

# **2015 GREATER SAGE-GROUSE JOB COMPLETION REPORT**



*T. Christiansen photo*

June 1, 2015 – May 31, 2016

Wyoming Game and Fish Department  
Cheyenne, WY



## Table of Contents

	Page
Table of Contents .....	i
Statewide Summary JCR .....	1
Bates Hole/Shirley Basin JCR.....	128
Big Horn Basin JCR.....	153
Northeast JCR .....	168
South-Central JCR.....	194
Southwest JCR .....	212
Upper Green River Basin JCR .....	232
Upper Snake River Basin JCR .....	256
Wind River/Sweetwater River JCR.....	275

Statewide  
Sage-Grouse  
Job Completion Report  
2015

June 2015-May 2016

Tom Christiansen  
Wyoming Game & Fish Dept.

# **Wyoming Sage-Grouse Job Completion Report**

Conservation Plan Area: **Statewide Summary**

Period Covered: **6/1/2015– 5/31/2016**

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 112%.

Following a lengthy process, in September 2015 the U.S. Fish and Wildlife Service issued a decision of “not warranted” for listing greater sage-grouse as threatened or endangered under the Endangered Species Act. This means the State of Wyoming maintains management authority over sage-grouse in Wyoming. In its decision document, the Service specifically cited Wyoming’s core area strategy as a mechanism that, if implemented as envisioned, should ensure conservation of sage-grouse in Wyoming and therefore help preclude the need for a future listing. The Service plans to reexamine the issue in 2020 to ensure planned conservation efforts are implemented and the status of the species remains unwarranted for listing.

Governor Matt Mead issued a new Sage-Grouse Core Area Protection Executive Order on July 29, 2015 that updated Wyoming’s core area strategy with the assistance of the Wyoming Sage-Grouse Implementation Team and the local sage-grouse working groups. The core area strategy addresses the threats (i.e., habitat loss and fragmentation and insufficient regulatory mechanisms) specifically identified by the Service in their 2010 listing decision that made greater sage-grouse a formal candidate for listing. The Core Areas are shown in Figure 1.

The 2014 Legislature approved the 2015-2016 biennium General Fund budget which again included 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 2016. The 2016 Legislature appropriated another \$1.1 million for use between mid-2016 and the end of 2018.

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.

Wyoming will host the 30<sup>th</sup> WAFWA Sage and Columbian Sharp-tailed Grouse Workshop in Lander in June 2016.

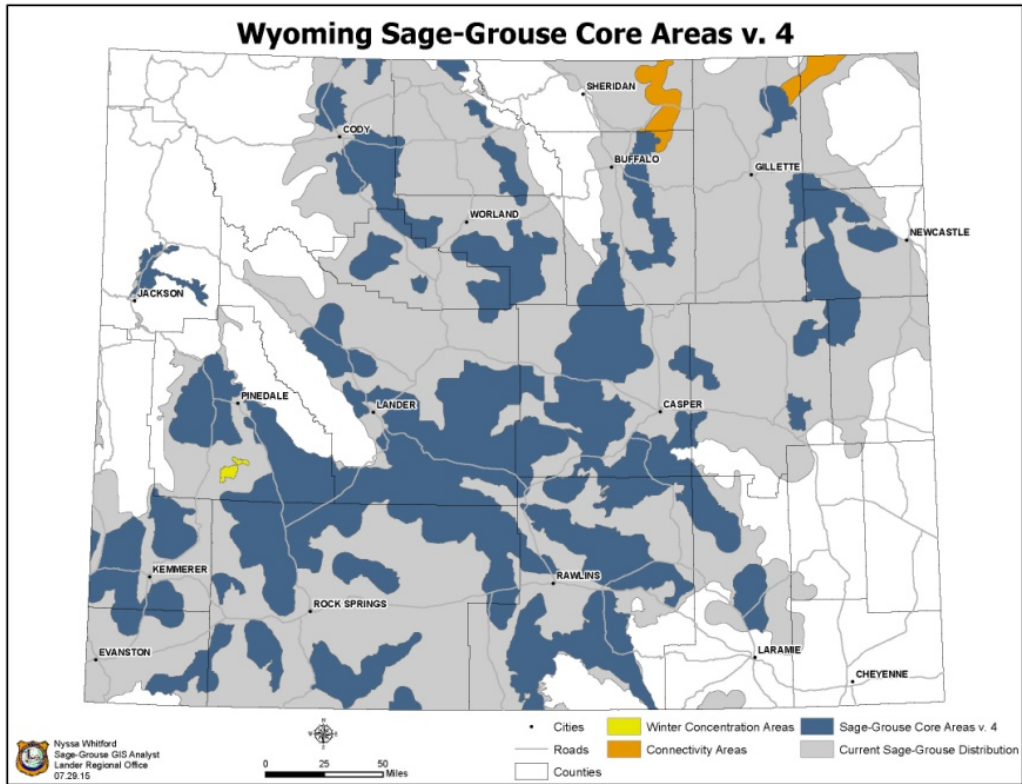


Figure 1. Wyoming Core Areas (version 4).

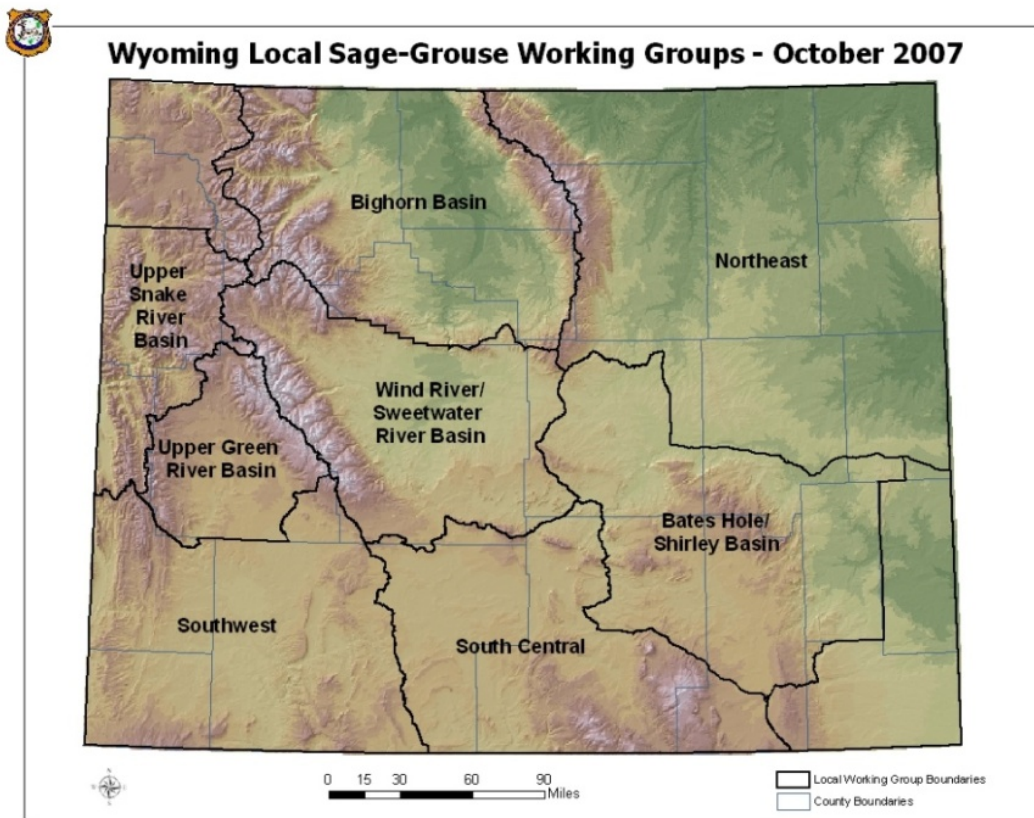


Figure 2. Wyoming Local sage-grouse working group boundaries.

## 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.

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.

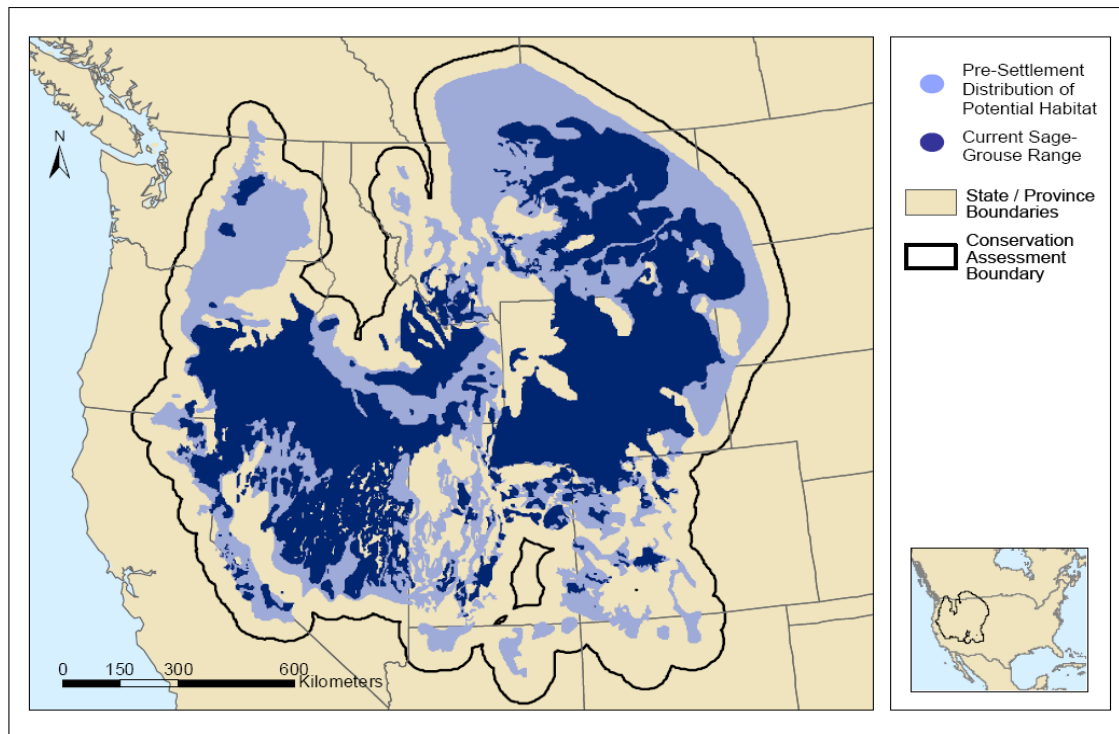


Figure 3. Current distribution of sage-grouse and pre-settlement distribution of potential habitat in North America (Schroeder 2004). For reference, Gunnison sage-grouse in SE Utah and SW Colorado are shown.

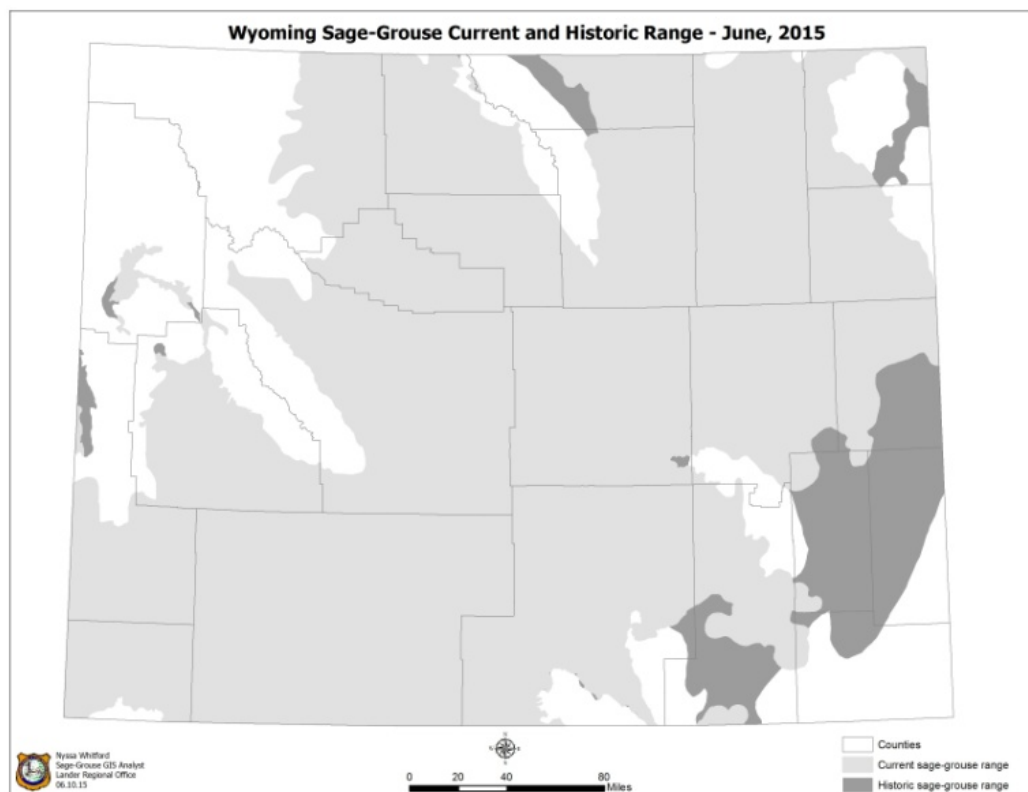


Figure 4. Sage-grouse range in Wyoming (updated 2015).

## 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 112%. Thus, there has been a long-term decline and short-term increase in the statewide sage-grouse population. The 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 2014-16 based on peak male lek counts and surveys.

Past 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.

### Monitoring Effort and Grouse Counted by Decade

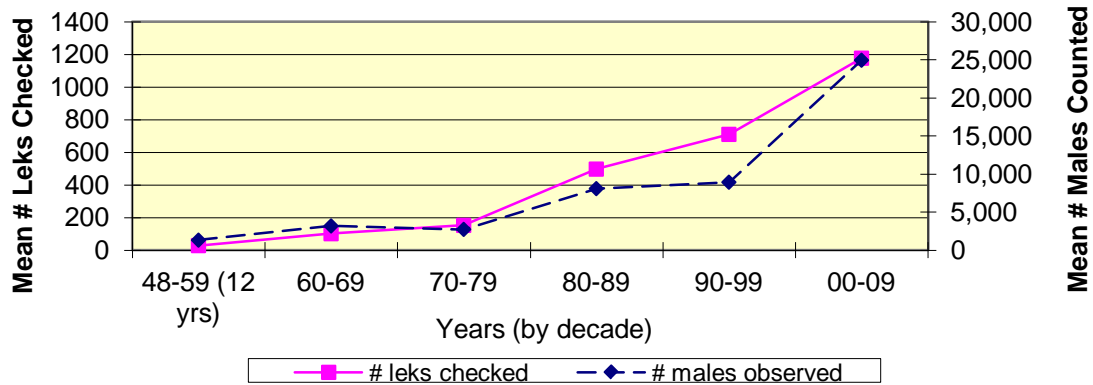


Figure 5. Mean annual numbers of leks checked (monitoring effort) and male grouse counted in Wyoming 1948-2009 by decade.

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 not reported since our data collection techniques are not designed to accurately capture these data and is therefore not a useful figure in assessing population trend.

Lek monitoring data for the 2016 breeding season are summarized in Tables 1a-d and Figures 6-11. Department personnel and others checked 90% (1,673/1,851) of the known occupied leks in 2016 (Table 1-c). Male attendance at all leks visited (counts and surveys) averaged 35.7 males per lek during spring 2016, a 16% increase above the 30.7 males/lek observed in 2015 but still 14% below the 41.7 males/lek observed in 2006. For the 10-year period (2007-2016), average male lek attendance ranged from 16.8 males/lek in 2013, the lowest average males per lek since 1997, to 31.9 males/lek in 2007.

The proportion of active, occupied leks remained stable at 82% in 2015 and 81% in 2016.

In 2016, 6,144 more male sage-grouse were observed on 27 more active leks checked. Cumulatively, the lek attendance data suggest there were more grouse in bio-year 2015 year than in 2014. 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/checked 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.

Five 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, 2015, Garton et al. 2011, Nielson et al. 2015). The trends reflected by these analyses are generally consistent with each other and with that shown in Figure 6. In 2013, WAFWA contracted with the University of Montana to develop better sampling designs and population trend estimators. This contract resulted in the development of a generalized integrated population model to estimate annual abundance from counts of males at breeding leks. This tool will be further tested and implemented as appropriate in Wyoming.

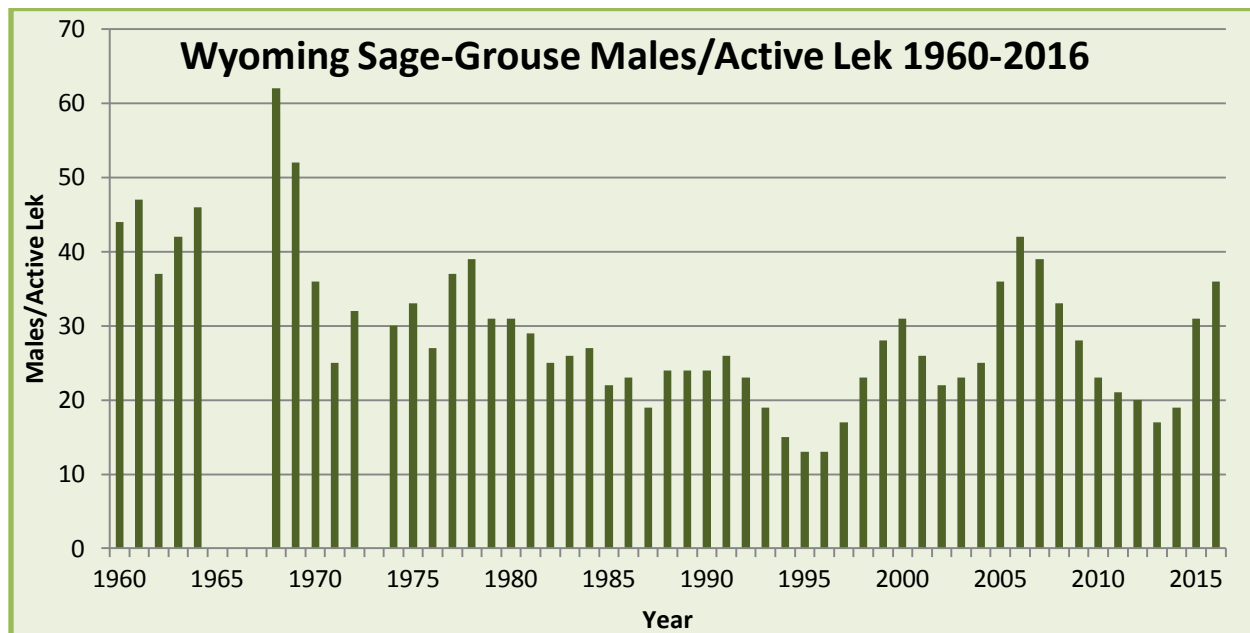


Figure 6. Average number of males per lek counted in Wyoming from 1960-2016 with a minimum of 100 leks checked each year.

**Table 1. Lek Attendance Summary (Occupied Leks)<sup>1</sup>**

**a. Leks Counted**

Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek <sup>2</sup>
2007	1600	508	32	21329	48.3
2008	1661	567	34	19463	39.2
2009	1689	582	34	15553	31.9
2010	1722	652	38	14154	27.2
2011	1759	648	37	11308	22.5
2012	1797	721	40	12665	22.9
2013	1809	650	36	10618	20.7
2014	1815	778	43	11469	20.5
2015	1841	746	41	19453	34.0
2016	1851	738	40	23292	40.2

**b. Leks Surveyed**

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek <sup>2</sup>
2007	1600	917	57	22224	33.1
2008	1661	827	50	16144	27.5
2009	1689	861	51	15034	25.5
2010	1722	827	48	11579	20.1
2011	1759	840	48	10143	18.6
2012	1797	830	46	8634	16.6
2013	1809	937	52	7631	13.3
2014	1815	850	47	8591	16.4
2015	1841	876	48	16745	27.5
2016	1851	935	51	19050	31.3

**c. Leks Checked**

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek <sup>2</sup>
2007	1600	1425	89	43553	39.1
2008	1661	1394	84	35607	32.8
2009	1689	1443	85	30587	28.4
2010	1722	1479	86	25733	23.4
2011	1759	1488	85	21451	20.5
2012	1797	1551	86	21299	19.8
2013	1809	1587	88	18249	16.8
2014	1815	1628	90	20060	18.5
2015	1841	1622	88	36198	30.7
2016	1851	1673	90	42342	35.7

**d. Lek Status**

Year	Active	Inactive <sup>3</sup>	Unknown	Known Status	Percent Active	Percent Inactive
2007	1135	128	162	1263	89.9	10.1
2008	1102	156	136	1258	87.6	12.4
2009	1098	185	160	1283	85.6	14.4
2010	1118	194	167	1312	85.2	14.8
2011	1085	215	188	1300	83.5	16.5
2012	1127	243	181	1370	82.3	17.7
2013	1120	288	179	1408	79.5	20.5
2014	1107	360	158	1467	75.5	24.5
2015	1209	271	142	1480	81.7	18.3
2016	1236	290	147	1526	81.0	19.0

<sup>1)</sup> Occupied - Active during previous 10 years (see official definitions)

<sup>2)</sup> 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

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

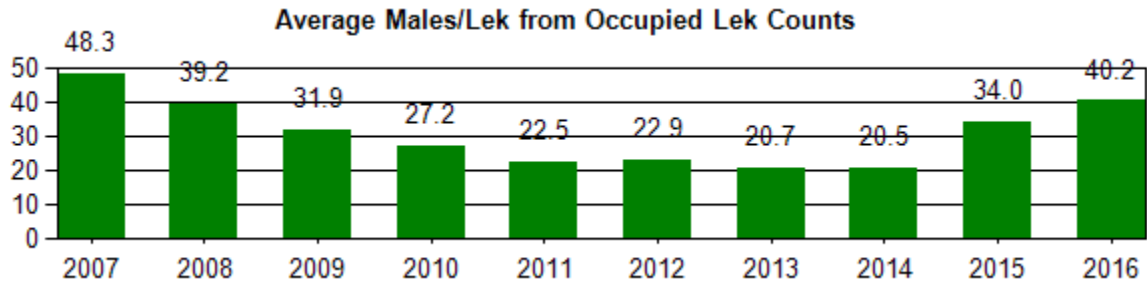


Figure 7. Average males/lek from occupied lek counts.

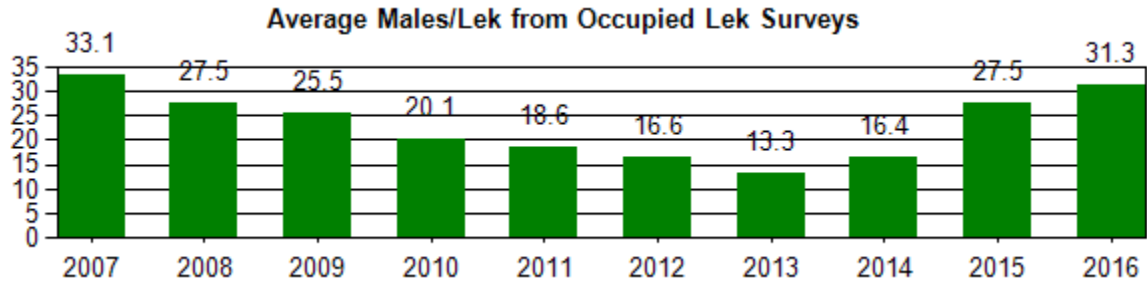


Figure 8. Average males/lek from occupied lek surveys.

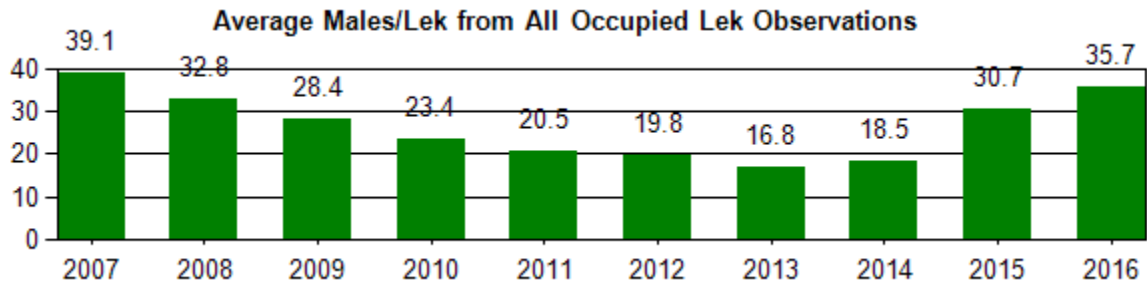


Figure 9. Average males/lek from all occupied leks checked (counts+surveys).

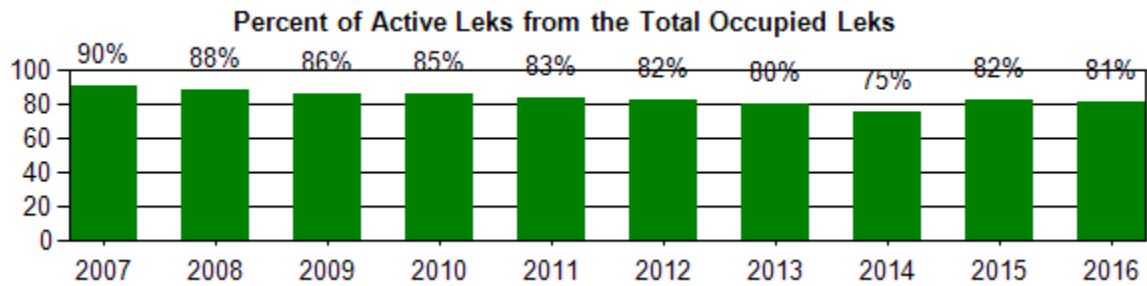


Figure 10. Percent active leks from the occupied leks checked with known status.

