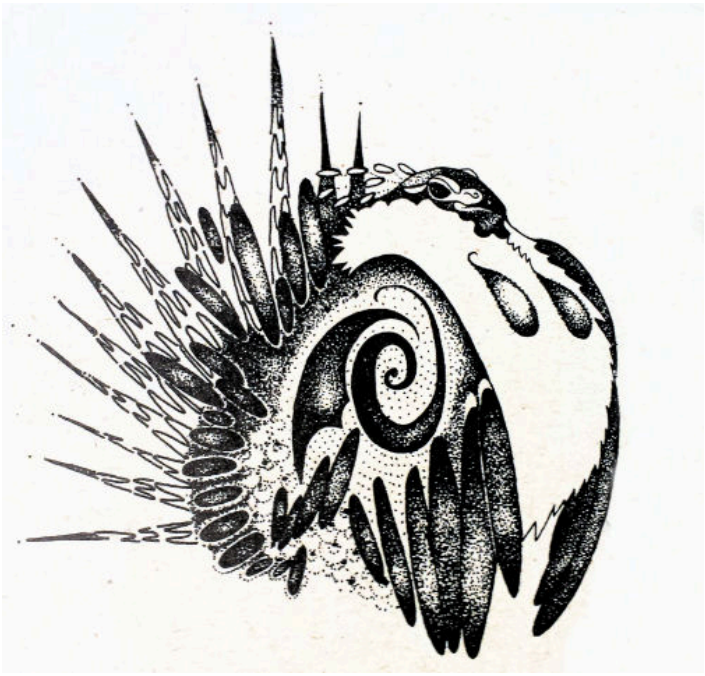
2014
GREATER SAGE-GROUSE
JOB COMPLETION REPORT



L. Inez Alcazar-Hagen

June 1, 2014 – May 31, 2015

Wyoming Game and Fish Department
Cheyenne, WY

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Tom Christiansen
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Period Covered: **6/1/2014– 5/31/2015**
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 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. From 2006-2013, average lek size declined though not to levels recorded in the mid-1990s. Since 2013, average lek size has increased 83%.

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 Service is under a court-ordered deadline of September 30, 2015 to determine if greater sage-grouse are warranted or not warranted for listing.

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. The core area map and details of the Executive Order were reviewed in early 2015 with a revised Executive Order expected in the summer of 2015, ahead of the Service's listing decision deadline.

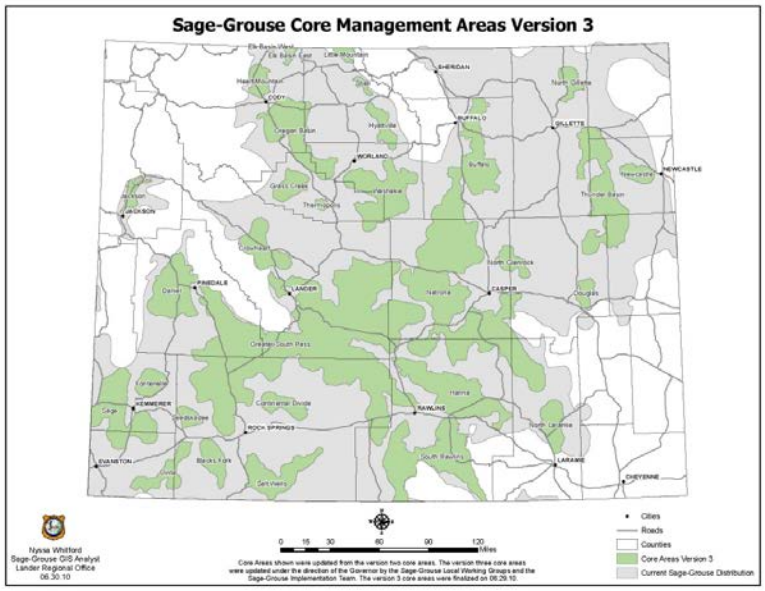


Figure 1. Wyoming Core Areas (version 3).

The 2014 Legislature approved the 2015-2016 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-2014 and will continue through mid-2016.

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.

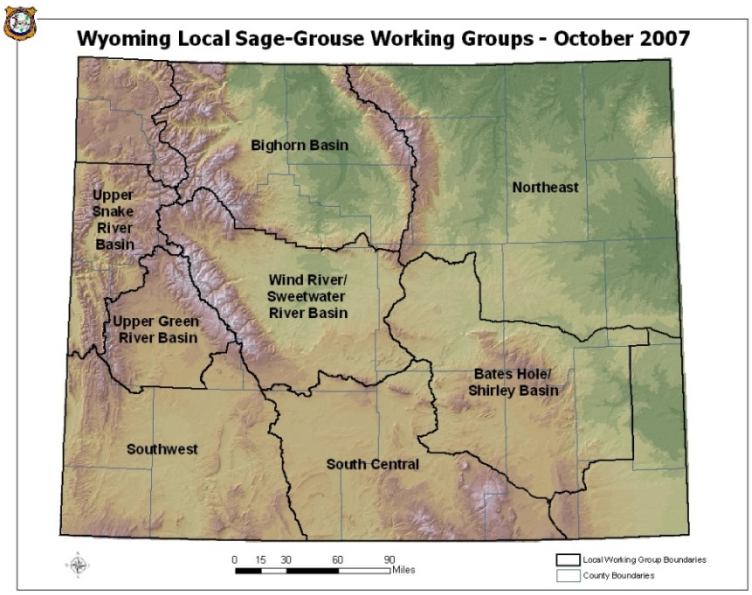


Figure 2. Wyoming Local sage-grouse working group boundaries.

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 individuals or sub-populations within 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.

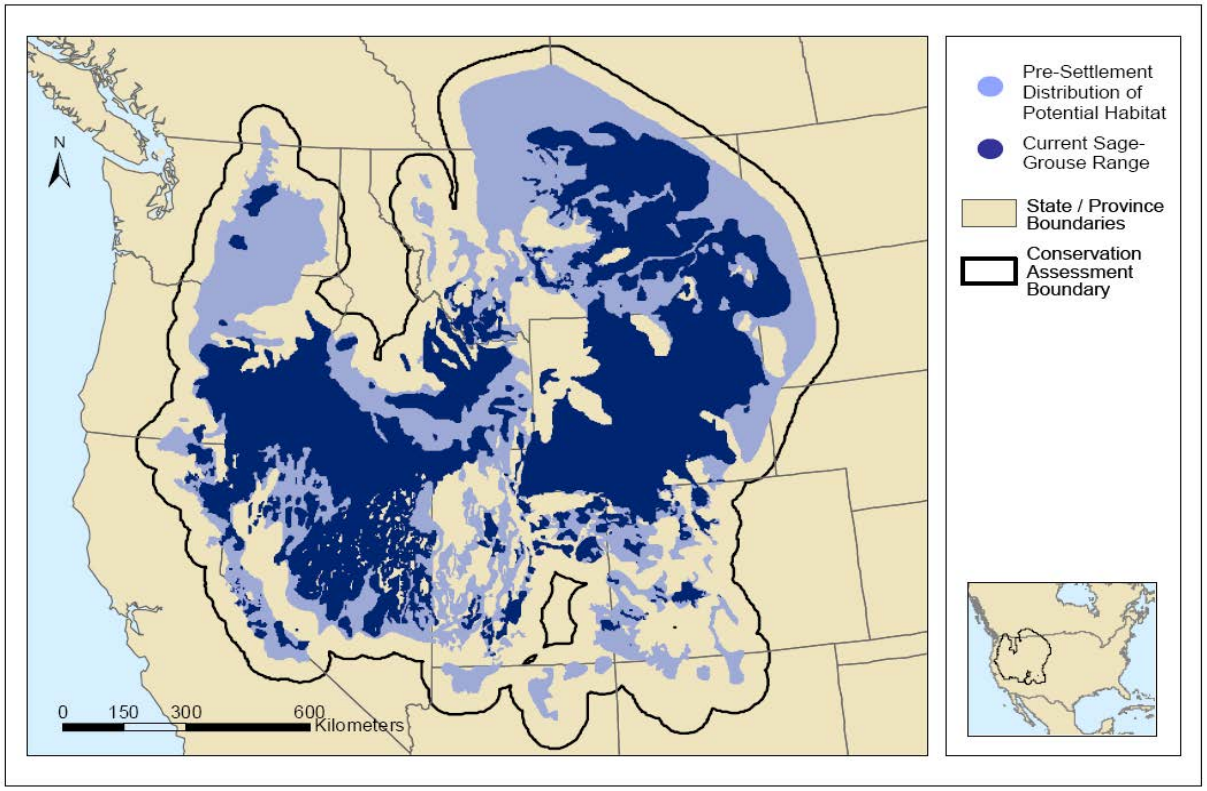


Figure 3. Current distribution of sage-grouse and pre-settlement distribution of potential habitat in North America (Schroeder 2004). For reference, Gunnison sage-grouse in SE Utah and SW Colorado are shown.

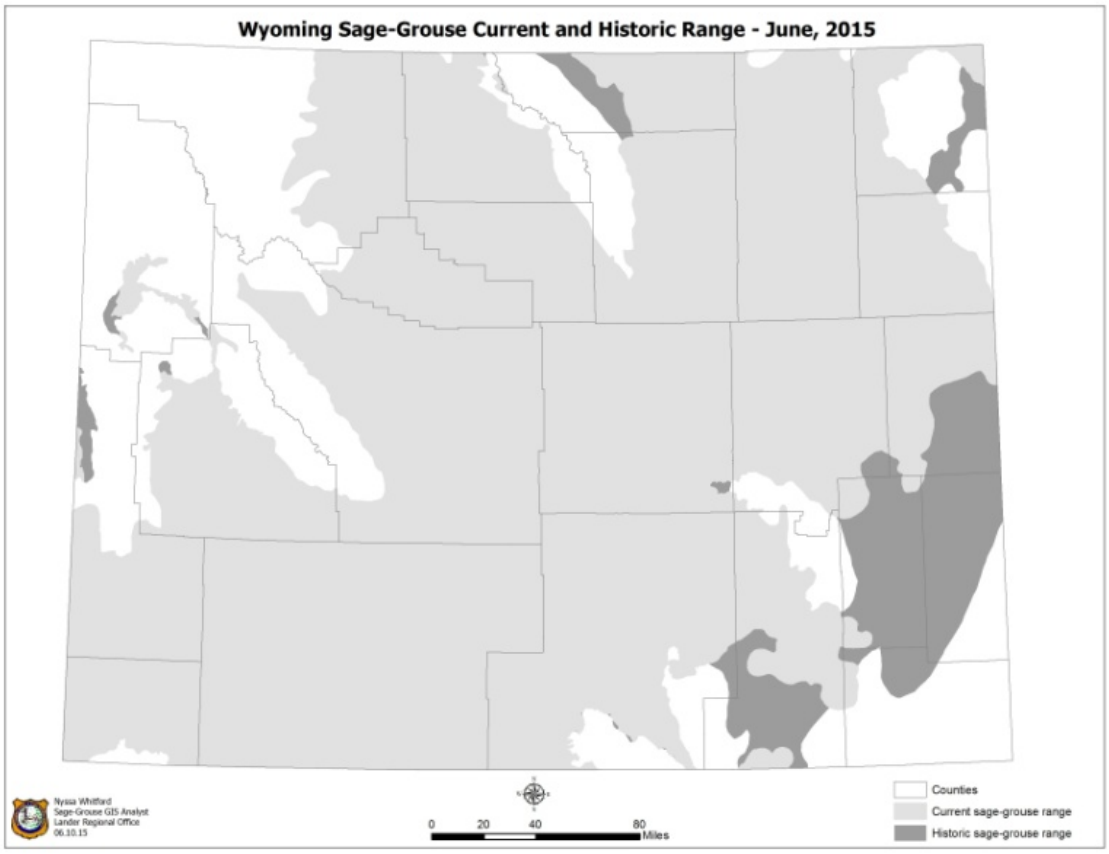


Figure 4. Sage-grouse range in Wyoming (updated 2015).

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 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.

A federal court-stipulated agreement requires the U.S. Fish & Wildlife Service to reevaluate the status of greater sage-grouse by September 30, 2015.

METHODS

Methods for collecting sage-grouse data are described in the sage-grouse chapter of the WGFD Handbook of Biological Techniques (Christiansen 2012), which is largely based on Connelly et al (2003). The definitions used in lek monitoring are attached (Attachment A).

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 7). 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 2006-2013 period during which the average number of cocks observed on leks declined, though not to levels documented in the mid-1990s. Since 2013, average lek size has increased 83%. 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 12 and 13 illustrate sage-grouse density changes between 2005-07 and 2013-15 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.

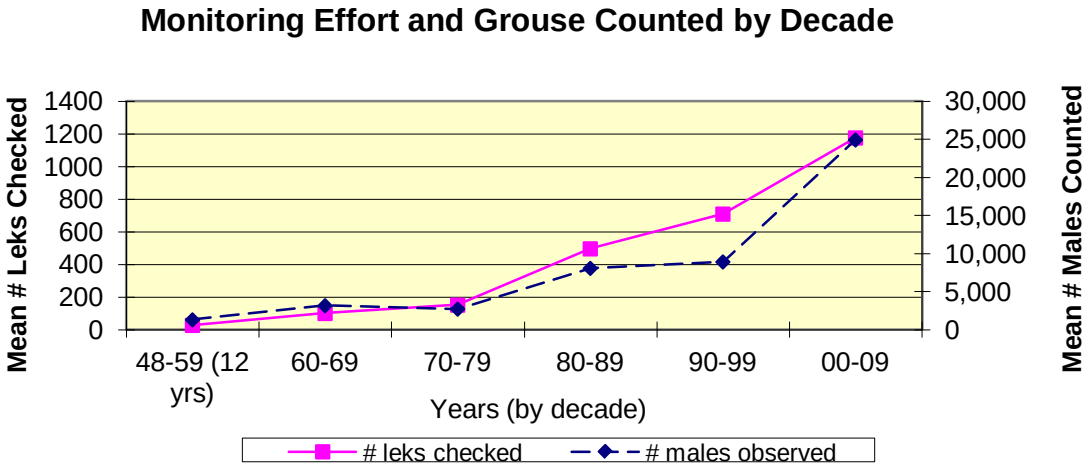


Figure 5. Mean annual numbers of leks checked (monitoring effort) and male grouse counted in Wyoming 1948-2009 by decade.

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 2015 breeding season are summarized in Tables 1a-d and Figures 6-11. Department personnel and others checked 88% (1,607/1,829) of the known occupied leks in 2015 (Table 1-c). Male attendance at all leks visited (counts and surveys) averaged 30.8 males per lek during spring 2015, a 66% increase above the 18.5 males/lek observed in 2014 but still 26% below the 41.7 males/lek observed in 2006. For the 10-year period (2006-2015), average male lek attendance ranged from 16.8 males/lek in 2013, the lowest average males per lek since 1997, to 41.7 males/lek in 2006, which was the highest average males per lek figure recorded since 1978.

The number of active, occupied leks increased from 75% in 2013 to 82% in 2015. This suggests an increasing population.

In 2015, 15,766 more male sage-grouse were observed on 92 more active leks checked. Cumulatively, the lek attendance data suggest there were more grouse in bio-year 2014 year than in 2013. Together with the generally favorable nesting/brood reports so far this spring/summer (2015), the decline in sage-grouse numbers documented in recent years has ended. It is important to note that the number of leks sampled increased 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.

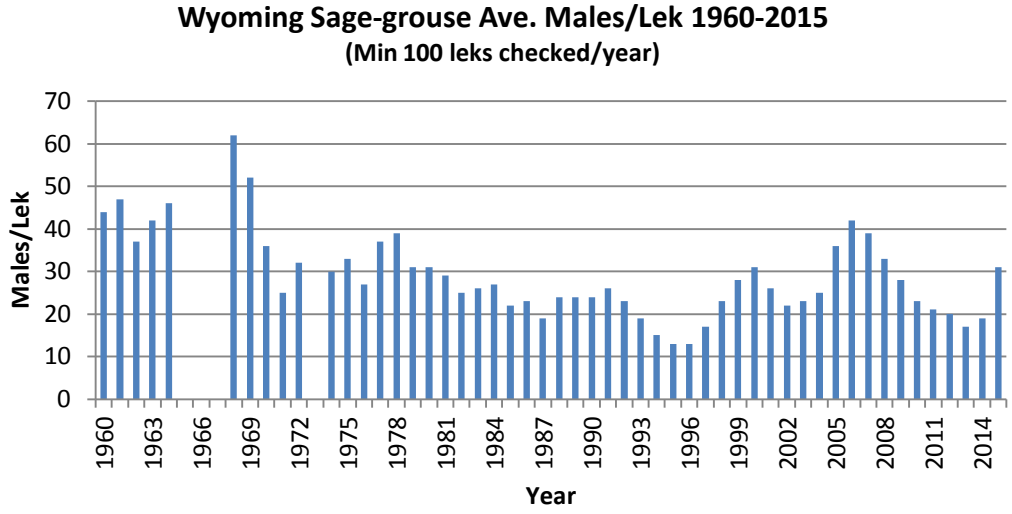


Figure 6. Average number of males per lek counted in Wyoming from 1960-2015 with a minimum of 100 leks checked each year.

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

a. Leks Counted

Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek [2]
2006	1538	461	30	21875	53.4
2007	1604	509	32	21329	48.3
2008	1665	567	34	19463	39.2
2009	1694	582	34	15553	31.9
2010	1727	652	38	14154	27.2
2011	1764	648	37	11308	22.5
2012	1803	722	40	12665	22.9
2013	1812	649	36	10613	20.7
2014	1817	776	43	11464	20.5
2015	1829	739	40	19291	34.2

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek[2]
2006	1538	886	58	22787	34.5
2007	1604	919	57	22246	33.1
2008	1665	829	50	16144	27.5
2009	1694	865	51	15064	25.4
2010	1727	831	48	11623	20.1
2011	1764	844	48	10159	18.6
2012	1803	834	46	8635	16.6
2013	1812	937	52	7625	13.3
2014	1817	848	47	8586	16.4
2015	1829	868	47	16525	27.5

c. Leks Checked

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek [2]
2006	1538	1347	88	44662	41.7
2007	1604	1428	89	43575	39.1
2008	1665	1396	84	35607	32.8
2009	1694	1447	85	30617	28.4
2010	1727	1483	86	25777	23.4
2011	1764	1492	85	21467	20.5
2012	1803	1556	86	21300	19.8
2013	1812	1586	88	18238	16.8
2014	1817	1624	89	20050	18.5
2015	1829	1607	88	35816	30.8

d. Lek Status

Year	Active	Inactive[3]	Unknown	Known Status	Percent Active	Percent Inactive
2006	1084	109	154	1193	90.9	9.1
2007	1137	126	165	1263	90.0	10.0
2008	1103	155	138	1258	87.7	12.3
2009	1100	183	164	1283	85.7	14.3
2010	1119	194	170	1313	85.2	14.8
2011	1088	213	191	1301	83.6	16.4
2012	1129	243	184	1372	82.3	17.7
2013	1118	288	180	1406	79.5	20.5
2014	1103	359	155	1462	75.4	24.6
2015	1195	268	144	1463	81.7	18.3

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)

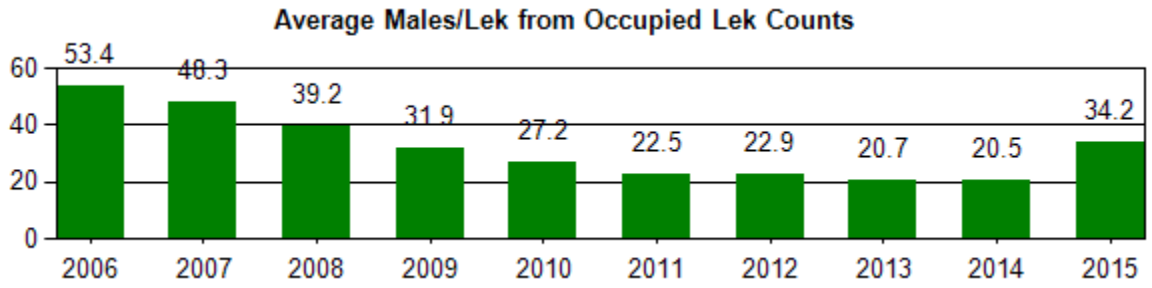


Figure 7. Average males/lek from occupied lek counts.

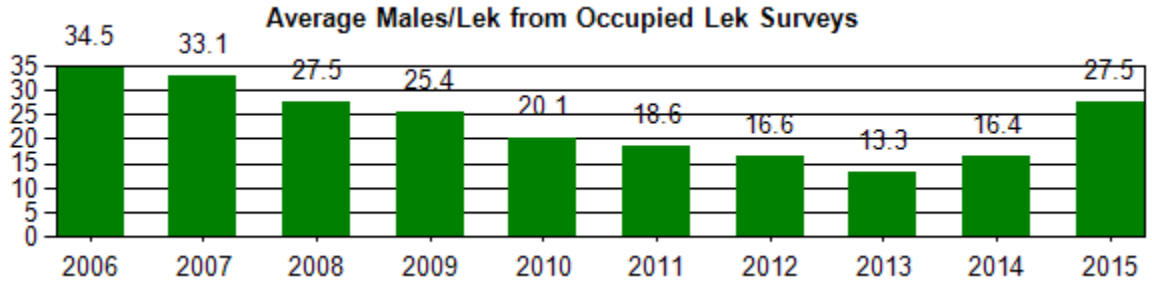


Figure 8. Average males/lek from occupied lek surveys.

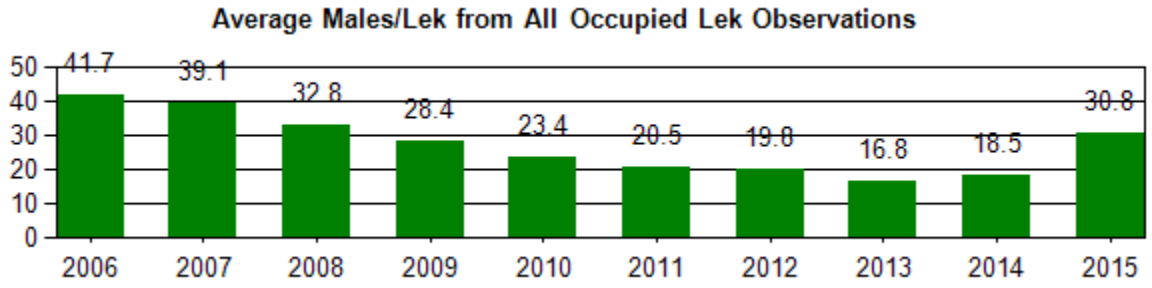


Figure 9. Average males/lek from all occupied leks checked (counts+surveys).

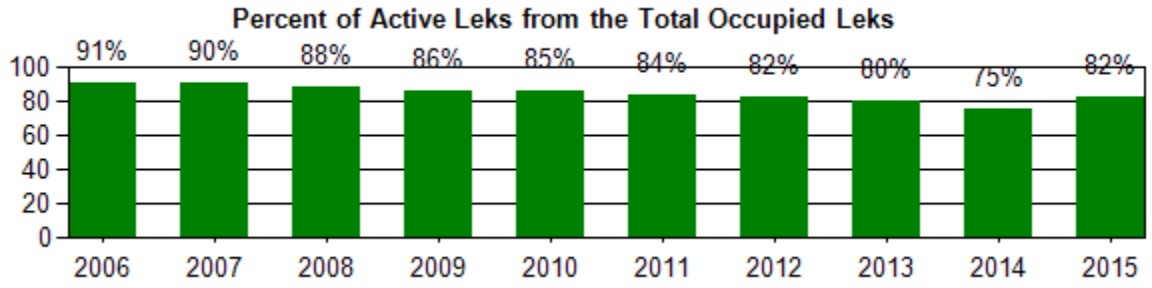


Figure 10. Percent active leks from the occupied leks checked with known status.

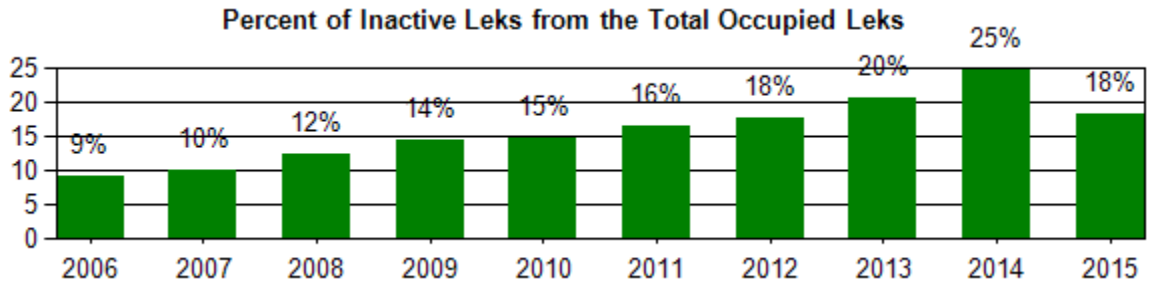
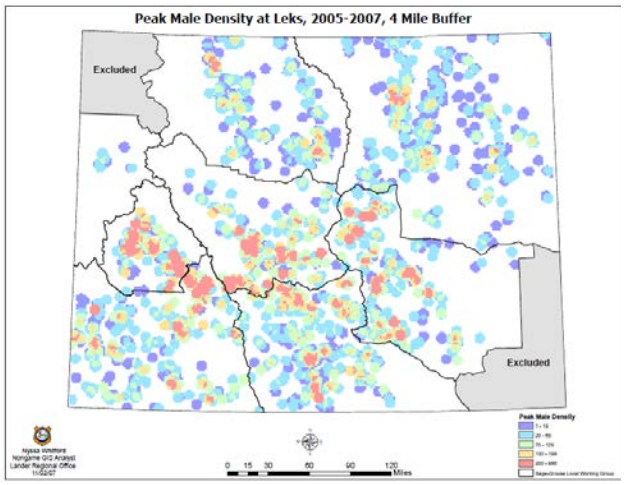
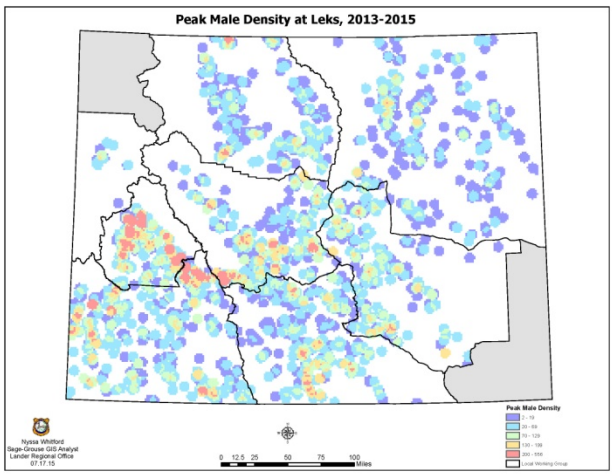


Figure 11. Percent inactive leks from the occupied leks checked with known status.



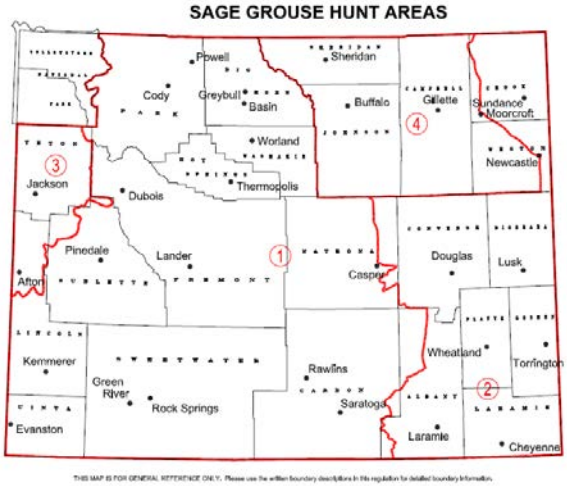


Figures 12 and 13. Relative sage-grouse density comparing 2005-2007 and 2013-2015 based on peak male lek counts and surveys.

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).

The 2014 hunting season (Figure 14, Table 2) was 1 day longer than 2013 due to the calendar effect of opening the season on the third Saturday of September. In 2013 the third Saturday was September 21 but in 2014 it was September 20.



Area	Season Dates	Daily/Poss. Limits	Falconry
1	Sept. 20-Sept. 30	2/4	Sept. 1-Mar. 1
2, 3	Closed	Closed	Closed
4	Sept. 20-Sept. 22	2/4	Sept. 1-Mar. 1

Figure 14 and Table 2. 2013 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 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 14).

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. The data presented in Table 3b and Figures 15-18 indicate hunter numbers and harvest increased between 2013 (3,383 hunters/5,726 birds) and 2014 (3,526 hunters/7,094 birds). The decline in the number of birds harvested from 2006-2013 is generally correlated with the declining population indicated by lek attendance trends.

Table 3. Sage Grouse Hunting Seasons and Harvest Data

a. Season

Year	Season Start	Season End	Length	Bag/Possesion Limit
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
2009-1	Sep-19	Sep-30	12	2/4
2009-4	Sep-19	Sep-25	7	2/4
2010-1	Sep-18	Sep-30	13	2/4
2010-4	Sep-18	Sep-20	3	2/4
2011-1	Sep-17	Sep-30	14	2/4
2011-4	Sep-17	Sep-19	3	2/4
2012-1	Sep-15	Sep-30	16	2/4
2012-4	Sep-15	Sep-17	3	2/4
2013-1	Sep-21	Sep-30	10	2/4
2013-4	Sep-21	Sep-23	10	2/4
2014-1	Sep-20	Sep-30	11	2/4
2014-4	Sep-20	Sep-22	3	2/4

b. Harvest

Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
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
2013	5726	3383	7672	0.7	1.7	2.3
2014	7094	3526	8642	0.8	2.0	2.5
Avg	10,198	4,621	10,601	1.0	2.2	2.3

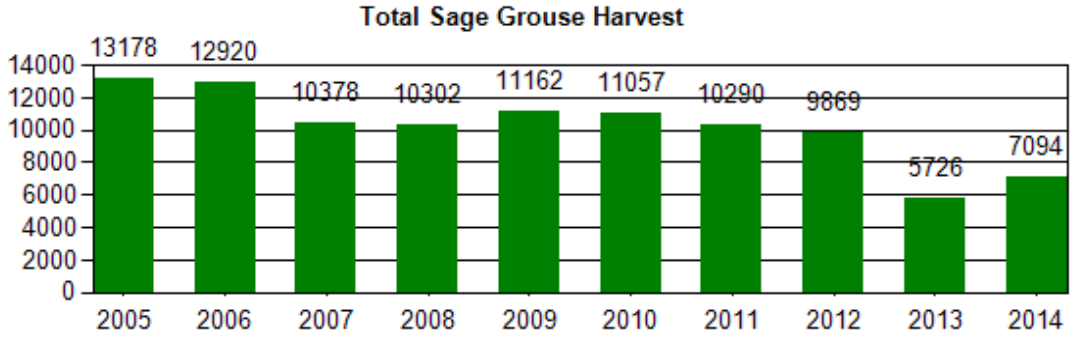


Figure 15. Wyoming statewide sage-grouse harvest 2005-2014.

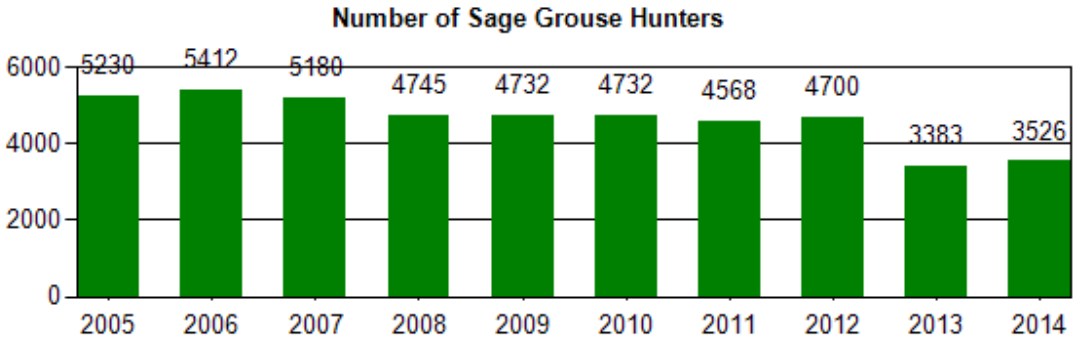


Figure 16. Wyoming statewide sage-grouse hunter numbers 2005-2014.

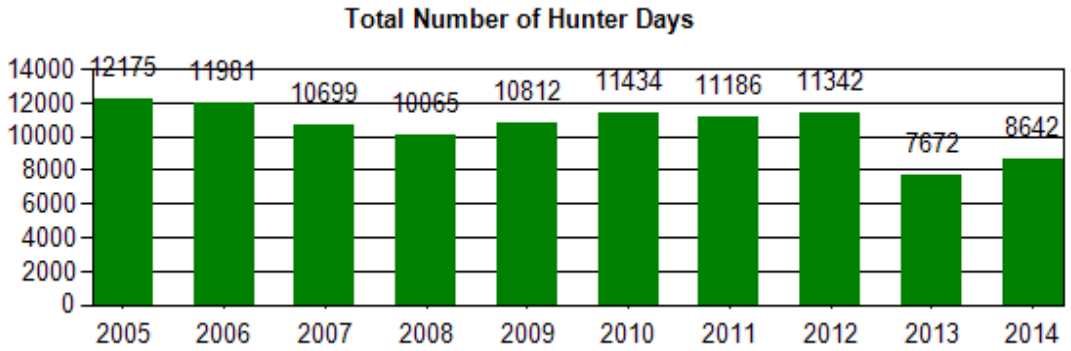


Figure 17. Wyoming statewide number of hunter days 2005-2014.

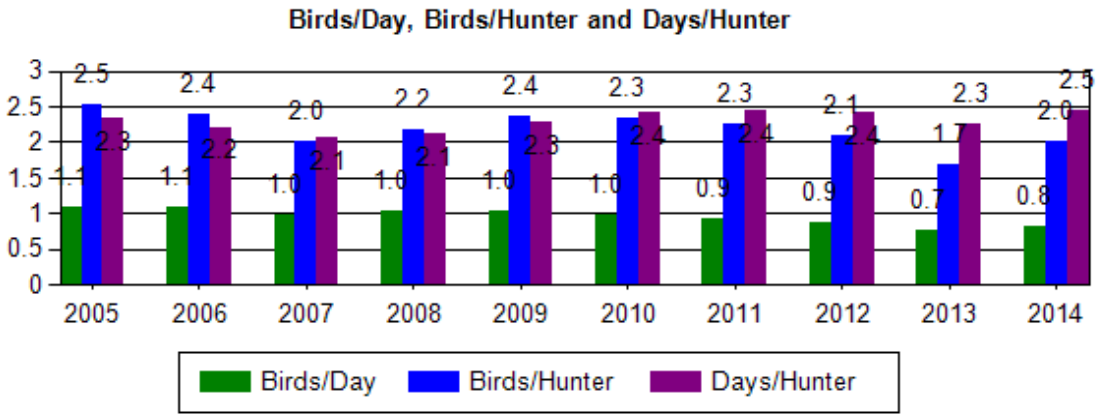


Figure 18. Wyoming statewide birds/day, birds/hunter and days/hunter 2005-2014.

The number of sage-grouse wings collected from hunters increased by 22% in 2014, which is similar to the 24% increase in estimated harvest between 2013 and 2014. In 2014, 1,533 wings were recorded (Table 4), which is about 22% of the estimated harvest. This is near the 10-year average of 20% and the changes between years are minor.

The 2014 chick:hen ratio (based on harvested wing analysis) was 1.8 chicks per hen (Table 4 and Figure 19). This level of productivity is typically associated with an increasing population. This is consistent with the 2015 lek data (all lek checks), which indicated a 66% increase 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 Yrlg		Percent Young		Chicks/ Hens
		Male	Female	Male	Female	Male	Female	
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	2015	20.8	32.9	3.4	5.8	16.9	20.2	1.0
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	1938	13.4	36.6	4.5	8.8	15.5	21.2	0.8
2013	1258	12.0	35.8	2.3	6.5	18.8	24.4	1.0
2014	1533	9.5	23.9	2.5	7.8	28.8	27.5	1.8

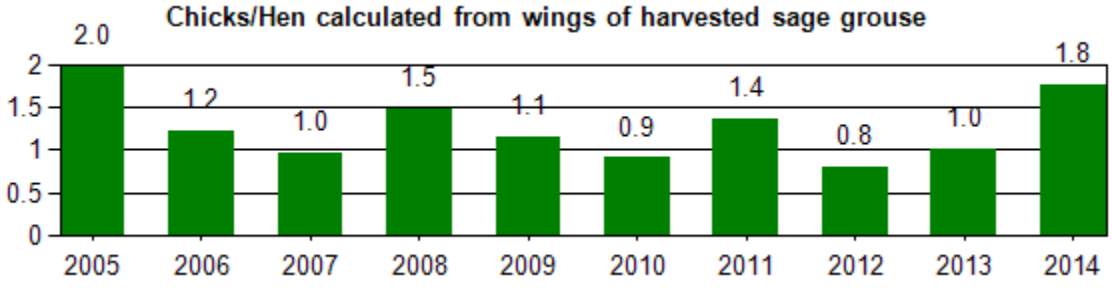


Figure 19. Chicks/Hen 2005-2014 based on wings from harvested grouse.

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

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%
2013	1.0	+11%
2014	1.8	+66%

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, Blomberg et al 2014a/b, Caudill et al. 2014). 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. While 2013 saw increased precipitation over 2012, the residual effects 2012 continued to impact

sage-grouse productivity. With the exception of mid-May snowstorms, most of Wyoming experienced favorable spring conditions in 2014 and 2015.

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 (Fedy et al. 2014), BLM, WGF, the Wyoming Geographic Information Science Center (WYGISC) of the University of Wyoming and others.

An updated current/historic range map for sage-grouse in Wyoming was finished in 2015 (Figure 4). NAIP imagery was used to delineate habitat at a finer scale than had been used in the past.

CONSERVATION STRATEGIES

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

In a move to coordinate sage-grouse conservation efforts across the State of Wyoming, then 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. These actions constituted Wyoming's Core Area Strategy.

Following the 2010 "warranted but precluded" listing decision by the U.S. Fish & Wildlife Service, Freudenthal reconvened the SGIT and tasked them to update the core area map (Figure 1) and strategy using the most recent data. The SGIT, with the assistance of the local working groups, prepared these updates and Governor Freudenthal issued a new Executive Order (2010-4) to replace that from 2008.

Subsequent to the 2010 gubernatorial election, Governor Matt Mead signed a 2011 version of the Executive Order (2011-5), reiterating and clarifying the Wyoming Core Area Strategy with further updates and modifications in 2013 (Executive Order 2013-3). Executive Order 2011-5 was attached to the 2011-12 statewide JCR and is also available at https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management . A list of the projects reviewed for consistency with the CAS is maintained by the WGFD Habitat Protection Program in Cheyenne.

In preparation for the U.S. Fish and Wildlife Service's court-ordered deadline of September 30, 2015 to again determine the listing status of sage-grouse and to comply with the existing Executive Order language to review core area boundaries after a 5-year period, Governor Mead tasked the SGIT with providing him recommendations to update the core area strategy. Local Working Groups were again engaged to assist in the process.

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 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 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 was completed in this reporting period. The updated plans were presented to the Wyoming Game and Fish Commission in March 2014.

From 2005-2014, Local Working Groups were allocated approximately $5.2 million to support implementation of local sage-grouse conservation projects. One hundred sixty-five (165) projects have been approved over that time. The source of this funding is the State of Wyoming General Fund as requested by Governor Freudenthal and approved by the legislature. The 2014 Legislature approved the 2015-2016 biennium General Fund budget which included another $1.2 million for local projects. Allocation of these funds began in mid-2014. Twenty-eight (28) projects (Attachment B) have been implemented so far during the 2015-16 biennium. Most of the projects are supported by multiple cost-sharing partners. Projects include habitat treatments/restoration, improved range management infrastructure and grazing management plans, applied research, inventories, monitoring and public outreach.

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 Service administered 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. Individual ranches are able to participate in conservation practices appropriate to their ranch.

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 2014 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.

In 2014, there were no confirmed West Nile virus sage-grouse mortalities documented.

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 eight peer-reviewed manuscripts based on Wyoming research were released (Applegate and Owens 2014, Dinkins et al. 2014a/b, Fedy et al. 2015, Gregory and Beck 2014, Holloran et al. 2015, Kirol et al. 2015, Manier et al. 2014).

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 LeBeau et al. (2014) is a peer-reviewed article based on this research.

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 C 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 D 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 implement local conservation plans in all 8 planning areas.

3) Continue to refine and de-bug the sage-grouse database and Job Completion Report intranet program.

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 Lek Definitions
(Revised November 2012)

The following definitions have been adopted for the purposes of collecting and reporting sage-grouse lek data. See the sage-grouse chapter of the Wyoming Game and Fish Department's Handbook of Biological Techniques for additional technical details and methods.

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

Satellite Lek – A relatively small lek (usually less than 15 males) within about 500 meters of a large lek often documented during years of relatively high grouse numbers. Locations of satellite leks should be encompassed within lek perimeter boundaries. Birds counted on satellite leks should be added to those counted on the primary lek for reporting purposes.

Lek Perimeter – The outer perimeter of a lek and associated satellite leks (if present). Perimeters of all leks should be mapped by experienced observers using accepted protocols (Section 1.b.v below); larger leks should receive higher priority. Perimeters may vary over time as population levels or habitat and weather conditions fluctuate. However, mapped perimeters should not be adjusted unless grouse use consistently (2+ years) demonstrates the existing perimeter is inaccurate. The lek location must be identified and recorded as a specific point **within** the lek perimeter. This point may be the geographic center of the perimeter polygon calculated though a GIS exercise, or a GPS waypoint recorded in the field, which represents the center of breeding activity typically observed on the lek.

Lek Complex - A cluster of leks within 2.5 km (1.5 mi) of each other, between which male sage-grouse may interchange from day to day.

Lek Count - A census technique that documents the number of male sage-grouse observed attending a particular lek, lek complex, or leks along a lek route based on repeated observation.

- Conduct lek counts at 7-10 day intervals over a 3-4 week period after the peak of mating activity. Although mating typically peaks in early April in Wyoming, the number of males counted on a lek is usually greatest in late April or early May when attendance by yearling males increases.
- Conduct lek counts only from the ground. Aerial counts are not accurate and are not comparable to ground counts.
- Conduct counts from ½ hour before sunrise to 1 hour after.
- Count attendance at each lek a minimum of three times annually during the breeding season.
- Conduct counts only when wind speeds are less than 15 kph (~10 mph) and no precipitation is falling.
- All leks within a complex should be counted on the same morning.

Lek Count Route – A lek route is a group of leks in relatively close proximity that represent part or all of a discrete breeding population/sub-population. Leks should be counted on routes to facilitate replication by other observers, increase the likelihood of recording satellite leks, and account for shifts in distribution of breeding birds. Lek routes should be set up so an observer following criteria described under "Lek Count" can count all leks within 1.5 hours.

Lek Survey - A monitoring technique designed primarily to determine whether leks are active or inactive. Obtaining accurate counts of males attending is secondary.

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

surveys involve substantially less effort and time than lek counts. They can also be done from a fixed-wing aircraft or helicopter. Lek surveys can be conducted from the initiation of strutting in early March until early-mid May, depending on the site and spring weather. When large numbers of leks are surveyed (50+) the resulting trends of lek attendance over time mirror that of lek counts.

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

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

- **inactive** – Any lek where sufficient data indicates no strutting activity took place throughout a strutting season. Absence of strutting grouse during a single visit is not sufficient documentation to establish a lek is inactive. This designation requires documentation no birds were present on the lek during at least 2 ground surveys separated by at least 7 days. The surveys must be conducted under ideal conditions (site visits between April 1 and May 7, no precipitation, light or no wind, ½ hour before to 1 hour after sunrise) or a ground check of the exact lek location late in the strutting season (after 4/15) during which sign (droppings/feathers) of strutting activity is not found. Data collected by aerial surveys cannot be used to designate inactive status.

- **unknown** – Leks for which active/inactive status has not been documented during the course of a strutting season. Excepting leks not scheduled to be checked in a particular year, the "unknown" status designation should be applied only in rare instances. Each lek should be checked enough times to determine whether it is active or not. It is preferable to conduct two good field checks every other year and confirm the lek is "inactive" rather than check it once every year and have it remain in "unknown" status.

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

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

- **unoccupied lek** – Two classifications of unoccupied leks are "destroyed" and "abandoned" (defined below). Unoccupied leks are not protected during surface disturbing activities.

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

    - **abandoned lek** – A lek in otherwise suitable habitat that has not been active during a period of 10 consecutive years. To be designated abandoned, a lek must be "inactive" (see above criteria) in at least four non-consecutive strutting seasons spanning the ten years. The site of an "abandoned" lek should be surveyed at least once every ten years to determine whether it has been reoccupied by sage-grouse.

undetermined lek – Any lek that has not been documented as active in the last ten years, but survey information is insufficient to designate the lek as unoccupied. Undetermined lek sites are not protected through prescribed management actions during surface disturbing activities until sufficient documentation is obtained to confirm the lek is occupied. This status should be applied only in rare instances (also see "unknown" above).

Attachment B: Wyoming sage-grouse projects supported with 2015-16 Wyoming General Fund Appropriation.

Project Name	Budget Biennium	Local Working Group	Total Cost	SG $	Project Description	Partners	Status
166 - Devils Slide Green Strip	2015-16	Big Horn Basin	$6,000	$3,000 requested/approved	Maintain existing green strip firebreak via cheatgrass treatment	BLM	Approved and on-going
167 - Beckley Juniper Treatment	2015-16	Big Horn Basin	$40,000	$20,000 requested/approved	Mechanical juniper removal from sage-grouse habitat	BLM	Approved and on-going
168 - Rome Hill Juniper Treatment	2015-16	Big Horn Basin	$80,000	$40,000 requested/approved	Mechanical juniper removal from sage-grouse habitat	BLM	Approved and on-going
169 - UW Bentonite impacts	2015-16	Big Horn Basin	$130,500	$16,451 requested/approved	Research of bentonite mining impacts to sage-grouse	American Colloid Co.	Approved and on-going
170 - SG habitat use in the Big Horn Basin	2015-16	Big Horn Basin	$1,123,330 (multi-year)	$30,000 requested; $15,000 approved	Determining sage-grouse habitat use and movements in 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 and on-going
171 - Shell Black Mtn Juniper Control	2015-16	Big Horn Basin	$81,000	$40,500 requested, $40,500 approved	Mechanical juniper removal from sage-grouse habitat	BLM, Wyoming Office of State Lands, private landowner	Approved and on-going
172 - Fathead minnows for mosquito control research	2015-16	Northeast	$84,024	$27,324 requested/approved	Research to determine efficacy of fathead minnows for mosquito control to address West Nile virus	University of Waterloo, Big Horn Environmental Consultants, landowners	Approved and On-going

173 - Modeling SG habitat suitability in the Thunder Basin	2015-16	Northeast	$91,200	$42,500 requested/approved	Develop RSF habitat selection models to prioritize areas for conservation and restoration	Thunder Basin Grasslands Prairie Ecosystem Assoc., Yellowstone Ecological Research Center, Wildlife Management Research Support	Approved and on-going
174 - Identifying priorities for land use and habitat restoration	2015-16	Northeast	$207,376 (multi-year)	$42,183 requested/approved	Research to prioritize habitats for land use and habitat restoration	University of Wyoming, WY Reclamation and Restoration Fellowship, Science Posse	Approved and On-going
175 - Hwy 450 - MM 35 Fire Research and Restoration	2015-16	Northeast	$48,200	14,962 requested/approved	Research to develop method for sagebrush restoration with intact understory and low density annual brome invasion	USFS, USDA-ARS	Approved
176 - Sage Creek cheatgrass treatment	2015-16	Southwest	$75,000	$25,000 requested; $20,000 approved	Chemical control of cheatgrass within a wildfire area	BLM; Sweetwater Co. Weed & Pest	Approved and On-going
177 - Currant Creek Ridge juniper removal	2015-16	Southwest	$110,000	$25,000 requested; $20,000 approved	Mechanical juniper removal from sage-grouse habitat	BLM	Approved and On-going
178 - Lousy George Spring Juniper removal	2015-16	Southwest	$268,200	$25,000 requested; $20,000 approved	Mechanical juniper removal from sage-grouse habitat	BLM	Approved
179 - Impact of Raven Removal on SG	2015-16	Southwest and South-Central	not provided by applicant	$40,000 requested/approved	Research to determine impacts of raven control to sage-grouse	Utah State University, private landowners	Approved and On-going
180 - Ferris Mtn/Bradley Peak Conifer Treatment	2015-16	South-Central	$61,000	$13,000 requested/approved	Mechanical conifer removal from sage-grouse habitat	BLM, WWNRT, WLCI	Approved
181 - Invasive species control in Teton Co.	2015-16	Upper Snake River Basin	$57,600	$4,000 requested/approved	Invasive weed control in Teton County Core Habitat	Jackson Hole Weed Mgt Assoc.	Approved and On-going

182 - Geophagy and sg movements in Hoback and Upper Green	2015-16	Upper Snake River Basin, Upper Green River Basin	$259,833	$10,000 requested/approved to date	Determine movements and habitat use of sage-grouse and determine significance of geophagy	Bridger Teton National Forest, BLM, Craighead Beringia South	Approved and On-going
183 - Kelly Hayfields restoration Phase 4	2015-16	Upper Snake River Basin	$123,177	$56,000 requested; $20,000 approved	Restore native vegetation to abondoned smooth brome hayfields.	Grand Teton National Park, NRCS	Approved and On-going
184 – Impacts of wind energy development on sage-grouse	2015-16	Bates Hole-Shirley Basin, South-Central, Southwest	$1,023,250 (multi-year)	$40,408 requested; $30,000 approved to date	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	Approved and On-going
185 - WY Core Area Habitat Condition Assessment	2015-16	Statewide	$654,072	$119,502 requested/$41,000 approved to date	RSF modeling to assess sagebrush habitat conditions at multiple scales and the repsonse of sage-grouse to changes in conditions	Audubon Rockies, TNC, Yellowstone Ecological Research Center, Governor's SG Implementation Team	Approved
186 - Response of SG to sagebrush treatments Phase III	2015-16	Wind River-Sweetwater River, South-Central, Bates Hole-Shirley Basin, Big Horn Basin, Southwest, Upper Green River Basin	$211,404 ($894,096 to date)	$211,404 requested/167,000 approved to date	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	Approved and On-going
187 – Bates Creek Cheatgrass Treatment	2015-16	Bates Hole-Shirley Basin	$315,550	$15,000 requested/approved	Continuing cheatgrass treatment	WWNRT, WGFD, private landowners	Approved and On-going

188 – Mud Springs Sagebrush Thinning	2015-16	Bates Hole-Shirley Basin	$315,550	$35,000 requested/approved	Fine-scale sagebrush mowing to improve soil water retention	WWNRT, WGFD, private landowners	Approved and on-goint
189 – 50-Mile Flat Restoration	2015-16	Bates Hole-Shirley Basin	$200,000	$30,000 requested/approved	Cheatgrass treatment	BLM, Natrona Co. Weed & Pest	Approved and on-going
190 – Audubon Traveling Trunk	2015-16	Bates Hole-Shirley Basin	$145,000	$10,000 requested/approved	School programs on sagebrush ecosystem	Audubon Rockies, various contributors	Approved and on-going
191 – South Hudson Weed Survey & Control	2015-16	Wind River-Sweetwater River	$151,300	$35,000 requested, $31,000 approved	Noxious weed surveys and treatment	WWNRT, BLM, Private Landowners, WYDOT, WSLB, Fremont Weed & Pest	Approved and on-going
192 – Sublette Cheatgrass Mapping and Control	2015-16	Upper Green River Basin	$136,000	$70,000 requested/approved	Surveys for and control of cheatgrass in core areas	WLCI, WY RNG Mule Deer Initiative, Sublette Weed & Pest	Approved and on-going
193 – Half-meter NAIP Imagery Acquisition	2015-16	Bates Hole-Shirley Basin, Northeast, South-Central, Southwest, Upper Green River Basin	$348,000	$63,000 approved	Half-meter (high resolution) imagery for use in the DDCT process	15 federal, state and county agencies	Approved and on-going

GREATER SAGE-GROUSE RESEARCH CONDUCTED IN WYOMING IN 2014

Presented to Wyoming Game and Fish Department

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

Revised November 3, 2014

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

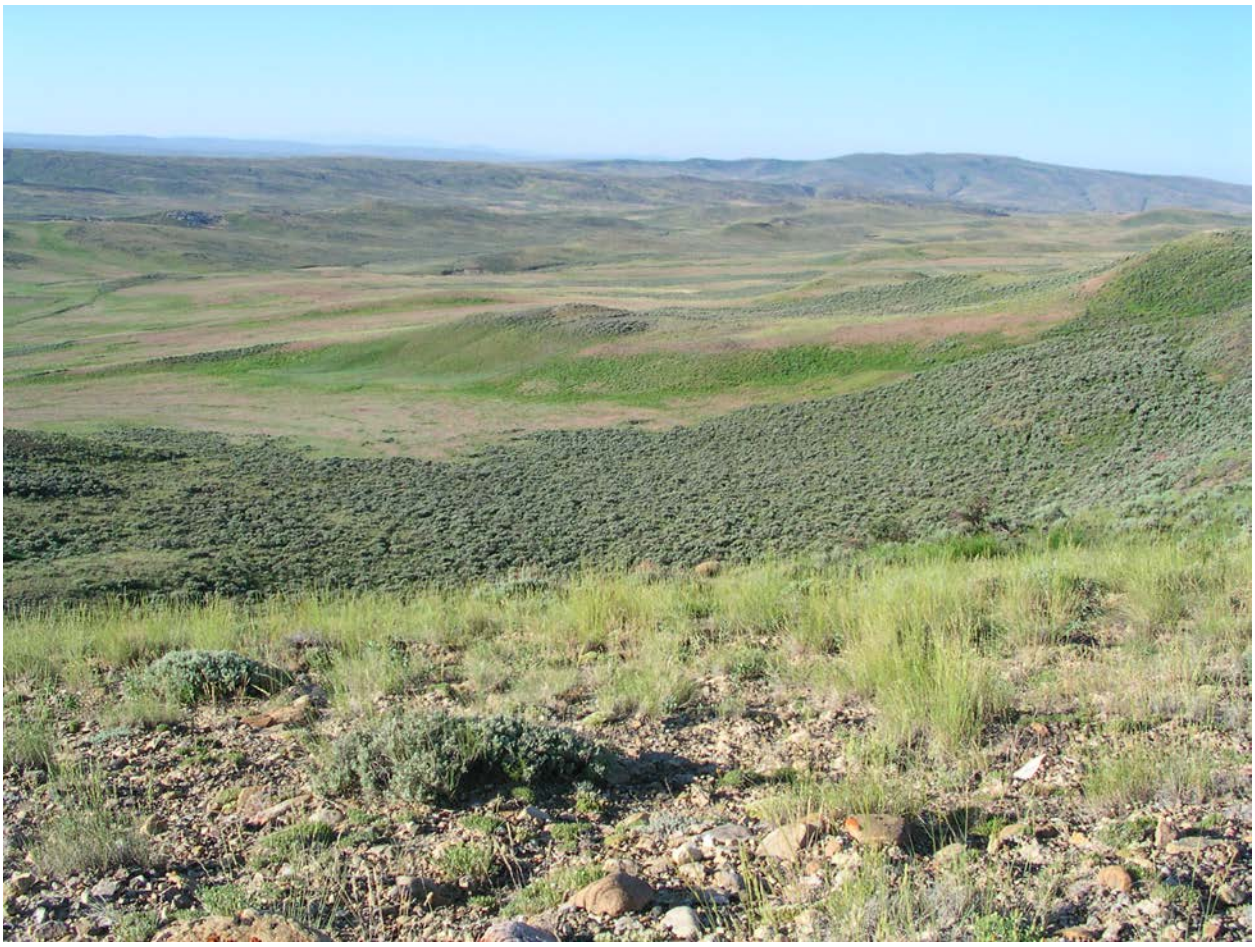

Photo of Greater Sage-Grouse Habitat in the Atlantic Rim, Wyoming by Mike Evans

1. GREATER SAGE-GROUSE POPULATION TRENDS IN WYOMING: EVALUATING LONG-TERM PERSISTENCE AT LEKS AND THE EFFECTS OF ENERGY DEVELOPMENT AND GRAZING ACTIVITIES

Contact: Dr. Cameron Aldridge; E-mail: cameron.aldridge@colostate.edu; Phone: (970) 226-9433

David Edmunds[1,2], Adam Green[1,2], Adrian Monroe[1,2], Cameron Aldridge[1,2], and Dan Manier[2]
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[2]United States Geological Survey, Fort Collins Science Center, 2150 Centre Ave, Bldg C, Fort Collins, CO 80526

We are using lek counts to investigate the influence of various different external factors that may influence the abundance, population change, and long-term persistence of sage-grouse populations. The state-wide lek dataset collected and compiled by Wyoming Game & Fish Department is the foundation for these analyses. Our first analysis expands on previous work, where we are developing a population viability analysis (PVA) to evaluate changes in lambda (population growth rate) for the state-wide sage-grouse population and five sub-populations. Here, population strongholds can be identified and compared with conservation reserves, such as core areas, where threats to habitats are reduced, compared habitat less intensively managed for conservation. Further, we are investigating the influence of the temporal changes in oil and gas development, distribution, density, and dispersion on sage-grouse population responses, using detailed datasets we have compiled to time-stamped energy developments and generate spatial metrics. Similarly we have previously compiled a national dataset containing 20 years of grazing data, for which we are evaluating how sage-grouse populations respond to changes in livestock management in habitats surrounding leks, as measured through such factors as timing of grazing or utilization. We are currently focused on Wyoming sage-grouse, but for several of these questions we may expand our analyses to other states within the range of sage-grouse through collaborative research efforts with colleagues. We are in the preliminary analytical stages for each of these analyses but have found minor effects of oil and gas development on sage-grouse abundance and believe grazing data suggest patterns may exist when linked to sage-grouse population trends.

