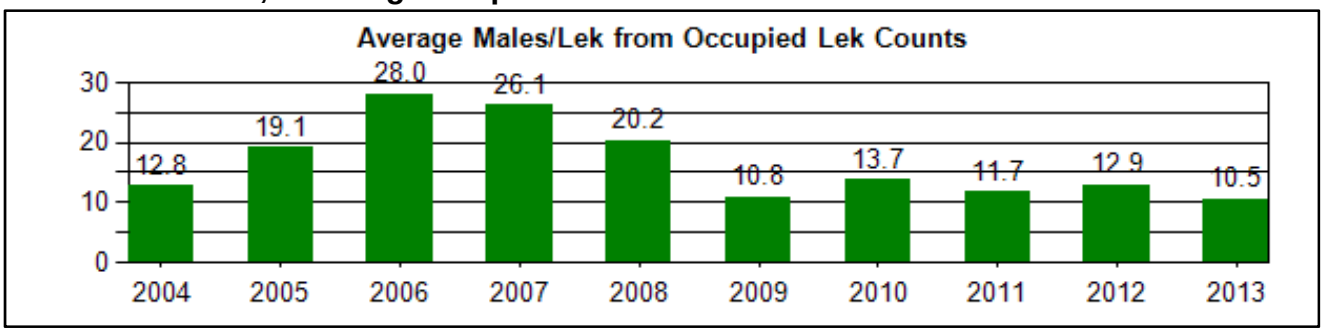
1) Occupied - Active during previous 10 years (see official definitions)

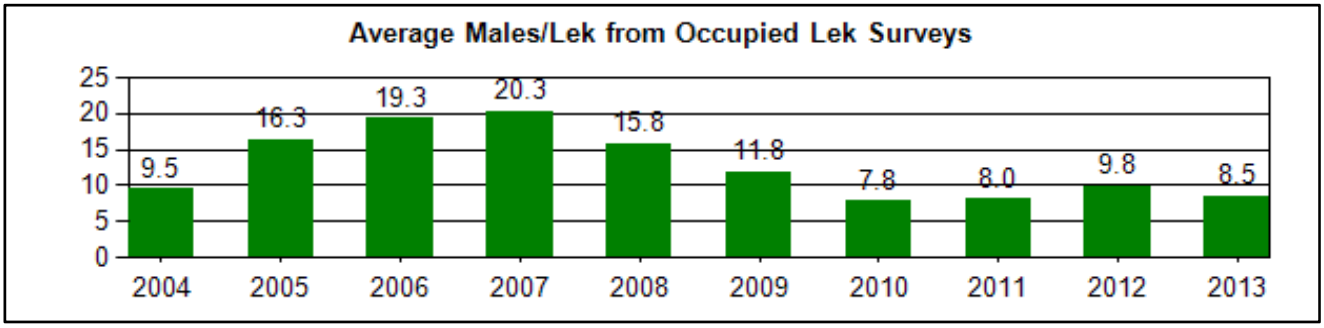
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

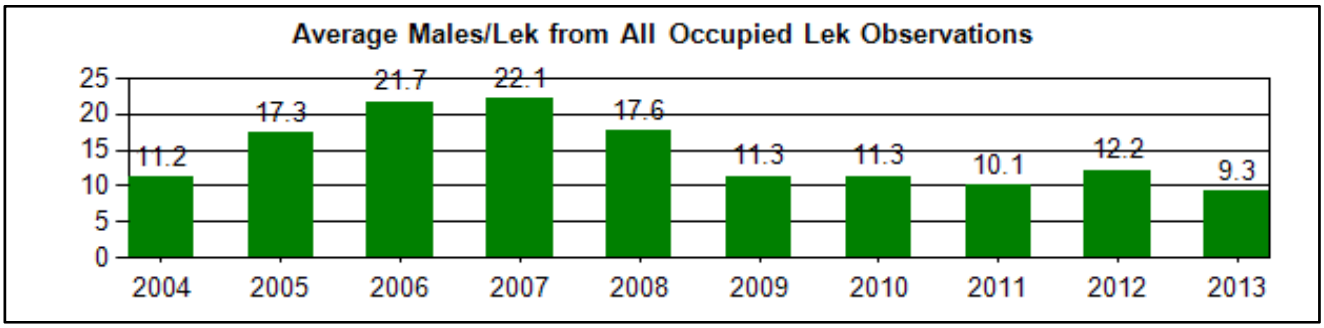
3) Inactive - Confirmed no birds/sign present (see official definitions)

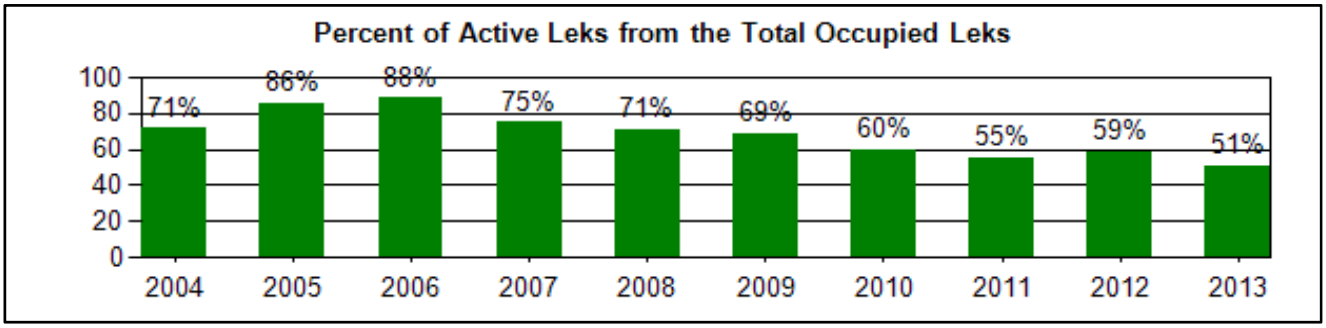
Sage Grouse Occupied Lek Attendance Summary

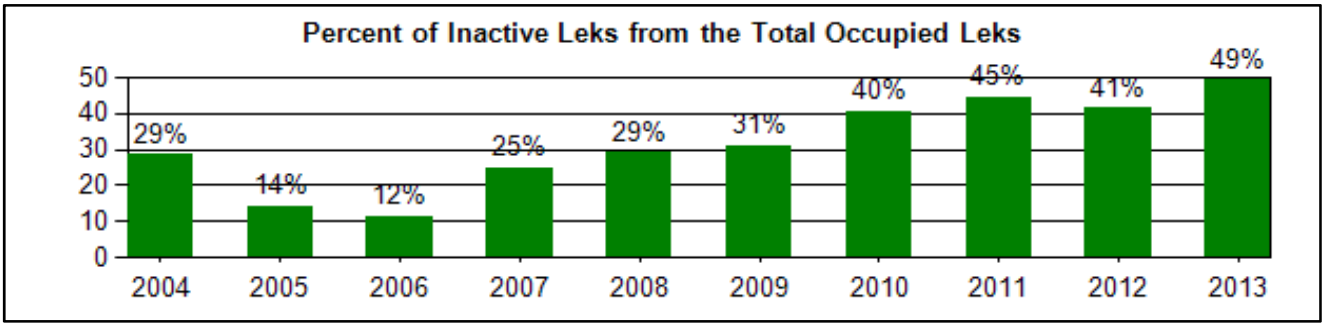
Year: 2004 - 2013, Working Group: Northeast











Sage Grouse Job Completion Report

Year: 2003 - 2012, Management Area: C

4. Sage Grouse Hunting Seasons and Harvest Data

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-25	7	2/4
2010	Sep-18	Sep-20	3	2/4
2011	Sep-17	Sep-19	3	2/4
2012	Sep-15	Sep-17	3	2/4

b. Harvest

Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2003	104	80	168	0.6	1.3	2.1
2004	347	271	471	0.7	1.3	1.7
2005	422	342	1649	0.3	1.2	4.8
2006	475	283	509	0.9	1.7	1.8
2007	532	297	632	0.8	1.8	2.1
2008	101	186	295	0.3	0.5	1.6
2009	311	230	559	0.6	1.4	2.4
2010	129	117	202	0.6	1.1	1.7
2011	158	124	173	0.9	1.3	1.4
2012	172	92	184	0.9	1.9	2.0
Avg	275	202	484	0.7	1.3	2.2

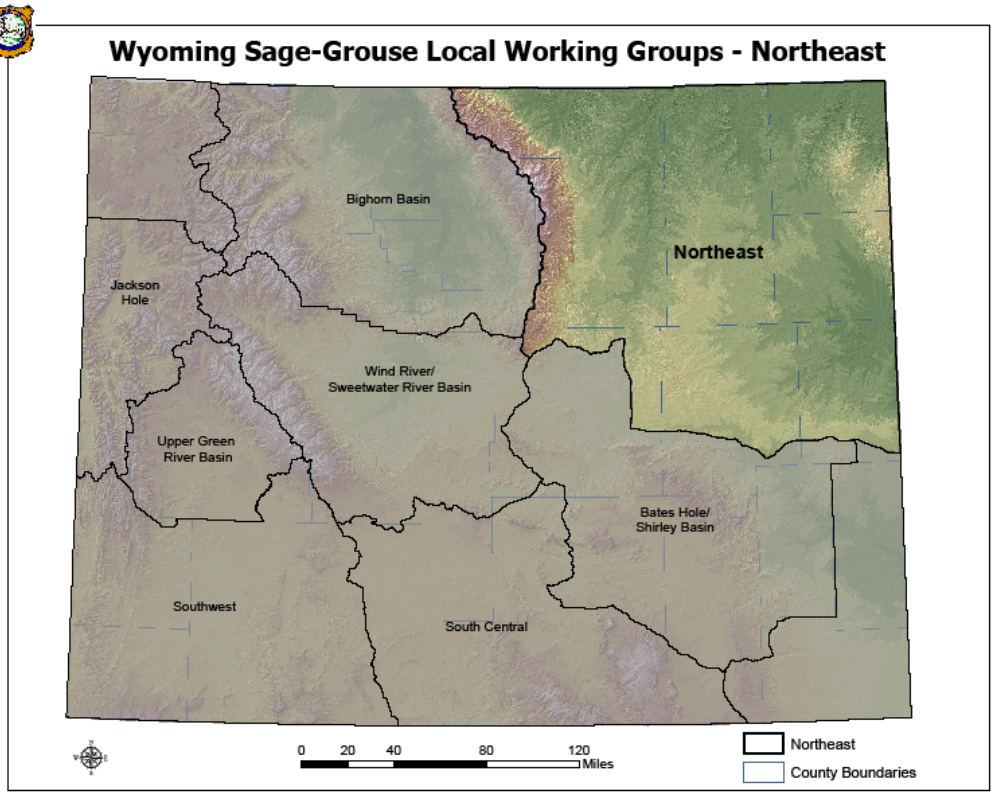
2012 JOB COMPLETION REPORT

Narrative
SPECIES: **Sage-grouse**
DAU NAME: **Northeast Wyoming Working Group**
Period Covered: **6/1/2012 – 5/31/2013**
Prepared by: **Dan Thiele, Wildlife Biologist**

INTRODUCTION

Sage-grouse data are reported for the area encompassed by the Northeast Wyoming Local Working Group Area (NEWLWGA) which was formed in 2004 to develop and facilitate implementation of a local conservation plan for the benefit of sage-grouse, their habitats, and whenever feasible, other wildlife species that use sagebrush habitats. The NEWLWGA covers Wyoming from the Bighorn Mountain divide to South Dakota and from Montana to Interstate Highway 25 and U.S. Highway 20/26 (Figure 1). The Area boundary encompasses the WGFD Sheridan Region and a portion of the Casper Region. In 2010 the Department revised sage-grouse management areas by eliminating the numbered upland and small game management areas and created management areas corresponding to working group area boundaries. The NEWLWGA now corresponds to Management Area C.

Figure 1. Northeast Wyoming Local Working Group Area.

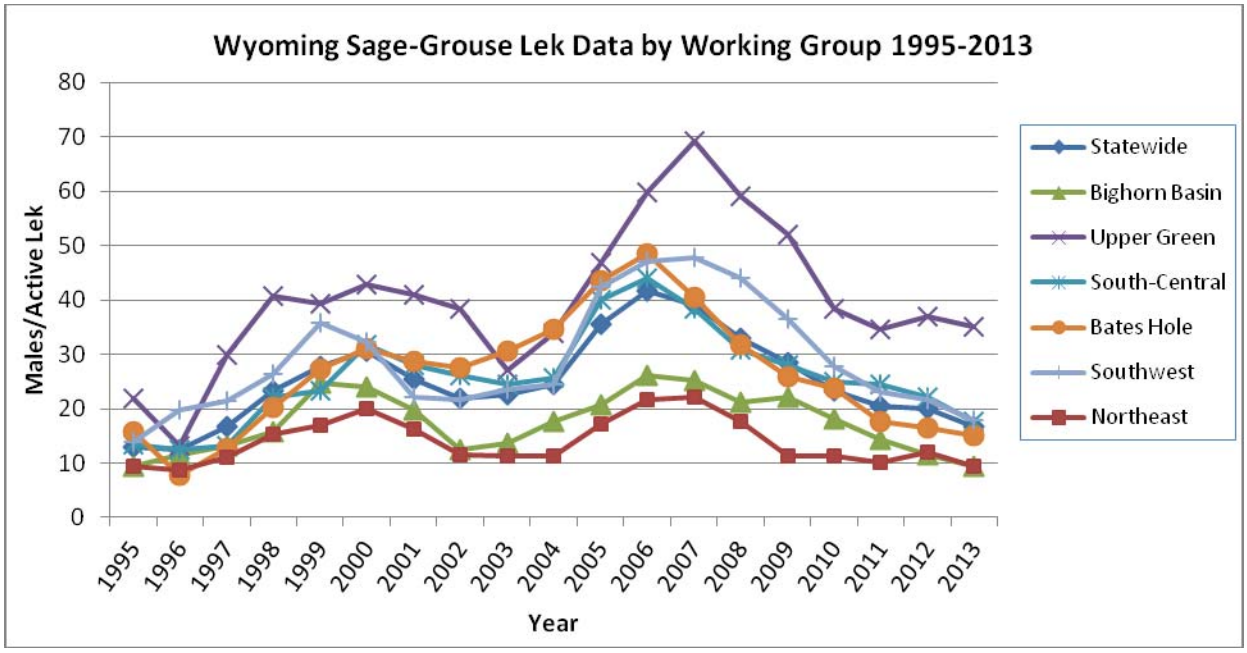


Sage-grouse are found throughout sagebrush grassland habitats of northeast Wyoming. Occupied habitat is fairly contiguous east of the Bighorn Mountains to the Black Hills and the Wyoming-Nebraska state line with the exception of forested, grassland and highly developed agricultural habitats. Sagebrush habitats are less continuous than western Wyoming, which

contributes to lower sage-grouse densities. Northeast Wyoming has the lowest average male lek attendance in the state, averaging 9 males per active lek in 2013 compared to the statewide average of 17 males per active lek (Figure 2). Male lek attendance for the other working group areas ranged from 10 to 35 males per active lek. It is interesting that over the last five years the Northeast Wyoming Local Working Group has exhibited a more stable trend than the other working group areas. However, the number and proportion of active leks has declined during that period so it is apparent the population has declined. Most leks in northeast Wyoming are small with less than 20 males. In years when grouse are at the peak of their cycle, less than 10% of the leks have greater than 50 males at peak count. In 2013, only one lek exceeded a peak male attendance of 50 males, the Kaufman Draw Lek with 53 males.

The average male lek attendance data in Figure 2 differs from previous years due to changes in the database calculations. These changes are explained in the Lek Monitoring Results section.

Figure 2. Wyoming Statewide and Local Working Group Area Lek Attendance Trends.



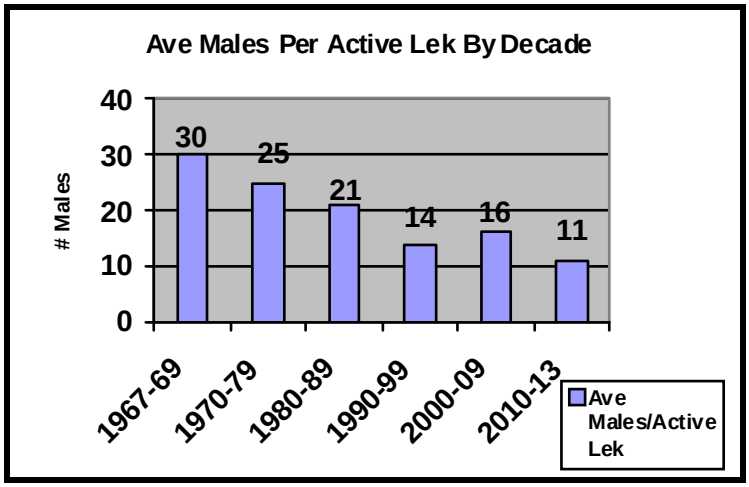
Average male lek attendance has decreased significantly over the years. Figure 3 shows the average number of males per active lek by decade since monitoring efforts began. Average male attendance has decreased by more than one-half over the last thirty years. A slight upswing occurred from 2000-2009, however, the long-term trend remains a concern.

Most occupied habitat for sage-grouse is held in private ownership. Approximately 70 percent of the known leks are found on private land with the remaining 30 percent found on Bureau of Land Management, U.S. Forest Service, and State owned lands. Because most sage-grouse are found on private land, little direct control exists to protect important habitats, including breeding and nesting areas, brood rearing areas, and major wintering areas.

The primary economic uses of lands currently or historically providing sage-grouse habitat are agriculture and energy. Livestock grazing, mainly cattle along with limited sheep production, is the primary agriculture use. Some crop production occurs as irrigated and dry land hay and some small grains. Historically, large parcels of sagebrush habitat were converted either to grasslands or crops. Limitations of remote sensing technology have prevented quantifying and mapping these conversions. Vast coal reserves are being developed with surface pit mines in

eastern Campbell County and northern Converse County. Oil and natural gas production has occurred in portions of the area since the early 20th century. An unprecedented energy boom began in the Powder River Basin in the late 1990's with the exploration and development of coalbed natural gas (CBNG) reserves. The BLM predicted 51,000 wells could be drilled in the Powder River Basin Oil and Gas Project Record of Decision (BLM 2003). At the peak of the CBNG play, more than 18,300 wells were in production (August 2008) with production peaking in January 2009 at 49,459,629 Mcf of methane gas (WOGCC 2013). Much of the development in the energy play involves federal minerals with private surface. Wells, roads, power lines, produced water, activity and dust are components of development which affect sage-grouse habitat at a broad scale. Since 2009, development and production has declined as CBNG leases have been drilled and natural gas prices remain low. In May 2013, the Wyoming Oil and Gas Conservation Commission reported that 10,017 producing wells yielded 27,337,563 Mcf of methane gas (WOGCC 2013). In addition to producing wells there are over 11,400 shut in wells. Federal mineral leases provided for 69% of the production while fee leases accounted for 23% and State leases 9%. This compares to May 2012 when 12,116 producing wells yielded 35,258,540 Mcf of methane gas. Many wells drilled early in the play on the eastern side of the basin have completed the production phase of development and are now being plugged and abandoned.

Figure 3. Average Number of Males per Active Lek by Decade for Northeast Wyoming Leks.



Deep well oil and gas development is increasing with new technologies enabling horizontal drilling. While CBNG activity decreases the interest in deep drilling increases. Within the BLM's Buffalo Field Office (Campbell, Sheridan & Johnson Counties) the number of pending conventional wells increased from 27 in fiscal year 2009 to 153 in fiscal year 2012 (WOGCC 2013). There have been more than 300 horizontal wells drilled in northeast Wyoming since 2007 and nearly 1,500 horizontal permits. Significant development is occurring in the Douglas area. Deep wells require large well pads and enormous amounts of truck traffic to deliver water, sand, etc for drilling and fracking.

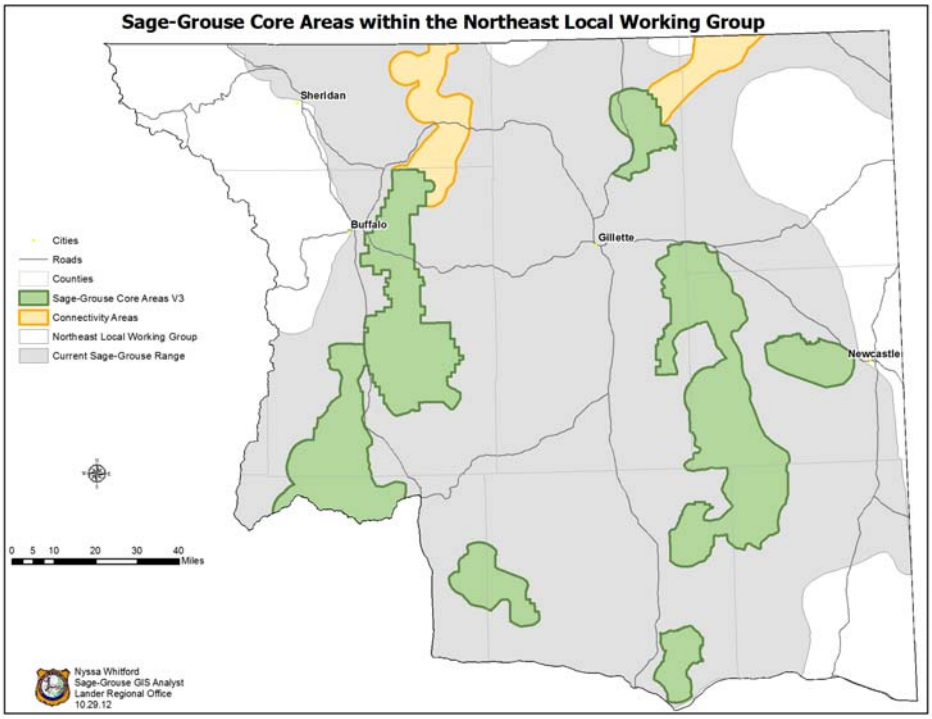
Considerable debate occurred on the effects of energy development on sage-grouse. Peer reviewed research findings show significant impacts (Walker et al. 2007, Doherty et al. 2008, Doherty et al. 2010, Harju et al. 2010 and others). These findings have yet to be embraced by some people and this has contributed to uncertainty in the public and political arenas as to the real effects of energy development. Furthermore, many continue to blame predation while some in the energy industry point to continued hunting of the species given that they are being asked for increased mitigation measures in areas of development.

A population viability analysis by Taylor et al. (2012) found that energy development had the greatest influence on male grouse lek attendance within 12.4 miles of a lek. At 8 wells per section (80 acre spacing), only 39% of males persisted while the number of large leks significantly decreased. Subjecting suppressed populations in developed areas to West Nile virus outbreaks or other stressors threatens local populations with extirpation.

The Wyoming Sage-Grouse Core Area Strategy (CAS) is based on a series of Executive Orders issued by former Governor Dave Fruedenthal and current Governor Matt Mead (WY-EO-2011-5). The CAS is designed to coordinate sage grouse conservation efforts across the State of Wyoming and directs state agencies to work to maintain and enhance greater sage grouse habitat in Wyoming. As a result of the 2008 Governor's Executive Order, core areas were designated in with the objective of identifying habitats that supported most of Wyoming's sage-grouse. Statewide, core areas account for approximately 34% of the current sage-grouse range while encompassing leks with 81% of the 2008 peak males. However, within a three county area of the Powder River Basin (Campbell, Johnson and Sheridan Counties), core areas were designated based on CBNG development patterns along with lek density data thereby encompassing leks supporting only 28% of the 2008 peak males.

In June 2010, the Northeast Local Working Group finalized recommendations for delineation of connectivity areas, core area boundary adjustments and sage-grouse development guidelines in and outside connectivity areas. Connectivity areas were identified using larger leks based on recommendations by Knick (2008) and habitat maps. Two connectivity areas were identified linking core habitat in Wyoming with Montana (Figure 4).

Figure 4. Wyoming Sage-grouse Core Area and Connectivity Areas (version 3).



Sage-grouse data collection efforts have focused on lek counts and surveys, which have been conducted each spring within the area since at least 1967. Lek searches may have been conducted earlier; however, no records exist for data verification. 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 population trends based on the average peak male attendance.

Lek surveys include lek attendance observations not following the count protocol, and are intended to determine general lek status (active, inactive or unknown).

Management of sage-grouse within the NEWLWGA has focused mainly on the protection of lek and nesting areas during the breeding season. Protection efforts have primarily occurred through the environmental commenting process and more recently the formation of core areas combined with the issuance of Governor's executive orders guiding development. Although more than 70% of the area's leks are found on private land, the split estate nature of the surface and mineral ownership provides for greater management influence by the BLM for oil and gas resource development.

WEATHER

Weather during the past biological year (June 2012 – May 2013) was much dryer and warmer than the 30-year averages (Figures 5 and 6). Precipitation was only 63% of normal, over five inches below normal, while the average temperature was more than one degree above normal. The biological year started off with June precipitation at just 23% of normal. Only two months, November and January, exceeded normal precipitation while spring 2013 started off very dry with April and May precipitation at only 76% of normal. Average monthly temperatures were above normal for eight of the 12 months with the most variation occurring in July (+6°) and November (+5°).

Figure 5. 2012 Bio-Year: Monthly Precipitation Data (in), Wyoming Climate Division 5.

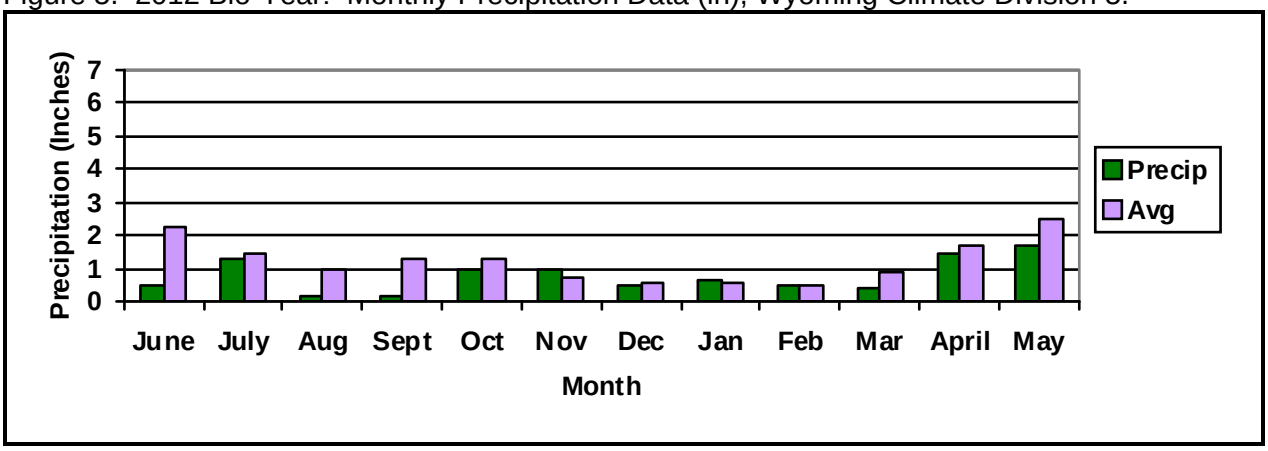
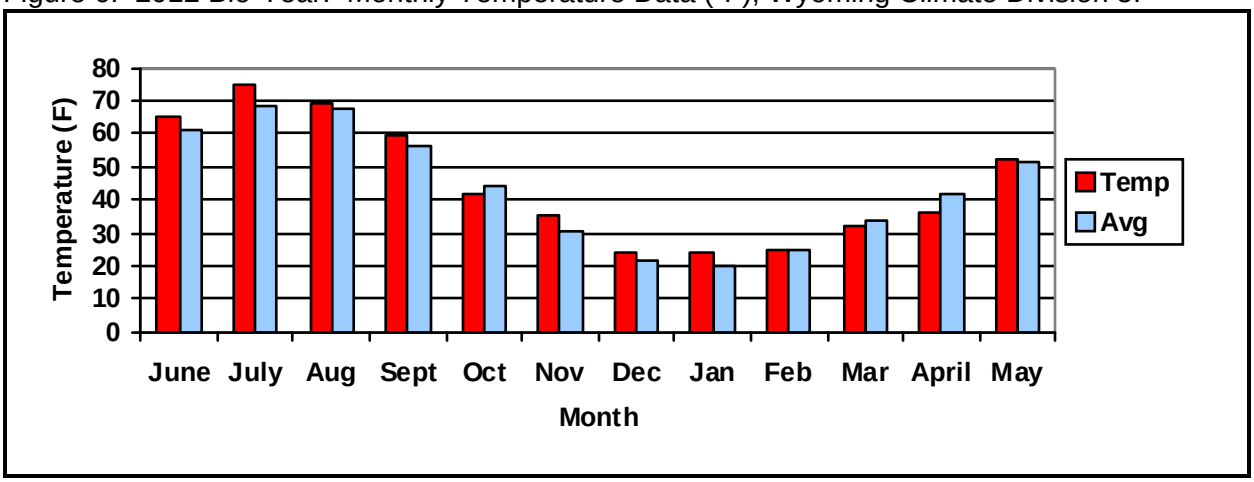


Figure 6. 2012 Bio-Year: Monthly Temperature Data (°F), Wyoming Climate Division 5.



Weather data was obtained from the National Climate Data Center/National Oceanic and Atmospheric Administration (NCDC/NOAA) for Wyoming Climatic Division 5 which includes the Powder River, Little Missouri River and Tongue River drainages. Weather data from this area are provided as a general indication of weather patterns over the entire working group area.

METHODS

Methods for collecting sage-grouse data are described in the sage-grouse chapter of the WGFD Handbook of Biological Techniques (Christiansen 2007), which is largely based on Connelly et al (2003).

RESULTS

Variation in this report from previous year's reports is expected because of new data added to the lek database. Old records are added each year as the data become available. Additionally, new leks discovered are added to existing complexes or create new complexes. New lek count routes may also be added. Data adjustments should be taken into consideration when the current report and tables are compared to previous editions.

West Nile Virus

No West Nile virus (WNv) mortalities were reported for northeast Wyoming in 2012-13. No major mortality events have been documented since 2003, however, there are fewer radio marked sage-grouse being monitored by researchers which decreases the likelihood of finding mortalities. Based on human diagnosed cases of WNv, outbreaks occurred in 2003 and 2007. Sage-grouse in North and South Dakota were reported to have suffered large losses to WNv in 2007 and there may have been undetected impacts in Wyoming.

Taylor et al. (2012) predicted that the low elevation population of northeast Wyoming is susceptible to West Nile virus outbreaks which can decrease a population by more than 50%. Furthermore, even with no additional energy development the authors predict that some local populations may be one outbreak year away from extirpation.

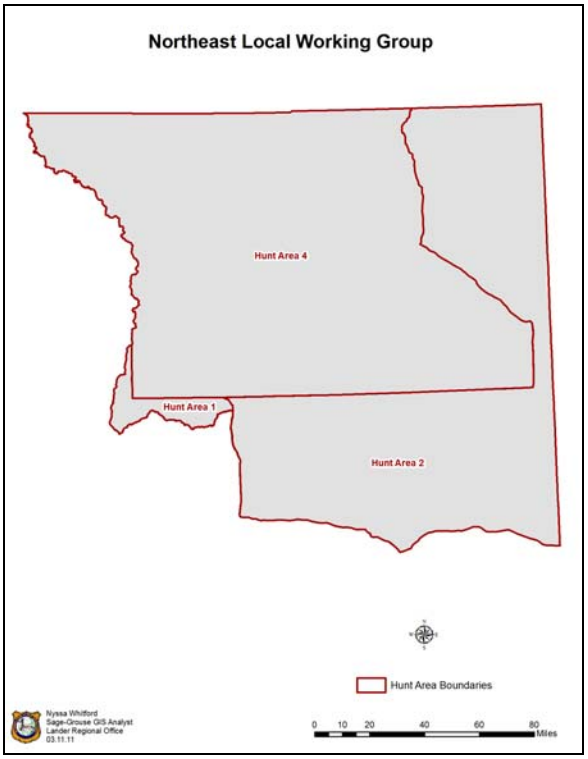
Harvest Results

The Northeast Working Group area is comprised of Hunt Area 4 and portions of Hunt Areas 1 and 2 (Figure 7). A very small amount of Hunt Area 1 occurs in the southwestern most extent of the Area while Hunt Area 2 is closed to hunting. In Hunt Area 4, a very conservative hunting season was implemented beginning in 2010 due to continuing concerns of decreasing lek attendance trends in the working group area.

Although sage-grouse numbers have decreased over time and are currently trending down, an adequate population exists to support the conservative hunting season. Over 1,600 males were observed during 2013 lek monitoring efforts with most of these birds in the portion of the Northeast Working Group Area included in Hunt Area 4. This number far exceeds the 100 male minimum threshold recommended to support a hunting season in the sage-grouse management guidelines (Connelly, et. al 2000). Even so, some segments of the public continue to voice concern that the WGFD continues to offer hunting seasons while working to reverse declining population trends. In response to this concern the Department produced a white paper on the implications of harvest strategies on sage-grouse in Wyoming, *Hunting and Sage-grouse: A Technical Review of Harvest Management on a Species of Concern in Wyoming*.

In 2012, the Department proposed to close the Area 4 hunting season due to the decreasing population trend and public concern with continued hunting where energy development and disease (west Nile virus) pose significant threats to the population. Significant public opposition to the proposal was voiced by sportsmen and conservation groups arguing that the proposal to close the hunting season was not science based, hunting was not influencing the population trend and closing the season without merit set a dangerous precedent. A Commission motion to close the Area 4 hunting season failed after which a motion to continue the hunting season passed on a 4 to 2 vote.

Figure 7. Northeast Wyoming Sage-grouse Hunt Areas.



The 2012 harvest survey indicated that 172 sage-grouse were harvested by 92 hunters who spent a total of 184 days hunting during the Hunt Area 4 three day season. The average number of birds harvested per hunter day was 0.9. The average number of sage-grouse harvested per hunter was 1.9 and the average number of days hunted was 2.0.

The 2012 sage-grouse harvest increased 10% from the 158 birds harvested in 2011 but remained well below the 311 birds harvested in 2009. The low harvest is attributed to the three day season, private land access and publicity about lower bird numbers and the bird's plight which likely reduces hunter interest. The ten-year average (2003-2012) is 275 birds, with harvest ranging from a low of 101 birds in 2008 to a high of 532 birds in 2007. More than 2,000 birds were harvested as recently as 2000. Hunter numbers over the last ten years have ranged from 80 hunters in 2003 when the season was closed in Campbell, Johnson and Sheridan counties due to a West Nile virus outbreak to 342 hunters in 2005. Hunter days increased 6% from 2011 but remained well below the 1,649 days logged in 2005.

Even though male lek attendance was higher from 2005 thru 2008, harvest was conservative compared to past levels. Beginning in 2010, the three day season appears to have dampened

hunter interest to about one-half of what it was. The more conservative season length and bag limit combined with increased publicity about the sage-grouse's status likely contributes to these trends.

A limited number of sage-grouse wings are collected during the hunting season, primarily in the eastern portion of the Area. Sample sizes are small due to the low harvest and the difficulty to strategically place enough collection barrels along the many roads and highways within the Area. Composition of the harvest as determined by analysis of wings deposited by hunters in wing barrels can provide insight into current year's chick production although in most years the sample is too small to allow for reliable interpretation of the sample. The 2012 sample was only 5 wings, all of which were adult birds. The sample is too small to draw meaningful conclusions.

Lek Monitoring Results

A new sage-grouse database was developed in 2012 in order to improve efficiency, reduce errors, and better facilitate data analysis. Changes were made to the manner in which lek data are calculated and reported in Table 1. The new version is based solely on "occupied" leks. The past version suggested that was the case in the title of Table 1, but when unoccupied leks were monitored those data were also included in the Table. The result of this change is that the number of "known occupied" leks is now more accurate, but reflects fewer leks than in the previous version. Similarly, the new version calculates average male lek attendance using only monitoring observations where one or more male grouse were observed strutting. The old version included a count of "0" males for leks where activity was confirmed by the presence of sign but no birds were observed. Together, these two changes result in somewhat higher, but more accurate, average male attendance for active leks than previously reported. The changes do not result in any change in population trend based on average male lek attendance. Interpreted population increases and decreases over time remain the same so no revisions to past reports are required.

Since only "occupied" leks are being reported on Table 1, it is important to consider trends in the numbers of active versus inactive leks in addition to the average size of active leks. During a period of population decline, the size of active leks typically declines and the number of inactive leks increases. The converse is typically true of an increasing population. Therefore the magnitude of both increases and decreases is usually greater than what is indicated by the average lek size alone.

Average female lek attendance is no longer being reported since our data collection techniques are not designed to accurately capture these data and is therefore not a useful figure in assessing population trend.