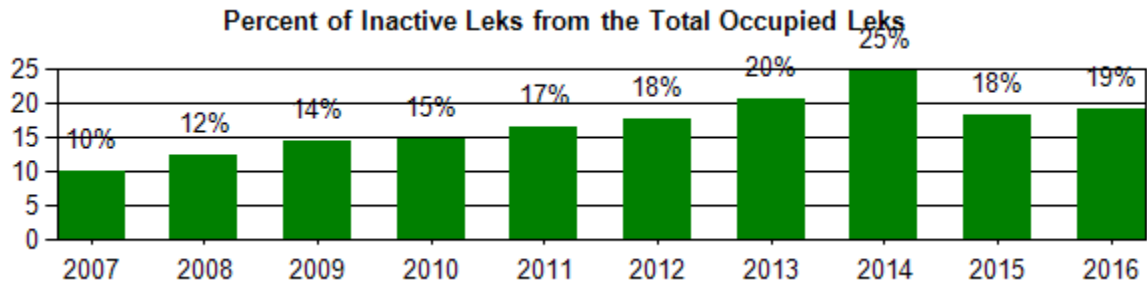
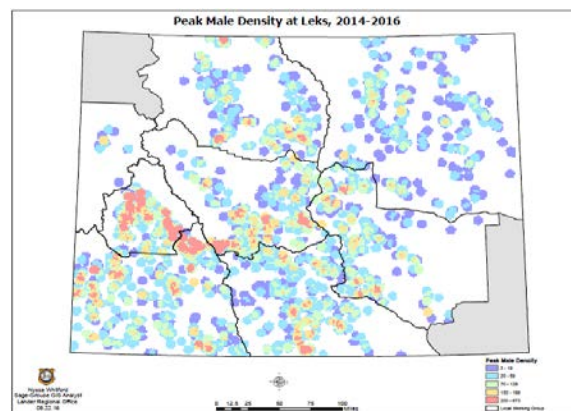
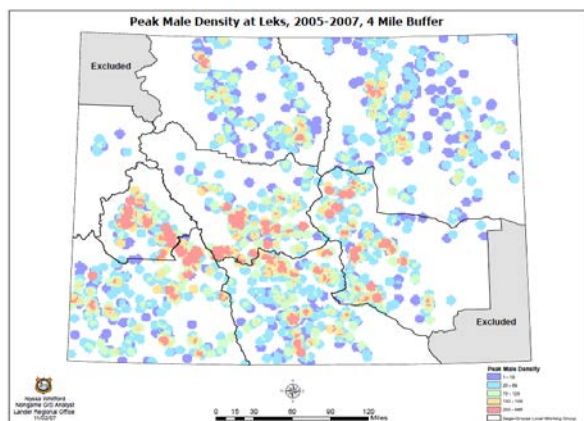


Figure 11. Percent inactive leks from the occupied leks checked with known status.

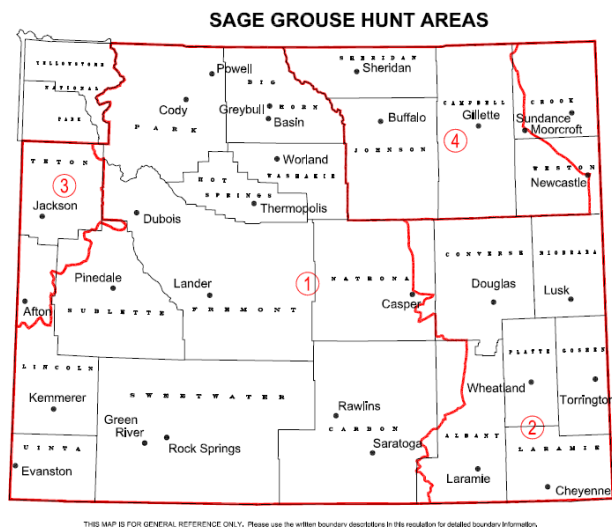


Figures 12 and 13. Relative sage-grouse density comparing 2005-2007 and 2014-2016 based on peak male lek counts and surveys.

### 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 2015 hunting season (Figure 14, Table 2) for most of the state (Area 1) was 1 day longer than 2013 due to the calendar effect of opening the season on the third Saturday of September. In 2014 the third Saturday was September 20 but in 2015 it was September 19.



THIS MAP IS FOR GENERAL REFERENCE ONLY. Please use the written boundary descriptions in this regulation for detailed boundary information.

Area	Season Dates	Daily/Poss. Limits	Falconry
1	Sept. 19-Sept. 30	2/4	Sept. 1-Mar. 1
2, 3	Closed	Closed	Closed
4	Sept. 19-Sept. 21	2/4	Sept. 1-Mar. 1

Figure 14 and Table 2. 2015 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. 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 2014 (3,526 hunters/7,094 birds) and 2015 (4,299 hunters/10,498 birds). The trend in the number of birds harvested is generally correlated with lek attendance trends.

**Table 3. Sage Grouse Hunting Seasons and Harvest Data**

<b>a. Season</b>	Year	Season Start	Season End	Length	Bag/Possession Limit
	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-21	3	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	3	2/4
	2014-1	Sep-20	Sep-30	11	2/4
	2014-4	Sep-20	Sep-22	3	2/4
	2015-1	Sep-19	Sep-30	12	2/4
	2015-4	Sep-19	Sep-21	3	2/4

<b>b. Harvest</b>	Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
	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
	2015	10498	4299	10231	1.0	2.4	2.4
	Avg	9,930	4,528	10,406	0.9	2.2	2.3

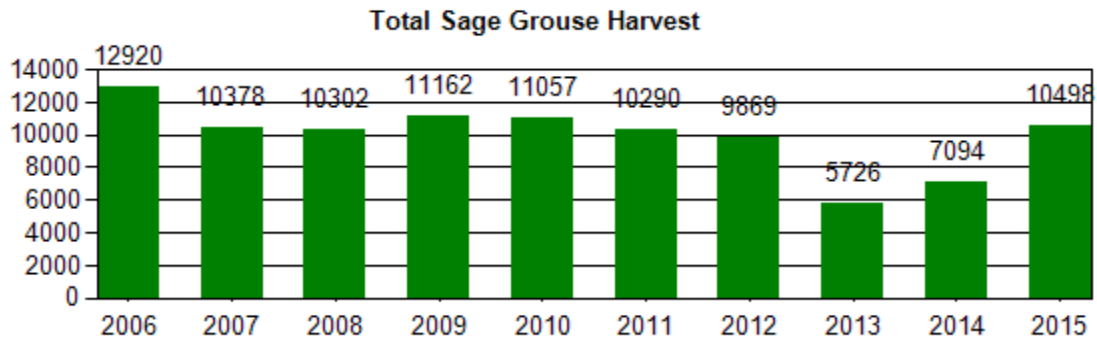


Figure 15. Wyoming statewide sage-grouse harvest 2006-2015.

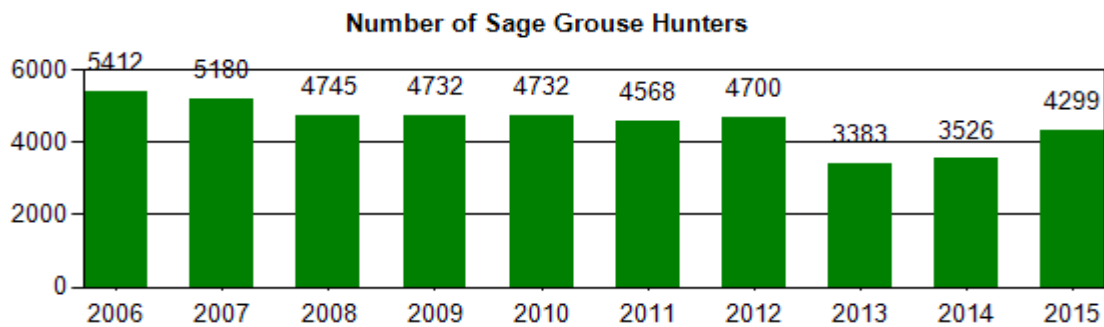


Figure 16. Wyoming statewide sage-grouse hunter numbers 2006-2015.

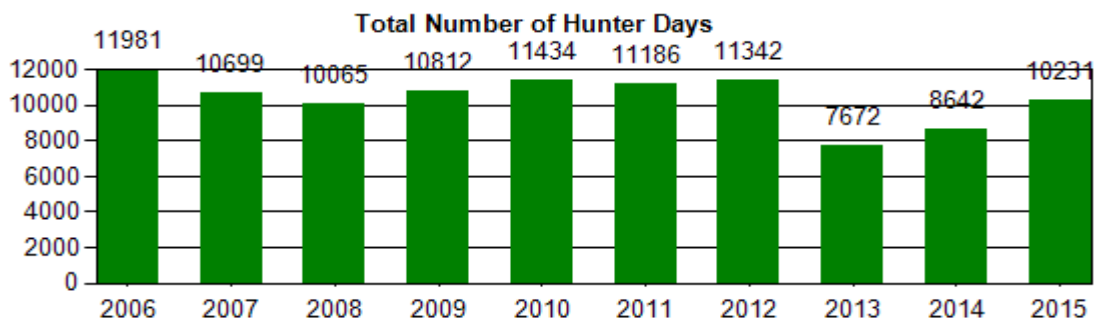


Figure 17. Wyoming statewide number of hunter days 2006-2015.

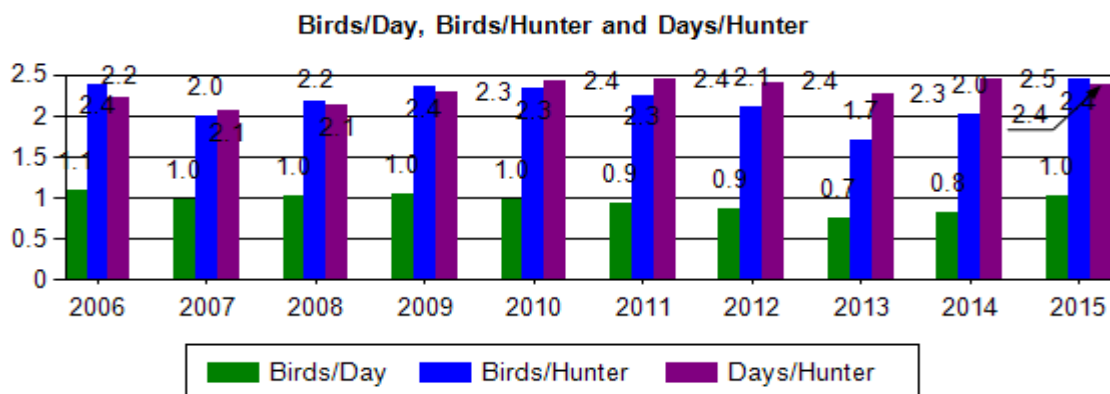


Figure 18. Wyoming statewide birds/day, birds/hunter and days/hunter 2006-2015.

The number of sage-grouse wings collected from hunters increased by 50% in 2015, which is similar to the 48% increase in estimated harvest between 2014 and 2015. In 2015, 2,300 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 2015 chick:hen ratio (based on harvested wing analysis) was 1.7 chicks per hen (Table 4 and Figure 19). This level of productivity is typically associated with a slightly increasing population. This is consistent with the 2016 lek data (all lek checks), which indicated a 16% increase in the average numbers of males on leks (Table 5). 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 basis of these analyses.

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

**Table 4. Composition of Harvest by Wing Analysis**

Year	Sample Size	Percent Adult		Percent Yearling		Percent Young		Chicks/ Hens
		Male	Female	Male	Female	Male	Female	
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
2015	2300	12.7	25.8	3.6	5.4	24.8	27.7	1.7

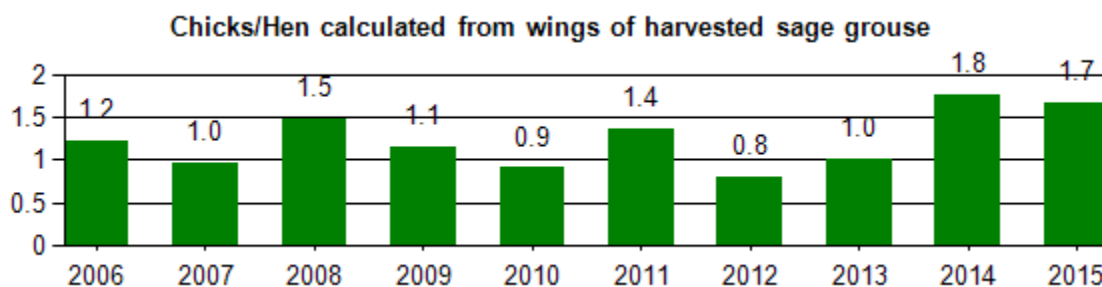


Figure 19. Chicks/Hen 2006-2015 based on wings from harvested grouse.

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%
2015	1.7	+16%

### **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 predictable 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. Many areas of the state experienced heavy precipitation and even flooding in May 2016 potentially reducing nesting success and chick survival.

### **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**

### **Endangered Species Act Status**

Following a lengthy process, in September 2015 the U.S. Fish and Wildlife Service issued a decision of “not warranted” for listing greater sage-grouse as threatened or endangered under the Endangered Species Act. This means the State of Wyoming maintains management authority over sage-grouse in Wyoming. In its decision document, the Service specifically cited Wyoming’s core area strategy as a mechanism that, if implemented as envisioned, should ensure conservation of sage-grouse in Wyoming and therefore help preclude the need for a future listing. The Service plans to reexamine the issue in 2020 to ensure planned conservation efforts are implemented and the status of the species remains unwarranted for listing.

### **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).

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. Governor Mead issued a new Sage-Grouse Core Area Protection Executive Order on July 29, 2015. Executive Order 2015-4 is attached to this JCR (Attachment B) 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.

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 2005-2016, Local Working Groups were allocated approximately \$6.3 million to support implementation of local sage-grouse conservation projects. One hundred ninety-six (196) projects have been approved over that time. The source of this funding is the State of Wyoming General Fund as requested by the Governor 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. Thirty-one (31) projects (Attachment C) have been or are being implemented 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. The 2016 Legislature appropriated another \$1.1 million for the 2017-18 biennium. Allocation of these funds will begin July 1, 2016.

### **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 2015 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 2015, there was one confirmed West Nile virus sage-grouse mortality documented; a bird from Campbell County.

### **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 on oil and gas development impacts but during this reporting period it appears only one peer-reviewed manuscript based on Wyoming research was released (Kirol et al. 2015). One area of research need identified during the 2015 Core Area Strategy revision is identifying natural gas development impact thresholds relative to sage-grouse winter concentration areas. That topic is being pursued by the SGIT. Research relative to wind energy development also continues and a general technical report was issued (LeBeau et al. 2016).

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 D 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 E 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 through 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).

MATTHEW H. MEAD  
GOVERNOR



STATE CAPITOL  
CHEYENNE, WY 82002

## Office of the Governor

### STATE OF WYOMING EXECUTIVE DEPARTMENT EXECUTIVE ORDER

Order 2015-4  
(Replaces 2011-5 and 2013-3)

#### **GREATER SAGE-GROUSE CORE AREA PROTECTION**

**WHEREAS**, the State of Wyoming is proud of its rich wildlife heritage and is one of few states remaining in the United States where wildlife exist in great abundance; and

**WHEREAS**, the Greater sage-grouse (*Centrocercus urophasianus*), an iconic western species, inhabits much of the sagebrush-steppe habitat in Wyoming; and

**WHEREAS**, the sagebrush-steppe habitat type is abundant across the State of Wyoming; and

**WHEREAS**, the State of Wyoming currently has the greatest population of Greater sage-grouse across the range; and

**WHEREAS**, the State of Wyoming has management authority over Greater sage-grouse populations in Wyoming; and

**WHEREAS**, the United States Department of the Interior has determined that listing the Greater sage-grouse range-wide as a threatened or endangered species is currently precluded making it a candidate species; and

**WHEREAS**, in response to the U.S. Fish and Wildlife Service finding under Listing Factor D, the State of Wyoming and partner federal, state and local agencies have developed and put into place a comprehensive and effective set of regulatory mechanisms designed to conserve the Greater sage-grouse; and

**WHEREAS**, it is the desire of the State of Wyoming and it is in the best interest of the State and the Greater sage-grouse that Wyoming maintain legal primacy for this species; and

**WHEREAS**, the State of Wyoming continues to be committed both logistically and financially to conserving the Greater sage-grouse; and

Executive Order 2015-4

Page 1 of 7

FAX: (307) 632-3909

**WHEREAS**, the State of Wyoming recognizes the necessity of a robust and scientifically rigorous system of monitoring; and

**WHEREAS**, agencies of the State of Wyoming have established oversight mechanisms and implemented management stipulations in compliance with this and previous Executive Orders; and

**WHEREAS**, the listing of the Greater sage-grouse would have a significant, adverse effect on the land and natural resource management of the State of Wyoming beyond that necessary to maintain and enhance Greater sage-grouse populations and habitat; and

**WHEREAS**, the listing of the Greater sage-grouse would have a significant, adverse effect on the economy of the State of Wyoming, including the ability to generate revenues from State lands; and

**WHEREAS**, the listing of the Greater sage-grouse would have a significant, adverse effect on the custom and culture of the State of Wyoming, and would substantially obstruct and conflict with ongoing and effective collaborative efforts to conserve Greater sage-grouse; and

**WHEREAS**, the Wyoming State Legislature, federal, state and local agencies, industry, conservation organizations, and landowners have dedicated significant time and resources to conserve Greater sage-grouse populations in Wyoming; and

**WHEREAS**, in order to maintain and enhance Greater sage-grouse populations and adequate sagebrush-steppe habitat, the State of Wyoming has developed and implemented a Greater sage-grouse Core Area Protection strategy; and

**WHEREAS**, this Executive Order is the State of Wyoming's primary regulatory mechanism to conserve the Greater sage-grouse and preclude the need for listing the bird as a threatened or endangered species pursuant to the Endangered Species Act of 1973; and

**WHEREAS**, the Sage-Grouse Implementation Team serves as the oversight team in implementing this Executive Order and the Wyoming State Legislature established the Team as a statutory body (W.S. § 9-19-101) to provide recommendations regarding regulatory actions necessary to maintain and enhance Greater sage-grouse populations and habitats in Wyoming; and

**WHEREAS**, Wyoming's Greater sage-grouse Core Area Protection strategy protects significant quantity and quality of Greater sage-grouse habitat and protects a substantial portion of Wyoming's Greater sage-grouse; and

**WHEREAS**, on April 17, 2008, the Office of the Governor requested that the U.S. Fish and Wildlife Service review Wyoming's Greater sage-grouse Core Area Protection strategy to determine whether it was a "sound policy that should be moved forward" and on May 7, 2008, the U.S. Fish and Wildlife Service responded that the "core population area strategy... is a sound framework for a policy by which to conserve Greater sage-grouse in Wyoming"; and

**WHEREAS**, in its March 23, 2010 status determination for the Greater sage-grouse (Decision; 75 Federal Register 13910, 13974) the U. S. Fish and Wildlife Service stated, “the Service believes that the core area strategy[,] if implemented by all landowners via regulatory mechanisms, would provide adequate protection for sage-grouse and their habitats in that State[;.]” and

**WHEREAS**, in a letter dated November 10, 2010, the U.S. Fish and Wildlife Service again confirmed that “[t]his long-term, science-based vision for the conservation of Greater sage-grouse has set the stage for similar conservation efforts across the species range,” and that “the Core Population Area strategy for the Greater sage-grouse provides an excellent model for meaningful conservation of Greater sage-grouse if fully supported and implemented”; and

**WHEREAS**, the State of Wyoming, the Bureau of Land Management, the U.S. Forest Service, and other land management agencies have coordinated Greater sage-grouse Core Area Protection conservation actions across their boundaries which encompass approximately 15 million acres of habitat for the Greater sage-grouse in Wyoming; and

**WHEREAS**, federal land management agencies including the Bureau of Land Management and the U.S. Forest Service are revising or amending their respective Land and Resource Management Plans consistent with this Executive Order to prioritize conservation of Greater sage-grouse and their habitats; and

**WHEREAS**, Candidate Conservation Agreements with Assurances (CCAA) through the U.S. Fish and Wildlife Service and the Sage-Grouse Initiative (SGI) through the Natural Resources Conservation Service on private lands, complemented by Candidate Conservation Agreements (CCA) on public lands, are a proven means of investing in the future of rural land management; and

**WHEREAS**, significant investments of both time and money have been made by all stakeholders to see the successful implementation of the Greater sage-grouse Core Area Protection strategy; and

**WHEREAS**, science, information, and data continue to emerge regarding the habitats and behaviors of the Greater sage-grouse; and

**WHEREAS**, the review process built into Wyoming’s Greater sage-grouse Core Area Protection strategy provides a mechanism to evaluate this emerging science, information, and data and has resulted in updated management recommendations from the Sage-Grouse Implementation Team.

**NOW, THEREFORE**, in consideration of the recommendations of the Sage-Grouse Implementation Team and pursuant to the authority vested in me by the Constitution and Laws of the State, and to the extent such actions are consistent with the statutory obligations and authority of each individual agency, including those found in the Wyoming Regulatory Takings Act, W.S. §§ 9-5-301 through 9-5-305, I, Matthew H. Mead, Governor of the State of Wyoming, do hereby issue this Executive Order providing as follows:

1. State agencies shall strive to maintain consistency by following the procedures outlined in this Executive Order, while recognizing that adjustments to the stipulations may be necessary based upon local conditions, opportunities, and limitations. The goal is to minimize future disturbance by co-locating proposed disturbances within areas already disturbed or naturally unsuitable.
2. Valid existing rights shall be recognized and respected. Activities existing or permitted in Core Population Areas prior to August 1, 2008, will not be required to be managed under Core Population Area stipulations. Activities existing or permitted prior to the date of this Executive Order and within Core Population Areas added as a result of this Executive Order will not be required to be managed under Core Population Area stipulations (see Attachment A, Figure 2). Examples of existing activities include oil and gas, mining, agriculture, processing facilities, housing, and other uses that were in place prior to the development of the Core Population Areas. Federal and state permitted activities, within a defined project boundary (such as a recognized federal oil and gas unit, drilling and spacing unit, mine plan, subdivision plat, utility ROW, grazing allotment etc.), shall be allowed to continue within the existing boundary even if the use exceeds recommended stipulations (see Attachment A, Figure 1).
3. It is critical that existing land uses and landowner activities continue to occur in Core Population Areas, particularly agricultural activities on private lands. Functioning ranches and agricultural lands provide crucial ecological and habitat services to wildlife. The failure or loss of these areas could have damaging implications to wildlife and their habitats. The loss of these important lands in their current status and role(s) could impact conservation objectives for Greater sage-grouse and other species (USFWS, February 5, 2015, Memo to State Directors and Field Supervisors: Service Position on Livestock Grazing and Working with the Rangeland Owners to Conserve Sage-Grouse).
4. For the most part, activities on private lands are not subject to state or federal agency review or approval. Only those activities which state agencies are required by state or federal law to review or approve are subject to review for consistency. Core Population Areas have been mapped to include additional habitat beyond that strictly necessary to prevent the listing of Greater sage-grouse. The additional habitat included within the Core Population Area boundaries is adequate to accommodate continuation of existing land uses and landowner activities. Existing land uses and landowner activities deemed to have negligible or no impacts to Greater sage-grouse are exempt from review for consistency under this Executive Order (see Attachment C).
5. Land uses and activities proposed inside Core Population Areas for which stipulations have not been developed in this Executive Order may be authorized on a case-by-case basis only when it can be demonstrated to the satisfaction of the permitting agency, and based upon recommendations made by the Wyoming Game and Fish Department, that the activity will avoid negative impacts to Greater sage-grouse.
6. Regulatory agencies and departments of the State of Wyoming including, but not limited to, the Office of State Land and Investments, Department of Environmental Quality, State

Engineer's Office, Industrial Siting Council and the Oil and Gas Conservation Commission, shall prioritize the maintenance and enhancement of Greater sage-grouse habitats and populations inside the Core Population Areas, connectivity areas, and winter concentration areas identified in Attachment A, Figure 1.

7. Development consistent with the stipulations set forth in Attachment B shall be deemed sufficient to demonstrate that the activity will avoid negative impacts to Greater sage-grouse.
8. Incentives to accelerate or enhance required reclamation in habitats adjacent to or within Core Population Areas should be developed, including but not limited to stipulation waivers, funding for enhanced reclamation, and other strategies. It is recognized that some incentives may result in reduced numbers of Greater sage-grouse outside of Core Population Areas.
9. Where consistent with the Greater sage-grouse conservation goals set forth herein, a non-regulatory approach should be used to influence management actions and activities within Core Population Areas. Permit stipulations should reflect unique localized conditions, including soils, vegetation, development type, predation, climate, and other local realities.
10. Wyoming is managing approximately 15 million acres of Core Population Area habitat to maintain high quality Greater sage-grouse habitat and maintain and enhance populations within normal variability.
11. Fire suppression efforts in Core Population Areas should be emphasized, recognizing that other local, regional, and national suppression priorities may take precedence. Public and firefighter safety remains the number one priority for all fire management activities.
12. The State of Wyoming will support research of activities in winter concentration areas where biologically significant numbers of Greater sage-grouse nesting in Core Population Areas are suspected of congregating. Further, the State of Wyoming will develop appropriate local, science-based standards to manage disturbance in identified and mapped winter concentration areas (see Attachment A, Figure 1).
13. To ensure continued sustainability of Wyoming's economy, all efforts to encourage, enhance, and prioritize development outside of Core Population Areas shall be made. State and federal agencies, with other relevant stakeholders, should work collaboratively to develop a strategic plan to achieve a beneficial balance between Greater sage-grouse protection and Wyoming's economy. Incentives, prioritization of projects outside of Core Population Areas, and streamlining permit processes should be considered.
14. State and federal agencies, including the U.S. Fish and Wildlife Service, Bureau of Land Management, U.S. Forest Service, Wyoming Game and Fish Department, and other stakeholders shall work collaboratively to ensure a uniform and consistent application of

this Executive Order to maintain and enhance Greater sage-grouse habitats and populations.

15. State agencies shall work collaboratively with all appropriate stakeholders to maintain and enhance Greater sage-grouse habitats and populations consistent with the language and spirit of this Executive Order.
16. The State of Wyoming will support voluntary enrollment and expanded coverage for conservation easements, CCAA, CCA, and commensurate improvements and investments by the U.S. Department of Agriculture and the U.S. Fish and Wildlife Service, where appropriate. These efforts should be focused and prioritized to take place in Core Population Areas.
17. Local Working Groups will continue to be engaged through the Local Working Group Charter.
18. The State of Wyoming will engage in adaptive management that will include the involvement of state and federal land management and regulatory agencies as appropriate (see Attachment B).
19. State agencies shall report all conservation and permitted actions occurring within Greater sage-grouse Core Population Areas annually, or more frequently, as determined necessary.
20. The State of Wyoming shall work with federal, state, county, private and non-governmental organization partners to collect data to determine the condition of each Core Population Area in relationship to the goals of the Wyoming's Greater sage-grouse Core Area Protection strategy.
21. Absent substantial and compelling information that adjustments are necessary to protect the integrity of the Greater sage-grouse Core Area Protection strategy, these Core Population Areas, connectivity areas, identified and mapped winter concentration areas, and protective stipulations identified in this Executive Order shall not be altered for a minimum of 7 years.
22. The State of Wyoming shall continue to monitor and document Greater sage-grouse populations and development activities to ensure that permitted activities under this authority do not result in negative impacts to Greater sage-grouse outside cyclical trends.
23. This Executive Order, together with its attachments, constitutes Wyoming's strategy for the conservation of the Greater sage-grouse and their habitats. Attachments A through I

are expressly adopted and incorporated by reference herein, and each shall have the full force and effect of this Executive Order.