Funding provided by: U.S. Geological Survey.

2. ASSESSING THE EFFECTIVENESS OF CORE AREAS FOR GREATER SAGE-GROUSE CONSERVATION: A SPATIALLY-EXPLICIT DEMOGRAPHIC APPROACH USING MANAGEMENT AND RESOURCE DEVELOPMENT SCENARIOS

Contact: Dr. Cameron Aldridge; E-mail: cameron.aldridge@colostate.edu; Phone: (970) 226-9433 or Julie Heinrichs: E-mail: julie.heinrichs@colostate.edu; Phone: (970) 226-9149

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David Gummer - Parks Canada, Banff, AB
Nathan Schumaker - USEPA, Corvallis, OR
Steven Garman - USGS Geosciences and Environmental Change Science Center, Lakewood, CO
Collin Homer - USGS/EROS Data Center, Sioux Falls, SD

Sage-grouse land managers are tasked with identifying populations that are secure versus those likely to decline. This is an onerous task with large landscapes, multiple diverse threats and data sources, and an uncertain future. We are developing a spatially-explicit individual-based population model that enables the quantitative investigation of the long-term dynamics of Sage-grouse populations under interacting protection, oil and gas development, and future climate scenarios. The initial state-wide model will link Wyoming seasonal habitat models (Fedy et al. 2014) with demography (published life history information, stage and sex-specific survival, reproduction), movement (habitat selection, dispersal and exploration), behavior (lek and nest site fidelities, flocking), and disease exposure (West Nile virus) to predict population distribution and dynamics within and outside of core areas. Using the core areas as static refuges surrounding leks, we are evaluating the effectiveness of the currently identified core areas to support long-term persistence. Within the WLCI region in southwestern Wyoming, we are modeling Sage-grouse responses to surface disturbance by oil and gas development, and interactions with climate change. A time series of future seasonal habitat maps will be used to describe the changes to the industrial footprint (wells, roads etc.) and climate-induced habitat changes. To assess the influence of non-footprint impacts we also will develop spatial risk/response surfaces that will describe a range of documented outcomes based on proximity to oil and gas infrastructure. We aim to create a transferrable modeling framework that will be helpful in identifying key areas for conservation in Wyoming and the western US.

Funding provided by: U.S. Geological Survey.

3. 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
Matthew Dillon, American Colloid Company, Lovell, 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 4 years; 2011–2014) the demographic rates and habitat selection patterns of greater sage-grouse in areas with greater (Shell) and lesser (Hyattville) amounts of bentonite mining activity. We are monitoring female survival, nest success, and brood survival with radio telemetry. For males, we are attaching bands and collecting feathers from leks 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. 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 in the 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 using stable isotope signatures to identify migration behavior. Field data collection will finish in spring 2015 and data analysis will start soon after.

Greater sage-grouse sample sizes obtained in the eastern Bighorn Basin, Wyoming, 2011–2014.

Sample	Female		Male		Nest	Brood	Microhabitat Plots	
	VHF	GPS	Band	GPS			Nest	Brood
2011-2013								
Shell	43	13	28	6	53	18	53	51
Hyattville	139	40	83	10	150	67	149	94
2014								
Shell	21	4	10	0	23	8	23	11
Hyattville	54	16	78	0	65	33	65	9

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

4. NUTRITIONAL QUALITY RESPONSE OF WYOMING BIG SAGEBRUSH TO TREATMENTS

Contact: Dr. Jeff Beck; E-mail: jlbeck@uwyo.edu; Phone: (307) 766-6863 or Dr. Jennifer Forbey: jenniferforbey@boisestate.edu; Phone: (208) 426-4426

Jeffrey L. Beck[1], Jennifer S. Forbey[2], Kurt T. Smith[1], Jason R. LeVan[1], and Naida Rizvic[2]
[1]Department of Ecosystem Science and Management, University of Wyoming, Laramie, Wyoming 82071
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In November 2013, we initiated a study in Fremont County, Wyoming to evaluate the effect of mechanical mowing and Spike® 20P (0.2 lbs Tebuthiuron ai/acre) herbicide treatments on the dietary quality (crude protein and plant secondary metabolites [PSM]) of Wyoming big sagebrush (*Artemisia tridentata wyomingensis*). Two study areas were mowed in January and February 2014 and herbicide was applied in two study areas in May 2014. We constructed six exclosures in each study area at random sites, which encompass 30 m x 30 m areas of treated and untreated sagebrush. Prior to treatments and exclosure construction, plants located within the future exclosures were randomly selected in both treated and untreated areas and marked with a metal tag to facilitate long term monitoring of dietary quality. Samples of 5-8 sprigs of current annual growth per sagebrush plant were collected from 18 plants from the mowed sites and 12 plants from the control site within the mowing treatment plots in November 2013. All leaves collected were stored on ice in the field and at –20 degree C prior to analysis. For laboratory analysis of diet quality, the leaves of each sample will be ground in liquid nitrogen using a mortar and pestle to a particle size of approximately 2 mm. A subsample will be stored at –20 degree C for monoterpene and total phenolic analysis, and the remaining sample will be weighed and dried to a constant weight at 50 degree C to determine dry weight. The dried sample will be analyzed for crude protein using the Total Kjeldahl Nitrogen method. We will also scan all samples with an ASD FieldSpec Pro to obtain spectral biomarkers that can be used to predict dietary quality. Laboratory analysis of the first set of collected samples started in October 2014. Samples of 5-8 sprigs of current annual growth per sagebrush plant will be collected again in November 2014 from the 6 plants that were sampled previously, plus 6 new plants within each of the treated and control sites for both mowing treatments. We will also collect samples of 5-8 sprigs of current annual growth from 18 sagebrush plants from the herbicide treated plants and 12 plants from the control site within the herbicide treatment plots in November 2014. These collections will be analyzed in the same way for diet quality as described above.

Funding: Wyoming Sage-Grouse Conservation Fund via Bates Hole, South Central, and Southwest Wyoming Local Sage-Grouse Work Groups.

5. 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[1], Jeffrey Beck[1], Anna Chalfoun[2] Jason Carlisle[2], Stan Harter[3], and Sue Oberlie[4]

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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. We intend 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.

Funding: Wyoming Game and Fish Department–Wyoming Sage-Grouse Conservation Fund; Bates Hole/Shirley Basin, South-Central, Southwest, and Wind River/Sweetwater River Local Sage-grouse Work Groups; University of Wyoming–Wyoming Reclamation and Restoration Center; Wyoming Wildlife and Natural Resource Trust; and the Margaret and Sam Kelly Ornithological Research Fund.

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], Andrea Orabona[2], Susan Patla[2], Zack Walker[2], Tom Christiansen[2], Stan Harter[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 investigating how effective Greater Sage-Grouse is as an umbrella species for the conservation of non-game wildlife, specifically sagebrush-associated wildlife designated as Species of Greatest Conservation Need (SGCN). Wyoming's Greater Sage-Grouse Core Population Areas and the host of current efforts to conserve sage-grouse provide a natural laboratory for testing the umbrella species concept, and our findings will be useful to managers interested in indirectly conserving SGCN under the streamlined approach of the sage-grouse umbrella.

We are addressing the following objectives at differing spatial scales to rigorously test sage-grouse as an umbrella species: 1) quantify overlap statewide between sage-grouse core areas and 52 SGCNs' suitable habitat using GIS data; 2) determine whether high sage-grouse abundance corresponds with high abundance of SGCN (birds, mammals, and reptiles) in the field; 3) evaluate whether nest-site selection of sagebrush-obligate passerine SGCN (Brewer's Sparrow and Sage Thrasher) corresponds with that of sage-grouse; and 4) examine the responses of sagebrush-obligate passerine SGCN (abundance, nesting success, and fledgling survival) to sagebrush-reducing habitat treatments implemented to improve sage-grouse brood-rearing habitat.

We have completed 3 years of field work near Jeffrey City, WY, and 2015 will be our last field season. Preliminary findings by objective: 1) core areas provide only marginal coverage for most SGCN (ongoing); 2) SGCN songbirds tend to be more abundant where sage-grouse are more abundant (ongoing); 3) forthcoming; and 4) SGCN songbirds still nest (one year post-treatment) in the vicinity of mowed areas, but do not appear to use the mowed footprint (ongoing).

Funding provided by: Wyoming Game and Fish Department, Southwest and Wind River/Sweetwater River Basin Local Working Groups, UW Biodiversity Institute, WEST/McDonald Research Award for Quantitative Analysis in Wildlife Ecology, and Laramie Audubon Society.

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

Contact: Dr. Mike Conover; E-mail: mike.conover@usu.edu; Phone: (435) 797-2436

Michael Conover, Jonathan Dinkins, Scott Mabray, and Luke Peebles, Department of Wildland Resources, Utah State University, Logan, Utah, 84322-5230

Common ravens are generalist predators that have the potential to influence greater sage-grouse nest success, which could influence future sage-grouse population trends. USDA Wildlife Services began targeted raven removal for the benefit of sage-grouse nesting at landfills and roosts throughout southwest Wyoming in January of 2014. During the removal period, we monitored 32 ravens equipped with backpack transmitters that were captured in the winter of 2013-2014. Seven marked ravens died due raven removal activities. We monitored individual movements using remote data logging stations, ground telemetry, aerial telemetry, and direct visual identification at landfills and roosts in the region. Point counts were conducted during the removal period at landfills to determine raven use dynamics at these areas, and roost counts were conducted at the three roosts known to be used by birds with transmitters to estimate population size.

The raven and raptor density dataset compiled by Jon Dinkins (2013), Scott Mabray (2014), and Luke Peebles (2015-expected) since 2008 will be used to evaluate the effects of raven density on spring sage-grouse lek counts. During the summer of 2014, Luke Peebles and his field technician conducted 1,026 raptor/corvid point counts. This effort involved visiting 168 random locations multiple times in sage-grouse habitat within the project's 12 designated study sites. Each random location was visited at least four times, yet a majority of these positions were visited either five or six times. Avian predators were spotted in 59% of the point counts. Detections of ravens during point counts occurred 15% of the time.

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, and the Wyoming Landscape Conservation Initiative.

8. CONSERVING MIGRATORY MULE DEER THROUGH THE UMBRELLA OF SAGE-GROUSE

Contact: Holly Copeland; E-mail: hcopeland@tnc.org; Phone: (307) 335-2129

Holly E. Copeland,[1] * Hall Sawyer,[2] Kevin L. Monteith,[3] David E. Naugle,[4] Amy Pocewicz, [1] Nicholas Graf,[5] and Matthew J. Kauffman, [6]

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[5]Wyoming Geographic Information Sciences Center, University of Wyoming, Laramie, WY 82071
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Conserving migratory ungulates in increasingly human-dominated landscapes presents difficult challenges to land managers and conservation practitioners. Nevertheless, ungulates may receive ancillary benefits from conservation actions designed to protect species of greater conservation priority where their ranges are sympatric. Sage-grouse (*Centrocerus urophasianus*) for example, have been proposed as an umbrella species for other sagebrush (*Artemisia spp.*) -dependent fauna. We examined a landscape where conservation efforts for sage-grouse overlap spatially with mule deer (*Odocoileus hemionus*) to determine whether sage-grouse conservation measures might also protect important migration routes and seasonal ranges of mule deer. We conducted a spatial analysis to determine what proportion of migration routes, stopover areas, and winter ranges used by mule deer were located in areas managed for sage-grouse conservation. Conservation measures overlapped with 66–70% of migration corridors, 74–75% of stopovers, and 52–91% of wintering areas for two mule deer populations in the upper Green River Basin, WY. Conservation actions targeted towards sage-grouse accounted for approximately half of the overlap in corridors and stopover areas, and nearly all overlap on winter ranges, indicating that measured benefits represent an important step in conserving migrating mule deer. Conservation of migratory species presents unique challenges because although overlap may be high, connectivity of the entire route must be maintained, and barriers to movement anywhere within the corridor could render it unviable. Our analysis highlights areas of potential conservation focus for mule deer, which are characterized by high exposure to residential development and use by a large proportion of migrating deer.

Funding: NRCS Sage-Grouse Initiative, Knobloch Family Foundation, Mule Deer Foundation.

Publication

Copeland, H. E., H. Sawyer, K. L. Monteith, D. E. Naugle, A. Pocewicz, N. Graf, and M. J. Kauffman. 2014. Conserving migratory mule deer through the umbrella of sage-grouse. Ecosphere 5(9):1-16.

9. MEASURING THE EFFECTIVENESS OF CONSERVATION: A NOVEL FRAMEWORK TO QUANTIFY THE BENEFITS OF SAGE-GROUSE CONSERVATION POLICY AND EASEMENTS IN WYOMING

Contact: Holly Copeland; E-mail: hcopeland@tnc.org; Phone: (307) 335-2129

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Increasing energy and housing demands are impacting wildlife populations throughout western North America. Wyoming has committed to maintain sage-grouse populations through conservation easements and policy changes that conserves high bird abundance "core" habitat and encourages development in less sensitive landscapes. In this study, we built new predictive models of oil and gas, wind, and residential development and applied build-out scenarios to simulate future development and measure the efficacy of conservation actions for maintaining sage-grouse populations. Our approach predicts sage-grouse population losses averted through conservation action and quantifies return on investment for different conservation strategies. We estimate that without conservation, sage-grouse populations in Wyoming will decrease under our long-term scenario by 14-29% (95%CI: 4-46%). However, a conservation strategy that includes the "core area" policy and $250 million in targeted easements could reduce these losses to 9-15% (95% CI: 3-32%), cutting anticipated losses by roughly half statewide and nearly two-thirds within sage-grouse core breeding areas. Core area policy is the single most important component, and targeted easements are complementary to the overall strategy. There is considerable uncertainty around the magnitude of our estimates; however, the *relative* benefit of different conservation scenarios remains comparable because potential biases and assumptions are consistently applied regardless of the strategy. Our framework using build-out scenarios to anticipate species declines provides estimates that could be used by decision makers to determine if expected population losses warrant ESA listing.

Funding through the NRCS Sage-Grouse Initiative.

Publication

Copeland, H. E., A. Pocewicz, D. E. Naugle, T. Griffiths, D. Keinath, J. S. Evans, and J. Platt. 2013. Quantifying the benefits of the core area policy and conservation easements to sage-grouse in Wyoming. PLoS ONE **8**:1-14.

10. ASSESSING THE EFFICACY OF FATHEAD MINNOWS FOR MOSQUITO CONTROL IN NE WYOMING

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Principal Investigator

Dr. Brad Fedy, Department of Environment and Resource Studies, University of Waterloo, Waterloo, Ontario, Canada

West Nile virus (WNv) has become a significant and increasing threat to wildlife populations and human health throughout North America. Mosquito control is a significant and effective means of controlling the spread of WNv, as the virus is primarily spread between avian and mosquito vectors. This is of particular concern for avian host species such as the Greater sage-grouse (*Centrocercus urophasianus*), where WNv has been documented to negatively affect sage-grouse survival. So far, the most popular methods for controlling mosquito vectors have focused on controlling mosquitoes at their larval life stages. Here, our primary objective is to test the efficacy of using fathead minnows (*Pimephales promelas*) as a biological control for mosquito populations in northeastern Wyoming, where WNv has been documented to negatively impact sage-grouse population persistence. Specifically, we address 3 main questions: 1) does the presence of fathead minnows influence mosquito larva density within reservoirs? 2) what pond and water quality characteristics support viable populations of fathead minnows?, and 3) when is the use of fathead minnows an economically sustainable alternative to larvacide? In 2013, we introduced 2500 minnows per surface acre into 7 of 15 monitored reservoirs. The presence of fathead minnows, mosquito larva density and adult mosquito populations were monitored at all sites on a weekly basis. Preliminary analysis suggests some sites were able to sustain minnow populations, which significantly reduced larva density at treated sites. Reservoirs will continue to be monitored in 2014.

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

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Principal Investigators

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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. We submitted two manuscripts for peer-review in 2014.

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

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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 monograph was published in 2014. We are currently preparing a USGS Data Series Report to make the models available.

Publication

Fedy, B. C., K. E. Doherty, C. L. Aldridge, M. O. O'Donnell, J. L. Beck, B. Bedrosian, D. Gummer, M. J. Holloran, G. D. Johnson, N. W. Kaczor, C. P. Kirol, C. A. Mandich, D. Marshall, G. McKee, C. Olson, C. C. Swanson, and B. L. Walker. 2014. Habitat prioritization across large landscapes, multiple seasons, and novel areas: an example using greater sage-grouse in Wyoming. Wildlife Monographs 190:1–39.

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

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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.

14. ECOLOGY OF THE GREATER SAGE-GROUSE IN THE COAL MINING LANDSCAPE OF WYOMING'S POWDER RIVER BASIN

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Current Collaborators: Amanda Hohnhorst, William Vetter, Roy Fenster, and Brandon Smith, ICF International; Bryan Hansen and Laurel Vicklund, Peabody Powder River Operations, LLC; Dave Pellatz, Thunder Basin Grasslands Prairie Ecosystem Association; Gwyn McKee, Thunderbird Wildlife Consulting, Inc.; Tim Byer, U.S. Forest Service, Thunder Basin National Grasslands; Melanie Murphy, University of Wyoming Department of Ecosystem Science and Management

Past Acknowledgements: Kimberley Brown and Kort Clayton, Thunderbird Wildlife Consulting, Inc.; Nathaniel West, Bureau of Land Management, Newcastle Field Office; Olin Oedekoven, Wyoming Game & Fish Department

In light of conservation concerns for greater sage-grouse and coal mining in Wyoming's Powder River Basin, multiple parties (particularly the North Antelope Rochelle Mine [NARM]) initiated a long-term study of the local sage-grouse population. This project was undertaken to gain a better understanding of how grouse use the landscape in the vicinity of active coal mines. The project provides valuable information in guiding post-mining reclamation efforts to benefit the local sage-grouse population. Initial objectives were to collect seasonal information on the distribution, movements, and habitat use of radio-collared grouse throughout the year, and document important habitat components of use sites, as well as to gather information on nest success, adult and juvenile mortality factors, and seasonal and individual home ranges. Additional factors recently incorporated include: evaluating use of reclaimed areas; exploring disturbance thresholds to aid in identifying the location and timing of future reclamation efforts; integrating findings with other local habitat studies to develop regionally appropriate reclamation guidelines; evaluating long-term raptor activity relative to grouse populations at NARM; and investigating if family relatedness or fidelity to natal areas are factors in nest site selection.

Information from this project provides the most temporally extensive information on sage-grouse habitat use in northeastern Wyoming. Understanding how sage-grouse use sagebrush stands that are smaller, shorter, and less dense relative to those in the remainder of the state provides unique regional information for agency land use planning and is also aiding landscape level conservation efforts initiated by the Thunder Basin Grasslands Prairie Ecosystem Association.

Funding and equipment provided by: Peabody Powder River Operations, LLC, Triton and Thunder Basin Coal Companies, Thunder Basin Grasslands Prairie Ecosystem Association, Bureau of Land Management, Newcastle Field Office, and the Wyoming Game & Fish Department.

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

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Chad LeBeau, Gregory Johnson, Ryan Nielson and Dr. Trent McDonald, Western EcoSystems Technology, Inc.; Dr. Matt Holloran, John Dahlke and Eli Rodemaker, 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 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 340 female sage-grouse between 2009-2014 including 156 females captured from 3 leks located ≤1.4 km from a wind turbine. Between April 1, 2009 and October 31, 2014 we collected 9,441 locations of this radio-equipped sample. We additionally collected vegetation and soils data at over 200 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 as directed by the National Wind Coordinating Collaborative Sage-grouse Committee (2011-2012-2013-2014); 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 (2011-2012-2013); South Central Local Sage-grouse Working Group (2012-2013-2014); Southwest Local Sage-grouse Working Group (2013-2014); EnXco (2011-2012); Iberdrola Renewables (2011); PacifiCorp (2011-2012-2013-2014); the American Wind Energy Association (2013); and the Avian Power Line Interaction Committee (2014).

Publication

LeBeau, C. W., **J. L. Beck**, G. D. Johnson, and M. J. Holloran. 2014. Short-term impacts of wind energy development on greater sage-grouse fitness. *Journal of Wildlife Management* 78:522–530.

16. 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

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

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 and dynamics. Our design calls for maintaining 50 females and 50 males tagged with GPS PTTs and 75 miles tagged with VHF transmitters. Since 2010, we have collected >340,000 locations on tagged hens and >120,000 locations on tagged males. Each spring, we conduct lek counts on 50-56 leks and collect sightability data (variables influencing male sage-grouse detection on leks) on tagged males on leks. During nesting and brood-rearing periods, we monitor survival and productivity of nests and broods to evaluate recruitment into the population. To evaluate microsite resource selection, we collect microsite vegetation characteristics at used and paired-random sites, using locations selected from the GPS data. It is anticipated that 5 years of pre-construction data will be collected for hens and 4 years of pre-construction data will be collected for males prior to the initiation of wind development activities.

Funding provided by: Power Company of Wyoming, Wyoming Game and Fish Department, U.S. Forest Service Rocky Mountain Research Station, National Renewable Energy Laboratory, National Fish and Wildlife Foundation, Western Association of Fish and Wildlife Agencies, Bureau of Land Management, National Wind Coordinating Collaborative, University of Missouri, and SWCA Environmental Consultants.

17. IDENTIFYING GREATER SAGE-GROUSE SOURCE AND SINK HABITATS FOR SONSERVATION PLANNING IN AN ENERGY DEVELOPMENT LANDSCAPE

Contact: Chris Kirol; E-mail: ckirol@uwyo.edu; phone: (307) 751-5455 or Dr. Jeff Beck; E-mail: jlbeck@uwyo.edu; Phone: (307) 634-1756

Habitat quality is often compromised when source habitats are lost or fragmented due to anthropogenic development. Our objective was to build an ecological model to classify habitat quality in terms of source or sink dynamics for greater sage-grouse (*Centrocercus urophasianus*) in the Atlantic Rim Project Area (ARPA), a developing natural gas field in south-central Wyoming. We used occurrence and survival modeling to evaluate relationships between environmental and anthropogenic variables at multiple spatial scales and for all female summer life-stages including nesting, brood-rearing, and non-brooding females. We modeled survival for nest, brood, and adult female summer survival. Our survival models combined with fixed vital rates in a fitness metric model that when mapped predicted habitat productivity (productivity map). Our results demonstrate a suite of environmental and anthropogenic variables at multiple scales that were predictive of occurrence and survival. We created a source-sink map by overlaying our female summer occurrence map and productivity map to predict habitats contributing to population surpluses (source habitats) or deficits (sink habitat) and low-occurrence habitats on the landscape. The source-sink map predicted that of the sage-grouse habitat within the ARPA, 30% was primary source, 29% was secondary source, 4% was primary sink, 6% was secondary sink, and 31% was low-occurrence. Our results provide evidence that energy development and avoidance of energy infrastructure was likely reducing the amount of source habitat within the ARPA landscape. Our source-sink map provides managers with a means of prioritizing habitats for conservation planning based on source and sink dynamics.

Funding Provided by: Anadarko Petroleum Corporation, Wyoming Game and Fish Department, South Central Local Sage-Grouse Work Group, and the School of Energy Resources at the University of Wyoming

Publications

Kirol, C.P., Beck, J.L., Huzurbazar, S.V., Holloran, M.J., & Miller, S.N. *In press*. Identifying greater sage-grouse source and sink habitats for conservation planning in an energy development landscape. Ecological Applications.

Smith, K. T., C. P. Kirol**, J. L. Beck,** and F. C. Blomquist. 2014. Prioritizing winter habitat quality for greater sage-grouse in a landscape influenced by energy development. *Ecosphere* 5(2):15.

18. GREATER SAGE-GROUSE TELEMETRY SURVEYS FOR SWEETWATER RIVER CONSERVANCY, LLC.

Contact: Chad LeBeau–Principal Investigator, Research Biologist, WEST, Inc., Laramie WY. E-mail: cwlebeau@west-inc.com; Phone: (307) 634-1756

The Sweetwater River Conservancy, LLC (SRC) is developing a greater sage-grouse habitat conservation bank and is targeting suitable sage-grouse habitat on SRC's private lands in central Wyoming. The objective of this study is to value sage-grouse habitat within the bank area by estimating resource selection functions from telemetry data. We captured and tracked 125 female sage-grouse to document sage-grouse habitat use within the bank area. This research is ongoing.

Funding: this research is privately funded.

19. HOW DO SAGE-GROUSE RESPOND TO ON-SITE MITIGATION IN AN ENERGY DEVELOPMENT ENVIRONMENT?

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Big Horn Environmental Consultants, P.O. Box 207 Sheridan, Wyoming 82801

Big Horn Environmental Consultants (BHEC) radio-marked and monitored sage-grouse females from 2008-2011 while maintaining a sample size of 100 radio-marked hens. The focus of this research was to understand the response of sage-grouse to on-site mitigation in a Natural Gas (NG) development area. Sage-grouse avoidance of energy development has been extensively researched and documented (Naugle et al. 2011) and sage-grouse productivity has been shown to be depressed in human-altered landscapes (Connelly et al. 2011). Sage-grouse researchers and managers have suggested on-site mitigation measures (e.g., remote well monitoring, burying power lines, etc.) as a tool to reduce these impacts; however, few studies have empirically tested the effectiveness of these mitigation efforts. We are quantifying the response of sage-grouse to these mitigation efforts by assessing critical components of sage-grouse population viability—habitat use and associated fitness outcomes during the female reproductive period. First, we are exploring female habitat use—in terms of avoidance of infrastructure—during the nesting period to assess if on-site mitigation reduces avoidance behavior in energy-altered landscapes. Second, we are exploring possible associations between specific NG infrastructure components and nest productivity in relation to mitigated and non-mitigated development areas to determine if on-site mitigation measures are targeting the energy features that are most consequential to sage-grouse productivity and if on-site mitigation, as a whole, improves sage-grouse productivity in energy-altered landscapes. We currently have two manuscripts in review that summarize some of our research findings.

Funding Provided by Anadarko Petroleum Corporation and in-kind support from BHEC.

20. INVENTORY AND ASSESSMENT OF SEASONAL SAGEBRUSH DEFOLIATION: PRELIMINARY DETERMINATION OF EXTENT AND DURATION

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Based on communication and collaboration with state (esp. WGF) and federal partners (esp. BLM) we are working to compile information regarding the location and magnitude of large-patch damage and/or mortality of sagebrush. Observations have suggested that local defoliation and/or mortality may be caused by flooding, insect defoliation, intense herbivory or a combination of these, and other unknown causes. Often defoliation events are followed by late season, or subsequent season re-growth. The extent and duration of this phenomenon is poorly documented, and the potential effects on the distribution and dynamics of sagebrush and sage-grouse habitats are largely unknown. Importantly, in several cases field observations indicate that defoliation does not mean mortality (re-foliation has been observed) and effects on cover and productivity are largely unknown, thus connecting these patterns to the condition of habitats is potentially important for habitat management. We are collecting observations of large-area defoliation events from partners and colleagues across the state, and we will match these field observations to 2014 Landsat data (when released from EROS) to attempt to map the location and extent of these events to inform subsequent monitoring.

Funding: U.S. Geological Survey for WLCI.

21. MITIGATION BY DESIGN IN WYOMING: MAKING THE CONNECTION BETWEEN HABITAT DISTURBANCE, RESTORATION ACTIVITIES AND RESOURCE ECONOMICS

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We are using a combination of core area designations, seasonal habitat distributions (modeled) and population distributions (based upon lek counts) to identify the distribution of valuable habitats (additional species may be added in the future, but sage-grouse are the immediate focus). We are using a combination of Ecological Site potentials (based on NRCS Ecological Site Descriptions) and previous restoration/remediation efforts (based on records of previous investments and results) to investigate the potential for recovery of suitable habitat conditions. Together, we expect these data to help inform and direct potential future efforts by identifying areas with high potential to contribute habitat values (actual use by sage-grouse) and provide mitigation or restoration effectiveness. Lands targeted for mitigation (protection) should be in good condition currently, but lack sufficient protections; lands targeted for restoration will lie in potentially valuable seasonal or migration habitats with sub-optimal conditions. To support development, interpretation and implementation, we are working with partners from BLM, WGF, USFWS and WLCI.

Funding: Provided by U.S. Geological Survey.

22. WHAT POTENTIAL MITIGATION AND RESTORATION SITES HAVE THE MOST POTENTIAL BENEFIT FOR GREATER 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 management objectives 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 in the Bighorn and Powder River basins:

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.

We have collected presence-absence (81 sites), genetic (140 leks), and sound (>25 sites) data. Preliminary occurrence models (including DWGF data) suggest that amount and configuration of habitat, growing season precipitation, and wetness influence probability of lek occurrence. Preliminary connectivity models suggest that geographic distance, sagebrush, topography and mean annual precipitation influence gene flow.

In 2015 we will work towards completing the final lek occurrence model (Objective 1) and lab work. Currently, PCR has been run on 2784 genetic samples of 2821 extracted samples for a subset of the microsatellites (7 microsatellites and sex ID). Once the lab work is completed we will work towards a final functional connectivity model (Objective 2). 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 (Objective 3).

Funding by: Wyoming Reclamation and Restoration Center, Northeast Wyoming Sage-grouse Working Group, University of Wyoming, RM-URISA, Society for Integrative and Comparative Biology, Margaret and Sam Kelly Ornithology Fund, Sigma Xi GIAR, RM-URISA, NSF – UW Science Posse, Laramie Audubon Society, and WRRC Reclamation Scholarship.

23. 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;** Email: gpatricelli@ucdavis.edu

Additional Investigators:
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. This project has three major objectives. First, we monitored noise sources in Sublette and Campbell counties that are associated with energy development, including drilling rigs, compressor stations, roads, and generators. Second, to examine the impacts of noise on sage-grouse, we conducted a noise playback experiment on leks in our study site in Fremont County from 2006-2009. We found immediate and sustained declines in male lek attendance and elevated fecal stress hormone levels on noise leks relative to paired controls. Third, we adapted landscape-level noise modeling software (NMSimNord) and are now using it, along with our measurements from noise sources, to map the "acoustic footprint" of natural gas development in the Pinedale Anticline from 1998-2011. We have expanded the model to include commonly-occurring weather scenarios for the region as well. We are currently working with our partners at the National Park Service to implement scripts that will allow us to model a large number of noise sources simultaneously, including a variety of traffic levels along main haul roads. The spatial data layers generated by the model are being included in habitat-selection models to determine the role that noise has played in sage-grouse declines, determine the noise exposure threshold for this species, and determine what metric or metrics are most appropriate for characterizing noise impacts.

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

24. MODELING SAGE-GROUSE HABITAT SUITABILITY IN THE THUNDER BASIN, WYOMING

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Bob Crabtree and Steve Jay, Yellowstone Ecological Research Center; Matt Holloran, WY Wildlife Consultants; Dave Pellatz, Thunder Basin Grasslands Prairie Ecosystem Association

The quality of sage-grouse habitat is constantly being affected by a variety of factors that change every year; and these changing conditions are even more evident in areas where ecotones are merging such as in northeastern Wyoming. Therefore, it is extremely important that temporal variability be incorporated into conservation planning tools. We propose to develop spatial analyses using a technique which takes into account inter and intra-annual changes in sage-grouse habitat suitability. The goal of these analyses is to create a series of habitat suitability maps and predictions which indicate critical habitat regions which are vital within a year and stable between years. We will use these maps along with population data (i.e., lek counts through time) to establish thresholds of the amount of critical habitat needed within a given area for population stability—these thresholds along with habitat stability assessments will then be used to prioritize areas for conservation as well as identify areas for restoration. Assessments will all be accomplished at scales relevant to northeastern Wyoming, using data collected by multiple entities throughout the area over the last decade; proposed analyses will be rigorous and thorough and will be submitted for peer review with the expectation of the work being published.

Funding/In-Kind: Cloud Peak Energy, Peabody Energy, NE Wyoming Sage-grouse Working Group, and Thunder Basin Grasslands Prairie Ecosystem Association.

25. Using assisted succession to improve sage-grouse habitat in high conflict areas of the Big Horn Basin, WY

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

Recent research has documented excellent survival (100%) and growth using container grown Wyoming big sagebrush. Additionally, mine operators have observed good survival rates of the perennial species crested wheatgrass, blue grama, bottlebrush squirreltail and slender wheatgrass when direct seeded into cheatgrass infested areas. The combination of grasses with native shrubs could be used to improve sage-grouse habitat. Assisted succession is a 2-step process that starts with 'claiming the site' from cheatgrass, followed by interplanting with sagebrush. The objectives of our proposal are to improve sage-grouse habitat by preventing invasive species, increasing structural complexity, species diversity and overall site productivity.

Two sites were covered with livecast soil and seeded (2012) with:

- 100% crested wheatgrass
- 1:1:1:1 crested wheatgrass:blue grama:bottlebrush squirreltail:slender wheatgrass
- No seeding (control)

All treatments were replicated 4 times at each site. Very little (<5%) of the seeding in 2012 emerged; therefore, both sites were reseeded in 2013. April 2014, sagebrush seedlings were transplanted into each treatment at densities of 1,4 and 9 plants/m^2. Each sagebrush 'island' was 4 m^2 in size. We will measure seedling survival and size, vegetation community (including cheatgrass cover), and soil parameters including soil moisture and organic matter between the three site conditions. Overtime, we will measure island expansion through natural dispersal and we will assess the sites for sage-grouse suitability.

26. HABITAT USE AND REPRODUCTIVE SUCCESS OF GREATER SAGE-GROUSE IN BIGHORN BASIN

Contact: Dr. Jimmy D. Taylor, USDA-WS, National Wildlife Research Center, Oregon Field Station, 321 Richardson Hall, Corvallis, Oregon, 97331; Phone: 541-737-1353; e-mail: jimmy.d.taylor@aphis.usda.gov and Dr. R. Doug Holt, Department of Forest Ecosystems and Society, Oregon State University, 321 Richardson Hall, Corvallis, Oregon, 97331; e-mail: doug.holt@oregonstate.edu

The Wyoming Greater Sage-grouse Conservation Plan 2003 and the Sage-grouse Conservation Plan for the Bighorn Basin identified predation as a potential source of sage-grouse population declines; however, little information exists on sage-grouse population dynamics in the Bighorn Basin. Since 2012, we have used VHF and Argos telemetry to monitor hen movement, hen survival, and cause-specific mortality across multiple study sites ($\leq$ 5) in the Big Horn Basin, some of which use predator control for big game and livestock protection. Levels include no control, low, moderate, and high; however, no predator control was implemented specifically for sage-grouse protection. Trail cameras were placed in close proximity to nests to determine nest fate and sources of nest failure. Hens with successful nests were observed at multiple intervals post-hatch to estimate chick survival. Over 4 breeding seasons, approximately 225 female grouse (157 adult and 68 juvenile) were radio-marked and released at leks. Approximately 204 nests were detected, most of which were monitored with trail cameras. Sources of hen mortality included depredation by golden eagle and coyote. Sources of nest failure were primarily due to depredation by common raven and coyote, but also included badger and bull snake. Model development and evaluation are currently underway for nest survival, hen survival, and chick survival. An interim report will be produced in spring 2015 and the study is planned to continue through 2016.

Funding provided by: Meeteetse, Cody, Hot Springs, Powell-Clarks Fork, Shoshone, South Big Horn, and Washakie Conservation Districts; Bighorn Basin Predator Management Districts (Park, Bighorn, Washakie, and Hot Spring); USDA-Wildlife Services; USDA-WS-National Wildlife Research Center; Wyoming Animal Damage Management Board; Wyoming Game and Fish Commission; Fidelity Exploration and Production; Marathon Oil Company; Park County Farm Bureau; Big Horn Basin RC&D; Wyoming Private Grazing Lands Team; Wyo-Ben; Breitburn Operating L.P.; Legacy Reserves; and numerous individuals and ranches. Local field support is provided by Jim Pehringer (USDA-Wildlife Services), and NW District Wildlife Services specialists.

27. 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

Contact: Dr. Brett L. Walker, Colorado Parks and Wildlife, Grand Junction, Colorado. Phone: 970-255-6125 (office), 970-778-0886 (cell). Email: brett.walker@state.co.us

Implementing effective monitoring and mitigation is crucial for conserving populations of greater sage-grouse (*Centrocercus urophasianus*). Lek-count data are widely used as an index of sage-grouse abundance, and buffers around lek locations are used to identify and protect important sage-grouse habitat, but the reliability and effectiveness of lek-based monitoring and management strategies has not been rigorously tested. It is unclear how closely lek-count data track actual year-to-year changes in male abundance, and the effectiveness of lek buffers at reducing disturbance to male sage-grouse and their habitat during the breeding season is poorly known. Colorado Parks and Wildlife conducted a multi-year study (2010-2014) to quantify variation in male breeding-season survival, lek attendance, inter-lek movements, detectability, and habitat use around leks to quantify the reliability of lek-count data and test the effectiveness of lek buffers in the Hiawatha Regional Energy Development project area in northwestern Colorado and southwestern Wyoming. Field work for the project concluded in June 2013, and we continued to monitor existing GPS males through June 2014 to obtain additional data on survival, lek attendance, between-year inter-lek movements, and habitat use. Analyses of habitat use, lek attendance, inter-lek movement, and detectability are ongoing.

Funding was provided by: Colorado Parks and Wildlife. Logistical support was provided by Wyoming Game and Fish Department, the Rock Springs and Little Snake Field Offices of the Bureau of Land Management, and private landowners.

28. SPATIAL AND TEMPORAL ANALYSIS OF OIL AND GAS DEVELOPMENT, MITIGATION, AND SAGE-GROUSE LEK ATTENDANCE IN THE PINEDALE PLANNING AREA, WYOMING: 1990-2012.

Contact: Dr. Rob Roy Ramey II, Wildlife Science International. Phone: (303)718- 6686; Email: robroyrameyii@gmail.com

The objective of this study was to test predictions (using a hypothesis testing approach) about effects of oil and gas development, mitigation efforts, and regional climate variation, and population quality, on sage grouse at a population level. The research initially focused on Pinedale Planning Area, and then expanded across other regions of Wyoming to test for similar effects (and therefore, provide greater confidence in the results). A spatial and temporal analysis (including Bayesian hierarchical state-space models) of 100 years of data on oil and gas development and 22 years of lek count data were used. Instead of taking a "microscopic" level view (e.g. comparison of disturbed versus undisturbed leks; active versus inactive leks; or behavioral responses of individual birds) we analyzed at responses and trends at both a local and population level. Results: The average number of males per lek in Pinedale Planning Area has been consistently above statewide averages during that period 1990 through 2012 with no evidence of population decline. Leks persist in areas of surface disturbance well above the recommended 3% threshold (within 4 miles of a lek or per section). In Pinedale and other areas, surface disturbance from oil and gas development was not found to a significant population driver. Instead, the Pacific Decadal Oscillation (PDO), a regional climate driver, accounts for the majority of annual variation in lek attendance.

Attachment D.
Wyoming Sage-Grouse Research Reports (through May 31, 2015)

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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Doherty, K. E. 2008. Sage-grouse and energy development: integrating science with conservation planning to reduce impacts. Dissertation. University of Montana, Missoula.

Doherty, M. K. 2007. Mosquito populations in the Powder River Basin, Wyoming: a comparison of natural, agricultural and effluent coal-bed natural gas aquatic habitats. Thesis. Montana State University, Bozeman.

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Hess, J. E. 2010. Greater sage-grouse (*Centrocercus urophasianus*) habitat response to mowing and prescribed burning Wyoming big sagebrush and the influence of disturbance factors on lek persistence in the Bighorn Basin, Wyoming. Thesis. University of Wyoming, Laramie.

Hnilicka, P. and D. Skates. 2010. Movements and survival of sage-grouse on the Wind River Reservation, Wyoming. Completion Report. U. S. Fish and Wildlife Service Lander, Wyoming.

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

Period Covered:
June 1, 2014 – May 31, 2015

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

December 14, 2015

Sage Grouse Job Completion Report

Year: 2006 - 2015, 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)
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	218	78	36	1222	20.0
2013	220	77	35	969	16.4
2014	221	87	39	1261	19.4
2015	217	100	46	2779	32.3

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
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	218	90	41	779	13.0
2013	220	98	45	777	13.9
2014	221	119	54	912	13.4
2015	217	92	42	1579	26.3

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: 2006 - 2015, 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)
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	218	168	77	2001	16.5
2013	220	175	80	1746	15.2
2014	221	206	93	2173	16.3
2015	217	192	88	4358	29.8

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2006	152	3	24	155	98.1	1.9
2007	134	6	26	140	95.7	4.3
2008	135	17	13	152	88.8	11.2
2009	130	16	14	146	89.0	11.0
2010	143	12	19	155	92.3	7.7
2011	159	31	8	190	83.7	16.3
2012	131	26	11	157	83.4	16.6
2013	121	41	13	162	74.7	25.3
2014	136	50	20	186	73.1	26.9
2015	150	32	10	182	82.4	17.6

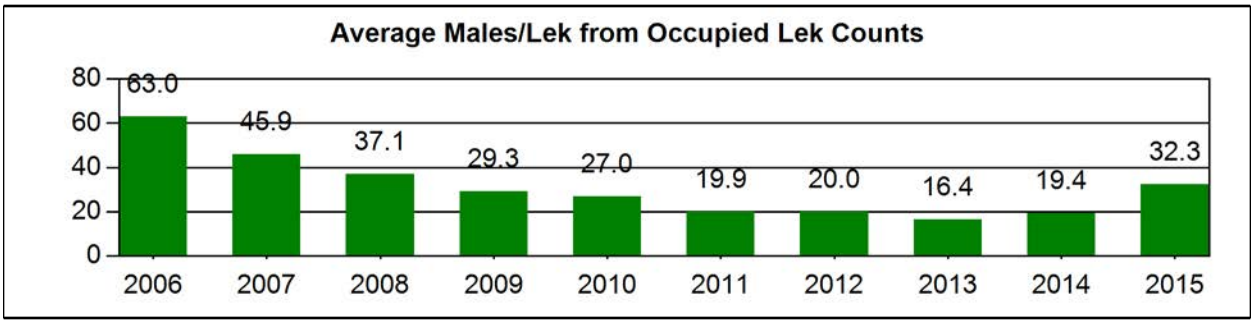
1) Occupied - Active during previous 10 years (see official definitions)

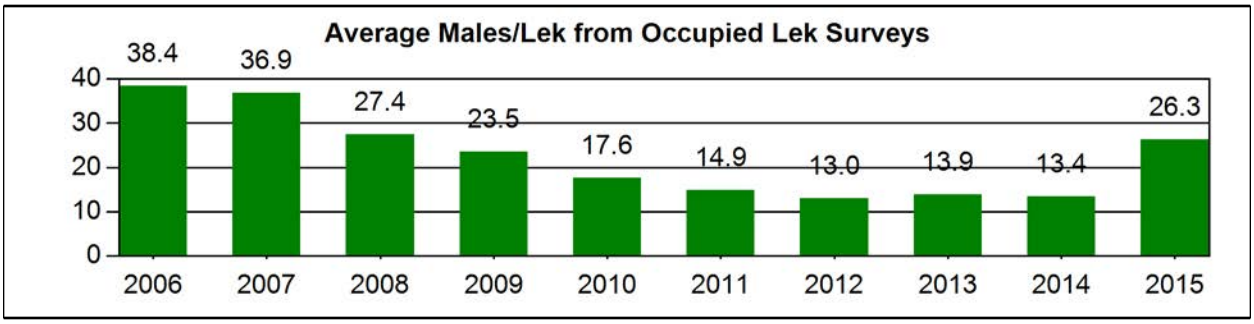
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

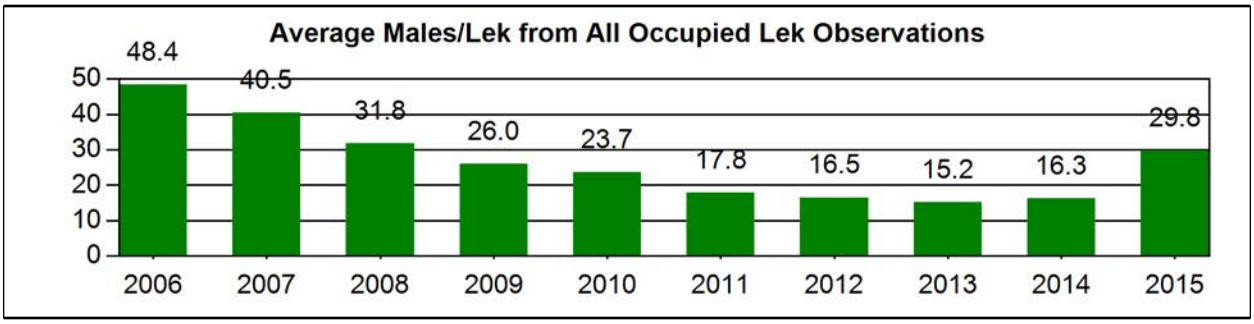
3) Inactive - Confirmed no birds/sign present (see official definitions)

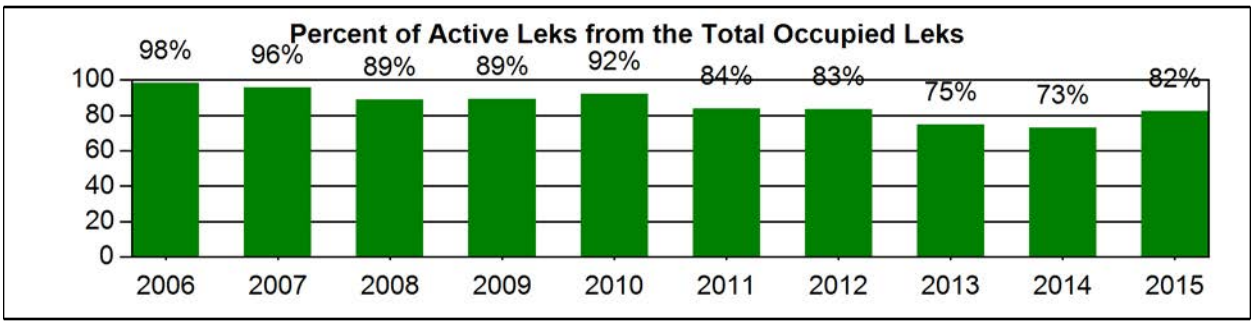
Sage Grouse Occupied Lek Attendance Summary

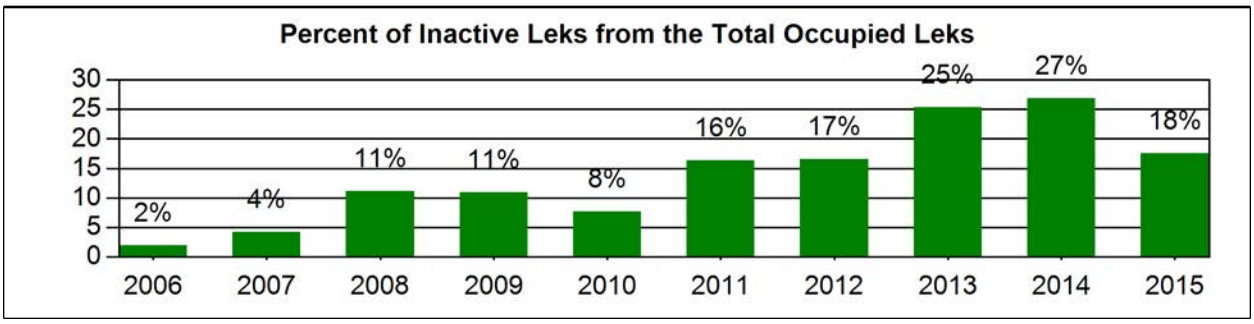
Year: 2006 - 2015, Working Group: Bates Hole











Sage Grouse Job Completion Report

Year: 2005 - 2015, Working Group: Bates Hole

4. Sage Grouse Hunting Seasons and Harvest Data

a. Season

Year	Season Start	Season End	Length	Bag/Possesion Limit
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
2013	Sep-21	Sep-30	10	2/4
2014	Sep-20	Sep-30	11	2/4

b. Harvest

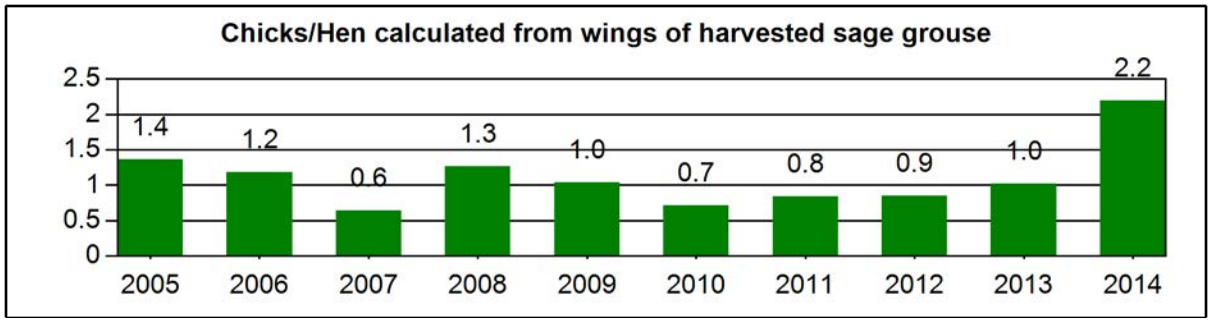
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2005	2304	925	1734	1.3	2.5	1.9
2006	1672	717	1169	1.4	2.3	1.6
2007	1365	655	1155	1.2	2.1	1.8
2008	1295	654	1161	1.1	2.0	1.8
2009	1026	532	956	1.1	1.9	1.8
2010	1027	480	1001	1.0	2.1	2.1
2011	1117	514	981	1.1	2.2	1.9
2012	688	415	852	0.8	1.7	2.1
2013	488	399	670	0.7	1.2	1.7
2014	588	352	804	0.7	1.7	2.3
Avg	1,157	564	1,048	1.1	2.0	1.9

Sage Grouse Job Completion Report

Year: 2005 - 2014, Working Group: Bates Hole

5. Composition of Harvest by Wing Analysis

Year	Sample Size	Percent Adult		Percent Yearling		Percent Young		Chicks/ Hens
		Male	Female	Male	Female	Male	Female	
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	329	25.2	38.9	4.3	4.0	11.9	15.8	0.6
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	145	20.7	33.8	1.4	8.3	19.3	16.6	0.9
2013	187	9.1	26.2	4.3	16.6	24.1	19.8	1.0
2014	190	10.5	16.8	2.1	10.5	30.5	29.5	2.2



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, transportation and utility corridors, 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 (Christiansen 2012). 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 2015 (version 4). 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 (Christiansen 2010). 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

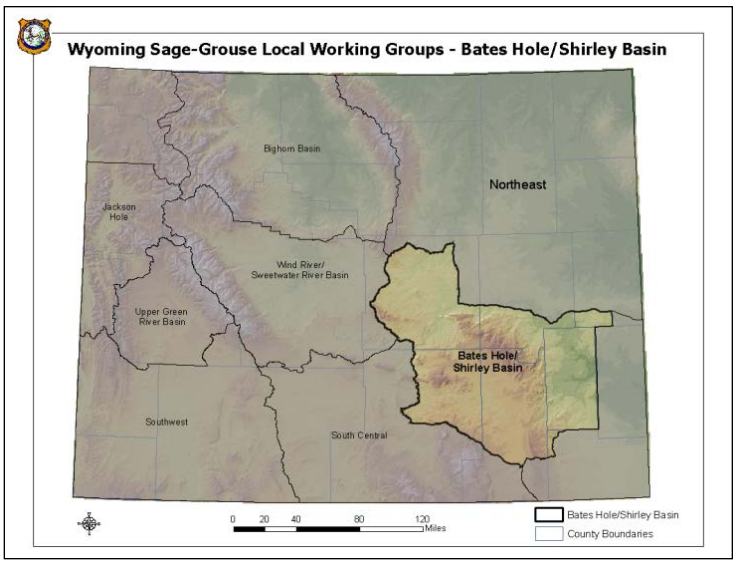
strategies dating back to the mid-1990's. Within sage-grouse populations having less than 100 males attending leks, hunting seasons should be closed to prevent additive mortality on small, isolated populations (BHSBLWG 2007). Hunting seasons have thus been closed in Niobrara, Platte, Goshen and Laramie 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 resulted in reduced harvest pressure on hens compared to an early September season (Heath et al. 1997). In early September, hunters tend to disproportionately focus harvest pressure along drainages and near water sources, which is where successful hens with broods are most commonly found. In late September, hens (especially successful brood rearing hens) are typically more widely distributed across the landscape and occur in mixed flocks. Therefore, shifting hunting seasons to late September has not only reduced harvest pressure on females, but has also reduced hunter effort (Christiansen 2010). 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

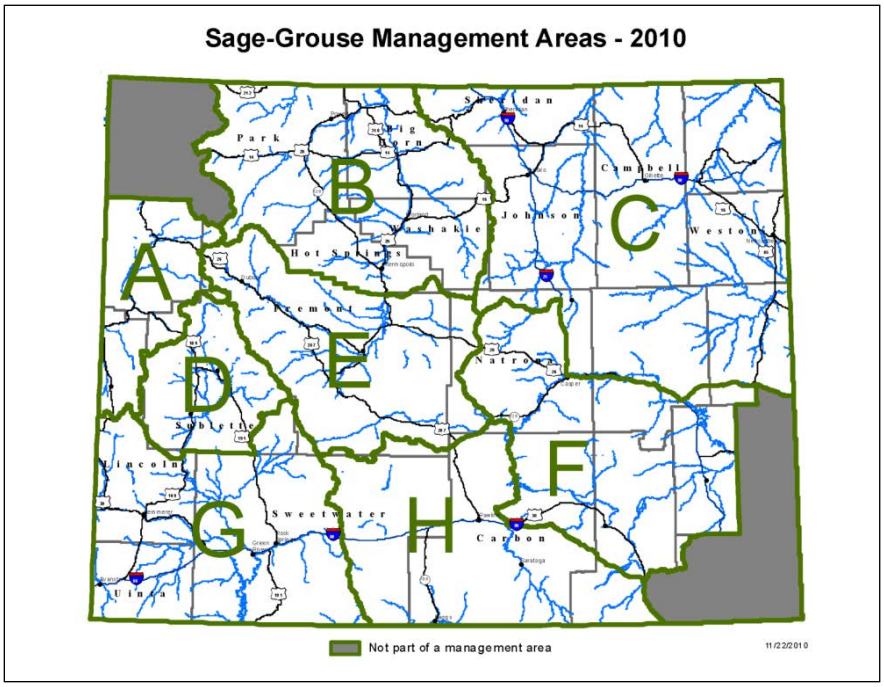
The BHSBLWG area includes Bates Hole, the Shirley Basin, the Rattlesnake Hills, the southern Bighorn Mountains, the Laramie Range, and isolated occupied habitats in southern Niobrara and Platte County (Figure 1). Political jurisdictions include Albany, Carbon, Converse, Laramie, Natrona, Niobrara, and 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

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 2015, 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 are included in the monitoring protocol (Christiansen 2012). 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, 2015.