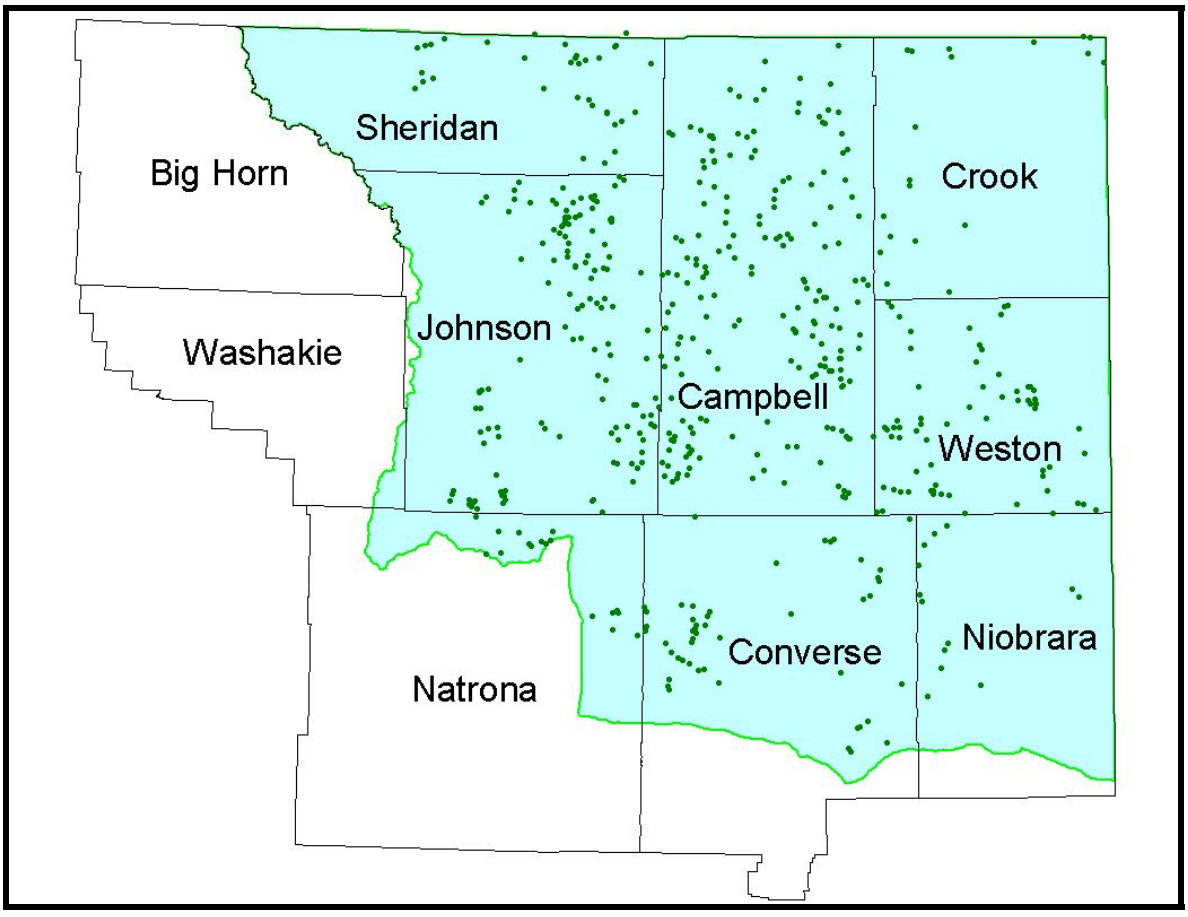
Lek monitoring efforts have increased substantially in recent years due to concerns over range wide declines in sage-grouse populations. Additionally, coalbed natural gas (CBNG) development in the Powder River Basin has resulted in extensive survey work to meet federal permitting requirements. The WGFD, BLM, U.S. Forest Service, private consultants and volunteers participated in ground and aerial monitoring of leks.

Sage-grouse lek monitoring efforts are accomplished through lek counts, lek surveys and searches for new leks. The Sheridan Region received additional funds from the Bureau of Land Management for sage-grouse surveys for the thirteenth consecutive year. This funding was used for aerial surveys to monitor known leks and fly grid searches for new leks in those areas with seemingly adequate habitat, but no previously known leks.

Following the 2013 lek monitoring period there are 548 documented leks in the NEWLWGA (Figure 8). Of this total, 412 are classified as occupied leks. During the 2013 breeding season 107 leks were counted, representing 26% of known occupied leks (JCR Table 1a). The 412 occupied leks is less than the 548 total leks because unoccupied leks (abandoned or destroyed) are not considered potentially active. The average number of males per active lek from these lek counts was 10.5. This is down from the 12.9 males/active lek in 2012 and compares to the 11.7 males/active lek in 2011. The most recent cycle high of 28.0 males/active lek occurred in 2006.

Lek count routes were established in 2000 to better document the actual number of male sage-grouse attending a lek or complex of leks. Lek counts consist of at least three ground visits to a lek following a stringent protocol to ensure accurate counts of male sage-grouse at lek sites. Designated lek count data, along with the lek counts from the private consultants and volunteers significantly improve the opportunity to better evaluate population trends. Thirty-eight official count routes covering 149 leks have been established.

Figure 8. Sage-grouse Leks in the Northeast Wyoming Working Group Area.



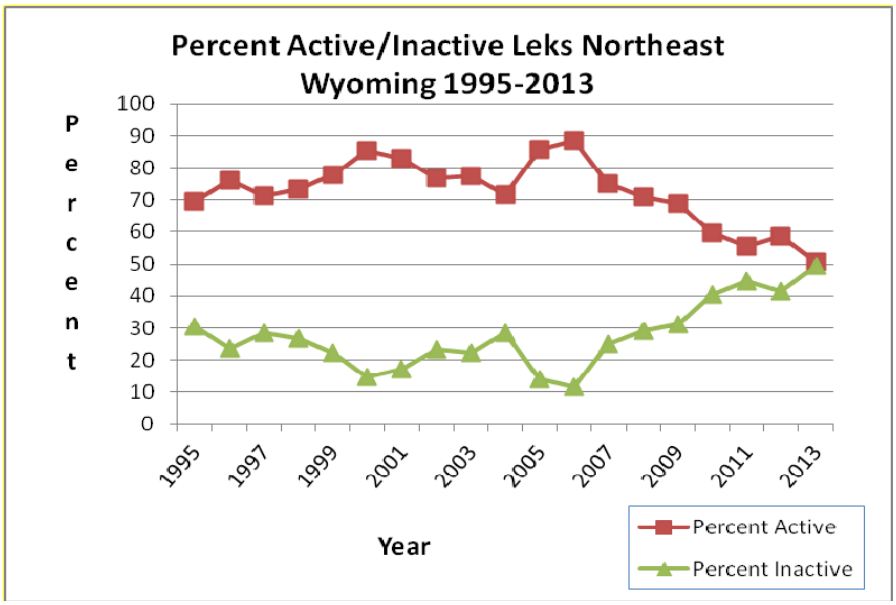
The number of known occupied leks checked by lek counts and lek surveys combined was 354 leks or 86% of the known occupied leks (JCR Table 1c). The average number of males/active lek was 9.3 compared to 12.2 males/active lek in 2012. The 2013 male lek attendance average was the lowest since 1997. For the 10-year period, 2004-2013, the number of males/active lek has ranged from 9.3 in 2013 to 22.1 in 2007. These numbers and trends are comparable to the lek count data. One-hundred-seventy-six leks were documented as active with peak male attendance ranging from 1 to 53 males. The three leks with the highest number of males were

the Kaufman Draw Lek with 53 males, the Watsabaugh IV Lek with 46 males and the Wind Cave Lek with 43 males. No lek has exceeded 100 males since 2007. The median peak male attendance was 7 males, down from 10 males per lek in 2012.

In total, there were 1,373 recorded observations of sage-grouse leks. This was over 800 fewer lek visits than were recorded in 2008 due to reduced survey effort resulting from decreased CBNG development activity and a coordinated effort of agencies and consultants to reduce excessive visits to leks. The Buffalo BLM Field Office sponsored a data sharing website on WYGIS which provided real time data sharing thereby reducing lek visits. This problem was most prevalent in the CBNG fields where monitoring buffers of Plan of Development (POD) boundaries overlap resulting in multiple visits to leks. Although some leks still experience more lek visits than necessary, the frequency has been greatly reduced. Likewise, aerial monitoring of leks counted or surveyed from the ground has been discouraged to minimize disturbance.

Lek status as determined from lek counts and lek surveys shows 347 leks with confirmed lek status. Fifty-one percent of the leks (n=176) with confirmed status were determined to be active (JCR Table 1d), meaning strutting males or sign of strutting (feathers/droppings) were observed at the lek site. One-hundred-seventy-one (49%) leks were determined to be inactive based on multiple ground visits and/or checks for sign (feathers/ droppings) late in the strutting season. The number of leks monitored annually has remained relatively stable since 2006, which was the last peak in the male lek attendance cycle. Since then, both the average number of males per active lek and the percentage of active leks have decreased significantly, suggesting a notable decrease in the population (Figure 9). This decrease in northeast Wyoming has been greater than that observed for the other working group areas. The decrease in 2013 was eight percent. A large number of leks (n=65) have an unknown activity status. This category includes leks that were not checked or were surveyed but had no strutting activity. For a lek to be considered inactive, two ground visits separated by 7 days and conducted under ideal conditions, or a ground check of the exact lek site late in the strutting season that fails to find sign is needed. Many leks were checked one or more times but protocol to confirm inactivity was not met. A list of sage grouse definitions is available in the statewide JCR and the Biological Techniques Manual.

Figure 9. Trends in Active and Inactive Leks, 1995-2013.



Comparisons of core and non-core area lek monitoring results shows that core areas have a lower number of males per active lek (8.8 vs 9.7) but confirmed lek activity is higher in core areas (61% vs 45%). This suggests the core area policy may be successful at maintaining lek persistence. However, it should be noted that core areas in Northeast Wyoming do not encompass all priority habitats which likely contributes to the discrepancy in average male lek attendance figures.

Some inconsistencies remain in complying with monitoring protocol and monitoring some leks on a regular basis. Some leks have not been documented as active in many years which may be due to inaccurate locations based on legal descriptions. Continued efforts at determining the exact location and status of these leks are needed. As birds on a lek are observed, UTM coordinates are recorded using GPS. GPS locations for lek sites should make future surveys more efficient even with changes in personnel. Furthermore, with the high amount of activity around leks in areas of CBNG development, caution must be used to ensure that strutting activity represents an actual lek and not birds displaced from established leks.

Table 1. Northeast Wyoming Working Group Area Sage-grouse Lek Site Characteristics.

Region	Number	Percent
Casper	143	26.1%
Sheridan	405	73.9%

Classification	Number	Percent
Occupied	416	75.9%
Undetermined	73	13.3%
Unoccupied	59	10.8%

Biologist	Number	Percent
Buffalo	68	12.4%
Casper	30	5.5%
Douglas	43	7.8%
Gillette	245	44.7%
Newcastle	70	12.8%
Sheridan	92	16.8%

County	Number	Percent
Bighorn, MT	1	0.2%
Campbell	199	36.3%
Converse	50	9.1%
Crook	22	4.0%
Johnson	136	24.8%
Natrona	16	2.9%
Niobrara	19	3.5%
Powder River, MT	1	0.2%
Sheridan	36	6.6%
Weston	68	12.4%

Management Area	Number	Percent
C	548	100.0%

Working Group	Number	Percent
Northeast	548	100.0%

BLM Office	Number	Percent
Buffalo	380	69.3%
Casper	56	10.2%
Newcastle	112	20.4%

Game Warden	Number	Percent
Buffalo	75	13.7%
Dayton	18	3.3%
Douglas	21	3.8%
East Casper	5	0.9%
Glenrock	28	5.1%
Kayceee	51	9.3%
Lusk	17	3.1%
Moorcroft	52	9.5%
Newcastle	66	12.0%
North Gillette	68	12.4%
Sheridan	19	3.5%
South Gillette	122	22.3%
Sundance	5	0.9%
West Casper	1	0.2%

Land Status	Number	Percent
BLM	57	10.4%
Private	403	73.5%
State	48	8.8%
US Forest Service	40	7.3%

Lek Status	Number	Percent
Active	176	32.1%
Inactive	171	31.2%
Unknown	201	36.7%

Lek Characteristics

There are 548 sage-grouse leks within the NEWLWGA. Table 1 shows the demographics of leks with regard to WGFD region, BLM Office, county, biologist district, game warden district, land status, and lek status.

In 2013, there were 416 occupied leks and 59 leks are classified as unoccupied leks. Unoccupied leks have either been destroyed or abandoned and are not used by sage-grouse, however, abandoned leks should be monitored on occasion. Seventy-three leks have an undetermined status meaning they have not been documented active in the last ten years, but survey information is insufficient to designate the lek as unoccupied. These figures may differ from the data provided in the JCR tables since the Lek Characteristics data is generated from lek status information entered into the lek database whereas the JCR tables are generated from lek monitoring data. A few discrepancies have yet to be corrected.

Population Trends

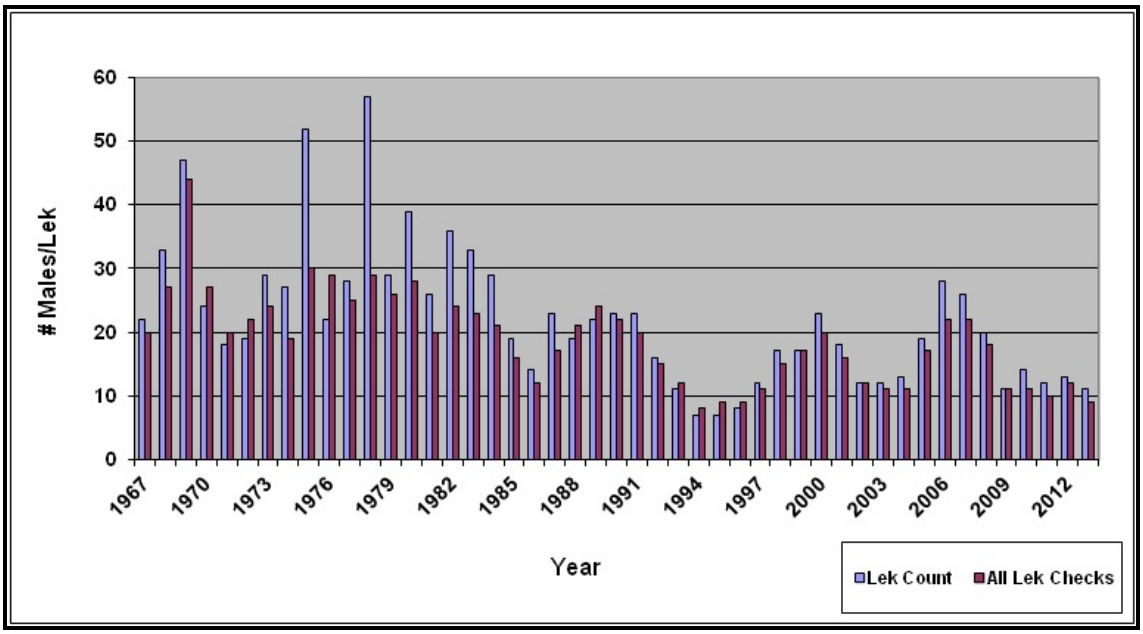
No reliable or cost effective method for estimating the sage-grouse population for the NEWLWGA exists at this time. However, the number of males/active lek provides a reasonable index of abundance of sage-grouse populations over time in response to environmental conditions and other influences. However, it must be noted that lek data must be interpreted with caution for several reasons: 1) the survey effort and the number of leks surveyed/counted has varied over time, 2) it is assumed that not all leks in the area have been located, 3) sage-grouse populations can exhibit cyclic patterns over approximately a decade, 4) the effects of unlocated or unmonitored leks that have become inactive cannot be quantified or qualified, and 5) lek sites may change over time. Both the number of leks and the number of males attending these leks must be quantified in order to estimate population size.

Figure 10 shows the average number of males/active lek for lek counts and all lek monitoring (counts and surveys) combined from 1967 to 2013 for the NEWLWGA. If the average number of males/active lek is reflective of the sage-grouse population, the trend suggests about a 10-year cycle of periodic highs and lows. Of concern, however, is that with the exception of the most recent cycle, subsequent peaks in the average male lek attendance are usually lower than the previous peak. Additionally, periodic lows in the average male attendance are generally lower than the previous low. The long term trend suggests a steadily declining sage-grouse population.

It appears that sage-grouse numbers reached a new peak in 2006 and 2007, exceeding the previous peak of 2000. In fact, the trends suggest sage-grouse may have been at their highest numbers since 1991. However, the percentage of active leks was nearly ten percentage points higher in 1991. The 2008 - 2013 data indicate that peak has passed and lek attendance has entered the declining phase of the cycle, rivaling that observed from 1994 through 1997. However, the percentage of inactive leks is currently much higher compared to the mid-1990's.

The number of total leks has increased over the last 15 years primarily due to increased survey effort associated with CBNG activities. However, the number of active leks has decreased in recent years. While the number of leks present historically cannot be known, recent monitoring confirms the number/proportion of active leks is declining.

Figure 10. Northeast Wyoming Working Group Male Sage-grouse Lek Attendance 1967- 2013.



HABITAT

Habitat Conditions

The general condition of native vegetation during the 2012 growing season was very poor with spring precipitation (March to June) at only 61% of normal. All months recorded below normal precipitation. The dry conditions broke the favorable precipitation pattern which had developed over the past five years. Fortunately, excellent residual herbaceous cover remained from 2011 which should have benefited nesting grouse in 2012. The Palmer Drought Index, a measure of long-term meteorological conditions, showed climate divisions in northeast Wyoming ranging from moderate to extreme drought in May 2013. Shrub surveys showed limited sagebrush leader production reflecting reduced precipitation.

Habitat Impacts

Sage-grouse are influenced by many factors, both individually and cumulatively. Habitat loss and fragmentation, direct mortality and disturbance affect sage-grouse populations. The NEWLWG identified and ranked those factors believed to be most influencing the northeast Wyoming sage-grouse population, as well as those factors that might most effectively be addressed to provide the greatest benefit for sage-grouse conservation in northeast Wyoming. Nearly all top ranking factors were directly related to, or indirectly related to, habitat. The working group felt oil, gas, and coal bed natural gas (CBNG) development, weather, vegetation management, invasive plants, and parasites and diseases were the most important influences on the northeast Wyoming sage-grouse population. In the opinion of the group, conservation efforts targeting oil, gas and CBNG development, vegetation management, invasive plants, local residential land use, and livestock grazing would be most effective in benefiting sage-grouse.

Powder River Basin Restoration Program

In 2011, the BLM created a position to coordinate sagebrush habitat restoration in northeast Wyoming. The biologist will look for opportunities to partner with agencies, industry, landowners

and conservation organizations to restore sagebrush habitat. The Powder River Basin Restoration (PRBR) program is a collaborative partnership to restore and enhance sage-grouse habitat on a landscape level in the Powder River Basin. This BLM High Plains District Office program was developed to form partnerships with local cooperators, federal and state agencies, private landowners, and industry to work collaboratively on sage-grouse habitat restoration. PRBR is focusing on areas affected by federal oil and gas development that has occurred over the past decade in the PRB in northeastern Wyoming.

Goals

- Build partnerships to restore habitat for the greater sage-grouse in large landscape or watershed.
- Integrate habitat improvement programs and projects implemented by partners to leverage funding to enhance sage-grouse habitat reclamation.
- Facilitate the sharing of data/data collection methods, monitoring data/methods, and best management practices.

Douglas Core Area

Sage-grouse within the Douglas Core Area (DCA) have declined precipitously since the last population peak in 2007, decreasing from 76 males to only 11 males known to attend the six leks in 2013. Only two leks were active in 2013, one of which is a new lek that needs additional documentation to confirm its status. The DCA has had a substantial increase in energy development over the past two years. Due to the high density of oil and gas development coupled with an extremely large wildfire that eliminated sagebrush cover over a large landscape, all permitted disturbance within the DCA exceeds thresholds established by the Governor's 2011-5 E.O.. Because the majority of the permitted activities are being developed under valid and existing rights secured prior to core area designation, development has continued to occur despite exceeding disturbance thresholds. To mitigate this, the Wyoming Governor's Office has worked closely with industry to identify a plan of development and establish a large industry funded restoration effort guided by a multi-faceted restoration team. The Restoration Team will identify future sage-grouse habitat restoration and improvement projects and will also sponsor sage-grouse population monitoring efforts within the DCA.

CATO Fire

A June 2012 wildfire burned 27,680 acres northeast of Buffalo, 82% of which was core habitat. The fire burned habitat in the area of three leks, the most notable of which was the Fieldgrove Lek which supported 42 males in 2009. The Lake DeSmet Conservation District, Johnson County Weed and Pest and the BLM coordinated to treat the burn with Plateau herbicide to minimize cheat grass establishment. The conservation district, with financial assistance from the NEWSGLWG, mapped the burn to assist in planning restoration efforts. Efforts continue to work with landowners in identifying and implementing restoration projects.

NRCS Sage-grouse Conservation Initiative

The United States Department of Agriculture – Natural Resource Conservation Service (NRCS) initiated the Sage-grouse Conservation Initiative (SGI) in 2010 to conserve sage-grouse populations by improving sagebrush habitats while improving sustainability and productivity of native rangelands. Because 40% of sage-grouse habitat is found on private lands, the NRCS works with landowners to address limiting factors affecting sage-grouse while maintaining traditional ranching operations. The program focuses on maintaining large, intact grazing

landscapes by reducing fragmentation, implementing grazing systems, targeting conifer encroachment and discouraging subdivisions and conversion to cropland. Seventy-five percent of the sage-grouse population occurs on 27% of sagebrush habitats.

SGI implementation in the Northeast Core Area has primarily been contracted using the Wyoming SGI Prescribed Grazing Option 2. This option is comprised of the following requirements:

- A grazing system will be implemented to improve sage-grouse nesting and early brood rearing habitat. At least 20% of total grazingland acres enrolled must improve residual cover for sage grouse nesting and early brood rearing habitat. The goal for nesting and brood rearing habitat is to provide at least 6 inches of residual herbaceous cover by March 15th and leave undisturbed until July 15th. Average perennial cover of 4 inches during the same period is the goal for precipitation zones of 10 inches or less. In order to achieve this, implementation of a rest/rotation grazing system or a deferred grazing system with light utilization will likely be required.

- All fences located within the high collision risk areas, as identified by the 2012 collision class GIS layer will be marked. In addition those fences within .6 miles of leks not identified by the collision class layer will be marked.

- All watering facilities will be equipped with escape ramps

- Monitoring at a minimum includes:
    - Actual Use Record, or equivalent; including percent utilization by weight of key species, AND
    - Photo point (follow procedure in 2008 WY Rangeland Monitoring Guide), AND
    - At least one additional different monitoring technique from the 2008 Wyoming Rangeland Monitoring Guide.

Table 2. NRCS Sage-grouse Conservation Initiative Contract Summary for Northeast Wyoming.

	Fiscal Years 2010 – 2012 Total	
County	**Contracts**	**Acres**
Campbell	4	45,427
Converse	0	0
Crook	3	37,103
Johnson	25	325,249
Natrona	1	5,210
Niobrara	0	0
Sheridan	4	20,540
Weston	5	66,449
TOTAL	42	499,978

Since the inception of the program the NRCS has developed contracts with 42 landowners totaling 499,978 acres within the Northeast Wyoming Local Working Group Area (Table 2). Johnson County has the bulk of the contracts and the acreage.

Information on the Sage-grouse Initiative is available at http://www.sagegrouseinitiative.com.

SPECIAL PROJECTS

Conservation Planning

The Local Working Group held three meetings during the reporting period. The group continued work on developing a conservation plan addendum to update the 2006 conservation plan. The group also allocated Wyoming Sage-grouse Conservation Funds and received presentations on ongoing research and habitat projects. The plan and other LWG information is available on the WGFD website at http://gf.state.wy.us/wildlife/wildlifemanagement/sagegrouse/index.asp.

The LWG reviewed and allocated $138,800 from the 2012-13 Wyoming Sage-grouse Conservation Fund which totaled $990,000 for conservation projects. The LWG prioritized the local projects for funding and supported funding a statewide project. Eight local projects and one statewide project were approved. Projects included wildfire restoration, noise research, habitat restoration research and education, water development, habitat mapping, disease management research and predator identification.

The group also coordinated with the Governor's Sage-grouse Implementation Team by identifying priority areas for reclamation. Areas identified included core area habitat and priority areas outside of core boundaries identified using the lek density map (male sage-grouse densities). Priority reclamation projects included habitat restoration within the energy play and restoration of habitat impacted by wildfires.

Bighorn Mountain Greater Sage-grouse Movement Pilot Study (excerpt from BLM final report)

This project was undertaken to beter understand where sage-grouse found in the summer and fall in the montane habitats in the southern Bighorn Mountains spend the remainder of the year, and if the southern Bighorn Mountains are an important connection between sage-grouse Management Zones 1 and 2. Twenty two Greater sage-grouse were captured using CODA net guns in the fall in 2008 (n=2) and 2009 (n=20) on the southern Bighorn Mountains of Wyoming where Johnson, Washakie, and Natrona Counties meet. Grouse movement from the montane habitats to lower elevation winter areas occurred between November and January, with birds returning to the mountains the next summer. Interestingly, the individuals captured on the northern study area near Fisher Springs (T44N, R85W) wintered and lekked in the Big Horn Basin around Tensleep (associated with leks in the Buffalo Creek 37 Complex, and Otter Creek Vee): whereas the birds captured in the southern study area near the Middle Fork of Powder River (T42N, 85W) all wintered and lekked in the Powder River Basin (Irish Lake Complex and unknown leks). The longest movement documented was approximately 30 miles, from the Middle Fork at Hazleton Rd to near I25 south of Kaycee.

The pilot study results indicate the montane habitats of the southern Bighorn Mountains are important for brood rearing as well as adult sage-grouse. There is a strong probability that sage-grouse broods from Management Zones 1 and 2 are mixing on summer/fall habitats on the Bighorn Mountains, providing genetic connectivity between Management Zones. Genetic analysis from collected feathers should confirm this hypothesis. Although the Bighorn

Mountains are not included in Wyoming Core Areas (v3), the birds collared on the Bighorns in the summer and fall spent the winter, breeding, and early brooding seasons in Core Areas from both Management Zones 1 and 2. The sage-grouse using the southern Bighorn Mountains should be considered migratory populations. Important brood-rearing and summer habitats have been identified though this study and should be managed accordingly.

Research

The following publications have been authored relative to research conducted in the Powder River Basin of Wyoming and Montana.

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RECOMMENDATIONS

1. Participate in the Northeast Wyoming Sage-grouse Working Group. The Group has developed a conservation plan for the species and designed and implemented projects that benefit sage-grouse. The Department representative will continue to assist with implementing projects identified in the plan.
2. Assist the BLM with developing and implementing the sage-grouse monitoring program as prescribed by the Powder River Basin CBNG EIS Record of Decision (April 2003).
3. Coordinate with the BLM and industry to minimize the number of visits to leks during lek monitoring efforts.
4. Participate in WNv monitoring.
5. Assist the BLM with coordinating sage-grouse population monitoring efforts with the private consultants doing work for energy development companies.
6. Use any additional flight money from the BLM in 2014 for lek searches and surveys. All leks should be checked at least once every three years. All leks should be recorded in UTMs (NAD 83) using GPS.
7. The sage-grouse database should be maintained and used to store and report sage-grouse data. Any old records that have not been included should be added to the database. Current records should be reviewed to eliminate leks without adequate documentation to support a lek designation.
8. The Working Group should continue to solicit habitat projects on private lands that will have benefit for sage-grouse.
9. The Regions should continue to recommend protection of occupied sage-grouse leks during environmental commenting and promote their protection on private land projects.
10. Additional effort is needed to document the status of undetermined leks. Encourage reporting of lek activity from the public and in particular landowners.
11. Document wintering sage-grouse locations. Develop a seasonal range map for sage-grouse for the Working Group Area based on guidelines provided in the Wyoming Sage-grouse Conservation Plan.
12. Document lek perimeters to ensure adequate buffer distance in protecting leks.

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South-Central
Sage-Grouse
Job Completion Report
2012

June 2012-May 2013

Will Schultz
Wyoming Game & Fish Dept.
Laramie Region

South Central Conservation Area

Job Completion Report

Species: **Sage-grouse** Conservation Plan Area: **South Central**

Period Covered: **June 1, 2012 – May 31, 2013** Sage-Grouse Mgmt Area: **H**

Prepared by: **Will Schultz**

Introduction

The South Central Conservation Area (SCCA) generally includes The Platte Valley, Laramie Plains, Great Divide Basin, North Ferris, south Sweetwater and Little Snake River Valley in the counties of Carbon, Sweetwater, Albany, Fremont and Natrona in southern Wyoming (Figure 1).

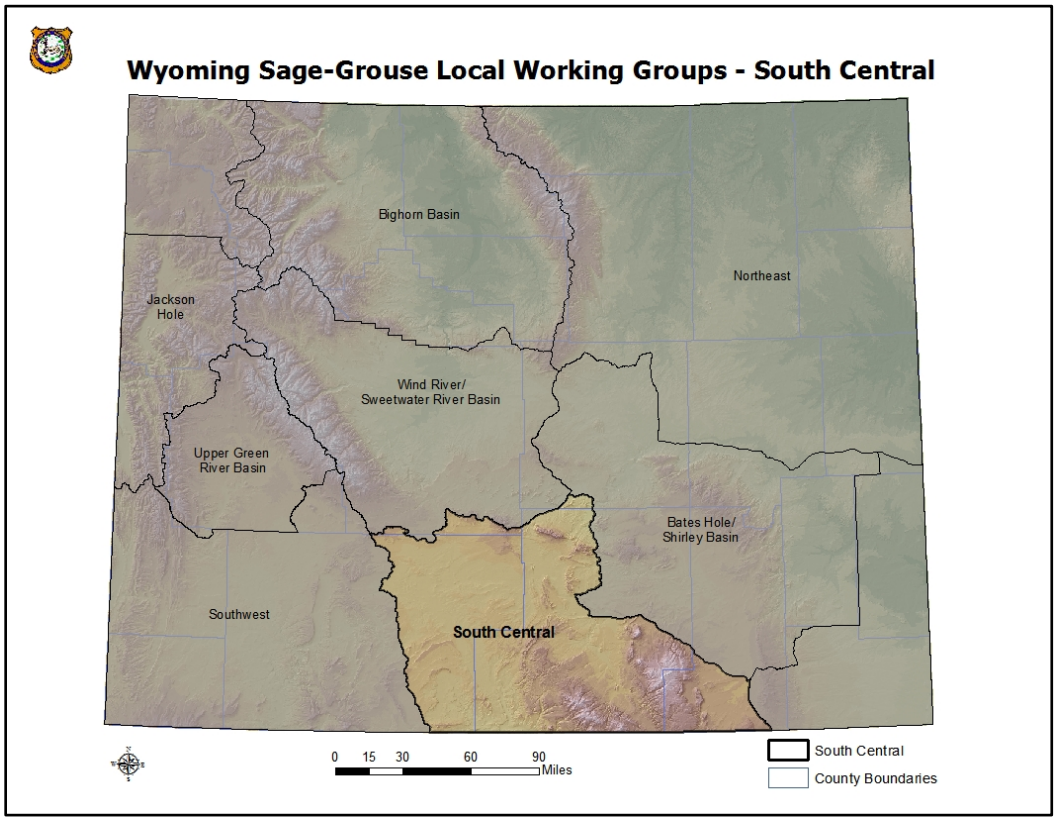


Figure 1. South Central Conservation Area in Wyoming.

Sage-grouse habitat in the SCCA is comprised of public land administered by the Bureau of Land Management (BLM), Wyoming State Land and Investments Board, and private land. A very minor portion of sage-grouse habitat is located on the fringe of the US Forest Service's Medicine Bow National Forest (Figure 2). A major portion of the SCCA is "checkerboard" land ownership (alternating public and private lands) within 20 miles of the railroad corridor in the center of the area. Major habitat types include sagebrush/grassland, salt desert shrub, short-grass prairie, mixed mountain shrub, mixed forest types, agricultural, riparian, and urban types. Transportation corridors include Interstate 80 (I-80), Union Pacific Railroad (mostly parallel to I-80), and State Highways 70, 789, 287, 230/130. Major cities and towns found in the area are Rawlins, Laramie, Saratoga, Encampment, Baggs, and Wamsutter.

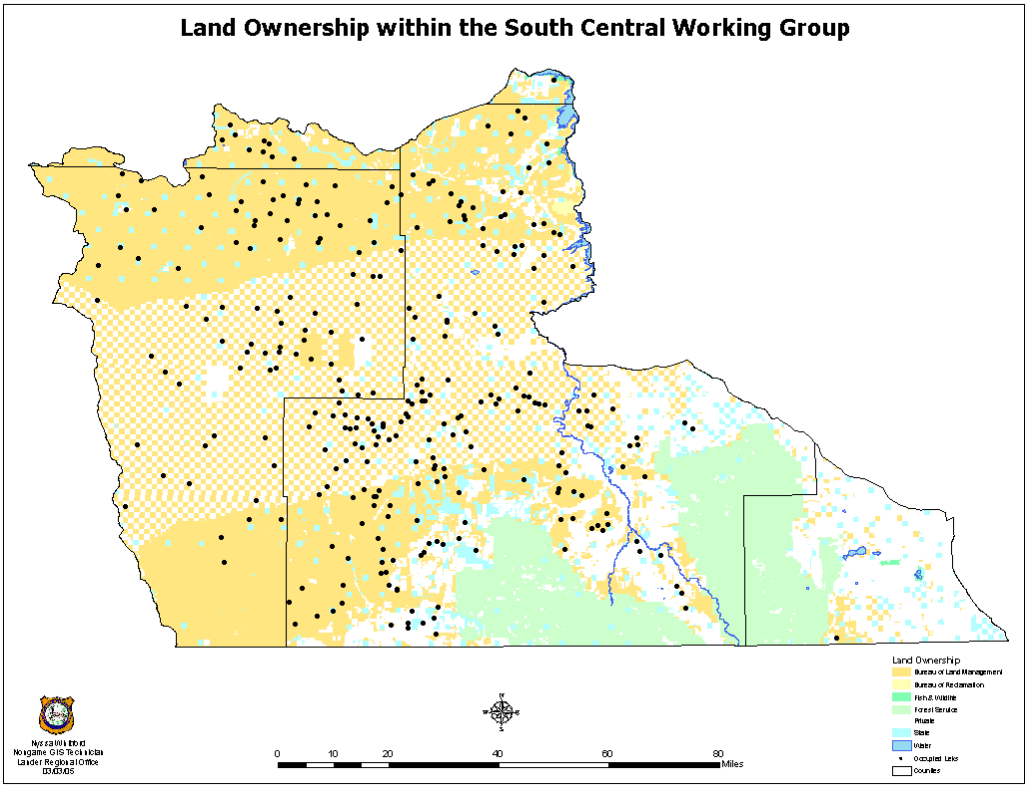


Figure 2. Landownership within the South Central Conservation Area of Wyoming.

The South Central Sage-Grouse Local Working Group (LWG) was initiated in September of 2004 and completed their Sage-grouse Conservation Plan (Plan) in 2007. In 2012, the LWG began developing an addendum to their Plan. Much has changed since 2007 with regard to our

knowledge about this species and the conservation efforts which have been implemented at both the state and range-wide level. This addendum will document the research and habitat projects the LWG supported since their Plan was completed and how these projects addressed the goals and action items identified in the Plan. The addendum will also provide a brief review for new science and for regulatory conservation mechanisms which support sage-grouse conservation efforts in the SCCA. The addendum will become available in late winter of 2014.

In 2013, there were 178 occupied, 99 unoccupied, and 99 unknown status leks in the SCCA. A total of 252 leks were monitored producing an average peak males/lek ratio of 17.6 males.

The 2012 upland harvest survey indicated 636 hunters spent 1,382 days to harvest 1,194 sage-grouse in the SCCA. Analyses of wing data from hunter harvested sage-grouse indicated the proportion of chicks in the harvest was 0.8 chicks/hen in the SCCA.

Weather

The National Climate Data Center/National Oceanic and Atmospheric Administration (NCDC/NOAA) has divided Wyoming into 10 climatic divisions for the purpose of weather data recording (Figure 3). These divisions correspond to major watersheds within the state. Wyoming's climatic division 10, the Upper Platte, covers much of the SCCA. Climatic data for all divisions can be found at the NCDC/NOAA web site: http://www.ncdc.noaa.gov/oa/ncdc.html .