Given under my hand and the Executive Seal of the State of Wyoming this 29 day of July, 2015.



  
Matthew H. Mead  
Governor

**EXECUTIVE ORDER 2015-4  
ATTACHMENT A**

Figure 1.

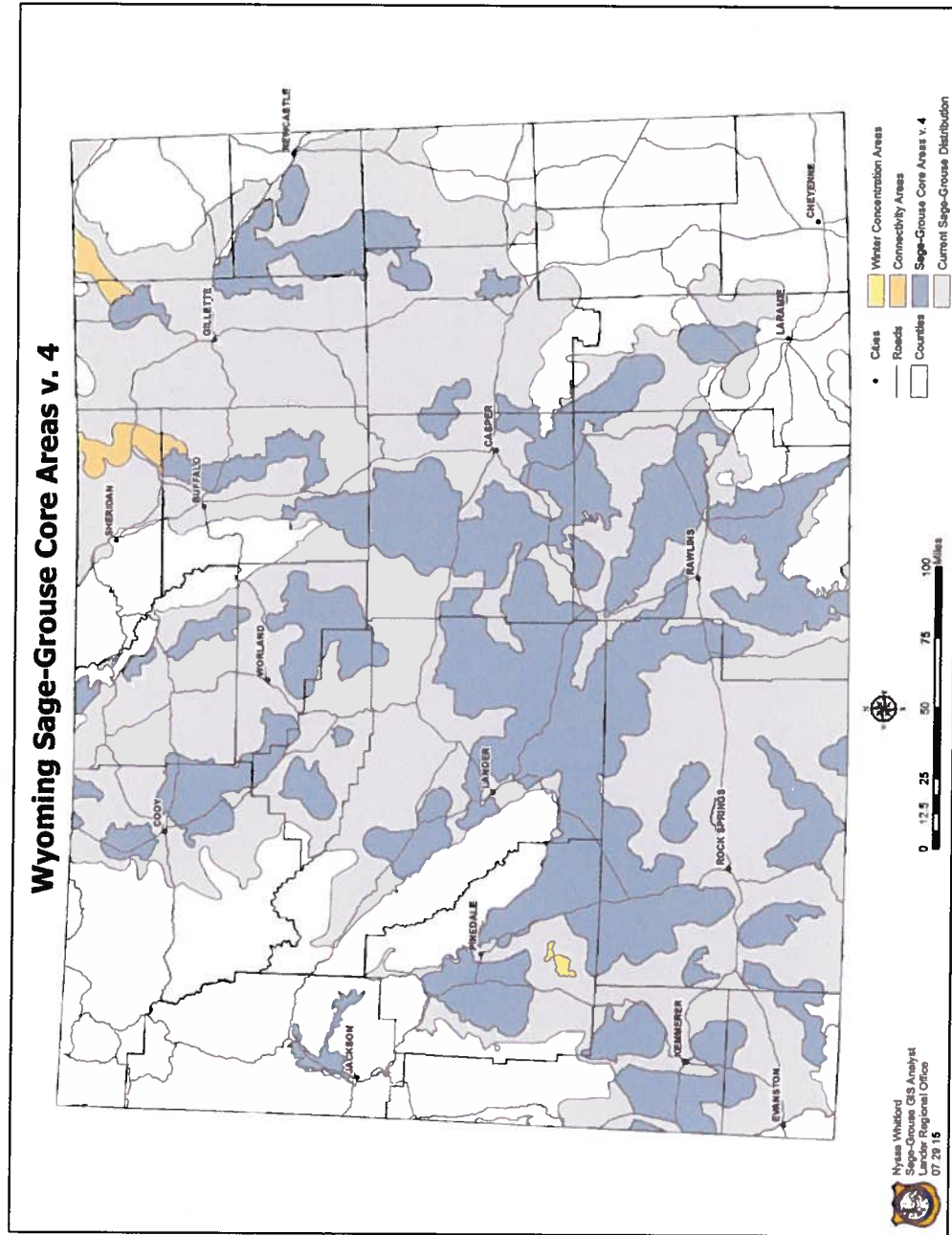
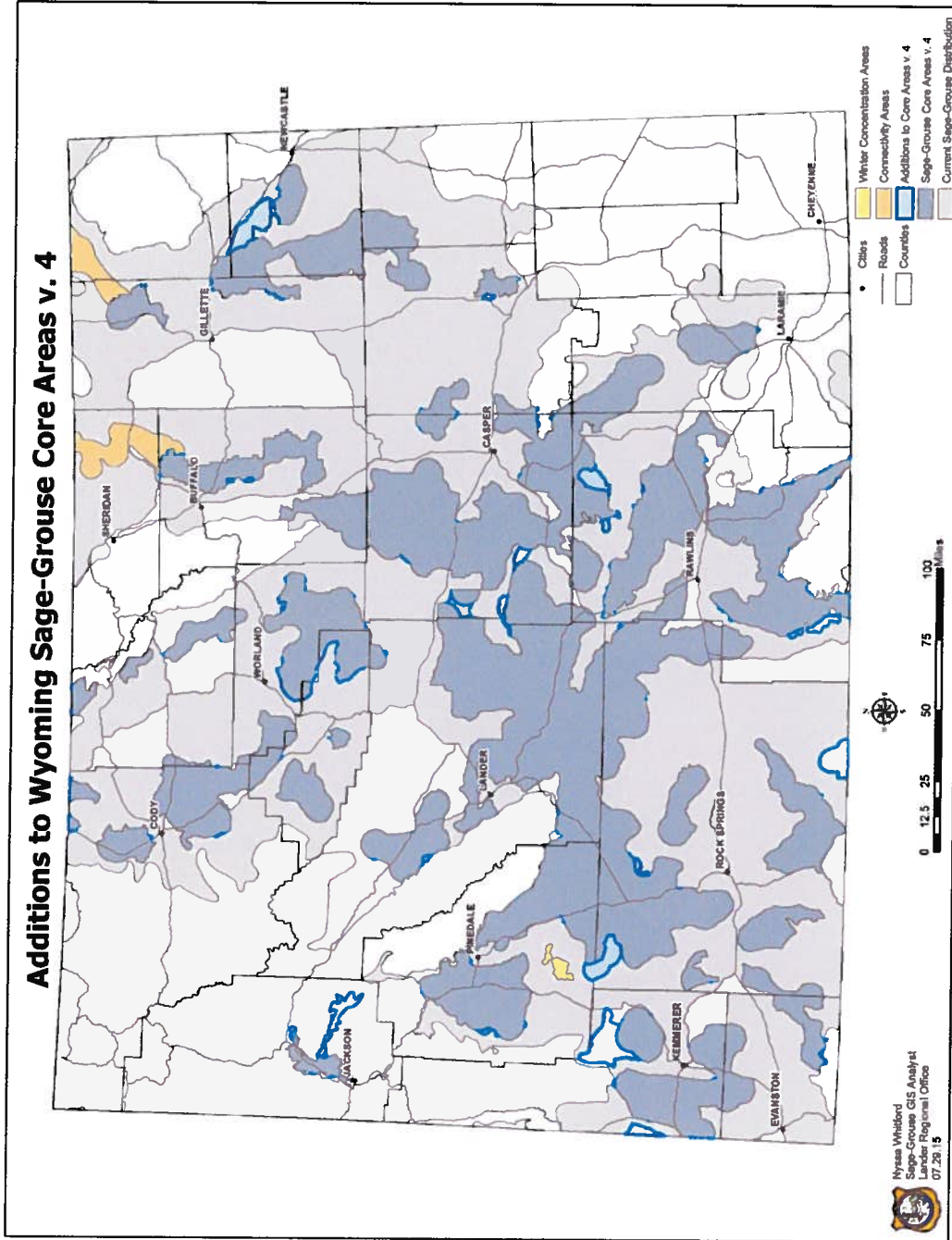


Figure 2.



## **HOW THE WYOMING GREATER SAGE-GROUSE CORE AREA PROTECTION STRATEGY WAS DEVELOPED**

Beginning in 2007, the Sage Grouse Implementation Team was charged with three primary tasks: (1) identification of areas where Greater sage-grouse and their habitats would be most effectively conserved, (2) development of a strategy to reduce or eliminate potential threats to the species, and (3) development of methodology to evaluate, document and track potential impacts over time. The following describes those efforts to date.

### **1. Establishment of Greater Sage-Grouse Core Population Areas**

Greater sage-grouse lek location and attendance data as identified through modeling of bird populations and habitat were overlaid with areas of valid existing rights to produce the Greater sage-grouse Core Population Area map for Wyoming (Figure 3). This iterative process consisted of a series of reviews conducted in the field by Local Working Group (LWG) and others with a thorough understanding of local Greater sage-grouse use to assure that areas included as core habitat were a true representation of actual conditions on the ground. Similar processes were used in 2010 (Figure 4) and 2015 (Figure 5) to refine the Core Population Area mapping, resulting in the current Core Population Areas.

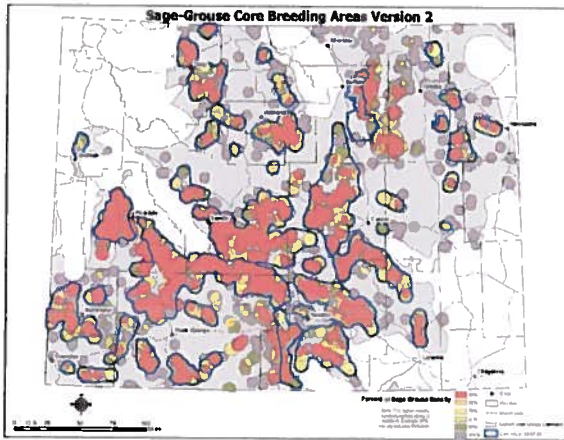


Figure 3. Greater sage-grouse breeding density and Core Population Areas (Version 2) associated with Executive Order 2008-2.

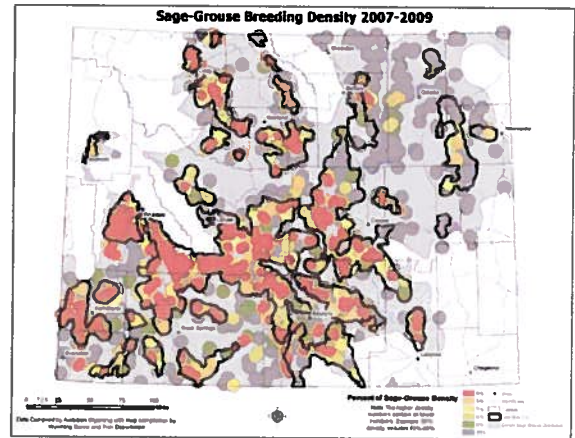


Figure 4. Greater sage-grouse breeding density and Core Population Areas (Version 3) associated with Executive Orders 2010-4 and 2011-5.

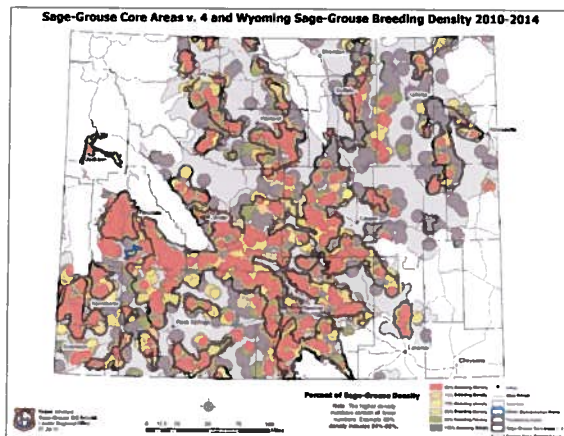


Figure 5. Greater sage-grouse breeding density and Core Population Areas (Version 4) associated with Executive Order 2015-4.

A kernel density function was applied to the lek location and attendance data to develop the final Greater sage-grouse density maps and later adjustments (Doherty et al. 2010, 2011). The red areas on Figures 3 and 4 represent the breeding habitat for 65% of Greater sage-grouse in Wyoming based on lek size and location. The maps illustrate population proportions at a given time, not trends over time. This method was based on breeding birds and did not take into account late brood-rearing and wintering seasonal habitats. During the 2010 revision of Core Population Area boundaries in Wyoming, both late brood-rearing and winter use were considered in the process and most of these seasonal habitats associated with birds in the existing Core Population Area were included in the final product (Figure 4). The eight LWGs assisted in the revision process by using highly-detailed habitat imagery (1 meter NAIP) and reviewing new

lek and development data. These activities were open to the public and other interests throughout the process.

The resultant 2008, 2010 and 2015 (Figures 3, 4, and 5) Core Population Areas encompass approximately 83% of the Greater sage-grouse population, on approximately 24% of the surface area of the State of Wyoming (unpublished data, Wyoming Game and Fish Department, Gamo et al. 2013).

### **Connectivity Areas**

Connectivity corridors are recognized as areas important for maintaining the transmission of genetic material between populations. These corridors have been identified as the most likely dispersal routes used by Greater sage-grouse to travel between potentially isolated populations in Wyoming to populations in neighboring states. Viable corridors reduce the threat of creating isolated populations in Wyoming and adjacent populations in neighboring states. Connectivity corridors are managed to limit anthropogenic development and have been delineated to increase the likelihood of natural immigration/emigration important for maintaining genetic variability in Core Populations Areas.

### **Winter Concentration Areas**

The identification of Core Population Areas is intended to capture all seasonal requirements for Greater sage-grouse; however, there is a recognition that in some cases Core Population Areas may not capture all Greater sage-grouse needs (Aldridge and Boyce 2007, Doherty et al. 2008, Doherty et al. 2011). Specifically, winter concentration areas, defined as places where large numbers of Core Population Area Greater sage-grouse congregate and persistently occupy between December 1 and March 14, should be identified and protected. Identification of winter concentration areas should be based on habitat features and repeated observations of winter use by biologically significant numbers of Greater sage-grouse (e.g., groups of  $\geq 50$  Greater sage-grouse) using a validated Resource Selection Function (RSF) modeling approach.

## **2. Management Goals and Mitigation in the Greater Sage-Grouse Core Area Protection Strategy**

The Wyoming Greater sage-grouse Core Area Protection strategy represents a proactive identification of a set of conservation actions to maintain and enhance a viable and connected set of populations before the opportunity to do so is lost (Doherty et al 2011). The strategy is based on the identification of important habitat areas for Greater sage-grouse and a set of actions that when taken are intended to ensure the long-term survival of Greater sage-grouse populations in Wyoming. The strategy follows an established hierarchy of *avoidance*, understanding that the primary mission is avoiding impacts to and protecting the best remaining habitat for Greater sage-grouse; *minimizing* impacts where they cannot first be avoided; and when Core Population Area thresholds are exceeded, *compensating* for any unavoidable impacts to Greater sage-grouse.

## **Avoidance**

Preferred development plans avoid negative impacts in Core Population Areas and other Executive Order delineated habitats used by Core Population Area Greater sage-grouse. This maximizes protections for both Greater sage-grouse and sagebrush habitat. Avoidance can be both spatial and temporal.

## **Minimization**

When development occurs within Core Population Areas and other Executive Order delineated habitats used by Core Population Area Greater sage-grouse, all reasonable options are pursued to minimize impacting additional suitable habitat and/or maintaining impacts below identifiable thresholds to the greatest extent possible. This may result in new disturbance within Core Population Areas, but the disturbance is managed not to exceed Executive Order thresholds and result in no discernible impacts at the population level. Development plans are managed to limit disturbance to less than 5% and no more than an average of one oil and gas pad or mining site per 640 acres within the Density Disturbance Calculation Tool (DDCT) project area.

## **Compensation**

The complexity of developing compensatory mitigation projects that provide biologically meaningful benefits to Greater sage-grouse populations requires rigorous standards for mitigation to be defined and developed. Performance standards (e.g., net benefit to Greater sage-grouse), monitoring requirements, and adaptive management plans should explicitly link landscape conservation actions to Core Population Areas and other Executive Order delineated habitats used by Core Population Area Greater sage-grouse and statewide landscape conservation objectives for Greater sage-grouse. See also Attachment H.

### **3. Use of the DDCT in Managing the Greater Sage-Grouse Core Area Protection Strategy**

A 4-mile radius around active leks captures 74-80% of nesting females associated within their lek of breeding. The 4-mile distance has been confirmed by multiple studies as having particular importance to Greater sage-grouse in the West, including the majority of seasonal habitats associated with an individual lek, and falls within a reasonable range of buffers (Manier et al. 2014) for Greater sage-grouse. This radius accounts for all types of disturbance within the background of measurable impacts to Greater sage-grouse in field studies. By using the 4-mile radius, the DDCT achieves both a realistic consideration of impacts in a relevant assessment area, while avoiding dilution of existing disturbance being considered in conjunction with any one proposed development.

## **Core Population Area Monitoring and Management:**

A system of interagency coordination has been developed to monitor and track development and conservation activities across Core Population Areas to determine whether development actually meets the thresholds of this Executive Order (see Attachment B).

### ***Literature Cited:***

- Aldridge, C. L. and M. S. Boyce. 2007. Linking occurrence and fitness to persistence: habitat-based approach for endangered greater sage-grouse. *Ecological Applications* 117:508–526.
- Doherty, K. E., D. E. Naugle, B. L. Walker, and J. M. Graham. 2008. Greater sage-grouse winter habitat selection and energy development. *Journal of Wildlife Management* 72:187–195.
- Doherty K.E., J.D. Tack, J.S. Evans, and D.E. Naugle. 2010. Breeding densities of Greater sage-grouse: A tool for range-wide conservation planning. BLM Completion Report: Interagency Agreement # L10PG00911. Bureau of Land Management. Washington, D.C.
- Doherty, K. E., D. E. Naugle, H. E. Copeland, A. Pocewicz, and J. M. Kiesecker. 2011. Energy development and conservation tradeoffs; systematic planning for Greater sage-grouse in their eastern range. Pp. 505-516 *in* S. T. Knick and J. W. Connelly (editors). Greater sage-grouse: ecology and conservation of a landscape species and its habitats. *Studies in Avian Biology* (vol. 38). University of California Press, Berkeley, CA.
- Gamo, R. S., J. D. Carlisle, J. L. Beck, J. C. Bernard, and M. E. Herget. 2013. Can the greater sage-grouse serve as an umbrella species for other sagebrush-dependent wildlife? *The Wildlife Professional*.
- Manier, D.J., Bowen, Z.H., Brooks, M.L., Casazza, M.L., Coates, P.S., Deibert, P.A., Hanser, S.E., and Johnson, D.H., 2014, Conservation buffer distance estimates for Greater Sage-Grouse—A review: U.S. Geological Survey Open-File Report 2014–1239, 14 p., <http://dx.doi.org/10.3133/ofr20141239>.
- USFWS. 2014. Greater Sage-Grouse Range-Wide Mitigation Framework v. 1.0

**EXECUTIVE ORDER 2015-4  
ATTACHMENT B**

**Permitting Process and Stipulations for Development in  
Greater Sage-Grouse Core Population Areas**

**PERMITTING PROCESS**

**Point of Contact**

The density of disruptive activities (1/640) and surface disturbance (5%) will be analyzed via the Density/Disturbance Calculation Tool (DDCT), and will be conducted by the Federal Land Management Agency or project proponent (as determined by the BLM Field Office Manager) on federal surface/mineral and the project proponent on non-federal (private, state). The DDCT analysis is then evaluated against Executive Order 2015-4 thresholds.

When State agency permit is needed, without a need for a federal permit:

The first point of contact for addressing Greater sage-grouse Core Population Area issues for any state permit application should be the Wyoming Game and Fish Department (WGFD). Project proponents should contact WGFD at least 45-60 days prior to submitting their application. More complex projects will require more time. It is understood that WGFD has a role of consultation, recommendation, and facilitation, and has no authority to either approve or deny the project. The purpose of the initial consultation with the WGFD is to become familiar with the project proposal and ensure the project proponent understands the DDCT and recommended stipulations. Project proponents need to have a thorough description of their project and identify the potential effects on Greater sage-grouse prior to submitting an application to the permitting agency.

When Federal agency permit is needed, with or without a State permit:

When a project requires federal action prior to approval, the proponent should contact the federal agency responsible for reviewing the action. The federal agency and the proponent will determine the best process for completing the DDCT and receiving recommendations from WGFD. Project proponents need to have a thorough description of their project and identify the potential effects on Greater sage-grouse prior to submitting an application to the permitting agency (see Attachment D).

**Maximum Density and Disturbance Process**

Density and Disturbance Calculation: The DDCT, ([ddct.wygisc.org](http://ddct.wygisc.org)), is a spatially based tool that calculates both the average density of disruptive activities and total surface disturbance within the area affected by the project, or DDCT assessment area. The DDCT assessment area is created based on an initial radius around projects proposed in Greater sage-grouse Core Population Areas (Doherty et al. 2011), and subsequent radius around any occupied, Core

Population Area leks within the initial radius (see Figures 1 – 2). A 4-mile radius is used to identify 75% of the Greater sage-grouse use around a lek (Walker et al. 2007, Fedy et al. 2012). Any portion of the analysis area not found in core is removed (see Figure 3). All activities will be evaluated within the context of maximum allowable disturbance (disturbance percentages, location and number of disturbances) of suitable Greater sage-grouse habitat (see Attachment F for definition of suitable Greater sage-grouse habitat and disturbance of suitable Greater sage-grouse habitat) within the DDCT assessment area (see Figure 4). This tool allows for better siting of projects rather than averaging the density/disturbance calculation per section.

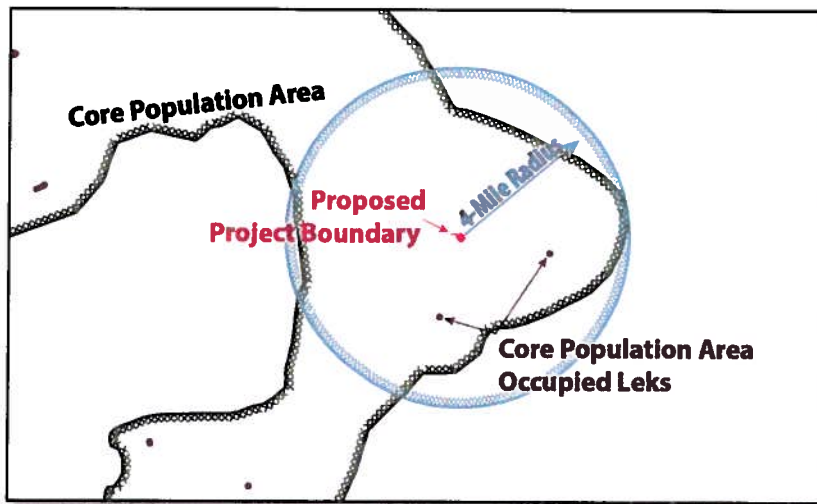


Figure 1 – DDCT assessment area step 1, proposed project boundary.

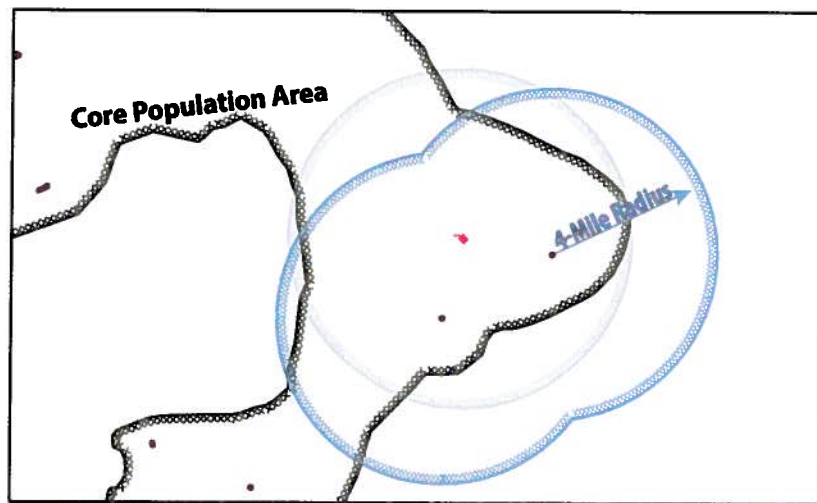


Figure 2 - DDCT assessment area step 2, lek boundaries.

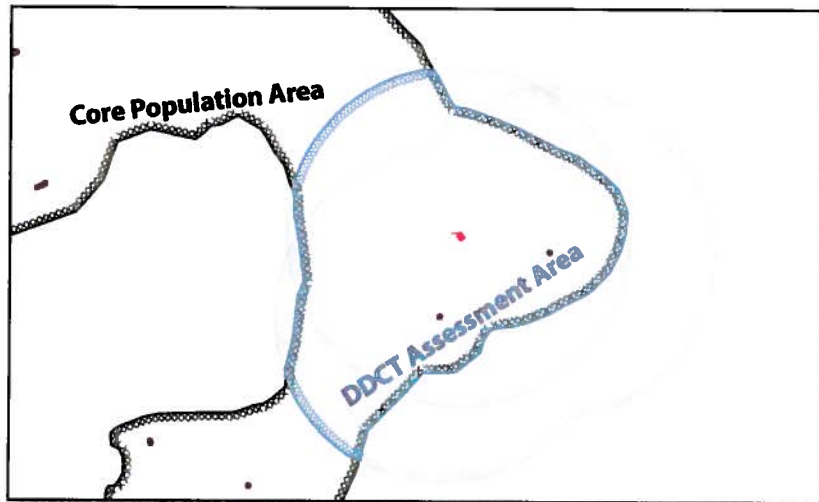


Figure 3 - DDCT assessment area step 3, remove non-core population areas.

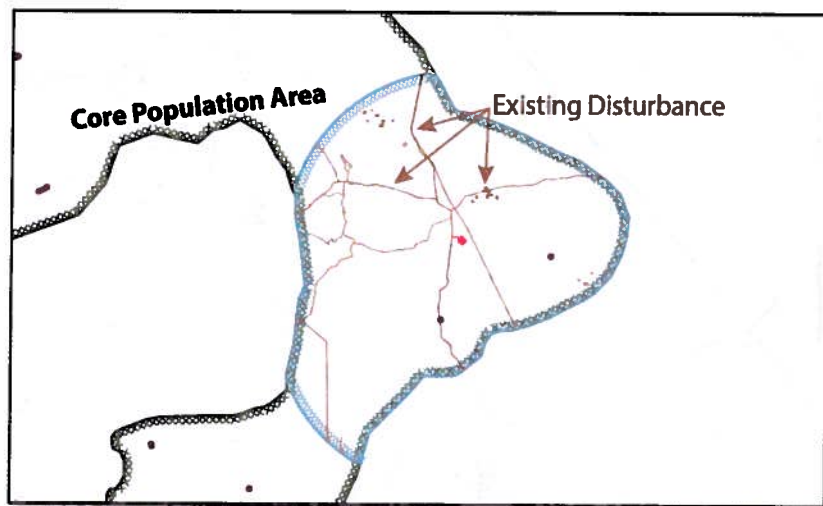


Figure 4 - Existing and proposed disturbance in the DDCT assessment area.