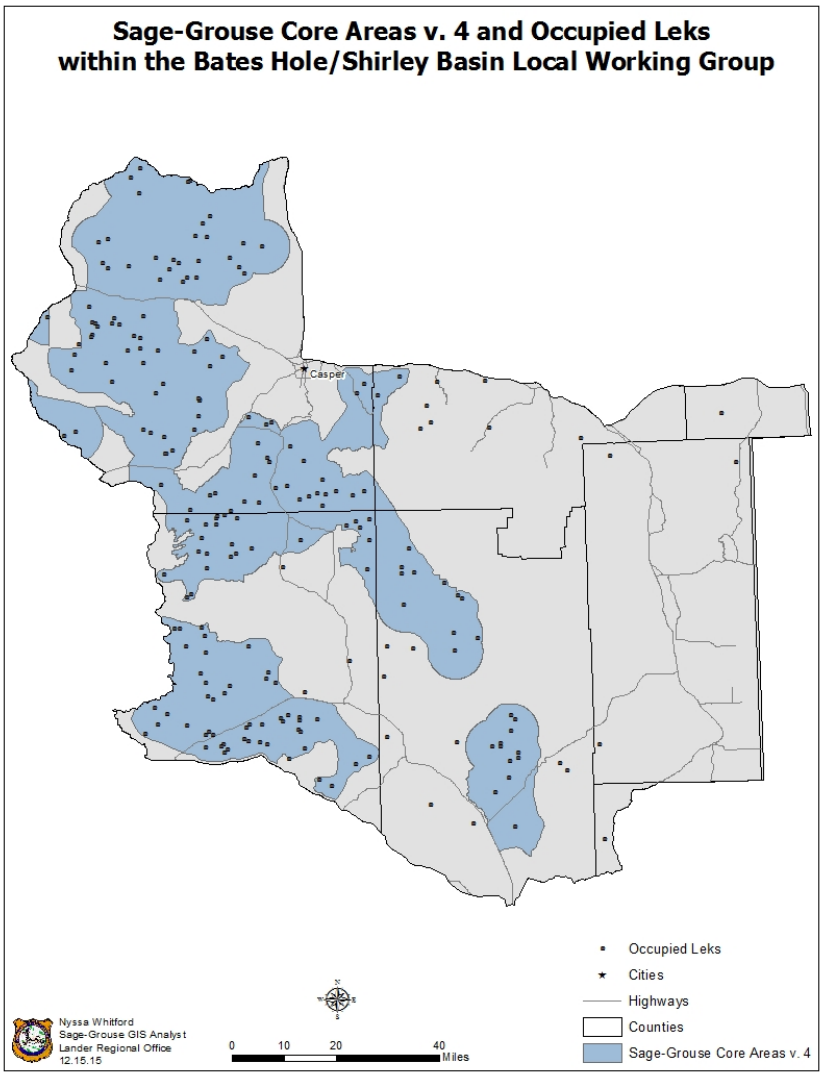


Figure 4. Sage-grouse lek demographics within the BHSBLWG area, 2015.

Sage Grouse Lek Characteristics

Working Group: Bates Hole

Region	Number	Percent
Casper	119	38.9
Lander	2	0.7
Laramie	185	60.5

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	120	39.2
Lander	2	0.7
Newcastle	1	0.3
Rawlins	183	59.8

Biologist	Number	Percent
Casper	114	37.3
Douglas	9	2.9
Laramie	107	35.0
Rawlins	2	0.7
Saratoga	67	21.9
Wheatland	7	2.3

Warden	Number	Percent
Cheyenne	2	0.7
Douglas	3	1.0
East Casper	37	12.1
East Rawlins	2	0.7
Elk Mountain	69	22.5
Glenrock	8	2.6
Lusk	1	0.3
Medicine Bow	66	21.6
North Laramie	40	13.1
West Casper	72	23.5
Wheatland	6	2.0

County	Number	Percent
Albany	74	24.2
Carbon	108	35.0
Converse	11	3.6
Laramie	2	0.7
Natrona	105	34.3
Niobrara	1	0.3
Platte	6	2.0

Land Status	Number	Percent
BLM	96	31.4
BOR	1	0.3
Private	183	59.8
State	26	8.5

Management Area	Number	Percent
F	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 increasing numbers of leks being monitored over time and enabling meaningful comparisons of current sage-grouse data to a running 10-year average. In 2015, WGFD personnel, BLM personnel, volunteers and consultants combined efforts to check 192 of the 217 (88%) known occupied leks in the BHSBLWG area. A total of 100 leks were counted while 92 leks were surveyed in 2015. Of the 192 occupied leks that were checked and annual status was confirmed (N=182), 150 (82%) were active and 32 (18%) were inactive.

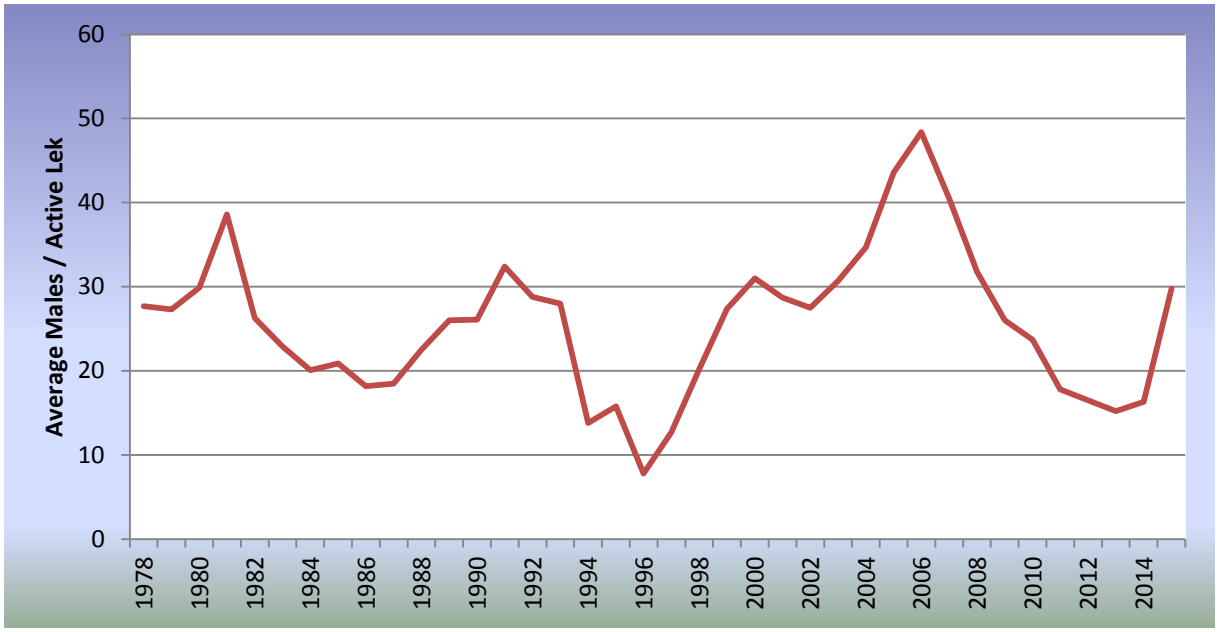
It is important to consider trends in the numbers of active versus inactive leks in addition to average male lek attendance. During a period of population decline, male lek attendance decreases while the number of inactive leks typically increases. The converse occurs with an increasing population. The percent of active occupied leks (that were checked) generally decreased in the BHSBLWG area over the past 10 years as sage-grouse numbers declined from 2006 – 2013. However, the 2015 percentage of active leks (82%) increased from last year (73% in 2014), but was still below the 10-year average of 86%. This increased percentage of active occupied leks was likely due to a growing sage-grouse population over the past two years, with some smaller leks again becoming active. There is always some variation in the annual percentage of occupied leks being active. This variation can be attributed to both population fluctuations and survey effort. Survey effort has been relatively consistent over the past 10 years in the BHSBLWG area, with the total number of leks checked ranging from 195 – 221. However, leks that are not checked in some years tend to be smaller, more difficult to access, or have been compromised in some manner (e.g. due to disturbance). Both disturbed and smaller leks have a higher probability of becoming inactive during a population nadir, such as that of 2013. Regardless, it is important to continue to monitor as many leks as possible, including smaller and marginal leks, to ensure they are classified appropriately (i.e. occupied, unoccupied or undetermined). Where sufficient monitoring data has shown a lek is no longer occupied, it is reclassified as unoccupied as per established protocol.

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, from anthropogenic disturbances such as natural resource development or poor grazing practices, or from natural disturbances such as wildfire. Since 1998, many abandoned leks have been monitored, with no indication these leks have begun to be reoccupied. However, many of these leks have generic location-data, which calls into question the veracity of the original lek locations. In cases where actual leks with historic data 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.

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 active 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. Regardless, 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 BHSBLWG area 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 37 years within the BHSBLWG area (Figure 5).

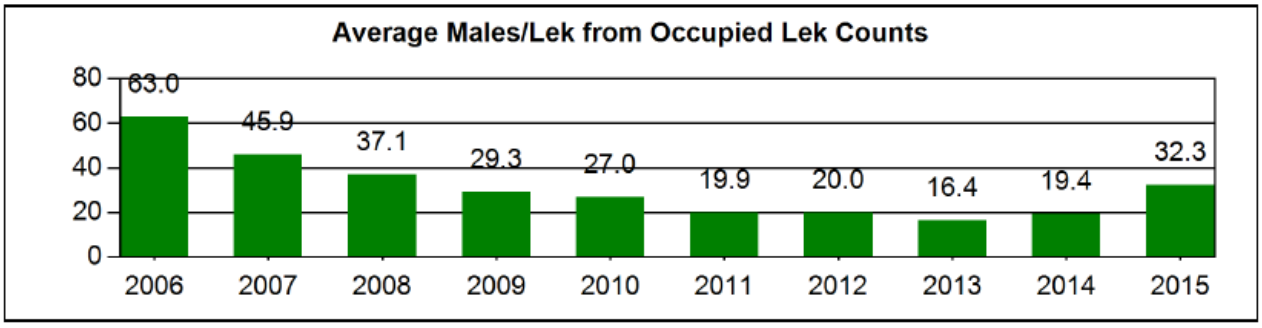
Figure 5. Mean number of peak males per active lek checked within the BHSBLWG area, 1978 – 2015.



*From 1978-1983, an average of 93 leks were checked each year.
*From 1984-1991, an average of 78 leks were checked each year.
*From 1992-1995, an average of 33 leks were checked each year.
*From 1996-2004, an average of 100 leks were checked each year.
*From 2005-present, an average of 175 leks were checked each year.

Following a period of substantial decline, sage-grouse populations have significantly increased over the past two years based on the mean maximum number of males observed per counted lek (Figure 6). The average number of males observed per count lek peaked at 63 in 2006, and subsequently declined each year to a nadir of 16 in 2013. Male lek attendance has since increased over the last two years. In 2015, the average number of peak males observed per count lek improved to 32.3, which marked a 97% increase compared to that of 2013. The 2013 nadir was the lowest average recorded male lek attendance for the BHSBLWG area since intensive lek monitoring began in 1998.

Figure 6. Mean number of peak males per count lek within the BHSBLWG area, 2006 – 2015.



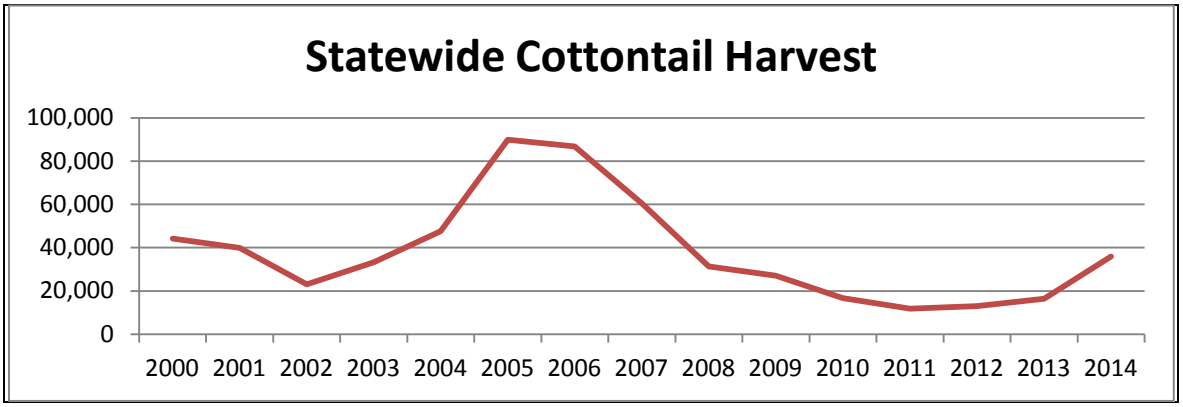
Productivity

Classifying wings based on sex and age from harvested sage-grouse provides a meaningful indicator of annual sage-grouse chick productivity. During fall hunting seasons, hunters predominantly select for hens and chicks, and typically do not differentiate between the two. Sampling bias is therefore assumed to be minimal when analyzing the ratio of chicks per hen in hunter harvested sage-grouse wings. However, hunter selectivity and sage-grouse habitat use do result in adult and yearling males being under-represented in the harvest compared to their proportion of the population. 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. Brood survey data will therefore not be discussed here.

Based on wing data, chick productivity was excellent in 2014 with an observed 2.2 chicks per hen in the BHSBLWG area. This marked the highest chick:hen ratio measured in wing data since 1998. Over the last 10 years, wing-barrel estimated productivity has fluctuated between 0.6 and 2.2 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 2014 ratio marked the first time in the past 10 years that chick production/survival has been high enough to permit a significant increase in sage-grouse populations. Such good productivity can be attributed to consecutive years of excellent precipitation resulting in abundant nesting cover and herbaceous forb production.

In addition, sage-grouse population cycles are highly correlated with cottontail rabbit population cycles over long time series (Fedy and Doherty 2010). Therefore, the current increasing trend in the BHSBLWG sage-grouse population may be partially explained by the dramatic increase in cottontail densities over the past two years. Within the BHSBLWG area, both sage-grouse populations and cottontail rabbit densities increased through 2006, subsequently declined, and are now increasing. In 2006, widespread epizootics of tularemia were reported in much of Wyoming, and cottontail rabbit densities subsequently crashed that year. The only cottontail rabbit data now collected in Wyoming is the estimated annual statewide harvest, which is highly correlated with cottontail densities (Figure 7). Statewide harvest data also infers cottontail populations peaked in 2006, subsequently crashed, and are now increasing. Anecdotal observations of rabbit densities from WGFD field personnel corroborate this, especially over the past two years. Although outside of this reporting period, WGFD personnel observations indicate cottontail densities were extremely high during the summer and fall of 2015.

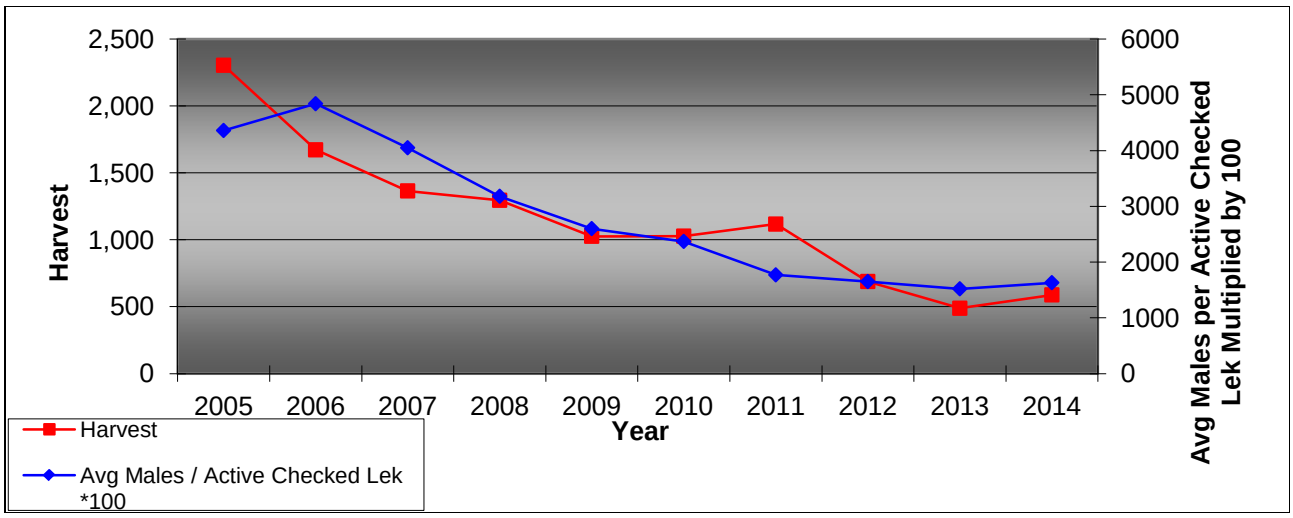
Figure 7. Statewide Wyoming cottontail harvest, 2000 – 2014.



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 when hunting seasons are consistent over time. 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 488 in 2013. In 2014, harvest increased to 588 sage-grouse in the BHSBLWG area as improved chick production/recruitment resulted in sage-grouse population growth. Over the last 10 years, trends observed in harvest data generally mirror those observed in male lek attendance within the BHSBLWG area (Figure 8).

Figure 8. Total sage-grouse harvested per year and the average number of males per active lek checked within the BHSBLWG area, 2005 – 2014.



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).

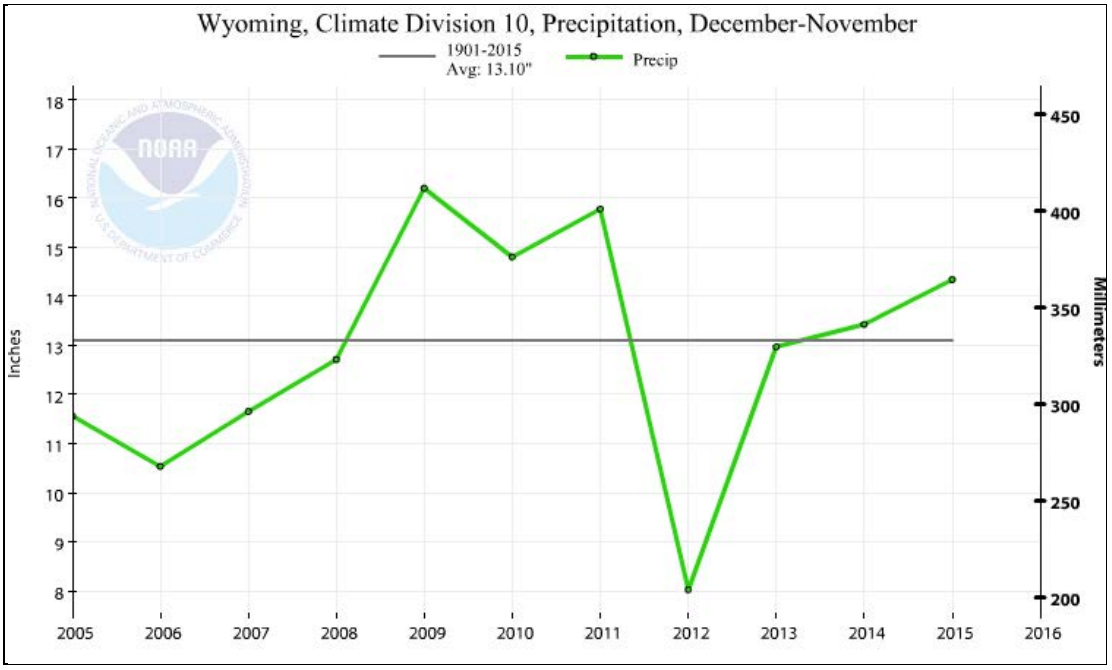
Habitat

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, large-scale sagebrush eradication programs have been largely abandoned, and significant portions of the landscape are now enrolled in grazing systems which are designed to be sustainable and promote healthy rangelands. In addition, 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 projects 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 within the BHSBLWG area 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 Bates Hole / Shirley Basin Local Working Group.

Weather

Based on the data obtained from the National Oceanic and Atmospheric Administration (NOAA), the Upper North Platte climatic division higher than normal precipitation in 2014 (Figure 9). This resulted in excellent sagebrush leader growth and herbaceous vegetation production in 2014. Nesting cover was excellent in 2014, without extensive cold, wet weather during the peak hatching period, which enhanced chick production and survival. The spring of 2015 also experienced wetter-than-normal conditions, which has certainly benefitted sage-grouse and sagebrush ecosystems over this past year.

Figure 9. NOAA Precipitation Data for the Upper North Platte drainage, Wyoming Climate Division 10, 2005-2015 (httphttp://www.ncdc.noaa.gov/cag/time-series/us).



Special Studies

Western EcoSystems Technology, Inc. has continued to provide 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 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). Some results from this thesis were also published in a peer-reviewed journal (LeBeau 2014.)

Diseases

There were no confirmed cases of West Nile virus (WNv) in sage-grouse within the BHSBLWG area during this reporting period. Normal monitoring efforts were in place. These consisted of requesting researchers with radio-marked 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 ranchers and 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 is unknown, but potentially significant. Regardless, sage-grouse populations have increased over the past two years despite any potential impacts from WNv.

Bates Hole / Shirley Basin LWG Conservation Plan Addendum
The BHSBLWG Conservation Plan was updated to reflect major state and federal policy changes in 2013. A Conservation Plan Addendum was completed in July 2013 and is available on the Wyoming Game and Fish Department website at:

https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Sage%20Grouse/SG_BSBASIN_CONSVPLAN.pdf.

Recommendations

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

2. Enhance efforts to document sage-grouse use in ephemeral / mesic drainages where sagebrush has been removed to enhance herbaceous grass and forb production for the benefit of early and late brood rearing habitats.

3. 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.

4. 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.

5. 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.

6. Continue to monitor inactive or unoccupied leks to adjust classification designation as appropriate.

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

8. Continue to inventory abandoned leks to ensure they are appropriately classified and determine whether or not they should continue to remain in the database as per protocol.

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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
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
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
SG Education and Community Outreach	2007-08	$13,000 requested/ approved	Develop and administer sage-grouse conservation educational programs in the Casper area	Audubon Wyoming
Western Natrona County Sage-Grouse Study	2007-08	$7,210 requested/ approved	Seasonal distribution and habitat use for land use planning along with parasite/disease assay	BLM, WGFD, University of Wyoming, Casper College
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
Shook Ranch Range Improvement	2007-08	$10,000 requested/ approved	Prescribed fire in mountain big sage, developing and protecting water sources, installing a cross fence and implementing rotational grazing system	Shook Ranch, NRCS
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
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

3-Man Ranch Upland Habitat Improvement	2007-08	$13,944 requested/ approved	Water development and fencing to facilitate rest-rotation grazing system	3-Man Ranch, WGF LIP, WWNRT
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
M&D Land Wildlife Inventory	2007-08	$10,500 requested/ approved; $10,302 spent	Wildlife surveys, range surveys & management consultation	NRCS
Schnoor/Flat Top Big Sagebrush Restoration	2007-08	$18,305 requested/ approved	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
Water trough escape ramps, spring protection and fence markers*	2007-08	$36,000 requested/ approved	Provide pre-fab wildlife escape ramps, fence collision deterents and spring protection fencing to private landowners throughout the state.	WWNRT, Landowners, WGFD
Impacts of wind energy development in SE WY*	2009-10	$22,750 requested/ approved	Research to determine impacts of wind energy development to sage-grouse	Horizon Wind Energy, Iberdrola Renewables
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
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
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

Impacts of wind energy development in SE WY*	2011-12	$110,000 requested; $85,000 approved	Research to establish the short-term effects of wind development to sage-grouse	National Wind Coordinating Collaborative, Western Assoc. of Fish & Wildlife Agencies
Henderson Draw cheatgrass treatment	2011-12	$50,000 requested/ approved	Cheatgrass control	BLM - Casper F.O.
Audubon Community Naturalist (see also #53)	2011-12	$10,000 requested/ approved	Sagebrush ecosystem education program for schools	various foundations and grants
North Laramie Range cheatgrass control	2011-12	$26,000 requested/ approved	Cheatgrass control	WWNRT, WGFD, Gov's Big Game Lic. Coalition
Response of sage-grouse to sagebrush treatment in Fremont County*	2011-12	$189,800 requested/ approved	Research to determine sage-grouse demographic and habitat use response to sagebrush treatments	Univ. of Wyoming, WGFD
Estimating noise impacts for habitat selection modeling*	2011-12	$49,335 requested/ approved	Research to develop a noise model and determine noise exposure thresholds	Univ. California-Davis
Audubon Community Naturalist (see also #53)	2013-14	$10,000 requested/ approved	Sagebrush ecosystem education program for schools	various foundations and grants
North Natrona cheatgrass treatment	2013-14	$60,000 requested/ approved	Cheatgrass control northwest of Casper in the Natrona Core Area	BLM - Casper F.O.
Impacts of wind energy development in SE WY*	2013-14	$50,000 requested/ approved	Research to establish the short-term effects of wind development to sage-grouse	National Wind Coordinating Collaborative, Western Assoc. of Fish & Wildlife Agencies
Impacts of wind energy development in SE WY*	2015-16	$18,000 approved	Research to establish the short-term effects of wind development to sage-grouse	National Wind Coordinating Collaborative, Western Assoc. of Fish & Wildlife Agencies
Audubon Community Naturalist (see also #53)	2015-16	$10,000 requested/ approved	Sagebrush ecosystem education program for schools	various foundations and grants
Response of sage-grouse to sagebrush treatment in Fremont County*	2015-16	$15,000 approved	Research to determine sage-grouse demographic and habitat use response to sagebrush treatments	Univ. of Wyoming

Audubon statewide sage-grouse habitat modeling	2015-16	$17,000 approved	Use various remote imaging and GIS mapping techniques to map sage-grouse habitat throughout Wyoming	Unknown
Bates Creek cheatgrass treatment	2015-16	$15,000 approved	Treat cheatgrass in sage-grouse habitat to promote rangeland health and restore perennial grass cover and forb production	WGFD, WWNRT
Mud Springs sagebrush thinning	2015-16	$35,000 approved	Mechanically treat dense high canopy coverage sagebrush in snow accumulation zones to open canopy and promote brood rearing habitat	WGFD, WWNRT
Statewide 0.5 meter resolution NAIP imagery for core areas	2015-16	$10,000 approved	Assist in statewide effort to obtain high resolution aerial imagery for all core areas in Wyoming	Various entities
50-Mile Flat restoration	2015-16	$30,000 approved	Restore vegetation including sagebrush to 50-Mile Flat (which is a monoculture of crested wheatgrass adjacent to sage-grouse habitat)	WGFD, BLM, others

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

Big Horn Basin
Sage-Grouse
Job Completion Report
2014

June 2014-May 2015

Leslie Schreiber
Wyoming Game & Fish Dept.
Cody Region

Cody Region Sage-Grouse Job Completion Report

Conservation Plan Area: **Big Horn Basin**
Period Covered: **6/1/2014 – 5/31/2015**
Prepared by: **Leslie Schreiber**

INTRODUCTION

During the late 1990s, concerns increased over degradation and fragmentation of sagebrush ecosystems and declines in greater sage-grouse (*Centrocercus urophasianus*; hereafter, sage-grouse) populations. Wyoming Game & Fish Department (WGFD) increased monitoring efforts for sage-grouse across the state and also formed an internal working group in 1997 to focus on sage-grouse management issues. In addition, a state-wide citizens working group was formed in 2000 consisting of representatives from government agencies (state and federal), agriculture, extractive industries, environmental groups, hunting groups, and Native American tribal interests. This citizens' group produced the *Wyoming Greater Sage-grouse Conservation Plan (The State Plan)*, which was approved and adopted by the WGF Commission in 2003. The State Plan called for creation of local working groups (LWG) to formulate strategies at a local level to address sage-grouse conservation; eight local working groups were formed in 2004 (Figure 1).

Similar to the state-wide working group, the Big Horn Basin LWG (BHBLWG), in north-central Wyoming (Figure. 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 and updated it in 2013 which can be found at: https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management.

Between 1999 and 2003, 7 petitions were filed to list the greater sage-grouse for protection under the Endangered Species Act. In 2010 the U.S. Fish and Wildlife Service (USFWS) re-issued its decision of "warranted but precluded" for listing greater sage-grouse after judicial and other extended reviews of its decisions. Thus, sage-grouse became a "candidate" for listing but were precluded from immediate listing due to higher priorities. A federal court stipulated agreement requires the U.S. Fish & Wildlife Service to reevaluate the status of greater sage-grouse by September 30, 2015.

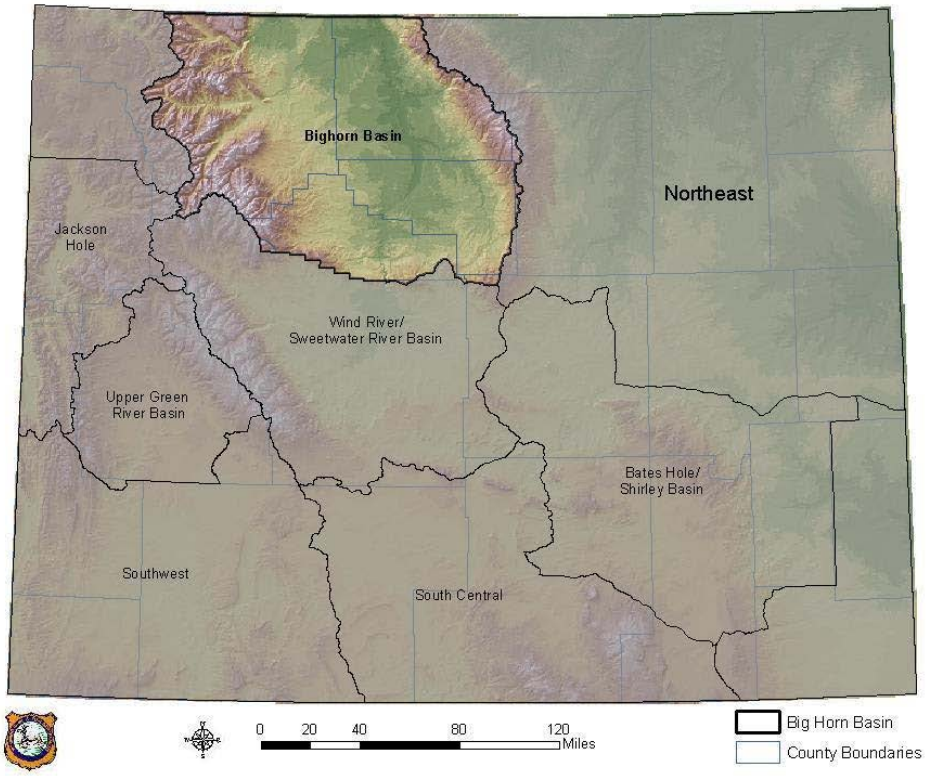
This report summarizes conservation efforts and data collected on sage-grouse in the Big Horn Basin during the 2014 biological year (1 June 2014–31 May 2015), including lek surveys conducted during the 2015 breeding season.

STUDY AREA

The Big Horn Basin Conservation Area (hereafter, Basin) encompasses over 12,300 square miles and is mostly public land managed by the BLM (40%), Forest Service (25%), State "school sections" (5%), or other government agencies (>1%; Bureau of Reclamation, National Park Service). Over 3,100 square miles of the Basin are private land (25%). Counties within the Basin include Big Horn, Hot Springs, Park, and Washakie. Historically, WGFD divided the state

into management areas for data collection and reporting of small and upland game species. Sage-grouse specific management areas were created in 2010 with the Basin as Area B (Figure 1). Primary land uses in the Basin include livestock grazing, farming, oil and gas development, bentonite mining, urban and suburban developments, recreation, and wildlife habitat.

Figure 1. Big Horn Basin Conservation Area in Wyoming.



Vegetation communities within the Basin are diverse and vary according to soil type, annual precipitation, and elevation. Major vegetation communities in the Basin include sagebrush/grassland, salt desert shrub, agricultural crops, pasture lands, cottonwood riparian corridors, mixed mountain shrub, and mixed conifer forests with interspersed aspen stands at higher elevations.

Connelly et al. (2004) recognized sage-grouse in the Basin as a distinct sub-population (Figure 2). Mountain ranges to the east and west restrict most sage-grouse movement due to unsuitable habitat. Sage-grouse movements are not well documented in the northwest and southeast areas of the Basin. There are several leks near the Wyoming/Montana state line with movement between states occurring. Copper Mountain, the Owl Creek Mountains, and the southern Bighorn Mountains provide suitable habitat serving as travel corridors to adjacent populations.

In 2015, 302 sage-grouse leks are known to occur in the conservation area with 246 leks known to be occupied and 33 leks known to be unoccupied (Table 1). Undetermined leks (n=23) need additional observations before being reclassified as occupied or unoccupied. A majority of leks (67%) occur on BLM managed land and 25% of leks occur on private land (Table 1). There are most likely other leks in the Basin not yet discovered.

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

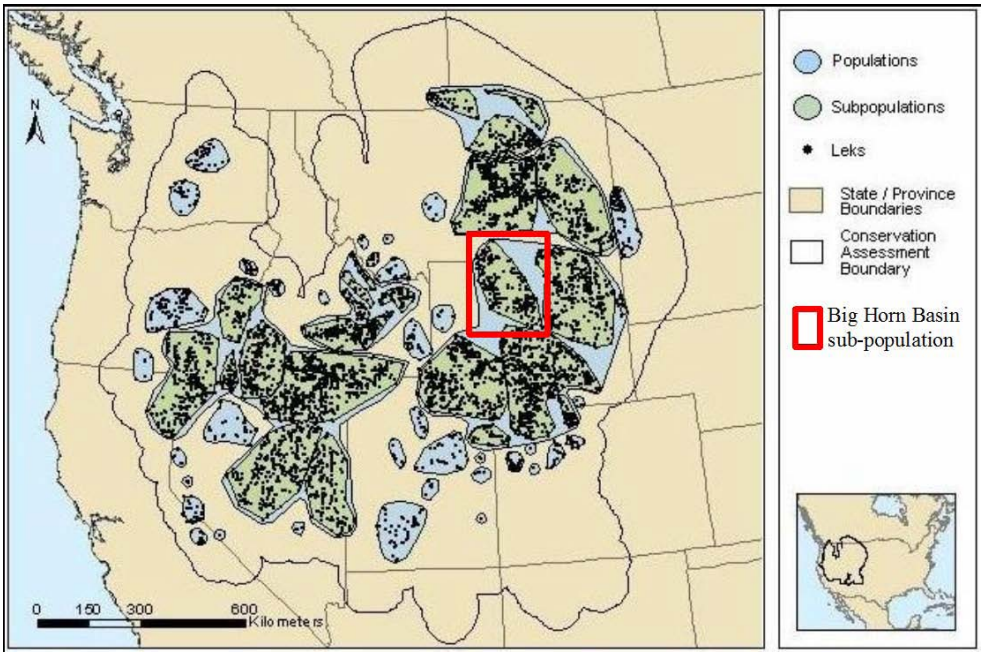


Table 1. Lek classifications in the Big Horn Basin by activity, ownership and geopolitical boundaries, 2015.

Working Group: Big Horn Basin

Region	Number	Percent
Cody	302	100.0

Working Group	Number	Percent
Big Horn Basin	302	100.0

Classification	Number	Percent
Occupied	246	81.5
Undetermined	23	7.6
Unoccupied	33	10.9

BLM Office	Number	Percent
Cody	111	36.8
Worland	191	63.2

Biologist	Number	Percent
Cody	81	26.8
Greybull	52	17.2
Worland	169	56.0

Warden	Number	Percent
Greybull	30	9.9
Lovell	20	6.6
Meeteetse	38	12.6
North Cody	21	7.0
Powell	16	5.3
South Cody	19	6.3
Tensleep	47	15.6
Thermopolis	44	14.6
Worland	67	22.2

County	Number	Percent
Big Horn	47	15.6
Hot Springs	58	19.2
Park	101	33.4
Washakie	96	31.8

Land Status	Number	Percent
BLM	202	66.9
BOR	3	1.0
Private	76	25.2
State	21	7.0

Management Area	Number	Percent
B	302	100.0

METHODS

Data on the number of male sage-grouse attending leks are collected in two ways: lek surveys and lek counts. Lek surveys inform us if the lek is active and require at least 1 visit to the lek during the breeding season from mid-March to mid-May. Whereas, lek counts document the maximum number of male sage-grouse in attendance and require 3 or more visits to a lek, with each visit separated by about 7-10 days, during the peak of strutting activity from early April to early May. For an in-depth review of lek survey methods, see the Biological Handbook (Christiansen 2012). Lek surveys in the Basin are performed by WGFD wardens and biologists, BLM personnel, and volunteers. After completing their surveys, observers send lek datasheets to the WGFD Cody Regional office for entry into the sage-grouse database.

In 2012, WGFD changed how lek data were calculated and reported. Prior to 2012, leks with fresh sign (feathers, droppings), but with 0 males were included in calculating average male lek attendance. Average male lek attendance is now calculated using only leks with ≥1 observation of strutting males, while leks with only sign (feathers, droppings) are excluded.

No consistent methodology has been established for brood surveys. Sage-grouse brood data is opportunistically collected by field personnel while doing other field work during July and August. Data on the number of chicks, adult hens, and adult males along with location (UTM coordinates) and habitat type, are recorded and then entered into the Wildlife Observation System (WOS).

Harvest information is obtained through a mail questionnaire of bird hunters who provide data on number of birds harvested, days hunted, and areas hunted. Hunter survey data was compiled by county prior to 1982; by small and upland game management area from 1982 to 2009; and then in 2010, sage-grouse management areas were consolidated into 8 conservation areas with the Basin designated as Management Area B (Figure 1).

RESULTS AND DISCUSSION

Lek Monitoring In spring 2015, 52 leks were counted in the Basin, resulting in an average of 26.5 males per lek (Table 2a). We surveyed 140 leks (2006-15 average=108; Table 2b), for a total of 192 leks checked during 2015 (2006-15 average=174; Table 2c). To evaluate long-term population trends, we combine and average survey and count lek data since the count protocol was not used during the late 1980s and early 1990s. Fortunately, long-term data sets from Wyoming and neighboring states indicate similar trends from both counts and surveys (Fedy and Aldridge 2011; Figure 3).

The average number of male sage-grouse on both counted and surveyed leks nearly doubled from 11.7 in 2014 to 21.6 in 2015 (Table 2c), indicating an upswing in the population (Figure 4). Sage-grouse populations cycle on approximate 7 to 10-year intervals (Fedy and Doherty 2010) (Figure 4). During an upswing in the population, we would expect a decrease in the number of inactive leks. However, the number of inactive leks in the Basin increased from 21 in 2014 to 23 in 2015. We attribute this increase to personnel expending greater effort to classify the lek as active or inactive. The number of active leks (n=157) and the number of inactive leks (n=23) are the highest in the last 10 years, but the number of unknown leks (n=12) is the lowest in the past 10 years (Table 2d). With 2 years of data indicating an increase in population abundance, it seems that the negative trend of the past 7 years is reversing (Figure 4).

Table 2 (a-d). Lek attendance summary of occupied[1] leks in the Big Horn Basin, 2006-2015.

a. Leks Counted

Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek[2]
2006	202	64	32	1694	28.7
2007	204	72	35	1901	28.4
2008	217	96	44	2083	24.8
2009	218	74	34	1717	25.6
2010	222	74	33	1495	21.7
2011	230	64	28	905	16.2
2012	234	53	23	816	16.7
2013	236	42	18	501	12.5
2014	234	69	29	824	14.2
2015	247	52	21	1085	26.5

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek[2]
2006	202	96	48	1753	24.0
2007	204	82	40	1550	22.1
2008	217	79	36	1121	16.7
2009	218	95	44	1244	18.6
2010	222	108	49	1242	15.1
2011	230	120	52	989	12.8
2012	234	127	54	778	8.7
2013	236	147	62	750	8.2
2014	234	89	38	525	9.2
2015	247	140	57	2289	19.9

c. Leks Checked (combined surveyed and counted)

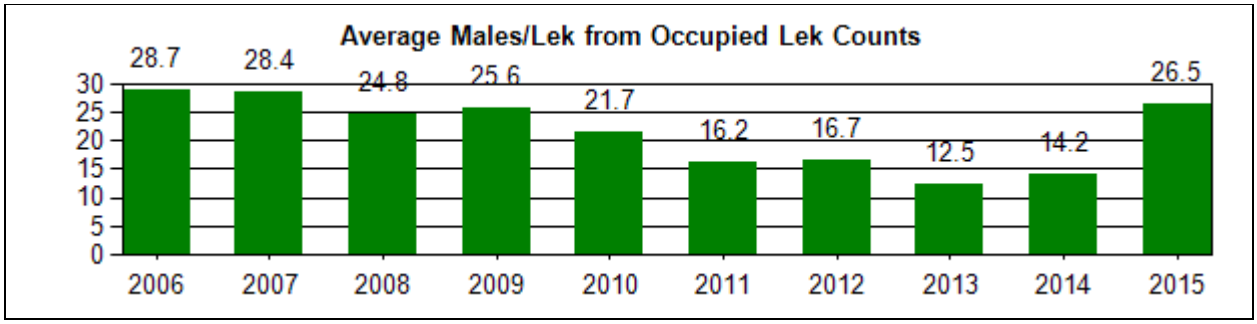
Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek[2]
2006	202	160	79	3447	26.1
2007	204	154	75	3451	25.2
2008	217	175	81	3204	21.2
2009	218	169	78	2961	22.1
2010	222	182	82	2737	18.1
2011	230	184	80	1894	14.2
2012	234	180	77	1594	11.6
2013	236	189	80	1251	9.5
2014	234	158	68	1349	11.7
2015	247	192	78	3374	21.6

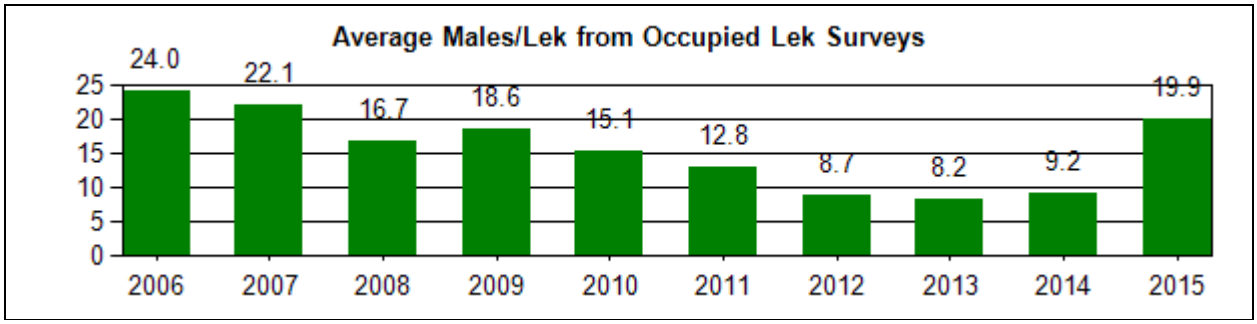
d. Lek Status

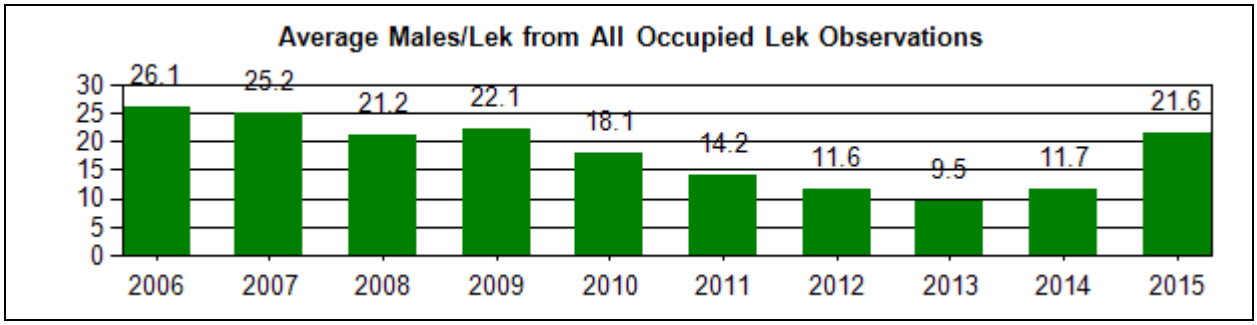
Year	Active	Inactive[3]	Unknown	Known Status	Percent Active	Percent Inactive
2006	130	13	17	143	90.9	9.1
2007	136	3	15	139	97.8	2.2
2008	148	6	21	154	96.1	3.9
2009	129	9	31	138	93.5	6.5
2010	144	7	31	151	95.4	4.6
2011	130	7	47	137	94.9	5.1
2012	145	4	31	149	97.3	2.7
2013	133	7	49	140	95.0	5.0
2014	117	21	20	138	84.8	15.2
2015	157	23	12	180	87.2	12.8

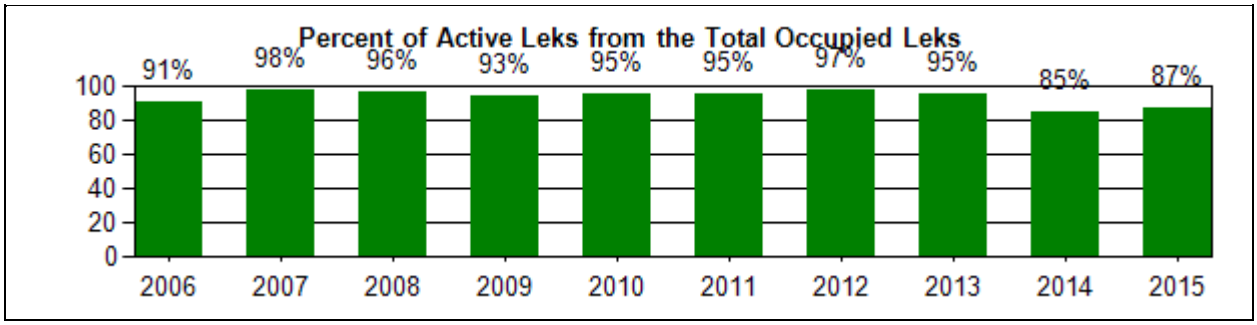
[1]Occupied – Active during previous 10 years (see official definitions)
[2]Avg Males/Active Lek – Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.
[3]Inactive – Confirmed no birds/sign present (see official definitions)

Figure 3. Average number of male sage-grouse observed per lek in the Big Horn Basin by counts, surveys and all observations, 2006-15.