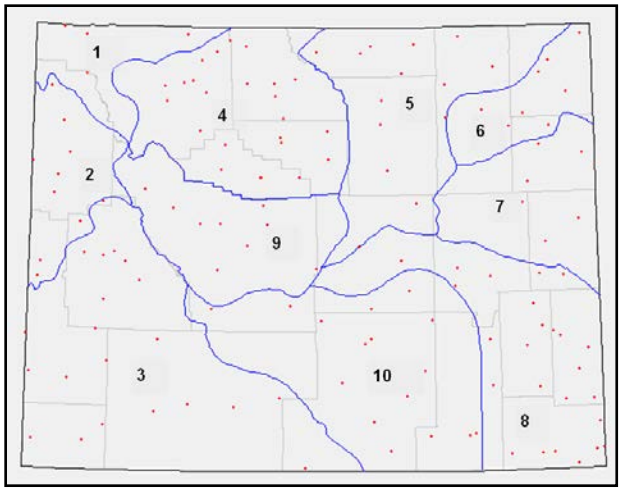


Figure 3. NCDC/NOAA, State of Wyoming Climate Division Map.

The Palmer Drought Severity Index uses temperature and precipitation data to determine dryness. Palmer Drought Severity Index data indicated over the past 11 years Division 10 has experienced 8 years of drought (Figure 4). There was a short period of time in bio-years (June 1 – May 31) 2009 - 2011 when Division 10 experienced a short period of wetter than average

weather. For more information about the Palmer Drought Severity index please visit the website below.

(http://www.ncdc.noaa.gov/oa/climate/research/prelim/drought/palmer.html)

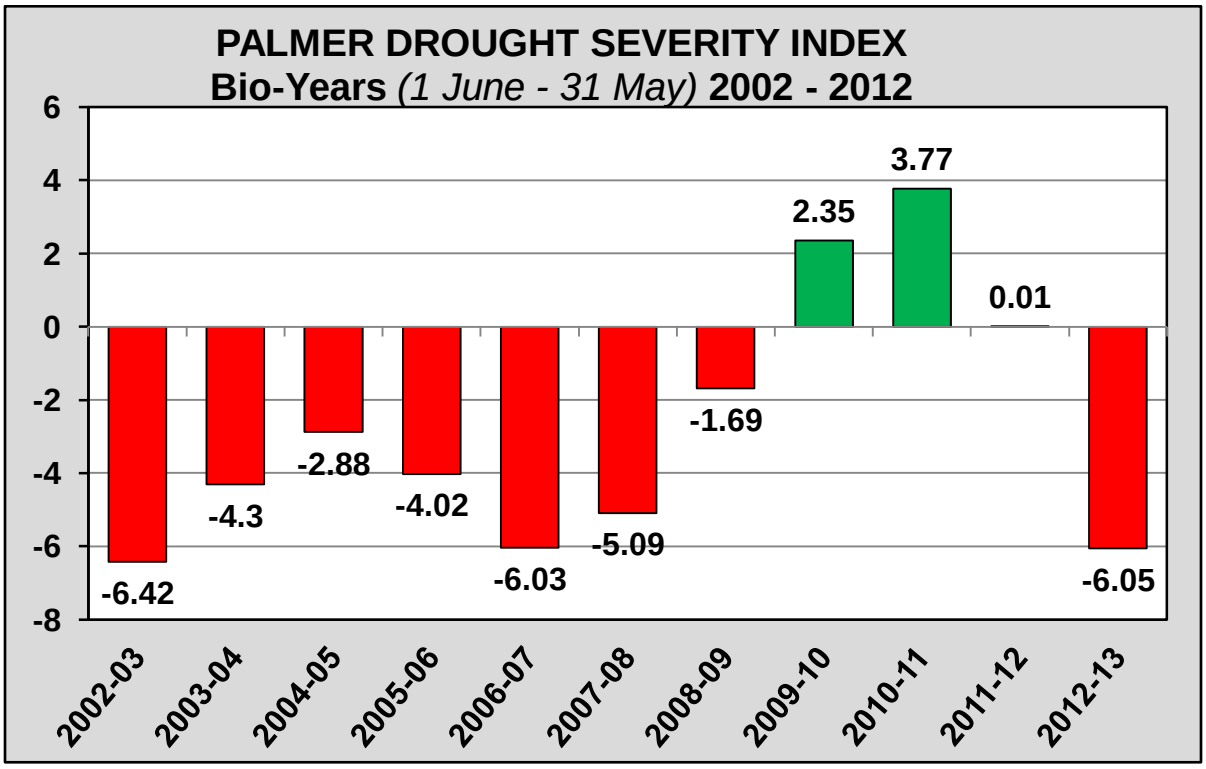


Figure 4. 2002-2012 Palmer Drought Severity Index indices for the Upper Platte Climatic Division 10, Wyoming.

Bio-year 2012 was second only to bio-year 2002 in ranking for the most severe drought period recorded since 1913. The warm and extremely dry conditions experienced in May and June of 2012 likely contributed significantly to reduced nesting success and chick survival. Spring habitat conditions are one of the most important factors in determining nesting success and chick survival. Specifically, shrub height, live and residual grass height and cover, and forb cover have a large impact on sage-grouse nesting success. The shrub and grasses provide screening cover from predators and weather while the forbs provide forage and also provide insects that reside in the forbs. Spring precipitation is an important determinant of the quality and quantity of these vegetation characteristics. Residual grass height and cover depends on the previous year's growing conditions and grazing pressure while live grass and forb cover are largely dependent on the current year's precipitation.

Habitat

Much of the sage-grouse habitat in the SCCA is comprised of an intact sagebrush ecosystem. The health of this ecosystem is predominately dependant on the type, amount, and timing of annual precipitation. However, several energy extraction developments are located within the SCCA. Most of this activity is producing natural gas from both deep gas and coal bed methane sources. In addition to natural gas, several wind energy projects have proposed in the SCCA. A 1,000 turbine wind energy development, known as the Chokecherry/Sierra Madre Wind Energy Project, is proposed to be located immediately south of Rawlins. While wind energy is a renewable resource, it is still an industrial development that has the potential for causing direct and indirect impacts to sage-grouse and other sagebrush obligates.

Livestock grazing is another predominate use of sage-grouse habitat in the SCCA. In the first half of the 20th century, much of the sage-grouse habitat in the SCCA provided winter grazing for hundreds of thousands of both domestic sheep and cattle. In the later part of the last century, sheep numbers declined dramatically while cattle became to primary species of livestock using the SCCA. Improved grazing management on both public and private lands during the last few decades has generally led to improved habitat for sage-grouse and other sage-brush obligates.

Lek Monitoring and Population Trend

Tables and graphs describing annual lek monitoring efforts, observations, and lek characteristics are provided in APPENDIX A. The WGFD, BLM, consultants, and volunteers monitored 252 leks in the spring of 2013. This represented checking approximately 90% of the occupied status leks in the SCCA. This effort was up from the 75% of leks checked in 2012. The 2004-2013 annual average of leks checked was 84%. The proportion of leks checked in the spring of 2012 was above the 10-year average.

A new sage-grouse database was developed in 2012 in order to improve efficiency, reduce errors, and better facilitate data analysis. Changes were made to the manner in which lek data are calculated and reported in Table 1. The new version is based solely on "occupied" leks. The past version suggested that was the case in the title of Table 1, but when unoccupied leks were monitored those data were also included in the Table. The result of this change is that the number of "known occupied" leks is now more accurate, but reflects fewer leks than in the previous version. Similarly, the new version calculates average male lek attendance using only monitoring observations where one or more male grouse were observed strutting. The old version included a count of "0" males for leks where activity was confirmed by the presence of sign but no birds were observed. Together, these two changes result in somewhat higher, but more accurate, average male attendance for active leks than previously reported. The changes do not result in any change in population trend based on average male lek attendance. Interpreted

population increases and decreases over time remain the same so no revisions to past reports are required.

Since only occupied leks are being reported on Table 1, it is important to consider trends in the numbers of active versus inactive leks in addition to the average size of active leks. The number of occupied leks which were inactive increased from 25% in 2012 to 35% in 2013. The average size of the active leks declined from 22.0 in 2012 to 17.6 in 2013. During a period of population decline, the size of active leks typically declines and the number of inactive leks increases. The converse is typically true of an increasing population. Therefore the magnitude of both increases and decreases is usually greater than what is indicated by the average lek size alone.

Average female lek attendance is no longer being reported since our data collection techniques is not designed to accurately capture these data and is therefore not a useful figure in assessing population trend.

Monitoring the total number of males on a lek is used as an index of trend, but these data should be viewed with caution since survey effort has varied over time, leks have moved, birds move among leks in a complex, and other reasons that are explained on page 12 in the Wyoming Greater Sage-grouse Conservation Plan (2003).

In 2013 (2012 bio-year), the peak male lek attendance was 3,073 and averaged 21.6 males/lek. The 2013 males/lek average was 17% below the average from the past 10 years of 39.4%, has been declining in trend since 2006. Count monitored leks averaged 21.6 males/lek compared to 14.6 males/lek for survey monitored leks. The current low male attendance rate is within the parameters observed since 1996 and most likely attributable to normal cyclic variation in populations and to weather conditions in recent years. Figure 5 illustrates the trends in average peak males/lek for all sage-grouse conservation areas in Wyoming, as well as the statewide average.

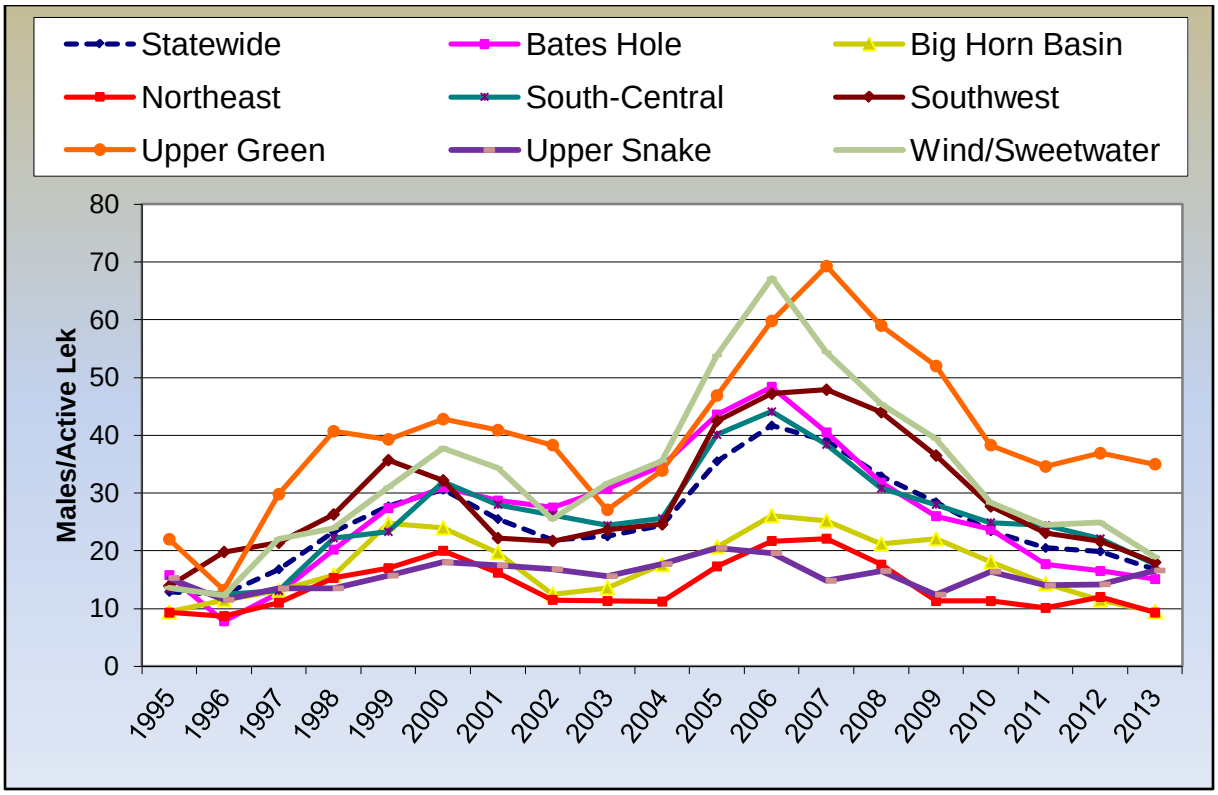


Figure 5. Peak male sage-grouse lek attendance by local working group, 1995-2013, Wyoming.

Harvest

Tables and graphs describing hunting season structure, annual harvest and subsequent wing survey analyses are provided in APPENDIX A. The 2012 sage-grouse hunting season was from September 15 to September 30, and allowed for the harvest of 2 sage-grouse/day and 4 in possession. The 2012 upland harvest survey indicated 636 hunters spent 1,382 days to harvest 1,194 sage-grouse in the SCCA. This equals about 0.9 birds/day, 1.9 birds/hunter, and 2.2 days/hunter. These hunter and harvest statistics were below the 10-year average. Compared to 2011 when hunting regulations were similar with the exception of 2 less days in the season length, hunter numbers increased by 7%, the birds/day remained the same, and the birds/hunter decreased by .2 birds. Generally during the past 10 years, harvest indices have been similar, and overall harvest would appear be correlated to hunter numbers rather than grouse abundance.

Hunter-harvested sage-grouse wings have been collected annually and used for estimating productivity. Wings were collected in barrels set at major road junctions where hunters are most likely to pass, and can provide a relatively consistent source of productivity data. Wings are gathered and then aged/sexed by molt patterns, and numbers of chicks/hen are calculated and used as a measure of productivity. This technique assumes hunter harvest is unbiased between

sex and age classes, especially chicks and hens. Even if this assumption is not met, trends still provide yearly comparisons of relative chick production.

During the 2012 hunting season we collected 220 wings from wing barrels within the SCCA. This was an decrease of 19% when compared to the 271 collected in 2011. Age and sex composition of the wings indicated the proportion of chicks/hen also decreased from 1.3 in 2011 to 0.8 in 2012. Statewide analyses of wing data have suggested chick/hen ratios of 1.4-1.7 typically results in relatively stable populations as determined by lek counts the following year. The chicks/hen ratio observed in the 2012 was the lowest during the past 10 years and appeared to correlate with the lower population size and lower production we have documented in recent lek monitoring efforts in the SCCA.

Disease

No disease mortalities for sage-grouse were reported within the SCCA during this period. However, one dead sage-grouse from Carbon County, within the adjacent Bates Hole/Shirley Basin Conservation Area, was confirmed positive for West Nile Disease during the summer of 2012.

Special Studies

In conjunction with development of the proposed Chokecherry/Sierra Madre Wind Farm, located south of Rawlins, a multi-faceted sage-grouse research project was initiated in late 2010. The principal investigators include the consulting firm SWCA, University of Missouri, and US Forest Service. A similar wind development impacts research effort was also initiated in the 7-Mile/Simpson Ridge area which is within the Bates Hole/Shirley Basin Conservation Area immediately adjacent to the SCCA. Principal investigators include W.E.S.T. Inc., Wyoming Wildlife Consultants, Inc. and the University of Wyoming.

Several academic research projects related to sage-grouse in the SCCA have been completed in recent years (Table 1). The SCCA LWG provided some of the funding for these research projects.

Table 1. Academic research projects in and adjacent to the South Central Conservation Area, Wyoming.

Project	Status
Common Raven Density and Greater Sage-Grouse Nesting Success in Southwest Wyoming: Potential Conservation and Management Implications Jonathan B. Dinkins., 2013. PhD Thesis, Utah State University, Logan, UT	Completed 2013
Herbaceous and avifauna responses to prescribed fire and grazing timing in a high-elevation sagebrush ecosystem. Heidi Jo Erickson. 2011. MS Thesis. Colorado State University. Fort Collins, CO	Completed 2011
Quantifying habitat importance for greater sage-grouse (*Centrocercus urophasianus*) population persistence in an energy development landscape. Christopher P. Kirol, C. P. 2012. MS Thesis. University of Wyoming, Laramie, WY.	Completed 2012
Microhabitat selection for nesting and brood-rearing by the greater sage-grouse in xeric big sagebrush. Christopher P. Kirol1, Jeffrey L. Beck, Jonathan B. Dinkins, and Michael R. Conover	Completed 2012
Evaluation of greater sage-grouse reproductive habitat and response to wind energy development in south-central, Wyoming Chad W. LeBeau. 2012. MS Thesis. University of Wyoming. Laramie, Wyoming.	Completed 2012

CONSERVATION STRATEGIES

Endangered Species Act Status

In 2010, U.S. Fish and Wildlife Service (Service) issued a decision for greater sage-grouse of warranted but precluded from immediate listing due to higher priorities. In its decision document, the Service specifically cited Wyoming's Core Area Strategy as a mechanism that, if implemented as envisioned, should ensure conservation of sage-grouse in Wyoming and therefore help preclude a future listing.

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

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 FS, NRCS, BLM, and FWS. 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. 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 the sage-grouse so that it is no longer in danger of extinction or likely to become in danger of extinction.

In summary, the report prepared by the COT (U.S. Fish and Wildlife Service 2013) listed energy development, infrastructure, improper livestock and/or improper wildlife grazing 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 South Central Conservation 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 (Table 1.).

The General Conservation Objectives identified by the COT are:

- Stop population declines and habitat loss.
- Implement targeted habitat management and restoration.
- Develop and implement state and federal sage-grouse conservation strategies and associated incentive-based conservation actions and regulatory mechanisms.
- Develop and implement proactive, voluntary conservation actions.
- Develop and implement monitoring plans to track the success of state and federal conservation strategies and voluntary conservation actions.
- Prioritize, fund and implement research to address existing uncertainties.

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.

Governor's Core Area Strategy and Executive Order

The Wyoming Sage-Grouse Core Area Strategy (CAS) is based on a series of Executive Orders issued by former Governor Dave Fruedenthal and current Governor Matt Mead (WY-EO-2011-5). The CAS is designed to coordinate sage grouse conservation efforts across the State of Wyoming and directs state agencies to work to maintain and enhance greater sage grouse habitat in Wyoming.

The CAS addresses the threats (habitat loss and fragmentation and insufficient regulatory mechanisms) specifically identified by the Service in their 2010 listing decision. In a June 2011 letter to Governor Mead, the Service said, "In summary, the Service believes the Greater Sage-grouse Core Area Protection provides an excellent model for meaningful conservation of sage-grouse if fully supported and implemented. We believe that when fully realized, this effort could ameliorate many threats to the Greater sage-grouse in Wyoming."

A key component of the strategy's implementation is the Density and Disturbance Calculation Tool (DDCT). This tool was developed by agency GIS specialists and made available in July 2012 as an interactive, on-line application through the University of Wyoming's Geographic Information and Science Center.

The Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) are working to adopt Wyoming's Core Area Strategy into their land management decision processes in Wyoming. A new WY-BLM sage-grouse instruction memorandum was issued in early 2012 (WY-BLM IM 2012-19). BLM Resource Management Plans (RMPs) and USFS Forest Plans

across the state are being amended to incorporate Wyoming's Core Area Strategy and new BLM national sage-grouse policy (BLM-IM-2012-043 and 044).

Conservation Plan Implementation

The South Central Sage-Grouse Local Working Group (LWG) was initiated in September of 2004 and completed their Sage-grouse Conservation Plan (Plan) in 2007. The SCCA LWG now meets 1-2 times per year, with additional meetings if needed. Project implementation is currently underway with several projects completed, and several more planned for the next 2-3 years.

In 2012, the LWG began developing an addendum to their Plan. Much has changed since 2007 with regard to our knowledge about this species and the conservation efforts which have implemented at both the state and range-wide level. This addendum will document the research and habitat projects the LWG supported since their Plan was completed and how these projects addressed the goals and action items identified in the Plan. The addendum will also provide a brief review for new science and for regulatory conservation mechanisms which support sage-grouse conservation efforts in the SCCA. The addendum will become available in late winter of 2014.

The projects being implemented by the SCCA Local Sage-Grouse Working Group in accordance with the SCCA Conservation Plan are shown in Table 2.

Table 2. Completed conservation actions supported by the South Central Local Working Group, 2007-2013, Wyoming. (Referenced to the 2007 South Central Sage-Grouse Conservation Plan's Goals and Objectives and Table of Commitments and Recommendations).

Goal/ Objective/ Action	Project	Status
1.3.a	Develop monitoring plan in SCCA and produce yearly report http://gf.state.wy.us/web2011/WILDLIFE-1000496.aspx	Completed 2008
1.3.b	Coordinate and conduct lek surveys in areas where threats have been identified and prioritized	Completed Annually
1.4.a	Use statewide database to store all SCCA lek data	Completed 2012

Goal/ Objective/ Action	Project	Status
1.5.a	Map sage-grouse lek perimeters	Completed Annually
1.5.b	Map winter concentration areas	Completed Annually
2.1.a	Identify issues, threats, opportunities in SCCA	Completed 2005
2.2.a	Map sage-grouse habitat in SCCA http://gf.state.wy.us/web2011/wildlife-1000817.aspx	Completed
3.1.a	Carbon County Reseeding- Forb seed is planted in right-of- way areas within the county, by Road and Bridge employees as a part of reclamation in construction areas. Project areas reclaimed are in suitable sage-grouse habitat throughout the SCCA.	Completed 2006,
3.4.a	16-Mile Project: Project Description: This project contains several smaller projects located throughout the Atlantic Rim/16-mile area, and consists of the development and protection of naturally occurring waters, while continuing to provide existing water sources outside of the riparian areas for livestock (and within for selected wildlife species). • Upper Jeps Spring Development- 2 springs, 2 tanks, and 2 enclosures. • Separation Drainage Spring Development - 3 springs, 3 tanks, and 3 enclosures. • Separation Peak Spring Development Project- 4 springs, 4 tanks, and 4 enclosures. • Dolittle Spring Development- 1 spring, 1 tank, and 1 pipeline. • Tank Battery Project- 1 spring, 1 tank, and 1 enclosure • Jeps Range Fence (4.5 miles • Hadsel Draw Fence (8 miles) • 7-Mile-Lake fence (1.5 miles)	Completed 2006

Goal/ Objective/ Action	Project	Status
3.4.a	Found Spring Improvement Project - Project Description: The project included the development of off-site upland watering for livestock and wildlife, in coordination with the already protected spring site. A head-box or spring-box in the Found Spring site and a buried pipeline will be used to fill a tire tank located 2000 feet off-site. The excess water from the tire trough would be returned to the drainage of origin via an overflow pipe in the tire trough. The plumbing in the spring development would allow the tire trough to flow water only when livestock use is being made within the allotment to reduce pressure in existing riparian areas.	Completed 2006,
3.4.a	Wildhorse Draw Spring Improvement Project - Project Description: The project included the development of off-site upland watering for livestock and wildlife and the protection of the existing spring site within the Buck pasture of the Seminoe grazing allotment. Developing the spring would provide off-site water using a head-box or spring-box and a buried pipeline to move water to a dirt tank located a few yards off-site with overflow returned to the drainage. The plumbing in the spring development would allow the tank to fill only when livestock use is being made within the allotment to reduce pressure in existing riparian areas.	Completed 2006,

Goal/ Objective/ Action	Project	Status
3.4a	The following 9 independent projects are a series of water development projects. All tanks have wildlife escape ramps, and overflows that allow water to be returned to the drainage to improve sage-grouse habitat. All spring developments are fenced to exclude livestock grazing. In total approximately 80,000 acres are benefited by these projects. Additional water has allowed for changes in grazing periods and times, which will result in improved habitat for sage-grouse. • Walcott Water development- 1 storage tank, pipeline, 3 drinking tanks. • Buck Draw water development- Spring development and protection, pipeline, 2 drinking tanks. • Tullis water development- 2 spring developments, 2 drinking tanks. • Ninemile Solar Pump- 3 solar pumps, 3 drinking tanks. • Sulfur Springs spring development- spring development, pipeline, drinking tank. • Shamrock water development- 3 wells drilled, solar panels, 3 drinking tanks. • Seminoe water development- spring development, pipeline, and tank. • Whiskey Gap water development- pipeline, and 3 drinking tanks from existing spring. • Lamont center pivot Irrigation system for alfalfa. Management to favor sage-grouse.	Completed 2007
3.4.a	Midway Grazing Management- 8 pasture prescribed grazing system.	Completed 2007
3.7a	Natural Resource Conservation Service – Sage-grouse Initiative Extension Biologist positions in Saratoga and Baggs.	Completed 2011

Goal/ Objective/ Action	Project	Status
4.1.a	Common Raven Density and Greater Sage-Grouse Nesting Success in Southwest Wyoming: Potential Conservation and Management Implications Jonathan B. Dinkins., 2013. PhD Thesis, Utah State University, Logan, UT	Completed 2013
5.1.b	Develop a "BMP's to maintain or enhance sage-grouse populations in areas of energy development within the SCCA" document for application on private, state, and federal lands. Will include BMP's for each type of development.	Completed 2008
5.1.b	Distribute "BMP's" pamphlet to energy developers	Completed 2009
5. 1. b.	Distribute sage-grouse place mats	Completed
5. 1. b.	Distribute informational brochure regarding sage-grouse and SCCA group.	Completed
5. 1. b.	Hold public information meetings upon completion of plan in conjunction with WGFD season setting open houses and meetings.	Completed 2007
5. 1. b.	Develop and distribute "recommended practices" pamphlet to all users in sage grouse habitat.	Completed 2008

Recommendations

1) Improve efforts to survey leks of unknown status.

2) Support LWG efforts to work on reclamation issues, especially seed mixes that benefit sage-grouse.

3) Continue to update data from SCCA in the sage-grouse database.

5) Continue to map seasonal habitats, especially winter habitats.

6) Work with BLM to ensure that burns and treatments in and around sage-grouse habitat meet sage-grouse habitat treatment prescriptions.

7) Build partnerships with private landowners to maintain or improve sage-grouse habitats on private lands through mutually beneficial habitat projects.

Literature Cited

U.S. Fish and Wildlife Service. 2013. Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report. U.S. Fish and Wildlife Service, Denver, CO. 113pp.

Wyoming Game and Fish Department (WGFD). 2003. Greater Sage-grouse Conservation Plan. 97pp.

_____. 2007. South Central Sage-Grouse Conservation Plan. 74pp.

APPENDIX A.

Sage Grouse Job Completion Report

Year: 2004 - 2013, Management Area: H, Working Group: South Central

1. Lek Attendance Summary (Occupied Leks) (1)

a. Leks Counted

Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek (2)
2004	256	35	14	1348	43.5
2005	253	27	11	1453	58.1
2006	250	39	16	2106	58.5
2007	250	47	19	2090	48.6
2008	258	49	19	1683	37.4
2009	262	68	26	2021	33.7
2010	267	54	20	1528	33.2
2011	264	50	19	1272	31.0
2012	278	56	20	1490	28.1
2013	281	93	33	1600	21.6

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2004	256	176	69	2677	21.2
2005	253	184	73	4882	36.7
2006	250	181	72	5564	40.3
2007	250	176	70	4523	35.1
2008	258	151	59	3085	28.0
2009	262	152	58	2648	24.7
2010	267	170	64	2849	21.9
2011	264	157	59	2460	22.0
2012	278	183	66	2206	19.2
2013	281	159	57	1473	14.6

1) Occupied - Active during previous 10 years (see official definitions)

2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

3) Inactive - Confirmed no birds/sign present (see official definitions)

Sage Grouse Job Completion Report

Year: 2004 - 2013, Management Area: H, Working Group: South Central

1. Lek Attendance Summary (Occupied Leks) (1) Continued

c. Leks Checked

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek (2)
2004	256	211	82	4025	25.6
2005	253	211	83	6335	40.1
2006	250	220	88	7670	44.1
2007	250	223	89	6613	38.4
2008	258	200	78	4768	30.8
2009	262	220	84	4669	28.0
2010	267	224	84	4377	24.9
2011	264	207	78	3732	24.4
2012	278	239	86	3696	22.0
2013	281	252	90	3073	17.6

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2004	161	7	88	168	95.8	4.2
2005	158	16	79	174	90.8	9.2
2006	173	24	53	197	87.8	12.2
2007	175	21	54	196	89.3	10.7
2008	163	17	78	180	90.6	9.4
2009	176	38	48	214	82.2	17.8
2010	181	28	58	209	86.6	13.4
2011	160	44	60	204	78.4	21.6
2012	180	61	37	241	74.7	25.3
2013	187	99	99	286	65.4	34.6

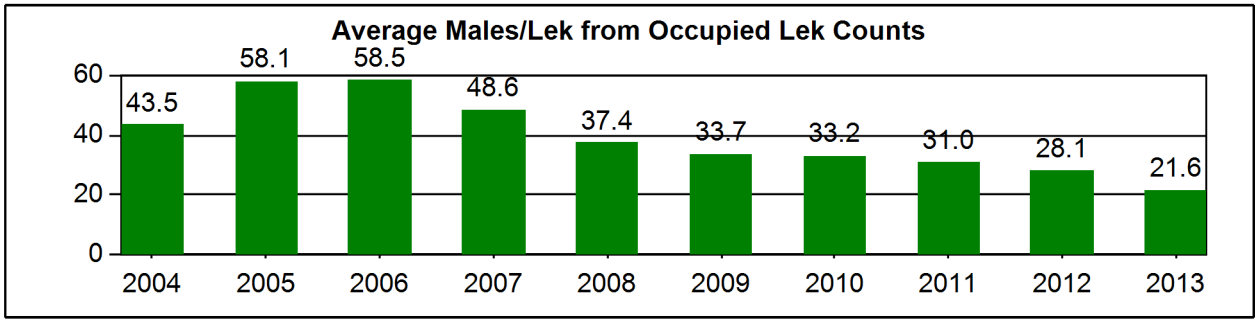
1) Occupied - Active during previous 10 years (see official definitions)

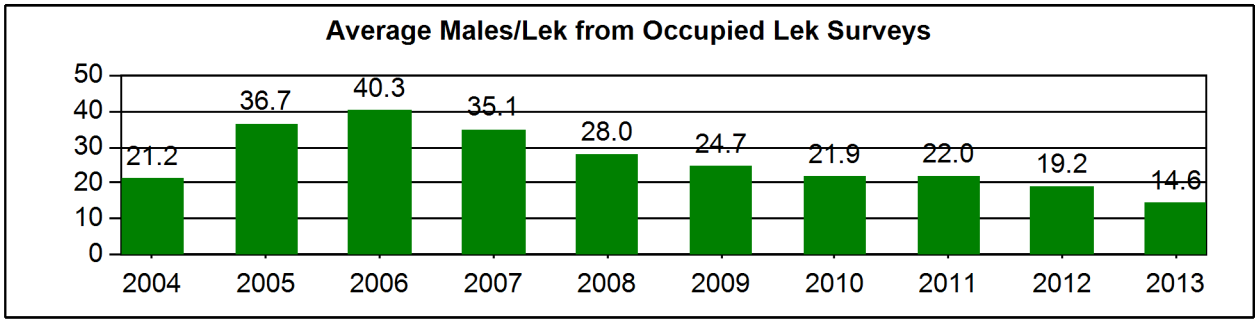
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

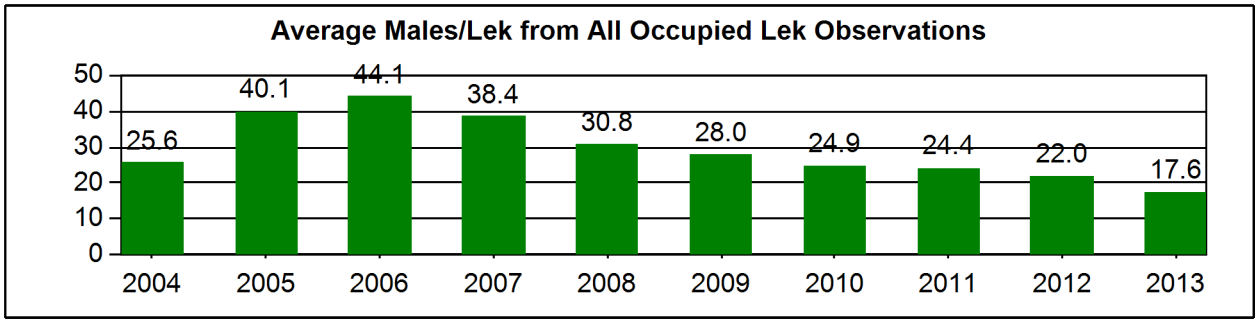
3) Inactive - Confirmed no birds/sign present (see official definitions)

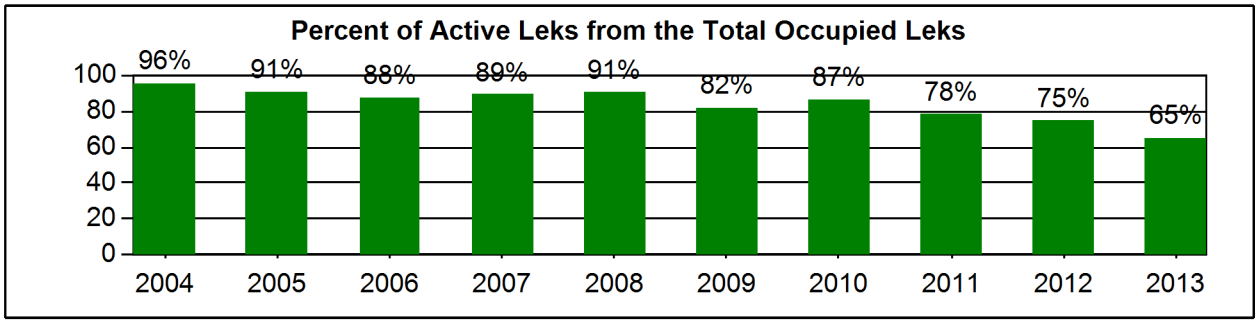
Sage Grouse Occupied Lek Attendance Summary

Year: 2004 - 2013, Management Area: H, Working Group: South Central



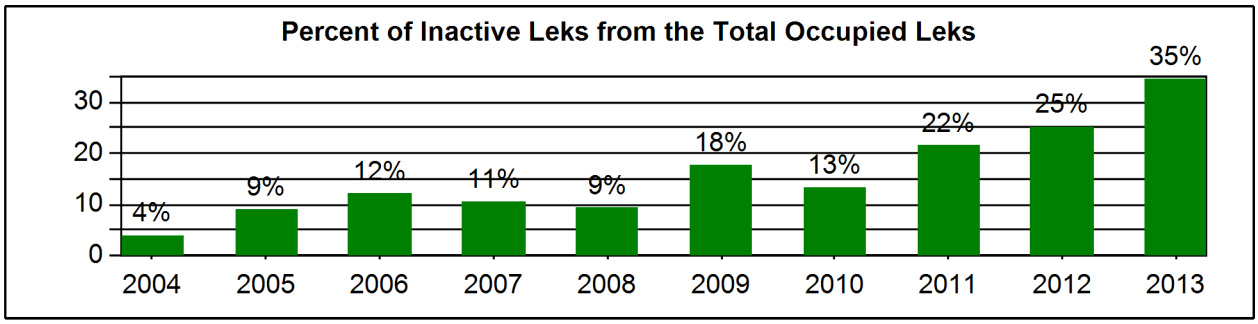






Sage Grouse Occupied Lek Attendance Summary

Year: 2004 - 2013, Management Area: H, Working Group: South Central



Sage Grouse Lek Characteristics

Management Area: H, Working Group: South Central

Region	Number	Percent
Green River	125	32.5
Lander	206	53.5
Laramie	54	14.0

Working Group	Number	Percent
South Central	385	100.0

Classification	Number	Percent
Occupied	330	85.7
Undetermined	20	5.2
Unoccupied	35	9.1

BLM Office	Number	Percent
Casper	2	0.5
Lander	23	6.0
Rawlins	346	89.9
Rock Springs	14	3.6

Biologist	Number	Percent
Baggs	111	28.8
Green River	14	3.6
Laramie	5	1.3
Rawlins	190	49.4
Saratoga	49	12.7
South Lander	16	4.2

Warden	Number	Percent
Baggs	110	28.6
East Rawlins	56	14.5
Elk Mountain	6	1.6
Rock Springs	15	3.9
Saratoga	43	11.2
South Laramie	5	1.3
West Rawlins	150	39.0

County	Number	Percent
Albany	5	1.3
Carbon	263	68.3
Fremont	13	3.4
Natrona	2	0.5
Sweetwater	102	26.5

Land Status	Number	Percent
BLM	221	57.4
BLM/Private	10	2.6
Not Determined	2	0.5
Private	125	32.5
Private/BLM	1	0.3
State	21	5.5
State/Private	1	0.3
USF&WS	1	0.3
WGFC	1	0.3
WGFD	2	0.5