All lands within Core Population Area boundaries are considered suitable habitat unless documented. Mapped unsuitable habitat is treated as neither suitable habitat, nor disturbance, which results in the area being removed from the DDCT assessment area altogether.

Density and disturbance analysis: The total number of discrete disruptive activity features, as well as the total disturbance acres within the DDCT assessment area will be determined through an evaluation of:

- Existing disturbance (Greater sage-grouse habitat that is disturbed due to existing anthropogenic activity and wildfire).
- Approved permits (that have approval for on the ground activity) not yet implemented.

- Validation of the digitized disturbance through on the ground evaluation.

## **Avoiding and Minimizing Impacts**

See Attachment A.

The following is the suggested administrative process for avoiding and minimizing impacts, as necessary.

For valid existing rights: If the proposed project DDCT is at or above Executive Order thresholds, the project proponent, WGFD and the permitting agency must determine whether or not there are ways to avoid or minimize impacts to Greater sage-grouse before issuing a permit to proceed.

The proponent will work with the permitting agency to site the project within the permit/lease area in a way that will likely have the least amount of impact on local Greater sage-grouse populations (i.e., existing anthropogenic disturbance, geographically remote from Greater sage-grouse habitat, unsuitable habitats). The surface disturbance and disruptive activity resulting from the proposed project will still count towards the 5% disturbance and 1/640 density thresholds (unless the proponent can show that there is a 0.6 mile buffer of unsuitable habitat between the proposed disturbance and suitable habitat). It is understood that project locations are often resource specific and that certain projects may not be able to be relocated to another location.

The proponent and the permitting agency will evaluate the DDCT area and the affected Greater sage-grouse Core Population Area for areas where additional reclamation/restoration actions or management of invasive species (especially within the proponents permit/lease area(s)) could reduce the amount of overall disturbance.

The proponent and the permitting agency should consider other opportunities to improve Greater sage-grouse habitat (i.e., conservation easements, additional reclamation of disturbed habitats in suitable habitats that are no longer necessary).

Should the proponent and the state permitting agency not come to agreement; the Sage Grouse Implementation Team (SGIT) will review the information. The BLM and U.S. Forest Service both have their own appeal process to handle disagreements but may coordinate through the SGIT.

## **Permitting**

The complete analysis package (DDCT results, map book, and worksheet), and recommendations developed by consultation and review outlined herein will be forwarded to the appropriate permitting agency(s). WGFD recommendations will be included, as will other

recommendations from project proponents and other appropriate agencies. Project proponent shall have access to all information used in developing recommendations. Where possible and when requested by the project proponent, State agencies shall provide the project proponent with potential development alternatives other than those contained in the project proposal.

If the permit for which a proponent has applied expires, another DDCT analysis is required before issuing a new permit. An additional DDCT is not required for Permit extensions or renewals when no changes are being authorized.

The Executive Order in effect at the time of a complete formal application will remain in effect through the final permit.

Projects that have formally applied for a permit (e.g., CPCN, CUP, NOA, NOI, Initiation of scoping, other permits, or other official public action declaring the project, etc.) should comply with the Executive Order in effect when the project application was made. It is recognized that project planning and permitting can take years to move to a final permit.

### **EXEMPT ACTIVITIES**

A list of exempt (“de minimus”) activities, including standard uses of the landscape is available in Attachment C.

### **GENERAL STIPULATIONS**

These stipulations are designed and intended to maintain existing suitable Greater sage-grouse habitat by permitting development activities in Core Population Areas in a way that will avoid negative impacts to Greater sage-grouse.

General stipulations are recommended to apply to all activities in Core Population Areas, with the exception of exempt (“de minimus”) actions defined herein (see Attachment C) or specifically identified activities. The specific industry stipulations are considered in addition to the general stipulations.

#### **Surface Disturbance**

Core Population Area: Surface disturbance will be limited to 5% of suitable Greater sage-grouse habitat per an average of 640 acres over the entire DDCT assessment area. The DDCT process will be used to determine the level of disturbance. Distribution of disturbance may be considered and approved on a case-by-case basis. Unsuitable habitat should be identified in a seasonal and landscape context, on a case-by-case basis, outside the 0.6 mile buffer around occupied leks. This will incentivize proponents to locate projects in unsuitable habitat to avoid creating additional disturbance acres. The primary focus should be on protection of suitable habitats and minimizing habitat fragmentation. See Attachment F for a description of suitable, unsuitable habitat and disturbance.

Non-Core Population Area: There are no limitations to disturbance outside the 0.25 mile no surface occupancy buffer.

## **Surface Occupancy**

Core Population Area: Within 0.6 miles of the perimeter of occupied Greater sage-grouse leks there will be no surface occupancy (NSO). NSO, as used in these recommendations, means no permanent surface facilities including roads shall be placed within the NSO area. Other activities may be authorized with the application of appropriate seasonal stipulations, provided the resources protected by the NSO are not adversely affected. For example, underground utilities may be permissible if installation is completed outside applicable seasonal stipulation periods and significant resource damage does not occur. Seasonal protections are to be determined on principal usage of site by Greater sage-grouse. The primary purpose of the 0.6 restriction around leks is to avoid disturbing leking birds and to maintain habitat integrity (Holloran 2005, Hess and Beck 2012). This necessitates the limitation of traffic or infrastructure that would encourage human activity around occupied leks.

Non-Core Population Area: Within 0.25 miles of the perimeter of occupied Greater sage-grouse leks there will be NSO (Braun et al. 2002). NSO, as used in these recommendations, means no permanent surface facilities including roads shall be placed within the NSO area. Other activities may be authorized with the application of appropriate seasonal stipulations, provided the resources protected by the NSO are not adversely affected. For example, underground utilities may be permissible if installation is completed outside applicable seasonal stipulation periods and significant resource damage does not occur.

## **Seasonal Use**

Core Population Areas (Holloran 2005): Activities will be allowed from July 1 to March 14 outside of the 0.6 mile perimeter of an occupied lek in Core Population Areas where breeding, nesting and early brood-rearing habitat is present.

Non-Core Population Areas (Braun et al. 2002, Dzialak 2011): Activity will be allowed from July 1 to March 14 outside of the 0.25 mile perimeter of an occupied lek. A 2-mile seasonal buffer from March 15 to June 30, applies to occupied leks where breeding, nesting and early brood-rearing habitat is present. Activities in unsuitable habitat may also be approved year-round on a case-by-case basis. Activities may be allowed during seasonal closure periods as determined on a case-by-case basis.

Special Considerations: Where credible data support different timeframes for these seasonal restrictions, dates may be shifted 14 days prior to or subsequent to the above dates, but not both.

Winter Concentration Areas: In areas identified as winter concentration areas, activities will be allowed March 14 to December 1. Activities in unsuitable habitat may also be approved year-

round on a case-by-case basis (except in specific areas where credible data shows calendar deviation). Activities may be allowed during seasonal closure periods as determined on a case-by-case basis.

Production and Maintenance Activities: Production and maintenance activities are exempt from seasonal use stipulations.

### **Geophysical Exploration**

Geophysical exploration which includes minimal disturbance (3 inch diameter drill holes or just “vibrating”) may be permissible in accordance with seasonal stipulations. Staging areas should be located outside of Core Population Areas, covered through a DDCT process, or placed on existing disturbance.

### **Transportation**

Locate new collector or arterial roads that will have relatively high levels of activity (accessing multiple wells, housing development) greater than 1.9 miles from the perimeter of occupied Greater sage-grouse leks (Lyons and Anderson 2003). Locate new local roads used to provide facility site access and maintenance greater than 0.6 miles from the perimeter of occupied Greater sage-grouse leks. Construct roads to minimum design standards needed for production activities.

Collector or Arterial Roads are single-lane or double-lane roads, with travel ways 12 to 24 feet in width. They collect traffic from local roads and connect to arterial roads or public highways. They are operated for intermittent or constant service.

Local Roads are single-lane roads with travel ways 12 to 14 feet in width. They connect terminal facilities, such as well sites, to collector, local, arterial, or other higher-class roads. They are operated for low-volume traffic.

### **Overhead Power Lines (Avian Power Line Interaction Committee (APLIC) 2015)**

It will be necessary to construct significant new transmission infrastructure to transport electricity generated in Wyoming to out-of-state load centers. Currently, it is unknown what type of lines impact Greater sage-grouse populations, how, and to what extent (Messmer, et al. 2014). There will be new distribution and transmission lines that will need to be built to service existing approved projects.

For purposes of consistency with this Executive Order there is established a transmission line corridor through Core Population Areas in south central and southwestern Wyoming as illustrated on Attachment I. This 2-mile wide corridor represents the State of Wyoming’s preferred alternative for routing electric transmission lines across the southern portion of the state while reducing impacts to Core Population Areas and other natural resources.

New transmission lines constructed within corridors identified in this Executive Order (see Attachment I) or within ½-mile either side of existing or permitted (prior to August 1, 2008) 115 kV or larger transmission lines, creating a corridor no wider than 1-mile shall be considered consistent with this Executive Order if construction occurs within the corridor between July 1 and March 14 (or between July 1 and December 1 in Executive Order identified and mapped winter concentration areas). New transmission lines constructed within ½-mile either side of 115kV or larger transmission lines in existence or permitted prior to the date of this Executive Order and within Core Population Areas added as a result of this Executive Order, creating a corridor no wider than 1-mile, shall be considered to be consistent with this Executive Order if construction occurs within the corridor between July 1 and March 14 (or between July 1 and December 1 in Executive Order identified and mapped winter concentration areas).

New transmission lines outside the above described corridors but within Core Population Areas should be authorized or conducted only when it can be demonstrated that the activity will avoid negative impacts to Greater sage-grouse. If it is absolutely necessary to site new distribution and transmission lines through a Core Population Area outside of an existing corridor, lines should be sited to minimize negative impact on Greater sage-grouse or their habitats, and preferentially consider siting along or adjacent to existing long-term linear disturbance features whenever possible (i.e., along existing occupied above ground utilities or roads).

Proponents are encouraged to apply appropriate Best Management Practices (BMPs) specific to electric utility facilities (see APLIC 2015); otherwise, locate overhead lines at least 0.6 miles from the perimeter of occupied Greater sage-grouse leks.

Lines permitted but not located in an Executive Order transmission corridor will be counted towards the 5% disturbance calculation (line disturbance is equal to ROW width X length and includes all access roads, staging areas, and other permanent surface disturbance associated with construction outside of the ROW).

## **Noise**

New project noise levels, either individual or cumulative, should not exceed 10 decibels (as measured by  $L_{50}$ ) above baseline noise at the perimeter of a lek from 6:00 pm to 8:00 am during the breeding season (March 1 to May 15). Specific noise protocols for measurement and stipulations for implementation will be developed as additional research and information emerges.

## **Vegetation Removal**

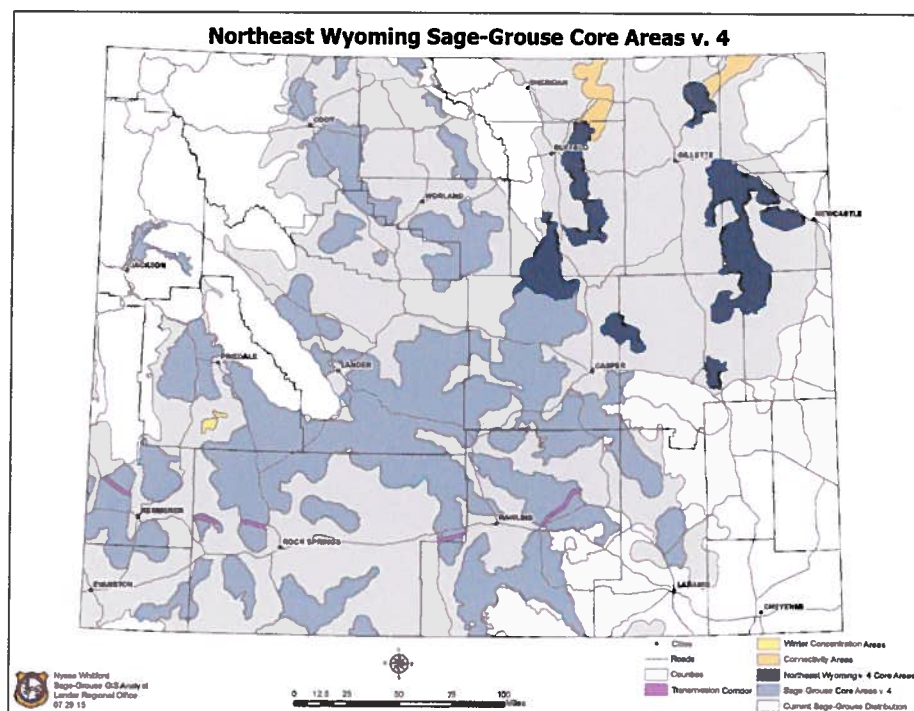
Vegetation removal should be limited to the minimum disturbance required by the project. All topsoil stripping and vegetation removal in suitable habitat is limited to between July 1 and March 14 in areas that are within 4-miles of an occupied lek. Production and maintenance activities (surface mining) outside seasonal stipulations are considered permissible once the vegetation is removed outside the seasonal stipulations. Initial disturbance in unsuitable habitat

between March 15 and June 30 may be approved on a case-by-case basis. It is important that the “viability” of the topsoil is maintained. A set of BMPs for protecting top soil are outlined in Attachment G.

## Sagebrush Treatment

Sagebrush eradication is considered disturbance and will contribute to the 5% disturbance factor. Northeast Wyoming, as depicted in Figure 5, is of particular concern because sagebrush habitats rarely exceed 15% canopy cover and large acreages have already been converted from sagebrush to grassland or cropland. Absent solid demonstration that the proposed treatment will not reduce canopy cover to less than 15% within the treated area, habitat treatments in Northeast Wyoming (Figure 5) should not be conducted. In stands with less than 15% cover, treatment should be designed to maintain or improve sagebrush habitat. Sagebrush treatments that maintain sagebrush canopy cover at or above 15% total canopy cover within the treated acres will not be considered disturbance. The WGFD has developed a Vegetation Treatment Protocol (July 8, 2011 or updated version) for treating sagebrush to be consistent with this Executive Order. Treatments in Core Population Areas shall follow the Protocol or the treatment acreage may be considered disturbance.

Figure 5



## **Reclamation**

Reclamation should re-establish native grasses, forbs and shrubs during interim and final reclamation to achieve cover, species composition, and life form diversity commensurate with the surrounding plant community or desired ecological condition to benefit Greater sage-grouse and replace or enhance Greater sage-grouse habitat to the degree that environmental conditions allow. Seed mixes should include two native forbs and two native grasses with at least one bunchgrass species. See Attachment E. Where sagebrush establishment is prescribed, establishment is defined as meeting the standard prescribed in the individual reclamation plan. Landowners should be consulted on desired plant mix on private lands. The operator is required to control noxious and invasive weed species, including cheatgrass. Rollover credit, if needed, will be outlined in the individual project reclamation plan.

Credit may be given for completion of habitat enhancements on bond release or other minimally functional habitat when detailed in a plan. These habitat enhancements may be used as credit for reclamation that is slow to establish in order to maintain the disturbance cap or to improve nearby Greater sage-grouse habitat.

Conditions for determining when disturbed lands are now considered suitable can be found in Attachment F.

## **Monitoring/Adaptive Response**

Proponents of new projects are expected to coordinate with the permitting agency and local WGFD biologist to determine which leks need to be monitored and what data should be reported by the proponent. Certain permits may be exempted from monitoring activities pending permitting agency coordination. If declines in affected leks (using a three-year running average during any five year period relative to trends on reference leks) are determined to be caused by the project, the operator will propose adaptive management responses to increase the number of birds. If the operator cannot demonstrate a restoration of bird numbers to baseline levels (established by pre disturbance surveys, reference surveys and taking into account regional and statewide trends) within three years, operations will cease until such numbers are achieved.

## **PREEXISTING OIL AND GAS UNITS**

In administering oil and gas plans of development in Core Population Areas, logical and systematic planning will occur in accordance with the terms of oil and gas unit agreements established prior to August 1, 2008 and the goals of this Executive Order. In administering oil and gas plans of development in Core Population Areas added as a result of this Executive Order, logical and systematic planning will occur in accordance with the terms of oil and gas unit agreements in existence prior to the date of this Executive Order and the goals of this Executive Order. This will be accomplished by concentrating activity within existing unit boundaries even if disturbance and density exceed Executive Order thresholds within the DDCT assessment area.

Each situation should be addressed with flexibility and an understanding of the local landscape, habitats, and other factors.

Federal oil and gas units in effect prior to August 1, 2008 are not subject to new Greater sage-grouse mitigation measures contained in Attachment B of this Executive Order with the exception that unit operators cannot initiate activities resulting in new surface occupancy within 0.6 miles of the perimeter of an occupied Greater sage-grouse lek. Federal oil and gas units in effect prior to the date of this Executive Order within Core Population Areas added as a result of this Executive Order are not subject to new Greater sage-grouse mitigation measures contained in Attachment B of this Executive Order with the exception that unit operators cannot initiate activities resulting in new surface occupancy within 0.6 miles of the perimeter of an occupied Greater sage-grouse lek.

For oil and gas development approved under the annual plan of development and associated surface disturbance proposals by the unit operator, the unit operator is required to complete the DDCT process including the appropriate worksheet when submitting those applications. It is understood that the level of existing and future development in pre-August 1, 2008 Federal oil and gas units may exceed Executive Order thresholds. It is understood that the level of existing and future development in Core Population Areas added as a result of this Executive Order for Federal oil and gas units may exceed Executive Order thresholds.

The DDCT results and worksheet completed for the pre-August 1, 2008 oil and gas unit activity will be used solely to track disturbance data inside the unit boundary to obtain baseline data for use in Executive Order monitoring and to calculate existing and future planned disturbance. For activity in federal oil and gas units in effect prior to the date of this Executive Order within Core Population Areas added as a result of this Executive Order, the DDCT results and worksheet completed will be used solely to track disturbance data inside the unit boundary to obtain baseline data for use in Executive Order monitoring and to calculate existing and future planned disturbance. Proponents and agencies are still expected to minimize surface disturbance whenever possible and follow all other existing, applicable lease stipulations. As projects are completed, as-built footprints will be collected and the disturbance layer updated with the as-built information.

For project proposals located outside unit boundaries, wherein a DDCT assessment area for the project proposal encompasses parts of pre-August 1, 2008 oil and gas units, disturbance will be based upon the existing disturbance, annual plans of development, or other relevant information regarding development provided by the unit operator, the BLM Reservoir Management Group or other credible sources of information such as the Wyoming Oil and Gas Conservation Commission. For project proposals located outside unit boundaries established prior to the date of this Executive Order, wherein a DDCT assessment area for the project proposal encompasses parts of oil and gas units in Core Population Areas added as a result of this Executive Order, disturbance will be based upon the existing disturbance, annual plans of development, or other relevant information regarding development provided by the unit operator, the BLM Reservoir Management Group or other credible sources of information such as the Wyoming Oil and Gas

Conservation Commission. In the absence of an annual plan of development or other relevant information, the unit affected will be considered fully developed for the purpose of calculating existing disturbance per the DDCT process.

For new development inside the boundary of a Federal oil and gas unit in effect prior to August 1, 2008 that is not directly related to oil and gas development (e.g., vegetation treatment or gravel pits), the project proponent will be required to comply with all aspects of this Executive Order. For new development inside the boundary of a Federal oil and gas unit in effect prior to the date of this Executive Order within Core Population Areas added as a result of this Executive Order that is not directly related to oil and gas development (e.g., vegetation treatment or gravel pits), the project proponent will be required to comply with all aspects of this Executive Order.

**SPECIFIC STIPULATIONS**  
**(to be applied in addition to general stipulations)**

**Oil and Gas**

Oil and gas well pads and associated infrastructure densities are not to exceed an average of one pad per square mile (1/640) and suitable habitat disturbed not to exceed 5% of suitable habitat within the DDCT assessment area. As an example, the number of well pads within a two mile radius of the perimeter of an occupied Greater sage-grouse lek should not exceed 11, distributed preferably in a clumped pattern in one general direction from the occupied lek.

**Mining**

For development drilling or ore body delineation drilled on tight centers, (approximately 100' X 100') the disturbance area will be delineated by the external limits of the development area. Assuming a widely-spaced disturbance pattern, the actual footprint will be considered the disturbance area.

Monitoring results will be reported annually in the mine permit annual report and to WGFD. Pre-disturbance surveys will be conducted as required by the appropriate regulatory agency.

The number of active mining development areas (e.g., operating equipment and significant human activity) is not to exceed an average of one site per square mile (1/640) within the DDCT.

Surface disturbance and surface occupancy stipulations will be waived within the Core Population Area when implementing underground mining practices that are necessary to protect the human health, welfare, and safety of miners, mine employees, contractors and the general public. The mining practices include but are not limited to bore holes or shafts necessary to: 1) provide adequate oxygen to an underground mine; 2) supply inert gases or other substances to prevent, treat, or suppress combustion or mine fires; 3) inject mine roof stabilizing substances; and 4) remove methane from mining areas. Any surface disturbance or surface occupancy

necessary to access the sites to implement these mining practices will also be exempt from any stipulation.

Coal mining operations will be allowed to continue under the regulatory and permit-specific terms and conditions authorized under the Wyoming Environmental Quality Act (WEQA) and the Surface Mining Control and Reclamation Act of 1977 (SMCRA) as administered by the Wyoming Department of Environmental Quality (WDEQ).

- i. There is the expectation that coal activities as permitted under the WEQA and SMCRA will be implemented to protect Greater sage-grouse and their habitat in Core Population Areas to a high level.
- ii. In Core Population Areas, to avoid significant “negative” impacts to Greater sage-grouse, unsuitability criteria for state high sensitive species (i.e., Greater sage-grouse), will be applied to each coal lease application during the federal coal leasing process. This process includes consultation with the State to identify any lands within the application area that are essential for maintaining high priority wildlife (i.e., Greater sage-grouse). Where appropriate, BLM will find such lands to be unsuitable for further federal coal leasing consideration. Incorporation of new leases into existing mining operations is considered allowable by the State without further regulatory obligations under the Greater sage-grouse Core Area Protection strategy, beyond the current requirements under the WEQA and SMCRA.
- iii. In Core Population Areas, it is understood that there will be exceptions for minimal impacts due to existing mines as they expand their existing operations through modified mine plans and new leases.
- iv. The USFWS has agreed that SMCRA is an adequate regulatory mechanism to protect Greater sage-grouse (USFWS letter dated November 10, 2010). Permitting under the WEQA is required to be equally or more stringent than SMCRA (Section 503 SMCRA 1977).

### **Connectivity Corridors**

See Attachment A.

The suspension of federal and state leases in connectivity corridors (see Attachment A) is encouraged where there is mutual agreement by the leasing agency and the operator. These suspensions should be allowed until additional information clarifies their need. Where suspensions cannot be accommodated, disturbance should be limited to no more than an average of 5% per 640 acres (DDCT Process) of suitable Greater sage-grouse habitat within connectivity corridors.

For protection of connectivity corridors (see Attachment A), a NSO buffer of 0.6 miles around occupied leks or their documented perimeters is required. In addition, a March 15 to June 30 timing limitation stipulation is required within nesting habitat within 4 miles of occupied leks.

### **Underground Rights of Way**

The State of Wyoming and federal management agencies have worked to develop utility corridors in current Resource Management Plans (RMPs). One of the primary purposes of these utility corridors is to encourage placement of future linear development (i.e., pipelines, water lines, fiber optics, etc.) adjacent to existing infrastructure to reduce habitat fragmentation. It is the intent of this Executive Order to continue to incentivize co-location of new pipelines in RMP designated utility corridors. New pipelines proposed in RMP established utility corridors will be required to complete DDCT calculations prior to construction. To allow for accurate future DDCT calculations for projects adjacent to but outside the utility corridors, applicants will submit to the SGIT as-built construction diagrams within 60 days of construction completion that delineate all areas of temporary and permanent disturbance in Core Population Areas including the construction and permanent rights-of-way, roads, storage yards, laydown areas and extra temporary work spaces. The pipeline proponents are not expected to meet Executive Order thresholds within the utility corridor, but the project construction would be subject to appropriate seasonal timing stipulations. The locations of permanent above-ground facilities (such as block valves, compressors, etc.) will be subject to Executive Order thresholds if located outside the designated corridor. Pipelines outside RMP designated utility corridors, but in Core Population Areas, are required to comply with the 5% disturbance per the DDCT analysis.

### **Wind Energy Development**

Wind development is not recommended in Greater sage-grouse Core Population Areas, but will be reevaluated on a continuous basis as new science, information and data emerges.

## **PROCESS DEVIATION OR UNDEFINED ACTIVITIES**

Development proposals incorporating less restrictive stipulations or development that are not covered by these stipulations may be considered depending on site-specific circumstances. The proponent must have data demonstrating that the alternative development proposal will avoid negative impacts to Greater sage-grouse in Core Population Areas. Proposals to deviate from standard stipulations will be considered by a team including WGFD and the appropriate land management and permitting agencies, with input from the USFWS. To deviate from standard stipulations project proponents need to demonstrate that the project development would meet at least one of the following conditions:

- No suitable habitat is present in one contiguous block of land that includes at least a 0.6 mile buffer between the project area and suitable habitat;

- No Greater sage-grouse use occurs in one contiguous block of land that includes at least a 0.6 mile buffer between the project area and adjacent occupied habitat, as documented by total absence of Greater sage-grouse droppings and an absence of Greater sage-grouse activity for the previous ten years; or
- Implementation of a development/mitigation plan that has demonstrated through previous research avoids negative impacts to Greater sage-grouse. The demonstration must be based on monitoring data collected and analyzed with accepted scientific based techniques.