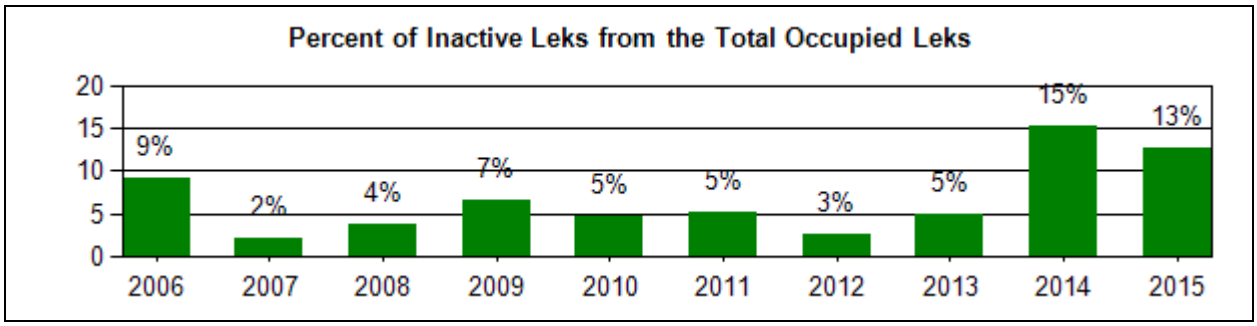
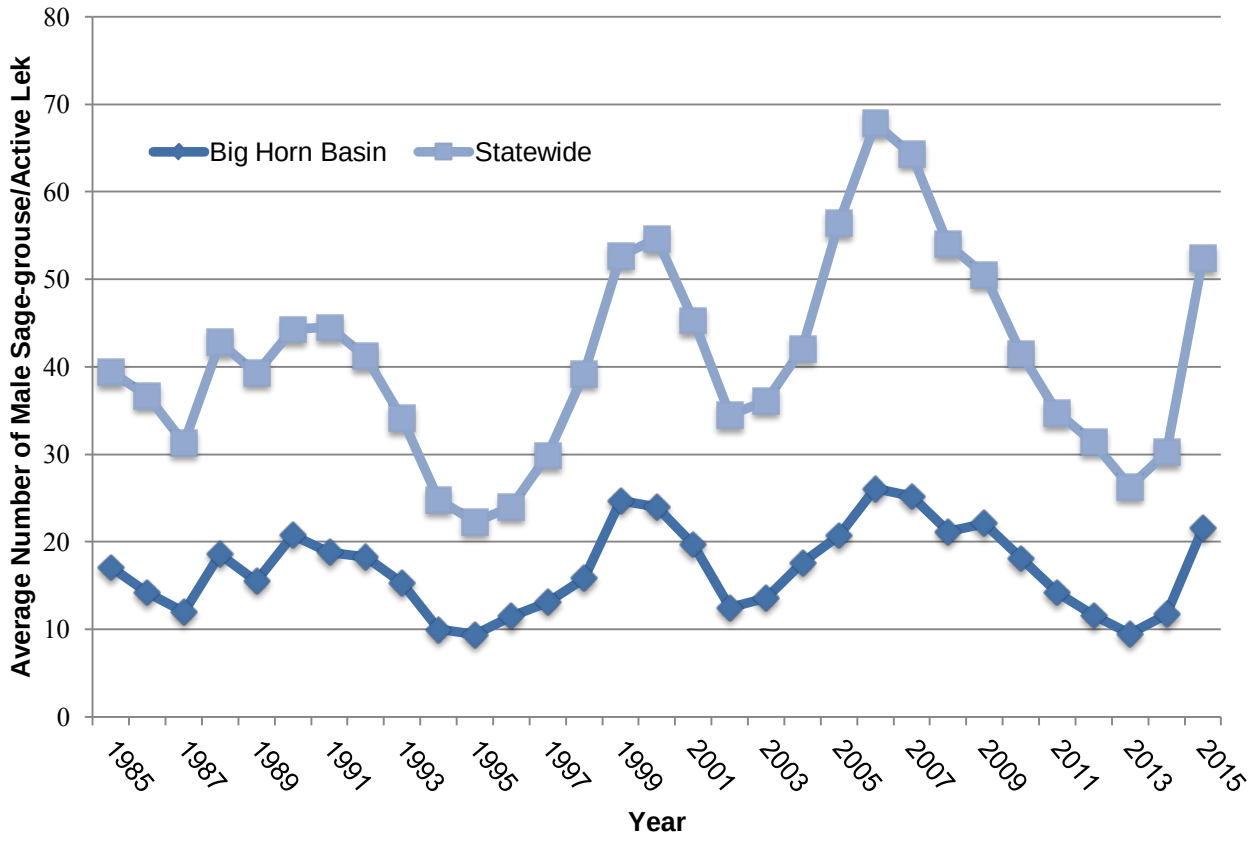


Figure 4. Trends in average male attendance for all lek observations in the Big Horn Basin and state-wide, 1985-2015.



Production surveys Thirteen sage-grouse broods were documented in 2015 (Table 3). Sample sizes (number of groups observed) from 2011-2014 were too small to estimate chick production (chicks/brood or chicks/hen) in the Bighorn Basin management area. Low sample sizes are likely a product of lack of effort. Sage-grouse brood data is opportunistically collected by field personnel while performing other duties during July and August. A direct connection between effort (time spent surveying for broods) and number of broods observed was established in previous Job Completion Reports (JCR). In other portions of Wyoming, wings from harvested grouse are analyzed to estimate chick production; however, we collect an insufficient number of wings in the Basin to draw meaningful conclusions, thus this technique was discontinued by the Cody Region.

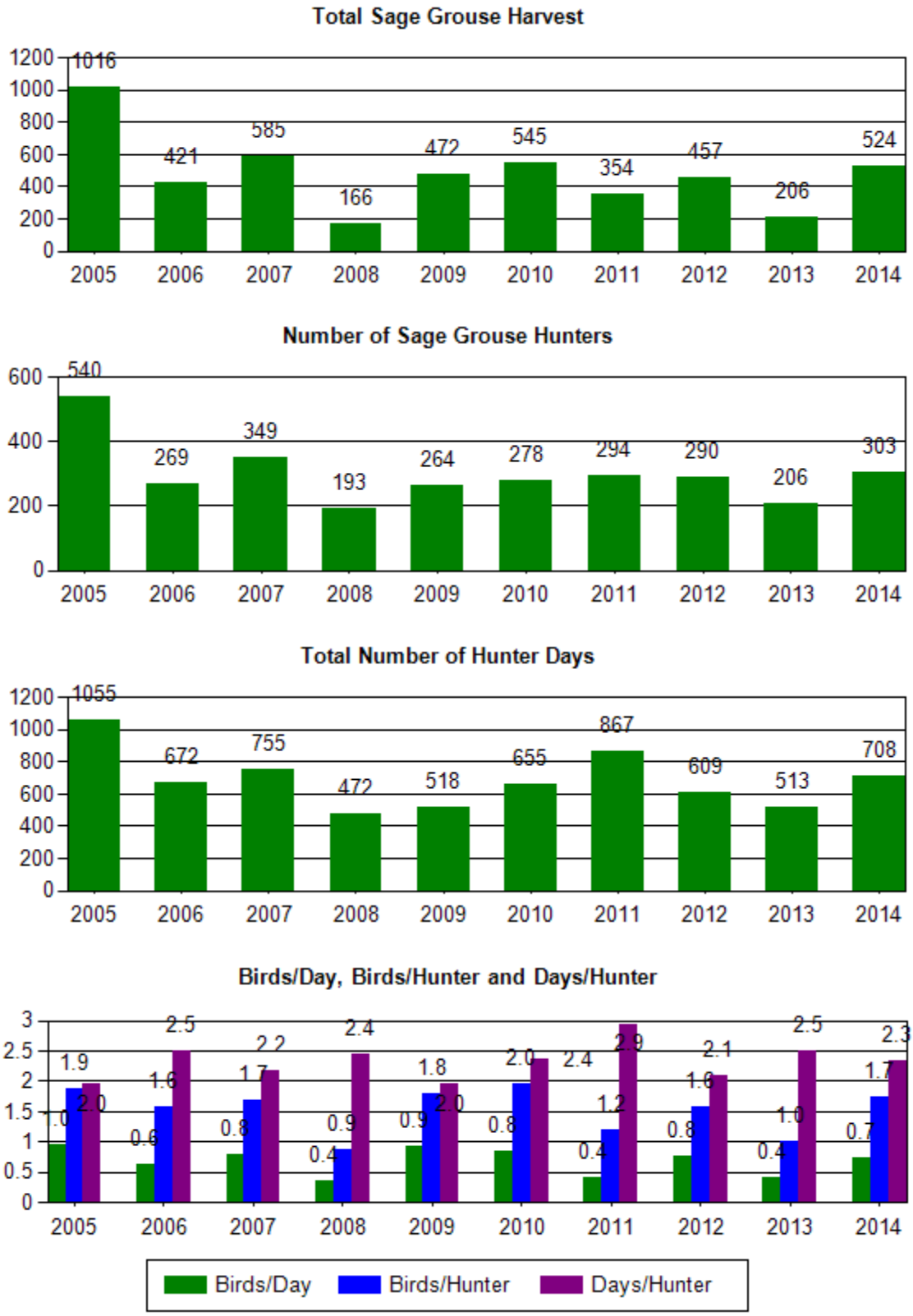
Table 3. Brood survey data collected by Wyoming Game & Fish Department personnel in the Bighorn Basin, 2001-15.

Year Observed	Broods	Chicks	Hens	Chicks/brood	Chicks/hen
2001	14	51	24	3.6	2.1
2002	10	35	16	3.5	2.2
2003	24	103	30	4.3	3.4
2004	17	71	73	4.2	1
2005	23	123	41	5.3	3
2006	24	99	38	4.1	2.6
2007	56	191	99	3.4	1.9
2008	18	88	29	4.6	3
2009	26	104	33	4	3.2
2010	17	64	17	3.8	3.8
2011	0	0	18	0	0
2012	8	26	8	3.3	3.3
2013	8	30	9	3.8	3.3
2014	6	31	27	5.2	1.1
2015	13	69	24	5.3	2.9
2001-14 average	***17.9***	***72.6***	***33.0***	***3.8***	***2.4***

Hunting season and harvest The opening day of sage-grouse season was moved from 1 September to the third Saturday in September during 1995. Research suggests that hens and broods are more dispersed and less vulnerable to hunting later in the fall. Hunting seasons averaged 25 days long (range 16-31 days) between 1982-94 and about 15 days between 1995-2001. Due to concerns over low populations, the hunting season was again shortened in 2002 and daily bag limit decreased from 3 to 2 sage-grouse. Hunting seasons averaged 11 days since 2002.

Changing the season and decreasing the bag limit reduced sage-grouse harvest and hunters in the Basin. 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). During 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). During the most recent period (2005-2014), hunters averaged 1.5 birds/hunter and 2.3 days/hunter. In 2014, 303 hunters in the Big Horn Basin harvested 524 sage-grouse (1.7 birds/hunter); spending 708 hunter-days afield (2.3 days/hunter) during the 11-day hunting season. The increase in sage-grouse harvest observed in 2014 is likely a result of increasing sage-grouse populations. More sage-grouse in the population equates to hunters harvesting more sage-grouse, with hunters expending slightly less effort in 2014 (2.3 days/hunter) than in 2013 (2.5 days/hunter). In addition, the weather during the 2014 hunting season was pleasant which may have encouraged sage-grouse hunters.

Figure 6. Sage-grouse hunting statistics for the Big Horn Basin, 2005-14.



CONSERVATION PLANNING

The BHBLWG was formed in September 2004 to develop and implement a local conservation plan for sage-grouse and 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 BHBLWG's local plan identifies factors and impacts that may influence sage-grouse populations in the Basin, and outlines goals and objectives to address habitats, populations, research and education. Strategies and commitments in the local plan are designed to improve sage-grouse habitats and populations in the Basin. The local plan was updated in 2013 and highlights completed and ongoing projects in the Basin in addition to summarizing state- and nation-wide policy and programs. The updated plan can be viewed at the WGFD website: https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management.

Most recently, the BHBLWG met in March 2015 to discuss proposed changes to sage-grouse core area boundaries. The group provided recommendations to the Sage Grouse Implementation Team who reviewed the recommendations from local working groups statewide and developed Wyoming's sage-grouse core areas, version 4, available at: https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management. Details on the state's Core Area Policy is also available at this site.

The BLM and the U.S. Forest Service released 14 Environmental Impact Statements that will help conserve greater sage-grouse habitat and support sustainable economic development on portions of public lands in 10 states across the West including the Big Horn Basin. The land management plans, developed during the past three years in partnership with the states and with input from local partners, are designed to benefit wildlife, outdoor recreation, ranching and other traditional land uses that rely on a healthy sagebrush landscape. The plans contain 3 common approaches: minimizing new or additional surface disturbance, improving sage-grouse habitat condition, and reducing the threat of rangeland fire.

RESEARCH

Sage-grouse research in the Basin has historically been limited, but recent projects are shedding light on sage-grouse habitat, movements, and survival. Hess (2010) and Hess and Beck (2012a) evaluated the relative influence of prescribed burning and mowing treatments on sage-grouse nesting and early brood-rearing habitats. Hess and Beck (2012b) evaluated landscape characteristics that explain differences between occupied and unoccupied leks using Basin lek data from 1980 to 2009.

In 2010, two research projects on sage-grouse were begun in the Basin. Pratt and Beck (2012) are evaluating possible effects of bentonite mining on sage-grouse near Hyattville and will be completed by late 2015. Orning and Young (2012, 2012a) started a multiphase sage-grouse predation project, with the completed first phase documenting predation levels on nests, broods, and adult hens at several sites in the Basin (Orning 2013). Dr. James Taylor USDA-APHIS (Wildlife Services Research Branch, Oregon State University) is doing the second phase of the predation project focusing on impacts of ravens that should be completed in late 2015 or early 2016.

CONCLUSIONS & RECOMMENDATIONS

Sage-grouse populations in the Basin experienced a low in the population cycle over recent years, but 2015's data suggests that populations are on an upswing, in conjunction with improved habitat conditions due to increased spring precipitation. Sage-grouse in the Basin face threats, but are not in danger of foreseeable extirpation, and on-going conservation efforts are intended to mitigate some anthropogenic impacts. Research and monitoring are important to help identify limiting factors, important habitats, and to track populations.

- Continue to improve the number and intensity of lek surveys, especially visiting previously unoccupied leks
- Update all lek observers on WGFD survey protocols, and familiarize them with standardized datasheets
- Conduct brood surveys whenever work schedules allow, and enlist volunteers where practical
- Formalize winter use areas in coordination with Worland and Cody BLM offices
- Continue to be WGFD liaison for ongoing and new research projects, as much as possible
- Work closely with local ranchers to improve sage-grouse habitat (especially early brood-rearing) while installing water developments
- Be a resource to the Bighorn National Forest, especially when developing prescribed burning plans

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Northeast
Sage-Grouse
Job Completion Report
2014

June 2014-May 2015

Dan Thiele
Wyoming Game & Fish Dept.
Sheridan Region

Sage Grouse Job Completion Report

Year: 2006 - 2015, 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)
2006	368	84	23	1793	28.0
2007	391	107	27	2036	26.1
2008	406	127	31	1934	20.4
2009	409	148	36	1135	10.8
2010	408	179	44	1561	13.7
2011	415	174	42	1134	11.7
2012	420	243	58	1862	12.8
2013	412	109	26	714	10.3
2014	410	197	48	929	9.6
2015	401	192	48	1928	16.3

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2006	368	233	63	3312	19.4
2007	391	254	65	3448	20.2
2008	406	236	58	2190	15.8
2009	409	219	54	1346	11.8
2010	408	178	44	636	7.9
2011	415	190	46	652	8.2
2012	420	149	35	476	9.5
2013	412	249	60	939	8.5
2014	410	161	39	695	10.1
2015	401	145	36	1062	15.6

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: 2006 - 2015, 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)
2006	368	317	86	5105	21.7
2007	391	361	92	5484	22.0
2008	406	363	89	4124	17.6
2009	409	367	90	2481	11.3
2010	408	357	88	2197	11.3
2011	415	364	88	1786	10.1
2012	420	392	93	2338	12.0
2013	412	358	87	1653	9.2
2014	410	358	87	1624	9.8
2015	401	337	84	2990	16.1

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2006	237	31	49	268	88.4	11.6
2007	251	58	52	309	81.2	18.8
2008	235	82	46	317	74.1	25.9
2009	221	81	65	302	73.2	26.8
2010	200	109	48	309	64.7	35.3
2011	184	112	68	296	62.2	37.8
2012	201	116	75	317	63.4	36.6
2013	181	121	56	302	59.9	40.1
2014	168	133	57	301	55.8	44.2
2015	189	92	56	281	67.3	32.7

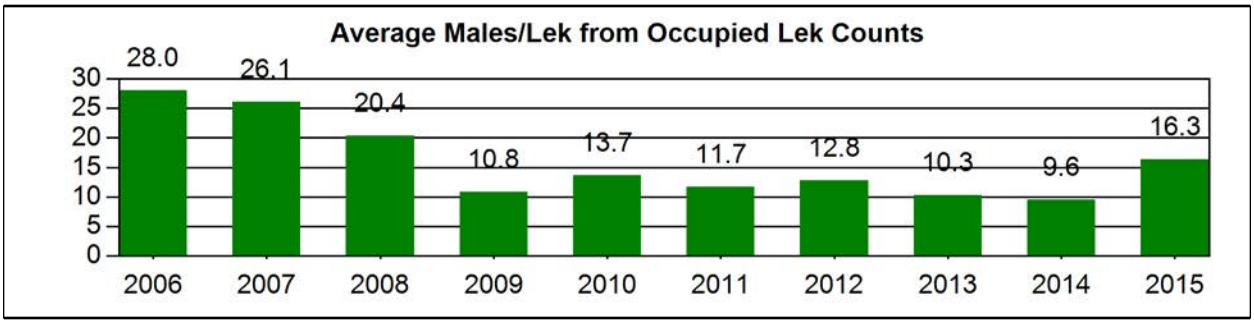
1) Occupied - Active during previous 10 years (see official definitions)

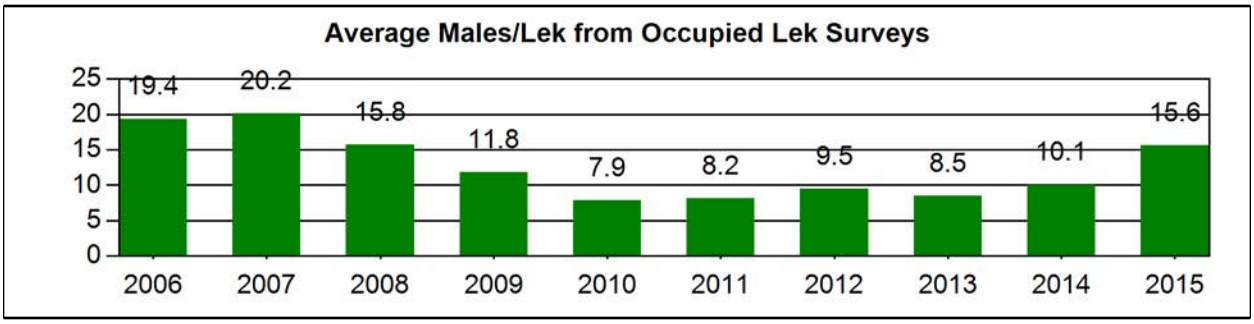
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

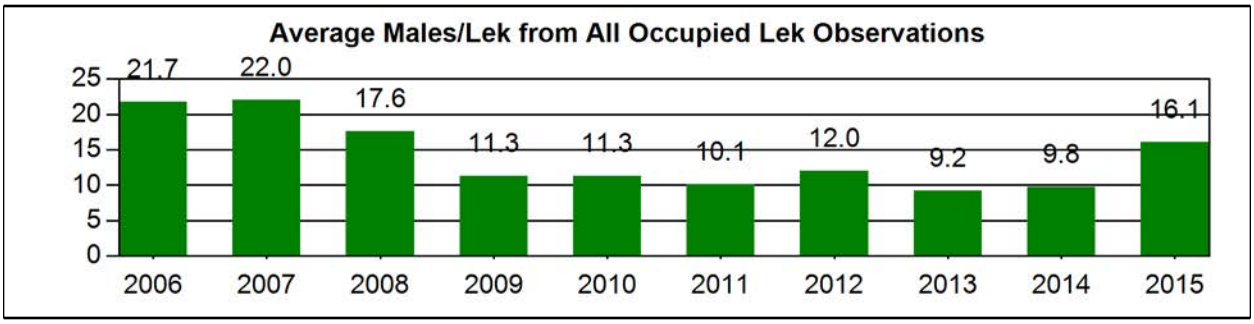
3) Inactive - Confirmed no birds/sign present (see official definitions)

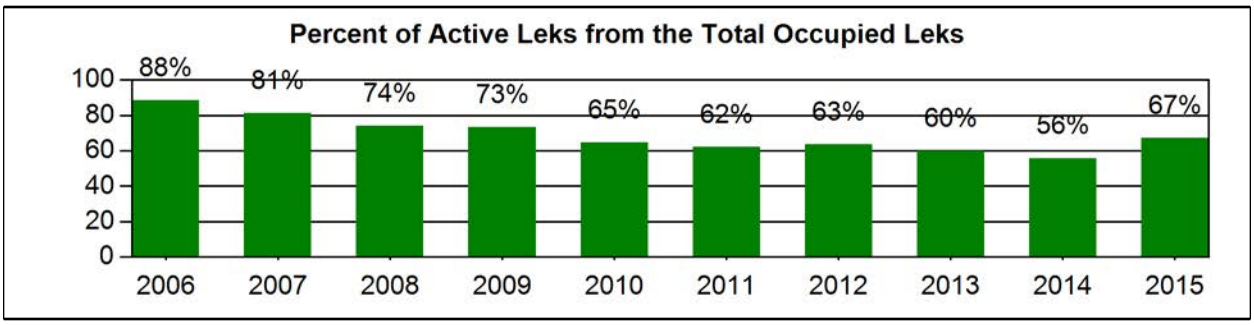
Sage Grouse Occupied Lek Attendance Summary

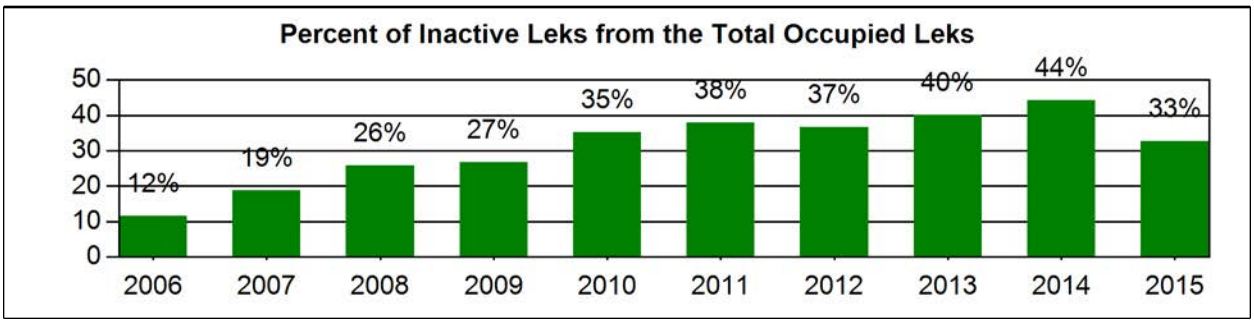
Year: 2006 - 2015, Working Group: Northeast











Sage Grouse Job Completion Report

Year: 2005 - 2014, Working Group: Northeast

4. Sage Grouse Hunting Seasons and Harvest Data

a. Season

Year	Season Start	Season End	Length	Bag/Possesion Limit
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
2013	Sep-21	Sep-23	3	2/4
2014	Sep-19	Sep-21	3	2/4

b. Harvest

Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
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	405	218	404	1.0	1.9	1.9
2013	27	82	249	0.1	0.3	3.0
2014	123	137	242	0.5	0.9	1.8
Avg	268	202	491	0.6	1.2	2.3

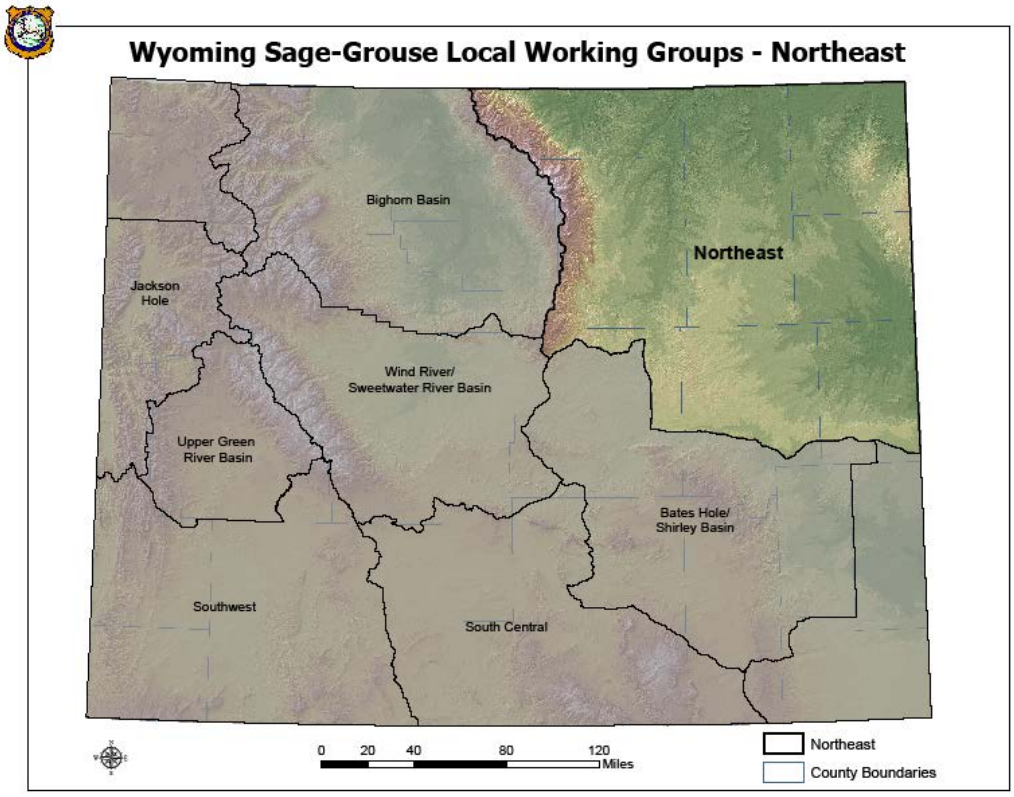
2014 JOB COMPLETION REPORT

Narrative
SPECIES: **Sage-grouse**
DAU NAME: **Northeast Wyoming Working Group**
Period Covered: **6/1/2014 – 5/31/2015**
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.

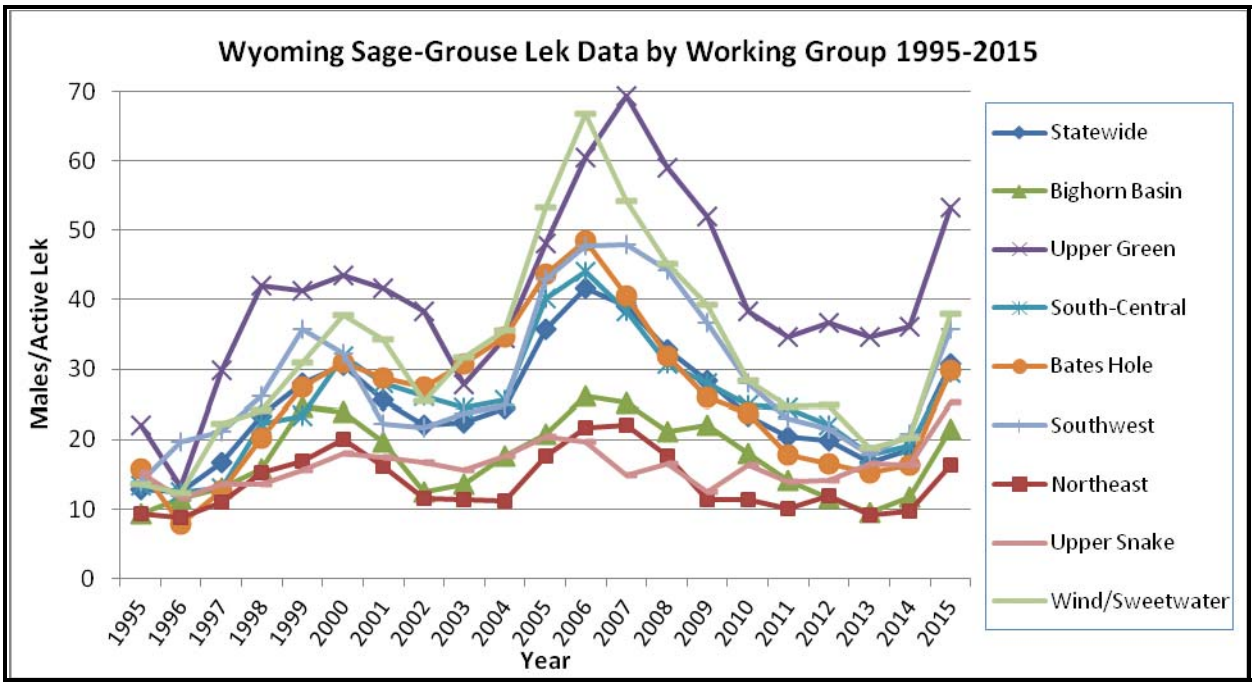
Figure 1. Northeast Wyoming Local Working Group Area.



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 16 males per active lek in 2015 compared to the statewide average of 31 males per active lek (Figure 2). Male lek attendance for the other working group areas ranged from 22 to 53 males per active lek. 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. Eleven leks exceeded 50 males in 2015 with the Red Wall Lek hosting the largest male attendance at 98 males.

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



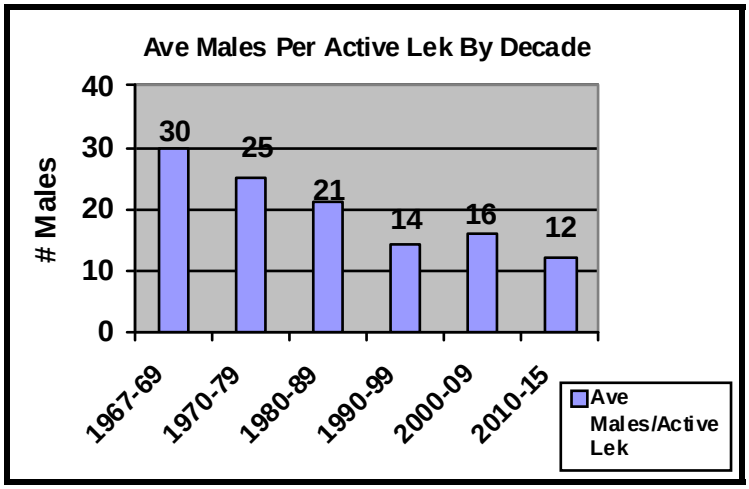
Average male lek attendance in northeast Wyoming has decreased significantly over the years. Figure 3 shows the average number of males per active lek by decade since monitoring efforts began. Average male attendance has decreased by more than one-half over the last thirty years. A slight upswing occurred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

Most occupied habitat for sage-grouse is held in private ownership. Approximately 75 percent of known leks are found on private land with the remaining 25 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 2015). 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 2015, the Wyoming Oil and Gas Conservation Commission reported that 7,710 producing wells yielded 17,256,299 Mcf of methane gas (WOGCC 2015). Federal mineral leases provided for 71% of the production while fee leases accounted for 21% and State leases 8%. In addition to producing wells there are 8,095 shut in wells. This compares to May 2014 when 8,516 producing wells yielded 21,258,605 Mcf of methane gas. More than 72,000 permits to drill have been issued, although many have expired. Many wells drilled early in the play have completed the production phase of development and are now being plugged and abandoned. Furthermore, low gas prices currently hamper the economic viability of CBNG production operations. Drilling new wells is occurring primarily to hold existing leases.

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



Deep well oil and gas development has increased in recent years with new technologies enabling horizontal and directional drilling. While CBNG activity decreased, the interest in deep drilling increased until low oil prices reduced the economic viability of oil exploration. In 2014, counties comprising the NEWLWG had 453 oil wells started (spud) including 365 horizontal wells and 13 directional wells (WOGCC 2015). Drilling for natural gas was limited to 10 wells, nine of which were horizontal wells. Exploration utilizing horizontal drilling has increased markedly from 10 wells in 2007 to 365 wells in 2014. More than 3,900 permits have been issued while nearly 960 horizontal wells have been spudded during the period. 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 accepted by

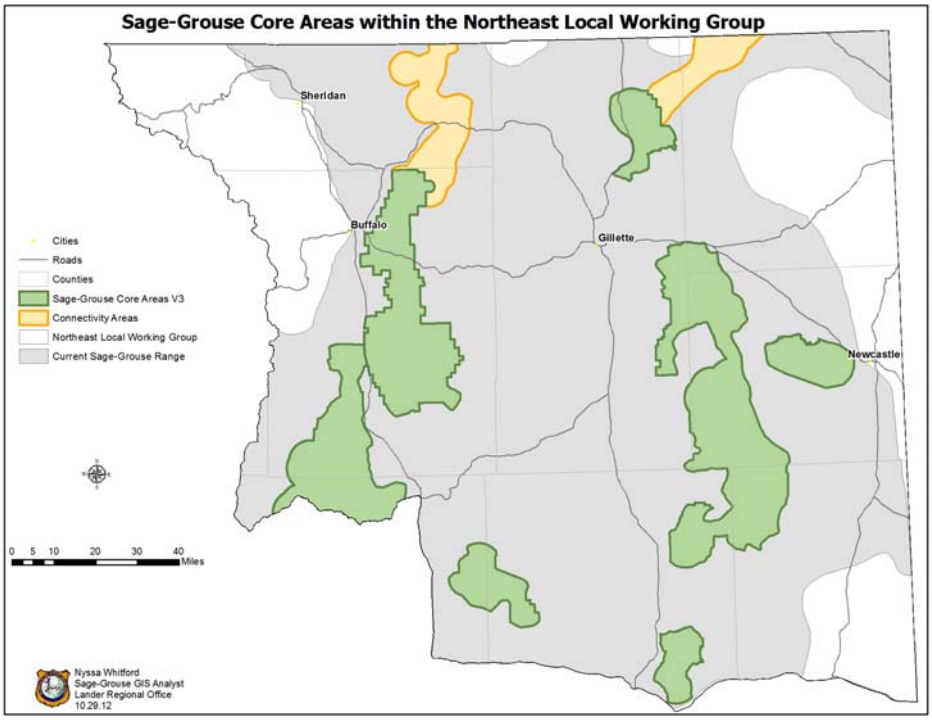
some people and this has contributed to uncertainty in the public and political arenas as to the real effects of energy development. Furthermore, many continue to blame predation while some in the energy industry point to continued hunting of the species given that they are being asked for increased 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 Freudenthal 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 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).



In 2015 Governor Mead directed the Wyoming Sage-grouse Implementation Team to review Wyoming's core areas and the Executive Order with assistance from the Local Working Groups. The NEWLWG held a series of meetings to review proposals for core area and connectivity area boundary adjustments and subsequently made recommendations to the Sage-grouse Implementation Team. A revised version of core and connectivity areas is expected prior to the U.S. Fish and Wildlife Service's September 30, 2015 Endangered Species listing decision.

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 75% 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 2014 – May 2015) was wetter with warmer winter and spring temperatures than the 30-year averages (Figures 5 and 6). Precipitation was 120% of average for the biological year. This marked the second consecutive year that precipitation was above average (2013-14 115% of average). The average temperature was more than 1° above normal. The biological year started off wet with June and August precipitation 35% and 139% above average, respectively. May 2015 precipitation was also well above average with more than 5 inches of rain (198% of average).

Figure 5. 2014 Bio-Year: Monthly Precipitation Data (in), Wyoming Climate Division 5.

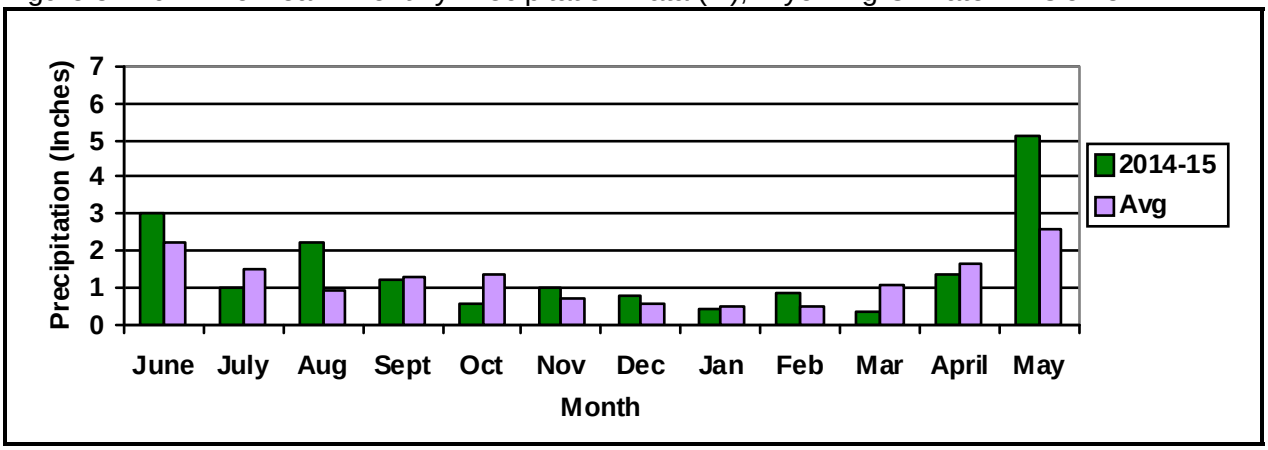
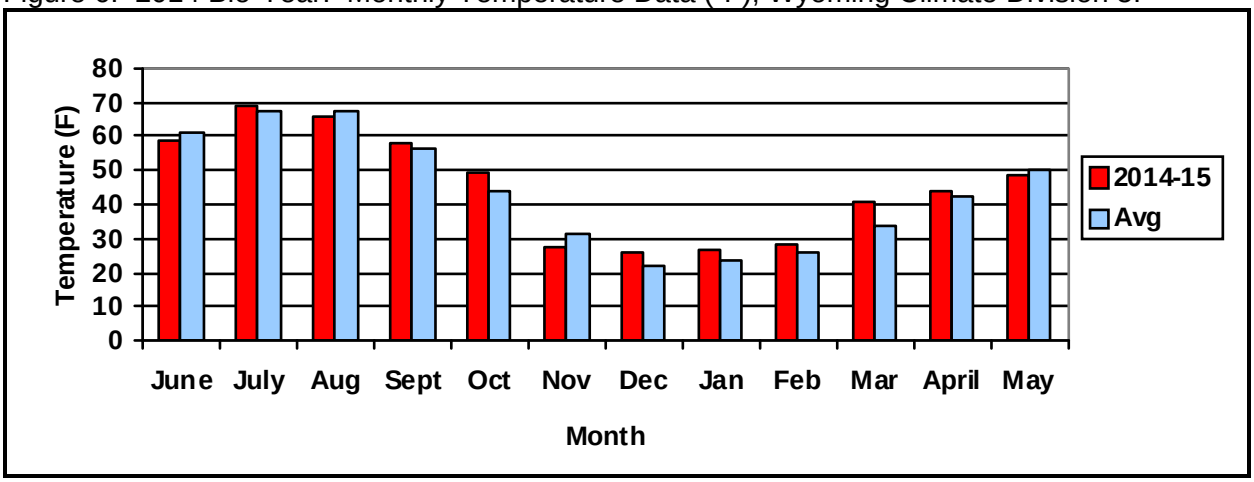


Figure 6. 2014 Bio-Year: Monthly Temperature Data (°F), Wyoming Climate Division 5.



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 2012), which is largely based on Connelly et al (2003).

RESULTS

Variation in this report from previous years' reports is expected because of new data added to the lek database. Old records are added each year as 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) mortality was reported for northeast Wyoming in 2014-15. 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.

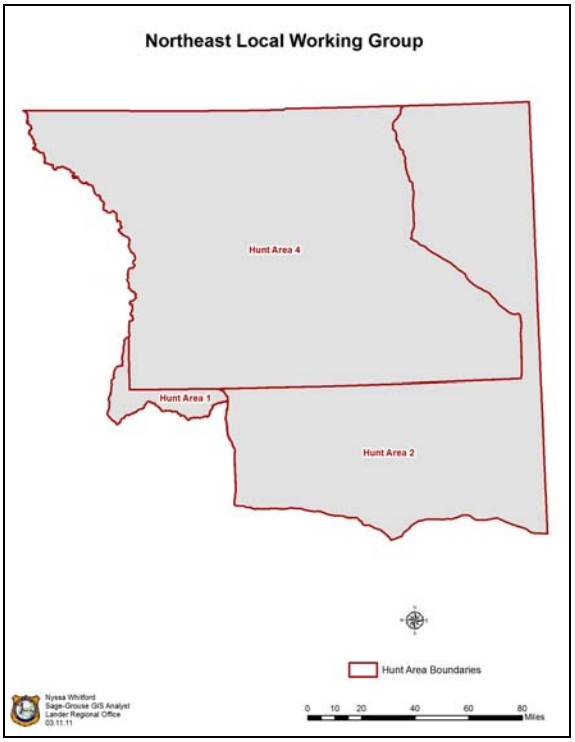
Harvest Results

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 long-term, an adequate population exists to support the conservative hunting season. Nearly 3,000 males were observed during 2015 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* (Christiansen 2010).

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 2014 harvest survey indicated that 123 sage-grouse were harvested by 137 hunters who spent a total of 242 days hunting during the Hunt Area 4 three day season. The average number of birds harvested per hunter day was 1.2. The average number of sage-grouse harvested per hunter was 1.2 and the average number of days hunted was 2.3.

The 2014 sage-grouse harvest increased nearly fivefold from the estimated 27 birds harvested in 2013 and was the highest harvest since an estimated 405 birds were harvested during the 2012 hunting season. The conservative harvest was the second lowest of the last 10 years and likely reflects public awareness of the low population. Recent low harvest levels have been 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 (2005-2014) is 268 birds, with harvest ranging from a low of 27 birds in 2013 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 82 hunters in 2014 to 342 hunters in 2005. Hunter days remained relatively stable from 2013 but were 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.

In past years a limited number of sage-grouse wings were collected during the hunting season, primarily in the eastern portion of the Area. Sample sizes were 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. No wings were collected during the 2014 hunting season.

Lek Monitoring Results

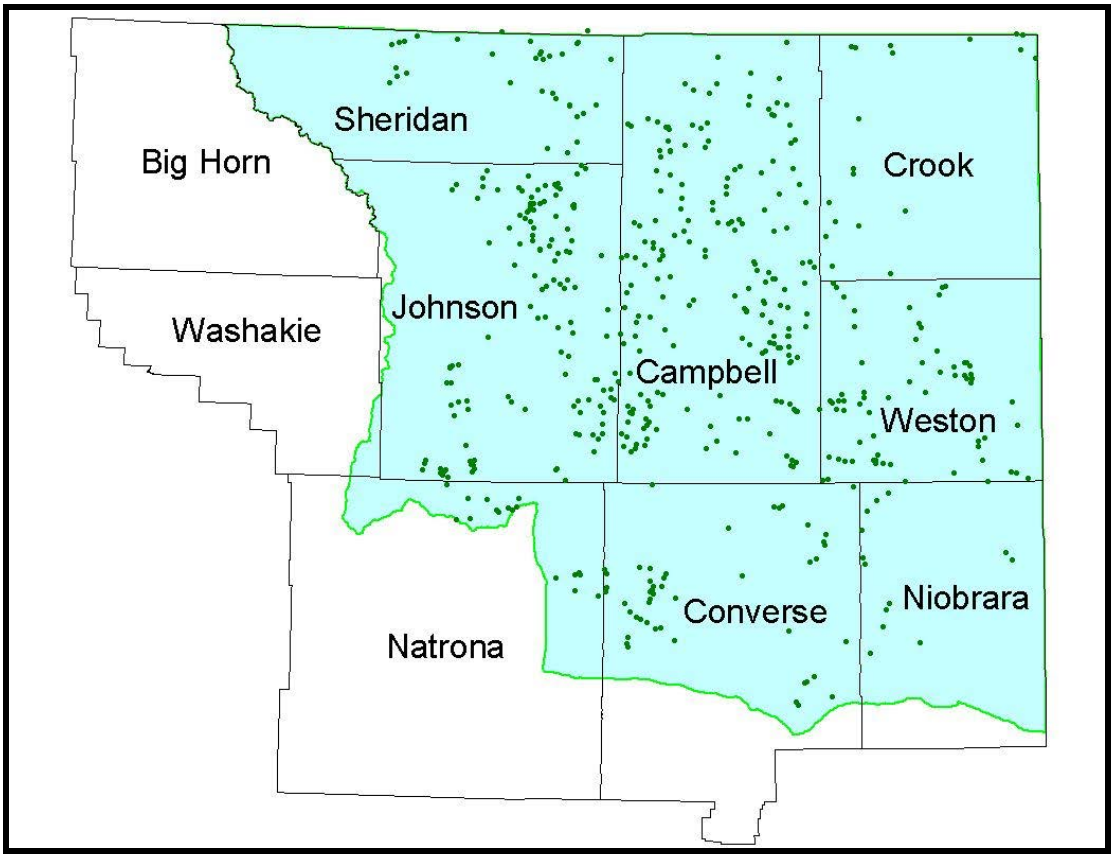
Lek monitoring efforts increased substantially beginning in 2000 due to concerns over range wide declines in sage-grouse populations. Additionally, coalbed natural gas (CBNG) development in the Powder River Basin resulted in extensive survey work to meet federal permitting requirements. The WGFD, BLM, 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 fourteenth 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 2015 lek monitoring period there are 556 documented leks in the NEWLWGA (Figure 8). Of this total, 401 are classified as occupied leks. The 401 occupied leks is less than the 556 total leks because unoccupied leks (abandoned or destroyed) are not considered potentially active. During the 2015 breeding season 192 leks were counted, representing 48% of known occupied leks (JCR Table 1a). The average number of males per active lek from lek counts was 16.3. This is up from the 9.6 males/active lek in 2014 and compares to 10.3

males/active lek in 2013. The 2015 lek counts suggest the sage-grouse population is increasing after trending down from the most recent cycle high of 28.0 males/active lek in 2006.

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



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.

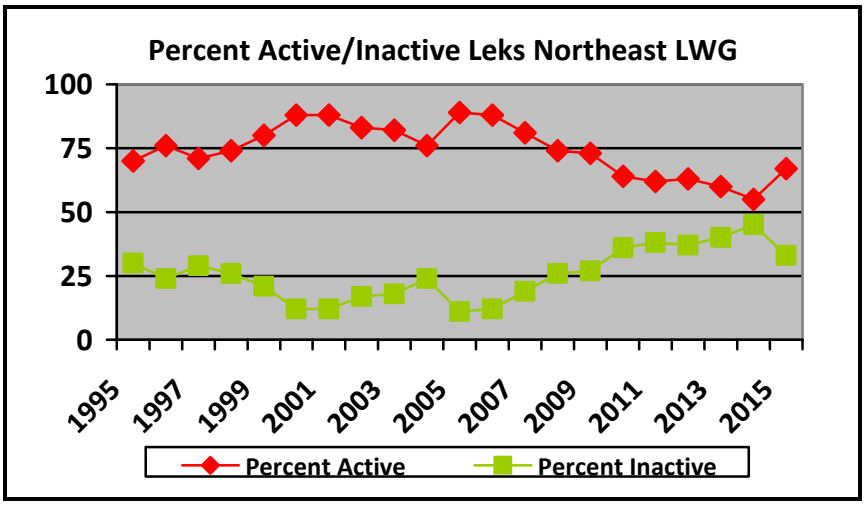
The number of known occupied leks checked by lek counts and lek surveys combined was 337 leks or 84% of the known occupied leks (JCR Table 1c). The average number of males/active lek was 16.1 compared to 9.8 males/active lek in 2014. The 2015 average attendance represents a 64% increase from last year. For the 10-year period, 2006-2015, the number of males/active lek has ranged from 9.2 in 2013 to 22.0 in 2007. These numbers and trends are comparable to the lek count data. One-hundred-eighty-nine leks were documented as active with peak male attendance ranging from 1 to 98 males. The three leks with the highest number of males were the Red Wall Lek with 98 males, Jewell Draw Lek with 90 males and Kaufman Draw Lek with 77 males. No lek has exceeded 100 males since 2007. The median peak male attendance was 12 males, up from 7 males in 2014.

In total, there were 1,270 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.

Since only "occupied" leks are being reported in 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.

Figure 9. Trends in Active and Inactive Leks, 1995-2015.



Lek status as determined from lek counts and lek surveys shows 281 leks with confirmed lek status. Sixty-seven percent of the leks (n=189) with confirmed status were determined to be active (JCR Table 1d), meaning strutting males or sign of leking activity (feathers/droppings) were observed at the lek site. Ninety-two leks (33%) 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. Until this year, both the average number of males per active lek and the percentage of active leks have trended down, suggesting a notable decrease in the population (Figure 9). The decrease in northeast Wyoming was greater than that observed for the other working group areas. The 11% increase in 2015 was the first notable increase in lek activity for the last 10 years. A large number of monitored leks (n=56) have an unknown activity status. This category includes leks that 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 (Christiansen 2012).

Comparisons of core and non-core area lek monitoring results shows that core areas have a similar number of males per active lek (16.3 vs 15.9) but confirmed lek activity is notably higher in core areas (74% vs. 62%). 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.