Management Area	Number	Percent
H	385	100.0

Lek Status	Number	Percent
Active	187	48.6
Inactive	99	25.7
Unknown	99	25.7

Sage Grouse Job Completion Report

Year: 2003 - 2012, Management Area: H

4. Sage Grouse Hunting Seasons and Harvest Data

a. Season

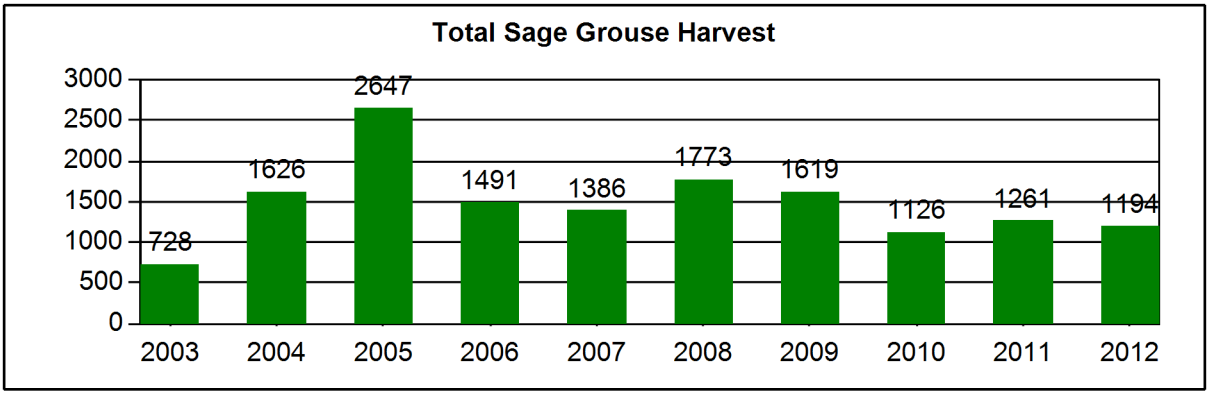
Year	Season Start	Season End	Length	Bag/Possesion Limit
2003	Sep-27	Oct-5	9	2/4
2004	Sep-23	Oct-3	11	2/4
2005	Sep-23	Oct-3	11	2/4
2006	Sep-23	Oct-3	11	2/4
2007	Sep-22	Oct-2	11	2/4
2008	Sep-22	Oct-2	11	2/4
2009	Sep-19	Sep-30	12	2/4
2010	Sep-18	Sep-30	13	2/4
2011	Sep-17	Sep-30	14	2/4
2012	Sep-15	Sep-30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

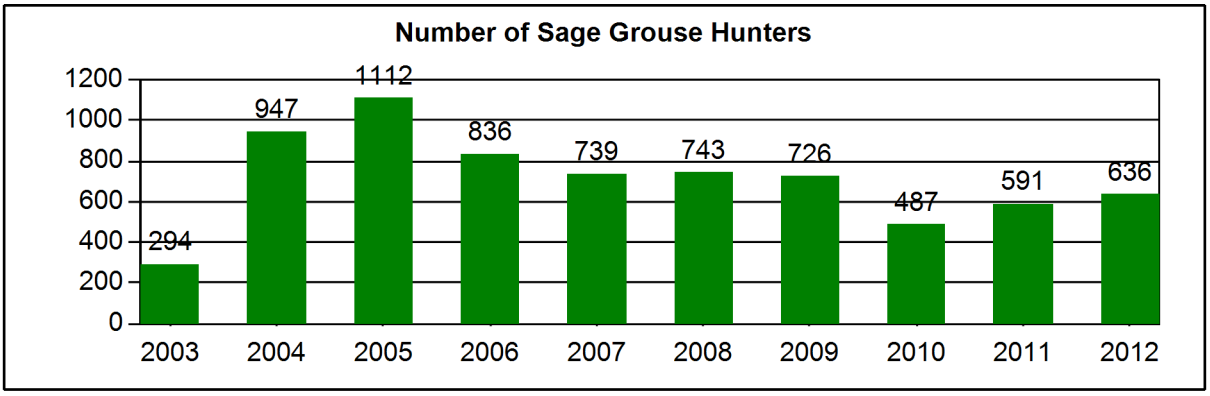
b. Harvest

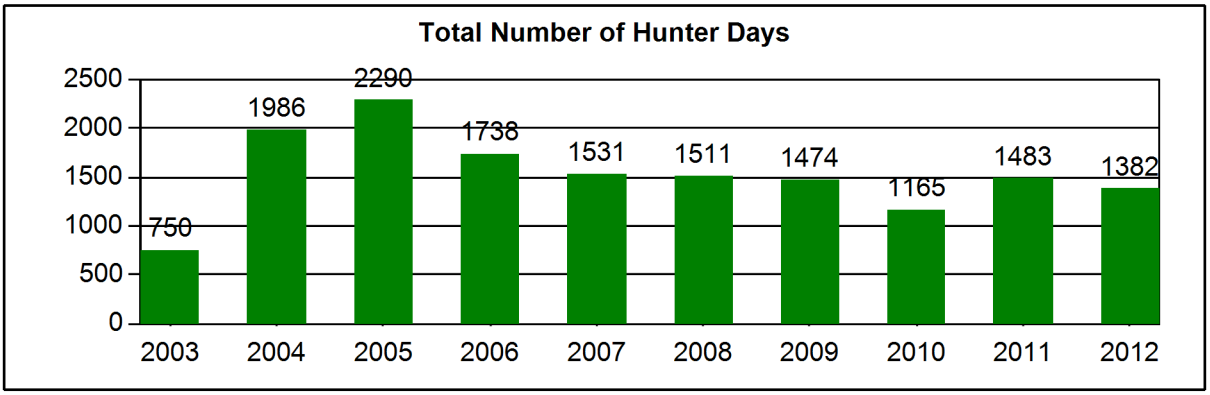
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2003	728	294	750	1.0	2.5	2.6
2004	1626	947	1986	0.8	1.7	2.1
2005	2647	1112	2290	1.2	2.4	2.1
2006	1491	836	1738	0.9	1.8	2.1
2007	1386	739	1531	0.9	1.9	2.1
2008	1773	743	1511	1.2	2.4	2.0
2009	1619	726	1474	1.1	2.2	2.0
2010	1126	487	1165	1.0	2.3	2.4
2011	1261	591	1483	0.9	2.1	2.5
2012	1194	636	1382	0.9	1.9	2.2
Avg	1,485	711	1,531	1.0	2.1	2.2

Sage Grouse Harvest Summary

Management Area: H

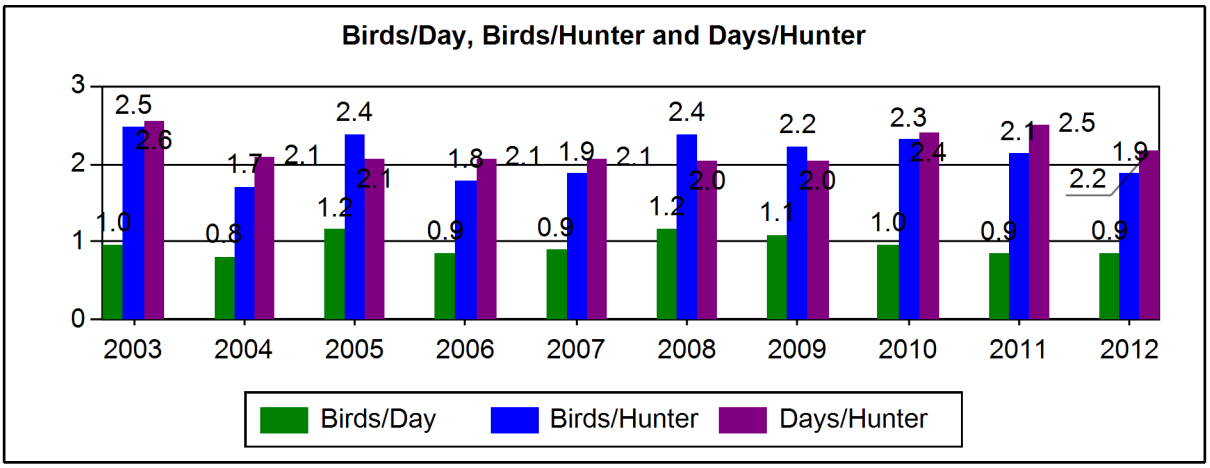






Sage Grouse Harvest Summary

Management Area: H

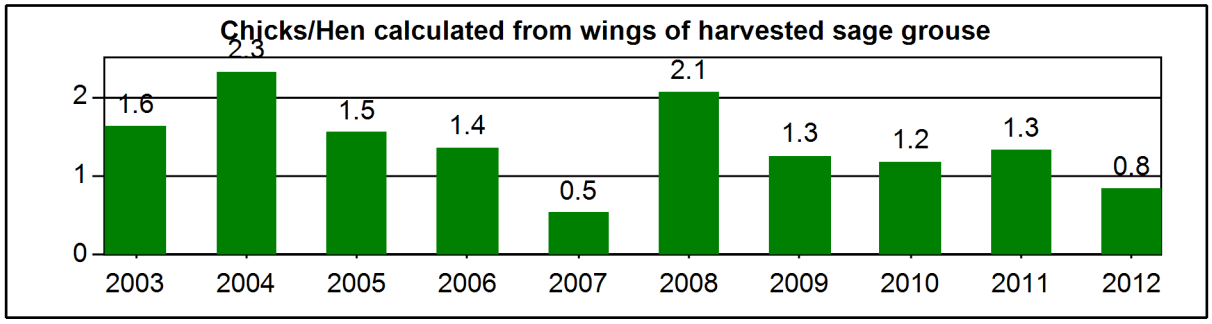


Sage Grouse Job Completion Report

Year: 2003 - 2012, Management Area: H

5. Composition of Harvest by Wing Analysis

Year	Sample Size	Percent Adult		Percent Yearling		Percent Young		Chicks/ Hens
		Male	Female	Male	Female	Male	Female	
2003	310	13.2	28.4	0.3	4.5	24.8	28.4	1.6
2004	284	7.4	22.5	0.4	5.3	30.3	34.2	2.3
2005	345	13.6	27.8	3.8	4.6	20.0	30.1	1.5
2006	315	16.8	28.3	3.8	5.4	21.6	24.1	1.4
2007	199	20.1	35.2	7.0	12.6	10.6	14.6	0.5
2008	233	8.2	24.5	2.1	4.7	26.2	33.9	2.1
2009	282	15.2	23.8	8.5	9.9	15.6	27.0	1.3
2010	230	10.4	33.9	1.3	6.5	13.0	22.2	1.2
2011	271	11.8	29.2	3.0	7.4	20.7	27.7	1.3
2012	220	10.0	38.2	5.5	7.7	15.5	23.2	0.8



Southwest
Sage-Grouse
Job Completion Report
2012

June 2012-May 2013

Patrick Burke
Wyoming Game & Fish Dept.
Green River Region

2012 Annual Sage-Grouse Job Completion Report

Conservation Plan Area: **Southwest**
Biological Year: **June 1, 2012 – May 31, 2013**
Prepared by: **Patrick Burke**

INTRODUCTION

The Southwest Wyoming Sage-Grouse Conservation Area (SWSGCA) is one of eight in Wyoming (Figure 4). The local working groups were created in 2004 and are charged with developing and implementing plans to promote sage-grouse conservation. The conservation plan for the SWSGCA was completed in July 2007. This report focuses on analysis of data for the biological year June 1, 2012- May 31, 2013.

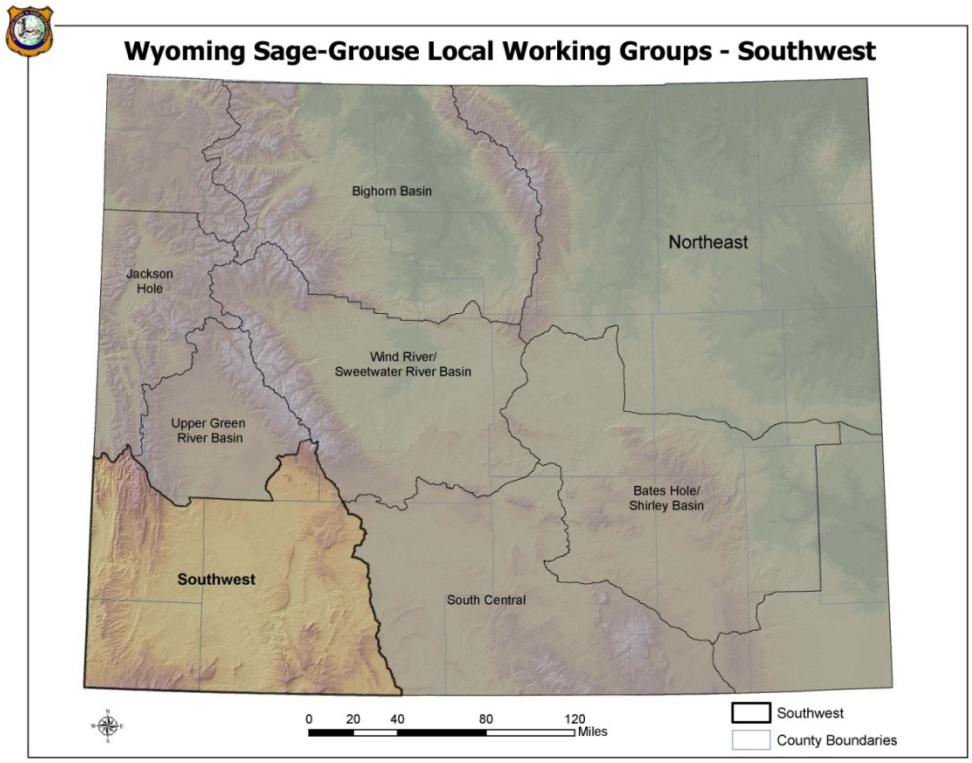


Figure 4. Wyoming Local Sage-Grouse Working Group Boundaries

In response to range-wide sage-grouse population declines and loss of sagebrush habitats, upon which sage-grouse depend, there has been an increased emphasis on sage-grouse data collection over the past two decades. Those monitoring efforts have suggested that sage-grouse populations in the SWSGCA were at their lowest levels ever recorded in the mid-1990s. Grouse numbers then responded to increased precipitation during the late 1990's with some individual leks seeing three fold increases in the number of males counted between 1997 and 1999. The return of drought conditions in the early 2000's led to decreases in chick production and survival and therefore population declines; although the populations have not fallen back to mid-1990s

levels. Timely precipitation in 2004-05 increased chick survival and later lek attendance, however drought conditions from 2006-08 appear to have caused the populations to decline. Increased springtime precipitation in 2009-2011 did not resulted in increased sage-grouse numbers. We suspect the moisture arrived with cold temperatures during the peak of hatching which may have reduced hatching success and early chick survival. Drought conditions again returned in 2012, which resulted in decreased chick to hen ratios, suggesting an increased rate of population decline.

In addition to the continuing drought conditions that have been experienced off and on for the last decade, and the impacts that drought might have on sage-grouse, some of the other causes of concern for sage-grouse populations in the SWSGCA include continued pressure from natural gas development, livestock grazing practices and vegetation treatment practices. In addition to the aforementioned threats, the recent interest in wind energy development is a cause for concern and could potentially have measurable impacts on sage-grouse populations throughout Wyoming and the west.

The issues of hunting and predation and the effects of hunting are concerns that are often raised by the public. There is little documentation hunting has any population level impacts on sage-grouse in Wyoming (Christiansen 2010). Research in the Upper Green River Basin area suggests raven populations are heavily subsidized by human activities and raven predation may be impacting grouse in that area (Bui 2009). Another raven impacts study is currently underway in the SWSGCA and South-Central SGCA.

WYOMING CORE AREA STRATEGY

In a move to coordinate sage-grouse conservation efforts across the State of Wyoming, Gov. Dave Freudenthal utilized the recommendations from his Sage-Grouse Implementation Team (SGIT) and released an Executive Order on Aug. 1, 2008 that directed state agencies to work to maintain and enhance greater sage grouse habitat in Wyoming. The 2008 Executive Order is appended to the 2008 Statewide Sage-Grouse JCR. These actions constituted Wyoming's Core Area Strategy. The executive order established a "core area" strategy of management.

Following the March 2010 "warranted but precluded" listing decision by the U.S. Fish & Wildlife Service, Governor Freudenthal reconvened the SGIT and tasked them to update the core area map and strategy using the most recent data. The SGIT, with the assistance of the local working groups, prepared these updates during the spring and summer of 2010 and Governor Freudenthal issued a new Executive Order on August 18, 2010 to replace that from 2008.

Governor Freudenthal did not seek reelection and in January 2011 newly elected Governor Matt Mead was inaugurated. Governor Mead issued his own Sage-Grouse Executive Order on June 2, 2011 which reiterated and clarified the intent of Wyoming's Core Area Strategy. The new executive order is appended to the 2010-11Statewide JCR.

Most of the changes to the core areas in the SWSGCA were relatively minor with the boundaries of some of the core areas being modified to remove areas that were not occupied by sage-grouse. Some of the areas removed were juniper habitats, or areas that have already experienced

substantial development and are no longer suitable sage-grouse habitat. The implementation team, at the request of wind energy development companies, modified two portions of the South Pass core area on White Mountain just north of Rock Springs. The current core areas are shown in Figure 5.

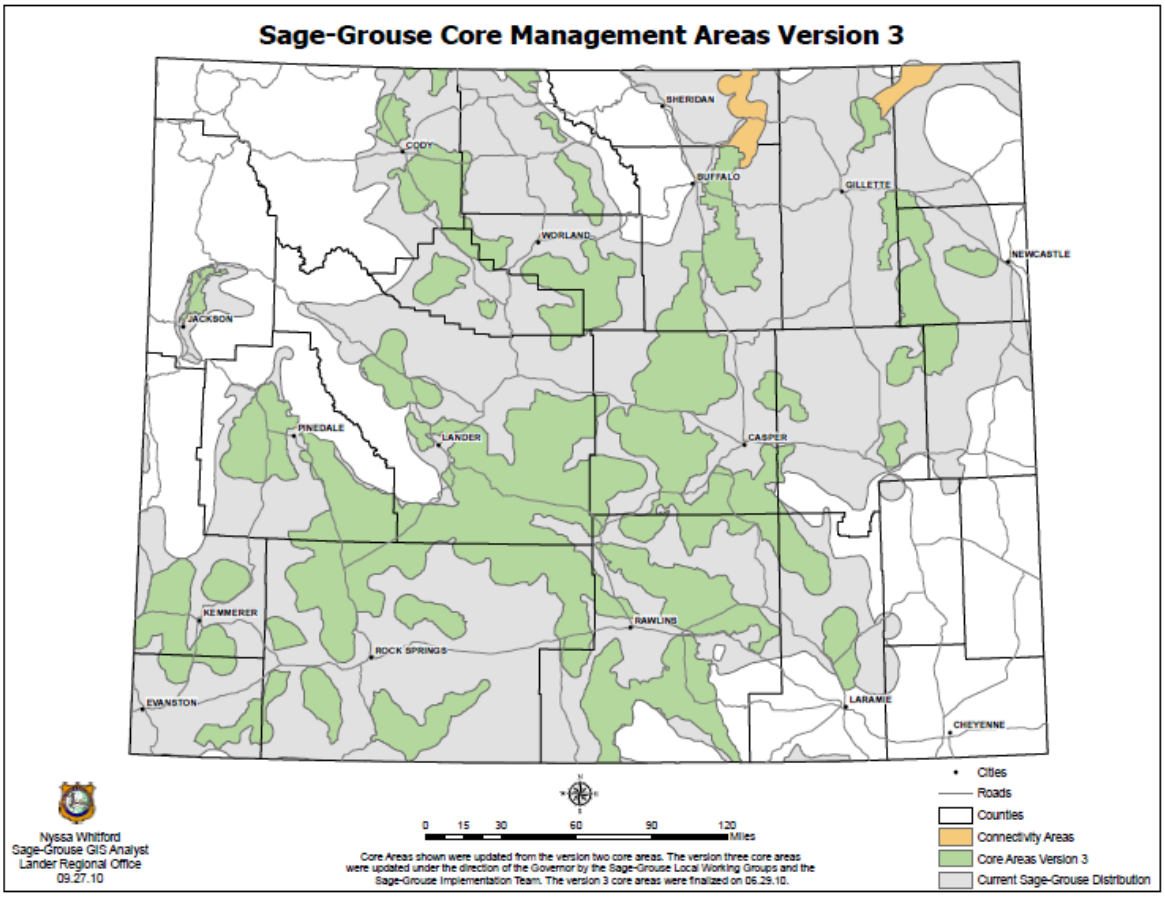


Figure 5. Wyoming sage grouse core areas Version 3.

METHODS

Data on numbers of sage-grouse males attending leks are collected in two ways: lek surveys and lek counts. Lek surveys are defined as at least one visit to a lek during the breeding season to determine if the lek was active or inactive. A lek is considered to be active if one or more males were observed strutting on the lek during one of the lek visits. Lek counts consist of three or more visits (separated by about 7-10 days) to a lek during the peak of strutting activity (late March-mid May) to better estimate the maximum number of males attending that lek. Average male attendance is calculated as the maximum number of males observed on each lek divided by the number of leks checked, using only those leks that were known to be active that year.

Harvest information is obtained through a mail/internet questionnaire of Wyoming game bird license holders. From 1982 to 2009 sage-grouse harvest data were compiled by Upland Game

Management Area. Management Areas in the SWSGCA included Areas 4, 5, 6, and a portion of Area 7 (Figure 6). The remainder of Management Area 7 was included in the Upper Green River Basin Conservation Planning Area (UGRBCA). Starting in 2010, sage-grouse harvest data are being reported by Sage-Grouse Management Area. The Sage-Grouse Management Areas were created to correspond to the local working group boundaries, which will allow for harvest data to be more accurately attributed to each conservation planning area. The Sage-Grouse Management Area for the SWSGCA is Management Area G. This change may result in a slight decrease in the harvest reported in the SWSGCA.

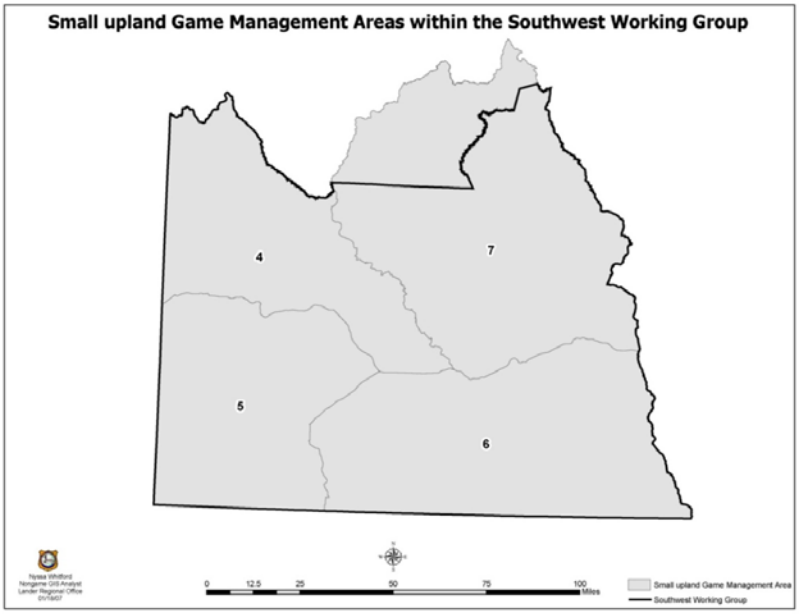


Figure 6. Small Game Management Areas within the Southwest Wyoming Sage-Grouse Conservation Planning Area. Small Game Management Areas were used to report sage-grouse harvest prior to 2010.

In addition to the mailed questionnaire, wings are collected on a voluntary basis from harvested sage-grouse in order to calculate the proportions of adults, juveniles, males, and females in the harvest. Wings were submitted by successful hunters at wing collection barrels distributed throughout the SWSGCA. Of primary interest is the chick to hen ratio, a statistic that provides an index of annual chick productivity and survival.

More specific methods for collecting sage-grouse data are described in the sage-grouse chapter of the WGFD Handbook of Biological Techniques (Christiansen 2007), which is largely based on Connelly et al (2003).

RESULTS

Lek Monitoring

A new sage-grouse database was developed in 2012 in order to improve efficiency, reduce errors, and better facilitate data analysis. Changes were made to the manner in which lek data are calculated and reported in Appendix B Tables 1a-d. The new version is based solely on "occupied" leks. The past version suggested that was the case in the title of Table 1, but when unoccupied leks were monitored those data were also included in the Table. The result of this change is that the number of "known occupied" leks is now more accurate, but reflects fewer leks than in the previous version. Similarly, the new version calculates average male lek attendance using only monitoring observations where one or more male grouse were observed strutting. The old version included a count of "0" males for leks where activity was confirmed by the presence of sign but no birds were observed. Together, these two changes result in somewhat higher, but more accurate, average male attendance for active leks than previously reported. The changes do not result in any change in population trend based on average male lek attendance. Interpreted population increases and decreases over time remain the same so no revisions to past reports are required.

Since only "occupied" leks are being reported on Appendix B Tables 1a-d, it is important to consider trends in the numbers of active versus inactive leks in addition to the average size of active leks. During a period of population decline, the size of active leks typically declines and the number of inactive leks increases. The converse is typically true of an increasing population. Therefore the magnitude of both increases and decreases is usually greater than what is indicated by the average lek size alone.

Average female lek attendance is no longer being reported since our data collection techniques is not designed to accurately capture these data and is therefore not a useful figure in assessing population trend.

Monitoring the total number of males on a lek is used as an index of trend, but these data should be viewed with caution for several reasons: 1) the survey effort and the number of leks surveyed/counted has varied over time, 2) it is assumed that not all leks in the area have been located, 3) sage-grouse populations can exhibit cyclic patterns over approximately a decade, 4) the effects of unlocated or unmonitored leks that have become inactive cannot be quantified or qualified, and 5) lek sites may change over time. Both the number of leks and the number of males attending these leks must be quantified in order to estimate population size.

All lek monitoring data for the 2013 breeding season along with data from the past ten years for comparison are summarized in Appendix B Tables 1a-d and JCR Data Figures 2a-e. There were 316 occupied leks known to exist in the SWSGCA during the 2013 breeding season. Of the known lek sites in the SWSGCA, 294 of them were checked in 2013 resulting in 239 being documented as being active, 49 were classified as being inactive and 28 leks were of unknown or undetermined status. Because of the quantity of leks in the SWSGCA, data collection efforts were focused on lek surveys, which involved at least one visit to the lek during the breeding season over lek counts, which are more labor intensive and involve three or more visits during

the breeding season. Fedy and Aldridge (2011) determined that population trends demonstrated by lek surveys are the same as those indicated by lek counts as long as the number of leks surveyed exceeds 50.

The average number of males per active lek for all leks checked (both counted and surveyed) was 17.8 males per active lek. This is a reduction from an average of 21.6 males per lek in 2011, and is the lowest average observed since 2002 when an average of 21.5 males per lek was observed. The average number of males in attendance on the 116 count leks in 2013 was 19.5 males per lek. This number is a decrease from the observed averages of recent years and is the lowest observed average since 1993 when 13.8 males per count lek were also observed. For the 176 leks that were surveyed in 2013, the average lek had 16.5 males in attendance.

It is important to note that data collection efforts have increased considerably since the early 2000's. Because of this, the observed increase in the number of grouse observed is an artifact of an increased sampling effort and does not represent an actual increase in the sage-grouse population. In 2000, only 63% of known occupied leks were checked, but in 2013, 93% of the occupied leks were checked. In addition, efforts by WGFD personnel, volunteers, and other government and private industry biologists have led to increased numbers of known leks.

Currently, no method exists to estimate sage-grouse population size in a statistically significant way. However, the decreased male per lek averages in recent years along with lower chick per hen ratios indicates the sage-grouse population in southwest Wyoming is declining.

Harvest

The 2012 hunting season for sage-grouse in the SWSGCA ran from September 15 to September 30 and allowed for a daily take of 2 birds with a limit of 4 grouse in possession (Appendix B Table 2a). The 2012 season was consistent with how the season has been run since 2002 when the season was shortened and the daily bag limit was reduced to 2 birds. The sage-grouse season had traditionally started as early as September first and ran for 30 days; during this time the daily limit was 3 grouse with a possession limit of up to 9 birds. Over time, the season was gradually shortened and the daily bag and possession limits reduced because of concern over declining sage-grouse populations. The opening date was moved back from the first of September to the third weekend because research suggested that hens with broods were concentrated near water sources earlier in the fall and therefore more susceptible to harvest. The later opening date allowed more time for those broods to disperse and therefore reduced hunting pressure on those hens that were successful breeders and on young of the year birds.

The data for grouse harvested in the SWSGCA are reported under Sage-Grouse Management Area G for the 2010 through 2012 hunting seasons. Note that for 2001-2009 the data for all birds harvested in Management Areas 4, 5, 6, and 7 were included in the SWSGCA report even though a portion of Area 7 was located in the UGRBSGCA. Since the majority of Area 7 resided within the boundaries of the SWSGCA, the decision was made to include all of the data from Area 7 in this report.

Based on the estimates resulting from harvest surveys returned by hunters, 1,775 hunters harvested 3,737 sage-grouse during the 2012 hunting season (Appendix B Table 2b and Figures 2a-d) which is similar to estimated hunter numbers and harvest reported for the last several years, with some slight declines in the harvest rate and total number of hunters in 2012 than the previous hunting seasons. The trends in harvest statistics over the last 10 years are not well correlated with average male lek attendance due to changes in hunting season structure over that period.

Successful hunters submitted 581 grouse wings during the 2012 hunting season (Appendix B Table 3). This represents approximately 16% of the estimated total harvest for 2012, which is right in line with the ten-year average submission rate of 16%, but down from the 2011 submissions, when almost one quarter of the estimated harvest was submitted.

Wings are collected to allow for the determination of the sex and age of harvested birds. Assuming that hen and chick harvest is proportional to the actual makeup of the population, chick production for that year can be estimated. Even if the rate of harvest between age/sex groups is not random, the information can be used as a tool for looking at population trends as long as any biases are relatively consistent across years. The most important ratio from the wing analysis is the chick to hen ratio; this ratio provides a general indication of chick recruitment. In general it appears that chick:hen ratios of about 1.3:1 to 1.7:1 result in relatively stable lek counts the following spring, while chick:hen ratios of 1.8:1 or greater result in increased lek counts and ratios below 1.2:1 result in subsequent declines. The chick:hen ratio as determined from hunter submitted wings for the 2012 hunting season was 0.7 chicks/hen (Appendix B Table 3 and Figure 3). This ratio suggests an overall population decline.

Weather

Spring habitat conditions are one of the most important factors in determining nesting success and chick survival for sage-grouse. Specifically, shrub height and cover, live and residual grass height and cover, and forb cover have a large impact on sage-grouse nesting success. The shrubs and grasses provide screening cover from predators and weather while the forbs provide forage and insects that reside in the forbs, which are an important food source for chicks. Spring precipitation is an important determinant of the quality and quantity of these vegetation characteristics. Residual grass height and cover depends on the previous year's growing conditions and grazing pressure while live grass and forb cover are largely dependent on the current year's precipitation.

The spring (March-June) precipitation and fall chick:hen ratios (as determined by hunter submitted wings) are given in Table 4 and Figure 7. Generally speaking, when spring precipitation is at or above 90% of average, chick to hen ratios are above average, but when spring precipitation is below average, chick:hen ratios are also below average.

In 2012, spring precipitation was only 30% of normal. The below average precipitation observed in 2012 coincides with the below average chick ratio observed in the 2012 wing submissions.

Winter weather has not been shown to be a limiting factor to sage-grouse except in areas with persistent snow cover that is deep enough to limit sagebrush availability. This condition is rarely present in the SWSGCA even during the above average winter of 2010-2011.

Table 4. Spring precipitation compared to fall chick:hen ratios in the SWSGCA 2003-2012. Precipitation data from: http://www.wrcc.dri.edu/index.html (Click on Monitoring – under Monitoring click on Drought Monitoring then click on Monthly divisional precipitation or temperature – click on the map in the relevant portion of Wyoming, in this case division #3 Green and Bear Drainage Division – set up the plot as desired including "List the data for the points plotted?" Option – add the percentages listed under March through June of the year of interest and divide by four).

Year	% of Average March-June Precipitation	Chicks:Hen
2003	93%	1.6
2004	92%	2.2
2005	134%	3.2
2006	50%	1.1
2007	57%	1.8
2008	64%	2.1
2009	141%	1.4
2010	139%	0.9
2011	117%	1.5
2012	30%	0.7

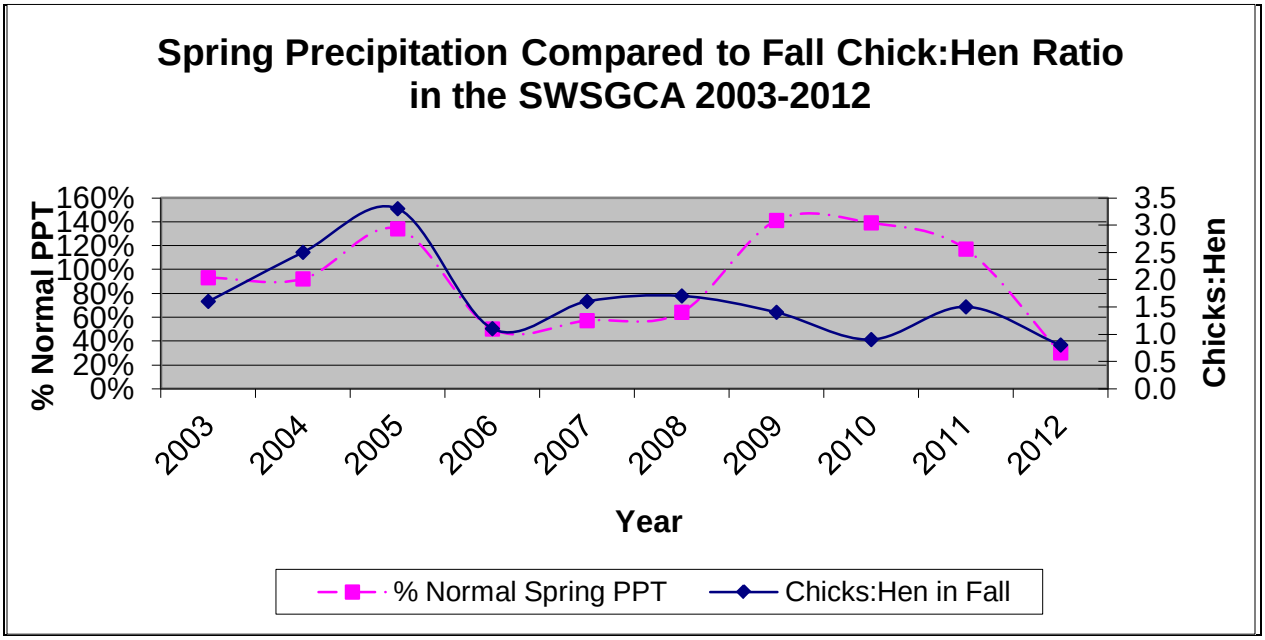


Figure 7. Percent of normal spring precipitation compared to fall chick to hen ratios in the Southwest Wyoming Sage-Grouse Conservation Planning Area

Habitat and Seasonal Range Mapping

While we believe that most of the currently occupied leks in the SWSGCA have been documented, other seasonal habitats such as nesting/early brood-rearing and winter concentration areas have not yet been adequately identified. Efforts to map seasonal ranges for sage-grouse will continue by utilizing winter observation flights and the product of the current research effort by the USGS Science Center in Fort Collins, CO to model seasonal sage-grouse habitat in Wyoming.

CONSERVATION PLANNING/IMPLEMENTATION

Since 2005, Local Working Groups have been allocated approximately $4.2 million to support implementation of local sage-grouse conservation projects. The source of this funding is the State of Wyoming General Fund as requested by Governor Freudenthal and approved by the legislature. See Attachment A for a list of the projects implemented in, or on behalf of, the SWSGCA during the 2013-14 biennium. Additional projects from this appropriation will be implemented during the 2013 bio-year.

PAST RESEARCH/STUDIES IN THE SWSGCA

Conover, M. R., J. S. Borgo, R. E. Dritz, J. B. Dinkins and D. K. Dahlgren. 2010. Greater sage-grouse select nest sites to avoid visual predators but not olfactory predators. The Condor 112(2):331-336.

Dinkins, J. B., M. R. Conover, C. P. Kirol, and J. L. Beck. 2012. Greater sage-grouse (*Centrocercus urophasianus*) select nest-sites and brood-sites away from avian predators. The Auk 129:600–610.

Heath, B. J., R. Straw, S. H. Anderson and J. Lawson. 1997. Sage-grouse productivity, survival, and seasonal habitat use near Farson, Wyoming. Completion Report. Wyoming Game and Fish Department. Cheyenne.

Patterson, R. L. 1952. The sage-grouse in Wyoming. Wyoming Game and Fish Department. Sage Books.