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**EXECUTIVE ORDER 2015-4  
ATTACHMENT C**

**Exempt (“de minimis”) Activities**

The following are considered “de minimis” activities:

1. Drilling and outfitting of agricultural or residential water wells (including tank installation, pumps, and agricultural water pipelines) more than 0.6 miles from the perimeter of an occupied lek. Construction within 0.6 miles is allowed from July 1 through March 14, after a habitat evaluation has occurred, and provided development does not occur on the lek. New tanks shall have escape ramps.
2. Electric utilities are obligated by regulation to serve customers with safe and reliable electric service. Likewise, utilities must comply with agency Greater sage-grouse protective stipulations. In order to allow electric utilities the operational ability to provide and maintain service to their customers while affording adequate protection for Greater sage-grouse, distribution lines within 0.6 miles from an occupied lek are considered “de minimus” provided that: (1) construction of lines occurs from July 1 through March 14; (2) such lines are not constructed on the lek itself; and (3) a habitat evaluation has occurred. For general and operational maintenance activities of existing distribution lines, the electric utility shall use appropriate/applicable Best Management Practices for electric utilities (Avian Power Line Interaction Committee 2015). Coordination of ongoing activities with Wyoming Game and Fish Department (WGFD) is encouraged.
3. Preventative or required county road maintenance activities within the right-of-way (blading/smoothing, filling pot holes, graveling, culvert replacement, right-of-way maintenance, cattle guard maintenance, etc.) are considered “de minimis”. Road construction activities (vertical or horizontal realignment, roadway widening, new construction, bridge replacement, etc.) are not considered “de minimis” and may require completion of a Density/Disturbance Calculation Tool (DDCT) analysis (Pendleton 2015).
4. Authorized or required cultural, paleontological, and biological resource and land surveys.
5. Emergency response and public health and safety issues.
6. Existing animal husbandry practices (including branding, docking, herding, trailing, etc.).
7. Existing farming practices and reclamation seeding (excluding conversion of sagebrush habitats to agricultural lands).
8. Construction of agricultural reservoirs, less than 10 surface acres and more than 0.6 miles from the perimeter of an occupied lek. Construction within 0.6 miles is allowed from July 1 through March 14, after a habitat evaluation has occurred, and provided that development does not occur on the lek.

9. Construction of aquatic habitat improvements, less than ten wetland or water surface acres, more than 0.6 miles from the perimeter of an occupied lek. Construction within 0.6 miles is allowed from July 1 through March 14, after a habitat evaluation has occurred, and provided development does not occur on the lek.
10. Irrigation (excluding the conversion of sagebrush habitats to new irrigated lands).
11. Spring development; if the spring is protected with fencing and enough water remains at the site to provide mesic (wet) vegetation. Fences should be constructed to be highly visible to Greater sage-grouse (i.e., buck-and-rail, steeljack, etc.) and/or marked to minimize collision potential.
12. New fencing more than 0.6 miles from the perimeter of an occupied lek. New fences or new stretches of fences, with high potential for collisions should be marked or be designed to minimize risk. Construction within 0.6 miles is permitted so long as construction does not occur from March 15 to June 30 or on the lek itself; coordination with WGFD is strongly suggested.
13. Maintenance of existing fence.
14. Herbicide applications within existing road, pipeline, and power line rights-of-ways, application within reclamation areas for weed control, application adjacent to structures or other applications for spot treatments. Pesticide treatment for Grasshopper/Mormon cricket control following Reduced Agent-Area Treatments protocol. Other required or authorized pesticide treatments for state or county listed species or vector treatments for other diseases such as West Nile Virus. All treatments must be done in accordance with regulations and labels. Coordination with Weed & Pest Districts is strongly encouraged.
15. Grazing operations that utilize recognized management approaches (allotment management plans, Natural Resource Conservation Service grazing plans, prescribed grazing plans, etc.).

It is Wyoming's primary premise that grazing activities are compatible with Greater sage-grouse conservation and may improve habitat for Greater sage-grouse. Grazing management practices maintain or enhance Wyoming rangelands. Properly managed rangelands are capable of sustaining robust Greater sage-grouse populations and a diversity of plant species important to Greater sage-grouse habitat. (USFWS, February 5, 2015, Memo to State Directors and Field Supervisors: Service Position on Livestock Grazing and Working with the Rangeland Owners to Conserve Sage-Grouse)

The State of Wyoming will collaborate with appropriate Federal agencies to: (1) develop appropriate conservation objectives; (2) define a framework for evaluating situations where Greater sage-grouse objectives are not being achieved on Federal land, to determine if a causal relationship exists between improper grazing (by wildlife, wild horses or livestock) and Greater sage-grouse conservation objectives; and (3) identify appropriate site-based action to achieve Greater sage-grouse conservation objectives within the framework.

If grazing adjustments are believed necessary to achieve Greater sage-grouse conservation objectives, coordination among land management agencies and permit/lease holders shall take place. Monitoring data used within the framework will, at a minimum: reflect 5 years of information, include rangeland health assessments, and require conclusion or action to be based on 3 out of 5 consecutive years of data (*i.e.*, Y1-2-3, Y2-3-4, Y3-4-5). These requirements may be waived in case of a catastrophic event such as fire. Further, the State recognizes there is a distinction between conservation objectives and land health standards and that it is possible to achieve land health standards while not achieving Greater sage-grouse conservation objectives and vice-versa. Federal agency participation in the implementation of this Executive Order in no way precludes them from managing federal surface for rangeland health.

**EXECUTIVE ORDER 2015-4  
ATTACHMENT D**

**Federal and State Permitting Agency Coordination**

**Background:**

The Density/Disturbance Calculation Tool (DDCT) process and review of project compliance with Executive Order 2015-4 will be coordinated through the DDCT web application ([ddct.wygisc.org](http://ddct.wygisc.org)).

The proponent should provide the most complete and comprehensive description of a project as possible. Splitting a project into smaller components can cause delay in review and could risk denial of a permit necessary for the entire project. It is recommended that proponents thoughtfully consider and include for review potential future development(s) and/or infrastructure associated with or that may be needed to support the current proposed project.

If the proponent has a concern that a project will not comply with this Executive Order, the proponent should contact the Wyoming Game and Fish Department (WGFD) and the appropriate land management and/or permitting agencies as soon as possible. Noncompliance with this Executive Order is not an automatic permit denial and all projects will be reviewed and potential impacts to local Greater sage-grouse populations and habitat will be assessed. Advanced planning with the permitting agencies and WGFD is the recommended way to resolve issues.

If the proponent submits a DDCT that is not in compliance, the agencies involved will need to discuss all options and potential impacts to local Greater sage-grouse populations and habitat. Initiating these discussions in advance of the final DDCT submittal may yield timelier review/decision results.

1. If federal surface/mineral is involved, the proponent works with the appropriate federal land management agency on the DDCT process and disturbance delineations, then:
  - The federal agency submits the DDCT (and worksheet) for technical review to the DDCT Data Steward at the Wyoming Geographic Information Science Center. The Data Steward will work with the federal agency in completing the technical review process (Note: the federal agency may use a contractor to make the corrections). When completed, the federal agency also submits the DDCT worksheet to the Data Steward.
  - Once technical review is completed, the Data Steward submits the DDCT final results and DDCT worksheet to WGFD Habitat Protection Program (HPP) for policy review.
  - WGFD HPP coordinates with state agencies and the federal agency if there are issues with Executive Order exceedances or compliance.
  - WGFD HPP sends a letter regarding Executive Order compliance and recommendations to the federal agency and copies the proponent and permitting agencies that may also be involved in the project.

- If agencies have questions about the recommendations, they should contact WGFD HPP.
2. If federal surface or mineral is not involved, the project proponent (NOTE: could be a consultant) completes the DDCT process, then:
- Submits the DDCT to the Data Steward for technical review. The Data Steward will work with the proponent to complete the technical review process. When completed, the proponent submits the DDCT worksheet to the Data Steward.
  - The Data Steward submits the DDCT final results and DDCT worksheet to WGFD HPP for policy review.
  - WGFD HPP coordinates with state agencies if there are issues with Executive Order exceedances or compliance.
  - WGFD HPP sends a letter regarding Executive Order compliance and recommendations to the proponent and copies permitting agencies.
  - If agencies have questions about the recommendations, they should contact WGFD HPP.

#### **Letters from WGFD:**

Letters from WGFD will determine whether or not the project complies with the process and stipulations outlined in this Executive Order and may provide recommendations on whether the permit should be issued and/or recommendations on how impacts to the Greater sage-grouse may be minimized. State agencies will be the point of contact for conducting a DDCT analysis for locatable minerals. These recommendations may or may not be accepted by the permitting agency and incorporated in the conditions of the permit. If there are changes to the project, the proponent should complete the DDCT review process again.

The permitting agency should document whether or not the recommendations were accepted and incorporated as part of permit. If the permitting agency is unable to implement a recommendation, the agency should document the circumstances which preclude incorporation into the permit. For example, it is not within the agency's regulatory authority or it is not physically or legally possible to make the recommended changes.

**EXECUTIVE ORDER 2015-4  
ATTACHMENT E**

**Vegetation Monitoring for Suitability Criteria of Reclaimed Areas**

**Goal:** Measurements that should be taken when there is uncertainty concerning the status of reclaimed areas contributing to suitable habitat.

If sagebrush canopy cover is 5%, or greater, as measured by the method described in the Bureau of Land Management's Sage-Grouse Habitat Assessment Framework, it is considered suitable habitat.

When sagebrush canopy cover is less than 5%, but within 60 meters of greater than 5% sagebrush canopy cover, measure to determine compliance with the following conditions:

**Measure for 2 (or more) desirable native grasses at least one of which is a bunchgrass in appropriate sites.** The species present in the reclaimed area should be reflected in an appropriate reference site, described in the ecological site description (ESD) for the reclaimed site(s), or be representative of pre-disturbance species data. A reference site will be agreed upon and determined by the land management agency or owner, Wyoming Game and Fish Department and the proponent. It is recognized that reference sites could be numerous for linear features.

- The **frequency** of occurrence of grass is expected to meet or exceed 70% of the frequency of grass as measured on the reference site, as described in the ESD for the reclaimed sites(s), or as represented in the pre-disturbance species data. Grass **canopy cover** measurement is expected to meet or exceed 70% of the grass canopy cover as measured on the reference site, as described in the ESD for the reclaimed sites(s), or as represented in the pre-disturbance species data.

**Likewise, measure for 2 desirable native forbs.**

- The **frequency** of occurrence of forbs is expected to meet or exceed 70% of the frequency of forbs as measured on the reference site, as described in the ESD for the reclaimed sites(s), or as represented in the pre-disturbance species data.
- Forbs **canopy cover** is expected to meet or exceed 70% of the forb canopy cover as measured on the reference site, as described in the ESD for the reclaimed sites(s), or as represented in the pre-disturbance species data.

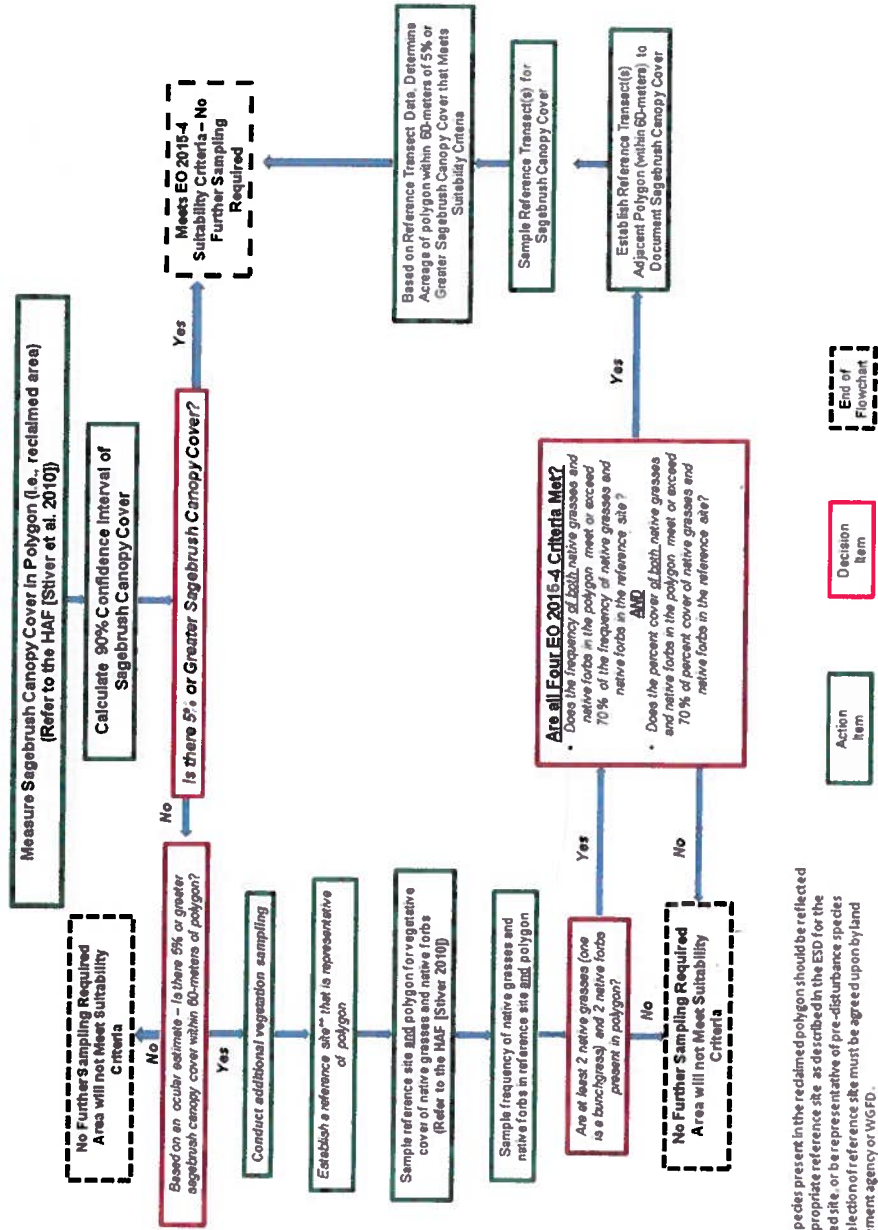
**Methodology**

- Sampling timing for grasses, forbs, and shrubs is typically not later than July 1.
- Canopy cover for grasses/forbs: Line Point Intercept (see Habitat Assessment Framework).
- Frequency for grasses/forbs: Plot (rectangles, squares or circles) frequency computed as number of quadrats with the species of interest rooted within it, divided by the total

Executive Order 2015-4  
Attachment E  
Page 1 of 3

number of quadrats that are sampled. This value will be multiplied by 100 to yield frequency as a percentage. It is recommended that a minimum of 5 to 10 transects, 30 to 50 meters wide be conducted with a minimum of 10 to 20 quadrats (e.g. Daubenmire frame or quadrat appropriate to the site) placed equidistantly along each transect.

- Canopy cover for sagebrush: Line Intercept (see Habitat Assessment Framework).
- Sample size: The Habitat Assessment Framework provides sample size recommendations. Final estimates must include a 90% confidence interval computed around the mean values estimated from vegetation sampling.



\*\*The species present in the reclaimed polygon should be reflected in an appropriate reference site as described in the ESD for the reclaimed site or be representative of pre-disturbance species data. Selection of reference site must be agreed upon by land management agency or WGF.

Decision-based Flowchart for Vegetation Sampling Methods and Suitability Determination (Source: TRC 2015)

**EXECUTIVE ORDER 2015-4  
ATTACHMENT F**

**Greater Sage-Grouse Habitat Definitions**

Greater sage-grouse require somewhat different seasonal habitats distributed over large areas to complete their life cycle. All of these habitats consist of, are associated with, or are immediately adjacent to, sagebrush. An abbreviated description of a complex system cannot incorporate all aspects of, or exceptions to, what habitats a local Greater sage-grouse population may or may not utilize. Refer to the Bureau of Land Management's Sage-Grouse Habitat Assessment Framework for further information.

**“Suitable”** Greater sage-grouse habitat (nesting, breeding, brood-rearing, or winter) is within the mapped occupied range of Greater sage-grouse, and:

1. has 5% or greater sagebrush canopy cover (for nesting, brood-rearing and/or winter) as measured by the point intercept method. "Sagebrush" includes all species and sub-species of the genus *Artemisia* except the mat-forming sub-shrub species: *frigida* (fringed) and *pedatifida* (birdfoot);
2. is riparian, wet meadow (native or introduced) or areas of alfalfa or other suitable forbs (brood rearing habitat) within 275 meters of sagebrush habitat with 5% or greater sagebrush canopy cover (for roosting/loafing); or
3. is reclaimed habitat containing at least 2 native grasses (at least one bunchgrass in appropriate sites) and 2 native forbs (see Reclamation, Attachment B) and no point within the grass/forb habitat is more than 60 meters from adjacent 5% or greater sagebrush cover.

**“Transitional”** Greater sage-grouse habitat is land that has been treated or burned prior to 2011 resulting in less than 5% sagebrush cover but is actively managed to meet a minimum of 5% sagebrush canopy cover with associated grasses and forbs by 2021 (as determined by analysis of local condition and trend) and may or may not be considered “disturbed”. Land that does not meet the above vegetation criteria by 2021 should be considered disturbed.

Habitat treatments must meet the current Wyoming Game and Fish Department Protocols for Treating Sagebrush to be consistent with Executive Order 2015-4, Greater Sage-grouse Core Area Protection, or the habitat treated will be considered disturbed. Following wildfire, lands shall be considered “disturbed” pending an implemented management plan with trend data showing the area returning to functional Greater sage-grouse habitat.

- Areas burned by wildfire (after 2011) shall be treated as disturbed pending an implementation management plan with trend data showing the area returning to functional Greater sage-grouse habitat. This is specific only to wildfire. This direction is not intended for other incentive/mitigation/habitat treatment situations.

Executive Order 2015-4  
Attachment F  
Page 1 of 3

- The goal is to incentivize restoration of wildfire burns to return as much of the affected burned area back to suitable habitat as quickly as possible. This is a landscape effort and is not considered mitigation banking. This process should be used when wildfire is impacting the disturbance percentages.
- A Technical Team comprised of the U.S. Forest Service, Bureau of Land Management, Natural Resource Conservation Service, the Wyoming Game and Fish Department, Office of State Lands and Investments Forestry Division, Wyoming Department of Agriculture (Weed and Pest), local working groups, conservation districts and private landowners would develop the plan and trending data. It would be the responsibility of the project proponent to conduct the monitoring. An upward trend would be determined through the collection of five years of data and review by the Technical Team.

**“Unsuitable”** Greater sage-grouse habitat<sup>1</sup> is land within the historic range of Greater sage-grouse that did not, does not, and will not provide Greater sage-grouse habitat due to natural ecological conditions such as badlands, canyons or forests.

**“Disturbed”** suitable Greater sage-grouse habitat<sup>1</sup> is land that has been converted from formerly suitable habitat to grasslands, croplands, mined or otherwise physically disturbed areas. To evaluate the 5% disturbance cap per average 640 acres using the Density/Disturbance Calculation Tool (DDCT), suitable habitat is considered disturbed when it is removed and unavailable for immediate Greater sage-grouse use. These areas may provide habitat at some time in the future through succession or restoration. Disturbed suitable habitats could also include those permanent disturbances such as major reservoirs and cities that once were considered suitable.

The following items are guidelines for determining disturbed habitat for the DDCT process:

- a. Long-term removal occurs when habitat is physically removed through activities that replace suitable habitat with long-term occupancy of unsuitable habitat such as a road, well pad or active mine.
- b. Short-term removal occurs when vegetation is removed in small areas, but restored to suitable habitat within a few years of disturbance, such as a successfully reclaimed pipeline, or successfully reclaimed drill hole or pit.
- c. There may be additional suitable habitat considered disturbed between two or more long-term (greater than 1 year) anthropogenic disturbance activities if the activities are located such that Greater sage-grouse use of the suitable habitat between these activities is significantly reduced due to the close proximity (less than 1.2 miles apart, 0.6 mile from each activity) and resulting cumulative effects of these large scale activities. Exceptions

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<sup>1</sup> The BLM Habitat Assessment Framework definition of “unsuitable” includes both “disturbed” and “unsuitable” habitats as defined above.

may be provided.

- d. Land in Northeast Wyoming (see Attachment B, Figure 8) that has had sagebrush removed post-1994 (based on Orthophoto interpretation), and not recovered to suitable habitat will be considered disturbed when using the DDCT.

**EXECUTIVE ORDER 2015-4  
ATTACHMENT G**

**Best Management Practices for Soils on Resource Extraction Sites**

1. Get to know the nature of the soil(s) on the site where you are working. Good basic information can be obtained from the Natural Resource Conservation Service Soil Survey and more detailed information can easily be gathered by digging a few soil pits and testing some soil properties on the site (pH, Electrical Conductivity, Texture, Calcium Carbonate content and gravel content).
2. Topsoil should be removed from the site before resource extraction activities and stored in suitable stockpiles to protect this valuable resource from loss or contamination during resource extraction. Topsoil is important to timely site reclamation. Topsoil should be salvaged while at a low moisture content. Avoid mixing A horizons with B horizons if the B horizons are salty and or clayey.
3. Topsoil stockpiles should be located in an area where they will not be disturbed by resource extraction activities or contaminated by foreign or spilled materials. Movement of stockpiles should be kept to a minimum. Stockpiles should be designed to minimize exposure to erosional forces and bury as little undisturbed soil as possible.
4. Upon completion of resource extraction activities or interim reclamation, topsoil should be respread on the disturbed site to approximate original conditions. Vegetation should be reestablished on the replaced soil as quickly as possible to stabilize the site and prevent erosion. Regular monitoring should be conducted to be sure that revegetation and stabilization of the site proceed according to expectations and no site degradation occurs.
5. The use of commercial fertilizers is generally not recommended for native rangeland reestablishment due to the possibility of increased annual weeds. Soil testing should be completed prior to reestablishment of native plants on highly disturbed soils and, if necessary, the appropriate amendments should be used.
6. It is important not to over-estimate the amount of vegetation removal (habitat loss) in a given year.
7. In order to minimize impacts to soil resources, an alternative to large-scale advanced removal of soil is to skim the surface of the soil with a motor patrol between July 1 and March 14. This may be useful or applicable where operational plans are uncertain or where there is a desire to “live-spread” soils at some point in the period of March 14 – July 1.
  - Leave as much root intact as possible.
  - Leave vegetative biomass in wind-rows to reduce wind and water erosion.

8. If unexpected changes in operational plans require vegetation removal between March 14 and July 1, a nest survey shall be completed by a competent biologist within 1 week prior to any vegetation removal in suitable habitat. Results shall be submitted to the appropriate regulatory agency with a copy to Wyoming Game and Fish Department (WGFD). If a nest is discovered, operations will not be allowed to proceed until after July 1 or otherwise approved by WGFD.

Source: Peter Stahl and Jay Norton, Wyoming Reclamation and Restoration Center, University of Wyoming

**EXECUTIVE ORDER 2015-4  
ATTACHMENT H**

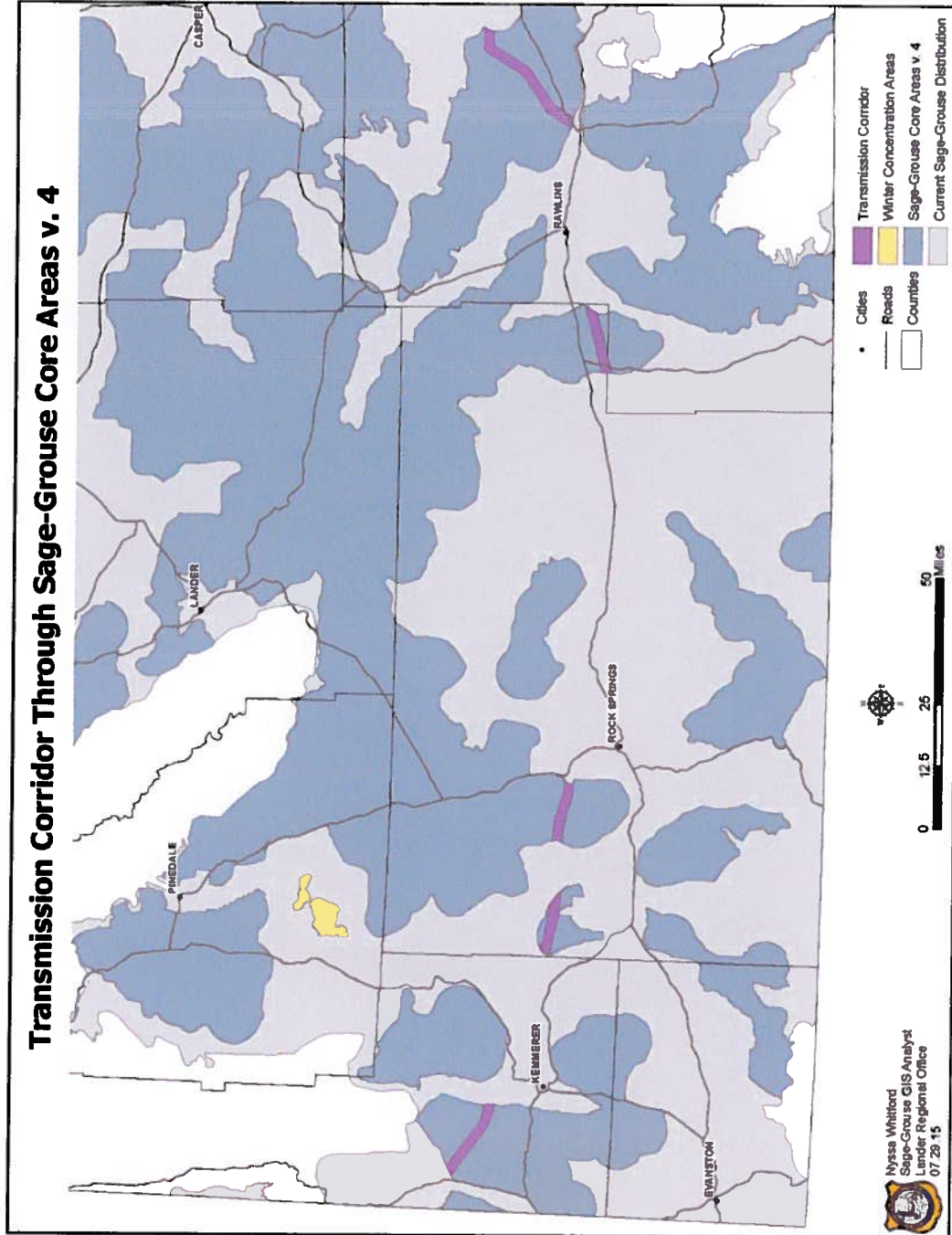
**Compensatory Mitigation**

Compensatory mitigation is an essential component of a long-term conservation strategy, where avoidance and minimization are either inadequate or impossible to assure perpetuation of a species of concern. By its nature, compensatory mitigation may be applicable “on-site”, but may often be achieved more effectively “off-site” in order to maintain a landscape-scale result that is beneficial to a species, and not a particular population or group of animals. Compensatory mitigation must be secured prior to any negative impact to a species or its habitat occurs.