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

Region	Number	Percent
Casper	151	27.2%
Sheridan	405	72.8%

Working Group	Number	Percent
Northeast	556	100.0%

Classification	Number	Percent
Occupied	392	70.5%
Unoccupied	89	16.0%
Undetermined	75	13.5%

BLM Office	Number	Percent
Buffalo	370	66.5%
Casper	72	12.9%
Newcastle	114	20.5%

Biologist	Number	Percent
Buffalo	70	12.6%
Casper	13	2.3%
Douglas	61	11.0%
Gillette	247	44.4%
Newcastle	77	13.8%
Sheridan	88	15.8%

Game Warden	Number	Percent
Buffalo	74	13.3%
Dayton	18	3.2%
Douglas	25	4.5%
East Casper	6	1.1%
Glenrock	29	5.2%
Kaycee	51	9.2%
Lusk	19	3.4%
Moorcroft	57	10.3%
Newcastle	66	11.9%
North Gillette	68	12.2%
Sheridan	18	3.2%
South Gillette	119	21.4%
Sundance	5	0.9%
West Casper	1	0.2%

County	Number	Percent
Bighorn, MT	1	0.2%
Campbell	196	35.2%
Carter, MT	1	0.2%
Converse	57	10.3%
Crook	23	4.1%
Johnson	137	24.6%
Natrona	15	2.7%
Niobrara	21	3.8%
Powder River, MT	1	0.2%
Sheridan	35	6.3%
Weston	69	12.4%

Land Status	Number	Percent
BLM	51	9.2%
Private	434	78.1%
State	37	6.7%
US Forest Service	34	6.1%

Management Area	Number	Percent
C	556	100.0%

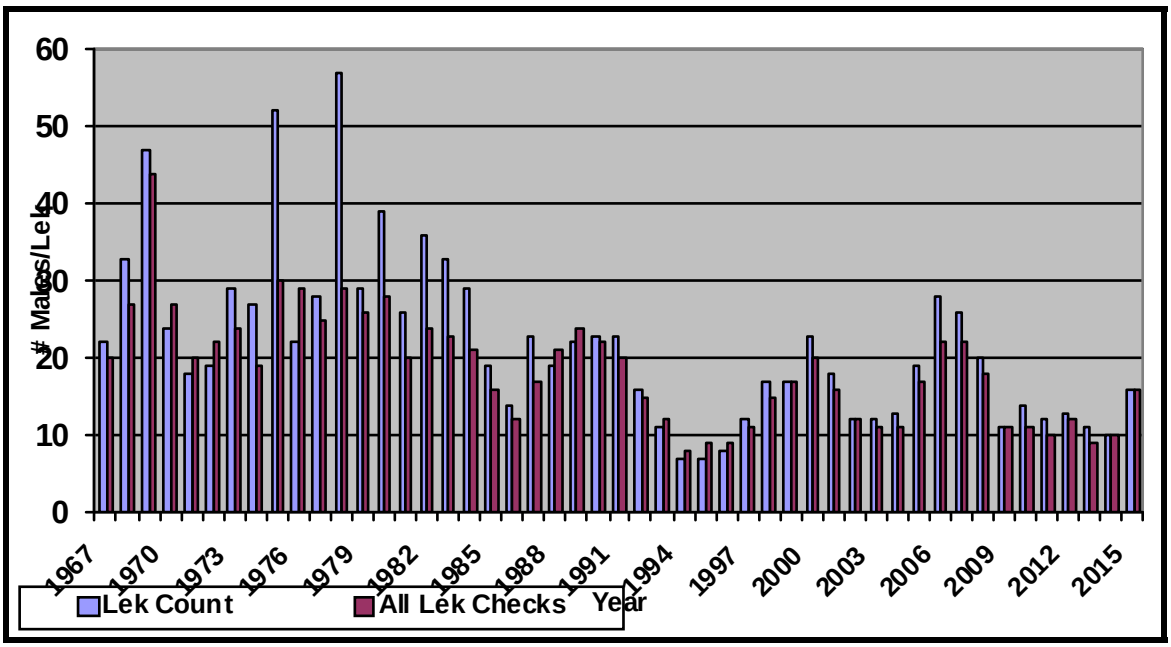
Some inconsistencies remain in complying with monitoring protocol and monitoring some leks on a regular basis. Some leks have not been documented as active in many years which may be due to inaccurate locations based on legal descriptions. Continued efforts at determining the exact location and status 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 energy development, caution must be used to ensure that strutting activity represents an actual lek and not birds displaced from established leks.

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 2015 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.

Figure 10. Northeast Wyoming Working Group Male Sage-grouse Lek Attendance 1967- 2015.



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 - 2014 data indicate that peak has passed and lek attendance entered the declining phase of the cycle, rivaling that observed from 1994 through 1997. The population now appears to be entering the increasing phase of the cycle with the increased male lek attendance documented in 2015.

The number of total known leks increased from 2000 - 2010 primarily due to increased survey effort associated with CBNG activities. However, even with the increased lek activity level in 2015, the percentage of active leks remains well below that observed during in the past. While the number of leks present historically cannot be known, recent monitoring confirms the number/proportion of active leks has declined.

HABITAT

Habitat Conditions

Habitat conditions in 2014 were very good following above normal fall 2013 precipitation. The Palmer Drought Index, a measure of long-term meteorological conditions, showed climate divisions in northeast Wyoming were moderate to extremely moist in May 2014. Late spring rains improved moisture and habitat conditions and extended spring green-up into July. Excellent residual forage remained through the season and shrub surveys showed good leader production. By May 2015, the dry spring weather decreased the Palmer Drought Severity Index in the Powder, Little Missouri and Tongue River drainages to mid-range while Belle Fourche River drainage was very moist and Cheyenne and Niobrara River drainages were moderately moist.

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

For the reporting period, the program reported the following accomplishments within northeast Wyoming core areas:

- 350 acres of conifer encroachment removed by the Montana Conservation Corp.
- Two unpermitted reservoirs were reclaimed to address West Nile virus.
- 140 sq. miles of 6” resolution ortho-imagery was flown and developed. These data will be used to determine areas of cheatgrass establishment in the Buffalo Core Area. Furthermore, the imagery will be used for additional vegetation inventory and monitoring.
- 2,000 acres of historic (1900-2014) wildfires were surveyed, including cheatgrass and prairie dog town mapping, inventory of sagebrush re-establishment and forb inventory.

Douglas Core Area

Sage-grouse lek attendance within the Douglas Core Area (DCA) totaled 59 males in 2015. This was an increase from the 31 and 11 males in 2014 and 2013, respectively. There are six occupied leks in the DCA, four of which were active in 2015.

The DCA has experienced a substantial increase in energy development over the past four 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, the Department and other partners have 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 plan of development includes practices such as avoiding key habitat areas, minimizing disturbance and significantly reducing traffic during breeding and nesting seasons. The Restoration Team has identified, and is currently implementing, multiple projects beneficial to sage-grouse within the DCA including sagebrush restoration, cheatgrass control and a West Nile virus management program. Additionally, the team has sponsored multiple research projects with the goal of developing best management practices for sagebrush restoration.

NRCS Sage-grouse Conservation Initiative

NRCS contracts for FY2015 within the NEWSGLWG area consisted of three contracts totaling 31,631 acres.

- Campbell County – 1 for 22,439 acres
- Converse County – no contracts
- Crook County – 1 for 5,980 acres
- Johnson County – no contracts
- Niobrara County – 1 for 7,151 acres
- Natrona County - 1 for 35,131 acres
- Sheridan County – 1 for 3,212 acres
- Weston County – no contracts

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

SPECIAL PROJECTS

Conservation Planning

The Local Working Group schedule was scaled back following completion of the conservation plan addendum in 2013. The plan and other LWG information is available on the WGFD website at http://gf.state.wy.us/wildlife/wildlifemanagement/sagegrouse/index.asp. The Working Group held two meetings during the reporting period. The group allocated Wyoming Sage-grouse Conservation Funds and received presentations on ongoing research and habitat projects.

The NEWLWG reviewed and allocated $142,000 from the 2015-16 Wyoming Sage-grouse Conservation Fund which totaled $1.2 million for conservation projects. Four local projects and one statewide project were approved. Projects included wildfire restoration, habitat restoration research, West Nile virus research and habitat mapping.

The group also coordinated with the Governor's Sage-grouse Implementation Team in reviewing core and connectivity area boundaries at the direction of the Governor. A number of proposals were reviewed and submitted to the Sage-grouse Implementation Team for consideration. The Sage-grouse Implantation Team will then submit final boundary changes and proposed changes to the Executive Order to the Governor for final review and approval prior to the U.S. Fish and Wildlife Service's September 30, 2015 deadline on the Endangered Species Act listing decision.

U.S. Fish and Wildlife Service Candidate Conservation Agreements With Assurances (CCAA)

A CCAA is a voluntary agreement between the U. S. Fish and Wildlife Service (USFWS) and a non-federal landowner(s) on non-federal lands that provides assurances that landowners covered by a CCAA will not be subject to additional restrictions if the sage-grouse is listed under the Endangered Species Act. Landowners must agree to implement agreed to conservation actions on their property to remove or reduce threats to the sage-grouse.

Table 2. U.S. Fish and Wildlife CCAA Sign-ups.

County	Sign-ups	Total Acres	Core Acres	Connectivity Acres	Core and Connectivity Area
Campbell	3	11,618	3,240	0	North Gillette Core
Converse	1	1,880	1,880	0	Natrona Core
Crook	1	20,916	0	20,916	North Gillette Connectivity
Johnson	4	48,023	32,419	0	Buffalo Core
Natrona	0	38,856	24,687	0	Natrona Core
Niobrara	0	0	0	0	
Sheridan	0	0	0	0	
Weston	0	0	0	0	
TOTAL		**121,293**	**62,226**	**20,916**	

From June 2014 to May 2015, the USFWS enrolled nine landowners and more than 121,000 acres within the NEWLWGA into CCAA's (Table 2). The agreements totaled 121,293 acres in five counties including 62,226 acres of core area habitat and 20,916 acres of connectivity area habitat.

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 Local 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 to benefit sage-grouse.
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 2016 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 2014

June 2014-May 2015

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, 2014 – May 31, 2015** Sage-Grouse Mgmt Area: **H**

Prepared by: **Will Schultz**

Introduction

The South Central Local 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).

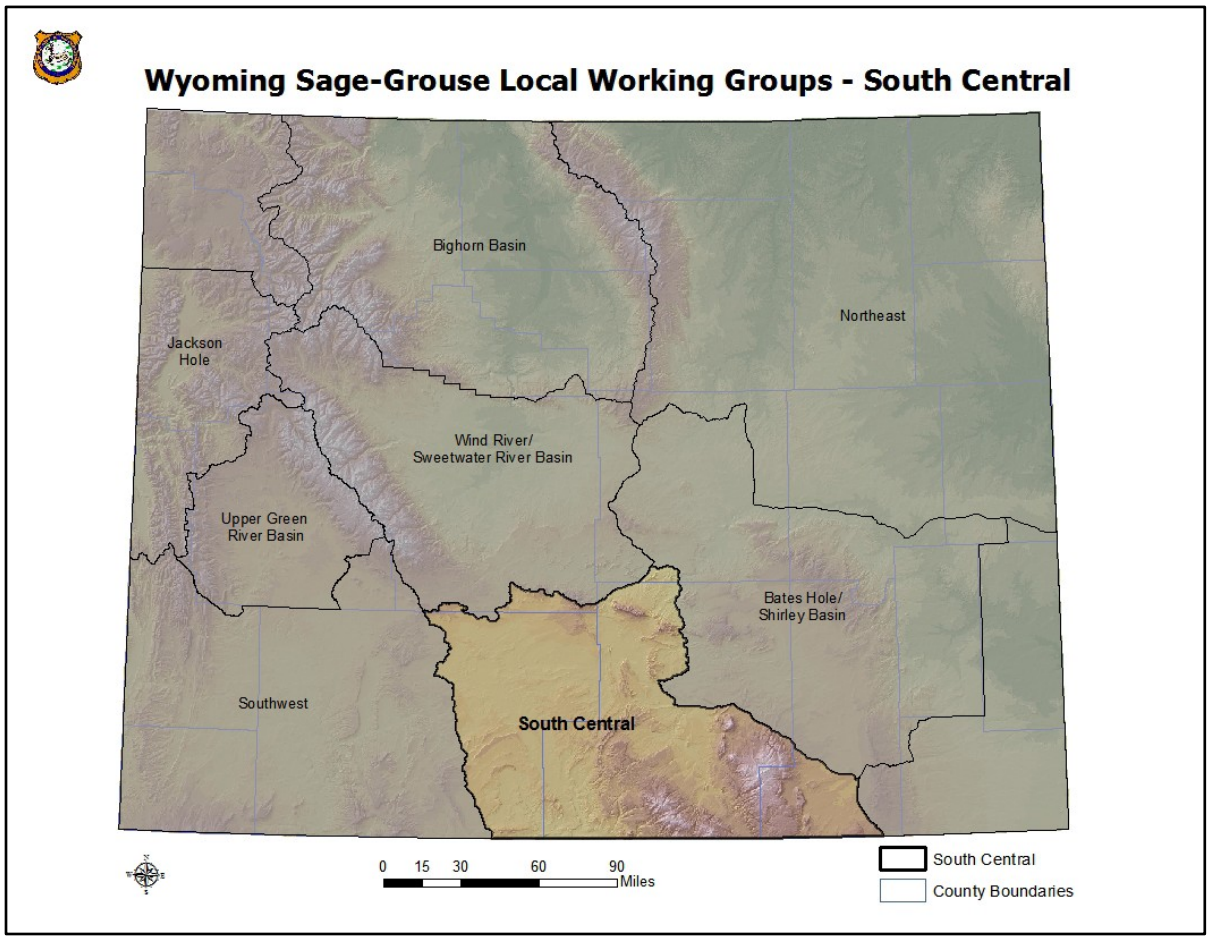


Figure 1. South Central Conservation Area in Wyoming.

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 (USFS) 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 Union Pacific 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.

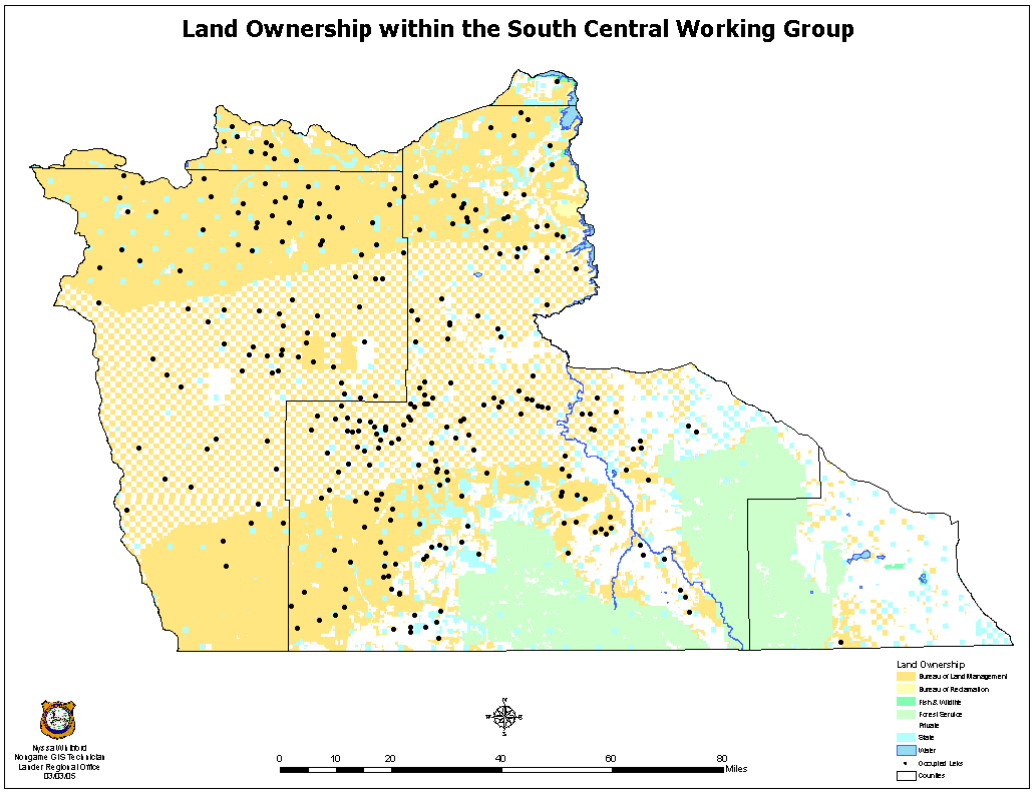


Figure 2. Landownership within the South Central Conservation Area of Wyoming.

The South Central Sage-Grouse Local Working Group (SCLWG) was initiated in September of 2004 to address local sage-grouse conservation in the SCCA. The SCLWG completed their Sage-grouse Conservation Plan (Plan) in 2007. 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. The SCLWG completed an addendum to their Plan in 2014. http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SG_SC_CONSERVPLAN0005526.pdf.

In bio-year 2014 (June 1, 2014 – May 31, 2015), there were 285 occupied leks in the SCCA. A total 259 of these leks were monitored. From these monitoring efforts it was determined 183 leks were active; producing an average peak males/lek ratio of 29.4 males.

The 2014 upland harvest survey indicated 391 hunters spent 934 days to harvest 612 sage-grouse in the SCCA. Analyses of wing data from hunter harvested sage-grouse indicated the proportion of chicks in the harvest was 2.1 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 website: http://www.ncdc.noaa.gov/oa/ncdc.html

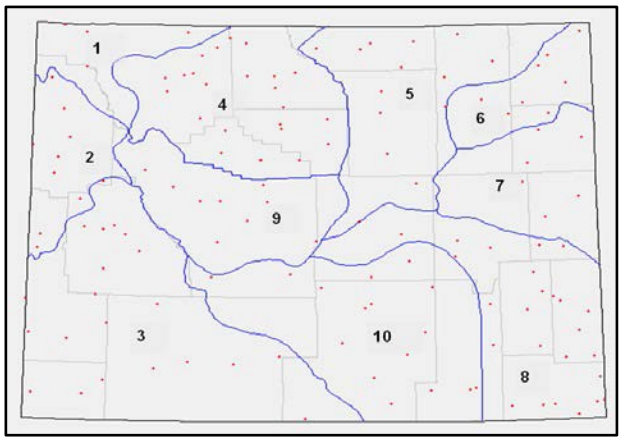


Figure 3. NCDC/NOAA, State of Wyoming Climate Division Map.

The Palmer Drought Severity Index uses temperature and precipitation data to determine dryness. For more information about the PDSI please visit the following website. http://www.ncdc.noaa.gov/oa/climate/research/prelim/drought/palmer.html. Palmer Drought Severity Index (PDSI) data indicated Division 10 has experienced 12 years of drought over the past 20 years (Figure 4) http://www.ncdc.noaa.gov/cag/time-series/us/48/10/pdsi/12/5/1995-2014?base_prd=true&firstbaseyear=1915&lastbaseyear=2014. There was a short period of time in bio-years 2010 - 2012 when Division 10 experienced a short period of wetter than average weather, which occurred primarily during the winter seasons.

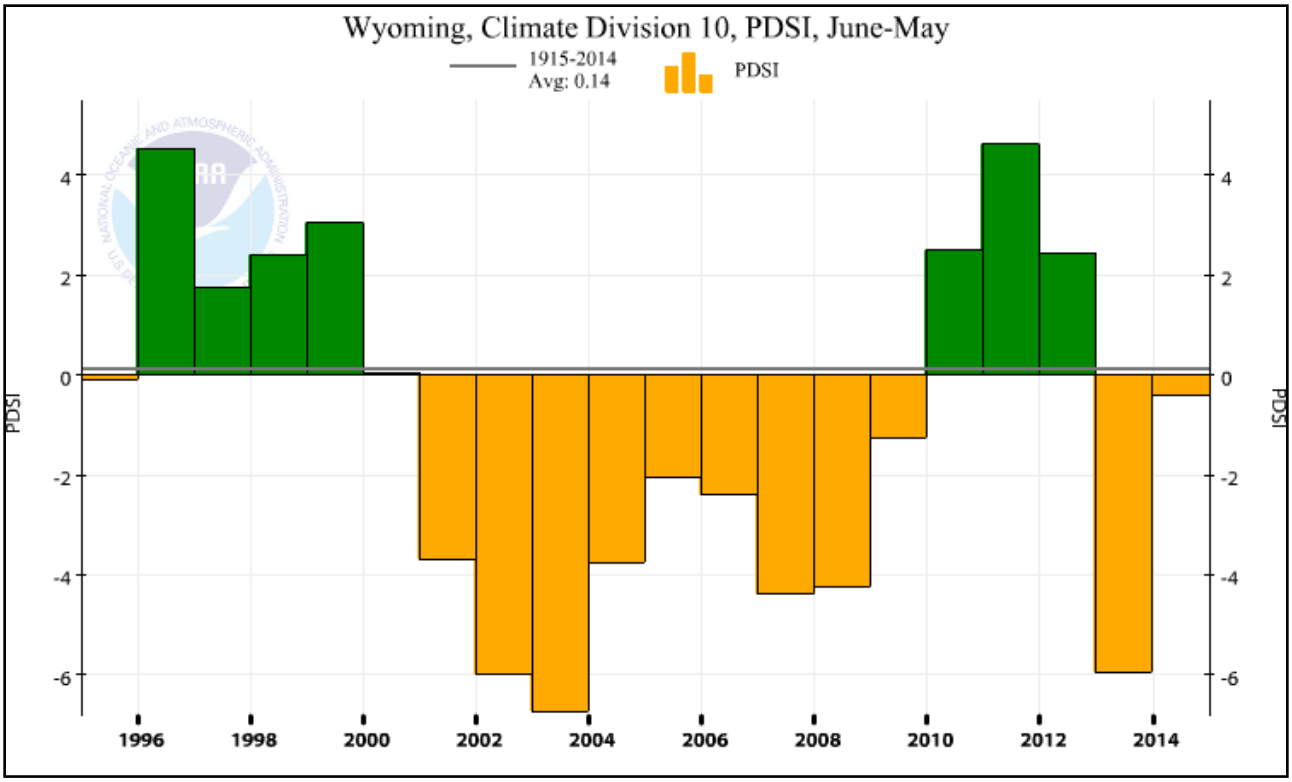


Figure 4. Bio-years 1995-2014 Palmer Drought Severity Index indices for the Upper Platte Climatic Division 10, Wyoming.

The 2014 bio-year PSDI improved to -0.55 for Wyoming's Division 10. The preceding bio- year's PDSI (n = -6.09), was ranked third above bio-years 2003 and 2002, respectively, for the most severe drought period recorded during the last 20 years. A return to wetter and cooler weather in bio-year 2014 resulted in relatively excellent nesting and brood rearing conditions and likely contributed to an increase in chick survival; as indicated in the analysis of wings collected from harvested sage-grouse. 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 enhance insect abundance for a food source for sage-grouse. Spring precipitation is an important determinant of the quality and quantity of these vegetation characteristics.

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.

Livestock grazing is a 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.

Energy development and mineral extraction are secondary uses of sage-grouse habitat within the SCCA. A majority of the energy development is associated with producing natural gas from both deep gas and coal bed methane sources. Energy development has directly or indirectly reduced the functionality of sage-grouse habitat in portions of the SCCA. Past and present uranium mining has also contributed to reducing sage-grouse habitat in the SCCA.

Lek Monitoring and Population Trend

Tables and graphs describing annual lek monitoring efforts, observations, and lek characteristics are provided in Appendix A. The monitoring techniques are described in Christiansen (2012). Wyoming Game and Fish Department (WGFD) and BLM personnel, as well as environmental consultants and volunteers, monitored 259 leks in the spring of 2015. This represented checking approximately 91% of the occupied status leks in the SCCA. This effort was down from 98% of leks checked in 2014. The 2006-2015 annual average of leks checked was 87%. The proportion of leks checked in the spring of 2015 was above the 10-year average.

Since only occupied leks are being reported on Table 1 in APPENDIX A., it is important to consider trends in the numbers of active versus inactive leks in addition to the average size of active leks. The proportion of occupied leks which were inactive decreased from 28% in 2014 to 23% in 2015. The average peak male/lek for active leks increased from 19.1 in 2014 to 29.4 in 2015. During periods of population increase, the size of active leks typically increases and the number of inactive leks decreases. The converse is typically true of a decreasing population. In addition, lek monitoring efforts have increased in recent years in order to reduce the number of unknown annual status leks and to better determine active or inactive status. This had the effect of increasing the proportion of known inactive leks because a higher proportion of unknown leks were actually inactive but past monitoring intensity was not sufficient to meet the criteria for inactive status.

In 2015 (2014 bio-year), the peak male lek attendance totaled 5,049 males in the SCCA. The males/lek average was 29.4. This was a remarkable 54% increase from the 2014 average of 19.1, and the highest observed average since 2008 in the SCCA. The 2015 males/lek average was also 2% above the average (n=28.9) for the previous 10 years. Count monitored leks averaged 32.5 males/lek compared to 27.7 males/lek for survey monitored leks. The current observed increase in male attendance rate is within the parameters observed since 1996 and most likely attributable to normal cyclic variation in populations and to weather conditions; at least within habitats least impacted by human disturbance. Figure 5 illustrates the trends in average peak males/lek for all sage-grouse conservation areas in Wyoming, as well as the statewide average.

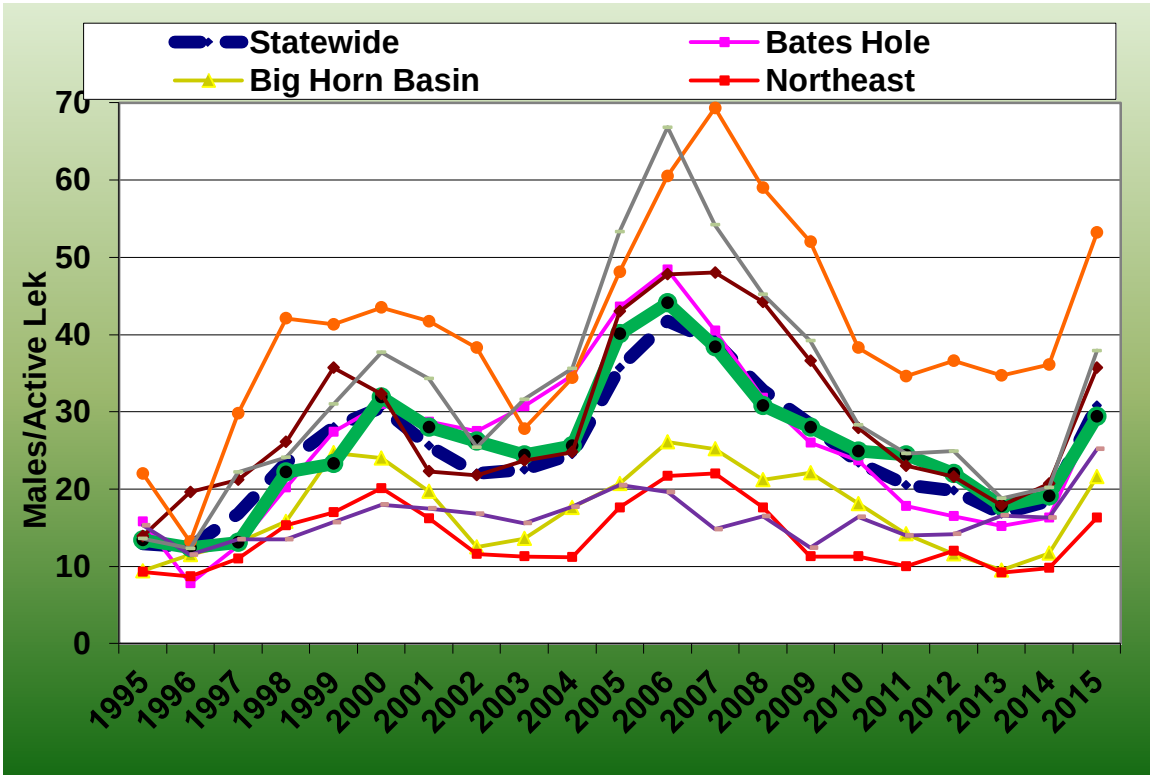


Figure 5. 1995-2015 Average peak male sage-grouse lek attendance, by Conservation Area and statewide, Wyoming.

Harvest

Tables and graphs describing hunting season structure, annual harvest and subsequent wing survey analyses are provided in Appendix A. The 2014 sage-grouse hunting season was from September 20 to September 30, and allowed for the harvest of 2 sage-grouse/day and 4 in possession. The 2014 upland harvest survey indicated 391 hunters spent 934 days to harvest 612 sage-grouse in the SCCA. This equals about 0.07 birds/day, 1.6 birds/hunter, and 2.4 days/hunter. Both hunter and harvest totals were the lowest observed during the past 13 years. Compared to 2013, when hunting regulations were similar with the exception of 1 less day in the 2013 season length, hunter numbers decreased by 11%, the birds/day remained at 0.7, and the birds/hunter increased by 0.2 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. Weather did not appear to have influenced the harvest in 2014 as much of the SCCA was accessible due good hunting conditions.

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. While there are biases associated with the hunter selectivity of different age/sex groups of sage-grouse, trends still provide yearly comparisons of relative chick production.

During the 2014 hunting season WGFD collected 146 wings from wing barrels within the SCCA. This was an increase of 36% when compared to the 107 collected in 2013, although total harvest was similar for both years. Age and sex composition of the wings indicated the proportion of chicks/hen

also increased from 1.1 in 2013 to 2.1 in 2014. The chicks/hen ratio observed in the 2014 harvest tied the 2008 ratio as highest during the past 10 years and resulted in 2015's increased average male lek attendance as discussed in the population trend analysis. 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. Male lek attendance earlier in 2014 (bio-year 2013) was the 2nd lowest observed during the past 10 years; and was considered to be correlated to relatively low sage-grouse numbers. Optimal weather conditions during the bio-year 2013 nesting and brood rearing season appeared to increase nesting success and chick survival rates. The increased nesting success and chick survival was considered to have contributed to the excellent ratio of chicks/hen observed in the 2014 harvest.

Disease

There were no confirmed cases of West Nile Virus documented in sage-grouse within the SCCA in bio-year 2014.

Special Studies

Several long term sage-grouse research projects related to the development of wind energy continued in the immediate vicinity of the SCCA. In conjunction with development of the proposed Chokecherry/Sierra Madre Wind Farm, located south of Rawlins, a multi-faceted sage-grouse research project has continued since 2010. The principal investigators include the consulting firm SWCA, University of Missouri, and US Forest Service. A similar wind energy development research effort was also initiated at the 7-Mile/Simpson Ridge area which is located within the Bates Hole/Shirley Basin Conservation Area; immediately adjacent to the SCCA. Principal investigators for the 7-Mile/Simpson Ridge project are WEST Inc., Wyoming Wildlife Consultants, Inc. and the University of Wyoming.

Several academic research projects and publications related to sage-grouse in the SCCA have been completed in recent years (Table 1). The SCCA LWG supported several of these research projects, in part, by awarding grants from the Wyoming Sage-Grouse Conservation Fund.

State and Federal Conservation Strategies

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. This strategy continued in 2014, to maintain and enhance greater sage grouse habitat in Wyoming. In early 2015, local working groups including the SCLWG, under the guidance of the Governor's Sage-Grouse Implementation Team, began a review of the CAS which included a detailed review of Core Area boundaries. As of the end of this reporting period, the Governor's Sage-Grouse Implementation Team has presented proposed changes to the CAS to Governor Mead for approval.

The BLM and the USFS continued to work on adopting Wyoming's Core Area Strategy into their land management decision processes in Wyoming. The WY-BLM sage-grouse instruction memorandum was issued in early 2012 (WY-BLM IM 2012-19). As of bio-year 2014 BLM Resource Management Plans (RMPs) and USFS Forest Plans across the state were still in the process of being amended to incorporate Wyoming's Core Area Strategy and new BLM national sage-grouse policies (BLM-IM-2012-043 and 044).

The US Department of Agriculture's Natural Resource Conservation Service continued to implement their Sage-Grouse Initiative program in the SCCA. However, landowner participation in the Sage-

Grouse Initiative program was limited in the SCCA, due to the program's adjusted gross income cap which precludes many larger landowners from enrollment.

In 2014, U.S. Fish and Wildlife Service (USFWS) issued a data call to the states as the USFWS began their review and evaluation of whether the greater sage-grouse was still warranted to be listed as a threatened species. Wyoming complied with this data call by providing an extensive amount of data detailing conservation efforts and protection mechanisms which had been implemented for the benefit of sage-grouse. The Service is scheduled to publish a decision in the fall of 2015.

The USFWS also continued to offer landowners enrollment in the sage-grouse Candidate Conservation Agreement with Assurances (CCAA) program. The CCAA program is a voluntary agreement whereby private landowners agree to manage their lands to remove or reduce threats to sage-grouse being listed under the Endangered Species Act (ESA). In return for managing their lands for the benefit of sage-grouse, these landowners receive assurances against additional regulatory requirements should that species ever be listed under the ESA.

Local Working Group Conservation Plan Implementation

The SCLWG was initiated in September of 2004 and completed their Sage-grouse Conservation Plan (Plan) in 2007. In 2014, the SCLWG adopted an addendum to their Plan. This addendum documented conservation action such as research and habitat projects the LWG had supported since their Plan was completed, as well as how these projects addressed the goals and action items identified in the Plan. In bio-year 2014, the SCLWG continued to support several new and ongoing sage-grouse conservation actions by allocating financial assistance, provided by the Wyoming Sage-Grouse Conservation Fund (Table 1).

Recipient	Project	LWG Support
University of Wyoming, Dr. Beck	Response of greater sage-grouse to treatments in Wyoming big sagebrush	$42,000
WEST Inc.	7-Mile Hill/Simpson Ridge wind energy and sage-grouse research	$25,000
Utah State University, Dr. Conover	Impacts of raven abundance on greater sage- grouse nesting success in south-central Wyoming	$20,000
University of Wyoming, Dr. Mealor	Evaluating threshold concepts for improving habitat through cheatgrass management	$10,000
Wyoming Geographic Information System Center	Purchase 0.5 meter NAIP imagery for assistance with DDCT	$10,000
Bureau of Land Management, Rawlins	Bradley Peak conifer removal	$10,000
Bureau of Land Management, Rawlins	Ferris Mountain conifer removal	$3,000

Table 1. Conservation actions supported by the South Central Local Working Group, bio-year 2014, Wyoming.

Management Recommendations for the SCCA

1. Continue to monitor a minimum of 80% of the occupied leks in the SCCA.

2. Support SCLWG efforts to work on mitigation and reclamation issues.

3. Support efforts identify seasonal habitats, especially winter concentration habitat.

4. Coordinate with BLM and USFS to ensure treatments in sage-grouse Core area comply with WY-EO-2011-5.

5. Continue to build partnerships with private landowners to maintain or improve sage-grouse habitats on private lands through mutually beneficial habitat projects

Literature Cited

Christiansen, T. 2012. Chapter 12: Sage Grouse (*Centrocercus urophasianus*). Pages 12-1 to 12-55 in S.A. Tessmann and J. R. Bohne (eds). Handbook of Biological Techniques: third edition. Wyoming Game and Fish Department. Cheyenne.

Wyoming Game and Fish Department (WGFD). 2007. South Central Sage-Grouse Conservation Plan. 74pp.

Sage Grouse Job Completion Report

Year: 2006 - 2015, 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)
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	277	56	20	1490	28.1
2013	282	94	33	1638	21.8
2014	286	101	35	1579	21.3
2015	285	90	32	1915	32.5

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
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	277	182	66	2206	19.2
2013	282	162	57	1564	14.9
2014	286	180	63	2019	17.7
2015	285	169	59	3134	27.7

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: 2006 - 2015, 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)
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	277	238	86	3696	22.0
2013	282	256	91	3202	17.8
2014	286	281	98	3598	19.1
2015	285	259	91	5049	29.4

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2006	173	10	37	183	94.5	5.5
2007	175	10	38	185	94.6	5.4
2008	163	8	29	171	95.3	4.7
2009	176	20	24	196	89.8	10.2
2010	181	14	29	195	92.8	7.2
2011	160	24	23	184	87.0	13.0
2012	179	31	28	210	85.2	14.8
2013	192	48	16	240	80.0	20.0
2014	196	78	7	274	71.5	28.5
2015	183	56	20	239	76.6	23.4

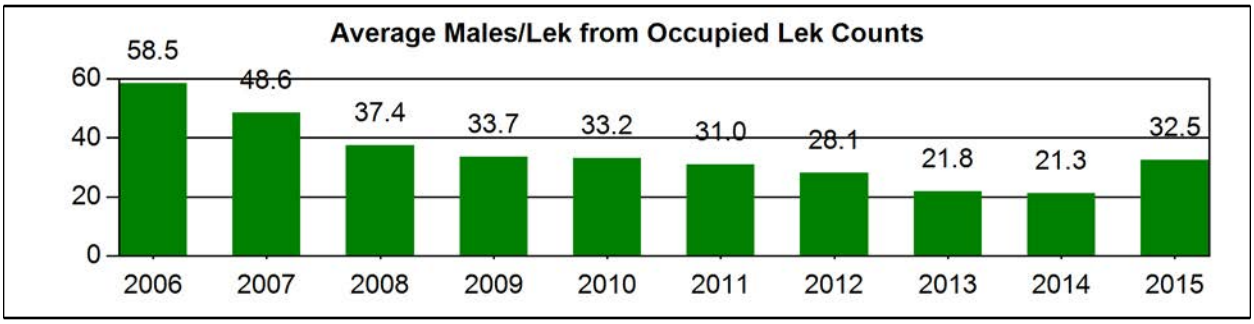
1) Occupied - Active during previous 10 years (see official definitions)

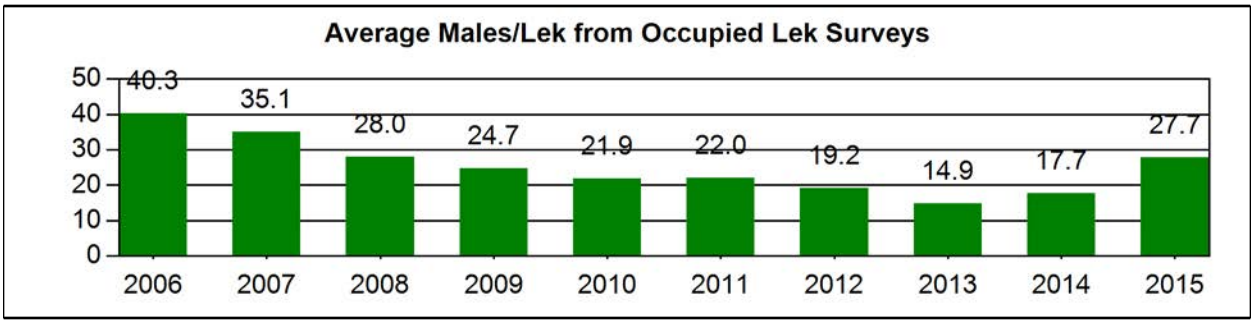
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

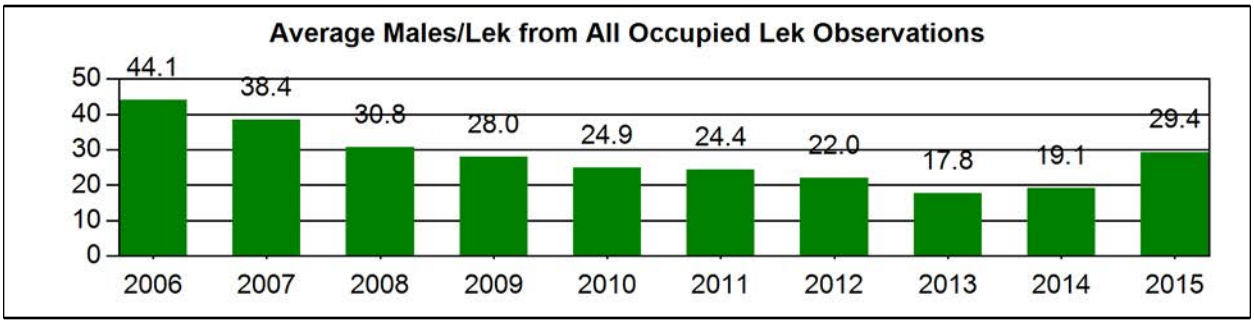
3) Inactive - Confirmed no birds/sign present (see official definitions)

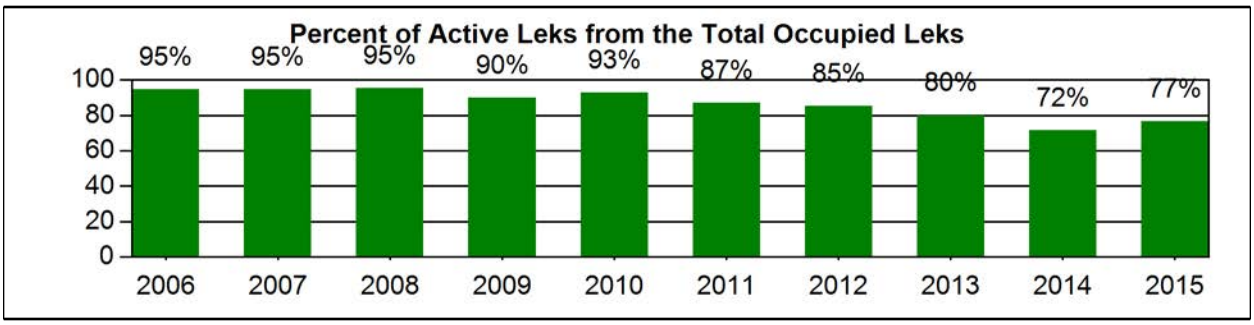
Sage Grouse Occupied Lek Attendance Summary

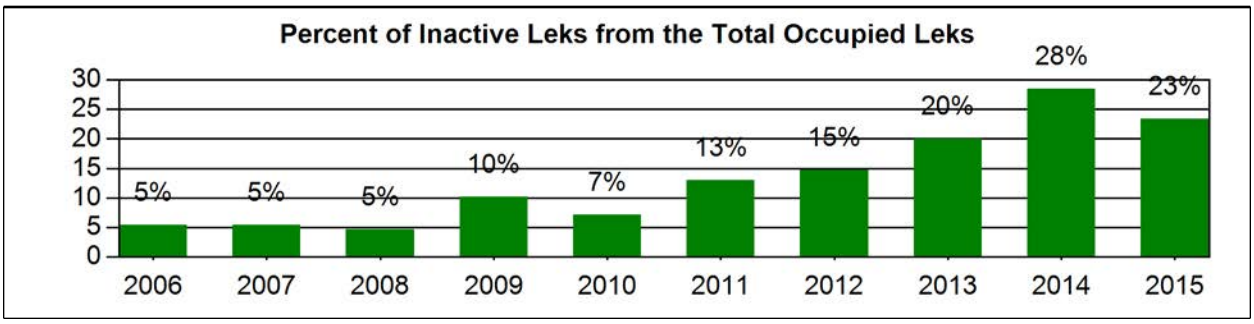
Year: 2006 - 2015, Management Area: H, Working Group: South Central











Sage Grouse Lek Characteristics

Management Area: H, Working Group: South Central

Region	Number	Percent
Green River	126	32.4
Lander	208	53.5
Laramie	55	14.1

Working Group	Number	Percent
South Central	389	100.0

Classification	Number	Percent
Occupied	328	84.3
Undetermined	26	6.7
Unoccupied	35	9.0

BLM Office	Number	Percent
Casper	2	0.5
Lander	26	6.7
Rawlins	344	88.4
Rock Springs	17	4.4

Biologist	Number	Percent
Baggs	112	28.8
Green River	14	3.6
Laramie	5	1.3
Rawlins	192	49.4
Saratoga	50	12.9
South Lander	16	4.1

Warden	Number	Percent
Baggs	111	28.5
East Rawlins	57	14.7
Elk Mountain	6	1.5
Rock Springs	15	3.9
Saratoga	44	11.3
South Laramie	5	1.3
West Rawlins	151	38.8

County	Number	Percent
Albany	5	1.3
Carbon	255	65.6
Fremont	13	3.3
Natrona	2	0.5
Sweetwater	114	29.3

Land Status	Number	Percent
BLM	218	56.0
Private	146	37.5
State	24	6.2
USF&WS	1	0.3

Management Area	Number	Percent
H	389	100.0

Sage Grouse Job Completion Report

Year: 2005 - 2014, Management Area: H, Working Group: South Central

4. Sage Grouse Hunting Seasons and Harvest Data

a. Season

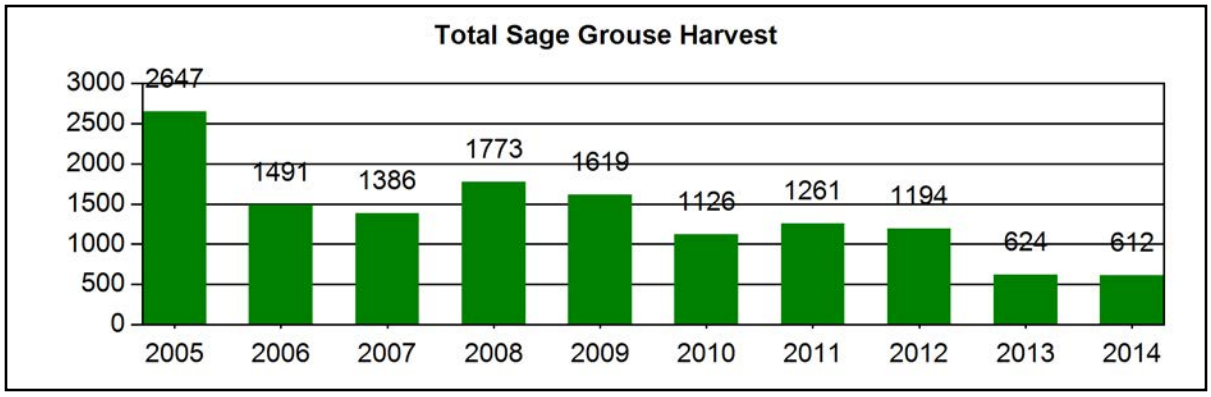
Year	Season Start	Season End	Length	Bag/Possesion Limit
2005	Sep-23	Oct-3	11	2/4
2006	Sep-23	Oct-3	11	2/4
2007	Sep-22	Oct-2	11	2/4
2008	Sep-22	Oct-2	11	2/4
2009	Sep-19	Sep-30	12	2/4
2010	Sep-18	Sep-30	13	2/4
2011	Sep-17	Sep-30	14	2/4
2012	Sep-15	Sep-30	16	2/4
2013	Sep-21	Sep-30	10	2/4
2014	Sep-20	Sep-30	11	2/4

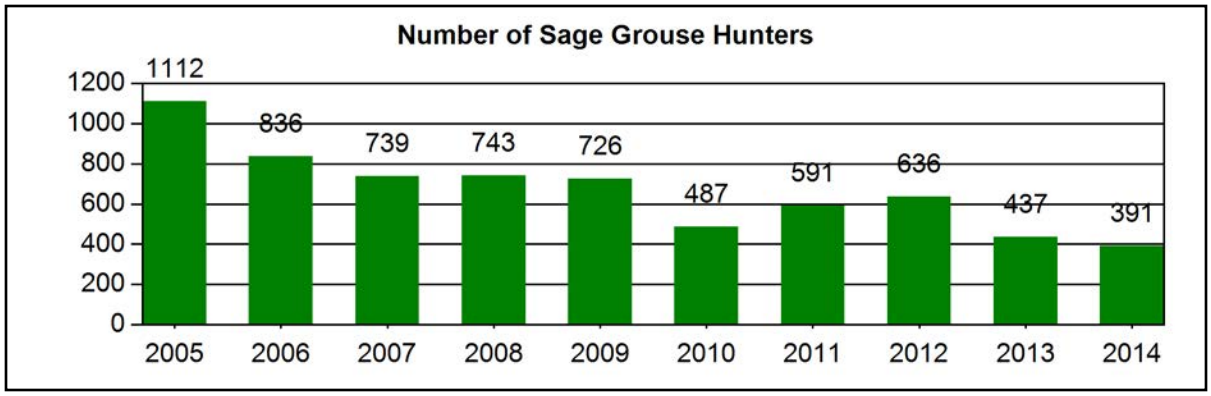
b. Harvest

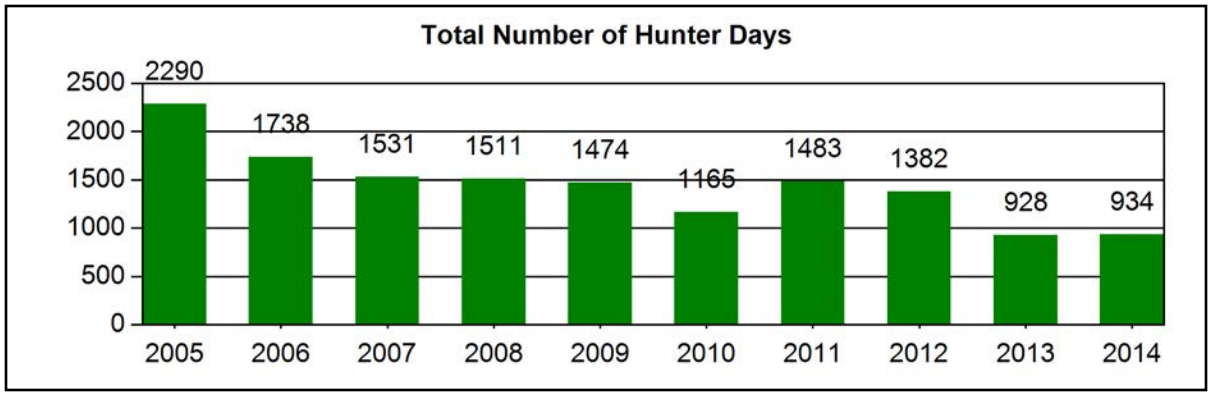
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2005	2647	1112	2290	1.2	2.4	2.1
2006	1491	836	1738	0.9	1.8	2.1
2007	1386	739	1531	0.9	1.9	2.1
2008	1773	743	1511	1.2	2.4	2.0
2009	1619	726	1474	1.1	2.2	2.0
2010	1126	487	1165	1.0	2.3	2.4
2011	1261	591	1483	0.9	2.1	2.5
2012	1194	636	1382	0.9	1.9	2.2
2013	624	437	928	0.7	1.4	2.1
2014	612	391	934	0.7	1.6	2.4
Avg	1,373	670	1,444	0.9	2.0	2.2

Sage Grouse Harvest Summary

Management Area: H, Working Group: South Central

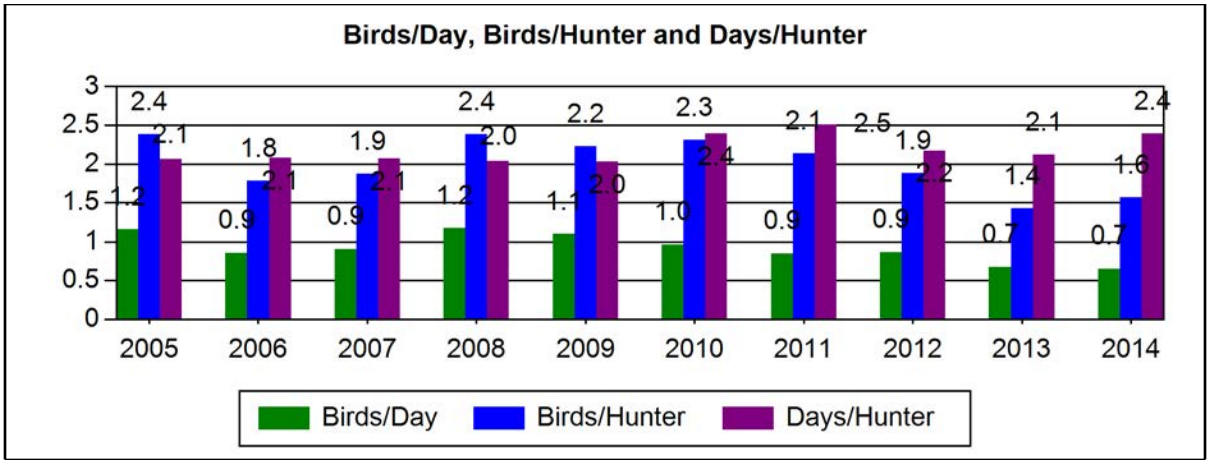






Sage Grouse Harvest Summary

Management Area: H, Working Group: South Central

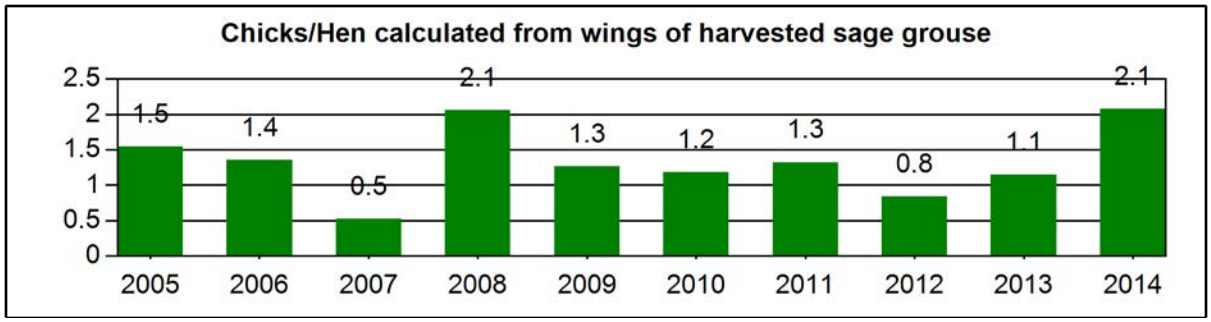


Sage Grouse Job Completion Report

Year: 2005 - 2014, Management Area: H, Working Group: South Central

5. Composition of Harvest by Wing Analysis

Year	Sample Size	Percent Adult		Percent Yearling		Percent Young		Chicks/ Hens
		Male	Female	Male	Female	Male	Female	
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
2013	107	14.0	36.4	1.9	1.9	15.9	27.1	1.1
2014	146	10.3	23.3	3.4	4.8	30.8	27.4	2.1



Southwest

Sage-Grouse
Job Completion Report
2014

June 2014-May 2015

Patrick Burke
Wyoming Game & Fish Dept.
Green River Region

2014 Annual Sage-Grouse Job Completion Report

Conservation Plan Area: **Southwest**
Biological Year: **June 1, 2014 – May 31, 2015**
Prepared by: **Patrick Burke**

INTRODUCTION

The Southwest Wyoming Sage-Grouse Conservation Area (SWSGCA) is one of eight in Wyoming (Figure 1). The local working groups were created in 2004 and charged with developing and implementing plans to promote sage-grouse conservation for their respective areas. The conservation plan put together by the Southwest Local Working Group for the SWSGCA was completed in July 2007 and an updated version was completed during the 2013 reporting period. This report focuses on analysis of data for the biological year June 1, 2014- May 31, 2015, with some comparisons made to the last ten years of data.