Slater, S. J. 2003. Sage-grouse *(Centrocercus urophasianus)* use of different-aged burns and the effects of coyote control in southwestern Wyoming. M.S. Thesis. University of Wyoming, Department of Zoology and Physiology. Laramie.

Slater, S. J. and J. P. Smith. 2010 Effectiveness of raptor perch deterrents on an electrical transmission line in southwestern Wyoming. Journal of Wildlife Management 74:1080-1088.

CURRENT RESEARCH IN THE SWSGCA

- Conservation planning maps and winter habitat selection of greater sage-grouse in the Hiawatha Regional Energy Development project area – Colorado Division of Wildlife.

- Impacts of raven abundance on greater sage-grouse nesting success in southwest Wyoming – Utah State University. A peer reviewed publication from this effort was published during this analysis period (Dinkins et al. 2012). Also in 2012, the WGFD requested raven control efforts via the USDA Wildlife Services across southwest Wyoming (including the SWSGCA, Upper Green SGCA and Wind River/Sweetwater River SCCA. This request resulted in USFWS approval of new permit language allowing ravens to be poisoned with the corvicide DRC1339 at landfills throughout the permit area in the late winter of 2013.

RECOMMENDATIONS

1) Identify important seasonal habitats, especially early brood rearing areas.

2) Implement provisions of the Governor's executive order for sage-grouse core area management.

3) Implement the SWSGCA Conservation Plan.

4) Map and integrate into the WGFD database perimeters for all known sage-grouse leks.

5) Expand lek searches to ensure that all active leks within the SWSGCA have been identified.

6) Ensure that all known lek locations are accurate and recorded using UTM grid coordinates in map datum NAD83.

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Dinkins, J. B., M. R. Conover, C. P. Kirol, and J. L. Beck. 2012. Greater sage-grouse (*Centrocercus urophasianus*) select nest-sites and brood-sites away from avian predators. The Auk 129:600–610.

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Attachment A: SWSGCA Sage-Grouse Projects Supported with 2013-14 General Fund Budget

Project Name	Budget Biennium	Local Working Group	Total Cost	SG $	Project Description	Partners	Status
143 - Raven/raptor density effects to lek count	2013-14	Southwest, South-Central	not provided by applicant	$100,000 requested; $70,000 approved	Research to determine impacts of raven control to sage-grouse	Utah State University	On-going
144 - Cheatgrass mapping and control in Sublette Co. phase III	2013-14	Upper Green River Basin, Southwest	$137,142	$62,142 requested/approved	Cheatgrass mapping and spot control	Sublette County Weed & Pest, Green River Basin Coordinated Weed Mgt Assoc.; WLCI	On-going
145 - Impacts of noise on sage-grouse	2013-14	Wind River-Sweetwater River, Northeast, South-Central, Southwest	$63,388	$41,626 requested/approved	Continuing research examining the effects of noise resulting from energy exploration and development	University of California-Davis, BLM	On-going
146 - Response of SG to sagebrush treatments Phase II	2013-14	Wind River-Sweetwater River, South-Central, Southwest	$956,593 (multi-year)	$99,841 requested/approved	Continuing research to determine sage-grouse demographic and habitat use response to sagebrush treatments	University of Wyoming, Kelly Ornith. Research Fund, BLM, WY Reclamation & Restoration Center, WWNRT	On-going

Sage Grouse Job Completion Report

Year: 2004 - 2013, Working Group: Southwest

Table 1. Lek Attendance Summary (Occupied Leks) (1)

a. Leks Counted

Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek (2)
2004	224	50	22	1389	30.2
2005	229	59	26	2955	51.8
2006	240	67	28	4153	62.9
2007	257	68	26	3840	58.2
2008	267	69	26	4284	63.0
2009	285	70	25	2589	39.8
2010	292	77	26	2191	30.9
2011	302	73	24	1855	26.9
2012	310	81	26	1697	23.2
2013	316	116	37	1946	19.5

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2004	224	109	49	1642	21.3
2005	229	117	51	3424	36.8
2006	240	152	63	3973	37.5
2007	257	176	68	5791	42.9
2008	267	149	56	3951	33.2
2009	285	190	67	5485	35.2
2010	292	186	64	3789	26.5
2011	302	168	56	2900	21.2
2012	310	189	61	2889	20.8
2013	316	178	56	2172	16.5

1) Occupied - Active during previous 10 years (see official definitions)

2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

3) Inactive - Confirmed no birds/sign present (see official definitions)

Sage Grouse Job Completion Report

Year: 2004 - 2013, Working Group: Southwest

1. Lek Attendance Summary (Occupied Leks) (1) Continued

c. Leks Checked

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek (2)
2004	224	159	71	3031	24.6
2005	229	176	77	6379	42.5
2006	240	219	91	8126	47.2
2007	257	244	95	9631	47.9
2008	267	218	82	8235	44.0
2009	285	260	91	8074	36.5
2010	292	263	90	5980	27.9
2011	302	241	80	4755	23.1
2012	310	270	87	4586	21.6
2013	316	294	93	4118	17.8

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2004	130	25	69	155	83.9	16.1
2005	152	19	58	171	88.9	11.1
2006	183	43	14	226	81.0	19.0
2007	214	35	8	249	85.9	14.1
2008	195	25	47	220	88.6	11.4
2009	233	33	19	266	87.6	12.4
2010	226	28	38	254	89.0	11.0
2011	220	15	67	235	93.6	6.4
2012	229	35	46	264	86.7	13.3
2013	239	49	28	288	83.0	17.0

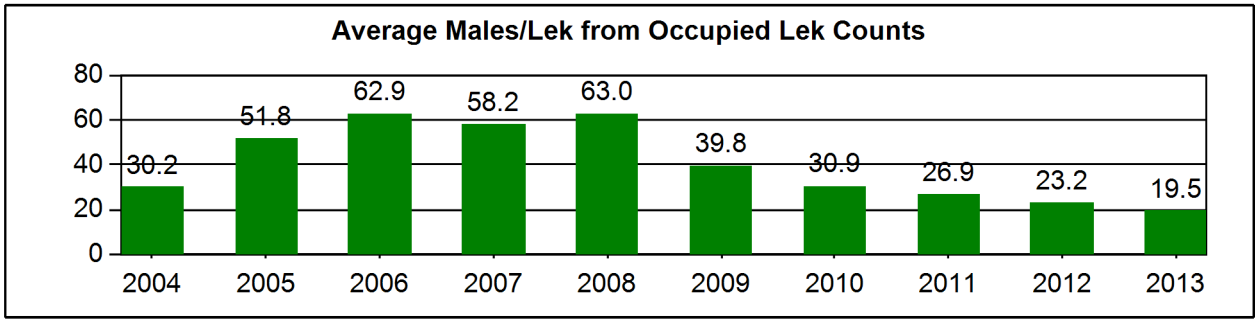
1) Occupied - Active during previous 10 years (see official definitions)

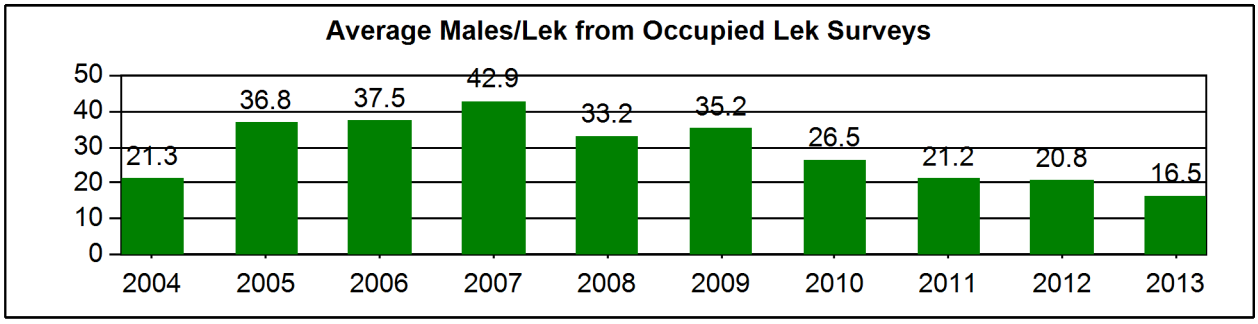
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

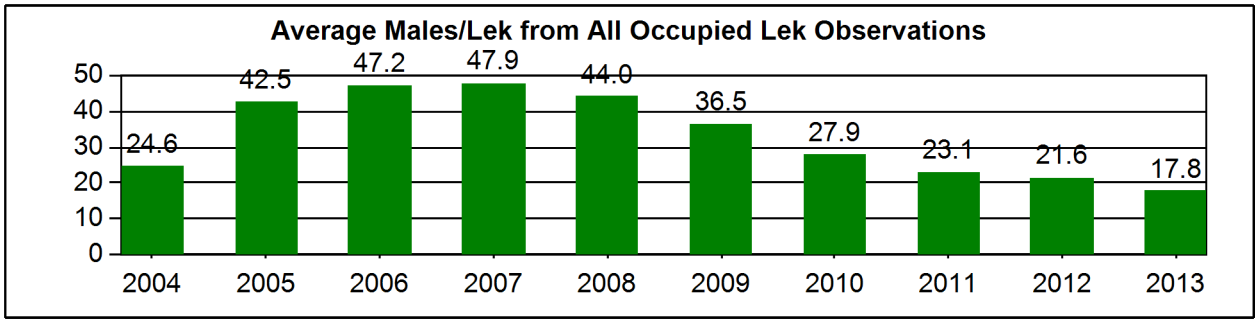
3) Inactive - Confirmed no birds/sign present (see official definitions)

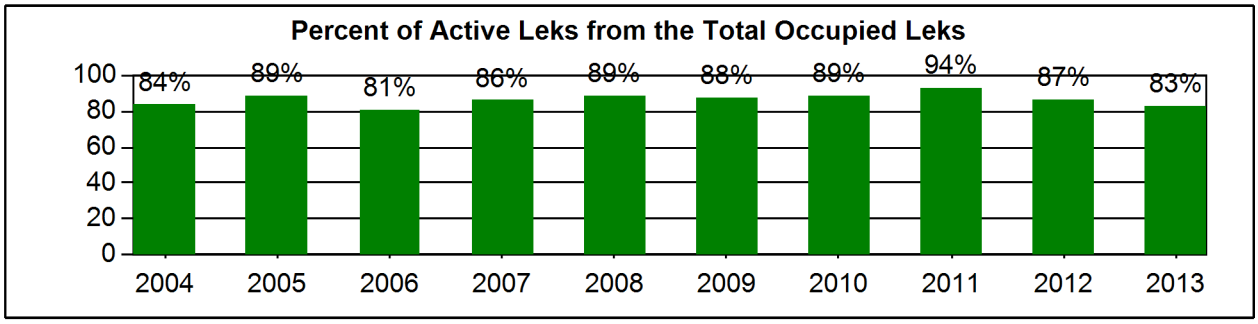
Sage Grouse Occupied Lek Attendance Summary

Year: 2004 - 2013, Working Group: Southwest Figures 1a-e.









Sage Grouse Occupied Lek Attendance Summary

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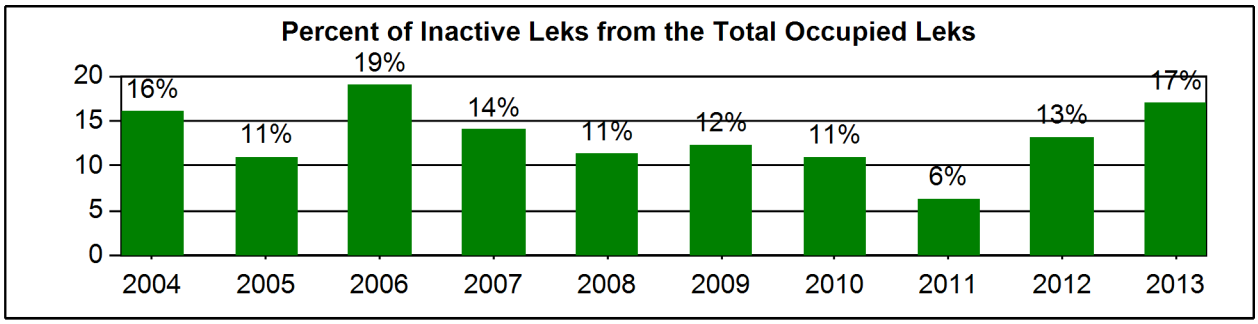


Sage Grouse Job Completion Report

Year: 2003 - 2012, Management Area: G

Table 2. Sage Grouse Hunting Seasons and Harvest Data

a. Season

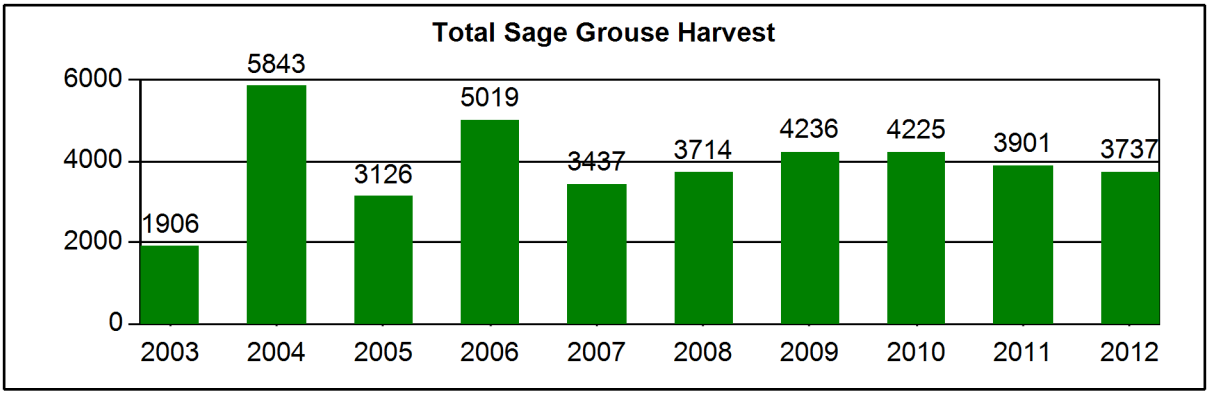
Year	Season Start	Season End	Length	Bag/Possesion Limit
2003	Sep-27	Oct-5	9	2/4
2004	Sep-23	Oct-3	11	2/4
2005	Sep-23	Oct-3	11	2/4
2006	Sep-23	Oct-3	11	2/4
2007	Sep-22	Oct-2	11	2/4
2008	Sep-22	Oct-2	11	2/4
2009	Sep-19	Sep-30	12	2/4
2010	Sep-18	Sep-30	13	2/4
2011	Sep-17	Sep-30	14	2/4
2012	Sep-15	Sep-30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

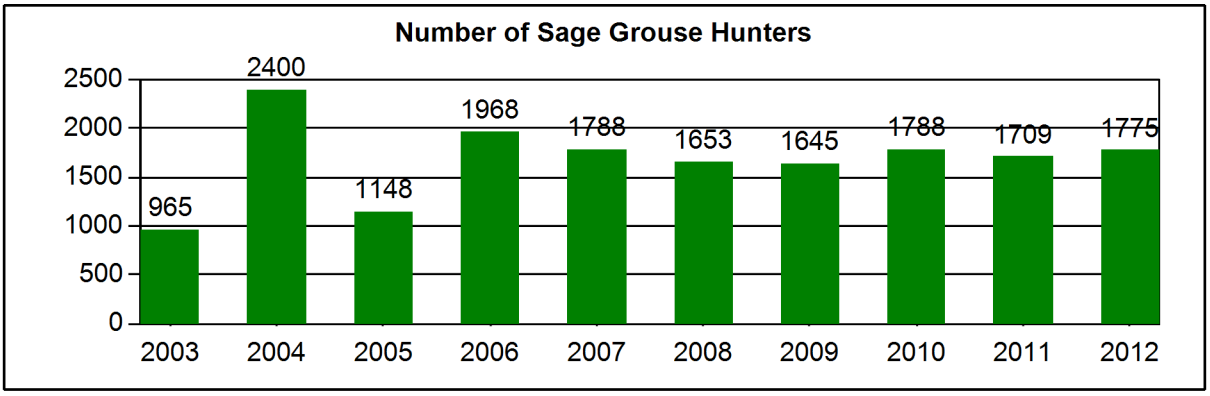
b. Harvest

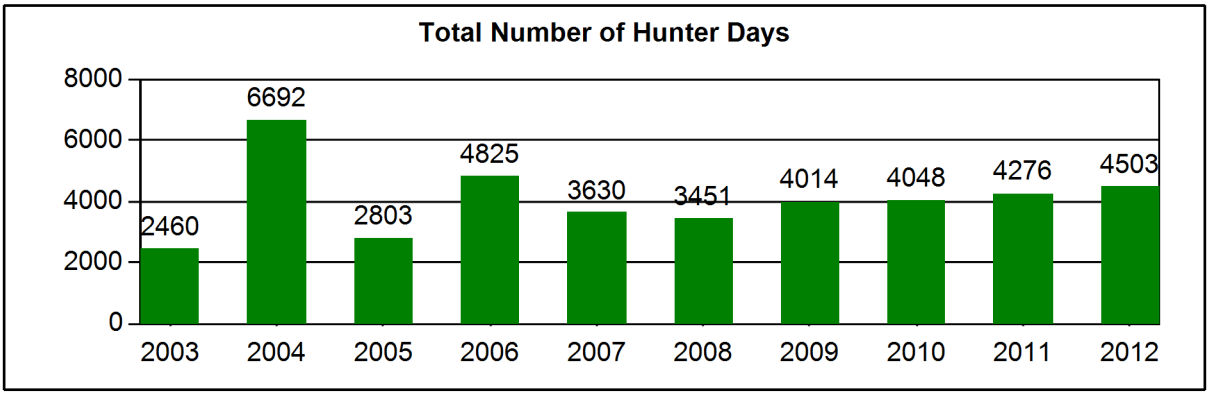
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2003	1906	965	2460	0.8	2.0	2.5
2004	5843	2400	6692	0.9	2.4	2.8
2005	3126	1148	2803	1.1	2.7	2.4
2006	5019	1968	4825	1.0	2.6	2.5
2007	3437	1788	3630	0.9	1.9	2.0
2008	3714	1653	3451	1.1	2.2	2.1
2009	4236	1645	4014	1.1	2.6	2.4
2010	4225	1788	4048	1.0	2.4	2.3
2011	3901	1709	4276	0.9	2.3	2.5
2012	3737	1775	4503	0.8	2.1	2.5
Avg	3,914	1,684	4,070	1.0	2.3	2.4

Sage Grouse Harvest Summary

Management Area: G Figures 2a-d

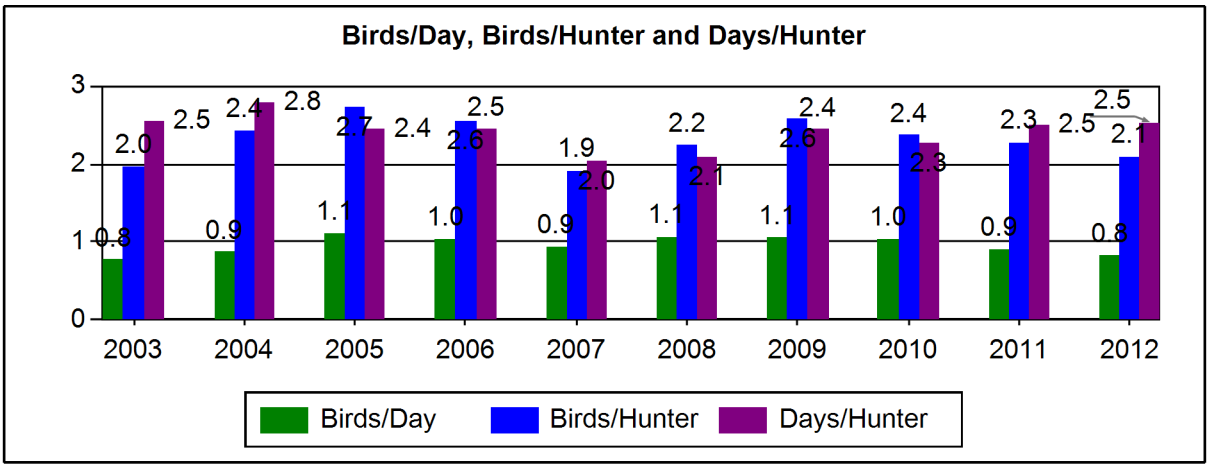






Sage Grouse Harvest Summary

Management Area: G



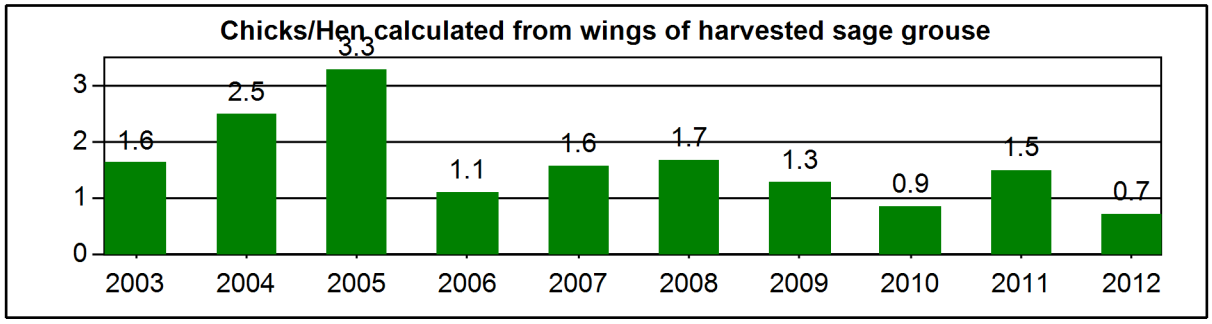
Sage Grouse Job Completion Report

Year: 2003 - 2012, Management Area: G

Table 3. Composition of Harvest by Wing Analysis

Year	Sample Size	Percent Adult		Percent Yearling		Percent Young		Chicks/ Hens
		Male	Female	Male	Female	Male	Female	
2003	530	10.0	28.1	1.7	5.5	23.4	31.3	1.6
2004	841	6.7	22.7	0.7	3.8	32.1	34.0	2.5
2005	845	8.3	16.9	1.9	4.0	32.7	36.2	3.3
2006	638	16.3	32.3	2.8	6.0	17.2	25.4	1.1
2007	509	18.5	26.5	3.3	3.7	22.6	25.3	1.6
2008	666	12.9	24.6	5.0	6.0	20.1	31.4	1.7
2009	887	11.7	30.0	4.4	6.7	20.0	27.3	1.3
2010	696	2.6	51.0	0.6	0.9	2.9	3.6	0.9
2011	998	6.1	31.9	2.9	4.3	23.9	30.9	1.5
2012	581	10.0	38.9	4.6	10.3	16.5	19.6	0.7

Figure 3.



Upper Green River Basin
Sage-Grouse
Job Completion Report
2012

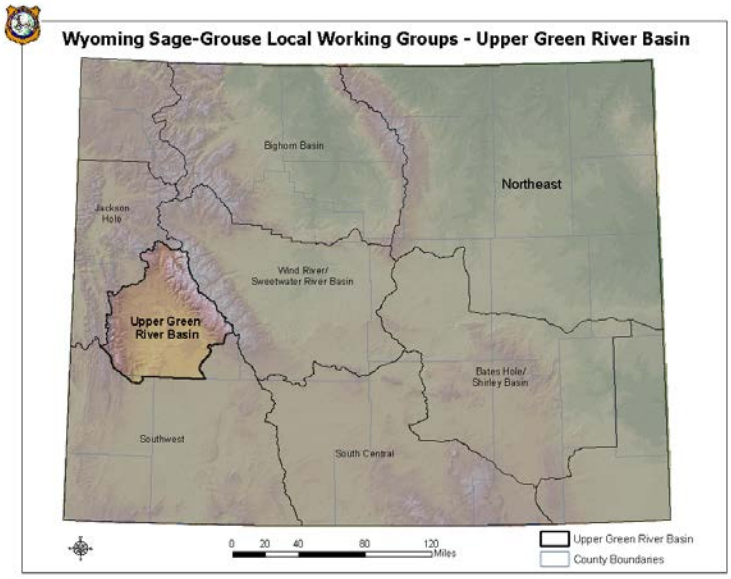
June 2012-May 2013

Dean Clause
Wyoming Game & Fish Dept.
Pinedale Region

Narrative
Conservation Plan Area: **Upper Green River Basin**
Period Covered: **6/1/2012 – 5/31/2013**
Prepared by: **Dean Clause**

Introduction

The Upper Green River Basin Working Group Area (UGRBWGA) covers Sage-grouse Management Area (SGMA) D that lies within Sublette County (prior to 2010 designated Upland Game Bird Management Area (UGBMA) 3 and the north portion of UGBMA 7). All lek data and harvest data from SGMA D is included in this 2011 JCR. Prior to 2010, only harvest data from UGBMA 3 was included in the report while that portion of UGBMA 7 that lies with UGRBWGA was reported in the Southwest WG JCR.



Sage-grouse are found in suitable sagebrush uplands throughout the Upper Green River Basin. Sage-grouse habitats within Sublette County are expansive and relatively intact outside of developing natural gas fields. Habitats for sage-grouse within Sublette County occur throughout mixed land ownership jurisdictions. Most sage-grouse leks are found on Bureau of Land Management (BLM) lands (88%), with fewer leks found on private (8%), and state (4%) ownership. Nesting and early brood rearing habitats are also found predominantly on BLM lands, while many birds move to moist meadow habitat located on private or public/private interfaces during late brood rearing and/or summer. Fall movements away from these moist areas to sagebrush-dominated uplands on BLM lands occur in late September/early October. As winter progresses, birds concentrate on sagebrush upland habitats, the location of which is determined by snow accumulations and winter severity. These winter concentration areas are also located primarily on BLM lands.

Traditionally, sage-grouse data collection within the Pinedale Region has focused on lek surveys, with a secondary emphasis on collecting information from harvested birds. Prior to 1994, relatively few leks were monitored and prior to 2000, standardized efforts were not used to collect sage-grouse lek information. Since 2000, efforts have been made to standardize lek data collection methods and increase lek monitoring efforts (i.e. collect data on more leks along with increasing the number of site visits per lek). Current lek monitoring has shifted from "lek surveys" to "lek counts" as described below.

Information presented in this report includes data and trend analysis for lek monitoring, population trends, harvest rates, productivity rates, winter distribution surveys, and weather data. Other categories covered in this report include special projects/research, management summaries, and recommendations.

Data Collection Efforts and Methods

Lek monitoring consists of inventory methods called "lek counts" or "lek surveys". A lek count consists of at least 3 site visits during the strutting season, with each visit conducted at least 7 days apart. Lek counts are used to determine annual status (active or inactive) along with determining population trends. A lek count can also be a census technique that documents the actual number of male sage-grouse observed on a lek complex. A lek complex is defined as a group of leks in close proximity between which male sage-grouse may be expected to interchange from one day to the next. In order to be classified as an accurate lek count (or census), a lek observation must include all leks within a complex on the same morning. These simultaneous observations must be performed at least 3 times during the strutting season, with at least 7 days separating each lek observation. Lek complex counts have not routinely been conducted due to manpower and logistical restraints. Lek complex counts are only practical when a few leks comprise a complex.

A lek survey consists of only 1 or 2 site visits during the strutting season. Lek surveys are primarily important to identify annual status (active or inactive) of a particular lek or lek complex and not for estimating population trends. Overall, lek counts are preferred over surveys and recent emphasis has been placed on collecting lek counts.

Based on the findings at each lek, the lek is assigned an annual status of "Active" (attended by more than one male sage-grouse), "Inactive" (it was known that there was no strutting activity during the breeding season), and "Unknown" (either active or inactive status has not been determined). Based on the past and current status, leks are assigned one of the three categories for management purposes. The category "Occupied" is a lek that has been active during at least one strutting season within the last ten years. Management protection will be afforded to occupied leks. An "Unoccupied" lek has not been active during the past 10 years, although there must be sufficient data to justify placing a lek into this category. A lek survey or count must have been conducted 4 out of 10 years during non-consecutive years (i.e. every other year) without activity to be placed in the "Unoccupied" category. Unoccupied leks are also broken down into two sub-categories ("Destroyed" – habitat no longer exists or "Abandoned" – habitat still exists). Management protection is not afforded to unoccupied leks. The third category is

"Undetermined" which is a lek that has not documented grouse activity in the past 10 years, but doesn't have sufficient data to be classified as unoccupied (as mentioned above).

Productivity information obtained from brood surveys (# chicks/hen) has been sporadic and often yields very low sample sizes. However, one permanent brood survey route on Muddy Creek near the Bench Corral elk feedground has been monitored for over ten years. This represents the only such route within the Upper Green River Basin. Past research in the WG area has collected nest success and brood information from radio-collared birds. Data collected from radio-collared birds provides good production information.

Information on the sex/age composition of harvested birds is collected through the use of wing barrels distributed throughout Sublette County each fall. Productivity information is estimated from this data set, as the number of chicks/hen can be derived. Wing collections can also provide valuable harvest trend data. Harvest estimates for each Sage-Grouse Management Area are obtained through a hunter harvest questionnaire that is conducted annually.

With declining long-term sage-grouse populations, both locally and range-wide, increased effort has been placed on collecting sage-grouse data. In addition, the increase in natural gas exploration and development within Sublette County raised concerns regarding the impact of such large-scale landscape developments on sage-grouse populations. In response, several sage-grouse research projects were initiated in this region. Local research has indicated that current habitat protection measures (stipulations) may not be restrictive enough to protect sage-grouse habitat. Current protection stipulations do not address human activities associated with maintenance and production stages of development, which also provides impacts (indirect impacts) on sage grouse. In addition, implementation of the existing habitat protection stipulations has been variable, as several exceptions have been granted associated with gas development activities. This has resulted in scrutiny of the effectiveness of the current stipulations intended to preserve sage-grouse and sage-grouse habitats on BLM lands.

In 2008 Governor Freudenthal signed Executive Order 2008-2 entitled, "Greater Sage-grouse Core Area Protection". The goal of the Executive Order is to maintain existing habitat conditions within core areas by permitting only development activities that will not cause declines in sage-grouse populations. *As a matter of general practice, this will be achieved by establishing a 0.6-mi. NSO around each occupied lek,* ***limiting well pad densities to an average of 1 per square mile within core area,*** *and implementing appropriate management practices. The number of well pads within a 2 mile radius of the perimeter of an occupied sage-grouse lek should not exceed 11,* ***distributed preferably in clumped pattern in one general direction from the lek***. Development scenarios in non-core areas are more flexible, but should still be designed and managed to maintain populations, habitats and essential migration routes. Non-core areas should not be construed as "sacrifice areas" since this conservation strategy requires habitat connectivity and movement between populations in core areas. The goal in non-core areas is to maintain habitat conditions that will sustain at least a 50%

probability of lek persistence over the long term. In some "non-core" locations, important habitat functions of other wildlife species will guide planning and mitigation considerations. Applicable standard management practices and sage-grouse BMPs should be applied to development within both core and non-core areas to achieve the goals of the Executive Order. In 2011 a new Executive Order (2011-5) http://wgfd.wyo.gov/ was enacted by a new governor (Matt Mead) with only a few minor changes being made to the original Executive Order from 2008 and a 2010 revision.

Prior to the winter of 2003, sage-grouse winter distribution information had only been collected opportunistically during other winter surveys (deer, elk, and moose composition counts) and ground observations that were documented in the Wildlife Observation System (WOS). Some data had also been collected by private wildlife consultants conducting ground surveys directed by the BLM for clearance associated with gas development. Since 2004, certain areas within the Upper Green River Basin have been surveyed to document important sage-grouse wintering areas. These surveys have been conducted aerially with a helicopter during January/February using stratified transects at approximately 1 minute (1 mile) intervals or less to document sign and live observations of grouse. These aerial surveys, along with other existing data, are very useful baseline information to identify important winter grouse habitats for future management decisions.

Weather data (particularly precipitation data) may be helpful in understanding the effects of environmental conditions on sage-grouse population dynamics. Lower than normal precipitation can affect sage-grouse by reducing the amount of herbaceous vegetation necessary for successful nesting, reduce insect and forb production for early brood success, and reduce the quantity and quality of sagebrush. Not only the amount of annual precipitation, but the timing of precipitation events can be a very significant influence on sage-grouse populations. Individual weather stations within the Upper Green River Basin include Big Piney, Cora, Daniel Fish Hatchery, and Pinedale. Some of these weather stations have incomplete and missing data, which makes monthly and annual comparisons difficult. In addition, these local weather stations do not adequately represent large portions of the Upper Green River Basin. For these reasons, a National Climatic Data Center (NOAA Satellite and Information Service) weather site has been utilized to gather moisture and temperature data. Wyoming is split into 10 different weather reporting Divisions. Division 3 covers the entire southwestern portion of Wyoming and is used in this UGRB Sage-grouse JCR to report precipitation and temperature trends. Climatic data for Division 3 can be found at the NCDC/NOAA web site: http://www.ncdc.noaa.gov/cag/time-series/us .

More specific methods for collecting sage-grouse data are described in the sage-grouse chapter of the WGFD Handbook of Biological Techniques (Christiansen 2007).

Results

Lek Monitoring

A new sage-grouse database was developed in 2012 in order to improve efficiency, reduce errors, and better facilitate data analysis. Changes were made to the manner in which lek data are calculated and reported in Table 1. The new version calculates average male lek attendance using only monitoring observations where one or more male grouse were observed strutting. The old version included a count of "0" males for leks where activity was confirmed by the presence of sign but no birds were observed. Together, these two changes result in somewhat higher, but more accurate, average male attendance for active leks than previously reported. The changes do not result in any change in population trend based on average male lek attendance. Interpreted population increases and decreases over time remain the same so no revisions to past reports are required.

A total of 152 leks are currently documented in the UGRBWGA. These leks are classified as follows; 129 occupied, 20 unoccupied, and 3 undetermined. During 2013, a total of 123 occupied leks (94%) were checked (survey or count). Lek monitoring efforts in 2013 primarily focused on counts (93%) over surveys (7%). Results from the counts and surveys showed that 75% of the leks were active and 25% were inactive. The average number of males/lek for all active leks decreased to 35 in 2013, compared to 37 in 2012, 35 in 2011, 38 in 2010, 52 in 2009, and 60 in 2008 (Figure 1). Recent declining trends (2008-2012) is opposite to increasing trends from 2004-2007 (27 males/lek in 2003 to 69 in 2007).

Generally, the proportion of leks checked that are confirmed "active" has stayed relatively stable during the past 10 years, ranging from 71% to 82%. Although there has been increased lek inactivity and abandonment in areas associated with gas development activity, additional lek monitoring efforts and searches have resulted in locating new or undiscovered leks (46 new leks since 2004) negating the downward trend in the proportion of active leks in the UGRBWGA .

Since 2007, observed average peak male sage-grouse lek attendance has declined by 49% (2007-2013). This trend is likely a combination of the cyclic nature of sage-grouse populations (Fedy and Doherty 2010) combined with documented influences from habitat fragmentation in the Upper Green River Basin. The last peak in attendance occurred in 2007 and was the highest level ever recorded for the area. Caution is warranted when analyzing long-range data sets within the UGRBWG area as the number of known (documented) leks have more than doubled during the past 15 years. Since many of these newly documented leks probably existed but were not monitored, there is some speculation in regards to what the average number of males/lek actually was prior to the mid 1990's.

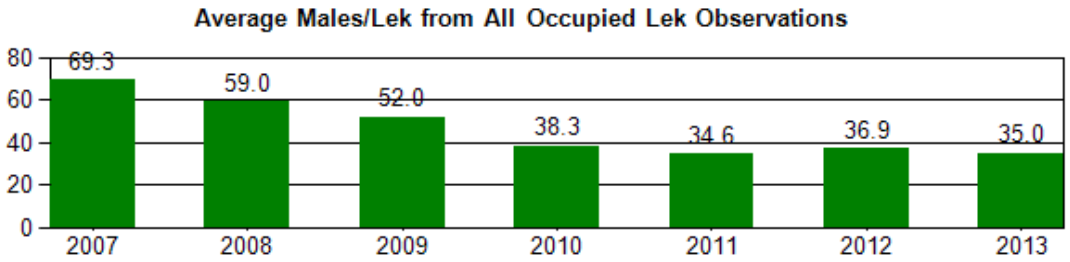


Figure 1. Average Peak Male Sage-grouse Lek Attendance 2007-2013, UGRBWG Area.