Compensatory mitigation that occurs “off-site” should meet the complete life-cycle needs of the species, be secured for an adequate time to assure the replacement of resources that are lost as a result of any negative action impacting the species, and be critically evaluated to provide adequate biological assurances that the initial impact, and any associated mitigation will maintain the species and its habitat until the impact has been removed and the species is recovered at the site of impact. Compensatory mitigation must provide an adequate ratio of assurance that the conservation of the species will not be compromised due to the failure of compensation measures to adequately protect the species, including management changes, natural disasters, and other impacts.

The State of Wyoming recognizes compensatory mitigation as a strategy that should be used when avoidance and minimization are inadequate to protect Core Population Area Greater sage-grouse. Any compensatory mitigation proposal must include approval from the State of Wyoming to assure the species considered is adequately protected, and that the benefits proposed for a species under the jurisdiction of the State of Wyoming are real, adequate, and fully realized prior to the time of acceptance.

**EXECUTIVE ORDER 2015-4  
ATTACHMENT I**



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

<b>Project Name</b>	<b>Budget Biennium</b>	<b>Local Working Group</b>	<b>Total Cost</b>	<b>SG \$</b>	<b>Project Description</b>	<b>Partners</b>	<b>Status</b>
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	Complete
167 - Beckley Juniper Treatment	2015-16	Big Horn Basin	\$40,000	\$20,000 requested/approved	Mechanical juniper removal from sage-grouse habitat	BLM	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	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.	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	Complete
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	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	Complete

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	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	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	On-going
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	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	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	On-going
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	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	Complete
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.	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	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 abandoned smooth brome hayfields.	Grand Teton National Park, NRCS	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	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 response of sage-grouse to changes in conditions	Audubon Rockies, TNC, Yellowstone Ecological Research Center, Governor's SG Implementation Team	On-going
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	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	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	On-going
189 – 50-Mile Flat Restoration	2015-16	Bates Hole-Shirley Basin	\$200,000	\$30,000 requested/approved	Cheatgrass treatment	BLM, Natrona Co. Weed & Pest	Complete
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	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	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	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	Complete
194 – UW Cheatgrass Thresholds Research	2015-16	South-Central, Upper Green River Basin	\$100,000	\$33,000 requested/approved	Evaluating cheatgrass treatments	UW, Wilbur-Ellis, Sublette Weed & Pest	On-going
195 – South LaBarge Weeds	2015-16	Southwest	\$40,000	\$23,000 requested; \$21,000 approved	Invasive weed control	Sublette County Weed & Pest, Sublette County Cheatgrass Task Force, BLM	On-going
196 – Sublette Windmill Conversions	2015-16	Upper Green River Basin	\$25,000	\$25,000 requested/approved	Convert windmills to solar pumps to reduce raven habitat	Grazing permittees	On-going

**ATTACHMENT D:  
GREATER SAGE-GROUSE RESEARCH  
CONDUCTED IN WYOMING IN 2015**

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 10, 2015

*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 in the USFS Thunder Basin National Grassland, Wyoming  
courtesy Courtney J. Duchardt, University of Wyoming**

# 1. LANDSCAPE MANAGEMENT FOR SAGEBRUSH AND GRASSLAND BIRD GUILDS IN THUNDER BASIN, WYOMING

**Contact:** Dr. Jeff Beck; E-mail: [jibeck@uwyo.edu](mailto:jibeck@uwyo.edu); Phone: (307) 766-6863

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<sup>2</sup> Rangeland Resources Research Unit, USDA-ARS, 1701 Center Avenue, Fort Collins, CO 80526

The Thunder Basin National Grasslands (TBNG) of northeastern Wyoming are composed of a heterogeneous mosaic of sagebrush (*Artemisia spp.*), short-grass, and mixed-grass plant communities. Portions of TBNG have been designated as Core Area for greater sage-grouse (*Centrocercus urophasianus*), and are also important for other sagebrush bird species. However, the grassland also contains some of the largest complexes of black-tailed prairie dogs (*Cynomys ludovicianus*) in North America; these colonies provide important habitat for shortgrass avifauna species (e.g., mountain plover [*Charadrius montanus*]), and are also prioritized as a reintroduction zone for the endangered black-footed ferret (*Mustela nigripes*). Because conservation of diverse species in the same landscape requires spatial optimization of management approaches, we initiated a study in 2015 to determine how shortgrass and sagebrush bird species are influenced by the composition and spatial configuration of habitat patches in the Thunder Basin landscape. We surveyed birds on transects placed across sage-grouse leks ("sagebrush,"  $n = 10$ ), prairie dog colonies ("shortgrass,"  $n = 10$ ), and also across edges between colonies and adjacent habitat ("edge,"  $n = 41$ ). In summer 2015, we observed 58 species across our 61 transects. In order of abundance, the most commonly observed species on sagebrush transects were Brewer's sparrow (*Spizella breweri*), western meadowlark (*Sturnella neglecta*), and lark bunting (*Calamospiza melanocorys*). The most commonly observed species on shortgrass transects were horned larks (*Eremophila alpestris*), western meadowlarks, and mountain plover. Western meadowlark, lark bunting, and horned lark were the most abundant species on edge transects. We will use data collected over the next two years (2016–2017) to generate models of single species density as a function of local and landscape habitat variables. We are especially interested in how the size and configuration of prairie dog colonies influences sagebrush species in this landscape. Because sage-grouse have low detectability on point counts, we will use lek data to examine sage-grouse response to prairie dog colony abundance and configuration in the Thunder Basin landscape. Our results will guide management for diverse taxa in this heterogeneous landscape.

**Funding provided by:** Wyoming Agricultural Experiment Station and the Rangeland Resources Research Unit of the USDA-Agricultural Research Service

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

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<sup>3</sup>Wyoming Game and Fish Department, Lander Regional Office, 260 Buena Vista Drive, Lander, WY 82520

<sup>4</sup>Bureau of Land Management, Lander Field Office, 1335 Main Street, Lander, WY 82520

Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) has been treated through chemical application, mechanical treatments, and prescribed burning to increase herbaceous forage species released from competition with sagebrush overstory. Originally intended to provide more 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) <sup>1</sup>	58(3) <sup>1</sup>	85(0) <sup>1</sup>	106(15) <sup>1</sup>	80(11) <sup>1</sup>
Broods	6	27	47	45	24

<sup>1</sup>Numbers in parentheses indicate number of re-nesting attempts

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

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

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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 was to monitor (for 4 years; spring 2011–spring 2015) 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 monitored female survival, nest success, and brood survival with radio telemetry. To help guide reclamation we sampled vegetation in microhabitat plots at nests, early-brood locations, and at paired random locations. We will complete analyses to 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 behavior of these populations using GPS-marked grouse. Observations have indicated 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 are currently conducting analyses relative to timing, duration, and habitat selection along migration routes. Field data collection for our study finished in spring 2015.

Greater sage-grouse sample sizes obtained in the eastern Bighorn Basin, Wyoming, 2011–2015.

Sample	Female		Male	Nest	Brood	Microhabitat Plots	
	VHF	GPS	GPS			Nest	Brood
Shell	72	20	6	78	26	76	62
Hyattville	210	66	10	226	100	214	103

**Funding provided by:** American Colloid Company.

#### **4. GREATER SAGE-GROUSE MALE SURVIVAL AND CONSEQUENCES OF MIGRATION BEHAVIOR IN THE BIGHORN BASIN, WYOMING**

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Aaron Pratt, Department of Ecosystem Science and Management, University of Wyoming  
Jeffrey Beck, Department of Ecosystem Science and Management, University of Wyoming

Our research is being conducted in conjunction with the research project “Greater Sage-Grouse Migration Ecology and Response to Bentonite Mining in the Bighorn Basin, Wyoming.” Our first objective is to investigate the feasibility of using mark-recapture methods to estimate male survival. If successful, we will relate male survival relative to different landscape disturbances. Males were marked by capture and leg bands or by genetic markers obtained from feather and fecal samples. During the spring 2011-2015 we captured, banded, and collected a genetic blood sample from 220 males associated with 20 leks in the eastern Bighorn Basin. During 2012-2015, we also collected feather and fecal samples from these same leks. Our second study objective is to investigate the feasibility of using stable isotope methods to classify migration behavior. If successful, we will determine if there is any breeding body condition, survival, or reproductive consequences of different behavior. Observations of radio-marked grouse have revealed that individuals that make farther interseasonal movements are associated with summer habitat at high-elevation sites while those that make shorter movements are associated with summer habitat in hayfields/pastures. Preliminary results from summer-captured grouse (2011-2013;  $n = 94$ ) show differences in  $^{13}\text{C}$ ,  $^{15}\text{N}$ ,  $^{18}\text{O}$ , and  $^2\text{H}$  isotope values between the 2 groups. These differences may allow for classifying spring-captured grouse with unknown behavior by measuring the stable isotope signatures in their feathers that were grown during the previous summer. Field data collection for our study finished in spring 2015 and final lab analyses will be completed during 2016.

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

## 5. EFFECTS OF MOWING AND HERBICIDE TREATMENTS ON THE NUTRITIONAL QUALITY OF SAGEBRUSH IN CENTRAL WYOMING

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Rizvic, Naida<sup>1</sup>, Jennifer Forbey<sup>1</sup>, Jeffrey Beck<sup>2</sup>, Kurt Smith<sup>2</sup>, and Jason LeVan<sup>2</sup>

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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*). 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.

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

## **6. SAGE-GROUSE GEOPHAGY AND MOVEMENTS**

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Bryan Bedrosian, Teton Raptor Center

Dale Woolwine, BLM – Pinedale

Ann Roberts, Bridger-Teton National Forest

We are entering our second year of study on the geophagy (soil ingestion) in the Upper Green River Drainage and movement of sage-grouse utilizing the Bridger-Teton National Forest. In 2015, the project and associated personnel moved from Craighead Beringia South to the Teton Raptor Center, where the project will continue. Data from sage-grouse marked as part of this research are being used in two different ways. First, GPS movement data are being compiled to investigate geophagy of sage-grouse on winter range in the Pinedale/Big Piney regions of the Upper Green River Drainage. This is a newly discovered phenomenon of large concentrations of grouse on winter range for the purpose of soil ingestion. Long-term questions on this behavior include where these sites are, why the behavior occurs, and how it affects movements and fitness. GPS data collected from >30 marked grouse this winter will help locate these sites as the first part of this investigation. Secondly, location data from grouse in this study are being used to help define occupied sage-grouse habitat in the Hoback and Upper Green areas on the Bridger-Teton National Forest. These areas may be key connectivity corridors between the large core grouse populations in the Pinedale region to the genetically isolated core population in the Jackson Hole region.

**Funding provided by:** the Upper Green River Basin, Upper Snake River Basin, and Southwest Wyoming Sage-Grouse Working Groups, and Bridger-Teton National Forest.

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

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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).

**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.

## 8. IMPACT OF RAVENS ON GREATER SAGE-GROUSE

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Over the past two years we have investigated winter raven removal by USDA Wildlife Services and its impacts on greater sage-grouse populations. We found that Wildlife Services was able to remove between 132 and 730 ravens each year over a 3 year period. These numbers were obtained through a population of radio-marked ravens. We also determined that the most accurate and cost-effective method to determine Wildlife Services raven mortality is to identify communal roosts, count ravens as they come into the roost the day of the poisoning event, and count the same roost 3 days following the poisoning event. We found that roost count mortality estimates were within  $\pm 15\%$  of radio-marked mortality estimates. We found that a decrease in raven density near lek complexes of 10%, resulted in an increase of sage-grouse at lek complexes by 2%. Beginning this winter, we will investigate whether winter resource denial can be used to disperse ravens from large communal roosts. Resource denial will include harassing out of landfills and road-kill collection. We will then characterize springtime dispersal of displaced ravens to nesting sites. If ravens do not return to the areas from which they were dispersed, winter resource denial may have utility as a means to remove large numbers of ravens near productive lek complexes. We will also describe raven foraging behavior before, during, and after resource denial.

**Funding provided by:** Anadarko Petroleum Corporation, South-Central Local Sage-grouse Working Group, Sweetwater County Weed and Pest Board, Sweetwater County Predator Board, Utah Agricultural Experiment Station, Utah State University, Wyoming Animal Damage Management Board, Wyoming Game and Fish Department, Wyoming Land Conservation Initiative, and Wyoming Wildlife and Natural Resource Trust.

## 9. INFLUENCE OF HUNTER HARVEST ON POPULATION TRENDS OF GREATER SAGE-GROUSE

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Hunter harvest of greater sage-grouse (*Centrocercus urophasianus*; hereafter “sage-grouse”) has been regulated by wildlife agencies during most of the past century. Range-wide population declines of sage-grouse have prompted wildlife agencies to restrict harvest with increasingly more conservative season regulations since the mid 1990’s. Concurrently, sage-grouse populations are known to oscillate over time, and population growth can be influenced by seasonal weather and disturbance. We are comparing lek trends from 15 relatively distinct sage-grouse populations in 8 western states and 2 Canadian provinces. These populations were categorized into 3 types of harvest histories (non-hunted, continuously hunted, and hunting season discontinued between 1996 and 2008) over 19 years (1995–2013) to evaluate the potential impact of harvest on sage-grouse populations. We are also evaluating the effects of different facets of harvest pressure (area open to harvest, bag and possession limits, season lengths, season start date, and hunt type [permit or general]) on sage-grouse lek trends.. Precipitation and temperature during the summer and winter are being assessed to describe oscillations in lek trends; whereas, habitat (agriculture, shrub, and tree cover), human population density, wildfire (low, moderate, and high fire severity), and anthropogenic factors (cities, coal mines, communication towers, oil and gas wells, power lines, power plants, roads, wind turbines, etc.) are concurrently being evaluated as other factors contributing to sage-grouse lek decline. Our results will clarify how harvest has impacted sage-grouse, and how weather relates to oscillations in sage-grouse populations; thereby providing wildlife researchers and managers knowledge about underlying processes generating population cycling.

**Funding:** Anadarko Petroleum Corporation.

## 10. MULTI-SCALE STATEWIDE WYOMING GREATER SAGE-GROUSE TRENDS DETERMINED BY POPULATION VIABILITY ANALYSIS

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We are investigating trends for Wyoming Greater Sage-grouse populations at multiple scales using population viability analysis (PVA) to determine local- and meta-population dynamics. Our objective is to use lek count data provided by the Wyoming Game and Fish Department to perform a PVA to determine the population growth rate ( $\lambda$ ) statewide and at two spatial scales based on lek clusters developed within current sage-grouse range (see “Hierarchical Clustering of Greater Sage-Grouse Leks to Improve upon the Detection of Population Persistence, Sinks, and Sources” by O'Donnell et al. for cluster specifics). We are using average peak male counts per lek annually (1948-2015) in a PVA to test density-independent (DI) and density-dependent (DD) models to determine  $\lambda$  within each cluster and state-wide. As clusters are defined by fine- and broad-scale habitat and climate attributes relevant to sage-grouse, trends within these clusters are more likely to be correlated and yield more precise trend estimates with PVA than other population demarcations (e.g., political boundaries or climate zones). This approach allows us to better establish the influence of local trends, where management actions are applied, on larger-scale population trajectories. We have developed our suite of DI and DD models and are in the process of applying them at the level-1 lek clusters scale. A manuscript assessing sage-grouse population viability will be submitted for peer-review in 2015.

**Funding provided by:** U.S. Geological Survey and Wyoming Landscape Conservation Initiative through USGS.

## 11. LARGE-SCALE CONTROL SITE SELECTION FOR POPULATION MONITORING: AN EXAMPLE ASSESSING SAGE-GROUSE TRENDS

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Human impacts on wildlife populations are widespread and prolific and understanding wildlife responses to human impacts is a fundamental component of wildlife management. The first step to understanding wildlife responses is the documentation of changes in wildlife population parameters, such as population size. Meaningful assessment of population changes in potentially impacted sites requires the establishment of monitoring at similar, nonimpacted, control sites. However, it is often difficult to identify appropriate control sites in wildlife populations. We demonstrated use of Geographic Information System (GIS) data across large spatial scales to select biologically relevant control sites for population monitoring. Greater sage-grouse (*Centrocercus urophasianus*; hereafter, sage-grouse) are negatively affected by energy development, and monitoring of sage-grouse population within energy development areas is necessary to detect population-level responses. We used population data (1995 – 2012) from an energy development area in Wyoming, USA, the Atlantic Rim Project Area (ARPA), and GIS data to identify control sites that were not impacted by energy development for population monitoring. Control sites were surrounded by similar habitat and were within similar climate areas to the ARPA. We developed nonlinear trend models for both the ARPA and control sites and compared long-term trends from the 2 areas. We found little difference between the ARPA and control sites trends over time. This research demonstrated an approach for control site selection across large landscapes and can be used as a template for similar impact-monitoring studies. It is important to note that identification of changes in population parameters between control and treatment sites is only the first step in understanding the mechanisms that underlie those changes. The manuscript associated with this work will be published in the December 2015 issue of the Wildlife Society Bulletin.

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

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Dr. Sara Oyler-McCance, U.S. Geological Survey, Fort Collins Science Center, Fort Collins, CO 80526, USA

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. One was published as:

Row, J. R., S. J. Oyler-McCance, J. a. Fike, M. S. O'Donnell, K. E. Doherty, C. L. Aldridge, Z. H. Bowen, and B. C. Fedy. 2015. Landscape characteristics influencing the genetic structure of greater sage-grouse within the stronghold of their range: a holistic modeling approach. *Ecology and Evolution* 15.

The other is still in review. We submitted two additional manuscripts for peer-review publication in 2015. Both are currently in review.

### **13. 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. This project was completed in 2015 with the publication of a USGS Data Series Report.

Publications:

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

O'Donnell, M. S., C. L. Aldridge, K. E. Doherty, and B. C. Fedy. 2015. Wyoming Greater Sage-grouse Habitat Prioritization : A Collection of Multi-scale Seasonal Models and Geographic Information System Land Management Tools Data Series 891. Reston, Virginia.

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

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### Principal Investigator

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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 and 2014, 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. Additionally, during our 2014 field season we used stable isotopes to assess whether minnows were consuming mosquito larva. Reservoirs were monitored during our final field season in 2015. We anticipate submitting the results for peer-reviewed publication early in 2016.

## **15. IMPROVING SUCCESS IN HABITAT RESTORATION FOR SAGEBRUSH-OBLIGATE WILDLIFE: ASSESSMENT OF AVIAN HABITAT USE AND VEGETATION COMPOSITION IN SAGEBRUSH STEPPE RECLAMATION ACTIVITIES**

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To improve outcomes of habitat restoration for sage-grouse and other sagebrush obligate birds, we need to understand relationships between distribution and composition of plant communities on reclaimed sites in relation to habitat use and population fitness of sagebrush-obligates. Generally speaking: how can we best restore birds when restoring sagebrush habitat? In collaboration with the Wyoming Reclamation and Restoration Center, we will be starting field research in the summer of 2016 to assess the influence of reclamation activities on habitat use and population fitness of sagebrush-obligate birds in the Powder River Basin in an area that is undergoing large-scale reclamation of coal bed natural gas (CBNG) infrastructure. This area provides for a before-after-control-impact (BACI) type study design because it overlaps study areas used in previous research focused on impacts of CBNG on sage-grouse populations (e.g., Walker et al. 2007, Doherty et al. 2008, Fedy et al. 2015). This study will involve two primary components: a vegetation component and a wildlife response component. The Wyoming Reclamation and Restoration Center, will lead the vegetation component. We will lead the wildlife component. Our primary objectives are to 1) assess the response of sage-grouse in terms of habitat use of reclaimed energy development and the vegetation composition of those reclaimed areas compared to adjacent habitats of active energy development and habitats not influenced by energy development, 2) assess the fitness responses of sage-grouse using reclaimed habitats and vegetation composition of those reclaimed areas compared to fitness responses in adjacent altered (active energy development) and non-altered habitats, and 3) assess and compare passerine bird communities and densities in these three habitats (reclaimed, active energy development, and non-altered) representing different stages of energy development. While other studies have attempted to either quantify plant community composition or wildlife-based outcomes of post-mine reclamation, few studies link vegetative composition and wildlife responses to identify the chain of reclamation events necessary for sage-grouse recovery or recovery of sagebrush passerines.

## **16. EFFECTIVENESS OF WYOMING’S SAGE-GROUSE CORE AREA POLICY: INFLUENCES ON ENERGY DEVELOPMENT AND MALE SAGE-GROUSE LEK ATTENDANCE**

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### **Abstract**

Greater sage-grouse (*Centrocercus urophasianus*) populations have declined across their range due to human-assisted factors driving large-scale habitat change. In response, Wyoming’s Executive Order for Sage-grouse (SGEO) implemented the Wyoming Sage-Grouse Core Area Protection policy in 2008 as a voluntary regulatory mechanism to minimize anthropogenic disturbance within defined sage-grouse core population areas. Our objectives were to evaluate the influence of the SGEO policy on: 1) oil and gas well pad development, and 2) peak male lek attendance in core and non-core sage-grouse populations. We conducted our evaluations at the statewide and Western Association of Fish and Wildlife Agencies management zone (MZ I and MZ II) scales. We used ANCOVA modeling to evaluate change in well pad development from 1986–2014 and peak male lek attendance from 958 leks with consistent lek counts within increasing (1996–2006) and decreasing (2006–2013) timeframes for core and non-core sage-grouse populations. Oil and gas well pad development was restricted in core areas. Trends in peak male sage-grouse lek attendance were greater in core areas compared to non-core areas at the statewide scale and in MZ II, but not in MZ I, during the period of increase. Trends in total male lek attendance did not differ between core and non-core population areas statewide, in MZ I, or MZ II during the period of decrease. Our results provide support for the effectiveness of the Wyoming SGEO policy in maintaining sage-grouse populations, but also indicate the need for restorative actions to increase sage-grouse populations in MZ I.

**Funding provided by:** Wyoming Game and Fish Department.

## **17. SPATIALLY-EXPLICIT FRAMEWORK FOR SIMULATING OIL AND GAS DEVELOPMENT SCENARIOS AND IMPACTS TO WILDLIFE SPECIES**

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In southwestern (SW) Wyoming, the extent of foreseeable natural gas development has the potential to substantially increase sagebrush fragmentation and to elevate risks to resident populations of sagebrush-obligate and other wildlife species. The potential to balance this foreseeable development with conservation goals is enhanced by advances in drilling technologies, such as directional and horizontal well bores, that help to minimize undesirable impacts while meeting energy-production demand. To aid in identifying oil and gas development strategies for sustainable futures, I developed an energy footprint model that simulates well, pad, and road patterns for resource recovery options that can vary in well numbers per pad, well spacing, and well bore types. Modeled energy-development scenarios provide spatially detailed information on the pattern and amount of surface disturbance which can be used to assess impacts to species' habitat (songbird densities, pygmy rabbit habitat occupancy, lek attendance, elk habitat effectiveness) and sagebrush fragmentation. Tradeoff assessments among proposed and alternative build-out designs can help inform decision makers about the types of future recovery options having the potential to achieve both energy production and wildlife conservation goals. Scenario simulations of proposed and pending development efforts in SW Wyoming also are being used to spatially portray future landscape conditions for a spatially-explicit demographic study of Greater Sage-grouse. A manuscript illustrating the footprint model and an example application was submitted for peer-review in 2015.

**Funded provided by:** U.S. Geological Survey Land Change Science Program and Wyoming Landscape Conservation Initiative through USGS.

## 18. IMPACTS OF OIL AND GAS DEVELOPMENT ON GREATER SAGE-GROUSE LEK ATTENDANCE IN WYOMING, USA

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Sagebrush ecosystems in the United States have experienced significant changes over the last century resulting in an approximately 50% loss, due to grazing, fire, and agricultural, urban, and energy development. The greater sage-grouse is dependent on sagebrush throughout its life history and, therefore, has also experienced large declines in distribution and abundance. One potential threat to populations is the increase in development associated with oil and natural gas extraction. To better understand how oil and gas development affects Greater Sage-grouse populations, we used a Bayesian state-space model to estimate the impacts of energy development, habitat, and precipitation on changes in lek attendance of male sage-grouse in Wyoming from 1984-2008. We explored these covariates at various scales (extents surrounding leks) and time lags to account for demographic and behavioral responses to development. We found annual declines in lek attendance of 2.5% from 1984-2008 across the state, with regional trends ranging from -12.9% to 4.9%. Well density within 6.4 km of a lek at a 4-year lag provided the best predictive ability of all energy development metrics and had negative impacts on lek attendance. Sagebrush cover had no effect and average spring precipitation within 3.2 km two years prior had a negative effect on changes in lek attendance. Our findings suggest that sage-grouse may experience further declines in Wyoming as energy development is expected to increase in the future. We are currently preparing this research for publication in a peer-reviewed scientific journal, and we hope to expand these analyses range-wide and predict the impacts of future oil and gas development on lek attendance.

**Funding:** U.S. Geological Survey and Wyoming Landscape Conservation Initiative through USGS.

## **19. PREDICTING HABITAT USE FOR GREATER SAGE-GROUSE USING A SPATIALLY-EXPLICIT DEMOGRAPHIC APPROACH IN WYOMING**

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Identifying and prioritizing habitats that are important for conserving species is a challenging task, particularly for those with fluctuating populations and spatially and temporally differing habitat needs such as the Greater Sage-grouse in the state of Wyoming. To assess the long-term use of sage-grouse habitat and occupancy of core areas, we developed a spatially explicit individual-based model informed by lek counts, habitat selection maps, life history information, population dynamics, movement, and behavior (i.e., nest site fidelities). Using a range of possible population trajectories, we quantified the contribution of areas inside and outside of protected core areas to population abundance. We also compared characterizations of important habitats generated from habitat selection (resource selection function) models with simulated habitat use influenced by population dynamics. We have predicted the long-term occupancy rates of sage-grouse within and outside of cores, and quantified the contribution of areas outside of cores to overall abundance and persistence. Lastly we have compared the predictions from the seasonal RSF surfaces (Fedy et al., 2014) to simulated habitat use informed by behavior, population dynamics and movement considerations. These outcomes and outputs are included in a manuscript that was submitted for publication to a peer-reviewed journal in early November, 2015.