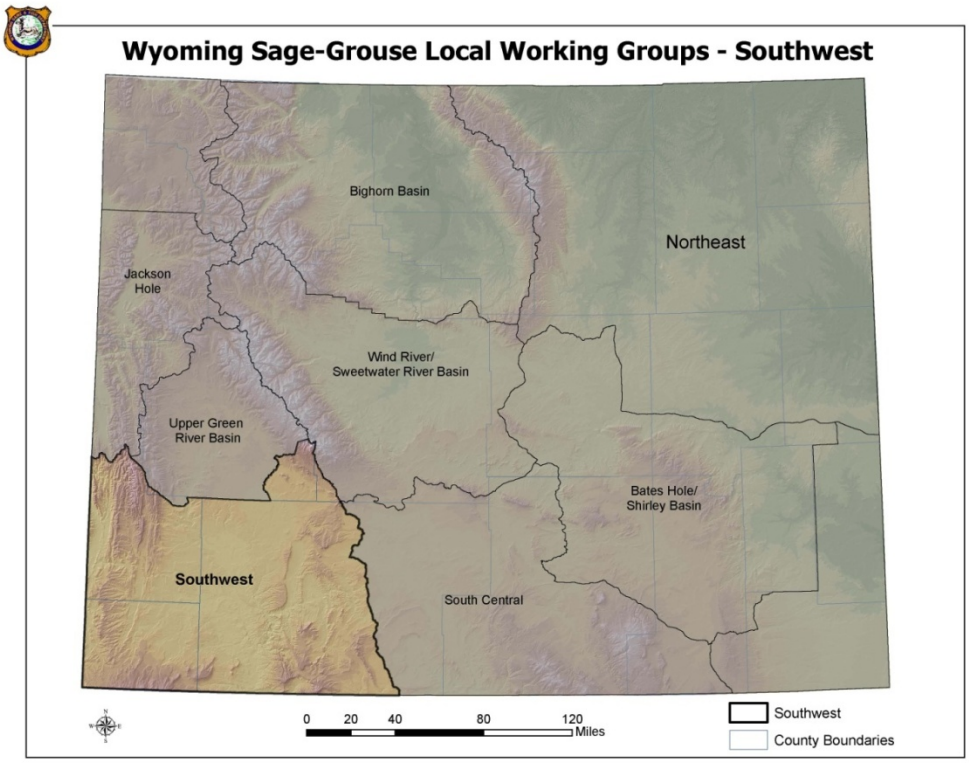


Figure 1. Wyoming Local Sage-Grouse Working Group Boundaries

In response to range-wide sage-grouse population declines and loss of sagebrush, upon which sage-grouse depend, habitats in the past two decades, there has been an increased emphasis on sage-grouse data collection. 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. Well-timed precipitation in 2004-05 increased chick survival and later lek attendance, however drought conditions from 2006-08 appear to have caused the population in the southwest part of the state 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 with that year being the driest year on record in Rock Springs. The drought conditions continued in 2013 and 2014, which resulted in decreased chick to hen ratios in 2013, suggesting a continuation of overall population declines. However, in 2014, the limited amount of moisture received must have come at a time that did allow for increased chick survival and resulted in improved chick to hen ratios that year.

In addition to the continuing drought conditions that have been experienced off and on for the last decade and a half, 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. While most of the proposed wind energy projects in the SWSGCA have been placed on the back burner, the potential for harm still exists if these projects are reinitiated.

The issues of hunting and predation and the potential impacts of hunting are concerns that are often raised by the public. There is little evidence suggesting that 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). Other raven impacts studies are continuing in the SWSGCA and South-Central SGCA with several resulting publications (Conover et al. 2010, Dinkins et al. 2012, Dinkins 2013, Dinkins et al. 2013, Dinkins et al. 2014).

WYOMING CORE AREA STRATEGY

In a move to coordinate sage-grouse conservation efforts across the State of Wyoming, then 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. These actions constituted Wyoming's Core Area Strategy.

Following the 2010 "warranted but precluded" listing decision by the U.S. Fish & Wildlife Service, 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 and Governor Freudenthal issued a new Executive Order (2010-4) to replace that from 2008.

Subsequent to the 2010 gubernatorial election, Governor Matt Mead signed a 2011 version of the Executive Order (2011-5), reiterating and clarifying the Wyoming Core Area Strategy with further updates and modifications in 2013 (Executive Order 2013-3).

In preparation for the U.S. Fish and Wildlife Service's September 2015 court-ordered deadline to again determine the listing status of sage-grouse and to comply with the existing Executive Order language to review core area boundaries after a 5 year period, Governor Mead tasked the SGIT with providing him recommendations to update the core area strategy. Local Working Groups were again engaged to assist in the process.

In the SWSGCA this process resulted in important habitats between Fontenelle and LaBarge Creeks and on the WY-CO border east of Hiawatha being recommended for addition to core while an area associated with the Tronox Mine was recommended for removal from core area status. Other smaller revisions were also recommended. The Governor is expected to decide the fate of these recommendations in the summer of 2015.

Executive Order 2011-5 is appended to the Statewide JCR The current core areas are shown in Figure 2.

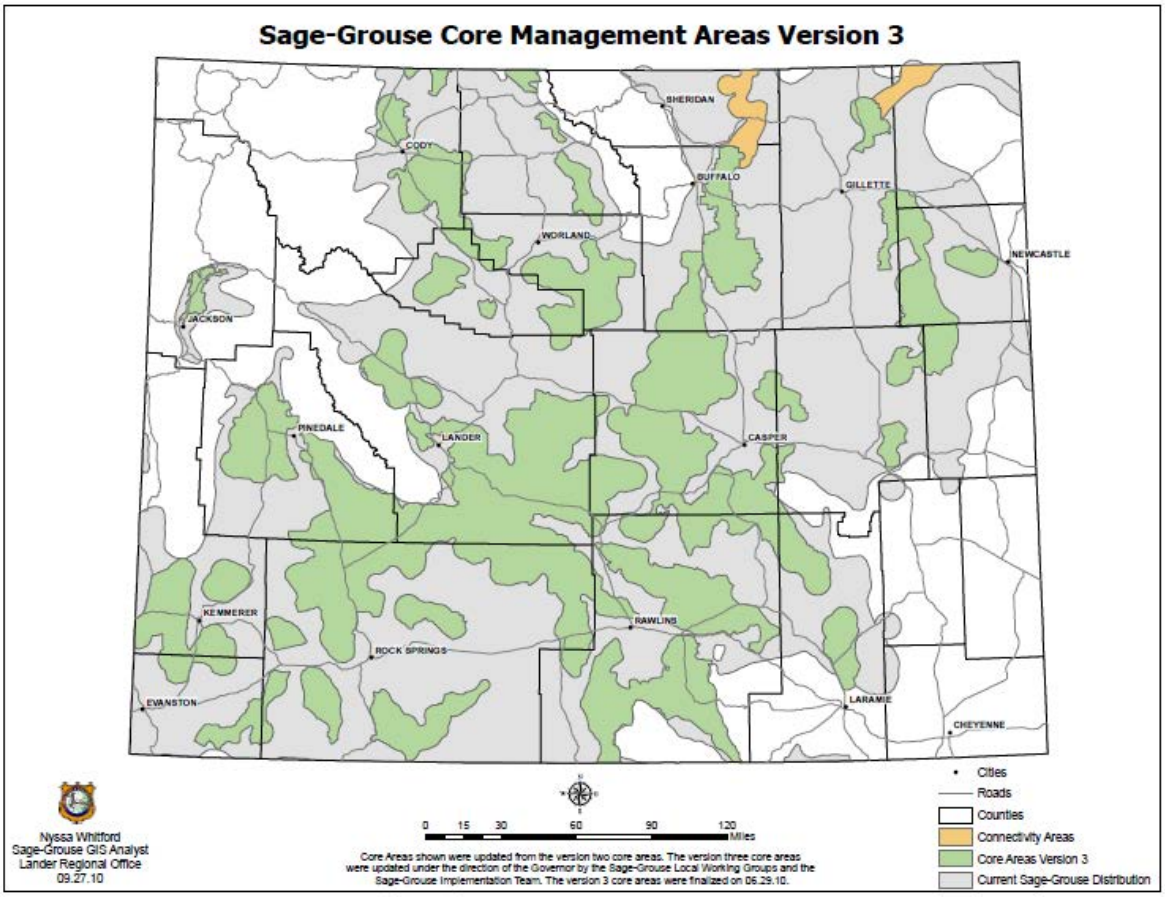


Figure 2. Wyoming sage grouse core areas Version 3.

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 is 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 more precisely 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 3). The remainder of Management Area 7 was included in the Upper Green River Basin Conservation Planning Area (UGRBCA). Since 2010, sage-grouse harvest data have been reported by Sage-Grouse Management Area. The Sage-Grouse Management Areas were created to correspond to the local working group boundaries, which 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.

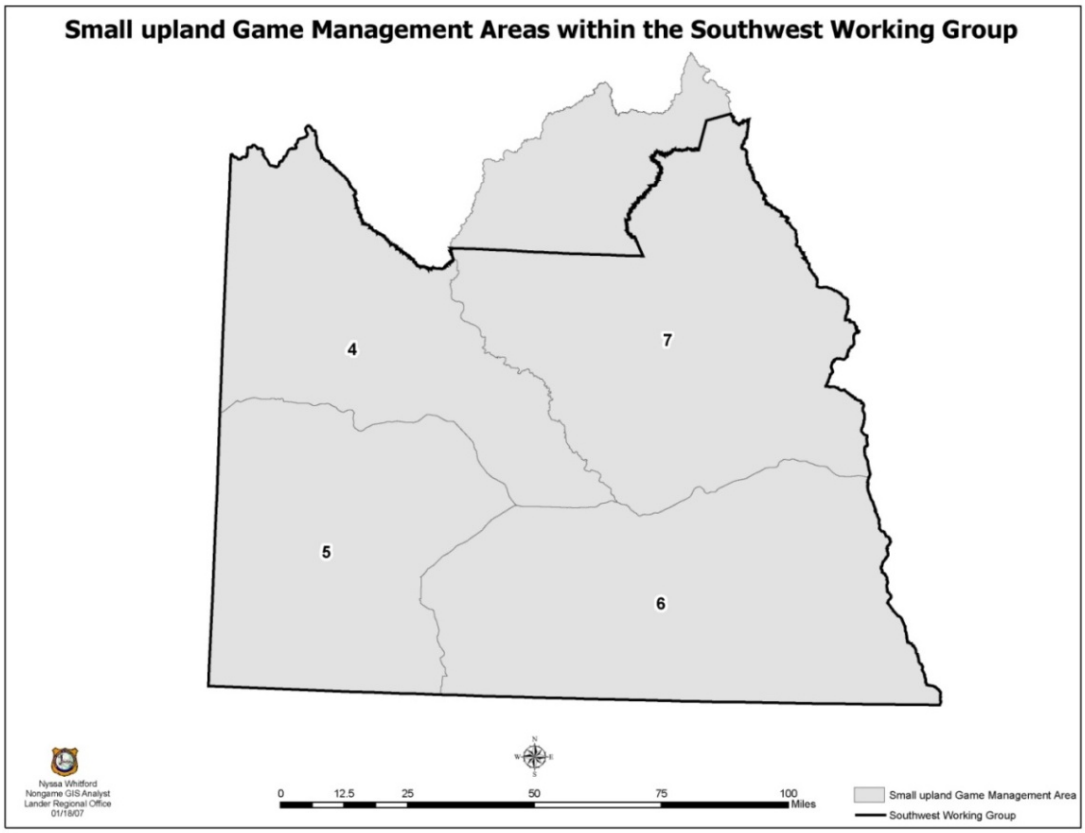


Figure 3. Small Game Management Areas within the Southwest Wyoming Sage-Grouse Conservation Planning Area. Small Game Management Areas were used to report sage-grouse harvest prior to 2010.

In addition to the mailed/on-line questionnaire, wings are collected on a voluntary basis from harvested sage-grouse in order to determine 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 2012), which is largely based on Connelly et al (2003).

RESULTS

Lek Monitoring

All lek monitoring data for the 2015 breeding season along with data from the past ten years for comparison are summarized in Appendix A Tables 1 a-d and Figures 1 a-e. There were 320 occupied leks known to exist in the SWSGCA during the 2015 breeding season. Of the known lek sites in the SWSGCA, 287 of them were checked in 2015 resulting in 242 being documented as being active, 19 were classified as being inactive and 26 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 leks.

Since only "occupied" leks are being reported on Appendix A Tables 1 a-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. The proportion of known status leks that were active in the SWSGCA has remained relatively steady over the 10-year reporting period varying from 88-98% active.

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 un-located or un-monitored 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.

The average number of males per active lek for all leks checked (both counted and surveyed) during the 2015 lekking season was 35.7 males per active lek. This is a 72% increase from the 20.7 males per active lek observed in 2014, and slightly above the 10 year average of 33.6 males per active lek. The average number of males in attendance on the 66 count leks in 2015 was 35.8 males per lek. This number is a major increase from 2014, and is the highest observed since 2009, and above the 10-year average of 34.5 males per count lek. For the 221 leks that were surveyed in 2015, the average lek had 35.6 males in attendance, which is an increase from recent years averages and the highest observed since 2007.

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 in the mid 2000's is probably an artifact of an increased sampling effort and does not necessarily represent an actual increase in the sage-grouse population. In 2000, only 63% of known occupied leks were checked, but in 2015, 90% 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 had been declining but has begun to increase during this reporting period.

Harvest

The 2014 hunting season for sage-grouse in the SWSGCA ran from September 20 to September 30 and allowed for a daily take of 2 birds with a limit of 4 grouse in possession (Appendix A Table 2 a). The 2014 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 historically 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 2014 hunting seasons. Note that for 2005-2009 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, 1,165 hunters harvested 2,645 sage-grouse during the 2014 hunting season (Appendix A Table 2 b and Figures 2 a-d). The estimated harvest of 2,645 birds in 2014 was well below the 10 year average harvest of 3,655 birds and just over half of the estimated harvest in 2006, when hunters harvested over 5,000 grouse. Part of this can explained by the change in how harvest is reported between 2006 and 2014 and the shorter hunting season in 2014, the rest is probably a result of lower sage-grouse numbers, wet weather during the hunting season and a concern from the public about the condition of the sage-grouse population. 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 517 grouse wings from the 2014 hunting season (Appendix A Table 3). This represents just under 20% of the estimated total harvest for 2014, 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 2014 hunting season was 2.3 chicks/hen (Appendix A Table 3 and Figure 3). This ratio suggests an overall increasing grouse population. This observed chick:hen ratio corresponds well with the increased male lek attendance seen in the spring of 2015.

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 production all have a large impact on sage-grouse nesting and brood rearing 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.

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.

The spring (March-June) precipitation and fall chick:hen ratios (as determined by hunter submitted wings) are given in Table 1 and Figure 4. 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 also tend to be below average.

In 2014, spring precipitation was 84% of normal. The below average precipitation observed in 2012 and 2013 coincides with the below average chick ratio observed in the 2012 and 2013 wing submissions. Precipitation increased in the fall of 2013 and weather conditions heading into the 2014 nesting season were favorable and even though the spring precipitation in 2014 was only 84% of normal it was enough moisture to result in improved chick survival in 2014.

Table 1. Spring precipitation compared to fall chick:hen ratios in the SWSGCA 2005-2014. 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
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
2013	55%	1.2
2014	84%	2.3

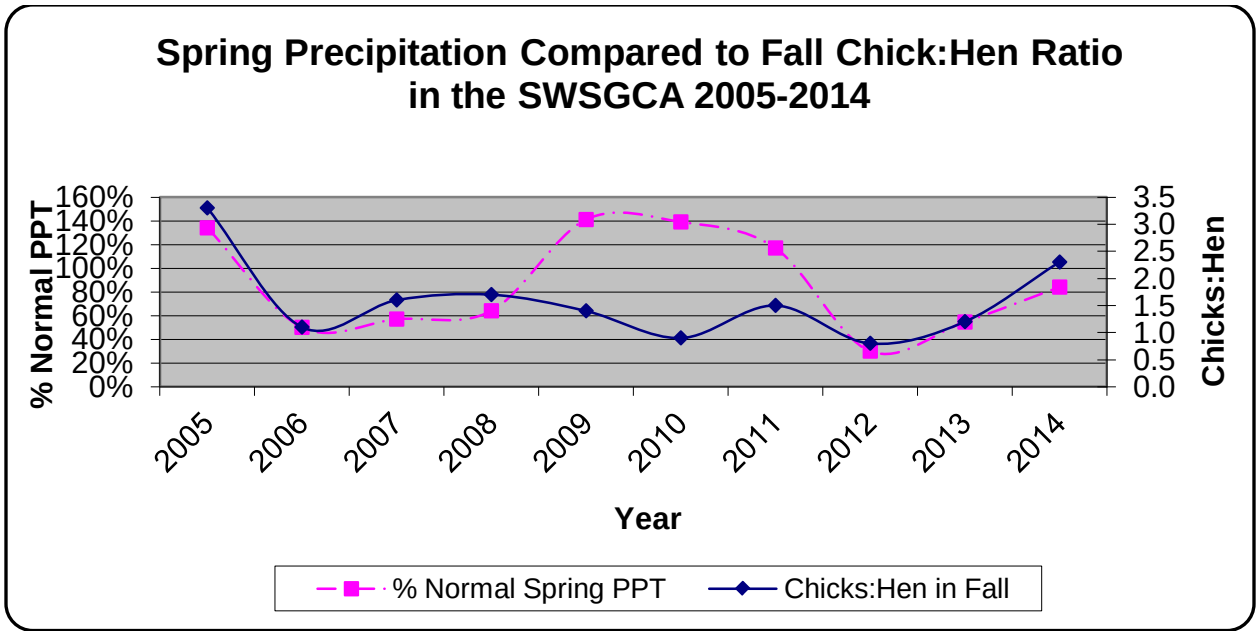


Figure 4. Percent of normal spring precipitation compared to fall chick to hen ratios in the Southwest Wyoming Sage-Grouse Conservation Planning Area

Habitat and Seasonal Range Mapping

While we believe that the majority 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.

CONSERVATION PLANNING/IMPLEMENTATION

Since 2005, Local Working Groups have supported implementation of local sage-grouse conservation projects with funding appropriated from State of Wyoming General Fund as requested by the governor and approved by the legislature. See Table 2 for a list of the projects implemented in, or on behalf of, the SWSGCA during this reporting period.

Table 2. Projects funded in part by the SWSGLWG June 1, 2014 - May 31, 2015.

Project Name	Project Description	Partners
Sage Creek cheatgrass treatment	Chemical control of cheatgrass within a wildfire area	BLM; Sweetwater Co. Weed & Pest
Currant Creek Ridge juniper removal	Mechanical juniper removal from sage-grouse habitat	BLM
Lousy George Spring juniper removal	Mechanical juniper removal from sage-grouse habitat	BLM
Impact of raven removal on SG	Research to determine impacts of raven control to sage-grouse	Utah State University, private landowners, South-Central LWG
Impacts of wind energy development on sage-grouse	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, Bates Hole-Shirley Basin LWG, South-Central LWG
WY core area habitat condition assessment	RSF modeling to assess sagebrush habitat conditions at multiple scales and the repsonse of sage-grouse to changes in conditions	Audubon Rockies, TNC, Yellowstone Ecological Research Center, Governor's SG Implementation Team, 6 LWGs
Response of SG to sagebrush treatments phase III	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, 6 LWGs
Half-meter NAIP imagery acquisition	Half-meter (high resolution) imagery for use in the DDCT process	15 federal, state and county agencies, 5 LWGs

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.

Dinkins, J.B., M.R. Conover and S.T. Mabray. 2013. Do artificial nests simulate nest success of greater sage-grouse? Human–Wildlife Interactions 7(2):299–312.

Dinkins, J.B. 2013. Common raven density and greater sage-grouse nesting success in southern Wyoming: potential conservation and management implications. Dissertation. Utah State Univeristy, Logan.

Dinkins, J.B., M.R. Conover, C.P. Kirol, J.L. Beck, and S.N. Frey. 2014. Greater sage-grouse (Centrocercus urophasianus) hen survival: effects of raptors, anthropogenic and landscape features, and hen behavior. Canadian Journal of Zoology 92:319-330.

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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

- Utah State University continued to study the effectiveness of common raven control in southern Wyoming in 2014-15 with a new graduate student.

RECOMMENDATIONS

1) Identify important seasonal habitats.

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

3) Continue to 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.

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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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Appendix A: Sage Grouse Job Completion Report

Year: 2006 - 2015, 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)
2006	240	67	28	4153	62.9
2007	257	69	27	3914	58.4
2008	267	69	26	4284	63.0
2009	285	71	25	2651	40.2
2010	292	78	27	2214	30.8
2011	302	73	24	1855	26.9
2012	310	82	26	1720	23.2
2013	317	117	37	1974	19.5
2014	319	98	31	1641	20.0
2015	320	66	21	2115	35.8

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2006	240	152	63	4074	38.4
2007	257	175	68	5791	42.9
2008	267	149	56	4021	33.5
2009	285	190	67	5485	35.2
2010	292	185	63	3789	26.5
2011	302	168	56	2909	21.1
2012	310	188	61	2889	20.8
2013	317	180	57	2259	16.7
2014	319	195	61	3182	21.1
2015	320	221	69	6085	35.6

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: 2006 - 2015, 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)
2006	240	219	91	8227	47.8
2007	257	244	95	9705	48.0
2008	267	218	82	8305	44.2
2009	285	261	92	8136	36.6
2010	292	263	90	6003	27.9
2011	302	241	80	4764	23.0
2012	310	270	87	4609	21.6
2013	317	297	94	4233	17.9
2014	319	293	92	4823	20.7
2015	320	287	90	8200	35.7

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2006	183	26	10	209	87.6	12.4
2007	215	18	11	233	92.3	7.7
2008	196	13	9	209	93.8	6.2
2009	234	17	10	251	93.2	6.8
2010	227	13	23	240	94.6	5.4
2011	221	5	15	226	97.8	2.2
2012	230	25	15	255	90.2	9.8
2013	244	29	24	273	89.4	10.6
2014	236	26	24	262	90.1	9.9
2015	242	19	26	261	92.7	7.3

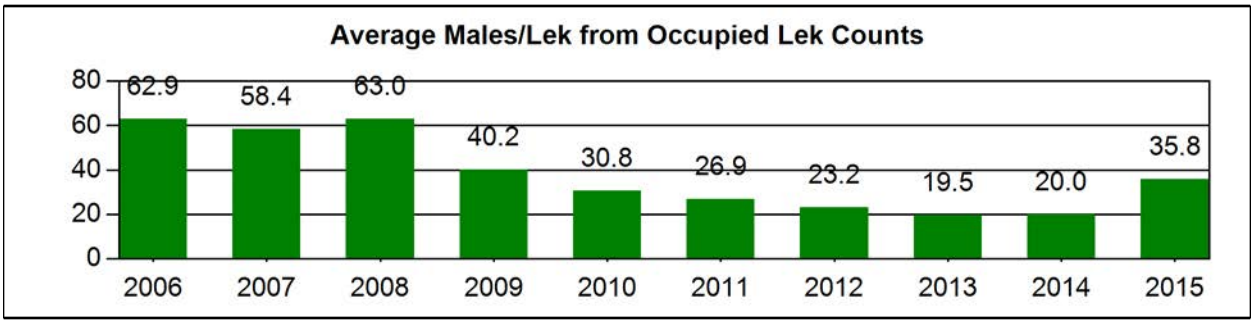
1) Occupied - Active during previous 10 years (see official definitions)

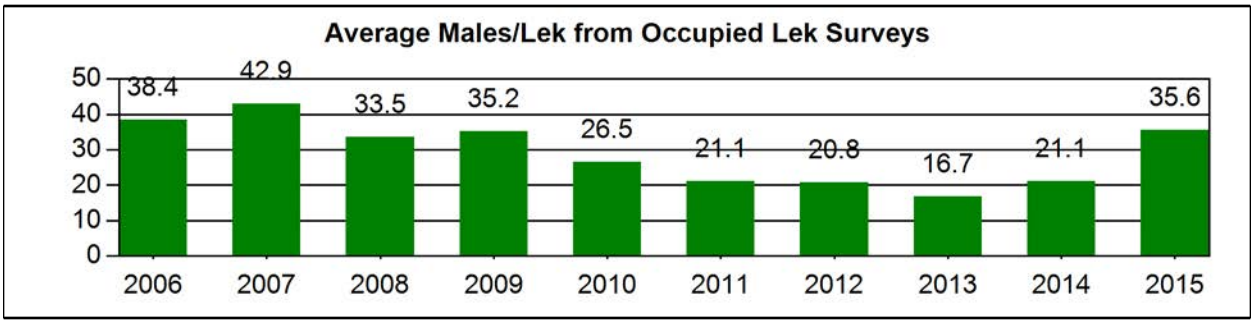
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

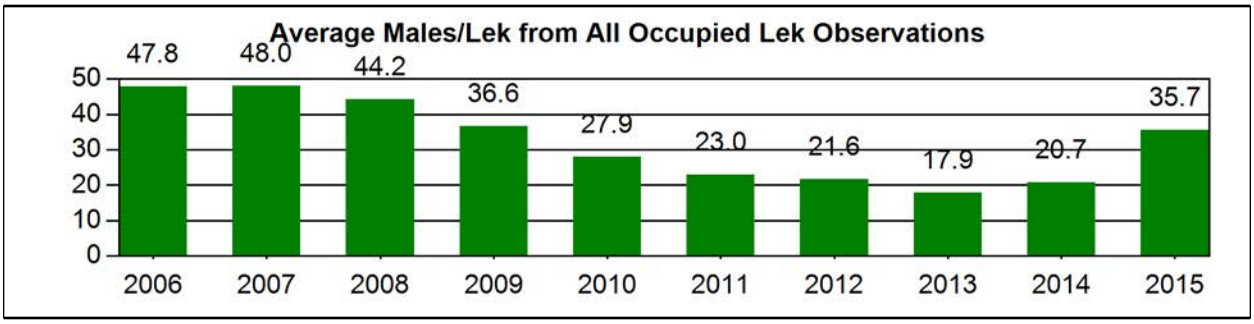
3) Inactive - Confirmed no birds/sign present (see official definitions)

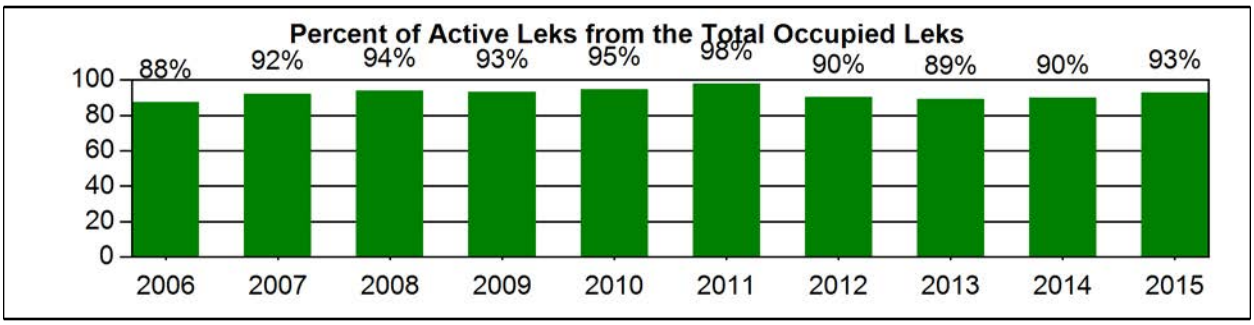
Figures 1 a-e. Sage Grouse Occupied Lek Attendance Summary

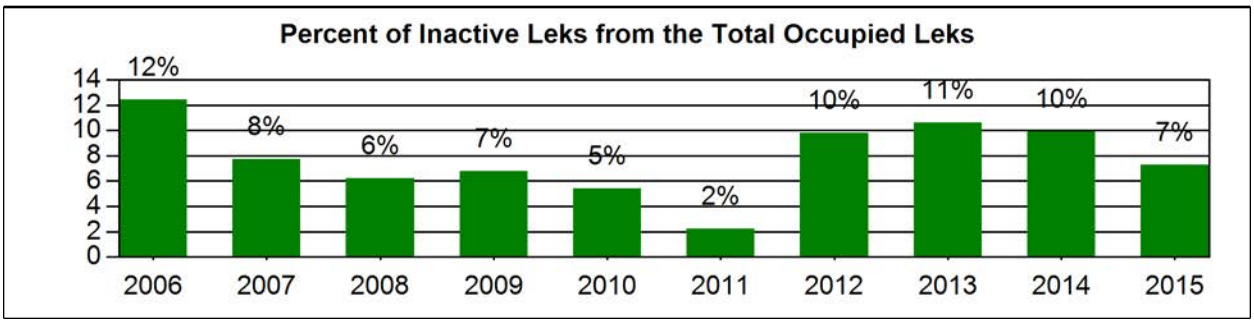
Year: 2006 - 2015, Working Group: Southwest











Sage Grouse Lek Characteristics

Working Group: Southwest

Region	Number	Percent
Green River	388	88.0
Pinedale	53	12.0

Working Group	Number	Percent
Southwest	441	100.0

Classification	Number	Percent
Occupied	319	72.3
Undetermined	19	4.3
Unoccupied	103	23.4

BLM Office	Number	Percent
Kemmerer	192	43.5
Pinedale	12	2.7
Rawlins	5	1.1
Rock Springs	232	52.6

Biologist	Number	Percent
Green River	164	37.2
Kemmerer	223	50.6
Pinedale	53	12.0
South Lander	1	0.2

Warden	Number	Percent
Cokeville	61	13.8
Evanston	30	6.8
Green River	82	18.6
Kemmerer	64	14.5
Lander	1	0.2
Mountain View	50	11.3
Rock Springs	100	22.7
South Pinedale	53	12.0

County	Number	Percent
Fremont	4	0.9
Lincoln	129	29.3
Sublette	34	7.7
Sweetwater	207	46.9
Uinta	67	15.2

Land Status	Number	Percent
BLM	309	70.1
BOR	14	3.2
National Park	2	0.5
Private	102	23.1
State	13	2.9
USFS	1	0.2

Management Area	Number	Percent
G	441	100.0

Sage Grouse Job Completion Report

Year: 2005 - 2014, Working Group: Southwest

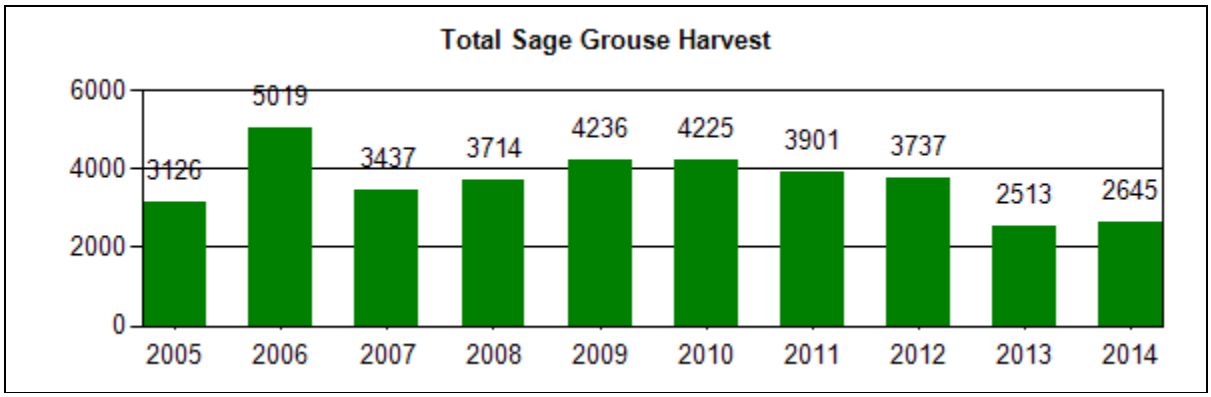
Table 2. Sage Grouse Hunting Seasons and Harvest Data

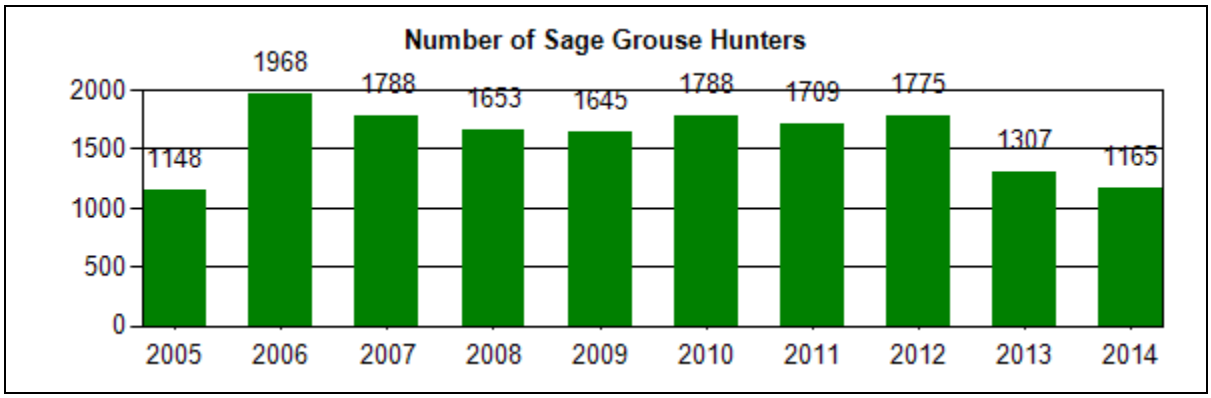
a. Season

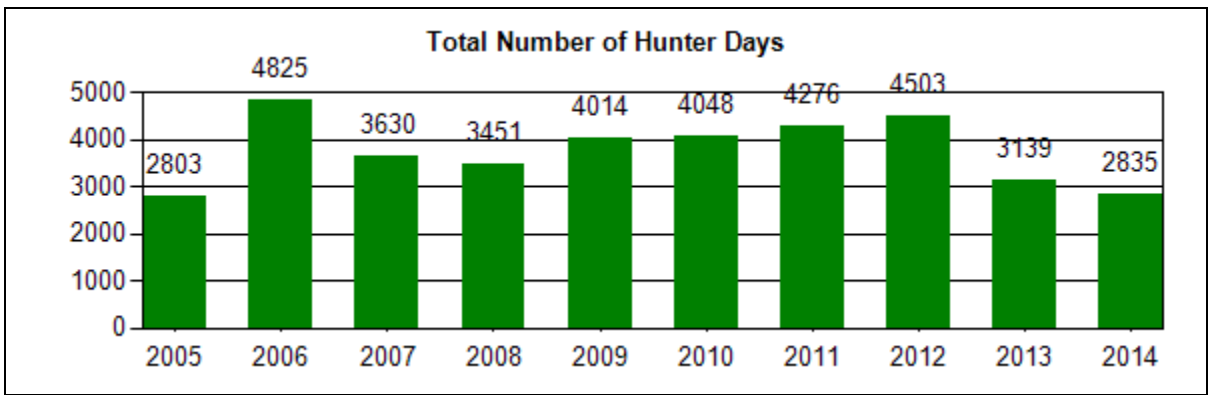
Year	Season Start	Season End	Length	Bag/Possesion Limit
2005	Sep-23	Oct-3	11	2/4
2006	Sep-23	Oct-3	11	2/4
2007	Sep-22	Oct-2	11	2/4
2008	Sep-22	Oct-2	11	2/4
2009	Sep-19	Sep-30	12	2/4
2010	Sep-18	Sep-30	13	2/4
2011	Sep-17	Sep-30	14	2/4
2012	Sep-15	Sep-30	16	2/4
2013	Sep-21	Sep-30	10	2/4
2014	Sep-20	Sep-30	11	2/4

b. Harvest

Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
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
2013	2513	1307	3139	0.8	1.9	2.4
2014	2645	1165	2835	0.9	2.3	2.4
Avg	3,655	1,595	3,752	1.0	2.3	2.4


Total Sage Grouse Harvest
6000
4000
2000
0
3126
5019
3437
3714
4236
4225
3901
3737
2513
2645
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


Number of Sage Grouse Hunters
2000
1500
1000
500
0
1148
1968
1788
1653
1645
1788
1709
1775
1307
1165
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


Total Number of Hunter Days
5000
4000
3000
2000
1000
0
2803
4825
3630
3451
4014
4048
4276
4503
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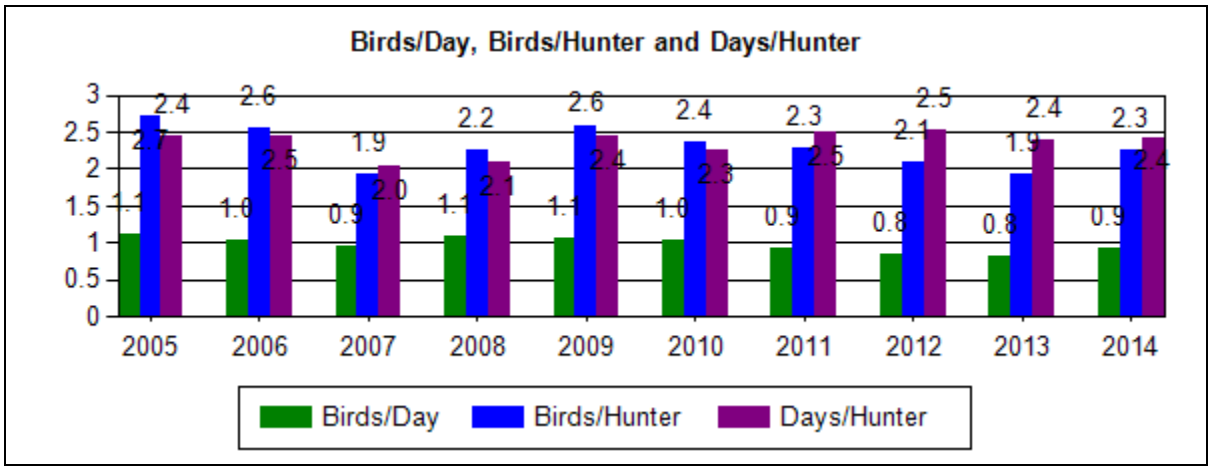
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


Birds/Day, Birds/Hunter and Days/Hunter
3
2.5
2
1.5
1
0.5
0
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Birds/Day
Birds/Hunter
Days/Hunter

Sage Grouse Job Completion Report

Year: 2005 - 2014, Working Group: Southwest

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	
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
2013	390	9.2	38.5	1.5	2.3	20.5	27.9	1.2
2014	517	5.6	20.7	2.3	7.0	33.5	30.9	2.3

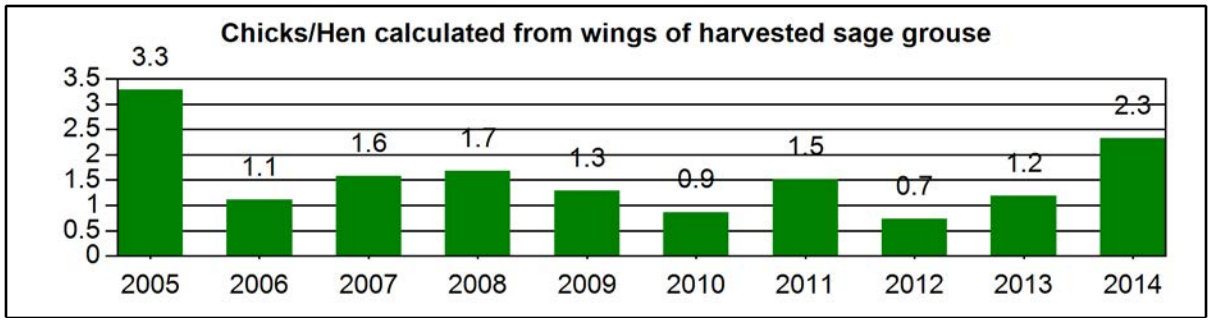


Figure 3. Chicks/hen 2005-2014 in SWSGCA.

Upper Green River Basin

Sage-Grouse
Job Completion Report
2014

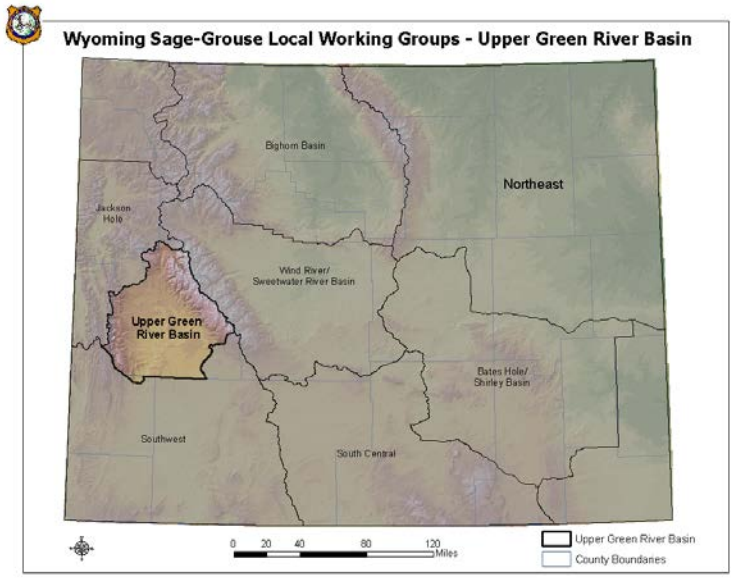
June 2014-May 2015

Dean Clause
Wyoming Game & Fish Dept.
Pinedale Region

Narrative
Conservation Plan Area: **Upper Green River Basin**
Period Covered: **6/1/2014 – 5/31/2015**
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. All lek data and harvest data from SGMA D is included in this 2014 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 (81%), with fewer leks found on private (12%), and state (7%) 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. 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. However, population trends are essentially the same between counts and surveys when over 50 leks are sampled (Fedy and Aldridge 2011). 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). Management protection is not afforded to undetermined leks.

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 indicated that habitat protection measures (stipulations) being implemented during the studies were not sufficient to protect sage-grouse and their habitats. The results of this research have been important in the revision of some stipulations, the development of the Wyoming Core Area Strategy (discussed below) and revisions to BLM and Forest Service planning documents.

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.

Habitat Protection and Core Area Policy

In 2007 Wyoming Governor Freudenthal convened a summit and created the Wyoming Governor's Sage-grouse Implementation Team (SGIT) to develop a conservation strategy, the Wyoming Core Population Area strategy, to manage sage-grouse to prevent listing under the ESA and retain State authority in management decisions. The strategy identified the most important sage-grouse habitat in Wyoming using a lek density map showing areas of the state which supported the highest densities of breeding activity from 2005 thru 2007.

The Governor issued an Executive Order 2008 outlining the core area strategy to conserve Wyoming's most important sage-grouse habitats while allowing for development outside core areas. Statewide, core areas accounted for approximately 34%

of sage-grouse range while encompassing leks with 81% of the 2008 peak males. Intentionally excluded from "core" habitat were existing, planned, and authorized energy development areas in the Upper Green River Basin.

Following the March 2010 listing decision of "warranted, but precluded" by the FWS, The core area map was revised using new and more fine scale sage-grouse and human use information, input from the state's 8 local sage-grouse working groups, and known areas of other important seasonal habitats (winter and late brood-rearing).

Following these revisions, Governor Freudenthal signed Executive Order 2010-4 which updated Wyoming's core area strategy as the framework to guide sage-grouse management in Wyoming.
Subsequent to the 2010 gubernatorial election, Governor Mead signed a 2011 version of the Executive Order (2011-5), reiterating and clarifying the Wyoming Core Area Strategy with further updates and modifications in 2013 (Executive Order 2013-3). In preparation for the U.S. Fish and Wildlife Service's September 2015 court-ordered deadline to again determine the listing status of sage-grouse and to comply with the existing Executive Order language to review core area boundaries after a 5 year period, Governor Mead tasked the SGIT with providing him recommendations to update the core area strategy. Local Working Groups were again engaged to assist in the process. In the Upper Green River Basin this process was controversial but resulted in the acknowledgement of designated "Winter Concentration Areas" in Alkali Draw. Exactly how these areas will be managed in the future is still to be determined. The current Executive Order (2015-4) was signed in July of 2015 making further modifications to core areas, policy, protections measures, and definitions. See the following a site for a copy of that Executive Order: https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Sage%20Grouse/SG_Executive_Order.pdf

The BLM and Forest Service have amended their land use planning documents in order to be more consistent with the current Executive Order and to address the regulatory concerns expressed by the U.S. Fish and Wildlife Service (USFWS). This amendment is referred as the Application for Resource Management Plan Amendment (ARMPA) for Greater Sage-grouse and was signed into management plans during September 2015.

Climate

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. Temperatures during nesting and early brood rearing periods (April – June) can also influence nest success and chick survival. 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 2012) located on the WGFD website (http://wgfd.wyo.gov/).

Results

Lek Monitoring

A total of 152 leks are currently documented in the UGRBWGA. These leks are classified as follows; 131 occupied, 21 unoccupied, and 0 undetermined. During 2015, a total of 128 occupied leks (98%) were checked (survey or count). Lek monitoring efforts in 2015 primarily focused on counts (84%) over surveys (16%). Results from the counts and surveys showed that 80% of the leks were active and 20% were inactive. The average number of males/lek for all active leks increased to 53 in 2015, compared to the past three years of 36 in 2014, 35 in 2013, 37 in 2012. This results in a 47% increase during 2015 compared to the previous 3 year average (Figure 1).

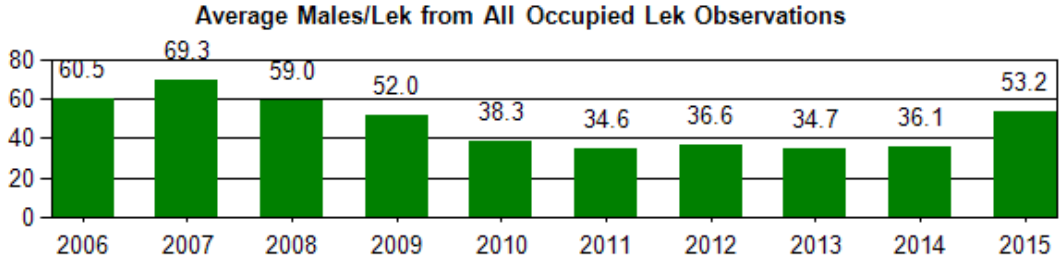


Figure 1. Average Peak Male Sage-grouse Lek Attendance 2006-2015, UGRBWG Area.

The last peak in male attendance occurred in 2007 and was the highest level ever recorded for the area. Since 2007, the observed average peak male has declined through 2010, stabilized from 2011-2014, and increased in 2015 (Figure 1). The 2015 peak male lek attendance is 23% lower compared to 2007 using all occupied leks within the UGRBWGA. 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. 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.

The proportion of leks checked that are confirmed "active" has stayed relatively stable during the past 10 years, ranging from 77% to 84%. 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 (51 new leks since 2004) mathematically negating the downward trend in the proportion of active leks in the UGRBWGA.

An analysis was performed to provide a more accurate assessment of longer range population trends in the UGRBWG area using only data from known leks that had some level of activity and reliable data during 1997, using no new leks documented after that 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 UGRBWGA. Fifty-one of the 66 known leks were used in this trend analysis (1997-2015). These leks were tracked from 1997 through 2015 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, stabilizing in 2012 -2014 and increasing in 2015. Although this trend analysis is only a sub-set of all the known leks in the UGRBWGA, overall trends are similar when compared to trends using all lek data within the UGRBWGA as shown in Figure 1.

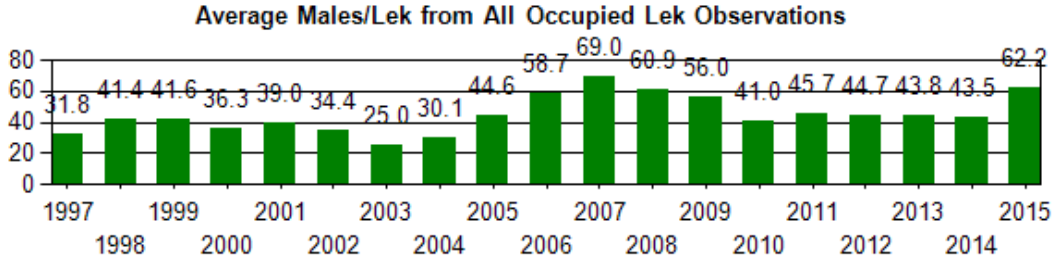


Figure 2. Average Peak Male Sage-grouse Lek Attendance 1997-2015, UGRBWG Area.

A lek analysis to assess natural gas development impacts in the Pinedale area has shown higher rates of decline on leks (males) near or within gas field development compared to leks away from gas development. Two data sets were derived from all the known leks within the UGRBWGA using the most current aerial imagery. 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 "Undisturbed Leks" used all the remaining leks not included in the Disturbed Leks data set. Note that some leks in the Undisturbed 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 1997-2015 (same reasons described in the previous paragraph), all leks outside the PAPA and Jonah were added to the Undisturbed Leks data set.

The Disturbed Leks data set includes 19 total leks in which 11 (58%) were classified as occupied and 8 (42%) were classified unoccupied in 2015. Of the 11 occupied leks, 11 were checked in 2015 resulting in 5 (45%) of those leks being active. The average peak

number of males/lek for these 11 occupied leks showed a 7% decline from 1997-2015, 32% decline from 2007-2015, and a 22% increase from 2014 to 2015 (Figure 3).

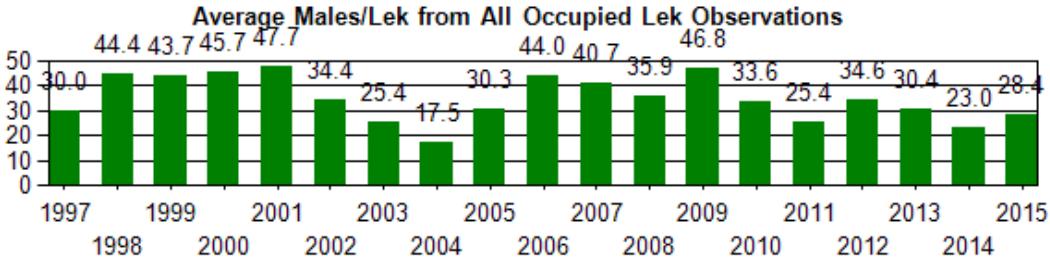


Figure 3. Average Peak Male Sage-grouse Lek Attendance 1997-2015, Disturbed Leks.

The Undisturbed Leks data set includes 127 total leks in which 114 (90%) were classified as occupied and 13 (10%) were classified as unoccupied in 2015. Of the 114 occupied leks, 111 were checked in 2015 resulting in 92 (83%) of those leks being active. The average peak number of males/lek for these occupied leks showed 90% increase from 1997-2015, 22% decline from 2007-2015, and a 54% increase from 2014 to 2015 (Figure 4).

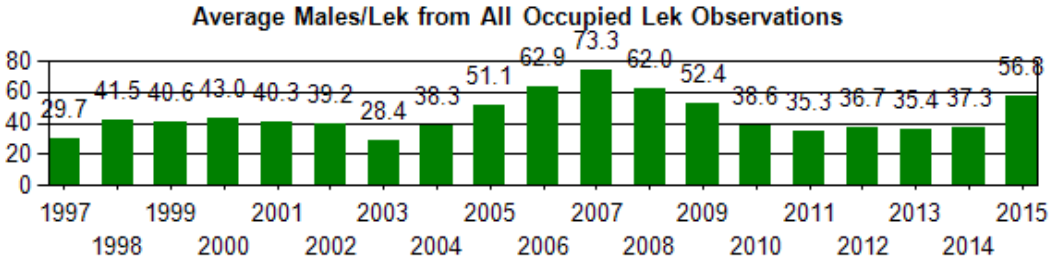


Figure 4. Average Peak Male Sage-grouse Lek Attendance 1997-2015, Undisturbed Leks.

In comparing the two data sets (Disturbed Leks vs. Undisturbed Leks), the average number of peak males/lek for occupied leks reveal similar trends as males declined in early 2000's, increased into the late 2000's, declined in 2010 and 2011, stabilized somewhat during 2012-2014, and increased in 2015. The overall changes (both up and down) in male lek numbers are more pronounced with the Undisturbed 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 86% (1997-2001) to 45% by 2015 (occupied leks only). The Undisturbed Leks show activity levels changing very little with an average of 81% (1997-2001) to 83% by 2015, 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 42% compared to 10% outside the PAPA and Jonah as fields (Undisturbed Leks).