An analysis was performed to possibly represent a more accurate assessment of longer range population trends in the UGRBWG area using only the reliable data from known leks that had some level of activity during 1997, with no new leks added after this year. The start year of 1997 was used since lek monitoring became more structured about this time and this was the first year that actual "count" data started to be collected in the UGRBWG Area. Fifty-one of the 66 known leks were used in this trend analysis (1997-2013). These leks were tracked from 1997 through 2013 to represent population trends (Figure 2). This trend in average peak males/active lek represents a stable grouse population from 1997-2001, declining through 2003, increasing through 2007, declining through 2010, slightly increasing in 2011, and stabilizing in 2012 and 2013. Although this trend analysis is only a sub-set of all the known leks in the UGRBWG Area, overall trends are similar compared to all lek data within the UGRBWG Area.

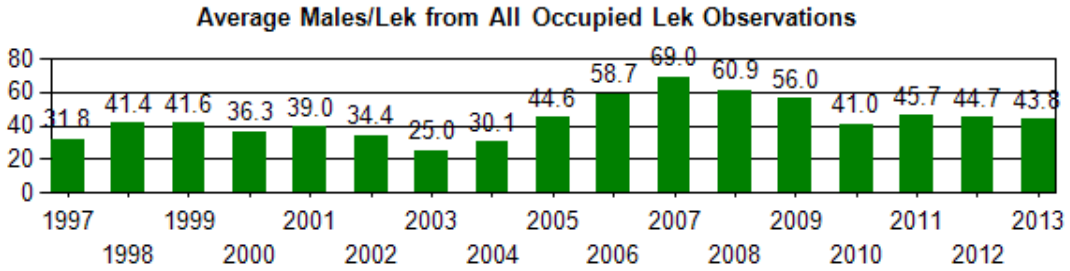


Figure 2. Average Peak Male Sage-grouse Lek Attendance 1997-2013, UGRBWG Area.

Previous lek analysis to assess natural gas development impacts in the Pinedale area have shown higher rates of decline on leks near or within gas field development compared to leks away from gas development. An updated analysis was conducted to compare sage-grouse trends from leks within or near gas field development verses leks away from gas development activities. Two data sets were derived from all the known leks within the UGRBWGA. The group of leks referred to as "Disturbed Leks" were those leks within or near (roughly within one mile) active gas field development within the Pinedale Anticline Project Area (PAPA) and the Jonah. The other group of leks referred to as "Not Disturbed Leks" used all the remaining leks not included in the Disturbed Leks data set. Note that some leks in the Not Disturbed Leks data set may have or had impacts associated with older gas development activities, such as the LaBarge and Deer Hills gas fields. Since the analysis with these two data sets only covers the periods 1997-2013 (same reasons described in the paragraph above), all leks outside the PAPA and Jonah were added to the Not Disturbed Leks data set.

The Disturbed Leks data set includes 20 total leks in which 13 (65%) were classified as occupied and 7 (35%) were classified unoccupied or undetermined in 2013. Of the 13 occupied leks, 11 were checked in 2013 resulting in 5 (45%) of those leks being active. The average peak number of males/lek for occupied leks showed little changes (1% increase) from 1997-2013 and a decline of 25% during the period of 2007-2013 (Figure 3).

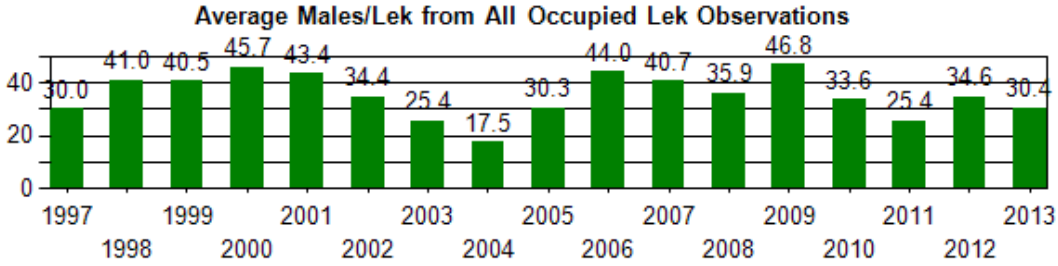


Figure 3. Average Peak Male Sage-grouse Lek Attendance 1997-2013, Disturbed Leks.

The Not Disturbed Leks data set includes 132 total leks in which 117 (89%) were classified as occupied and 15 (11%) were classified as unoccupied or undetermined in 2013. Of the 117 occupied leks, 111 were checked in 2013 resulting in 91 (82%) of those leks being active. The average peak number of males/lek for occupied leks showed 19% increase from 1997-2013 and a decline of 52% during the period of 2007-2013 (Figure 4).

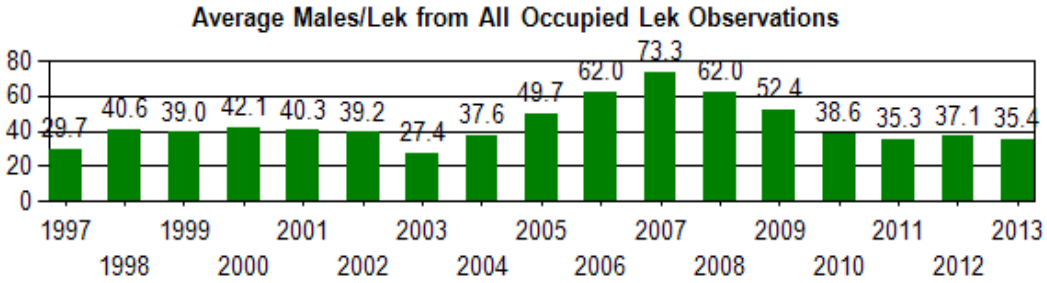


Figure 4. Average Peak Male Sage-grouse Lek Attendance 1997-2013, Not Disturbed Leks.

In comparing the two data sets (Disturbed Leks vs. Not Disturbed Leks), the overall trends in the average number of peak males/lek for occupied leks reveal minor differences as males declined in early 2000's, increased into the late 2000's, declined in 2010 and 2011, and stabilized during 2012 and 2013. The overall changes (both up and down) in male lek numbers are more pronounced with the Not Disturbed Leks data set, which is also much more robust (many more leks). The significant difference documented between the two data sets is associated with the proportion of active and occupied leks. The Disturbed Leks show activity levels declining from an average of 85% (1997-2001) to 33% by 2013, a of 52 percentage points in active leks. The Not Disturbed Leks show activity levels changing very little with an average of 79% (1997-

2001) to 81% by 2013 (an increase of 2 percentage points in active leks), see Figure 5. In addition, a much higher proportion of leks are currently unoccupied (abandoned or destroyed) within or near the PAPA and Jonah gas fields (Disturbed Leks) at 35% compared to 12% outside the PAPA and Jonah as fields (Not Disturbed Leks).

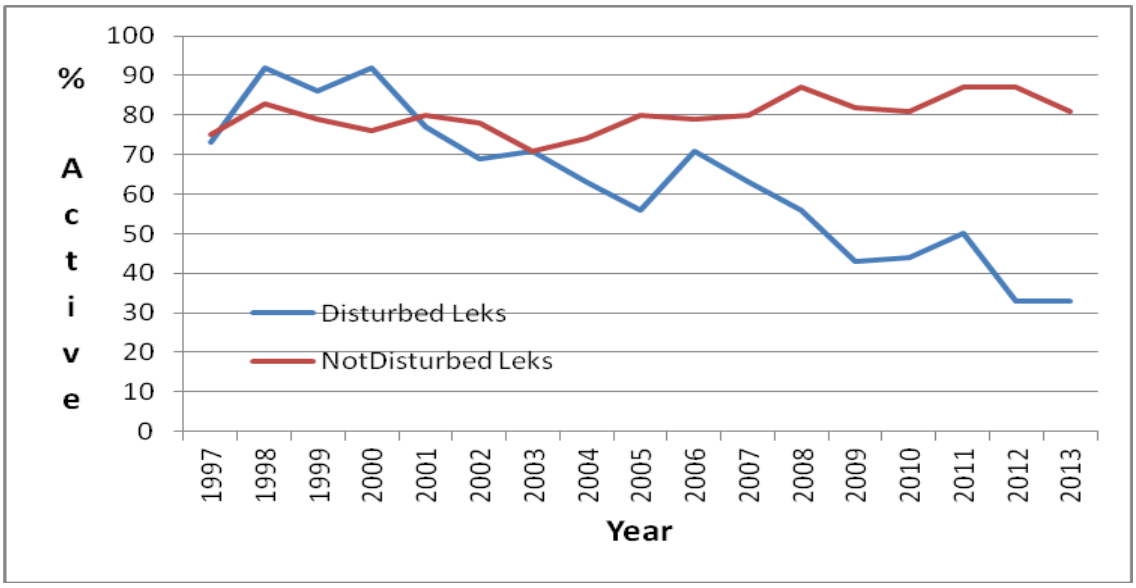


Figure 5. Proportion of active leks 1997-2013, Disturbed Leks verses Not Disturbed Leks.

Population Trends and Estimates

No reliable population estimate can be made from data collected during 2013 (or any of the previous years), due in part to unknown male:female sex ratios and the fact that not all active leks have been located. An increasing population trend during 2004 - 2007 is indicated by an increase in the average number of males/lek since 2003. While 2008-2013 lek monitoring indicate a declining trend in the number of males/lek.

Harvest

The 2012 sage-grouse season was September 15 through September 30, which allowed a 16-day hunting season. The 2012 season was similar to the 2004 – 2011 seasons. A nine-day hunting season was initiated during both 2002 and 2003. Essentially, hunting seasons since 2002 allowed for the season to remain open through two consecutive weekends. From 1995 – 2001 hunting seasons were shortened to a 15-16 day season that typically opened during the third week of September and closed in early October. Prior to 1995, the sage-grouse seasons opened on September 1 with a 30 day season. Seasons have been shortened with later opening dates to increase survival of successful nesting hens (as they are usually more dispersed later in the fall) and to reduce overall harvest.

Bag limits from 2003 to 2012 were 2 per day and 4 in possession. 2003 was the first year that bag/possession limits had been this conservative. Bag limits traditionally (prior to 2003) were 3 birds/day with a possession limit 9 (changed to 6 birds from 1994-2002).

Prior to 2010, harvest estimates in the UGRBWGA were only reported from UGBMA 3 and not in that portion of UGBMA 7 that lies within the UGRBWGA. New Sage-grouse Management Areas (SGMA) was developed in 2010, in which SGMA D covers all of the UGRBWGA and will be reported that way in future years.

The 2012 harvest survey estimated that 476 hunters bagged 1320 sage grouse and spent 1296 days hunting. The average number of birds per day was 1.0, the average number of birds per hunter was 2.8, and the number of days spent hunting was 2.7 during 2012. The harvest trend data indicates there had been similar hunter participation and overall harvest since 2007. Prior to 2010, only a portion (UGBMA 3) of the UGRBWGA was included in the harvest statistics, and that portion of UGBMA 7 was left out of the reported harvest. Starting in 2010, all harvest within the UGRBWGA is now reported in Sage-grouse Management Area D. Harvest rates (# birds/day, # birds/hunter, and # days/hunter) have remained similar the past ten years (2003-2012). From 1995 to 2002, overall harvest and harvest rates significantly declined following altered seasons (shortened and moved to a later date). Since 2003, hunter participation has varied somewhat and then stabilized during the previous 5-years.

Brood Count Surveys

Two permanent brood survey routes, one located on Muddy Creek near the Bench Corral elk feedground (Lower Muddy Creek) and one in the Upper Muddy Creek drainage (Cottonwood Ranches) are routinely conducted and results have been reported in previous JCR's. Since overall sample sizes have been poor from these brood surveys, no reliable production data exists, and therefore this data is no longer reported in JCR's. Other documented brood count data has come from random searches or opportunistic sightings.

Although sage-grouse research has been conducted in the Upper Green River Basin for over the past decade providing some nest establishment, nest success, and brood production data, no active studies have been conducted since 2009. See previous Sage-grouse JCR's (2009 or earlier) for nest success and production data summaries.

Wing Collections

A total of 18 sage-grouse wing barrels were distributed throughout Sublette County in 2012 within Sage-grouse Management Area D. Barrels were placed prior to the sage-grouse hunting season opener and were taken down following the closing date. Wing collections were typically made following each weekend of the hunting season (collected twice). The primary feathers from these wings are used to determine age and sex based on molting patterns and feather characteristics.

A total of 544 sage-grouse wings were collected from barrels in the UGRBWGA during 2012, which is very similar to the 547 wings in 2011, and slightly higher from collections during the previous 5-year period, ranging from 421 to 494. Of the 544 wings collected in 2012, 41% were juvenile birds, indicating a lower proportion of harvest on juveniles

compared to 2011. The overall composition of wings in 2012 indicated a ratio of 0.9 chicks/hen (adult and yearling females), which is lower than 1.4 chicks/hen in 2011, slightly higher than 0.8 chicks/hen in 2009 and 2010, and lower than the survival of 1.3 chicks/hen during 2008. The overall past five years (2008-2012) chick survival has been poor, resulting in declining population trends. This chick/hen ratio from wing collections has provided a good indicator for future grouse population trends, as male lek attendance trends have correlated well with previous year's production (# chicks/hen) data.

Winter Distribution Surveys

Winter sage-grouse surveys were conducted in portions of the UGRBWGA during January of 2012, with funds secured through the BLM and natural gas companies. Winter surveys have been conducted annually since 2004 in portions of the Upper Green River Basin. This winter data has been used to develop winter concentrations area maps (first map developed in 2008), and continues to be updated as new data becomes available. Additional analysis efforts such as Resource Selection Function (RSF) models are currently being evaluated as another tool for delineating winter concentration areas.

Weather Data

Wyoming Climatic Division 3 (Green and Bear Drainage Basin) monthly temperature and, precipitation data were obtained from: http://www.ncdc.noaa.gov/cag/time-series/us. Graphs were generated comparing 3-month (March-May) average precipitation (Figure 6) and 3-month (March-May) average temperature (Figure 7) for years 2011, 2012, and 2013. A 30-year average was also plotted on these figures to indicate a long range average for those 3-month periods.

Precipitation during March thru May was above average during 2011, well below average during 2012, and below average in 2013 (Figure 6). Temperatures had an inverse relationship to precipitation during this same 3-month period showing below average temperatures in 2011, well above average temperatures in 2012, and near average temperatures in 2013 (Figure 7). These precipitation and temperature trends adequately reflect conditions documented within the UGRBWGA.

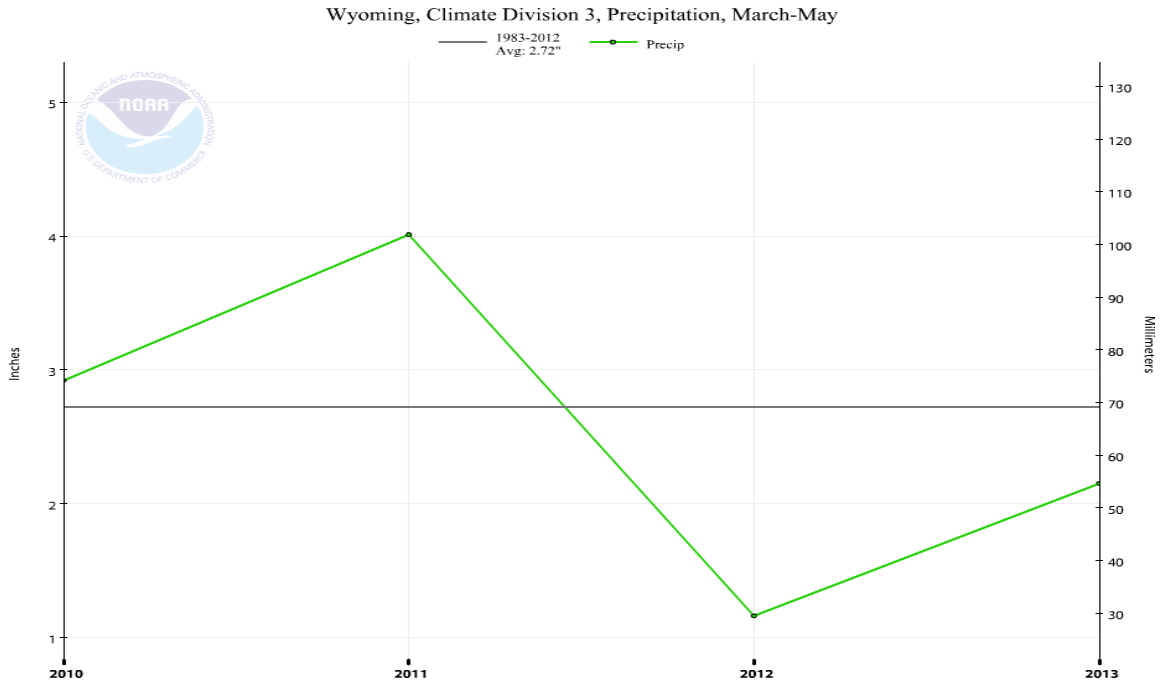


Figure 6. 3-month average (March-May) precipitation for 2010-2013.

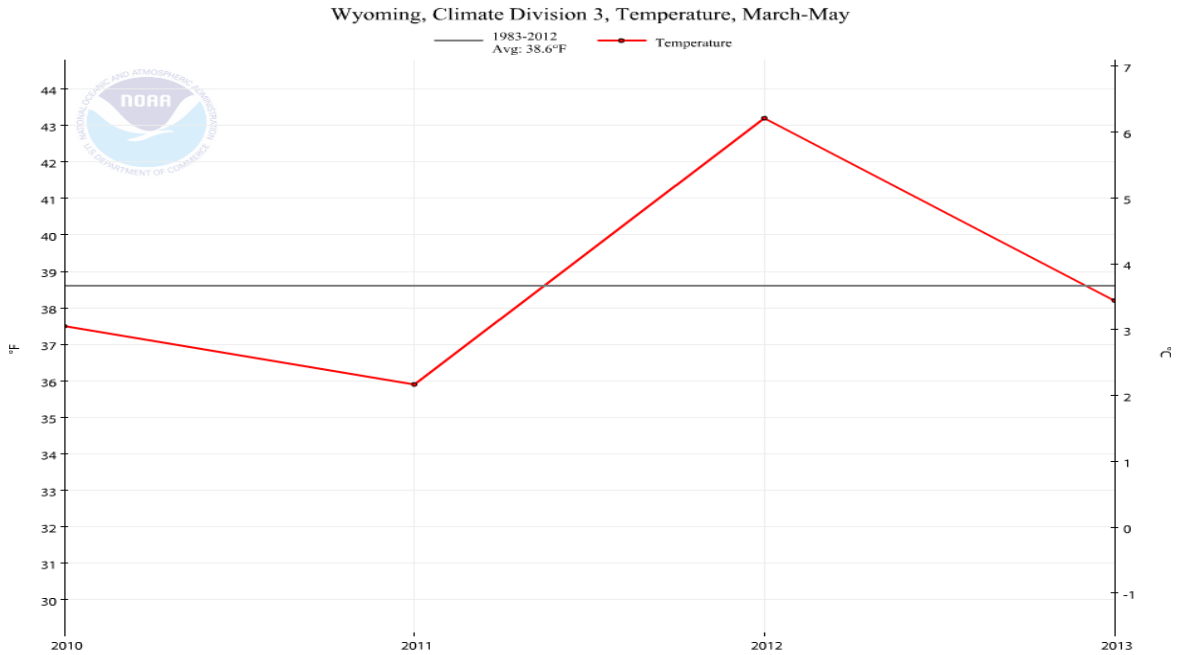


Figure 7. 3-month average (March-May) temperature for 2010-2013.

Special Projects

Sage-grouse Research Projects

From 1998-2009 there have been several research projects initiated and completed that have provided information on sage-grouse demographics and effects of natural gas development on sage-grouse populations. See UGRBWGA 2010 JCR for a summary of past sage-grouse research in the Pinedale area. Currently, no sage-grouse research is being conducted in the UGRBWGA.

Sage-Grouse Working Group

The Upper Green River Basin Sage-grouse Working Group was formed in March of 2004. The group is comprised of representatives from agriculture, industry, sportsmen, public at large, conservation groups, and government agencies (federal and state). The purpose of the UGRB Working Group is to work towards maintaining or improving sage-grouse populations in the Upper Green River basin. The group is directed to formulate plans, recommend management actions, identify projects, and allocate available funding to support projects that will benefit sage-grouse. A local sage-grouse plan (Upper Green River Basin Sage-Grouse Conservation Plan) was finalized in May of 2007 and can be found on the WGFD website (http://wgfd.wyo.gov/). This Plan identifies past, proposed, and ongoing projects; recommended management activities; funding sources; and other relevant sage-grouse information within the Working Group Area intended to maintain and/or increase sage-grouse populations. The Working Group is currently working on an addendum to this 2007 Conservation Plan that provides updated information on activities, projects, and management strategies within the UGRBWGA. In addition to this Conservation Plan update, a new appropriation of State monies was approved for sage grouse projects during 2012 and 2013 resulting in higher activity levels by the Working Group. Raven control and cheatgrass inventory projects continue to accounted for the majority of allocated funds granted to the UGRB Working Group in recent years.

Management Summary

Data collected and reported in this 2012 Sage-Grouse Job Completion Report (June 2011 thru May 2013) gives insight to population trends. Analysis of the past years of data indicates that the sage-grouse populations steadily increased from 2003 to 2007, dropped slightly in 2008, continued to decline through 2011, and stabilized through May of 2013. Lek trend data indicate grouse populations were at the lowest level in 2003 during the past 10-year period.

Lek monitoring in the UGRBWGA showed a 156% increase in the peak number of males per lek from 2003 to 2007 as males increased from 27.1 males/lek to 69.3 males/lek. This trend then reversed since 2007, as the number of males/lek has declined by 49% dropping to 35.0 males/lek by spring of 2013. Sage-grouse leks within developing gas fields continue to show declines and lek abandonment regardless of lek trends outside of

gas development, indicating negative impacts to leks and populations in and near natural gas fields.

Sage-grouse hunting season dates, season length, and bag limits have remained similar since 2002, running from late September to early October for 9-14 days with a daily bag limit of 2 birds and a possession limit of 4 birds. Although season length and bag limits have remained similar since 2002, overall harvest and hunter participation has varied somewhat, while harvest rates (# birds taken/day, #birds taken/hunter, and # days/hunter) have remained similar. With grouse numbers steadily increasing from 2003-2007 and declining since 2007, the progression of hunter participation was expected to show similar trends. The fluctuation in hunter numbers is not very clear but may be attributed to hunter's assessment of grouse populations due to annual or seasonal (spring/summer) precipitation levels instead of trends in grouse populations. Variation in hunter participation can also be affected by weather conditions, especially during the current short seasons.

Wing collection from wing barrels (drop locations) continue to provide good sample sizes to determine overall chick survival trends within the UGRBWGA. During 2008, 2009, 2010, and 2011 wing collections accounted for 45%, 37%, 31%, and 32% of the reported harvest. Although the sample size of wings were very similar to those collected in 2011 and previous years, the 2012 wing collections accounted for 71% of the harvest due to the low harvest reported in 2012. These annual wing samples can vary significantly based on weather conditions affecting hunter participation, especially during the weekend days of hunting season. Overall, wing trends have not shown a good correlation between trends in sample sizes vs. harvest, but do provide managers the most reliable data for determining annual reproductive rates and population trends in the UGRBWGA.

Trends in chicks/hen derived from wing collections continue to show a direct correlation with following year lek trends. An increase (or decrease) in the number of chicks/hen in the harvest typically results in similar trends documented on leks the following year(s). In general, a chick/hen ratio below 1.1 has shown declines in overall male lek attendance the following spring, 1.1 to 1.5 chicks/ hen has shown stable attendance, and a chick/hen ratio greater than 1.5 has shown increases in lek attendance in the UGRBWGA. During the past 6 years (2007-2012) the ratio of chicks/hen average was less than 1.0 (0.96) correlating with a 49% decline in the peak number of males on leks during that period.

Above normal precipitation during 2004 and 2005 during key periods (specifically in the spring and early summer) contributed to increased sage-grouse numbers due to enhanced production and juvenile survival in the Upper Green River Basin. Declining chick survival was documented in 2006 and 2007 caused by spring and summer drought conditions in the Upper Green River Basin. Male sage-grouse lek numbers declined by 15% during 2008, 12% in 2009, 26% in 2010, 10% in 2011, increased by 7% in 2012, and declined by 5% in 2013. Good to above average spring precipitation during 2008-2011 has led to good herbaceous production, which should have helped turn around the recent declining trends in the UGRBWGA. Although, it appears the cold temperatures during the spring of 2009 and 2010 impacted reproduction resulting in further declines in

lek numbers in 2010. Spring moisture in 2011 resulted in some of the better habitat production documented in quite some time, most likely contributing to the slight increase in bird numbers documented during the spring of 2012. Severe drought conditions in 2012 most likely attributed to poor chick survival and lower male lek counts in 2013.

The sage-grouse population in the UGRBWGA appears to be showing some fluctuation attributed to natural influences, such as spring precipitation and temperature. On a more localized level, the current amount and rate of natural gas development in the Upper Green River Basin has and will continue to impact sage-grouse habitat and local populations. Lek monitoring data has shown lower male attendance and in several cases total bird abandonment on leks within and adjacent to developing gas fields. Sage-grouse studies and research in the UGRBWGA has also documented impacts to grouse from gas development. Direct, indirect, and cumulative impacts to sage-grouse from gas and residential development will continue to challenge managers to maintain current grouse numbers.

Recommendations

1. Continue to monitor sage-grouse leks and look for new ones.
2. Continue to monitor and provide input on natural gas development/sage-grouse projects being conducted.
3. Continue to place wing barrels in enough locations to obtain an adequate and representative sample to derive sex/age and harvest trend information.
4. Continue existing efforts and encourage new efforts to document and identify important sage-grouse areas (breeding, brood rearing, and winter).
5. Continue to work with GIS personnel and land managers to create seasonal range maps (breeding, summer/fall, and winter) to aid land managers in protecting and maintaining important sage-grouse habitats.
6. Continue to identify needed sage-grouse research, data collection efforts, project proposals, development mitigation, and funding.
7. Implement proposals and management recommendations identified in the Upper Green River Basin Sage-Grouse Working Group Conservation Plan. Update this Plan as needed.

Literature Cited

Christiansen, T. 2007. Chapter 12: Sage Grouse (*Centrocercus urophasianus*). Pages 12-1 to 12-51 in S.A. Tessmann (ed). Handbook of Biological Techniques: third edition. Wyoming Game and Fish Department. Cheyenne.

Fedy, B. C., and K. E. Doherty. 2010. Population cycles are highly correlated over long time series and large spatial scales in two unrelated species: greater sage-grouse and cottontail rabbits. Oecologia 165:915-924.

Sage Grouse Job Completion Report

Year: 2004 - 2013, Management Area: D, Working Group: Upper Green River

1. Lek Attendance Summary (Occupied Leks) (1)

a. Leks Counted

Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek (2)
2004	97	57	59	1531	33.3
2005	105	77	73	3003	49.2
2006	110	76	69	3953	63.8
2007	115	78	68	4329	69.8
2008	114	80	70	3721	53.9
2009	118	84	71	3850	55.0
2010	130	92	71	3099	41.9
2011	133	100	75	2692	31.7
2012	134	117	87	3514	36.6
2013	131	115	88	3115	34.6

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2004	97	24	25	503	35.9
2005	105	20	19	657	38.6
2006	110	23	21	828	46.0
2007	115	28	24	1354	67.7
2008	114	24	21	1414	78.6
2009	118	27	23	619	38.7
2010	130	30	23	573	26.0
2011	133	25	19	943	47.2
2012	134	6	4	179	44.8
2013	131	8	6	280	40.0

1) Occupied - Active during previous 10 years (see official definitions)

2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

3) Inactive - Confirmed no birds/sign present (see official definitions)

Sage Grouse Job Completion Report

Year: 2004 - 2013, Management Area: D, Working Group: Upper Green River

1. Lek Attendance Summary (Occupied Leks) (1) Continued

c. Leks Checked

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek (2)
2004	97	81	84	2034	33.9
2005	105	97	92	3660	46.9
2006	110	99	90	4781	59.8
2007	115	106	92	5683	69.3
2008	114	104	91	5135	59.0
2009	118	111	94	4469	52.0
2010	130	122	94	3672	38.3
2011	133	125	94	3635	34.6
2012	134	123	92	3693	36.9
2013	131	123	94	3395	35.0

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2004	60	24	13	84	71.4	28.6
2005	76	24	5	100	76.0	24.0
2006	79	22	9	101	78.2	21.8
2007	82	24	9	106	77.4	22.6
2008	87	20	7	107	81.3	18.7
2009	86	26	6	112	76.8	23.2
2010	95	29	6	124	76.6	23.4
2011	104	22	7	126	82.5	17.5
2012	101	24	9	125	80.8	19.2
2013	97	32	2	129	75.2	24.8

1) Occupied - Active during previous 10 years (see official definitions)

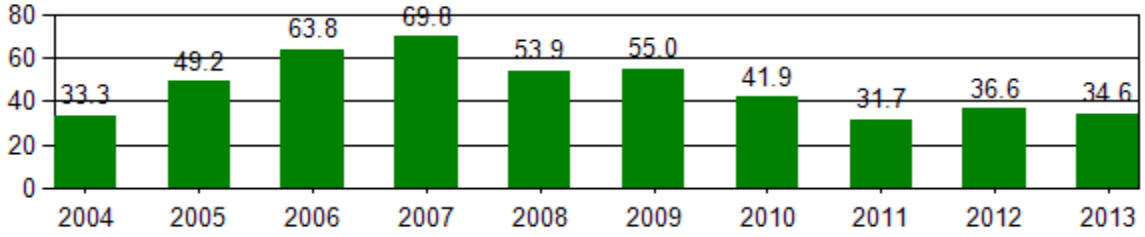
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

3) Inactive - Confirmed no birds/sign present (see official definitions)

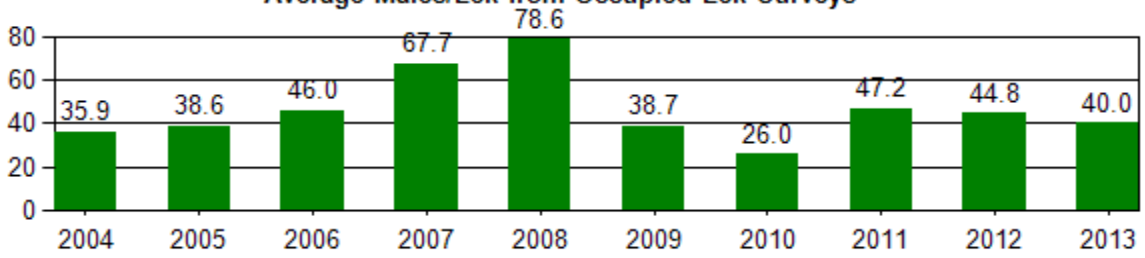
Sage Grouse Occupied Lek Attendance Summary

Year: 2004 - 2013, Management Area: D, Working Group: Upper Green River

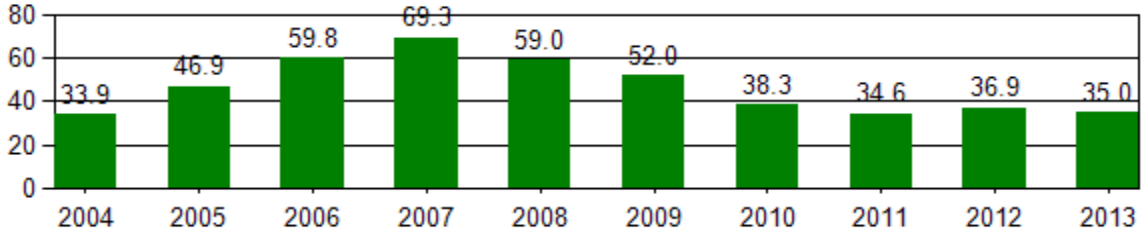
Average Males/Lek from Occupied Lek Counts



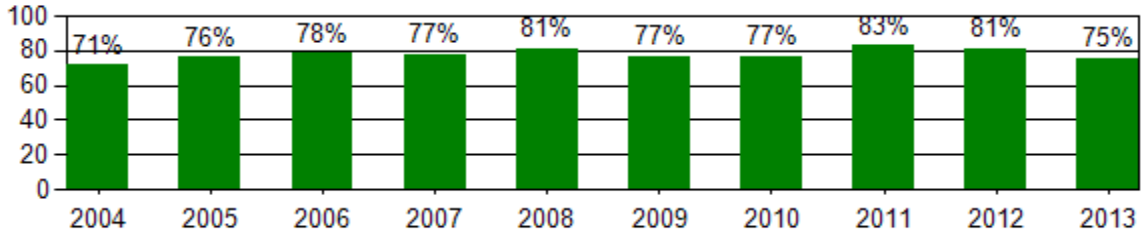
Average Males/Lek from Occupied Lek Surveys



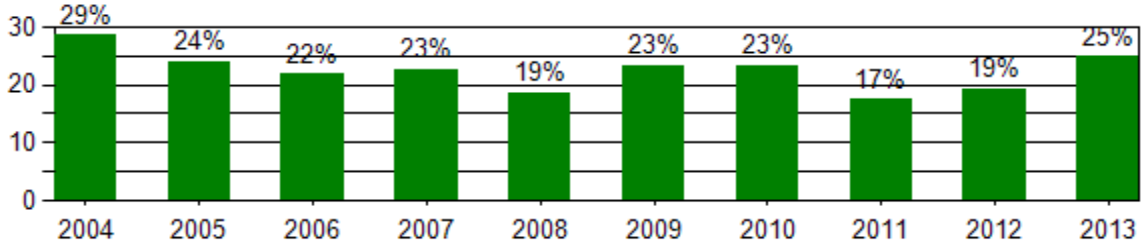
Average Males/Lek from All Occupied Lek Observations



Percent of Active Leks from the Total Occupied Leks



Percent of Inactive Leks from the Total Occupied Leks



Sage Grouse Lek Characteristics

Management Area: D, Working Group: Upper Green River

Region	Number	Percent
Pinedale	152	100.0

Working Group	Number	Percent
Upper Green River	152	100.0

Classification	Number	Percent
Occupied	129	84.9
Undetermined	3	2.0
Unoccupied	20	13.2

BLM Office	Number	Percent
Pinedale	138	90.8
Rock Springs	14	9.2

Biologist	Number	Percent
Pinedale	80	52.6
South Jackson	72	47.4

Warden	Number	Percent
Big Piney	77	50.7
North Pinedale	14	9.2
South Pinedale	61	40.1

County	Number	Percent
Sublette	152	100.0

Land Status	Number	Percent
BLM	134	88.2
Private	12	7.9
State	6	3.9

Management Area	Number	Percent
D	152	100.0

Lek Status	Number	Percent
Active	98	64.5
Inactive	33	21.7
Unknown	21	13.8

Sage Grouse Job Completion Report

Year: 2003 - 2012, Management Area: D

4. Sage Grouse Hunting Seasons and Harvest Data

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	440	178	401	1.1	2.5	2.3
2004	1040	398	1020	1.0	2.6	2.6
2005	669	233	564	1.2	2.9	2.4
2006	2132	781	1885	1.1	2.7	2.4
2007	1297	564	1300	1.0	2.3	2.3
2008	1109	453	1116	1.0	2.4	2.5
2009	1203	460	1177	1.0	2.6	2.6
2010	1510	526	1497	1.0	2.9	2.8
2011	1720	565	1605	1.1	3.0	2.8
2012	1320	476	1296	1.0	2.8	2.7
Avg	1,244	463	1,186	1.1	2.7	2.5

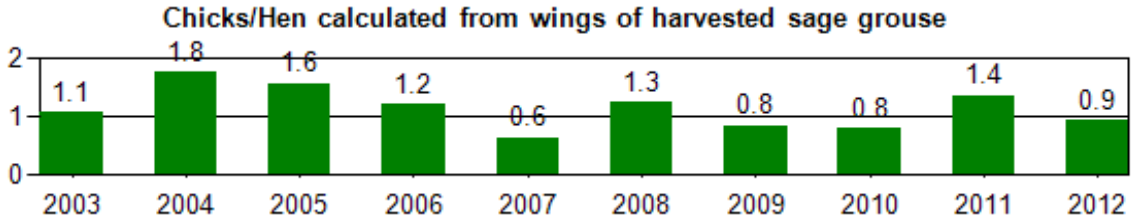
Sage Grouse Wing Analysis Summary

Year: 2012, Management Area: D, Working Group: Upper Green River

Adult Males:	66	% of All Wings:	12.1
Adult Females:	186	% of All Wings:	34.2
Adult Unknown:	0	% of All Wings:	0.0
Total Adults:	252		
Yearling Males:	19	% of All Wings:	3.5
Yearling Females:	52	% of All Wings:	9.6
Yearling Unknown:	0	% of All Wings:	0.0
Total Yearlings:	71		
Chick Males:	93	% of All Wings:	17.1
Chick Females:	128	% of All Wings:	23.5
Chick Unknown:	0	% of All Wings:	0.0
Total Chicks:	221		
Unknown Sex/Age:	0		
Total for all Sex/Age Groups:	**544**		

Chick Males:	93	% of All Chicks	42.1
Yearling Males:	19	% of Adult and Yearling Males	22.4
Adult Males:	66	% of Adult and Yearling Males	77.6
Adult and Yearling Males:	85	% of Adults and Yearlings	26.3
Total Males:	178	% of All Sex/Age Groups	32.7
Chick Females:	128	% of All Chicks	57.9
Yearling Females:	52	% of Adult and Yearling Females	21.8
Adult Females:	186	% of Adult and Yearling Females	78.2
Adult and Yearling Females:	238	% of Adults and Yearlings	73.7
Total Females:	366	% of All Sex/Age Groups	67.3

Chicks:	221	% of All Wings:	40.6
Yearlings:	71	% of All Wings:	13.1
Adults:	252	% of All Wings:	46.3
Chicks/Hen	0.9		



Upper Snake River Basin Sage-Grouse Job Completion Report 2012

June 2012-May 2013

Doug Brimeyer
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Jackson Region

Species: Sage Grouse
Period Covered: June 1, 2011 – May 31, 2012
Management Areas: A
Working Group Area: Upper Snake River Basin
Prepared by: Doug Brimeyer

Introduction

With establishment of eight Sage Grouse Working Groups throughout the state in 2004, Sage Grouse Job Completion Reports (JCR) were revised to Working Group Areas and not Game and Fish Department Regions. Until 2010 the Upper Snake River Basin Working Group included Game Bird Management Areas (GBMA) 1 (Gros Ventre and Jackson Hole) and 2 (Hoback Basin and Star Valley). However upland game management areas were revised in 2010 and the Upper Snake River Basin working group area was designated as Area A, which is covered in this report

The initial role of the Upper Snake River Basin Working Group was to develop and facilitate implementation of a local working group plan for the benefit of sage-grouse and, whenever feasible, other species that use sagebrush habitats. The 2008 Conservation Plan identified management practices for the purposes of improving sage-grouse numbers and maintaining a viable population in entire Snake River Basin in Teton, Lincoln, and Sublette counties in Wyoming. Specifically the plan addressed management of four small, isolated populations in Jackson Hole, the Gros Ventre Valley, Hoback Basin and an interstate population shared by Wyoming and Idaho in the Salt River drainage. The 2008 Plan is being revised to reflect current policy for sage-grouse conservation under Wyoming Executive Order 2011-5 and other relevant information. The draft plan will be available for public review in early 2014.