**Funding provided by:** U.S. Geological Survey.

## 20. GREATER SAGE-GROUSE RESPONSES TO FUTURE CUMULATIVE AND INTERACTING CLIMATE AND ENERGY DEVELOPMENT IN WYOMING

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The persistence of Greater Sage-grouse in Wyoming depends on future habitat changes, including oil and gas development and climate-induced changes in habitat. Yet, we have a poor understanding of the potential magnitude of these effects and how these stressors may shape future sage-grouse outcomes in Wyoming. We are developing a series of future landscape change maps, which will be used to update seasonal habitat selection maps, and quantify future sage-grouse responses. Within the Wyoming Landscape Conservation Initiative (WLCI) study area of southwestern Wyoming, we are simulating future loss and fragmentation of sagebrush habitats resulting from oil and gas development and associated roads infrastructure. Models will be parameterized using realistic oil and gas development scenarios, and will rely on algorithms previously developed and tested in southwestern Wyoming (by collaborator Garman). Climate change scenarios will incorporate changes in sagebrush predicted from climate change models (collaborator Homer) to evaluate the effects of projected climate change on sage-grouse populations. Future changes in habitat will be coupled with behavioral responses (e.g., habitat selection, avoidance, fitness consequences) within a spatially explicit individual-based model to quantify the likely range of impacts on sage-grouse distribution, abundance, and persistence. The effects of industrial development will be compared to climate-induced impacts and their combined influences on sage-grouse persistence will be evaluated. A manuscript will be submitted for peer-review in 2016.

**Funding provided by:** U.S. Geological Survey and Wyoming Landscape Conservation Initiative through USGS.

## 21. ASSESSING GREATER SAGE-GROUSE RESPONSES TO TRANSMISSION LINE DEVELOPMENT PROJECTS IN WYOMING

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Wind energy is rapidly developing in Wyoming and the BLM is facilitating the development of new transmission line projects in sensitive grouse habitats in southern Wyoming. Although impact assessments are being conducted for the Gateway South, West, and TransWest Express projects, the tools used to inform the siting of the and assessment of Greater Sage-grouse impacts are not using the best available data products (e.g., USGS seasonal Sage-grouse habitat selection models by Fedy et al. 2014 and associated spatially-explicit individual based model by Heinrichs et al. *In Review*). We will use the seasonal sage-grouse habitat layers that our team previously developed to further enhance our existing spatially-explicit individual-based model for sage-grouse in Wyoming. We will characterize the amount of sage-grouse habitat implicated in three transmission line projects in Wyoming and model a range of sage-grouse movement, behavioral, and demographic responses to transmission line infrastructure. Results can be used to identify areas where development is most likely to impact sage-grouse, to quantify the impact of transmission line development on sage-grouse populations, and to suggest more accurate habitat equivalency targets. Our framework could further be developed in cooperation with partners to assess responses to wind farm impacts and inform siting of associated transmission lines and energy corridors, which has yet to be considered for a species like sage-grouse.

**Funding provided by:** U.S. Geological Survey.

## **22. THE ECOLOGY OF 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

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 in 2001. 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. The objectives maintained throughout the course of the project include collecting seasonal information on the distribution, movements, and habitat use of radio-collared grouse and to document information on nest success and mortality factors. Additional areas of interest include: exploring disturbance thresholds to aid in identifying the location and timing of future reclamation efforts; integrating findings with other relevant habitat studies to develop regionally appropriate reclamation guidelines; mapping seasonal and individual home ranges; and investigating if family relatedness or fidelity to natal areas are factors in nest site selection. Data collected from this long-term monitoring effort provides the most temporally extensive telemetry 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 also aids in 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.

## 24. WYOMING SAGE-GROUSE CORE AREA HEALTH ASSESSMENT

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Dr. Matt Holloran: Wildlife Management Research Support

The State of Wyoming took a bold step in enacting the Wyoming Core Area Policy (WyCAP) in 2008 to minimize disturbance to sage-grouse populations within Core Areas. The policy focuses on guiding new energy development in core areas, with the key stipulations being limits to surface disturbance and infrastructure density; similar stipulations are included in state and federal management plans recently adopted throughout the western U.S. Changes in habitat “health” within core areas has not been quantified since inception of WyCAP, and this information is critical for assessing the efficacy of conservation actions implemented through WyCAP. Our goal was to assess changes in landscape health in core areas since 2008, and develop a framework that could be used to quantify changes in habitat health across spatial scales moving forward. We tailored the habitat metrics investigated to those proposed in the *Sage-grouse Habitat Assessment Framework* (HAF; Stiver et al. 2015), modifying metrics as necessary to suit the specific conditions and needs in Wyoming. Habitat metrics were used to model population metrics across the state: Phase I of this project addresses 1<sup>st</sup> and 2<sup>nd</sup> orders (as described in the HAF) using lek count data as the population metric, and Phase II addresses 3<sup>rd</sup> and 4<sup>th</sup> orders using individual bird data (e.g., seasonal habitat selection and success) as population metrics. We have completed Phase I modeling, submitted the final report to the state, and a manuscript generated from the assessment is currently in peer-review. We are currently generating and compiling habitat metrics required to address Phase II in the Upper Green River Basin (pilot region), and anticipate initiating Phase II modeling prior to the end of the year.

**Funding provided by:** Wyoming Governor’s Office (Phase I); The Bureau of Land Management Wyoming State Office (Phase II); and the Wind River/Sweetwater River, Upper Snake River, Southwest, Bates Hole/Shirley Basin, and Upper Green River Sage-grouse Local Working Groups (Phase II).

## **25. LONG-TERM SAGEBRUSH HABITAT COMPONENT MONITORING AND FUTURE CLIMATE RESPONSE FORECASTING IN SOUTHWEST WYOMING**

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The USGS has been conducting sagebrush and vegetation change monitoring in southwest Wyoming with field measurements every year since 2006, and with satellite remote sensing since 1985. Remote sensing offers the opportunity to scale up field measurements and subsequently provide wall-to-wall vegetation monitoring. We quantified sagebrush habitat as components of bare ground, shrub, sagebrush, herbaceousness and litter. Once components were quantified using current satellite measurements, previous year satellite images from the Landsat archive were then quantified to understand historical trends. Analysis of imagery back to 1985 shows components of bare ground and herbaceous increasing over time and sagebrush decreasing over time across the Wyoming Landscape Conservation Initiative (WLCI) area. We then applied a linear model to relate the historical trend of the component value for each pixel to the historical precipitation trend – and projected this into the future for the year 2050. This process provides a way to quantify the potential impact of future climate change on the quantity of sagebrush components. Results indicate that with projected 2050 precipitation amounts, sagebrush will continue to decline and bare ground to increase across WLCI. For a small subset of the WLCI area, this approach was used to see how 2050 quantities of change translated to future sage-grouse habitat. There was a projected loss of 4% of summer sage grouse habitat and 11% of nesting sage grouse habitat by climate change alone. Future work will provide more comprehensive analysis of potential climate change and sage-grouse habitat effects.

**Funding provided by:** U.S. Geological Survey and Wyoming Landscape Conservation Initiative through USGS.

### **Publication:**

Homer, C.G., G. Xian, C.L. Aldridge, D.K. Meyer, T. Loveland, and M. O'Donnell. 2015.

Forecasting sagebrush ecosystem components and greater sage-grouse habitat for 2050: capitalizing on 28 years of Landsat satellite imagery and climate data. *Ecological Indicators* 55: 131-145.

## 26. USGS CHARACTERIZATION AND MONITORING OF SHRUBLAND COMPONENTS IN WYOMING

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The USGS in collaboration with the BLM is producing a new remote sensing-based quantification of Wyoming shrub lands. This circa 2015 database will replace the previous shrub component products produced by the USGS from circa 2006 data. For the new products, nine individual products are being produced with values representing the proportion (fractional vegetation) of each target component for every 30 m pixel. Component products include percent shrub, percent sagebrush, percent big sagebrush, percent herbaceous, percent annual herbaceous, percent litter, percent bare ground, shrub height and sagebrush height. This approach relies on three major steps including creating training datasets using field measurements and high resolution satellite imagery at selected sites; extrapolating these training datasets to the landscape level using medium resolution satellite images, and validating the final products with independent field measurements. New modeling improvements should result in an improved product over the original 2006 products. Similar work is being completed throughout the sagebrush ecosystems of the west so data will be comparable to other areas. Field sampling in Wyoming was accomplished in 2015, with final products expected to be available in early 2016. For sagebrush ecosystems, research has shown this approach enables more successful modeling of sage-grouse habitat, provides improved monitoring of gradual habitat change and offers opportunities to develop historical 30-year trends of habitat change from climate influences that can be used to model future habitat responses to climate.

**Funding provided by:** U.S. Geological Survey, BLM – AIM program, and MRLC

### **Publication:**

Xian, G., Homer, C. Rigge, M., Shi, H., and D. Meyer. 2015. Characterization of shrubland ecosystem components as continuous fields in the northwest United States, *Remote Sensing of Environment*, 168 (2015): 286-300.

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

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In June 2008, the U.S. Department of Energy (DOE) set forth development of wind-generated electricity as a national energy priority. DOE estimated that the U.S. has ample wind resources to reach the goal of 20% of our nation's power supplied by wind energy by 2030, but one of the greatest hindrances to this accomplishment may be uncertainties regarding the potential impacts of wind energy developments to wildlife. The impacts of wind development to sage-grouse are currently unknown; however, potential effects to the species are enough to limit energy development in some sagebrush-dominated regions of the West, especially throughout much of central and western Wyoming. The overall goal of the research updated here is to establish the short-term effects of a wind energy development on female sage-grouse. We are studying sage-grouse inhabiting areas near the PacifiCorp Seven Mile Hill wind project located approximately 15 km west of Medicine Bow, WY. Research was initiated in April 2009; the National Wind Coordinating Collaborative joined the effort in 2011. Female sage-grouse equipped with VHF radio-transmitters were radio-tracked to document seasonal habitats (e.g., nesting, brood-rearing, summer, winter) selected and population demographics (e.g., survival, nesting success, chick productivity); the 2014 field season represented the last for this project. We are currently in the process of analyzing data and writing the final report. The report will consist of 3 chapters (nest selection and survival, brood selection and survival, and summer selection and survival), each formatted for submission for publication in a peer-reviewed journal.

**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).

## **28. HOW DO SAGE-GROUSE RESPOND TO ON-SITE MITIGATION IN AN ENERGY DEVELOPMENT AREA?**

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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. To-date we have described our research findings in two publications. The first publication focuses on habitat use relative to on-site mitigation (Fedy et al. 2015) and the second focuses on fitness outcomes relative to on-site mitigation (Kirol et al. 2015).

**Funding provided by:** Anadarko Petroleum Corporation and in-kind support from BHEC.

### **Publications:**

Fedy, B. C., C. P. Kirol, A. L. Sutphin, and T. L. Maechtle. 2015. The Influence of Mitigation on Sage-Grouse Habitat Selection within an Energy Development Field. PLoS ONE, 10(4), e0121603.

Kirol C. P., A. L. Sutphin, L. Bond, M. R. Fuller and T. M. Maechtle. 2015. Mitigation effectiveness for improving nesting success of greater sage-grouse influenced by energy development. Wildlife Biology 21:98-109.

## 29. ASSESSING THE DISTRIBUTION AND POTENTIAL CAUSES OF SAGEBRUSH DEFOLIATION EVENTS

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Our overall objective is to establish an understanding of sagebrush defoliation and/or mortality in Wyoming and determine the magnitude of the problem. We will evaluate the potential for landscape scale remote sensing to detect the extent and/or severity of the issue and establish a framework to assess potential causes and effects. In 2015, we obtained locations of sagebrush mortality and defoliation from WLCI partners (NRCS, WGFD) who completed a compilation of evidence and summary of potential causes. Preliminary information suggests potential for multiple determinants/causes of these events. USGS collected additional field data on sagebrush mortality and adjacent areas with healthy sagebrush, including stem samples that we are analyzing for a dendrochronological signature (ring-width analysis) that can relate growth rates to mortality. We have shared data with scientists from USGS SWBC and the University of Wyoming who are evaluating the role of soil water and drought in sagebrush mortality events. In 2016 we will continue to collect and organize information into a database with photos of field documented mortality and areas of live sagebrush. We continue to work with partners to build a network of observers to obtain additional field locations. We have acquired Landsat satellite imagery from the USGS EarthExplorer archive to investigate spatial and temporal patterns associated with known defoliation events/locations. We will test the ability of remotely sensed imagery to delineate between areas of mortality and healthy sagebrush. We expect areas that have experienced mortality may exhibit a decrease in productivity before the year of observed defoliation. We hypothesize that, if present, a decrease in productivity can be captured as a deviation from the average long-term productivity of a site using trend analysis of remote sensing data and growth signatures recorded in woody structure of affected plants.

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

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Many areas within designated priority habitats are currently in degraded condition due to various combinations of land use history, and improvement of range conditions should benefit ecosystem services for wildlife (including sage-grouse) and livestock. Specifically, improving the condition of sagebrush habitats within priority and general habitat areas is likely to provide durable conservation benefit and may be used to off-set effects of development and other land-uses. Project cooperators (e.g. land managers) would like tools to help target valuable habitat areas that also have high potential for cost-effective restoration or mitigation to inform planning and implementation across the landscape. USGS and other scientists (U. Wyoming and Colorado State U.) are working to develop a framework, and the data required, for a prioritization tool differentiating potential for successful restoration and mitigation projects across the landscape. The framework uses previously identified seasonal and protected habitat locations along with predictors of environmental conditions including sagebrush and herbaceous cover, soils (STATSGO), climate (e.g. PRISM, BioClim), and records from previous restoration efforts in conjunction to meet this objective. Preliminary results will be presented at The Wildlife Society of Wyoming – WLCI joint conference, December 1-3, in Lander.

### **31. 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**

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Power Company of Wyoming has proposed to construct the 1,000 turbine, 3,000 megawatt Chokecherry and Sierra Madre Wind Energy Project south of Rawlins, Wyoming. We are using a before-after-control-impact design to evaluate the impacts of wind energy development on greater sage-grouse. The research effort will compare pre- and post-construction habitat selection, population demographics, movement and distribution patterns, and lek attendance trends and dynamics. Our design calls for maintaining GPS-PTTs on 50 females and 50 males and 100 VHF transmitters on males and juveniles. Since 2010, we have collected >390,000 locations on tagged hens and >180,000 locations on tagged males; conducted lek counts on 50-58 leks; collected sightability data on leks; measured microsite vegetation at used and paired-random sites; and monitored survival and productivity of nests and broods. Pre-construction research efforts related to males have ceased and will resume upon the initiation of wind energy development activities if funding is available. All other aspects of the research effort, including female monitoring, are ongoing. We spent the last year analyzing data and developing manuscripts to be published in peer-reviewed journals. Manuscripts detailing brood-rearing site selection and sightability of males on leks were accepted to *Western North American Naturalist* and the *Journal of Wildlife Management*, respectively. Four other manuscripts (chick survival, nest selection/survival, male lek attendance, and male transitions between leks) have been submitted to peer-reviewed journals and are pending decision. We also completed a manuscript detailing interseasonal movements that is being reviewed by co-authors. We are currently developing survival, resource selection, and space use manuscripts that will be submitted this winter.

**Funded 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, SWCA Environmental Consultants.

### 32. EFFECTS OF LEK COUNT TIMING ON GREATER SAGE-GROUSE POPULATION TREND ESTIMATES

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Annual counts of males displaying at lek sites are an important tool for monitoring Greater Sage-grouse populations, but seasonal and diurnal variation in lek attendance may increase variance and bias of trend analyses. Recommendations for protocols to minimize observation error have called for restricting lek counts to within 30 min from sunrise, but this may limit the number of lek counts available for analysis, particularly from years before monitoring was widely standardized. Reducing the temporal window for conducting lek counts also may constrain the ability of agencies to monitor leks efficiently. We used lek count data collected across Wyoming during 1990–2014 to investigate the effect of including lek counts collected <60 and <90 min after sunrise on bias and precision of population trend estimates. We also used simulation based on a lek attendance model to compare observed and estimated values of annual change in population size ( $\lambda$ ) from scenarios of varying lek sample size,  $\lambda$ , lek count timing, and count frequency. Restricting analyses to counts conducted <30 min after sunrise generally did not improve precision or accuracy of population trend estimates. Simulation indicated that, despite declining lek attendance >30 min after sunrise, inclusion lek counts conducted up to 90 min after sunrise can increase lek sample size and result in greater precision compared to trend estimates based on counts from <30 min after sunrise. Increasing count frequency also improved precision. We submitted our results for peer-review in 2015, which have tentatively been accepted for publication.

**Funding provided by:** U.S. Geological Survey and Wyoming Landscape Conservation Initiative through USGS.

### 33. GREATER SAGE-GROUSE POPULATION RESPONSE TO GRAZING TIMING AND INTENSITY IN WYOMING

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Grazing may influence Greater sage-grouse population trends because herbaceous cover is important for nesting and brood rearing. However, sage-grouse population response to grazing management has yet to be evaluated across large spatial extents. We used grazing data collected by the Bureau of Land Management from grazing allotments across Wyoming to examine for sage-grouse responses to grazing timing and intensity, and interactions with vegetation productivity. We used annual counts of displaying males from 673 lek sites (2004-2014) and modeled population trends using state-space models in a Bayesian framework. Preliminary results indicate a positive response to sagebrush cover, whereas effects from grazing timing and intensity varied with vegetation productivity. Among drier sites with low vegetation productivity, early grazing was compatible with sage-grouse populations but at lower intensities; higher intensity grazing was permissible later in the growing season. Conversely, we found that late-season grazing among mesic sites, particularly at high intensities, had a negative effect on sage-grouse populations. While the exact mechanisms behind these trends remain to be tested at finer scales, our findings may inform future grazing management policies by BLM and other agencies, as well as on private lands. We will submit a manuscript for peer-review in late 2015.

**Funding provided by:** U.S. Geological Survey.

### **34. WHAT POTENTIAL MITIGATION AND RESTORATION SITES HAVE THE MOST POTENTIAL BENEFIT FOR GREATER SAGE-GROUSE?**

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

Preliminary occurrence models (81 sites plus WGFD data) show that amount and configuration of habitat, growing season precipitation, and wetness influence probability of lek occurrence. We are currently adding additional independent variables that represent different aspects of development (i.e., pipeline, compressor stations, power lines).

Preliminary genetic data (140 leks sampled) have high genetic diversity (alleles/locus= 13.6), high genetic structure ( $F_{st} = 0 - 0.236$ ;  $D_{ps} = 0.268 - 0.744$ ) and genetic connectivity influenced by geographic distance, sagebrush, topography and mean annual precipitation. Approximately 65% of the genetic data have been generated (~3000 extracted samples) and we are currently replicating genotypes to ensure high data quality. Both the occurrence (Objective 1) and connectivity model (Objective 2) will be completed in 2016. Occurrence (Objective 1) and functional connectivity (Objective 2) of sage-grouse will then 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 provided 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, WRRRC Reclamation Scholarship.

### **35. HIERARCHICAL CLUSTERING OF GREATER SAGE-GROUSE LEKS TO IMPROVE UPON THE DETECTION OF POPULATION PERSISTENCE, SINKS, AND SOURCES**

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Michael O'Donnell<sup>1</sup>, David Edmunds<sup>1,2</sup>, Cameron Aldridge<sup>1,2</sup>, and Julie Heinrichs<sup>1,2</sup>

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<sup>2</sup>Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, CO 80523

We are interested in understanding whether naïve hierarchical-clustering of leks based on landscape characteristics can better inform monitoring of Greater Sage-grouse abundance and long-term persistence of populations. Our objectives include: (1) identifying biologically important and relevant landscape surrogates; (2) developing hierarchical clusters; (3) identifying relevant spatial scales (six are tested) and configurations (six are tested); and (4) identifying appropriate cluster sizes driven by the data. Our study area includes the state of Wyoming. The multi-scaled statewide hierarchical clustering relies on a minimum spanning tree (MST, of graph theory) developed from Wyoming lek locations (vertices) and landscape surrogates (edges). A partitioning algorithm breaks the weakest edge, creating new MSTs, until we achieve an optimal number of clusters. We select the top model from of all spatial configurations by minimizing the within cluster heterogeneity and maximizing the between cluster heterogeneity (AIC<sub>c</sub> selection). We have completed objectives 1-4 for the level one clusters and we are currently working through the analysis and model selection of the level two hierarchical clusters. Future efforts will (1) apply rigorous simulations for sensitivity analysis between the top cluster models and sage-grouse management zones (see “Multi-scale statewide Wyoming Greater Sage-grouse trends determined by population viability analysis” by Edmunds et al.), (2) extend these methods range-wide, and (3) evaluate the clusters with genetic similarities and dissimilarities as this data becomes available.

**Funding provided by:** U.S. Geological Survey.

### **36. PROBING THE SAGE-GROUSE GENOME FOR SIGNATURES OF ADAPTIVE GENETIC VARIATION**

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Identifying and maintaining genetic adaptations to environmental variation is key for developing sound conservation and management strategies, especially in species that occur across ecologically diverse ranges. Genomics can greatly augment our ability to precisely characterize the genetic basis of important adaptations within extant populations. We recently produced the first draft whole-genome sequence for sage-grouse and are in the process of sequencing additional greater sage-grouse DNA samples from across the species range. Leveraging these whole-genome sequences as a reference, we are using a landscape genomics approach to scan for genetic loci correlated with environmental variables across Wyoming. The genetic analyses are being carried out on Wyoming sage-grouse blood and muscle samples already housed in the FORT Molecular Ecology Lab archives. Ecological data will be obtained from recently-developed fine-scale sagebrush mapping products, and climate data will be pulled from WorldClim databases. We are also using a candidate gene approach to examine putative adaptations to consumption of different sagebrush species that occur across Wyoming, some of which exhibit distinct profiles of toxic secondary metabolites. Recent work has highlighted metabolic pathways in sage-grouse that appear highly efficient at breaking down these toxic compounds, suggesting that some populations might carry unique genetic adaptations for particular forage species.

**Funding provided by:** USGS.

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

**Principal Investigator:** Gail Patricelli, Professor, Dept. Evolution and Ecology, University of California, Davis; Email: [gpatricelli@ucdavis.edu](mailto: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. 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.

**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.

### **38. MODELING SAGE-GROUSE HABITAT SUITABILITY IN THE THUNDER BASIN, WYOMING**

**Contact:** Dave Pellatz; E-mail: [dave.pellatz@tbgpea.org](mailto:dave.pellatz@tbgpea.org); Phone: (307) 359-1328

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

Initial work began with collating, analyzing, and calibrating the input data for the habitat model. A series of tests was run to determine the minimum sage-grouse sample size necessary for adequate habitat suitability analysis. There were too few observations to perform the analysis on an annual basis and winter sample sizes were too inconsistent for accurate winter habitat analysis. After removing winter points, the remaining data was binned by years when the population increased and years when the population decreased while keeping the breeding and summer seasonal subsets. This increased the sample size, thus producing better preliminary results, while maintaining some variation on sage-grouse population trends. Preliminary covariate inputs were then investigated. These included environmental covariates (net primary production, soil moisture, precipitation, minimum temperature, maximum temperature, slope, aspect, elevation, percent wetland, percent forest, percent bare shrub, percent bare ground) as well as human-related covariates (distance from paved roads, distance from unpaved roads, distance from oil and gas wells, distance from wind turbines, distance from active mines). Consistent trends were found with most of the individual environmental covariates, indicating that the data being used will work well in the final RSPF analysis. However, significant bias was found in the human-related covariates, primarily the proximity to roads data. Discreet, unchanging anthropogenic features, such as wind turbines, also did not perform well during the initial analysis. Techniques to overcome these problems are being investigated. Additional environmental covariates, such as sagebrush patch size, are also being tested to further improve model estimates.

**Funding/In-Kind:** Arch Coal, Cloud Peak Energy, Peabody Energy, NE Wyoming Sage-grouse Working Group, Thunder Basin Grasslands Prairie Ecosystem Association, USDA-Forest Service.

### 39. USING ASSISTED SUCCESSION TO IMPROVE SAGE-GROUSE HABITAT IN HIGH CONFLICT AREAS OF THE BIG HORN BASIN, WY

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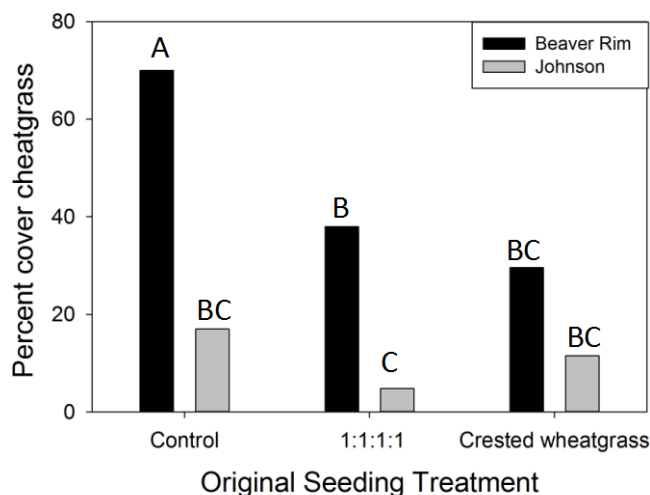
Recent research has documented excellent survival (100%) and growth using container grown Wyoming big sagebrush. Additionally, mine operators have observed good survival rates of the perennial species crested wheatgrass, blue grama, bottlebrush squirreltail and slender wheatgrass when direct seeded into cheatgrass infested areas. The 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 (Johnson and Beaver Rim) 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.

#### Results – July 2014



#### **40. HABITAT USE AND REPRODUCTIVE SUCCESS OF GREATER SAGE-GROUSE IN BIGHORN BASIN**

**Contacts:** 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](mailto:jimmy.d.taylor@aphis.usda.gov) and Dr. R. Douglas Holt, Department of Forest Ecosystems and Society, Oregon State University, 321 Richardson Hall, Corvallis, Oregon, 97331; E-mail: [doug.holt@oregonstate.edu](mailto: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 2011, we have used VHF and Argos telemetry to monitor hen movement, hen survival, and cause-specific mortality across five study sites in the Big Horn Basin. Over 5 breeding seasons, approximately 313 female grouse (202 adult and 111 juvenile) were radio-marked and released at leks. 204 nests were detected and monitored with motion sensing cameras from 2011-2014. 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. Based on population modelling using demographic parameters collected during this study, sage-grouse populations are increasing on 3 of 4 study areas and one local population is declining. The likely limiting factor in this population is low nest survival due to increased nest depredation by common ravens relative to the other sites in this study. Further research is required to determine the magnitude and mechanism of raven impacts on the Polecat Bench sage-grouse population and to develop management activities to mitigate these impacts.