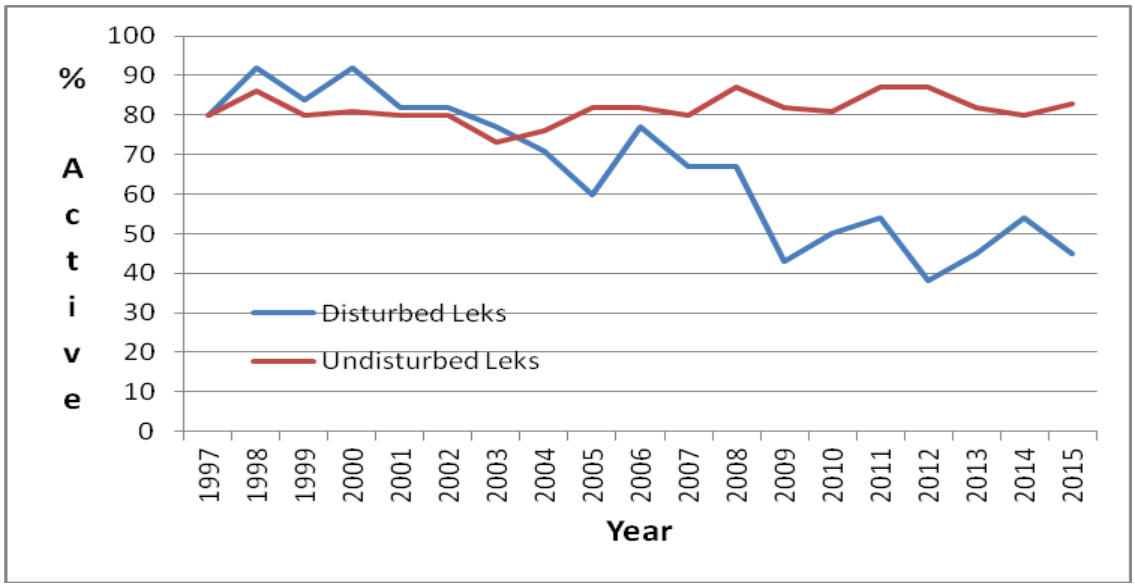


Figure 5. Proportion of active leks 1997-2015, Disturbed Leks verses Undisturbed Leks.

Population Trends and Estimates

No reliable population estimate have be made from data collected during 2015 (or any of the previous years), due in part to unknown male:female sex ratios and since it is unknown if all active leks have been located within the UGRBWGA. An increasing population trend during 2004 - 2007 is indicated by an increase in the average number of males/lek since 2003. While 2008-2010 lek monitoring indicate a declining trend, with population stabilization during 2011-2014. A significant increase in male lek attendance during 2015 indicates an upward population trend. With the exception of the disturbed leks noted above, the proportion of active leks in the UGRBWGA has remained relatively stable at 77% to 84% over the last ten years. Thus the average males/lek is a reasonable indicator of population trend over that time.

Harvest

The 2014 sage-grouse season was September 20 through September 30, an 11-day hunting season, similar to seasons since 2004. Hunting seasons since 2002 have allowed 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 2014 have been 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) were developed in 2010, where SGMA D covers all of the UGRBWGA and will be reported that way in future years.

The 2014 harvest survey estimated that 406 hunters bagged 1056 sage grouse and spent 1266 days hunting. The average number of birds per day was 1.0, the average number of birds per hunter was 2.6, and the number of days spent hunting per hunter was 2.6 during 2014. Harvest survey data indicates there had been a slight decline in hunter participation during the past 5-years. 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), while declining in 2013. 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 from 233-781 averaging 484.

Wing Collections

Eighteen sage-grouse wing barrels were distributed throughout Sublette County in 2014 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 wings are used to determine age and sex based on molting patterns and feather characteristics.

A total of 337 sage-grouse wings were collected from barrels in the UGRBWGA during 2014, which is lower than the 372 wings collected during 2013. The number of wings collected during 2013 and 2014 is the lowest sample during the past 10-year period, ranging from 337 to 547. Of the 337 wings collected in 2014, 42% were juvenile birds, indicating a higher proportion of harvest on juveniles compared to 2012 and 2013. The overall composition of wings in 2014 indicated a ratio of 1.0 chicks/hen (adult and yearling females), which is higher than 0.8 chicks/hen in 2013 and 0.9 chicks/hen in 2012. These wing collections have indicated poor chick survival in recent years, resulting in stable grouse numbers, which was not anticipated. The good chick production of 1.4 chicks/hen during 2011 can be attributed to keeping grouse number from further declines in recent years. This chick/hen ratio derived from wing collections has been a relatively good indicator to predict future population trends, as male lek attendance trends have correlated relatively well with previous year's production (# chicks/hen) data.

Winter Distribution Surveys

No winter sage grouse surveys were conducted during the 2014-2015 winter within the UGRBWG Area. 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). Additional analysis methods

such as Resource Selection Function (RSF) models have recently been utilized with this winter survey data to help refine existing winter concentration areas (WCA). Although, WCA have been identified throughout the UGRBWG Area, the Sage Grouse Implementation Team (SGIT) has only recognized one area in the Alkali Draw & Alkali Creek Area as of 2015.

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. A graph was generated comparing 3-month (April-June) average precipitation for years 2012-2015 (Figure 6) and should correlate to forage production during that year. A graph comparing 3-month (April-June) average temperatures (Figure 7) for years 2012-2015 might provide some insight on nest and early brood-rearing success. A 30-year average was also plotted on these graphs to indicate a long range average.

The average precipitation for the 3-month period of April - June was below average during 2012, 2013, and 2014, and above average during 2015 (Figure 6). The above average precipitation reported in 2015 during this 3-month period is attributed to nearly 4 inches of precipitation in May, significantly higher than the 30-year average near 1.6 inches of precipitation for May. Temperatures have remained above average for the 3-month period of April-June for 2012-2015 (Figure 7). Overall, this reported precipitation and temperature data from Climatic Division 3 trends appear to reflect conditions documented within the UGRBWGA. The higher than normal temperatures and precipitation recorded during the Spring of 2015 should result in improved nest success and chick survival during 2015, and improved male lek counts in 2016.

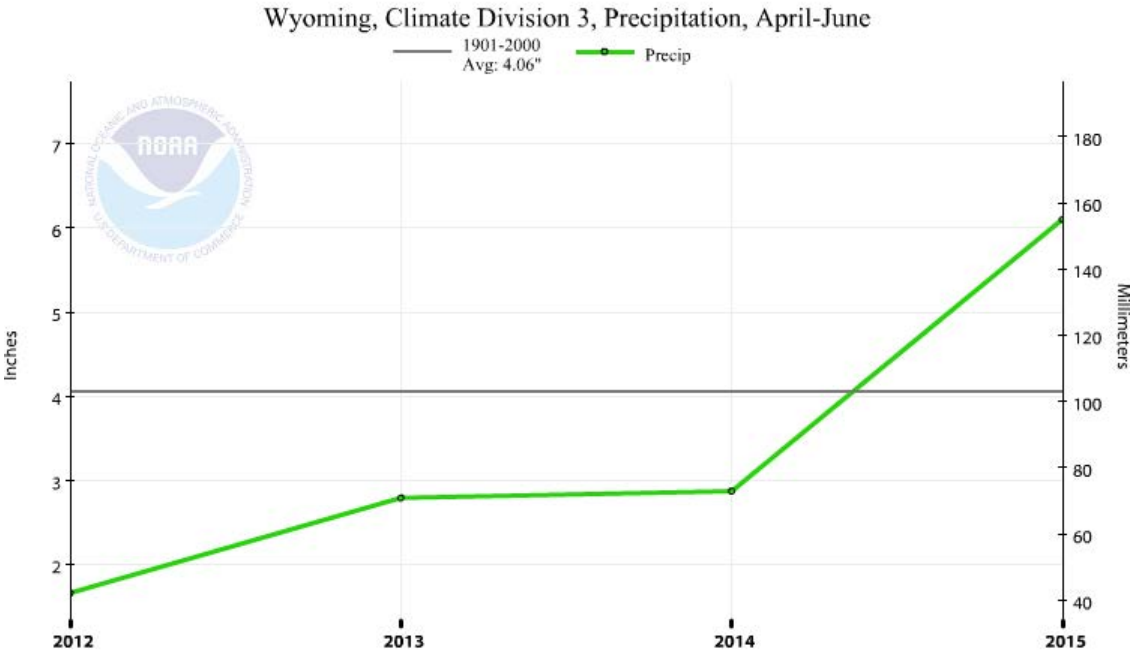


Figure 6. 3-month average (April-June) precipitation for years 2012-2015.

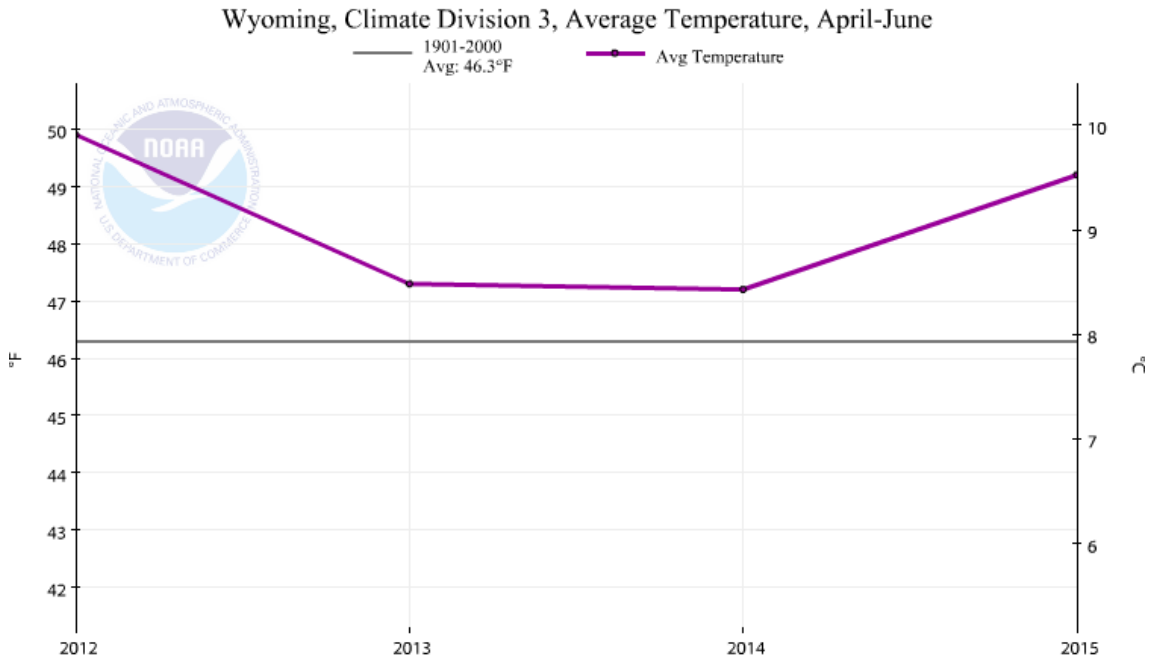


Figure 7. 3-month average (April-June) temperature for years 2012-2015.

Special Projects

Sage-grouse Research Projects

From 1998-2009 there were 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.

There is an on-going study (initiated in 2013) looking into the significance of geophagy (consumption of soil) by sage grouse within the UGRBWGA. Sage-grouse geophagy, or intentional ingestion of dirt, was documented in Sublette County Wyoming during the winter of 2012 – 2013. While it is well-known for a variety of other birds and mammals, it represents a behavior that has never before been described for sage-grouse. The goal of this project is to assess the importance of "dirt-eating" areas in describing winter habitat selection by sage-grouse. Currently, within the Upper Green River Basin researchers have identified 15 confirmed locations of geophagy behavior. An additional 14 potential locations have also been identified. Coordinated tracking, GPS downloading of grouse on winter range, and site verification efforts involving BLM, Teton Raptor Center, Wyoming Wildlife Consultants, and Sublette County Conservation District are underway. Soil will be collected and tested at each newly confirmed location in order to identify the potential target mineral or compound responsible for the behavior. Using the spatial data collected from this project, future plans involve development of a resource selection model in order to assess the importance of available dirt eating sites on selection of winter habitat by sage-grouse in Wyoming.

Another ongoing study within the within the UGRBWGA was initiated by the U.S. Forest Service and Bryan Bedrosian with the Teton Raptor Center to obtain better sage grouse distribution and use information in the upper Green River Drainage on forest service managed lands. The study was first initiated in August of 2014 when nine grouse were captured and fitted with GPS backpack transmitters. Another nine sage grouse were captured and transmitters installed during August of 2015. These grouse are also being tracked during the winter months on habitats located further south in the Green River Basin, typically on BLM lands, to gain migration information on seasonal habitat use. These grouse have also been utilized in to help locate geophagy sites associated the study mentioned previously.

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 identified past, proposed, and ongoing projects; recommended management activities; funding sources; and other relevant sage-grouse information within the UGRBWGA intended to maintain and/or increase sage-grouse populations. The Working Group recently completed an addendum to this 2007 Conservation Plan (Upper Green River Basin Sage-Grouse Conservation Plan Addendum – 2014) that provides updated information on activities, projects, and management strategies within the UGRBWGA, which can also be found at http://wgfd.wyo.gov/. A new appropriation of State monies was approved for sage grouse projects during 2015 and 2016 to be allocated by UGRB Working Group on local conservation measures that benefit sage grouse. Raven control, water windmill to solar pump conversion, and cheatgrass inventory/control projects continue to account for the majority of allocated funds granted to the UGRB Working Group in recent years.

Management Summary

Data collected and reported in this 2014 Sage-Grouse Job Completion Report (June 2014 thru May 2015) 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, stabilized through 2014, and increased significantly in 2015. Lek trend data indicate grouse populations were at the lowest level in 2003 and highest level in 2007.

Lek monitoring in the UGRBWGA showed a 149% increase in the peak number of males per lek from 2003 to 2007 as males increased from 27.8 males/lek to 69.3 males/lek. This trend reversed since 2007, as the number of males/lek has declined by 47% dropping to 36.4 males/lek by spring of 2014. During 2015, lek counts showed a 47% (53 males/lek) increase compared to 2014. 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. Variation in hunter participation can be affected by hunting season structure, weather conditions, especially during the current short seasons, as well as hunter perceptions of sage-grouse populations.

Wing collection from wing barrels (drop locations) continue to provide good sample sizes to determine overall chick survival trends within the UGRBWGA. During 2008-2014 wing collections ranged from 31% to 45% of the reported harvest. Although the sample

size declined in 2014, wing collections accounted for 32% of the reported harvest. 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 and 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 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 1.3 chicks/ hen has shown stable attendance, and a chick/hen ratio greater than 1.3 has shown increases in lek attendance in the UGRBWGA. During the past 5 years (2010-2014) the chicks/hen average was has only exceed 1.0 chicks/per hen during 2011. The 2014 documented chick/hen ratio was 1.0 and the 2015 spring male lek counts showed a 47% increase, which wasn't expected and can't fully be explained as past correlations have show this level of male lek attendance increase following a marginal chick/hen ratio of 1.0.

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 since 2007 with some stabilization in recent years. Good to above average spring precipitation during 2008-2011 led to good herbaceous production, which should have helped turn around the recent declining trends in the UGRBWGA. 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 very good habitat production , and most likely contributing to the slight increase in bird numbers documented during the spring of 2012. Drought conditions in 2012 and 2013 most likely attributed to poor chick survival as spring temperatures were near normal, resulting in little change on spring lek counts in 2014. In 2014, good forage production was the result of good precipitation during the fall of 2013 and spring of 2014 which resulted in increased male lek counts in 2015. Although the winter of 2014-15 was mild with low precipitation, the spring of 2015 had above average precipitation, primarily attributed to a very wet May.

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 and update 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 and Plan Addendum.

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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.

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Sage Grouse Job Completion Report

Year: 2006 - 2015, 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)
2006	106	75	71	3953	63.8
2007	111	78	70	4329	69.8
2008	111	79	71	3721	53.9
2009	115	84	73	3850	55.0
2010	127	92	72	3099	41.9
2011	131	100	76	2692	31.7
2012	132	117	89	3514	36.6
2013	130	116	89	3125	34.3
2014	130	111	85	3207	36.9
2015	131	108	82	4627	53.8

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2006	106	22	21	827	48.6
2007	111	27	24	1354	67.7
2008	111	24	22	1414	78.6
2009	115	27	23	619	38.7
2010	127	30	24	573	26.0
2011	131	25	19	943	47.2
2012	132	6	5	149	37.3
2013	130	8	6	280	40.0
2014	130	14	11	290	29.0
2015	131	20	15	850	50.0

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: 2006 - 2015, 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)
2006	106	97	92	4780	60.5
2007	111	105	95	5683	69.3
2008	111	103	93	5135	59.0
2009	115	111	97	4469	52.0
2010	127	122	96	3672	38.3
2011	131	125	95	3635	34.6
2012	132	123	93	3663	36.6
2013	130	124	95	3405	34.7
2014	130	125	96	3497	36.1
2015	131	128	98	5477	53.2

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2006	79	18	0	97	81.4	18.6
2007	82	22	1	104	78.8	21.2
2008	87	16	0	103	84.5	15.5
2009	86	25	0	111	77.5	22.5
2010	95	27	0	122	77.9	22.1
2011	104	21	0	125	83.2	16.8
2012	101	22	0	123	82.1	17.9
2013	98	26	0	124	79.0	21.0
2014	99	26	0	125	79.2	20.8
2015	103	25	0	128	80.5	19.5

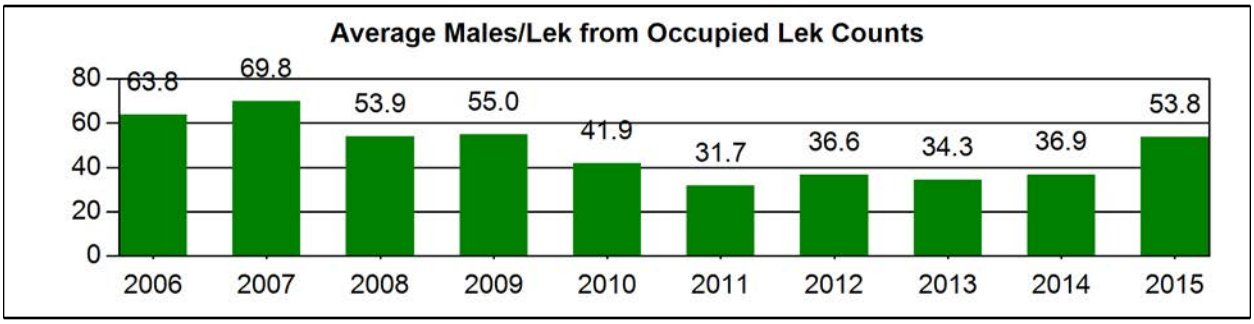
1) Occupied - Active during previous 10 years (see official definitions)

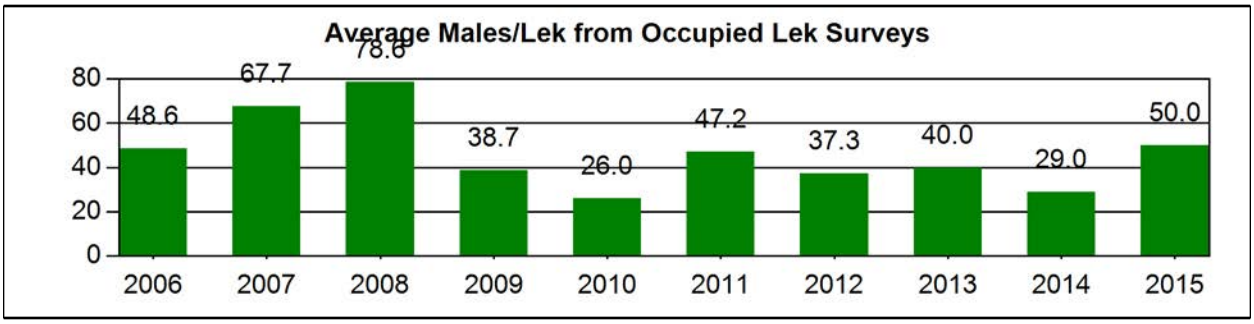
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

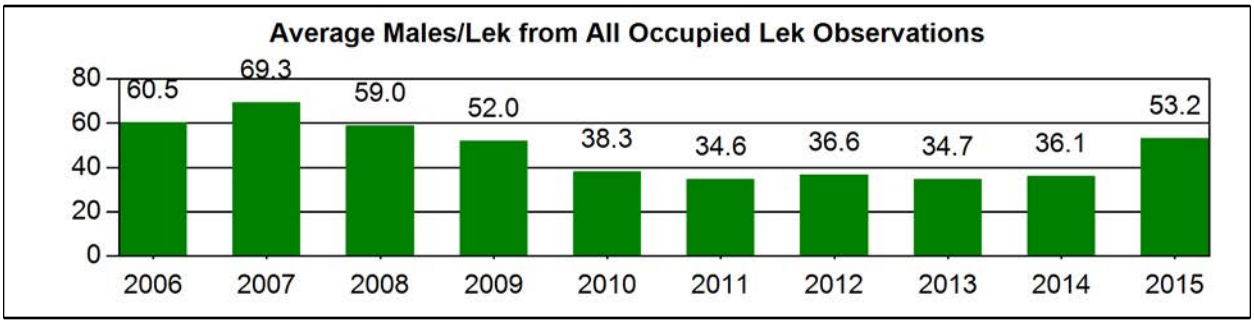
3) Inactive - Confirmed no birds/sign present (see official definitions)

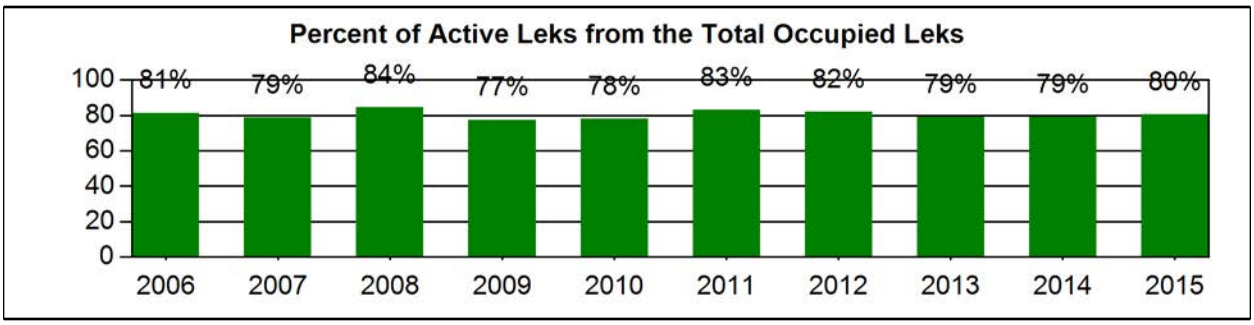
Sage Grouse Occupied Lek Attendance Summary

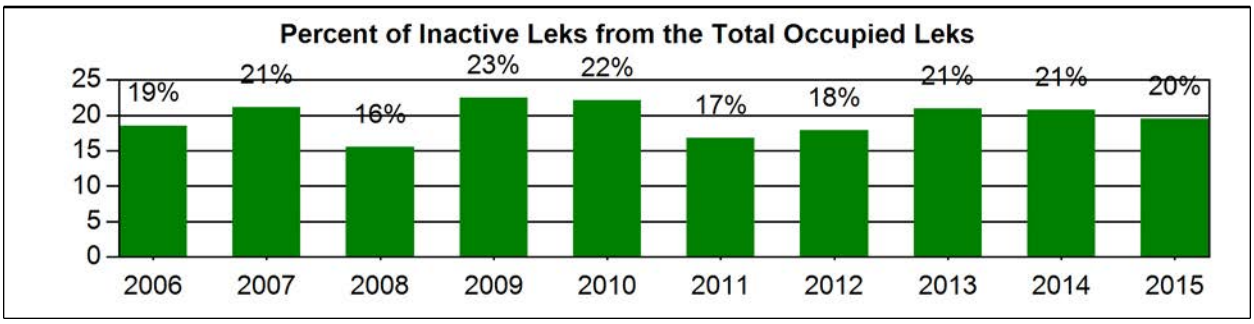
Year: 2006 - 2015, Management Area: D, Working Group: Upper Green River











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	131	86.2
Unoccupied	21	13.8

BLM Office	Number	Percent
Pinedale	140	92.1
Rock Springs	12	7.9

Biologist	Number	Percent
Pinedale	79	52.0
South Jackson	73	48.0

Warden	Number	Percent
Big Piney	79	52.0
North Pinedale	14	9.2
South Pinedale	59	38.8

County	Number	Percent
Lincoln	2	1.3
Sublette	150	98.7

Land Status	Number	Percent
BLM	124	81.6
Private	18	11.8
State	10	6.6

Management Area	Number	Percent
D	152	100.0

Lek Status	Number	Percent
	13	8.6
Active	103	67.8
Inactive	35	23.0
Unknown	1	0.7

Sage Grouse Job Completion Report

Year: 2005 - 2014, Management Area: D, Working Group: Upper Green River

4. Sage Grouse Hunting Seasons and Harvest Data

a. Season

Year	Season Start	Season End	Length	Bag/Possesion Limit
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
2013	Sep-21	Sep-30	10	2/4
2014	Sep-20	Sep-30	11	2/4

b. Harvest

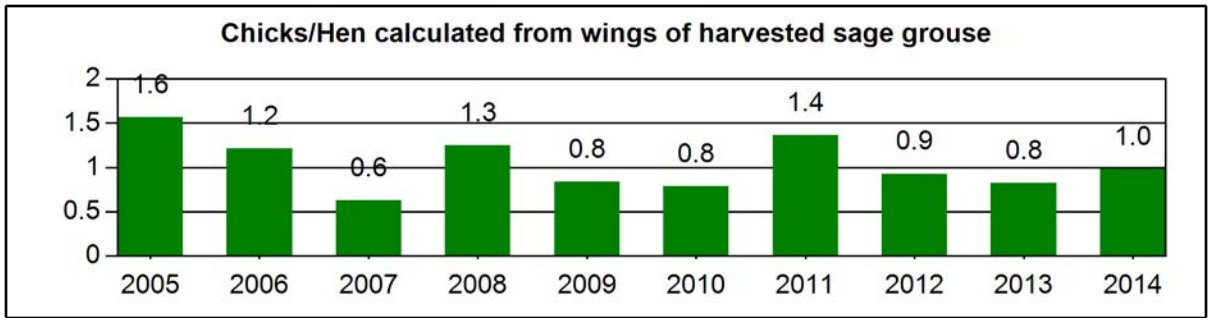
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2005	669	233	564	1.2	2.9	2.4
2006	2132	781	1885	1.1	2.7	2.4
2007	1297	564	1300	1.0	2.3	2.3
2008	1109	453	1116	1.0	2.4	2.5
2009	1203	460	1177	1.0	2.6	2.6
2010	1510	526	1497	1.0	2.9	2.8
2011	1720	565	1605	1.1	3.0	2.8
2012	1320	476	1296	1.0	2.8	2.7
2013	628	387	848	0.7	1.6	2.2
2014	1056	406	1266	0.8	2.6	3.1
Avg	1,264	485	1,255	1.0	2.6	2.6

Sage Grouse Job Completion Report

Year: 2005 - 2014, Management Area: D, Working Group: Upper Green 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	
2005	537	17.7	23.3	3.4	7.4	19.0	29.2	1.6
2006	421	15.4	28.7	3.6	7.8	20.9	23.5	1.2
2007	485	20.0	39.2	2.3	8.5	13.6	16.5	0.6
2008	494	12.8	29.4	3.4	7.9	22.3	24.3	1.3
2009	445	14.8	38.7	3.4	5.8	15.7	21.6	0.8
2010	469	13.6	39.2	2.1	7.9	17.3	19.8	0.8
2011	547	8.6	32.5	4.0	4.4	24.1	26.3	1.4
2012	544	12.1	34.2	3.5	9.6	17.1	23.5	0.9
2013	372	12.1	40.9	3.2	5.6	17.2	21.0	0.8
2014	337	13.4	33.8	3.0	8.3	18.1	23.4	1.0



Upper Snake River Basin

Sage-Grouse
Job Completion Report
2014

June 2014-May 2015

Alyson Courtemanch
Wyoming Game & Fish Dept.
Jackson Region

Species: Sage-Grouse
Period Covered: June 1, 2014 – May 31, 2015
Management Areas: A
Working Group Area: Upper Snake River Basin
Prepared by: Alyson Courtemanch

Summary

The Upper Snake River Basin Sage-Grouse Area includes the entire Snake River drainage basin in Wyoming including the major tributaries of the Gros Ventre, Hoback, and Salt River drainages. The area encompasses almost all of Teton County and small portions of Sublette and Lincoln Counties. The boundaries of the core areas were revised in 2015 by the Governor's Sage-Grouse Implementation Team, with input from the local working groups. The Upper Snake River Basin Core Area expanded to include portions of the Gros Ventre drainage.

Sage-grouse in this area are non-migratory and genetically isolated from surrounding populations. In recent years, 16 occupied and historical sage-grouse leks have been monitored annually to track population trends. The majority of these leks are within Grand Teton National Park (n=11) with an additional 2 on the National Elk Refuge and 3 on Bridger-Teton National Forest in the Gros Ventre drainage and Hoback Basin areas. This population follows a cyclical trend. The average peak males per lek declined in the early 1990's, then increased from 2002-2006, declined from 2007-2011, and has been increasing again during the past 4 years. The counts in 2015 were the highest recorded since 1994 (25.2 average peak males per lek). This is likely due to increased chick production and over-winter survival.

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 Wyoming Game and Fish Department Regions. Until 2010, the Upper Snake River Basin Working Group (USRBWG) 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 Conservation Area (USRBCA) was designated as Area A, which is covered in this report

The initial role of the USRBWG 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 Drainage, Hoback Basin, and an interstate population shared by Wyoming and Idaho in the Salt River drainage. The 2008 Plan was revised in 2014 to reflect current policy for sage-grouse conservation under Wyoming Executive Order 2011-5 and other relevant information. The 2014 Plan was approved by the Wyoming Game and Fish Commission in February 2014. The plan is available at:
https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Sage%20Grouse/SG_USR_CONSERVPLAN.pdf

Only lek monitoring data is presented in this report. Due to the size of the population in the Upper Snake River Basin, no productivity data or sex/age composition data are collected. The entire area has been closed to hunting since 2000.

Plan Area

The USRBCA includes the entire Snake River drainage basin in Wyoming including the major tributaries of the Gros Ventre, Hoback and Salt River drainages. The area boundary encompasses 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 Drainage, 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 sage-grouse distribution map was updated in this reporting period (Figure 2). A more fine scale review of the habitats underlying the former map of occupied range resulted in the changes shown in Figure 2. The core population in Jackson Hole is found primarily in Grand Teton National Park (GTNP) and on the National Elk Refuge (NER). 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 2015 by the SGIT, with input from the local working groups (Figure 3). The Jackson Core Area expanded to include portions of the Gros Ventre drainage.

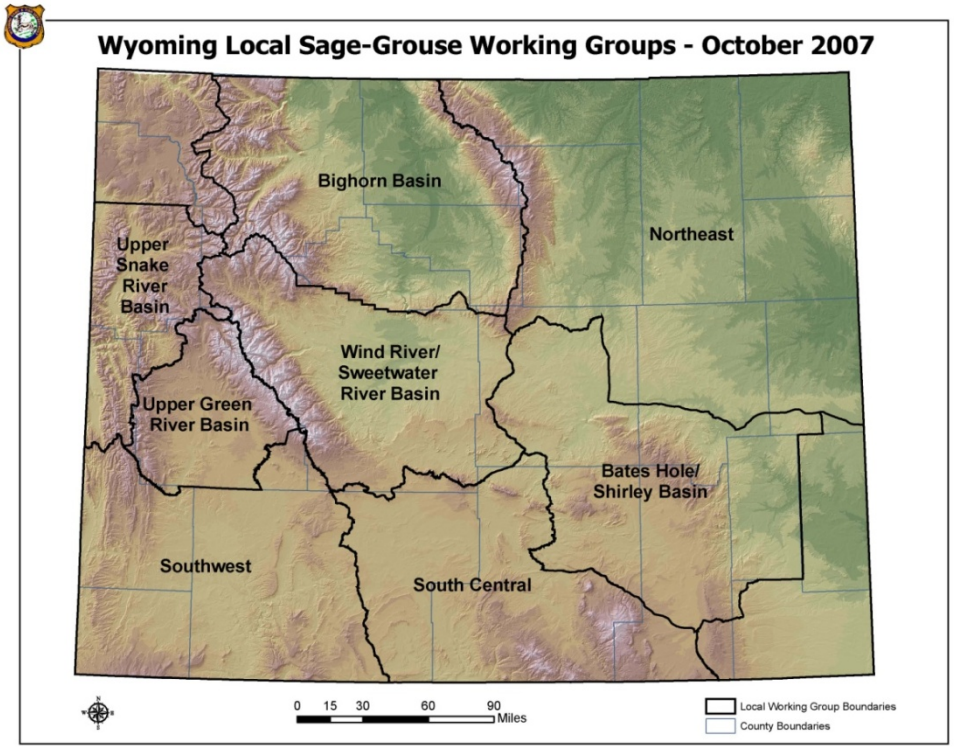


Figure 1. Wyoming local sage-grouse working group boundaries.

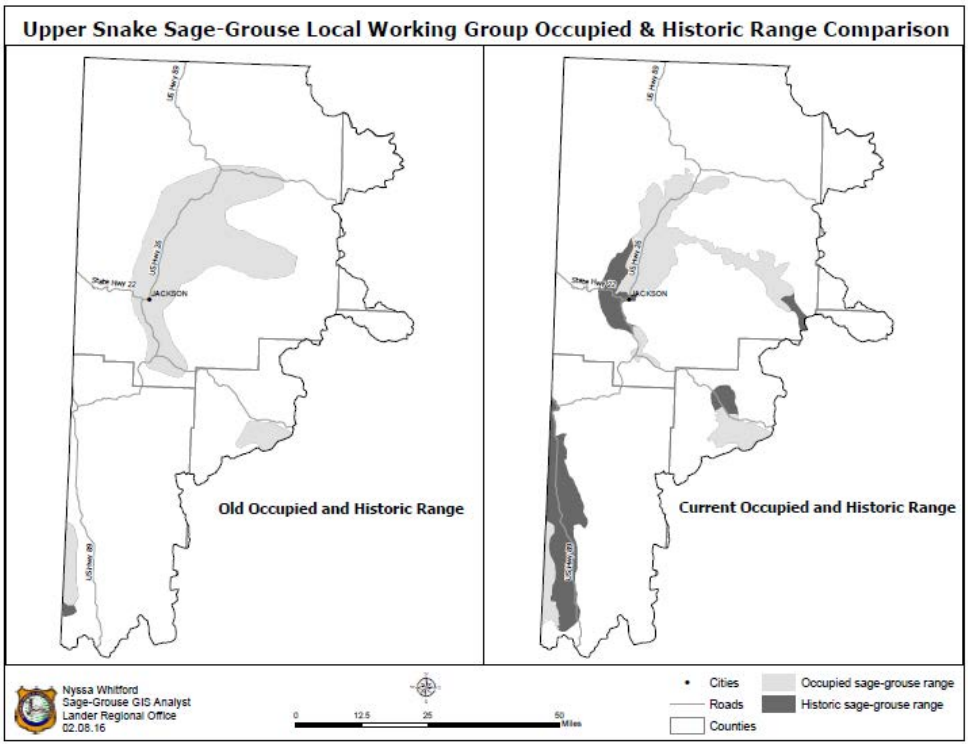


Figure 2. Comparison of the former and the revised occupied and historic range map for the Upper Snake River Basin, WY.

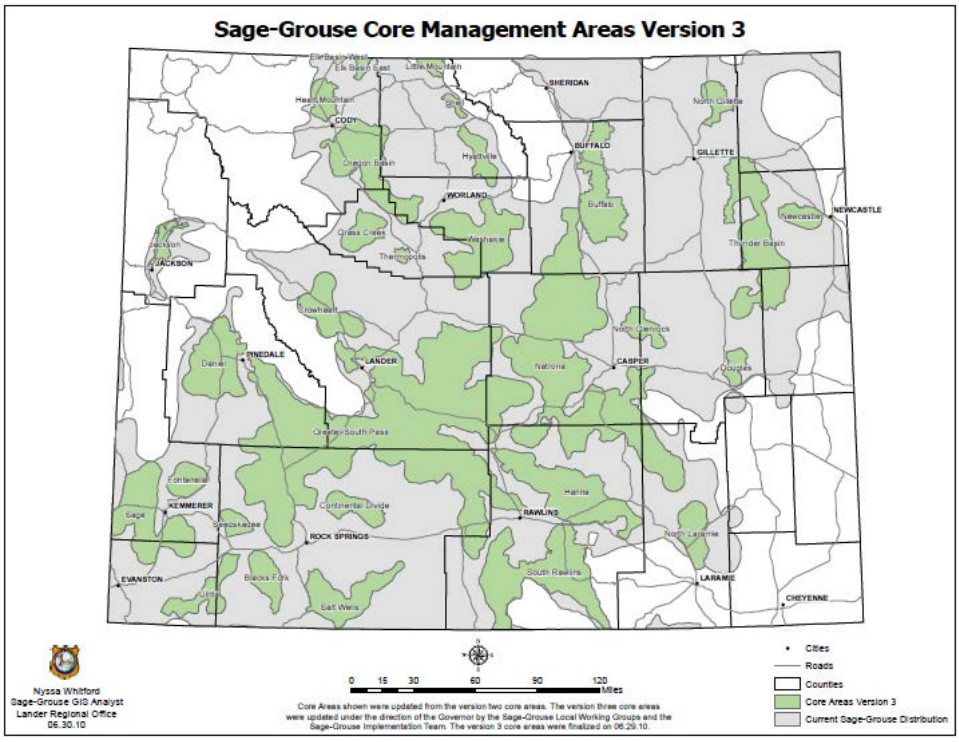


Figure 3. Wyoming Sage-Grouse Core and Connectivity Areas, revised in 2015.

Sage-grouse in Jackson Hole are non-migratory and genetically isolated from surrounding populations (Schulwitz et al. 2014). There is evidence of one-way genetic interchange from the Jackson Hole segment to the Gros Ventre Drainage segment, but very little interchange with Pinedale populations (Schulwitz et al. 2014). 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

Sage-grouse data collection within the USRBCA focuses on lek surveys. Prior to 1994, relatively few leks were monitored and since 2000, efforts have been made to increase data collection on leks and standardize data collection methods. Starting in 2005, lek counts in GTNP, and to some extent on the NER, were coordinated to occur on the same days when it was logistically possible. This presumes that all leks in Jackson Hole constitute a sub-population and the leks in the Gros Ventre drainage constitute a second sub-population. No marked birds from the Gros Ventre leks have appeared on the Jackson Hole leks (Holloran and Anderson 2004, Bryan Bedrosian pers. com.) and there is no evidence of genetic flow from the Gros Ventre to Jackson Hole (Schulwitz et al. 2014).

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 USRBCA are summarized in Table 1 from 1989 through 2015. In some years it is uncertain from the data provided by GTNP if leks that were recorded as inactive were actually checked. 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 USRBCA is displayed in Figure 4.

Table 1 summarizes the high count of males on each lek over the survey period and the average high count of males across active leks. There is some movement of males between leks, particularly from the North Gap lek on the NER to leks in GTNP and between leks in the lower valley with leks in the upper valley as the spring progresses and snow melt occurs. 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 occupied and historical sage-grouse leks reported in Table 1. Thirteen leks are considered to be occupied (active at least one year during the past 10 years) and three appear to be unoccupied historical leks within the plan area (3 Bar H/Circle EW, Antelope Flats, and McBride). In recent years the Simpson lek, formerly called Poverty Flats lek on the NER was considered to be unoccupied but 3 males were sighted there in 2012. The Beacon lek is classified as occupied but has only been active on a sporadic basis in recent years (four males in 2006) 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 has 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 are warranted (Bryan Bedrosian pers. comm.). Searches in 2015 for this lek did not produce results, although sage-grouse have been observed wintering in the area (Jon Stephens, pers. comm.).

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 activity 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 (GTNP 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 - 2015 with 15 males observed in 2015.

During research activities in 2008, a lek was located in the Pot Holes area of GTNP (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 has been active every year since its discovery, with the most recent count of 21 males in 2015.

The Clark Draw lek was discovered in the Hoback Basin in April 2010. The lek has been active for the past 5 years. In 2015, 17 males were counted (Table 1).

Of the 16 leks in the USRBCA, 13 were checked in 2015. Nine leks had grouse present and four leks did not have birds (Airport Pit, McBride, Simpson, and Dry Cottonwood). Three leks were not checked during the 2015 season (Beacon, Circle EW, and Antelope Flats).

It must be noted 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 found; 3) sage-grouse populations can exhibit cyclic patterns over approximately a decade; 4) the effects of unknown or unmonitored leks that have become active or 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 GTNP 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 and satellite lek data were combined (i.e. Beacon and Airport leks, Moulton East and Moulton West leks, Bark Corral East and West leks, and North Gap and Simpson leks) 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.

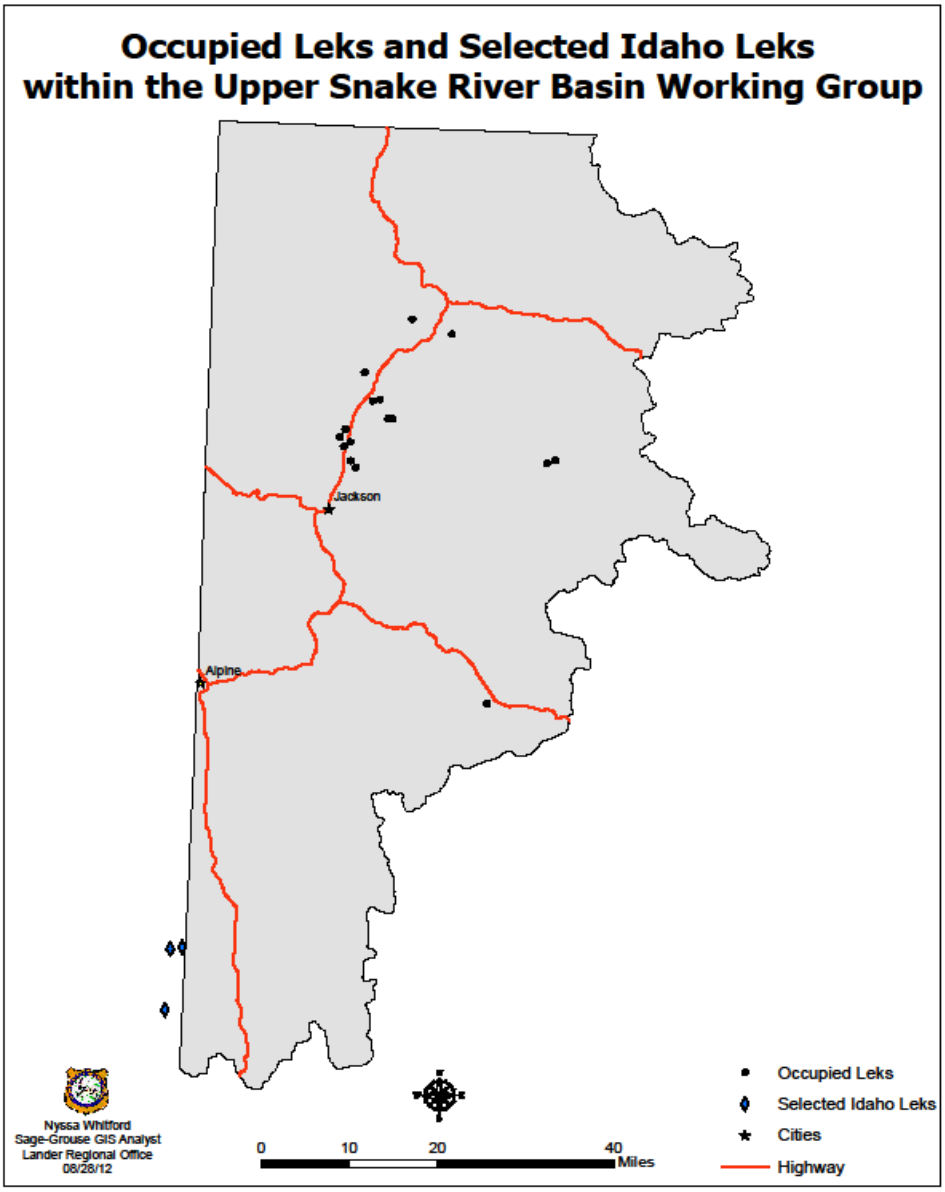


Figure 4. Occupied leks in the Upper Snake River Basin Working Group Area and adjacent selected leks in Idaho.

Table 1. Maximum male counts at sage-grouse leks in the Upper Snake River Basin Conservation Area, 1989-2015 (unpublished data from Grand Teton National Park and Wyoming Game and Fish Department).

Year	Airport	Beacon	Airport Pit	3 Bar H/ Circle EW	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
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	28.0
1993	37	21		NC	16	5	24		8		9	54					198	24.8
1994	NC	NC		NC	27	NC	50		NC		7	NC					84	28.0
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	18.0
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
2014	11	NC	3	NC	NC	0	61	8	10	16	21	0	18	0	8	7	163	16.3
2015	12	NC	0	NC	0	NC	103	15	11	11	10	0	27	0	21	17	227	25.2

**new lek in 2008 with multiple obs.

***Bark Corral 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 USRBCA exists at this time. Both the number of leks and the number of males attending those leks must be accurately quantified in order to estimate the number of males in the population, population size and population trend. However, the peak number of males per 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 counted each year may be a more reliable index of population trends over time. Average peak number of males per active lek declined in the early 1990's (Figure 5). Counts from the past 6 years have showed an increasing trend (Figure 5). The average peaks males per lek in 2015 was the highest recorded since 1994. The increasing trend could be skewed by the addition of newly discovered leks (5 new leks discovered in the past decade). These leks have likely existed all along, but were unknown until recent years when survey and research efforts have increased. Trends in peak males are different when considering only the three main leks (Moulton, Airport, and North Gap) that have been consistently surveyed since 1989 (Figure 6). These data indicate a decline in the early 1990's, a modest rebound by 2006, followed by a decline through 2009, and then an increasing trend during the past six years (Figure 6).

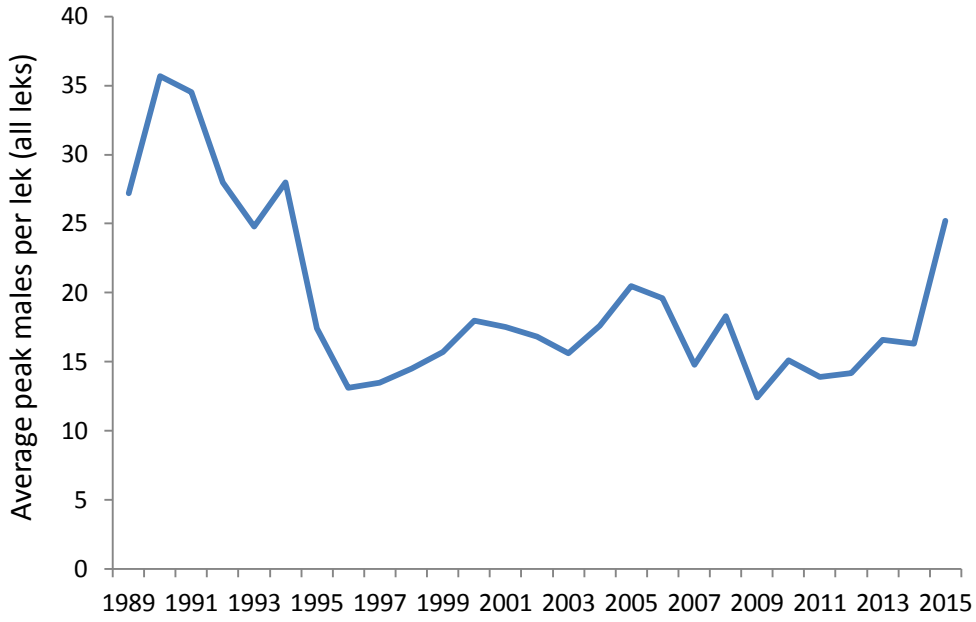


Figure 5. Average peak male counts for all leks in the Upper Snake River Basin Conservation Area, 1989-2015.

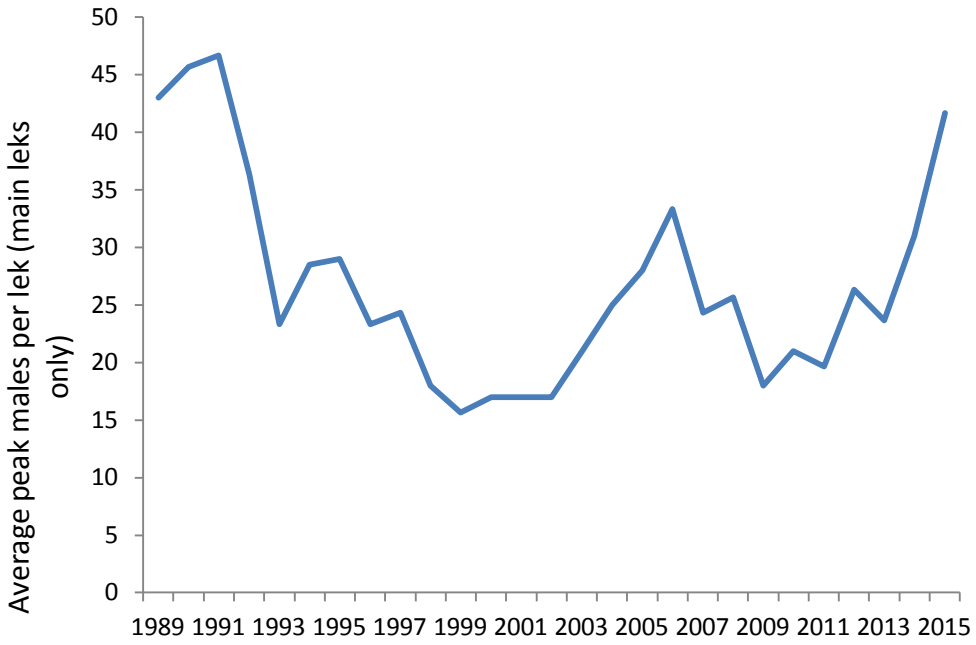


Figure 6. Average peak male counts for three main leks only (Moulton, Airport, and North Gap), 1989-2015.

Table 2. Lek attendance and peak males for leks in the USRBCA 2006 - 2015.

Leks Counted

Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek (2)
2006	11	9	82	153	21.9
2007	11	9	82	132	16.5
2008	13	13	100	165	16.5
2009	13	12	92	124	12.4
2010	14	12	86	151	16.8
2011	14	14	100	112	14.0
2012	16	15	94	142	14.2
2013	16	13	81	149	16.6
2014	16	13	81	163	16.3
2015	16	14	88	227	25.2

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 are not designed to accurately capture these data and is therefore not useful in assessing population trend.

Data from the most recent 10 year period suggests that the sage-grouse population declined from 2006-2009 in the USRBCA, but has slowly increased during the past 5 years with a marked increase in 2015. In 2015, the peak number of males was 227 which is higher than the number of males observed in 2014 (163) and more than double the previous 10-year average (140 males). Despite increases in recent years, the long term persistence of this population is of paramount concern to the local working group and resource managers.

Productivity

During 2015, no productivity data were collected on this population.

Harvest

Most of the USRBCA has been closed to hunting since the establishment of GTNP 1929. No hunting for sage-grouse has been allowed on lands under the jurisdiction of GTNP or the NER. In 2000, the hunting season was closed in the entire WSRBWGA and remains so today.

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 "warranted but precluded" listing decision by the U.S. Fish and Wildlife 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 and attached to the Statewide JCR. Most of the Jackson population's habitat has been designated a core area while the remainder of the small sage-grouse populations in the USRBCA fell into the non-core area designation.

In preparation for the U.S. Fish and Wildlife Service's September 2015 court-ordered deadline to again determine the listing status of sage-grouse and to comply with the existing Executive Order language to review core area boundaries after a 5 year period, Governor Mead tasked the Sage-Grouse Implementation Team with providing him recommendations to update the core area strategy. Local Working Groups were again engaged to assist in the process.

In the USRBCA this process ultimately resulted in the Gros Ventre River portion of the conservation area being recommended for addition to core. The Governor is expected to decide the fate of these recommendations in the summer of 2015.

No wildfires or prescribed burns occurred in sagebrush habitat in sage-grouse core areas within the USRBCA this year. There were no significant human developments or surface disturbances in core areas this year.

Special Projects

Jackson Hole Airport Wildlife Hazard Management Plan

SUMMARY
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 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 many stakeholders, including the local working group, to create a management plan for the Jackson Hole Airport.

Sage steppe plant community restoration in abandoned smooth brome dominated hayfields in Grand Teton National Park

Ken Stella, Grand Teton National Park

SUMMARY
The sagebrush steppe vegetation within 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 Beringia 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. These abandoned hayfields are within 4 miles of the Moulton lek. 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.