Information presented in this report includes only lek monitoring data. Due to the size of the population in the Upper Snake River Basin, no productivity data or sex/age composition data were collected during 2012. The entire DAU has been closed to hunting since 2000.

Plan Area

The Upper Snake River Basin Working Group Area (USRBWGA) includes the entire Snake River drainage basin in Wyoming including the major tributaries of the Gros Ventre, Hoback and Salt River drainages. The area boundary encompasses almost all of Teton County and small portions of Sublette and Lincoln Counties (Figure 1).

The occupied sage-grouse habitat in the plan area is primarily sagebrush grassland habitat in the valley floor and foothills of Jackson Hole, Hoback Basin, Gros Ventre River Valley and in the western foothills of Star Valley. Much of the remainder of the working group area is forested habitat that is not occupied by sage-grouse. The core population in Jackson Hole is found primarily in Grand Teton National Park and on the National Elk Refuge. Sage-grouse also use some of the foothill areas on the Bridger-Teton National Forest and private land on East and West Gros Ventre Buttes. The Jackson population was designated as a core area by the Governor's Sage-grouse Implementation Team (SGIT) in August 2008. The boundaries of the core areas were revised in 2010 by the SGIT, with input from the local working groups (Figure 2).

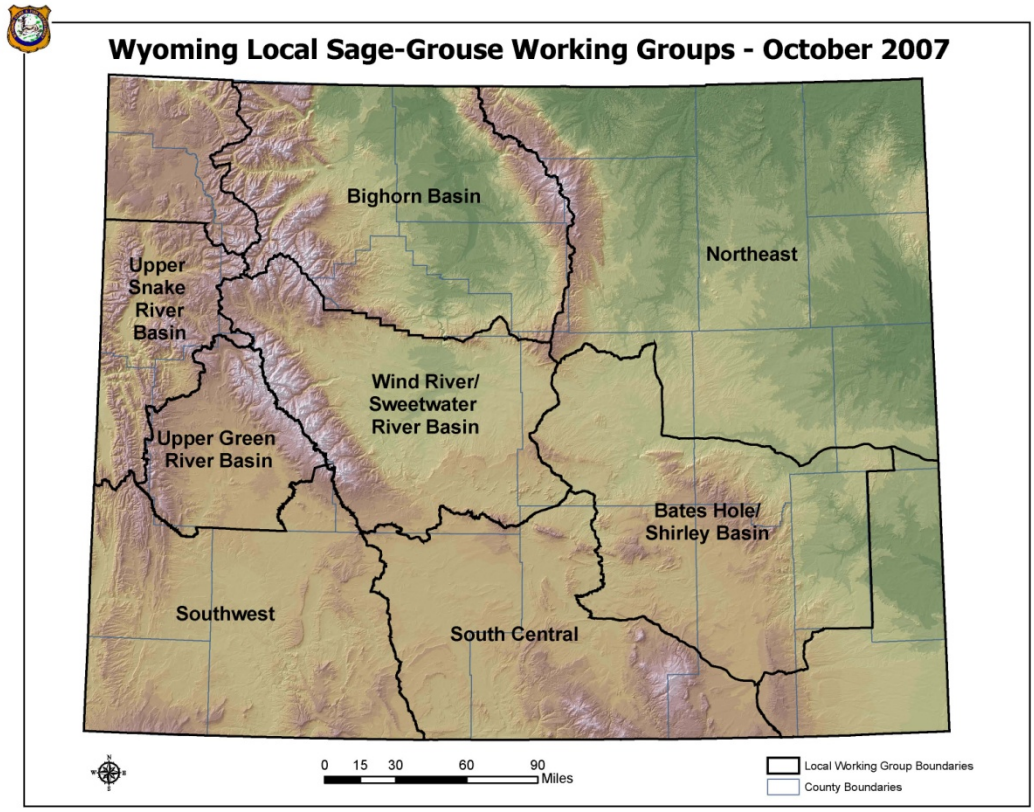

Figure 1. Wyoming local sage-grouse working group boundaries.

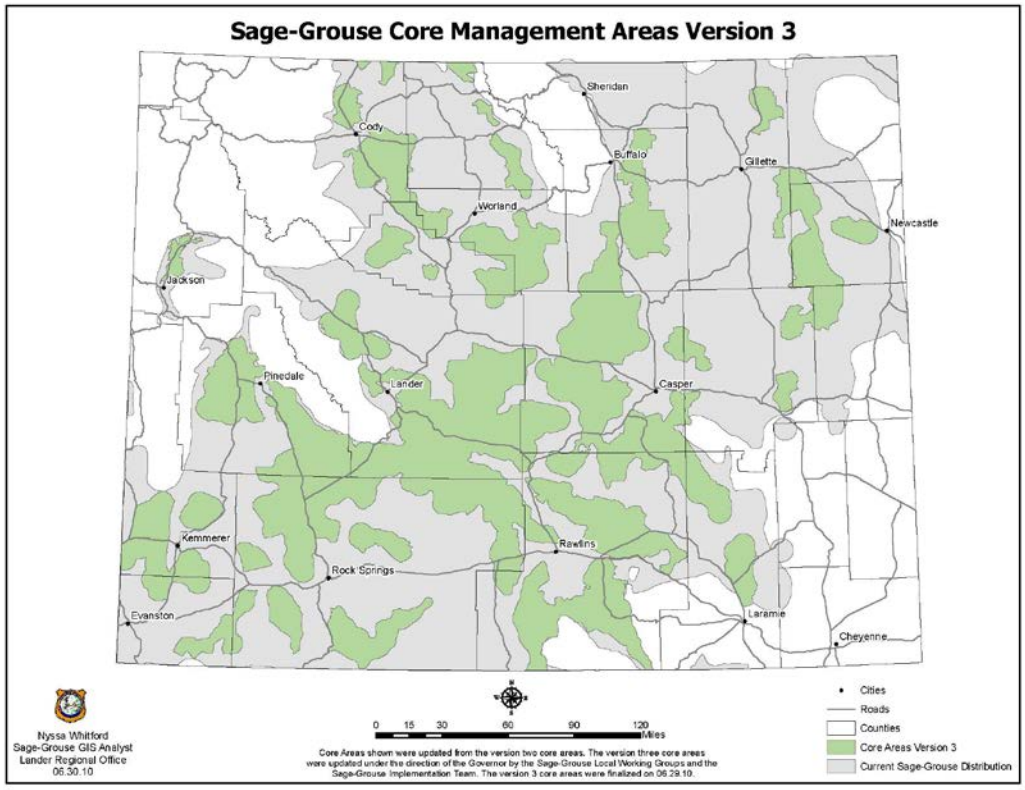

Figure 2. Wyoming Sage-Grouse Core Areas.

Sage-grouse in Jackson Hole are thought to be non-migratory but some interchange with the birds using the Gros Ventre drainage is possible (Holloran and Anderson 2004). In the Hoback Basin, a lek was discovered in the Clark Draw area in April 2010. A small population of sage-grouse use habitat associated with the Gannet Hills in Wyoming and Idaho along the western edge of Star Valley. There are three leks located in Idaho in the Crow Creek and Stump Creek drainages near the Wyoming-Idaho state line.

Lek Monitoring

Traditionally, sage-grouse data collection within the Snake River Basin has focused on lek surveys and the age and sex composition of harvested birds. Prior to 1994, relatively few leks were monitored and since 2000, efforts have been made to increase data collection on sage grouse leks and standardize data collection methods. Starting in 2005, lek counts in Grand Teton National Park, and to some extent on the National Elk Refuge, were coordinated to occur on the same days when it was logistically possible. This presumes that all the leks in Jackson Hole proper constitute a lek complex and the leks in the Gros Ventre drainage constitute a second lek complex. No marked birds from the Gros Ventre leks have appeared on the Jackson Hole leks (Holloran and Anderson 2004, Bryan Bedrosian pers. com.).

Lek counts and lek surveys have been conducted within the area since 1948; however, the most consistent data sets occur from 1989 to the present. Sage-grouse leks within the USRBWGA are summarized in Table 1 from 1985 through 2013. In some years it is uncertain from the data provided by Grand Teton National Park if leks that were thought to be inactive were actually checked and if they were checked and no birds were observed was the null value reported. Since the status of these leks is uncertain they are noted in the lek database report as not checked (undetermined). It is likely most of these leks are inactive in these years but occasionally some birds do appear to use leks that have been inactive for several years. The distribution of leks in the USRBWGA is displayed in Figure 3.

Table 1 summarizes the high count on each lek over the survey period and the average number of males counted on active leks based on the high counts at each lek. There is some movement of males between leks, particularly from the North Gap lek on the National Elk Refuge to leks in Grand Teton National Park and between leks in the lower valley with leks in the upper valley as the spring progresses and snow melt occurs on leks at higher elevations to the north. As a result, the total of the high counts on all leks in each year may represent an inflated estimate of total males in the population. However data collected in the early years have only been reported as the high count on each lek and the summary in Table 1 is presented in this manner for comparative purposes. We presume the trends in the population based on these counts still mimic actual trends in the population. Similar trends are observed in the report using the conventional analysis provided by the WGFD sage-grouse database report.

There are 16 known or historic sage-grouse leks reported in Table 1. Thirteen leks are considered to be occupied and two appear to be unoccupied historic leks within the plan area (3 BAR H and Antelope Flats in GTNP). In recent years the Simpson lek, formerly called Poverty Flats lek in the NER was considered to be unoccupied but 3 males were sighted there in 2012. The McBride lek is classified as occupied but has only been active on a sporadic basis in recent years (one male in 2007) and warrants additional scrutiny. It is unclear if the Airport Pit lek is really a lek, a satellite lek or a sporadic activity center for birds displaced off the airport lek by airport operations. The Bark Corral lek may have 2 activity centers (East and West)) or the West

lek may be a satellite of the Bark Corral East lek. The Cottonwood lek in the Gros Ventre drainage (reported in the 2006-2007 annual report) was dropped as a lek since birds were only observed there once. However, researchers suspect there may be an additional unconfirmed lek near the Fish Creek Elk Feedground and additional searches in the Gros Ventre drainage in 2012 are warranted (Bryan Bedrosian pers. com).

Moulton East and Moulton West leks were combined in 2007 (reported as separate leks in previous reports) and reported as the Moulton lek (one lek with two activities centers) in 2008. In some years it appears the total birds counted on the same day for both activity centers were reported as the high count and in other years a high count for each activity center was reported, but not necessarily on the same date (Grand Teton National Park Database). We have attempted to correct what may have been double counts by taking the highest count for a particular date on both activity centers and reporting that number for the Moulton lek.

The Spread Creek lek was located in 2007 near the east end of Wolff Ridge in the sagebrush flat between the ridge and Spread Creek. In 2010 birds were also seen strutting on the bare ridge top of Wolff Ridge where there is considerable grouse sign. The lek was reported by other observers in the past but its location was never confirmed. The Spread Creek lek has been active in 2008 - 2011.

During research in 2008 a lek was located in in the Pot Holes area of Grand Teton National Park (RKO Road lek). Birds were located on the RKO Road lek on a number of occasions in 2008 and one male was trapped and fitted with radio transmitters near this new lek. The lek was active again in 2009 with a high count of 15 males and again in 2010 with a high count of 13 males, and in 2013 with 6 males.

The Clark Draw lek was discovered in the Hoback Basin in April 2010. The lek has been active every year since with peak counts ranging from 12-14 (Table 1).

Of the 16 leks in the USRBCA, thirteen were checked in 2013. Nine leks had grouse present and 4 leks did not have birds present during monitoring. Three leks were not checked during the 2013 breeding season (Beacon, Circle EW and McBride).

It must be noted that that lek data in Table 1 must be interpreted with caution (as with all sage-grouse lek data)for several reasons: 1) the survey effort and the number of leks surveyed/counted has varied over time; 2) it is assumed that not all leks in the area have been located; 3) sage-grouse populations can exhibit cyclic patterns over approximately a decade; 4) the effects of unknown or unmonitored leks that have become inactive cannot be quantified; 5) lek sites may change over time; 6) not all males attend leks on any day or within a lekking season: 7) lek data collected in Grand Teton National Park from 1952 through 1985 is missing from the agency files and no record has been found from other sources; and 8) in some years it appears that lek data were combined for some leks, which may be considered satellite leks by the observers (i.e. Beacon and Airport leks or Moulton East and Moulton West leks or Bark Corral East and West leks or North Gap and Simpson leks on NER) and it is uncertain in some years if both of these paired leks were surveyed since only a total count is presented for one of the paired leks. However, in some years prior to 2000 it appears totals may have been lumped.

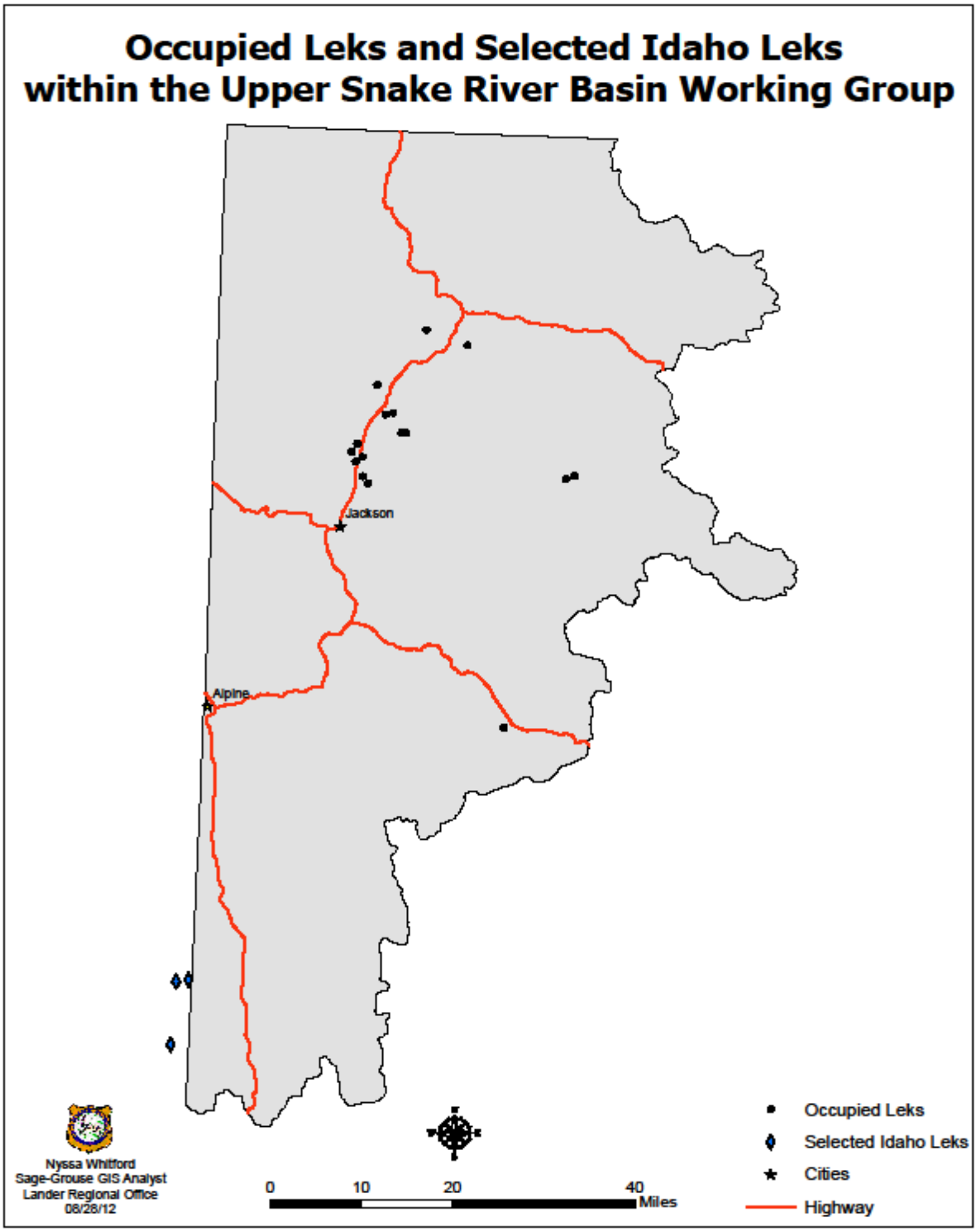

Figure 3. Occupied leks in the Upper Snake River Basin Working Group Area and adjacent selected leks in Idaho.

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

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

* includes males and females

** new lek in 2008 with multiple obs.

*** BarkCorral lek has 2 activity centers which may be separate leks. In the past birds have been observed at both sites but observations have been combined in this report.

Population Trends and Estimates

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

A new sage-grouse database was developed in 2012 in order to improve efficiency, reduce errors, and better facilitate data analysis. Changes were made to the manner in which lek data are calculated and reported in Table 2. The new version is based solely on "occupied" leks. The past version included unoccupied leks that were monitored. The result of this change is that the number of "known occupied" leks is now more accurate, but reflects fewer leks than in the previous version. Similarly, the new version calculates average male lek attendance using only monitoring observations where one or more male grouse were observed strutting. The old version included a count of "0" males for leks where activity was confirmed by the presence of sign but no birds were observed. Together, these two changes result in somewhat higher, but more accurate, average male attendance for active leks than previously reported. The changes do not result in any change in population trend based on average male lek attendance. Interpreted population increases and decreases over time remain the same so no revisions to past reports are required.

Since only "occupied" leks are being reported in Table 2, it is important to consider trends in the numbers of active versus inactive leks in addition to the average size of active leks. During a period of population decline, the size of active leks typically declines and the number of inactive leks increases. The converse is typically true of an increasing population. Therefore the magnitude of both increases and decreases is usually greater than what is indicated by the average lek size alone. Average female lek attendance is no longer being reported since our data collection techniques is not designed to accurately capture these data and is therefore not a useful figure in assessing population trend.

Table 2. Lek attendance and lek status for leks in the USRCA 2004- 2013.

Year: 2004 - 2013, Working Group: Upper Snake River Basin

1. Lek Attendance Summary (Occupied Leks) (1)

c. Leks Checked

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek (2)
2004	10	10	100	106	17.7
2005	11	9	82	123	20.5
2006	11	11	100	157	19.6
2007	11	10	91	133	14.8
2008	13	13	100	165	16.5
2009	13	12	92	124	12.4
2010	14	14	100	164	16.4
2011	14	14	100	112	14.0
2012	16	15	94	142	14.2
2013	16	13	81	149	16.6

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2004	6	1	3	7	85.7	14.3
2005	6	1	4	7	85.7	14.3
2006	8	2	1	10	80.0	20.0
2007	10	2	-1	12	83.3	16.7
2008	11	1	1	12	91.7	8.3
2009	10	2	1	12	83.3	16.7
2010	10	4	0	14	71.4	28.6
2011	8	5	1	13	61.5	38.5
2012	11	4	1	15	73.3	26.7
2013	10	4	2	14	71.4	28.6

Data from the most recent 10 year period suggests that the sage-grouse population declined through 2012 in the USRBCA. In 2013 the peak number of males was 149 cocks which was similar to the number of males observed in 2012 (142) and slightly higher than the 2004 – 2012 average (136 males). Clearly the long term persistence of this population is of paramount concern to the local working group and resource managers.

Productivity

During 2012 no productivity data were collected on this population.

Harvest

Most of the plan area has been closed to hunting since the establishment of Grand Teton National Park. No hunting for sage-grouse has been allowed on lands under the jurisdiction of Grand Teton National Park or the National Elk Refuge. In 2000 the hunting season was closed in the entire USRBWGA.

Habitat Protection

In 2008 Governor Freudenthal issued Executive Order 2008-2 establishing core areas and stipulations to protect sage-grouse habitat and populations in those core areas. Following the release of the new "warranted but precluded" listing decision by the Service in 2010, the Governor issued a new Executive Order to replace that from 2008. Then, newly elected Governor Matt Mead issued his own Executive Order in 2011 which reiterated and further clarified the intent of the Core Area Policy. The current Executive Order and Core Area Policy can be found on the WGFD website. Most of the Jackson Hole population's habitat was designated a core area while the remainder of the small sage-grouse populations in the working group conservation area fell in the non-core area designation.

Special Projects

Jackson Hole Wildlife Hazard Management Plan

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

Safety issues related to the potential for sage-grouse strikes with airplanes arriving or leaving the airport has prompted the FAA to require the Jackson Hole Airport to create a Wildlife Hazard Management Plan. This plan creates an action plan and mitigation measures for the Jackson Hole Airport to reduce airplane strike risk with all wildlife, but emphasis is placed on the sage-grouse given the lek proximity and historical strikes. The FAA is tasked with managing all wildlife risks within 10 miles of the airport perimeter, but GTNP also has jurisdiction over wildlife within that region. This led to a highly collaborative project between all stakeholders, including the local working group, to create a management plan for the Jackson Hole Airport. The pending plan from the FAA will likely be released for public review in early 2014.

Returning Sagebrush to the Kelly Hayfields: A 150 Acre Restoration in Grand Teton National Park.

The sagebrush steppe vegetation within Grand Teton National Park (GTNP) forms the core habitat for sage grouse within the Upper Snake River Basin. While the Park contains 47,000 acres of big sagebrush, it has nearly 9,000 acres of abandoned hayfields that were once sagebrush. These hayfields are now dominated by a nearly shrubless monoculture of smooth brome (*Bromus inermis*). In the 30-50 years that these hayfields have been abandoned, sagebrush has re-established in only a limited area. However, where the sagebrush has returned, the native bunchgrass/forb understory hasn't always.

Since 2006, Craighead Bergingia South has been collecting GPS points from collared sage grouse and has demonstrated that grouse do not utilize the hayfields nearly frequently as the intact sagebrush nearby. Clearly, for these hayfields to ever be prime habitat for sage grouse and other sagebrush obligates, they must be restored to their former sagebrush-steppe vegetation. During 2013 the Park Service continued to monitor vegetation on the restoration area and spot treat for noxious weeds.

Low neutral genetic diversity in an isolated greater sage-grouse (Centrocercus urophasianus) population in northwest Wyoming

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ABSTRACT
Habitat loss is well recognized as an immediate threat to biodiversity. Depending on the dispersal capabilities of the species, increased habitat fragmentation often results in reduced functional connectivity and gene flow followed by population decline and a higher likelihood of eventual extinction. Knowledge of the degree of connectivity between populations is therefore crucial for better management of small populations in a changing landscape. A small population of greater sage-grouse (Centrocercus urophasianus) exists in northwest Wyoming within the Jackson Hole valley, including Grand Teton National Park and the National Elk Refuge. To what degree the Jackson population is isolated is not known as natural dispersal barriers in the form of mountains and anthropogenic habitat fragmentation may limit the population's connectivity to adjacent populations. Using 16 microsatellite loci and 300 greater sage-grouse samples collected throughout Wyoming and southeast Montana, significant population differentiation was found to exist among populations. Results indicated that the Jackson population was isolated relative to the other sampled populations, including Pinedale, its closest neighboring large population to the south. The one exception was a small population immediately to the east of Jackson, in which asymmetric dispersal from Jackson into Gros Ventre was detected. Both Jackson and Gros Ventre populations exhibited significantly reduced levels of neutral genetic diversity relative to other sampled populations. More work is warranted to determine the timing at which Jackson and Gros Ventre populations had become isolated and whether it was primarily due to recent habitat fragmentation or more historic processes. Due to its small population size, continual monitoring of the population is recommended with the goal of at least maintaining current population size and, if possible, increasing suitable habitat and population size to levels recorded in the past.

Occurrence and survival informed modeling of sage-grouse habitat in Jackson Hole, WY

Trapper Haynam, Craighead Beringia South
Bryan Bedrosian, Craighead Beringia South
Bob Crabtree, Yellowstone Ecological Research Center

The end goal of this project is to develop spatially explicit metrics of greater sage-grouse habitat response in Jackson Hole, WY. This research will relate sage-grouse survival and location data to a

suite of environmental variables. We are developing models for nesting, brood rearing, summer foraging, and winter foraging life history stages. Our response data were collected from 2007-2010. We have >70,000 GPS and VHF telemetry locations, from all life history stages, for ~25 male and ~75 female birds. We will utilize well established habitat selection modeling methodologies, such as resource selection probability functions (logistic models) or generalized linear mixed-effects models. In these use-availability modeling frameworks, statistical models are fit to biologically relevant covariates (e.g., sagebrush canopy cover, herbaceous understory, past fire severity, raven occurrence) that are sampled at points where sage-grouse were relocated, or could have been present. Fitting these models will provide relative measures (parameter estimates) of apparent sage-grouse preference for particular habitat characteristics. The estimated parameters can then be used to generate resource use probability surfaces. Using a similar approach, and semi-parametric survival analysis, parameters will be estimated and then survival or risk surfaces can be generated. If a best supported model is deemed to have biologically significant parameter estimates; risk surfaces and resource selection surfaces will be combined to calculate a habitat suitability surface. The final method for generating a habitat suitability surface is still being developed. The candidate model structures have not yet been finalized, some covariates have yet to be synthesized, and covariate data arrays are still being populated.

Past Research Projects

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Management Summary

If the average number of males per lek is reflective of the sage-grouse population, the trend suggests relatively high populations in the early 1990s with a sharp decline through 1999 and a modest but short lived recovery starting in 2000. The increase number of males observed on leks in early 2013 may be the result of increased over winter survival during the 2012-13 winter.

Lek data summarized in Tables 1 and 2 suggest the population is declining both over the long term (1986-2011) and in the short term (2002-2012). The long-term viability of this population probably can be assured only if mortality factors currently affecting this population do not increase, resulting in greater losses of adult and juvenile hens. Based on this assumption, reinstituting the hunting season in Management Area A is not warranted at this time.

Habitat monitoring and mapping of sagebrush habitats used by sage-grouse are a priority. Additional documentation of sage-grouse distribution is needed to confirm habitat selection and seasonal distribution. Key areas on public lands used by sage-grouse should be protected from management actions which could have adverse impacts on that habitat. Wildfire suppression should be a priority in most of the occupied sage-grouse habitat in Jackson Hole and the Gros Ventre drainage. Restoration of native sagebrush habitats on lands formerly farmed in Grand Teton National Park appear to have the greatest potential to expand and enhance habitat used by sage-grouse in the USRBCA.

The impact of the Jackson Hole Airport on the sage-grouse population is an ongoing issue. Management options that do not adversely affect the Jackson Hole sage-grouse population should be considered in any risk assessment and wildlife plan associated with safe aircraft operations at the Jackson Hole Airport. Efforts to reduce the risks that sage-grouse may pose to airport operations should be carefully evaluated to avoid negative impacts to this population.

The sage-grouse study by Craighead Beringia South provides essential information to manage the sage-grouse population and its habitat in Jackson Hole. Land management agencies and the Wyoming Game and fish Department should consult this report when considering habitat projects in Jackson Hole and the Gros Ventre Valley.

Recommendations

1. Coordinate lek surveys across jurisdictional boundaries using the lek survey protocols adopted by the WGFD.
2. Search for new leks annually and check historic, unoccupied or inactive leks.
3. Continue to collect lek data consistently between jurisdictions following the established WGFD protocol.
4. Continue to document sage-grouse observations to expand habitat mapping.
5. Cooperate with Wildlife Services, the National Park Service, and the Jackson Hole Airport Board to complete the wildlife assessment and design projects to minimize risks of sage-grouse strikes on aircraft.
6. Consider the findings of the sage-grouse study by Craighead Beringia South to determine demographic data and vital rates for the Jackson Hole population, determine seasonal distribution and habitat use, identify critical habitat, identify limiting factors for the population, determine the influence of potential predators, develop an accurate population model, design long term monitoring protocols, propose management strategies for sagebrush habitats and fire regimes, and provide baseline data for future research.
7. Cooperate with the Pocatello Region of the Idaho Fish and Game Department to gather more information on the interstate population in Star Valley along the Idaho-Wyoming state line
8. Support Grand Teton National Park's sagebrush habitat restoration projects in the Mormon Row and Hayfields areas which could be used as winter and nesting habitats for sage-grouse in Jackson Hole
9. Minimize impacts to sage-grouse breeding habitat in general sage-grouse habitat when conducting habitat project for other wildlife species, livestock range enhancementprojects , or fuels reduction projects.
10. Implement the USRBWG Sage-grouse Conservation Plan. Work to implement the strategies and projects identified in the plan.

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Wind River - Sweetwater River Basin

Sage-Grouse

Job Completion Report

2012

June 2012-May 2013

Stan Harter

Wyoming Game & Fish Dept.

Lander Region

Wind River/Sweetwater River Conservation Area
Job Completion Report

Species: **Greater Sage-grouse**
Mgmt. Areas: **E & WR (1 lek from G)**
Period Covered: **June 1, 2012 – May 31, 2013**
Prepared by: **Stan Harter, South Lander Wildlife Biologist**

Introduction

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. Habitats within the Gas Hills and Badwater Creek areas appear to be the most fragmented by changes in habitat type and energy development. 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.

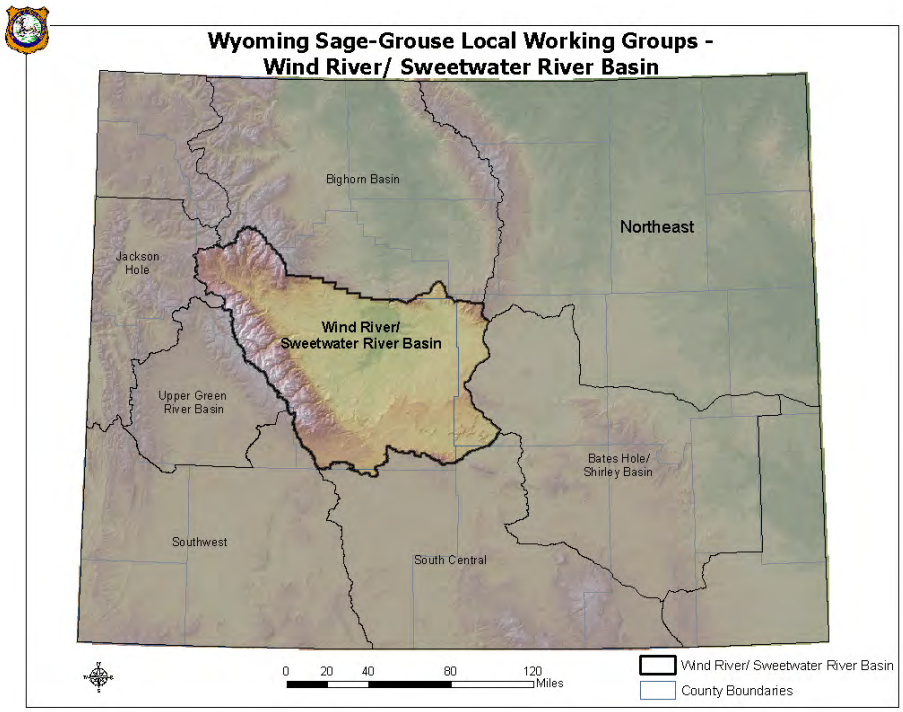

Figure 1. The Wind River/Sweetwater River Conservation Area.

Known sage-grouse leks within the WRSRCA are predominantly located on public lands (Bureau of Land Management (BLM) - 58% and Bureau of Reclamation (BOR) - 2%), or tribal lands on the Wind River Reservation (WRR) – 25%. Approximately 10% of known leks are found on private land with the remaining 5% found on Wyoming State Trust lands (Appendix 1).

Conservation Area

The Wind River/Sweetwater River Conservation Area features the Wind River and Sweetwater River drainages. The area extends from Dubois in the west to Muddy Gap and Waltman in the east and from South Pass and Cyclone Rim in the south to the Owl Creek Mountains and South Bighorns in the north. The WRR 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 2 indicates land ownership within the WRSRCA, including areas managed by the U.S. BLM (Lander, Rock Springs, Casper and Rawlins Resource Areas), the U.S. BOR, 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 WRR, in association with the U.S. Bureau of Indian Affairs and U.S. Fish and Wildlife Service (USFWS). 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 within the WRSRCA include: livestock grazing, oil/gas development, mining, dryland and irrigated crop production, recreation, and urban expansion.

The Wind River/Sweetwater River Local Working Group was organized in fall 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". The Wind River/Sweetwater River Local Sage-Grouse Conservation Plan was completed in 2007 and is currently being updated. This plan and other Wyoming sage-grouse information is located on the WGFD website at http://wgfd.wyo.gov/web2011/wildlife-1000817.aspx

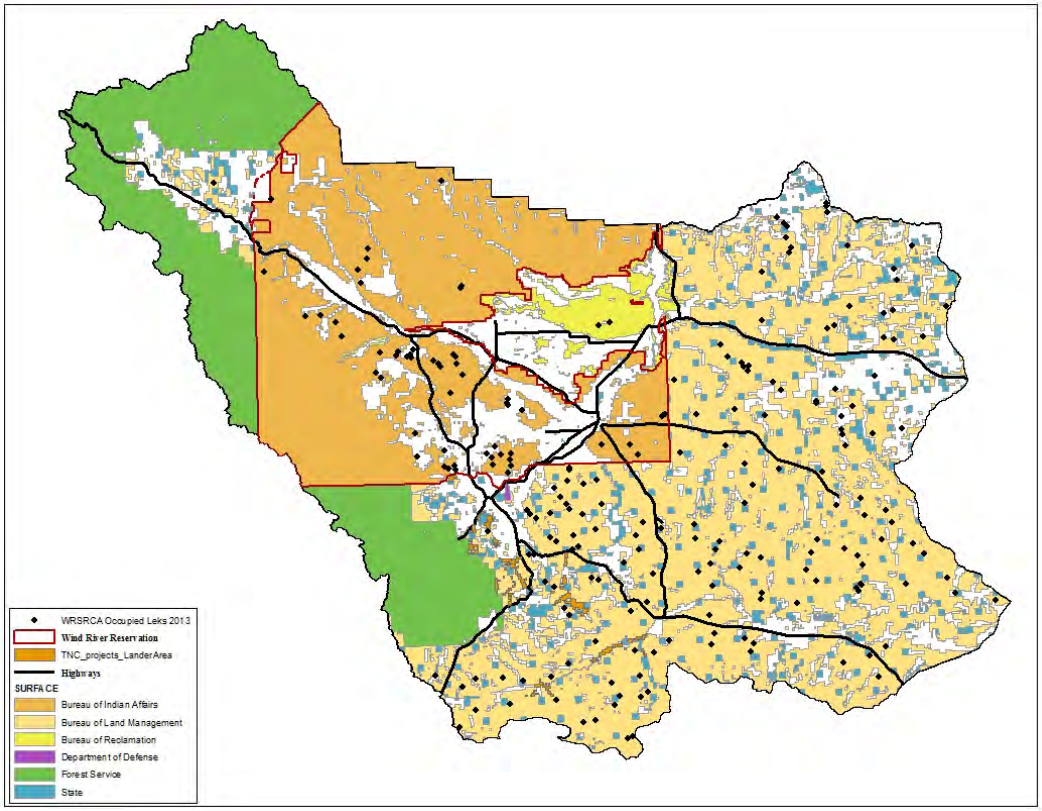

Figure 2. Land ownership within the WRSRCA (dots = 2013 occupied leks). Source: WGFD, BLM.

The WRSRCA encompasses all of the WGFD's Small/Upland Game Management Areas E and WR (Figure 3), with one lek in Management Area G which will be revised in 2014 to be included in the Southwest LWG area. Management recommendations and conservation efforts apply to all tribal lands within the WRR in both Fremont and Hot Springs Counties. Management areas do not directly correspond to sage-grouse population boundaries, but are used for general data collection and reporting.

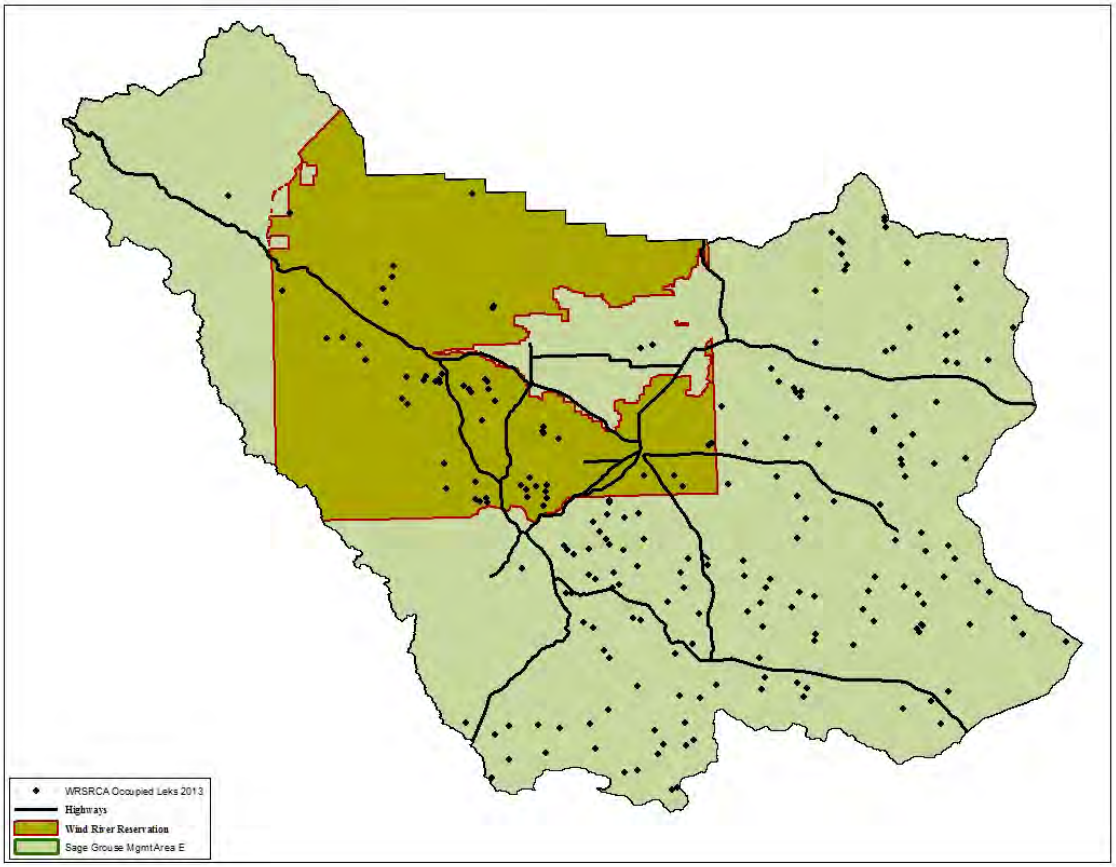

Figure 3. WGFD upland game bird management areas and known leks within WRSRCA (dots=leks). Source WGFD.

Endangered Species Status and Wyoming Greater Sage-Grouse Core Areas

On March 5, 2010 the U.S. Fish and Wildlife Service (Service) 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 priorities. This status is reviewed annually by the Service.

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

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.

In an unprecedented move to coordinate sage grouse conservation efforts across the State of Wyoming, Governor Dave Freudenthal utilized the recommendations from his Sage-Grouse Implementation Team 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 Governor's Sage Grouse Implementation Team 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 Implementation Team, Governor Freudenthal issued a new Executive Order on August 18, 2010 to replace that from 2008.

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 80% of the known leks in the WRSRCA are in core areas (Figure 4).

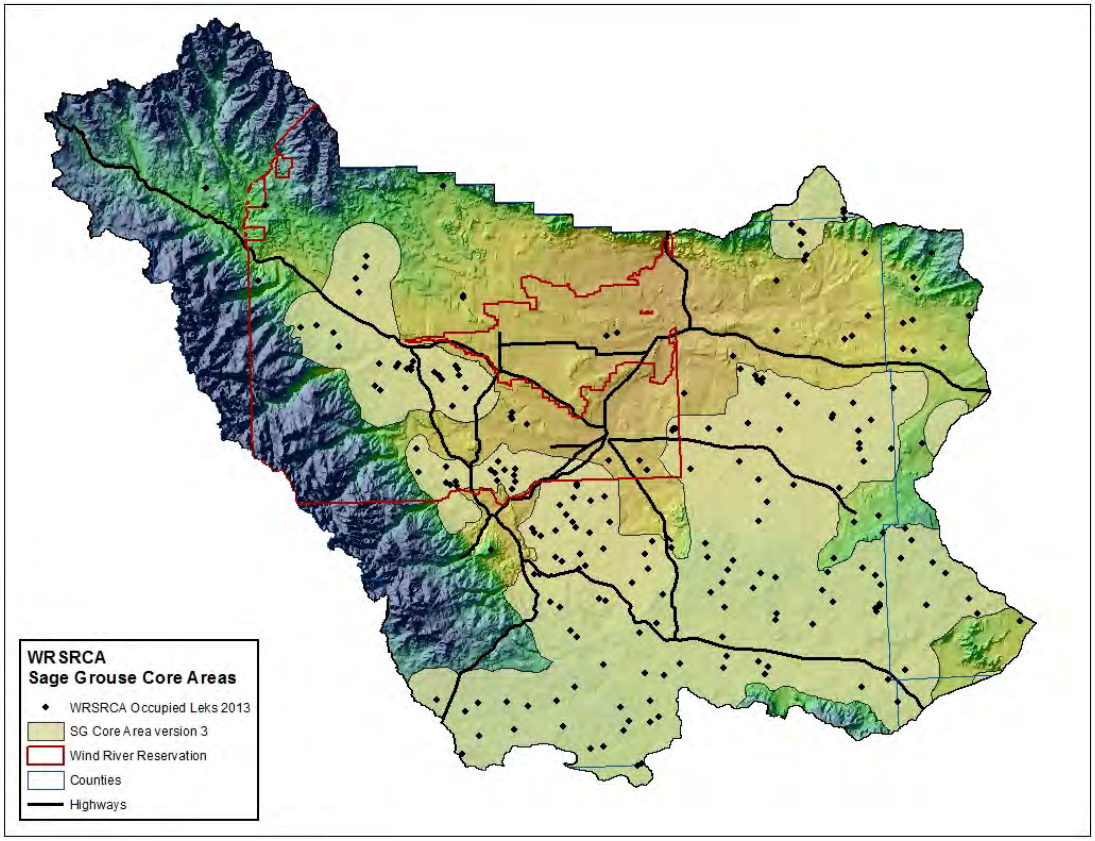

Figure 4. Wyoming Sage-Grouse Core Areas (Version 3, 2010) within the WRSRCA (dots=2013 leks). Source WGFD.

Lek Monitoring

WGFD, federal agencies, and volunteers have conducted lek counts and surveys each spring within the WRSRCA for over 40 years, providing some of the best long-term management data currently available for sage-grouse. Lek counts include those lek observations conducted 3–4 times each spring, about 7–10 days apart. Lek counts are a census technique that document the actual number of male sage-grouse observed attending a particular lek or lek complex. Lek surveys typically consist of only one spring visit and are intended to determine general lek status although trends reflected by lek surveys are adequately similar to lek counts when sample sizes exceed 50 leks (Fedy and Aldridge 2011). Known leks indicate sage-grouse distribution within the WRSRCA as represented previously in Figures 2, 3, and 4.

Lek Attendance - 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 (1 lek in Casper Region), 4 BLM Resource Areas, 5 Wyoming counties, and the WRR. There were 202 known occupied leks within the conservation area in 2013, along with 26 unoccupied and 7 undetermined leks. 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 5, 6, 7). With intensified monitoring and search efforts since 1995, at least 76 new or newly discovered leks have been documented in the WRSRCA.

Of the 202 known occupied leks in the WRSRCA, 175 were checked in 2013 by WGFD, BLM, USFWS, and Shoshone-Arapahoe Tribal Fish and Game (SATFG), assisted by several researchers, consultants, and volunteers. Of those checked, 82 were counted and 93 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 22.4, which is 52% below the average since 2004 (46.7), and 70% below the peak in 2006 (76.0).

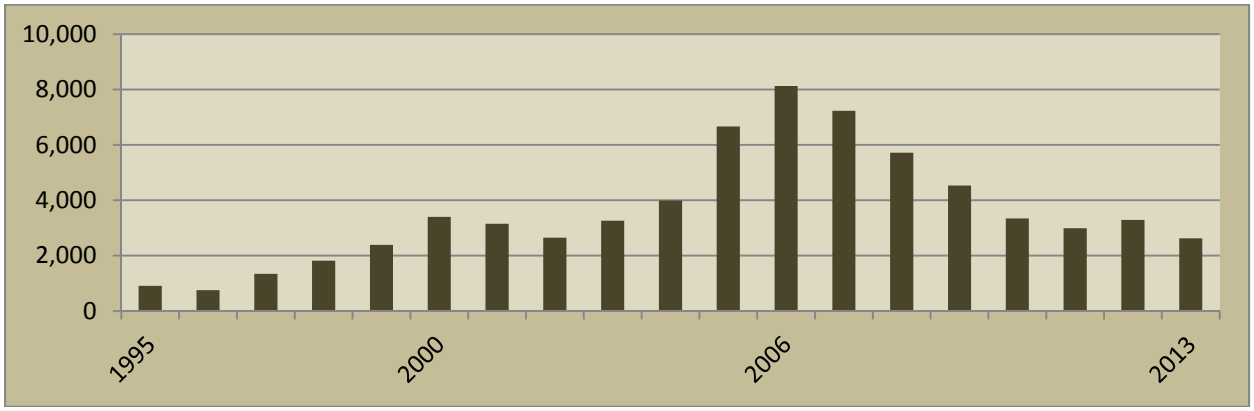

Figure 5. Total male attendance at leks within the Wind River/Sweetwater River Conservation Area, 1995 – 2013.

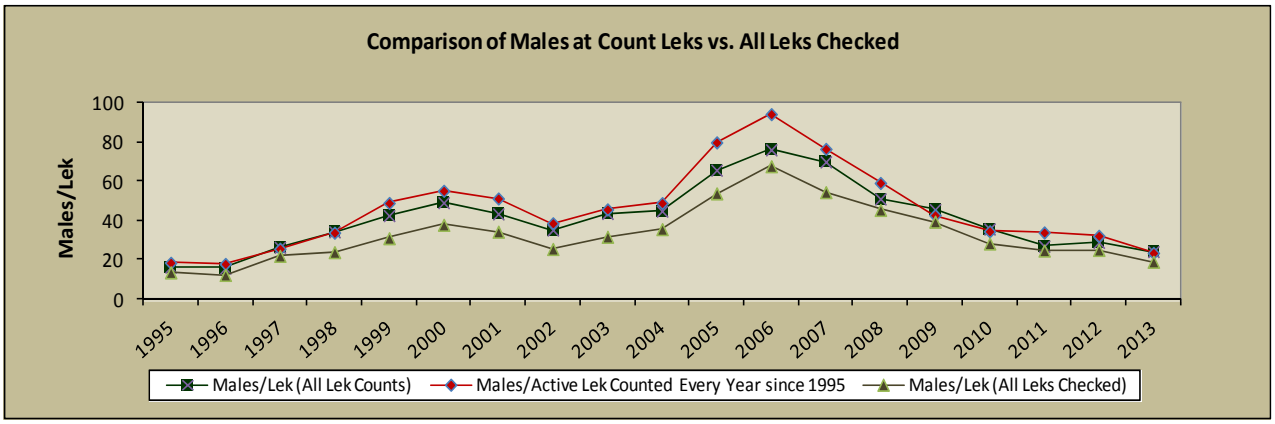

Figure 6. Average males per lek in the Wind River/Sweetwater River Conservation Area, 1995 – 2013.

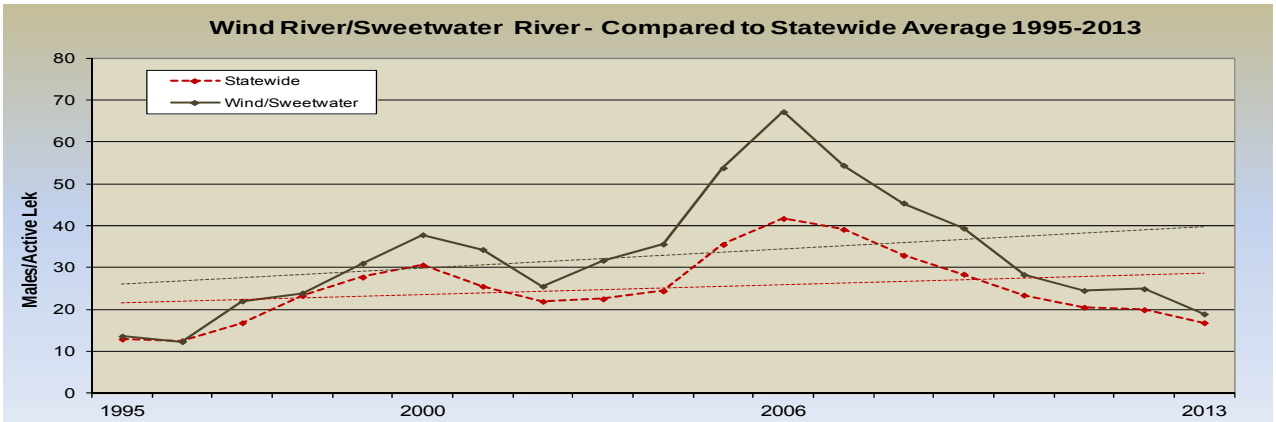

Figure 7. Average male lek attendance in WRSRCA compared with Wyoming statewide trends, 1995 – 2013.

A new sage-grouse database was developed by Wyoming Game and Fish Department in 2012, to improve efficiency, reduce errors, and better facilitate data analysis. Changes were made to the manner in which lek data are calculated and reported in Table 1 (Appendix 1). The new version is based solely on active "occupied" leks. The past version suggested that was the case in the title of Table 1, but when inactive or unoccupied leks were monitored those data were also included in the table. The result of this change is that the number of "known occupied" leks is now more accurate, but reflects fewer leks than in the previous version. Similarly, the new version calculates average male lek attendance using only monitoring observations where one or more male grouse were observed strutting. The old version included a count of "0" males for leks where activity was confirmed by the presence of sign but no birds were observed. Together, these two changes result in somewhat higher, but more accurate, average male attendance for active leks than previously reported. The changes do not result in any change in population trend based on average male lek attendance. Interpreted population increases and decreases over time remain the same so no revisions to past reports are required.

Since only "occupied" leks are being reported on Table 1 of Appendix 1, it is important to consider trends in the numbers of active versus inactive leks in addition to the average size of active leks. During a period of population decline, the size of active leks typically declines and the number of inactive leks increases. The converse is typically true of an increasing population. Therefore, the magnitude of both increases and decreases is usually greater than what is indicated by the average lek size alone.

Average female lek attendance is no longer reported since our data collection techniques is not designed to accurately capture these data and is therefore not useful in assessing population trend.

Lek Perimeter Mapping

With increased interest in developing Wyoming's energy resources, emphasis has arisen to map all known sage grouse leks, complete with perimeters outlining the extent of strutting activity on each lek. As of 2013, almost all lek perimeters were mapped in the WRSRCA. Distance and timing stipulations for developments are applied to the perimeter of each mapped lek, rather than a centralized point. This is a significant difference for many large leks with some total lek perimeter areas reaching up to 100 acres or larger.

Productivity

Limited annual 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 most years, brood data are limited because of low sample sizes, due to low populations or conflicting work schedule demands. No brood

count protocol is established within the WRSRCA. Annual pronghorn classifications are conducted via ground observations and often allow personnel to observe numerous broods in August.

Where available, harvest wing data provide a more reliable indicator of recruitment than do brood data. Several wing barrels placed annually along major hunting area exit roads in Upland Game Bird Management Area E have typically provided significant wing data, due to a relatively high number of sage-grouse hunters. Wing data are summarized for the WRSRCA from 2003 – 2012 and analyzed in detail for 2012 (Appendix 1). Wings collected from hunter harvested birds during the 2012 hunting season yielded an average brood size of 0.8 chicks per hen, signifying summer chick survival was very poor.

Hunting Season and Harvest

The 2012 sage grouse hunting season was 16 days long, keeping opening day on the 3rd Saturday in September (Sept. 15 – 30). Hunter numbers and sage grouse harvest increased (16% and 15% respectively), despite other indications (lek attendance and productivity) of decreasing sage grouse populations. Hunter effort (days/bird) and birds/hunter statistics have generally followed numbers of grouse since 2003 (Appendix 1, Table 4b). The increased harvest and effort reported in 2012 may suggest increased interest in sage-grouse hunting ahead of potential Endangered Species Act decisions.

Weather

Drought conditions have been extreme to exceptional for the past 2 years, beginning with minimal snowfall in winter 2011-12 and continuing with almost no precipitation during spring and summer 2012, with 2012 being both the driest and hottest in Wyoming in 118 years of record keeping. This resulted in an almost complete lack of herbaceous or shrub production across the WRSRCA. This lack of precipitation likely led to reduced nest success and/or chick survival, as demonstrated by the low ratio of 0.8 chicks/hen observed in the wing barrel data for fall 2012. Some hens lost nests due to the cold, wet conditions and renesting attempts were met with marginal success. Lek attendance also declined throughout most of the WRSRCA in 2013, confirming poor chick recruitment in 2012.

Habitat (Current and Historic)

Sage-grouse habitat quality has been affected by long-term drought throughout the WRSRCA. Disturbance (i.e., localized energy development, 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. In an effort to improve conditions 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

No habitat monitoring transects were measured in 2012, due to personnel turnover. Habitat monitoring is discussed in the 2011-12 WRSRCA JCR; also included in the 2007 WRSRCA Local Sage Grouse Conservation Plan and upcoming 2014 Addendum.

Habitat Inventory

No new habitat inventories were conducted in 2012-13. Habitat assessments have been conducted in past years as reported in previous JCRs, with a detailed summary also included in the 2007 WRSRCA Local Sage Grouse Conservation Plan and upcoming 2014 Addendum.

Winter Habitat Survey

Limited winter observations were collected in 2012 – 13, mostly as opportunistic observations during deer, elk, and moose classifications flights or random ground surveys.

Habitat Treatments

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. Summaries of these treatments are reported in past JCRs and in the 2007 WRSRCA Local Sage Grouse Conservation Plan and upcoming 2014 Addendum. Reports for current year activities follow.

University of Wyoming - "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 in the Dishpan Butte and Cedar Rim project areas and tebuthiuron (Spike 20P®) applications in the West Long Creek and Black Mountain project areas are planned for winter/spring 2013-14.

Lander Front Mule Deer Habitat Improvement

Approximately 1,000 acres were treated with Spike 20P® to thin sagebrush and encourage bitterbrush in mule deer winter ranges near Red Canyon and about 1,300 acres were sprayed with Plateau® to inhibit cheatgrass germination in 2012-13. Additional mule deer habitat projects have been reported in past year's JCRs and in the 2007 WRSRCA Local Sage Grouse Conservation Plan and upcoming 2014 Addendum.

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.

Conservation Easements

Conservation easements totaling more than 3,600 acres were completed in 2012 on the 3 Bar X and Double A Ranches along the Lander Foothills. Both easements were partially funded with NRCS' Farm and Ranchland Protection Program (FRPP) with sage grouse habitat (core area) as part of the justification. These conservation easements bring the total of private lands protected by conservation easements to nearly 30,000 acres in the WRSRCA.

Research

A number of research projects have been conducted in the WRSRCA since 2000. Abstracts and progress reports for studies conducted or published in 2012-13 follow, with earlier studies reported in past JCRs and in the 2007 WRSRCA Local Sage Grouse Conservation Plan and upcoming 2014 Addendum.

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

ABSTRACT: 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 – no citation)*

ABSTRACT: 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 variation 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 – no citation)*

ABSTRACT: 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.

Diseases

No new cases of West Nile Virus (WNV) or other avian diseases are known to have occurred in sage grouse in the WRSRCA in 2012-13.

Management Recommendations

1. Incorporate recommendations outlined in Wyoming Governor's Executive Orders and associated "Stipulations for Development in Core Sage-Grouse Population Areas".

2. Implement the Wind River/Sweetwater River Local Sage-Grouse Conservation Plan and work with land management agencies to incorporate recommended management practices.

3. Continue to collect age and sex composition of the harvest via wing collection and analyses.

4. Continue intensive lek counts in the Government Draw area south of Hudson.

5. Continue ground checks of all non-intensively monitored leks.

6. Continue to search for new or undiscovered leks in remote areas of WRSRCA.

7. Continue to cooperate with private landowners and Federal/State land managers to reduce negative impacts to crucial sage-grouse habitats.

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Sage Grouse Lek Characteristics

Working Group: Wind River/Sweetwater River

Region	Number	Percent
Casper	1	0.4
Lander	179	74.9
WRIR	59	24.7

Working Group	Number	Percent
Wind River/Sweetwater River	239	100.0

Classification	Number	Percent
Occupied	206	86.2
Undetermined	7	2.9
Unoccupied	26	10.9

BLM Office	Number	Percent
Lander - WRR	59	24.7
Casper	9	3.8
Lander	162	67.8
Rock Springs	7	2.9
Worland	2	0.8

Biologist	Number	Percent
WRR - USFWS	59	24.7
Casper	1	0.4
North Lander	65	27.2
South Lander	114	47.7

Warden	Number	Percent
Shoshone-Arapahoe Tribal	59	24.7
Dubois	1	0.4
Lander	66	27.6
North Riverton	29	12.1
South Riverton	52	21.8
West Casper	1	0.4
West Rawlins	31	13.0

County	Number	Percent
Carbon	1	0.4
Fremont	212	88.7
Hot Springs	5	2.1
Natrona	20	8.4
Sweetwater	1	0.4

Land Status	Number	Percent
BLM	138	57.7
BLM/Private	1	0.4
BOR	4	1.7
Private	24	10.0
Private/BLM	1	0.4
Reservation	59	24.7
State	12	5.0

Management Area	Number	Percent
E	179	74.9
G	1	0.4
WR	59	24.7

Sage Grouse Job Completion Report

Year: 2004 - 2013, Working Group: Wind River/Sweetwater River

1. Lek Attendance Summary (Occupied Leks) (1)

a. Leks Counted

Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek (2)
2004	158	36	23	1300	44.8
2005	164	39	24	2229	65.6
2006	168	60	36	4179	76.0
2007	177	72	41	4568	70.3
2008	184	72	39	3367	51.0
2009	182	66	36	2506	45.6
2010	184	55	30	1644	35.7
2011	192	70	36	1668	26.9
2012	199	79	40	1922	28.7
2013	202	82	41	1571	22.4

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2004	158	115	73	2691	32.4
2005	164	113	69	4438	49.3
2006	168	85	51	3948	59.8
2007	177	94	53	2666	39.2
2008	184	88	48	2352	39.2
2009	182	82	45	2029	33.8
2010	184	93	51	1660	23.4
2011	192	90	47	1320	22.0
2012	199	93	47	1368	21.0
2013	202	93	46	1056	15.3

1) Occupied - Active during previous 10 years (see official definitions)

2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

3) Inactive - Confirmed no birds/sign present (see official definitions)

Sage Grouse Job Completion Report

Year: 2004 - 2013, Working Group: Wind River/Sweetwater River

1. Lek Attendance Summary (Occupied Leks) (1) Continued

c. Leks Checked

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek (2)
2004	158	151	96	3991	35.6
2005	164	152	93	6667	53.8
2006	168	145	86	8127	67.2
2007	177	166	94	7234	54.4
2008	184	160	87	5719	45.4
2009	182	148	81	4535	39.4
2010	184	148	80	3304	28.2
2011	192	160	83	2988	24.5
2012	199	172	86	3290	24.9
2013	202	175	87	2627	18.9

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2004	113	9	36	122	92.6	7.4
2005	125	6	33	131	95.4	4.6
2006	123	11	34	134	91.8	8.2
2007	135	11	31	146	92.5	7.5
2008	129	14	41	143	90.2	9.8
2009	115	15	52	130	88.5	11.5
2010	120	11	53	131	91.6	8.4
2011	123	12	57	135	91.1	8.9
2012	133	17	49	150	88.7	11.3
2013	140	16	46	156	89.7	10.3

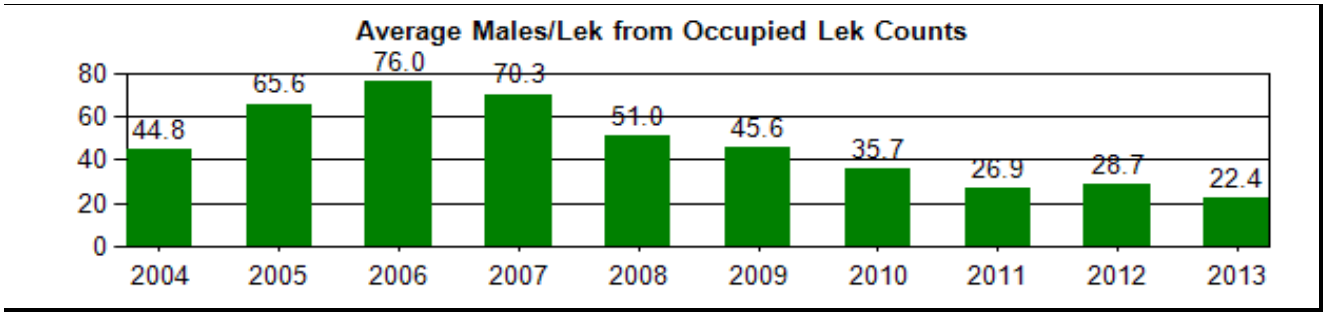
1) Occupied - Active during previous 10 years (see official definitions)

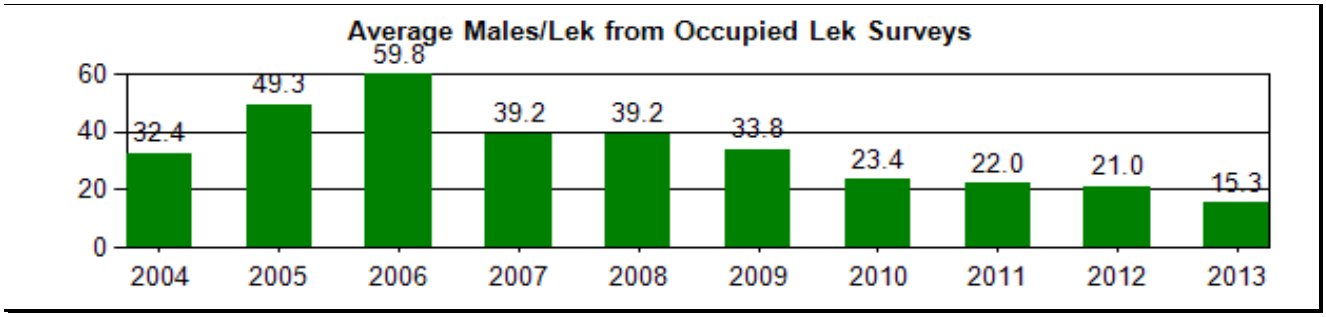
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

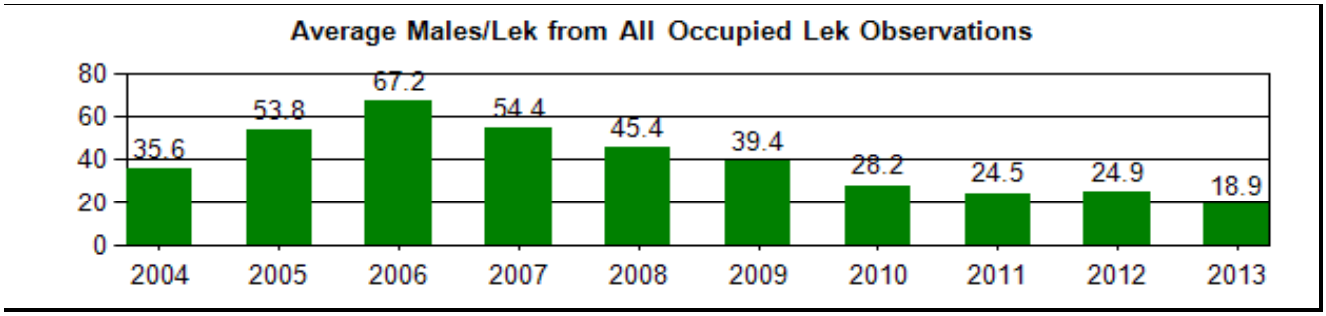
3) Inactive - Confirmed no birds/sign present (see official definitions)

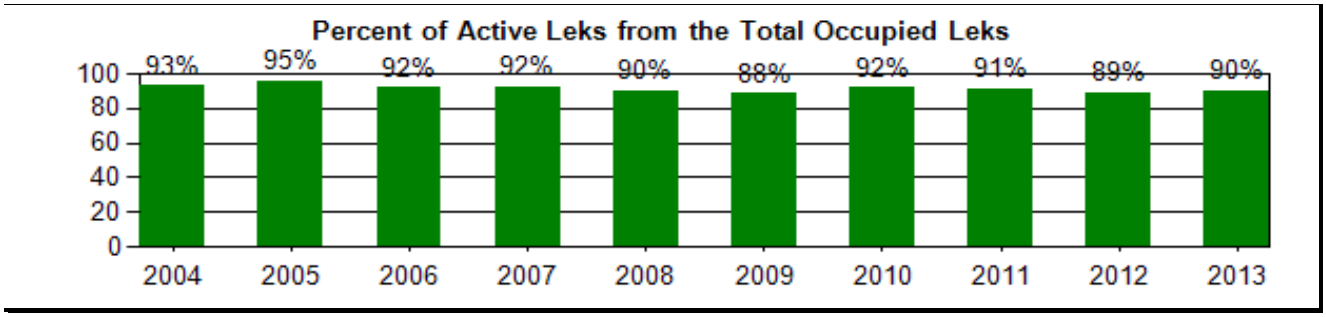
Sage Grouse Occupied Lek Attendance Summary

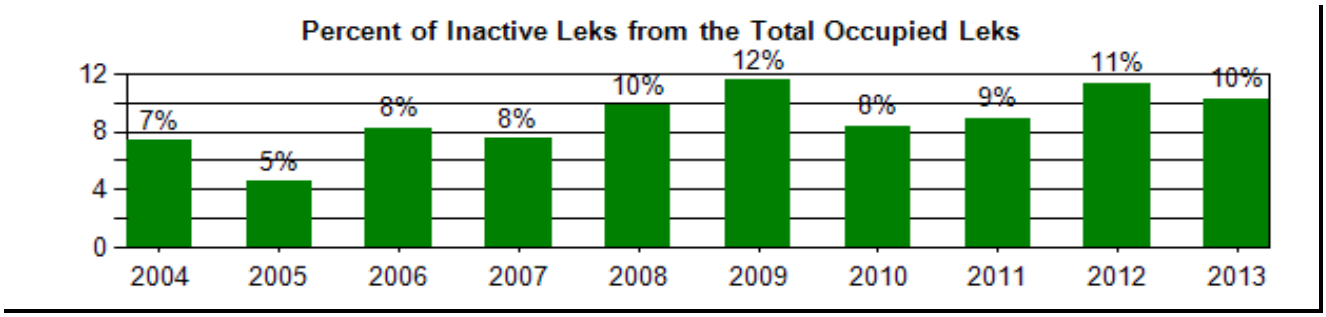
Year: 2004 - 2013, Working Group: Wind River/Sweetwater River











Sage Grouse Job Completion Report

Year: 2003 - 2012, Management Area: E

4. Sage Grouse Hunting Seasons and Harvest Data

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

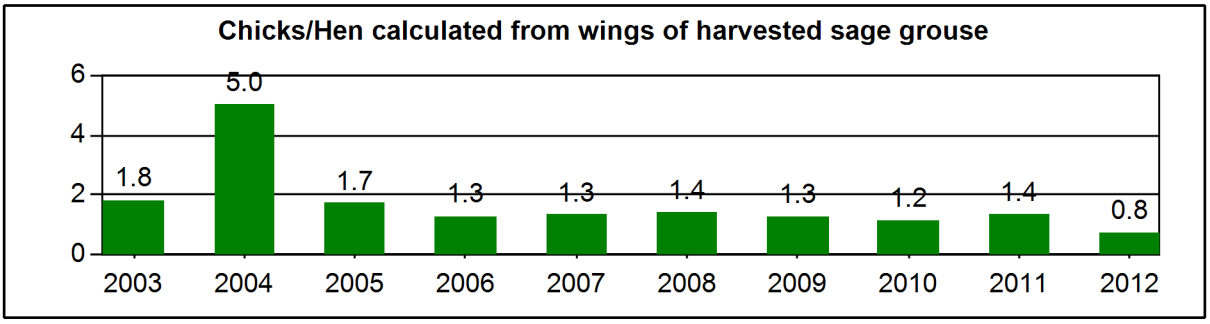
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2003	669	307	617	1.1	2.2	2.0
2004	1,398	572	1,444	1.0	2.4	2.5
2005	2,994	930	2,080	1.4	3.2	2.2
2006	1,710	558	1,183	1.4	3.1	2.1
2007	1,776	788	1,696	1.0	2.3	2.2
2008	2,144	863	2,059	1.0	2.5	2.4
2009	2,295	875	2,114	1.1	2.6	2.4
2010	2,495	1,056	2,866	0.9	2.4	2.7
2011	1,779	771	1,801	1.0	2.3	2.3
2012	2,068	890	2,296	0.9	2.3	2.6
Avg	1,933	761	1,816	1.1	2.5	2.3

Sage Grouse Job Completion Report

Year: 2003 - 2012, Management Area: E, Working Group: Wind River/Sweetwater River

5. 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



Sage Grouse Wing Analysis Summary

Year: 2012, Working Group: Wind River/Sweetwater River

Adult Males:	82	% of All Wings:	18.5
Adult Females:	160	% of All Wings:	36.1
Adult Unknown:	0	% of All Wings:	0.0
Total Adults:	242		
Yearling Males:	28	% of All Wings:	6.3
Yearling Females:	30	% of All Wings:	6.8
Yearling Unknown:	0	% of All Wings:	0.0
Total Yearlings:	58		
Chick Males:	49	% of All Wings:	11.1
Chick Females:	94	% of All Wings:	21.2
Chick Unknown:	0	% of All Wings:	0.0
Total Chicks:	143		
Unknown Sex/Age:	0		
Total for all Sex/Age Groups:	**443**		

Chick Males:	49	% of All Chicks	34.3
Yearling Males:	28	% of Adult and Yearling Males	25.5
Adult Males:	82	% of Adult and Yearling Males	74.5
Adult and Yearling Males:	110	% of Adults and Yearlings	36.7
Total Males:	159	% of All Sex/Age Groups	35.9
Chick Females:	94	% of All Chicks	65.7
Yearling Females:	30	% of Adult and Yearling Females	15.8
Adult Females:	160	% of Adult and Yearling Females	84.2
Adult and Yearling Females:	190	% of Adults and Yearlings	63.3
Total Females:	284	% of All Sex/Age Groups	64.1

Chicks:	143	% of All Wings:	32.3
Yearlings:	58	% of All Wings:	13.1
Adults:	242	% of All Wings:	54.6
Chicks/Hen	0.8