For the benefit of sage-grouse and many other species, the park has begun to restore these hayfields to native sagebrush-steppe vegetation. This work has been initiated with funds from the Wyoming Sage-Grouse Conservation Fund and the National Park Service. The park has initiated restoration treatments on 875 acres of abandoned hayfields. These include the Elbo East and Elbo West Units near the Teton Science Schools, the Hunter and Aspen Units, and the Henrie unit. Smooth brome removal and restoration of native sagebrush steppe plant communities is a multi-year and multi-stage process. Generally, removal of smooth brome and other exotic plants is the first stage. Removal can include two or three stages: 1) use of prescribed fire to remove dense thatch accumulations, 2) herbicide applications following fire, and 3) secondary herbicide applications, if necessary. Following smooth brome removal the land is seeded with native seed. National Park Service policy dictates that all seed applied in park lands is native and originates from locally occurring genetics. Thus, seed used in this type of restoration originates from hand collections in the park. Following seeding of native seed in the restoration areas the fields are monitored via transect and quadrat monitoring to track seeded species survivorship and success. Also following seeding, non-native grass and forb species are controlled with manual and chemical treatments while native plants are developing.

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 GTNP and the NER. 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.

Geophagy and movements of sage-grouse in the Hoback and Upper Green River drainages

Bryan Bedrosian, Teton Raptor Center
Dale Woolwine, Bureau of Land Management – Pinedale Office
Josh Hemenway, Bureau of Land Management
Matt Holloran, Wildlife Management Research Support

SUMMARY
During the 2012-13 winter, managers working for the BLM in Pinedale documented sage-grouse congregating in several areas and pecking at the dirt. Motion-activated cameras were placed at several of these locations and consistent use by large numbers of sage-grouse during the second half of the winter was documented. This geophagy ("dirt-eating") behavior has also been documented in several areas in Jackson Hole (B. Bedrosian, unpublished data). Geophagy is usually attributed to an animal's search for minerals that are otherwise missing in their diets (e.g., sodium, calcium, iron – with sodium the most commonly cited). Sage-grouse in Wyoming may be seeking the nutrients needed to prepare for breeding and nesting by consuming soil. Conversely, sage-grouse eat predominantly sagebrush throughout the winter, and sagebrush leaves contain terpenoids, tannins and other volatile oils. Therefore, sage-grouse may be consuming soils to aid in detoxification of their winter diet.

Beginning this year, we began investigating the potential of a resource – geophagy sites – selected by sage-grouse during the winter and/or early spring that to our knowledge has not been investigated or considered in the past. We will further investigate how to map that resource in a GIS for use in spatial modeling. Research objectives are to: 1) determine if soil characteristics at areas where geophagy has been documented differ from those of other available soils and food items, 2) document and verify additional geophagic locations frequented by sage-grouse, 3) map in a GIS the distribution of potential geophagy sites throughout the Hoback and Upper Green River Basin and potentially southwest Wyoming, 4) assess how important the availability and distribution of geophagy sites are to sage-grouse selection of winter/early spring habitats, and 5) further investigate movements, genetics, and habitat selection of marked sage-grouse to improve management.

Invasive species control in occupied sage-grouse habitat

Amy Collett, Teton County Weed and Pest District
Kerry Murphy, Bridger-Teton National Forest
Travis Ziehl, Teton County Weed and Pest District

SUMMARY
This project is designed to address the issue of noxious weeds out-competing the natural habitat in such a way that sage-grouse suffer from lack of cover and inadequate forage. By employing Early Detection/Rapid Response tactics we will be more efficiently managing our resources. Over time this method can greatly conserve cost because it targets small problems while they are still manageable before they become too expensive and extensive to treat. Our project would benefit the grouse in preserving their natural habitat and keeping their habitat free of large noxious weed infestations. Well established noxious weed infestations will be controlled so they do not continue their spread.

Sage-grouse in the Upper Gros Ventre watershed number only 80–100 individuals, yet this unique population and key portions of its spatially limited winter range are vulnerable to loss of habitat due to noxious weed infestations. The core winter ranges (Breakneck Flats and the Cottonwood-Fish Creek) on Bridger-Teton National Forest support a large percentage (> 60%) of the high quality foraging and thermal cover in the entire watershed. Thus, little other habitat is available to displaced birds. Because the Upper Gros Ventre population is considered to be part of a meta-population complex with ties to populations in Jackson Hole and the Green River Basin, maintaining Gros Ventre birds may be critical to the persistence of sage-grouse in the region. Treatment in these areas will cover approximately 3,500 acres of spot spraying weed infestations. This is an ongoing project that has received financial support numerous times by the Upper Snake River Basin Sage-Grouse Working Group.

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

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

SUMMARY
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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Schulwitz, S., B. Bedrosian, and J.A. Johnson. 2014. Low neutral genetic diversity in isolated Greater Sage-Grouse (*Centrocercus urophasianus*) populations in northwest Wyoming. The Condor 116:560-573.

Management Summary

If the average peak 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 several small rebounds and declines since. It appears that the population has been rebounding for the past three years. The increased number of males observed on leks in early 2015 may be the result of increased over winter survival and good chick production during 2013-2015.

Lek data summarized in Tables 1 and 2 suggest the population has declined over the long term (1989-present). The long-term viability of this population probably can be assured only if mortality factors currently affecting adult and juvenile hens do not increase. Based on this assumption, reinstituting the hunting season in Management Area A (formerly Areas 1 and 2) is not warranted at this time.

Monitoring and mapping 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 considered in occupied sage-grouse habitat in Jackson Hole and the Gros Ventre drainage. Restoration of native sagebrush habitats on lands formerly farmed in GTNP appears 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.

Past sage-grouse research by Craighead Beringia South and ongoing research by Bryan Bedrosian (Teton Raptor Center) provides essential information to manage the sage-grouse population and its habitat in Jackson Hole. Recent genetics work by Schulwitz et al. (2014) has provided new insights

into the genetic isolation of the Jackson Hole and Gros Ventre populations, but from each other and in a regional context.

Recommendations

1**.** Continue to help 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 document sage-grouse observations to improve occupied habitat mapping.

4. 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.

5. Support GTNP's sagebrush habitat restoration projects in the Mormon Row and Hayfields areas which could be used as winter, nesting, and brood-rearing habitats for sage-grouse in Jackson Hole

6. Continue to work with land management agencies during the implementation of habitat improvement projects to minimize impacts to sage-grouse occupied habitats.

7. Implement the USRBWG Sage-Grouse Conservation Plan (2014). Work to implement the strategies and projects identified in the plan.

8. Support implementation of the most current version of the Governor's Executive Order for Greater Sage-Grouse Core Area Protection.

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Bedrosian, B. and S. Walker. 2010. Sage-grouse baseline survey and inventory at the Jackson Hole Airport. Completion Report. Craighead Beringia South, P.O. Box 147, Kelly, WY 83011.

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Schulwitz, S., B. Bedrosian, and J.A. Johnson. 2014. Low neutral genetic diversity in isolated Greater Sage-Grouse (*Centrocercus urophasianus*) populations in northwest Wyoming. The Condor 116:560-573.

Wind River - Sweetwater River Basins

Sage-Grouse

Job Completion Report

2014

June 2014 - May 2015

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**
Period Covered: **June 1, 2014 – May 31, 2015**
Prepared by: **Stan Harter, South Lander Wildlife Biologist**

Introduction

The Wind River/Sweetwater River Conservation Area (WRSRCA) encompasses just over 10,000 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.

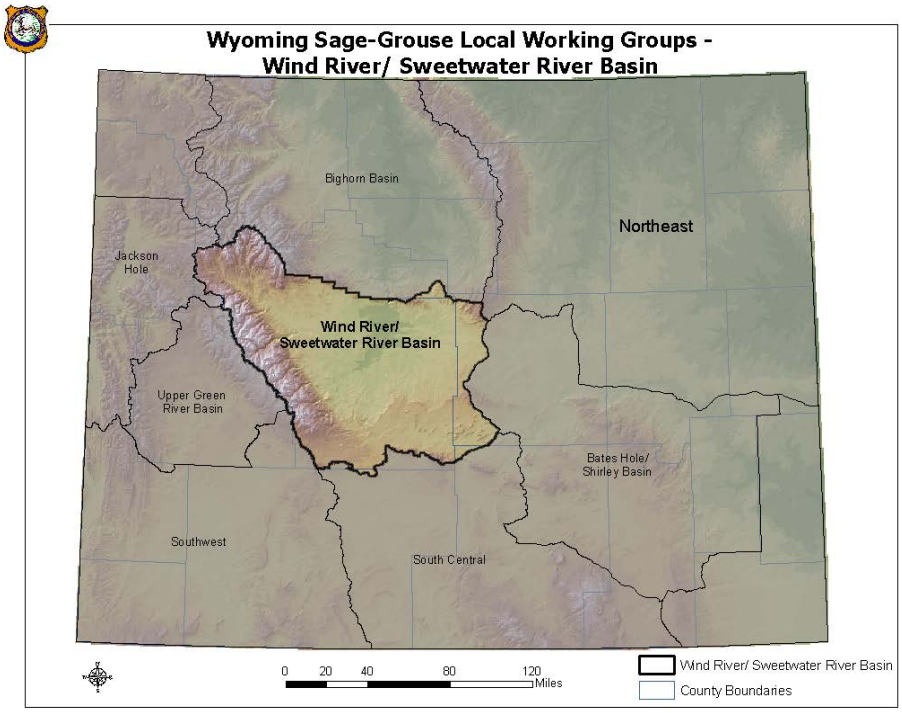

Figure 1. The Wind River/Sweetwater River Conservation Area within Wyoming.

Known sage-grouse leks within the WRSRCA are predominantly located on federal lands (Bureau of Land Management (BLM) – 57.8% and Bureau of Reclamation (BOR) – 1.6%), or tribal lands on the Wind River Reservation (WRR) – 25.1%. Private lands contain 10% of known leks with the remaining 5.6% located 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 shows land ownership within the WRSRCA, including areas managed by the U.S. BLM (Lander, Rock Springs, Casper, and Worland 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, with an Addendum to the Plan completed in March 2014. The plan, addendum, and other Wyoming sage-grouse information are located on the WGFD website at https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management

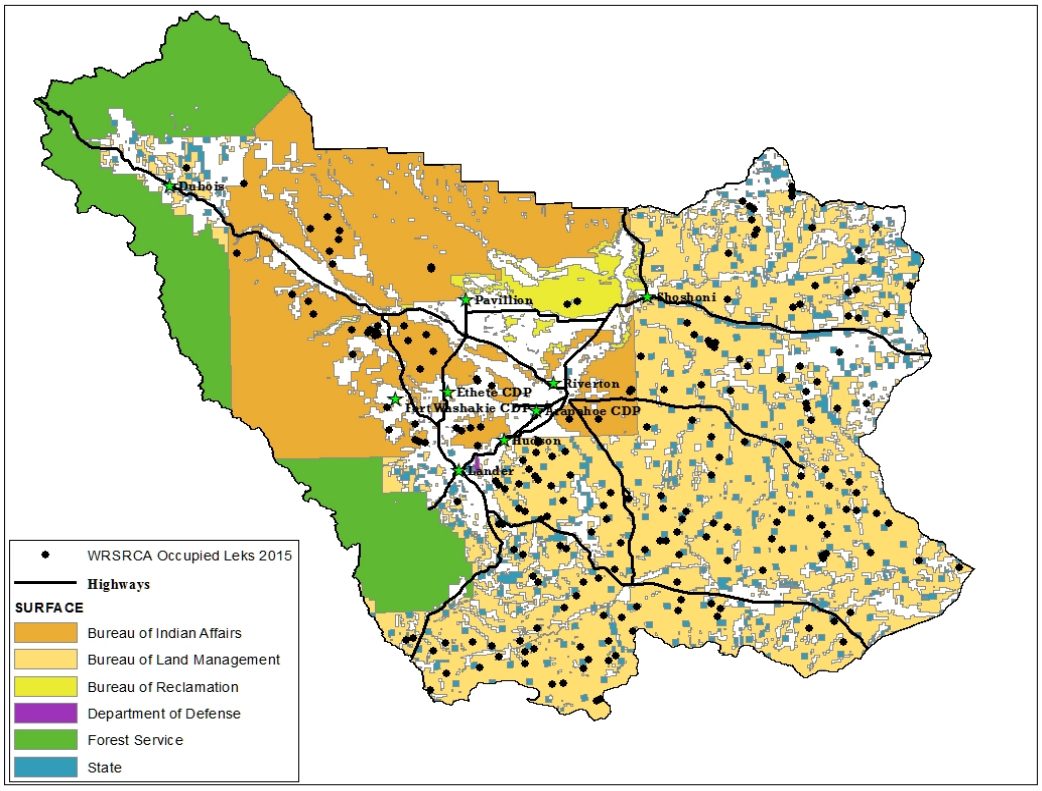

Figure 2. Land ownership within the WRSRCA (dots = 2015 occupied leks). Source: WGFD, BLM.

The WRSRCA encompasses all of the WGFD's Small/Upland Game Management Areas E and WR (Figure 3). Management recommendations and conservation efforts apply to all tribal lands within the WRR in both Fremont

and Hot Springs Counties. These management areas do not directly correspond to sage-grouse population boundaries, but are used for general data collection and reporting.

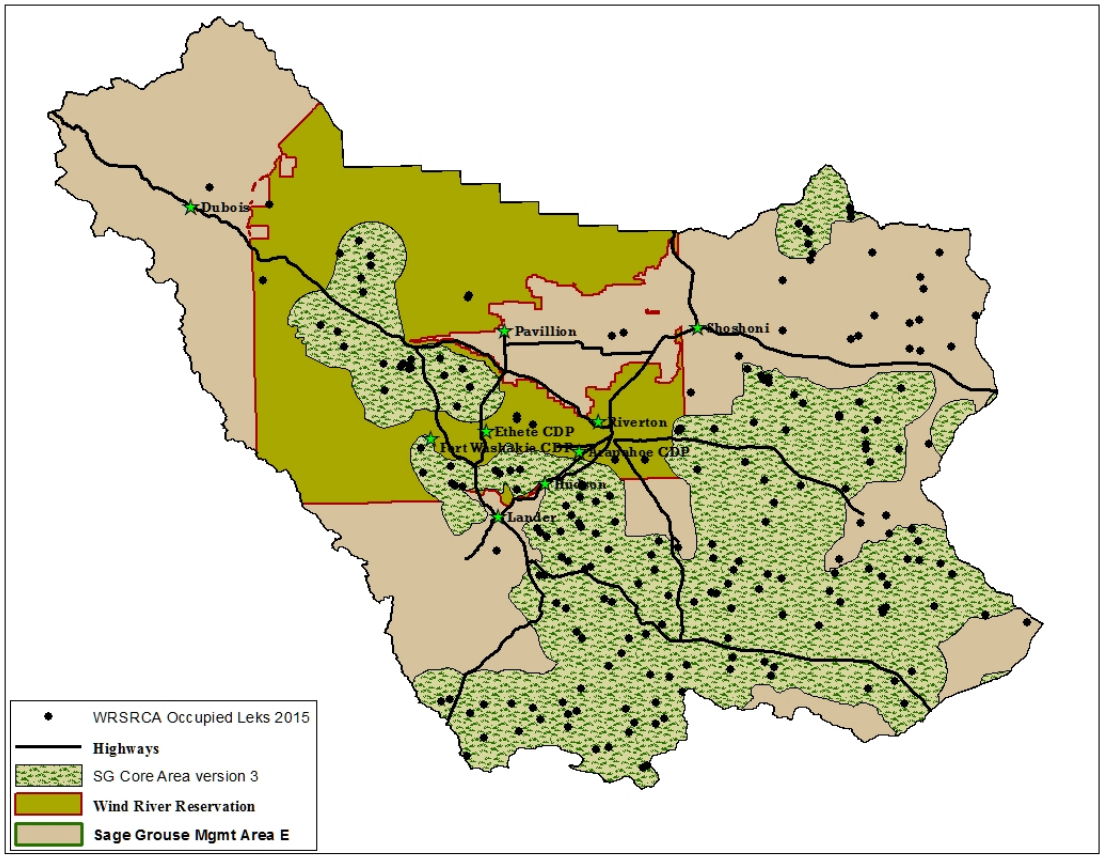

Figure 3. WGFD upland game bird management areas, core areas, and occupied leks within WRSRCA (dots=leks). Source WGFD.

Wyoming Governors' Executive Orders and Greater Sage-Grouse Core Areas

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

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

Subsequent to the 2010 gubernatorial election, Governor Matt Mead signed a 2011 version of the Executive Order (2011-5), reiterating and clarifying the Wyoming Core Area Strategy with further updates and modifications in 2013 (Executive Order 2013-3). Executive Order 2011-5 is appended to the Statewide JCR. The current core areas are shown in Figure 3.

In preparation for the U.S. Fish and Wildlife Service's September 2015 court-ordered deadline to again determine the listing status of sage-grouse and to comply with the existing Executive Order language to review core area boundaries after a 5 year period, Governor Mead tasked the SGIT with providing him recommendations to update the core area strategy. Local Working Groups were again engaged to assist in the process.

In the WRSRCA, this process resulted in important habitats along the east end of Beaver Rim, Ervay Basin/Coalbank Hills area southwest of Waltman, and near Lost Cabin to Arminto (north of the Moneta Divide designated energy development areas) being recommended for addition to core. Additional minor additions and deletions were recommended along the edge of core near South Pass and Crowheart on the Wind River Reservation. Governor Mead is expected to decide the fate of these recommendations in the summer of 2015.

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.

FEDERAL AGENCY ACTIONS REGARDING GREATER SAGE GROUSE

U.S. Fish and Wildlife Service (USFWS)

On March 5, 2010 the U.S. Fish and Wildlife Service (USFWS) issued a decision of "warranted but precluded" for listing Greater Sage-grouse as threatened or endangered under the Endangered Species Act (ESA). This means Greater Sage-grouse have become a "candidate" for listing, but are precluded from immediate listing due to higher priority species. As such the USFWS will evaluate the species status annually with the expectation of future listing if the status does not improve. The USFWS has also entered into a settlement agreement to remove sage-grouse from the candidate list and declare the bird either "warranted" or "not warranted" in 2015.

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

USFWS, in conjunction with the Wyoming Governor's Office, NRCS, WGFD, Wyoming Department of Agriculture, Wyoming Association of Conservation Districts, Wyoming BLM, and the U.S. Forest Service, have released a draft Greater Sage-grouse Umbrella Candidate Conservation Agreement with Assurances (CCAA) for Wyoming Ranch Management. The purpose of this agreement is to encourage landowners to voluntarily implement conservation measures to conserve, restore, or enhance habitat for the greater sage-grouse on non-Federal lands in Wyoming. In return, participating landowners and land managers would receive regulatory assurances concerning land use restrictions that might otherwise apply to them should the greater sage-grouse become protected under the ESA. The Umbrella CCAA will be in effect for 40 years following its approval.

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

Bureau of Land Management (BLM)

With over 80% of core areas occurring on lands administered by the BLM, that agency initiated a series of state and national Instructional Memoranda (IMs) designed to provide guidance to their field offices on sage-grouse habitat management for proposed activities and resource management planning. These memoranda incorporated the core area concept and executive orders initiated by the Governors. The state IM currently in effect was distributed in March of 2012 (WY-IM 2012-019). The national IMs are WO-IM 2012-43 and 44.

The WRSR LWG area lies predominantly within the BLM's Lander Field Office but also overlaps into the Casper and Worland Field Offices. The Lander and Worland Field Offices have revised their resource management plans (RMP) which will incorporate measures to enhance sage-grouse and sagebrush management, patterned after and including the state and national IMs. The Casper Field Office is in the process of completing an amendment to their existing RMP to incorporate the same types of measures to protect and enhance sage-grouse habitat. The record of decision (ROD) for Lander RMP revision was released on June 26, 2014 and the Worland RMP revision and Casper RMP amendment are expected to be completed later in 2015.

Natural Resources Conservation Service (NRCS)

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

Several large-scale threats facing sage-grouse are identical to factors impacting the sustainability and productivity of grazing lands throughout the West. SGI aims to remove or reduce those threats common to sustainable ranching and sage-grouse conservation. Fragmentation of sagebrush habitats from a variety of sources is one of the primary causes of the decline in both sage-grouse populations and rangeland productivity. Exotic species invasions, unsustainable grazing systems, sod-busting, subdivision development, and conifer encroachment are other examples of mutual threats. Identifying the species' limiting factors at the level of the individual property owner is essential to ensure that the goals of the Conservation Practice Standard are met through SGI. SGI fosters coordination and implementation on a range-wide scale while ensuring local input and control. NRCS and USFWS came to an agreement in 2012 that is intended to provide "take protections" for producers/landowners that implement specific, approved conservation practices as part of SGI contracts. Some of the conservation practices implemented by NRCS, including SGI contracts are reported in the Project Commitments table in Appendix B of the Addendum for the Wind River/Sweetwater River Local Sage Grouse Conservation Plan (2014).

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

Data Collection Methods

Data collection methods and definitions can be found in the Wyoming Game and Fish Department Handbook of Biological Techniques sage-grouse chapter (Christiansen 2012).

Lek Monitoring

Since only "occupied" leks are being reported on JCR 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 data collection techniques are not designed to accurately capture these data, and is therefore not useful in assessing population trend.

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 usually 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 and 3.

Lek Attendance - 2015

Sage-grouse are generally found throughout the WRSRCA, except in heavily forested, agriculturally developed, or urbanized areas. Sage-grouse leks in the WRSRCA are located within the Lander WGFD Region, 4 BLM Resource Areas, 5 Wyoming counties, and the WRR. There were 212 known occupied leks within the conservation area in 2015, along with 28 unoccupied and 12 undetermined leks. It is highly probable there are leks within the WRSRCA that have not yet been documented, as evidenced by at least 123 new or newly discovered leks being documented in the WRSRCA through intensive monitoring and search efforts since 1995. Similarly, there are leks that have been abandoned or destroyed that are undocumented. Lek attendance generally increased between 1995 and 2006, declined until 2013, with increases the last 2 years, mimicking Wyoming's statewide trends, but with generally higher numbers than the Wyoming average (Figures 4, 5).

Of the 212 known occupied leks in the WRSRCA, 198 were checked in 2015 by WGFD, BLM, USFWS, and Shoshone-Arapahoe Tribal Fish and Game (SATFG), assisted by several researchers, consultants, and volunteers. Of those checked, 117 were counted and 81 were surveyed. Of the 178 leks where status was confirmed, 162 (91%) were active and 16 (9%) were inactive, equaling the averages since 2006.

Average male lek attendance for all leks checked increased from 20.2 in 2014 to 37.9 in 2015. Average annual maximum male attendance at count leks doubled from 21.6 in 2014 to 43.5 in 2015, which is 3% above the average since 2006 (42.2), and 43% below the peak in 2006 (76.0).

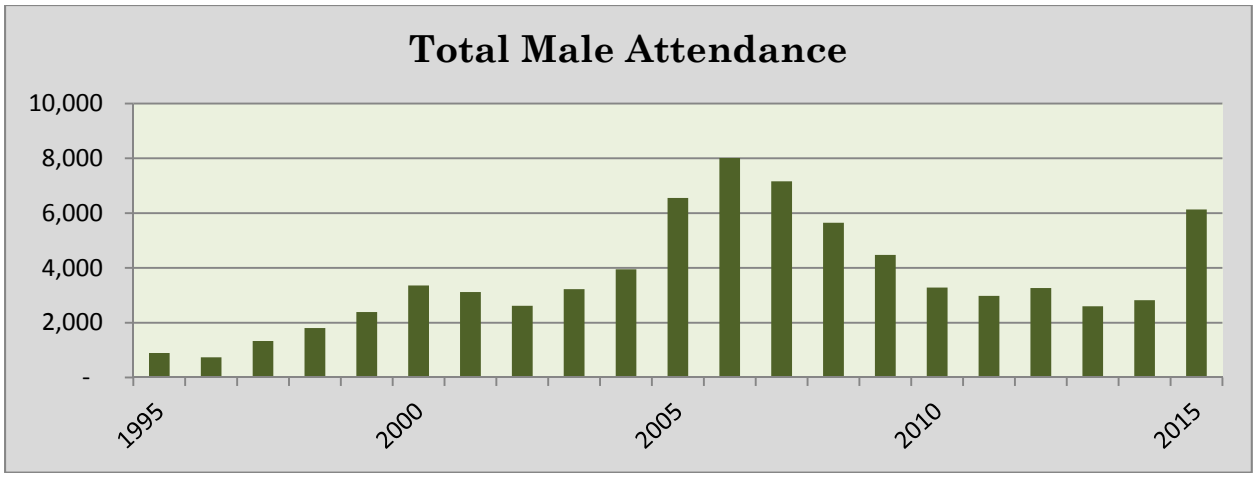

Figure 4. Total male attendance at leks within the Wind River/Sweetwater River Conservation Area, 1995–2015.

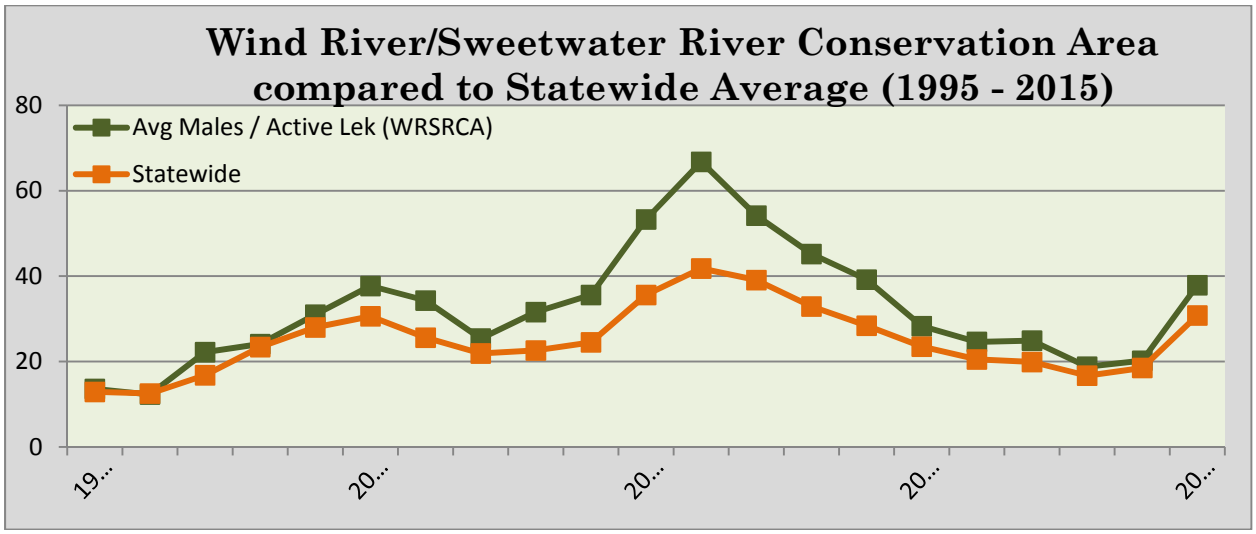

Figure 5. Average male lek attendance in WRSRCA compared with Wyoming statewide trends, 1995 – 2015.

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 2015, nearly 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 100 acres or larger.

Productivity

Since summer brood data are very limited in the WRSRCA, wing data collected from harvested birds provide a more reliable indicator of recruitment than do brood survey 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 2005 – 2014 and analyzed in detail for 2014 (Appendix 1). Wings collected from hunter harvested birds during the 2014 hunting season yielded an average brood size of 1.7 chicks per hen, indicating chick survival was much improved when compared with the average of 1.1 chicks per hen since 2006, and more than double the low productivity of 0.8 chicks/hen observed in 2012. Population growth typically requires greater than 1.7 chicks/hen based on historic statewide averages, which is confirmed with lek attendance increases in 2015 as described previously.

Hunting Season and Harvest

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

Sage-grouse hunting season was 11 days long in 2014, keeping opening day on the 3rd Saturday in September (Sept. 20 – 30). Hunter numbers and sage grouse harvest increased (25% and 37% respectively, compared with 2013) with more birds available, along with indication from some hunters concerned about the loss of sage-grouse hunting with regards to the potential for listing of the species under the ESA in 2015. Hunter effort (days/bird) and (birds/hunter) statistics have been relatively stable since 2005 (Appendix 1, Table 4b).

Weather

Drought conditions were extreme to exceptional for most of 2011-13, beginning with minimal snowfall in winter 2011-12 and continuing with almost no precipitation during spring and summer 2012. In April 2013, a series of several late winter/early spring snow storms produced heavy snow through early May throughout much of the WRSRCA. These storms lessened the effects of drought, yet the drought status only improved from Extreme to Severe. Drought returned in summer 2013, with only 0.34 and 0.2 inches of precipitation recorded in Lander and Jeffrey City respectively from June 1 to August 30. This inhibited production in herbaceous and shrub species across the WRSRCA, although some improvement over 2012 conditions was noted.

Rain and snow returned to the area in September and October 2013, with nearly 300% of "normal" precipitation recorded in Lander and Jeffrey City with warm temperatures between early storms. Although winter 2013-14 had lower than average snowfall, the increase in soil moisture from the fall 2013 precipitation carried over into spring and was followed by good rainfall throughout most of the conservation area over summer 2014, leading to improvement in vegetation condition. Consequently, this led to improved enhanced chick survival through summer, and increased lek attendance in 2015. Winter 2014-15 was fairly mild, with above average temperatures and slightly below average snowfall/precipitation. Precipitation from April 1 through early May 2015 was above average in Lander and Jeffrey City, ahead of 2014 pace, likely leading to improved habitat conditions. Yet, due to long-term drought, many shrubs remain in poor condition.

Habitat (Current and Historic)

Sage-grouse habitat condition 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 WRSRCA 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 2014. Habitat monitoring is discussed in past WRSRCA JCRs, and in the 2007 WRSRCA Local Sage Grouse Conservation Plan and 2014 Addendum. WGFD introduced a newly developed "Rapid Habitat Assessment" program in May 2015, and future monitoring will be centered on these assessments.

Habitat Inventory

No new habitat inventories were conducted in 2014-15. 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 2014 Addendum.

Winter Habitat Survey

Limited winter observations were collected in 2014-15, mostly as opportunistic observations during deer, elk, and moose classifications flights or random ground surveys. Winter habitat use was obtained via GPS location data from University of Wyoming research in the Jeffrey City/Beaver Rim area. These data were compared with WGFD's Wildlife Observation System (WOS) data and historic winter use maps dating back to the 1960s. Maps of winter use areas were prioritized in May 2015, with BLM Lander Field Office and WGFD wildlife biologists, and await direction as to how to designate these winter use areas.

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 2014 Addendum. Reports for current year activities follow.

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

Phase 2: This phase of the study consisted of treating sagebrush with Spike® 20P and mowing within early sage-grouse brood-rearing habitats during winter and spring 2014. Female early brood-rearing locations were selected along with areas predicted to have high early brood-rearing occurrence to identify 4 treatment locations (2 Spike and 2 mowing treatments) and 2 reference locations to form replicated study sites to evaluate the response of grouse to habitat treatments. Treatments followed guidelines of the "Wyoming Game and Fish Department Protocols for Treating Sagebrush" to be consistent with Wyoming Executive Order 2011-5, Greater Sage-Grouse Core Area Protection. The only exception to the WGFD protocols is instead of grazing rest for 2 growing seasons after treatments, exclosures were installed to measure post-treatment vegetative response in the absence of grazing. The size of these exclosures permit evaluation of vegetation and ground cover characteristics within an area equivalent to the size of plots used to assess sage-grouse microhabitat selection at nests and brood-rearing locations. During January and February 2014, the WGFD and the University of Wyoming mowed approximately 1,208 acres of sagebrush habitats across 2 mowing treatment areas. Spike treatments occurred in early May 2014 applying 1 pound/acre (0.2 pounds/acre active ingredient), anticipating a 50% kill rate of sagebrush, to 1,500 acres across 2 study areas. Exclosures were erected in May 2014 following treatments.

Conservation Easements

Within the WRSRCA, several privately owned properties have been placed under conservation easements with deed restrictions ranging from minimal to no new construction of houses, barns, or other buildings. Conservation easements are mostly located in the Lander Foothills, Sweetwater River, Twin Creek, Dubois, and Ervay Basin areas. No new conservation easements were completed in 2014. However, a few properties are being considered for easements with completion possible in 2016. Presently, nearly 30,000 acres of private lands are permanently protected by conservation easements within the WRSRCA, and provide protection of crucial wildlife habitat, water quality, maintain migration routes, and continue traditional agricultural land uses.

Research

A number of research projects have been conducted in the WRSRCA since 2000. Abstracts for studies conducted or published in 2014-15 follow, with earlier studies reported in past JCRs and in the 2007 WRSRCA Local Sage Grouse Conservation Plan and 2014 Addendum, which contains the most complete bibliography of sage grouse research for the WRSRCA to date.

Response of Greater Sage-grouse to Treatments in Wyoming Big Sagebrush –
LeVan, University of Wyoming, et al

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 including 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, Wyoming is designed as a Before-After Impact-Control study with 3 years of pre-treatment and at least 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 or GPS rump-mounted transmitters to measure pre-treatment nest and brood-rearing success. During winter 2014, we mowed 489 ha (1,208 acres) of sagebrush habitats across 2 mowing treatment areas and applied Spike® 20P on 607 ha (~1,500 acres) across 2 herbicide treatment areas in May 2014. To date, we have monitored demographic parameters from n = 371 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.

Sample sizes (*n*) of greater sage-grouse monitored near Jeffrey City, Wyoming, 2011–2015.

	Before Treatment			After Treatment	
Sample size (*n*)	**2011**	**2012**	**2013**	**2014**	**2015**
Females monitored	32	84	101	100	86
Total nests	23(2)[1]	58(3)[1]	85(0)[1]	106(15)[1]	80(11)[1]
Broods	6	27	47	45	24

[1]Numbers in parentheses indicate number of re-nesting attempts

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

ABSTRACT: We are investigating how effective Greater Sage-Grouse is as an umbrella species for the conservation of non-game wildlife, specifically sagebrush-associated wildlife designated as Species of Greatest Conservation Need (SGCN). Wyoming's Greater Sage-Grouse Core Population Areas and the host of current efforts to conserve sage-grouse provide a natural laboratory for testing the umbrella species concept, and our findings will be useful to managers interested in indirectly conserving SGCN under the streamlined approach of the sage-grouse umbrella. We are addressing the following objectives at differing spatial scales to rigorously test sage-grouse as an umbrella species: 1) quantify overlap statewide between sage-grouse core areas and 52 SGCNs' suitable habitat using GIS data; 2) determine whether high sage-grouse abundance corresponds with high abundance of SGCN (birds, mammals, and reptiles) in the field; 3) evaluate whether nest-site selection of sagebrush-obligate passerine SGCN (Brewer's Sparrow and Sage Thrasher) corresponds with that of sage-grouse; and 4) examine the responses of sagebrush-obligate passerine SGCN (abundance, nesting success, and fledgling survival) to sagebrush-reducing habitat treatments implemented to improve sage-grouse brood-rearing habitat. We have completed field work near Jeffrey City, WY (4 seasons, 2012-2015). Preliminary findings by objective: 1)

core areas cover 0-63% of associated SGCN's suitable habitat (ongoing); 2) SGCN songbirds tend to be more abundant where sage-grouse are more abundant (ongoing); 3) forthcoming; and 4) SGCN songbirds still nest (two years post-treatment) in the vicinity of mowed areas, but do not appear to use the mowed footprint (ongoing).

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

ABSTRACT: In November 2013, we initiated a study in Fremont County, Wyoming to evaluate the effect of mechanical mowing and Spike® 20P (0.2 lbs Tebuthiuron active ingredient/acre) herbicide treatments on the dietary quality (crude protein and plant secondary metabolites [PSM]) of Wyoming big sagebrush (*Artemisia tridentata wyomingensis*). Although the response of structural attributes of sagebrush communities to treatments is well understood, there is a need to identify how sagebrush treatments influence the quality of winter food available for species such as greater sage-grouse (*Centrocercus urophasianus*) and mule deer (*Odocoileus hemionus*). Two study areas were mowed in January and February 2014 and herbicide was applied in two study areas in May 2014. We constructed six exclosures in each study area (24 total), which encompassed 30 m X 30 m areas of treated and untreated sagebrush within each exclosure. Samples of current annual growth were collected from 18 sagebrush plants from treatment sites and 12 plants from control sites within each exclosure during November 2013 and 2014. Samples were analyzed for crude protein and secondary metabolites known to influence diet selection and palatability by sage-grouse and other wildlife species. Preliminary results suggest that mowing treatments may slightly increase nutrient concentrations directly after treatments without immediate changes in secondary metabolites. Assessing dietary quality during additional years following treatments and potential trade-offs with loss of biomass associated with treatments will allow us to determine the influence of sagebrush treatments on dietary quality for sage-grouse and other co-occurring wildlife.

Courtship Negotiation in a Life-history Context: Interaction between on- and off-lek Tactics in Sage-grouse – *Patricelli, et al, University of California-Davis*

PROJECT GOALS: The greater sage-grouse (*Centrocercus urophasianus*) is one of North America's best-known lekking animals and the focus of decades of seminal work on sexual selection. As with many species, one of the strongest predictors of male fitness is male display effort, however little is known about factors that contribute to variation in display output, such as persistence and intensity. This study is expanding upon previous studies of courtship negotiation on the lek by exploring how condition, foraging efficiency and off-lek movements affect the dynamics of courtship for both males and females. This study has 4 objectives over 3 years. In Objective 1, we are examining tactical courtship haggling—how long males will pursue courtship with a coy female, how their behavior changes with female signals of interest, and how these tactics relate to male assets. In Objective 2, we are examining tactical allocation of assets in courtship negotiation across multiple time scales, testing the interdependency between off-lek behavior and on-lek display effort. In Objective 3 we are considering female tactics by manipulating outside options and the opportunity for mate-choice copying. In Objective 4, we are using the data collected over the course of the study to examine sage-grouse foraging behavior relative to the location, nutritional quality and toxicity of their food, how these behaviors change with foraging group and lek size; further we will examine whether tactical abilities in foraging relate to tactical abilities and display quality during courtship. The educational goal of the project is to educate people about sage-grouse conservation. This goal has never been more critical, as sage-grouse populations continue to decline. The principal investigators conduct outreach combining audio, video and demonstrations of the robotic grouse, targeting primary-school through college students in Wyoming.

Examining the Effects of Noise from Energy Development on the Breeding Biology of the Greater Sage-Grouse (Centrocercus Urophasianus) – *Patricelli and Hooper, University of California-Davis*

ABSTRACT: The goal of this project is to investigate the effects of noise from natural gas development on sage-grouse reproductive behaviors. We have completed three major objectives of the project. First, we monitored noise sources in Sublette and Campbell counties that are associated with energy development, including drilling rigs, compressor stations, roads, and generators. Second, to examine the impacts of noise on sage-grouse, we

conducted a noise playback experiment on leks in our study site in Fremont County from 2006-2009. We found immediate and sustained declines in male lek attendance and elevated fecal stress hormone levels on noise leks relative to paired controls. Third, we adapted landscape-level noise modeling software (NMSimNord) with our measurements from noise sources, to map the "acoustic footprint" of natural gas development. We are now using this model to map noise on the Pinedale Anticline from 1998-2011 during commonly-occurring weather scenarios for the region. We are using scripts developed with our partners at the National Park Service to combine the model outputs of noise levels from drilling rigs, producing wells, and a variety of traffic levels along roads servicing each well pad, for each study year. The spatial data layers generated by the model are being included in habitat-selection models to determine the role that noise has played in sage-grouse declines, determine the noise exposure threshold for this species, and determine what metric or metrics are most appropriate for characterizing noise impacts.

Investigating Female Mate Choice for Mechanical Sounds in the Male Greater Sage-grouse – *Koch, University of California-Davis, Auburn University; Krakauer, Patricelli, University of California-Davis (2015)*

ABSTRACT: Although birds are generally known for their vocally produced songs and calls, some species have evolved alternate means of acoustic communication that do not require the syrinx. While many of these mechanical sounds are used in a courtship context, the importance of among- and within-individual variation in these sounds is almost entirely unknown. We investigated feather-produced sounds in male Greater Sage-Grouse (*Centrocercus urophasianus*), which congregate on leks during the spring breeding season and perform elaborate displays to attract females. Despite decades of research on the vocal components of the display, the frequency-modulated and mechanically generated "swish" sounds remain poorly studied. We used 2 years of acoustic data to evaluate the relationship between the time and frequency characteristics of the swish display and male mating success. Although characteristics of the swish sounds showed individual-specific patterns of variation, neither univariate nor multivariate analyses revealed direct effects of the acoustic qualities of these mechanical sounds on number of copulations. However, we did find that the frequency range of individual notes was correlated with note duration, and that males who successfully copulated showed a larger frequency range for a given duration than unsuccessful males. Furthermore, successful males increased this frequency change more strongly with the approach of a female than did unsuccessful males. These results parallel previous findings that successful and unsuccessful males show different patterns of adjustment with changing courtship conditions. Our results emphasize the importance of considering the interaction among multiple components of displays in analyses of mate choice, and help to broaden our understanding of the function of mechanical sounds in this and other species of birds.

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 2014.

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 2014 Addendum 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.
8. Continue to coordinate research projects with University of Wyoming, University of California-Davis, and others within or applicable to the WRSRCA.

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Sage Grouse Lek Characteristics (2015)

Working Group: Wind River/Sweetwater River

Region	Number	Percent
Lander	188	74.9
WRR	63	25.1

Working Group	Number	Percent
Wind River/Sweetwater River	251	100.0

Classification	Number	Percent
Occupied	211	84.1
Undetermined	12	4.8
Unoccupied	28	11.2

BLM Office	Number	Percent
Lander - WRR	58	23.1
Casper	11	4.4
Lander	173	68.9
Rock Springs	7	2.8
Worland	2	0.8

Biologist	Number	Percent
WRR-USFWS	63	25.1
Casper	1	0.4
North Lander	65	25.9
South Lander	122	48.6

Warden	Number	Percent
Shoshone-Arapahoe Tribal	63	25.1
Dubois	1	0.4
Lander	71	28.3
North Riverton	29	11.6
South Riverton	54	21.5
West Casper	1	0.4
West Rawlins	32	12.7

County	Number	Percent
Carbon	1	0.4
Fremont	223	88.8
Hot Springs	4	1.6
Natrona	22	8.8
Sweetwater	1	0.4

Land Status	Number	Percent
BLM	145	57.8
BOR	4	1.6
Private	25	10.0
Reservation	63	25.1
State	14	5.6

Management Area	Number	Percent
E	188	74.9
WR	63	25.1

Sage Grouse Job Completion Report

Year: 2006 - 2015, 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)
2006	166	60	36	4179	76.0
2007	175	71	41	4494	70.2
2008	182	72	40	3367	51.0
2009	180	65	36	2444	45.3
2010	182	54	30	1621	36.0
2011	190	70	37	1668	26.9
2012	196	78	40	1899	28.8
2013	199	81	41	1543	22.4
2014	201	101	50	1860	21.6
2015	212	117	55	4615	43.5

b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2006	166	84	51	3832	59.0
2007	175	94	54	2666	39.2
2008	182	87	48	2282	38.7
2009	180	82	46	2029	33.8
2010	182	93	51	1660	23.4
2011	190	89	47	1311	22.2
2012	196	92	47	1358	21.2
2013	199	93	47	1056	15.3
2014	201	89	44	963	17.8
2015	212	81	38	1526	27.3

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: 2006 - 2015, 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)
2006	166	144	87	8011	66.8
2007	175	165	94	7160	54.2
2008	182	159	87	5649	45.2
2009	180	147	82	4473	39.2
2010	182	147	81	3281	28.3
2011	190	159	84	2979	24.6
2012	196	170	87	3257	25.1
2013	199	174	87	2599	18.8
2014	201	190	95	2823	20.2
2015	212	198	93	6141	37.9

d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2006	122	7	15	129	94.6	5.4
2007	134	9	22	143	93.7	6.3
2008	128	12	19	140	91.4	8.6
2009	114	14	19	128	89.1	10.9
2010	119	9	19	128	93.0	7.0
2011	122	10	27	132	92.4	7.6
2012	131	16	23	147	89.1	10.9
2013	139	13	22	152	91.4	8.6
2014	141	22	27	163	86.5	13.5
2015	162	16	20	178	91.0	9.0

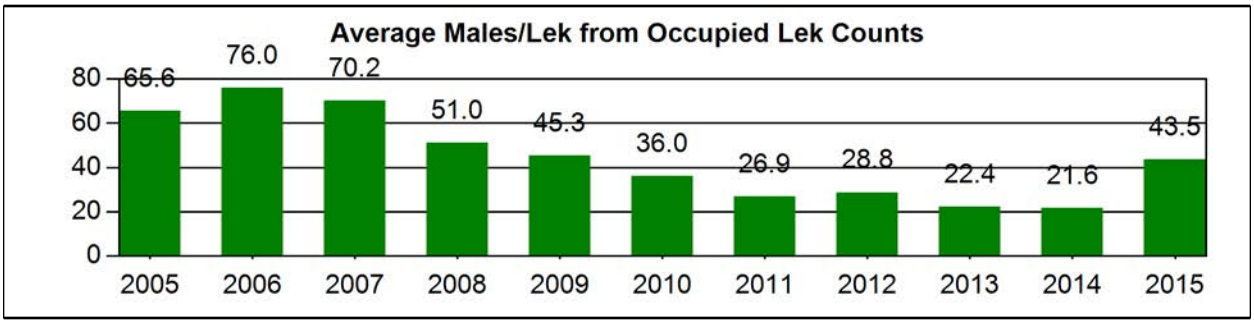
1) Occupied - Active during previous 10 years (see official definitions)

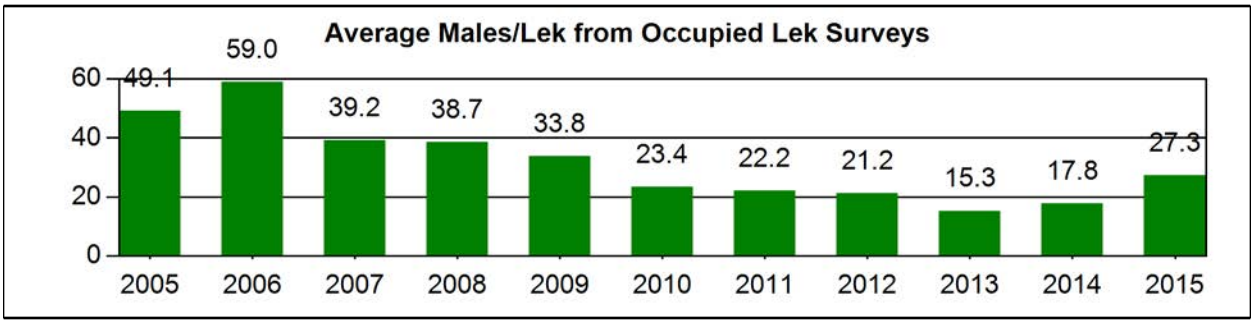
2) Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed. Does not include "Active" leks where only sign was documented.

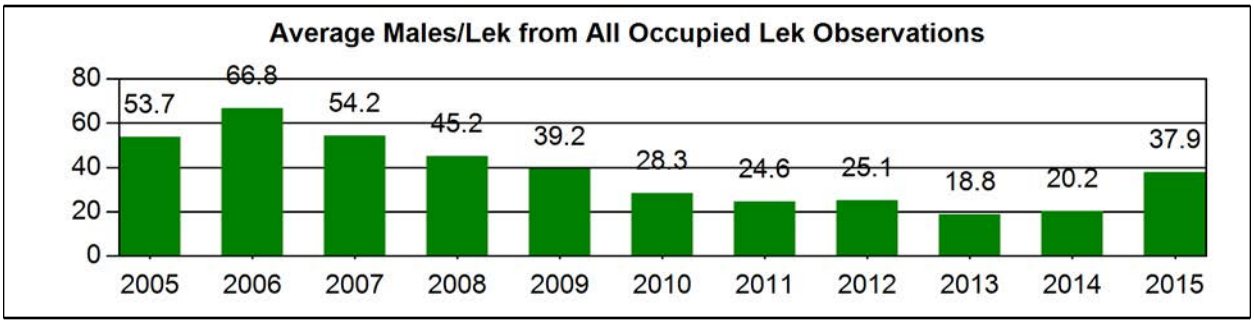
3) Inactive - Confirmed no birds/sign present (see official definitions)

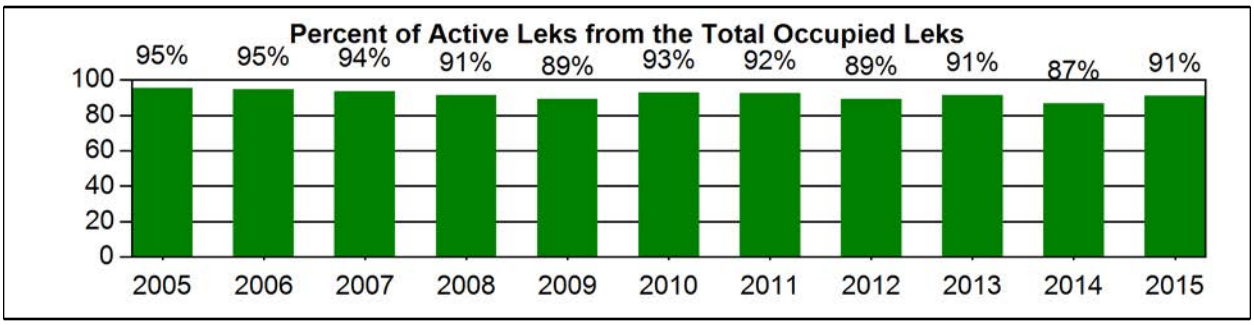
Sage Grouse Occupied Lek Attendance Summary

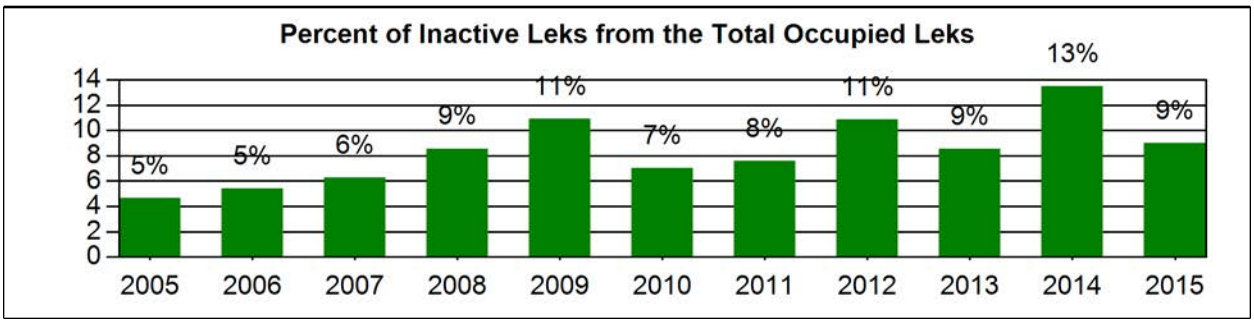
Year: 2005 - 2015, Working Group: Wind River/Sweetwater River











Sage Grouse Job Completion Report

Year: 2005 - 2014, Working Group: Wind River/Sweetwater River

4. Sage Grouse Hunting Seasons and Harvest Data

a. Season

Year	Season Start	Season End	Length	Bag/Possesion Limit
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
2013	Sep-21	Sep-30	10	2/4
2014	Sep-20	Sep-30	11	2/4

b. Harvest

Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2005	2994	930	2080	1.4	3.2	2.2
2006	1710	558	1183	1.4	3.1	2.1
2007	1776	788	1696	1.0	2.3	2.2
2008	2144	863	2059	1.0	2.5	2.4
2009	2295	875	2114	1.1	2.6	2.4
2010	2495	1056	2866	0.9	2.4	2.7
2011	1779	771	1801	1.0	2.3	2.3
2012	2068	890	2296	0.9	2.3	2.6
2013	1240	565	1325	0.9	2.2	2.3
2014	1546	772	1853	0.8	2.0	2.4
Avg	2,005	807	1,927	1.1	2.5	2.4

Sage Grouse Job Completion Report

Year: 2005 - 2014, 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	
2005	633	13.6	22.7	5.1	7.1	21.0	30.5	1.7
2006	366	26.0	25.4	4.6	4.6	13.4	26.0	1.3
2007	397	23.9	29.2	1.0	3.0	17.1	25.7	1.3
2008	538	21.6	24.5	5.6	5.6	17.8	24.7	1.4
2009	598	16.7	24.6	6.9	8.9	14.7	28.3	1.3
2010	476	16.0	30.3	4.4	6.7	15.1	27.5	1.2
2011	376	9.0	27.1	6.9	8.5	14.4	34.0	1.4
2012	443	18.5	36.1	6.3	6.8	11.1	21.2	0.8
2013	202	18.8	29.7	0.5	9.4	14.9	26.7	1.1
2014	343	10.5	23.3	2.3	8.5	30.3	25.1	1.7