**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 was provided by USDA-Wildlife Services, NW District specialists.

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

**Principal Investigator:** Dr. Brett L. Walker, Colorado Parks and Wildlife, Grand Junction, Colorado. Phone: 970-255-6125. E-mail: [brett.walker@state.co.us](mailto:brett.walker@state.co.us)

Implementing effective monitoring and mitigation is crucial for conserving populations of greater sage-grouse (*Centrocercus urophasianus*). Despite relying on untested assumptions, lek-count data are widely used as an index of sage-grouse abundance by state and federal agencies to monitor sage-grouse populations. Buffers around lek locations are also commonly used to identify and protect important sage-grouse habitat. However, the reliability and effectiveness of current 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 (fall 2010-spring 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, but we continued to monitor GPS males through June 2014 to obtain an additional year of data on survival, lek attendance, between-year inter-lek movements, and habitat use. Analyses for this project are ongoing.

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

## **42. ENHANCING FITNESS OR GIZZARD ENVY: ARE SAGE-GROUSE SELECTING WINTER HABITATS IN SOUTHWESTERN WYOMING WITH AN EYE TOWARDS EATING DIRT?**

**Contact:** Mr. Dale Woolwine; E-mail: [dwoolwin@blm.gov](mailto:dwoolwin@blm.gov); Phone: (307) 367-5363  
Dale Woolwine and Josh Hemenway: Bureau of Land Management Pinedale Field Office  
Bryan Bedrosian: Teton Raptor Center  
Matt Holloran: Wyoming Wildlife Consultants, LLC

Geophagy – or the intentional consumption of soil by vertebrates – has been recorded for a wide range of bird and mammal taxa and 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). However, most soils consumed by wild birds show that they prefer soils with high clay content suggesting that detoxification of plant secondary compounds may be an important function of the behavior. During the 2012-13 winter, managers working for the BLM in Pinedale documented sage-grouse congregating in distinct, relatively small areas and pecking at the dirt. Opportunistic searching for new sites was intensified during the 2013-14 winter, and 14 locations where geophagy was occurring were identified in the Upper Green River Basin (UGRB) of southwestern Wyoming. In fall 2014 we initiated the first year of a telemetry study to assist in identifying more geophagy locations in the UGRB; this effort was combined with an effort to document habitat use and movements of sage-grouse utilizing the Bridger-Teton National Forest. GPS movement data from >30 marked grouse are being compiled to investigate geophagy of sage-grouse on winter range in the Pinedale/Big Piney regions of the Upper Green River Drainage. Motion-activated cameras will be used to verify geophagy sites identified with telemetry data, and to document general numbers of sage-grouse using each distinct area and the consistency of this use. This effort represents the first of several phases meant to address the overriding goal assessing how important the availability and distribution of sites suitable for geophagy are to sage-grouse selection of winter/early spring habitats in western Wyoming.

**Funding provided by:** The Upper Green River Basin Sage-grouse Local Working Group, the Wyoming Landscape Conservation Initiative, the Wyoming State Office of the Bureau of Land Management, and the Wyoming Agriculture Producer Research Grant Program. Sage-grouse radio-collared as part of another study in the Upper Green are being used for this study and include funding provided by the Snake River Basin and Southwest Wyoming Sage-grouse Local Working Groups, and the Bridger-Teton National Forest (see Bedrosian, Woolwine and Roberts abstract).

**Attachment E.**  
**Wyoming Sage-Grouse Research Reports (through May 31, 2016)**

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.

Brooks, M.L., Matchett, J.R., Shinneman, D.J., and Coates, P.S., 2015, Fire patterns in the range of greater sage-grouse, 1984–2013—Implications for conservation and management: U.S. Geological Survey Open-File Report 2015-1167, 66 p., <http://dx.doi.org/10.3133/ofr20151167>.

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

Period Covered:  
**June 1, 2015 – May 31, 2016**

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

**December 28, 2016**

# Sage Grouse Job Completion Report

Year: 2007 - 2016, 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)
2007	203	55	27	2433	45.9
2008	209	62	30	2226	37.1
2009	210	60	29	1611	29.3
2010	213	109	51	2485	27.0
2011	216	103	48	1670	19.9
2012	216	77	36	1222	20.0
2013	220	77	35	969	16.4
2014	221	86	39	1261	19.4
2015	220	100	45	2779	32.3
2016	218	86	39	2893	40.2

### b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2007	203	110	54	2913	36.9
2008	209	102	49	2031	27.4
2009	210	98	47	1663	23.4
2010	213	63	30	852	17.8
2011	216	93	43	895	14.9
2012	216	90	42	779	13.0
2013	220	98	45	786	13.8
2014	221	120	54	912	13.4
2015	220	94	43	1647	26.1
2016	218	98	45	2183	32.6

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: 2007 - 2016, 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)
2007	203	165	81	5346	40.5
2008	209	164	78	4257	31.8
2009	210	158	75	3274	26.0
2010	213	172	81	3337	23.8
2011	216	196	91	2565	17.8
2012	216	167	77	2001	16.5
2013	220	175	80	1755	15.1
2014	221	206	93	2173	16.3
2015	220	194	88	4426	29.7
2016	218	184	84	5076	36.5

#### d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2007	134	6	25	140	95.7	4.3
2008	135	17	12	152	88.8	11.2
2009	129	16	13	145	89.0	11.0
2010	142	12	18	154	92.2	7.8
2011	158	31	7	189	83.6	16.4
2012	131	25	11	156	84.0	16.0
2013	122	40	13	162	75.3	24.7
2014	137	49	20	186	73.7	26.3
2015	152	32	10	184	82.6	17.4
2016	141	23	20	164	86.0	14.0

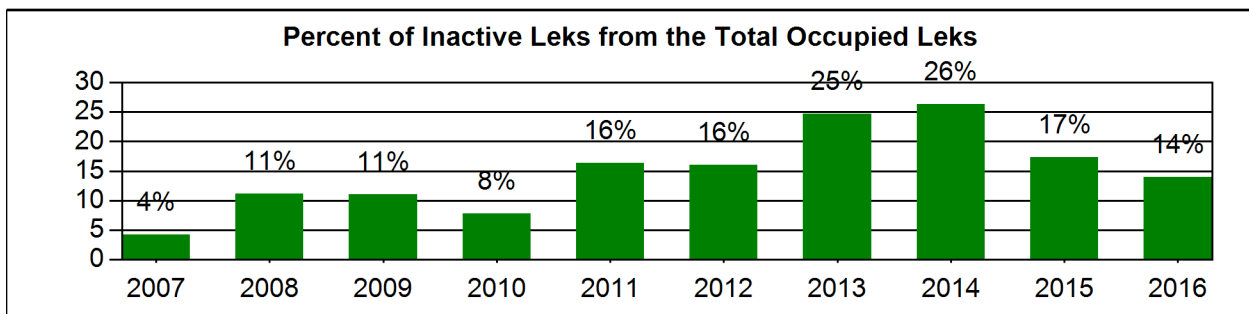
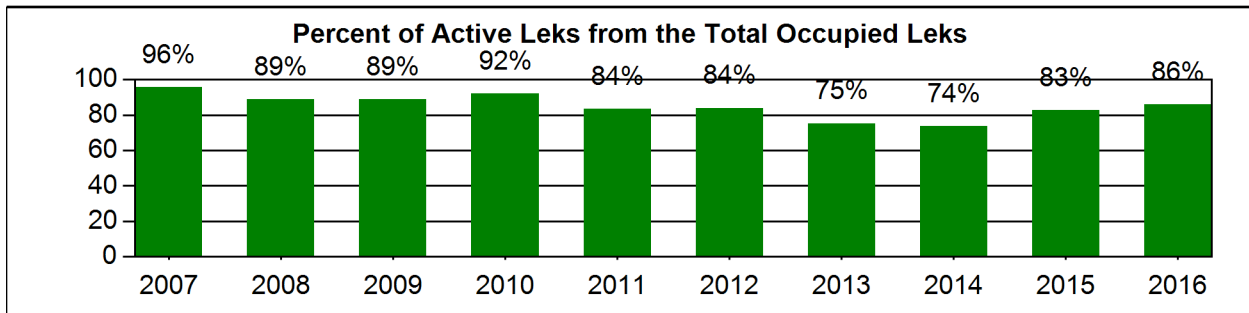
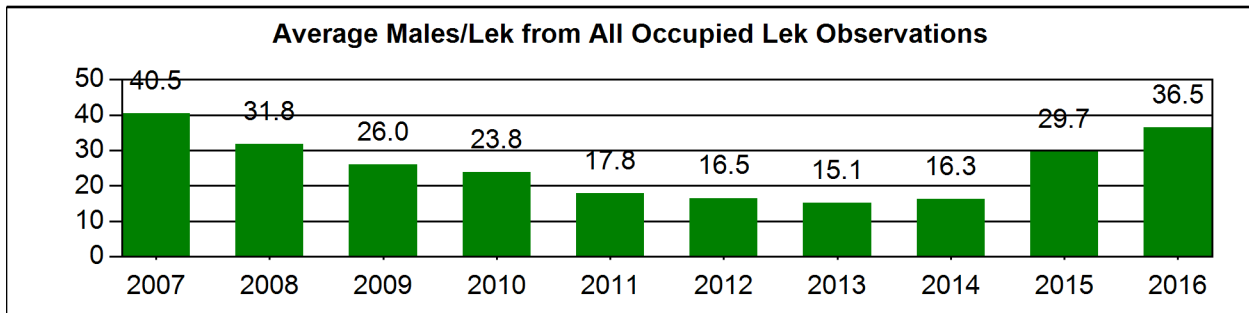
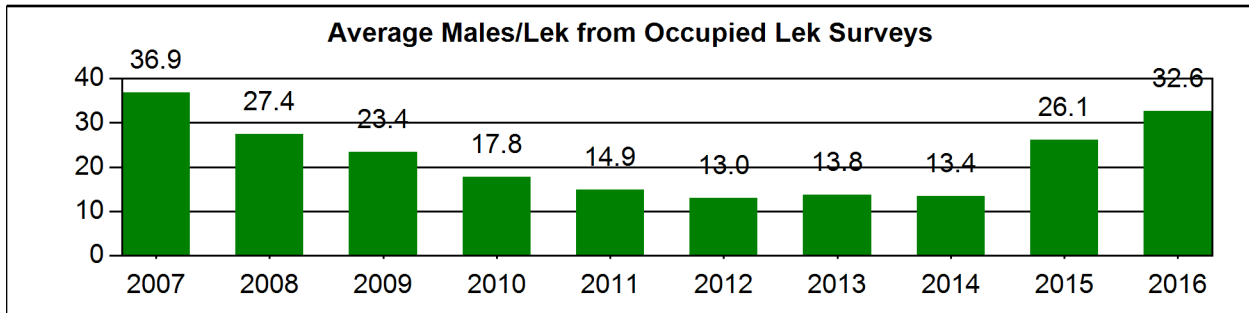
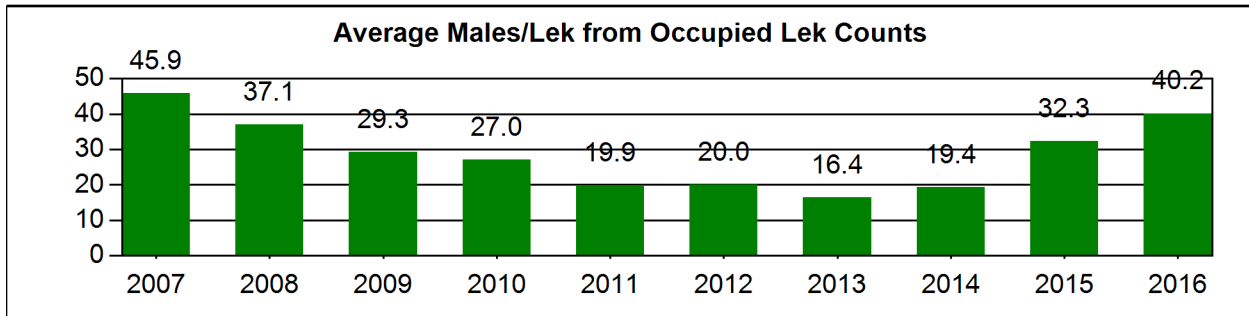
1) Occupied - Active during previous 10 years (see official definitions)

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: 2007 - 2016, Working Group: Bates Hole



## Sage Grouse Job Completion Report

Year: 2006 - 2015, Working Group: Bates Hole

### 4. Sage Grouse Hunting Seasons and Harvest Data

#### a. Season

Year	Season Start	Season End	Length	Bag/Possesion Limit
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
2015	Sep-19	Sep-30	12	2/4

#### b. Harvest

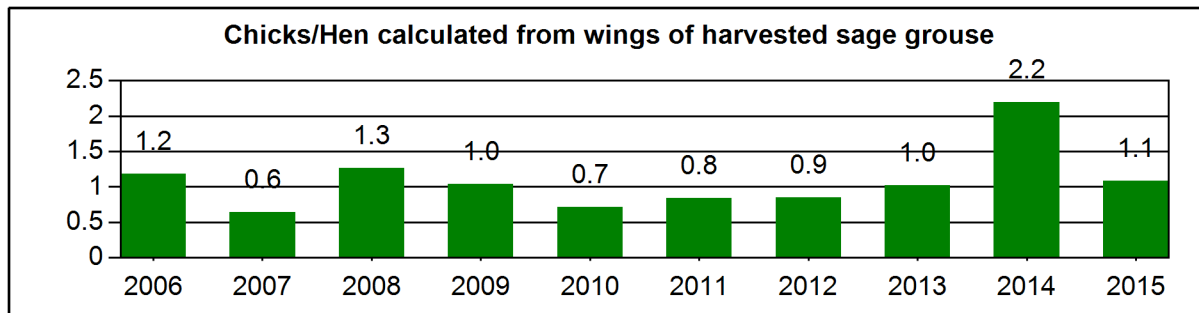
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2006	1672	717	1169	1.4	2.3	1.6
2007	1365	655	1155	1.2	2.1	1.8
2008	1295	654	1161	1.1	2.0	1.8
2009	1026	532	956	1.1	1.9	1.8
2010	1027	480	1001	1.0	2.1	2.1
2011	1117	514	981	1.1	2.2	1.9
2012	688	415	852	0.8	1.7	2.1
2013	488	399	670	0.7	1.2	1.7
2014	588	352	804	0.7	1.7	2.3
2015	837	380	889	0.9	2.2	2.3
Avg	1,010	510	964	1.0	1.9	1.9

## Sage Grouse Job Completion Report

Year: 2006 - 2015, 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	
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
2015	253	14.6	31.6	5.5	6.7	22.9	18.6	1.1



## **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 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 a series of Governor's Sage Grouse Executive Orders. This strategy enhances protections to sage-grouse within delineated core areas, which were further refined in 2015 (Wyoming Executive Order 2015-4). 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

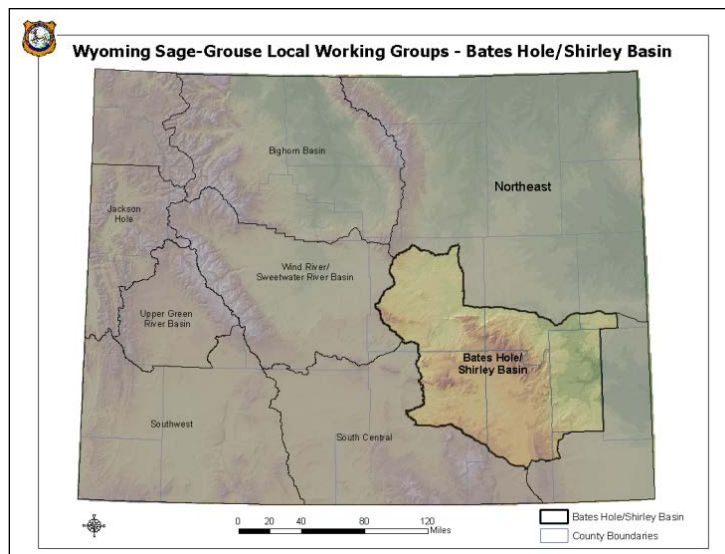
strategies dating back to the mid-1990's. Within sage-grouse populations having less than 100 males attending leks, hunting seasons should be closed to prevent additive mortality on small, isolated populations (BHSBLWG 2007). Hunting seasons have thus been closed in Niobrara, Platte, Goshen and Laramie 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. Harvest mortality within these small populations 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. 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**

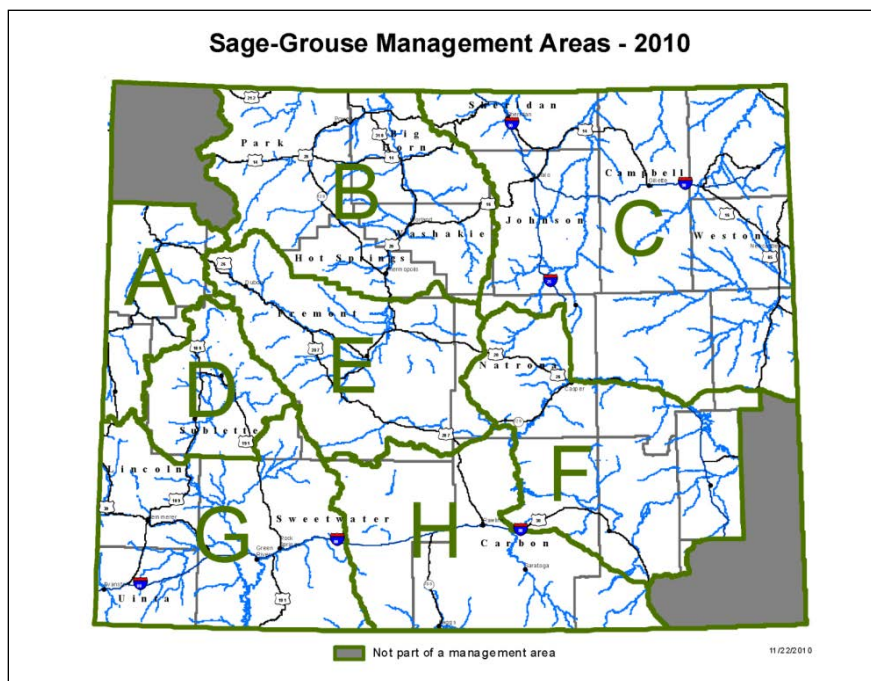
The BHSBLWG area includes Bates Hole, the Shirley Basin, the Rattlesnake Hills, the southern Bighorn Mountains, the Laramie Range, and isolated occupied habitats in southern Niobrara and Platte County (Figure 1). Political jurisdictions include Albany, Carbon, Converse, Laramie, Natrona, Niobrara, and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

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



The BHSBLWG area equates to 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 2016, there are 229 known occupied leks, 60 unoccupied leks, and 21 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.

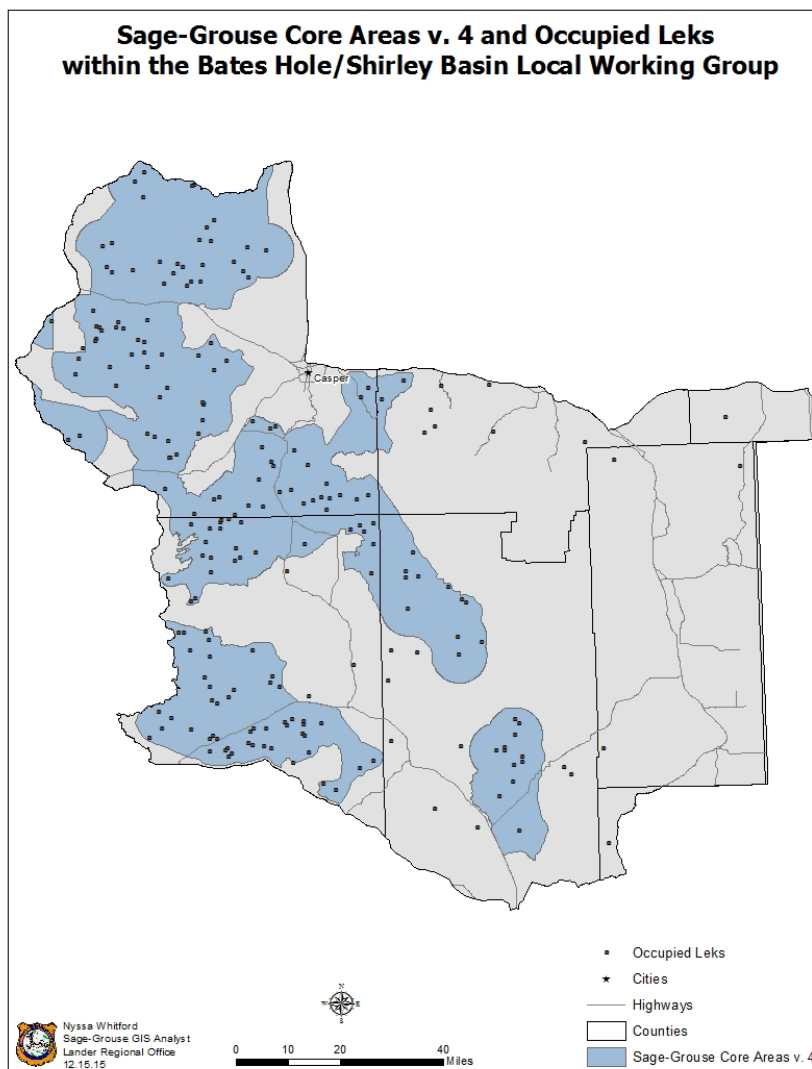


Figure 4. Sage-grouse lek demographics within the BHSBLWG area, 2016.

<b>Sage Grouse Lek Characteristics</b>					
<b>Working Group: Bates Hole</b>					
Region	Number	Percent	Working Group	Number	Percent
Casper	121	39.2	Bates Hole	309	100.0
Lander	2	0.6			
Laramie	186	60.2			
Classification	Number	Percent	BLM Office	Number	Percent
Occupied	228	73.8	Casper	122	39.5
Undetermined	21	6.8	Lander	2	0.6
Unoccupied	60	19.4	Newcastle	1	0.3
			Rawlins	184	59.5
Biologist	Number	Percent	Warden	Number	Percent
Casper	112	36.2	Cheyenne	2	0.6
Douglas	8	2.6	Douglas	3	1.0
Laramie	108	35.0	East Casper	36	11.7
Saratoga	71	23.0	East Rawlins	2	0.6
Sinclair	2	0.6	Elk Mountain	69	22.3
Wheatland	8	2.6	Glenrock	7	2.3
			Lusk	1	0.3
			Medicine Bow	70	22.7
			North Laramie	39	12.6
			West Casper	74	23.9
			Wheatland	6	1.9
County	Number	Percent	Land Status	Number	Percent
Albany	75	24.3	BLM	101	32.7
Carbon	107	34.6	BOR	1	0.3
Converse	10	3.2	Private	183	59.2
Laramie	2	0.6	State	24	7.8
Natrona	108	35.0			
Niobrara	1	0.3			
Platte	6	1.9			
Management Area	Number	Percent	Lek Status	Number	Percent
F	309	100.0	Active	159	51.5
			Inactive	77	24.9
			Unknown	73	23.6

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 2016, WGFD personnel, BLM personnel, volunteers and consultants combined efforts to check 184 of the 218 (84%) known occupied leks in the BHSBLWG area. Eighty-six leks were counted while 98 leks were surveyed in 2016. A total of 164 occupied leks were checked with annual status being confirmed. Of these, 141 (86%) were active and 23 (14%) were inactive.

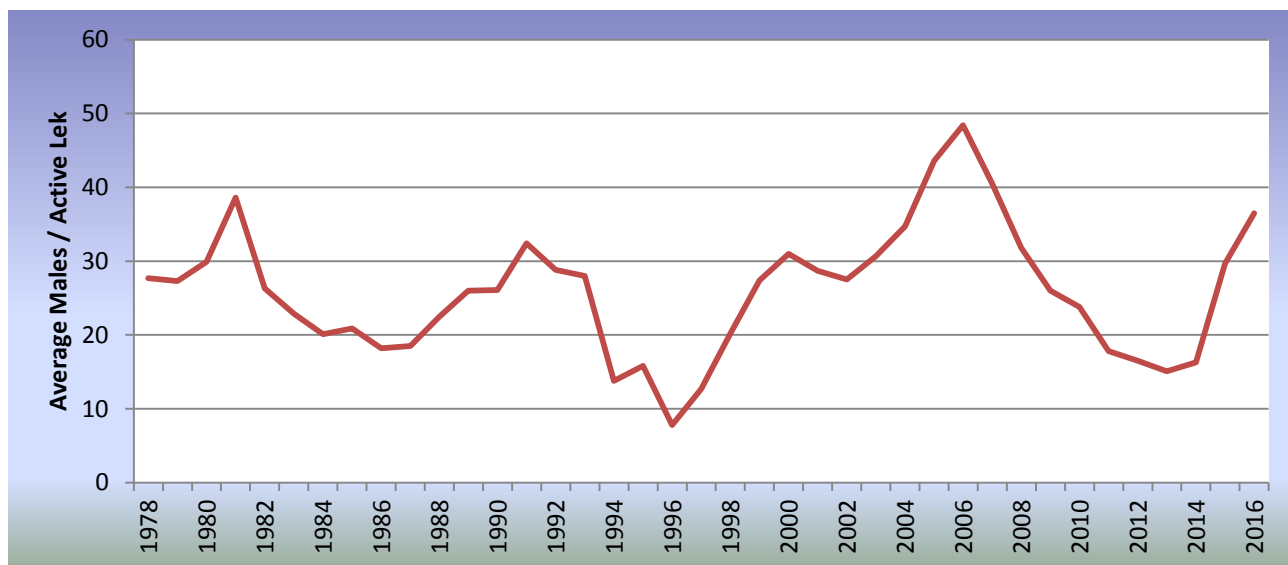
It is important to consider trends in the numbers of active versus inactive leks in addition to average male lek attendance. During a period of population decline, male lek attendance decreases while the number of inactive leks typically increases. The converse occurs with an increasing population. The percent of active occupied leks (that were checked) generally decreased in the BHSBLWG area as sage-grouse numbers declined from 2006 – 2013. However, the 2016 percentage of active occupied leks (86%) increased for the third straight year as this population has grown since 2014. In addition, some new leks have been discovered in the past three years while other smaller leks have again become active after recent periods of inactivity. 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 occupied leks checked ranging from 203 – 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.

### ***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, 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 over time to estimate population trend. 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.

Despite the aforementioned considerations regarding the interpretation of male lek attendance data, 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 that time frame within the BHSBLWG area (Figure 5).

Figure 5. Mean number of peak males per active lek checked within the BHSBLWG area, 1978 – 2016.



\*From 1978-1983, an average of 93 leks were checked each year.

\*From 1984-1991, an average of 78 leks were checked each year.

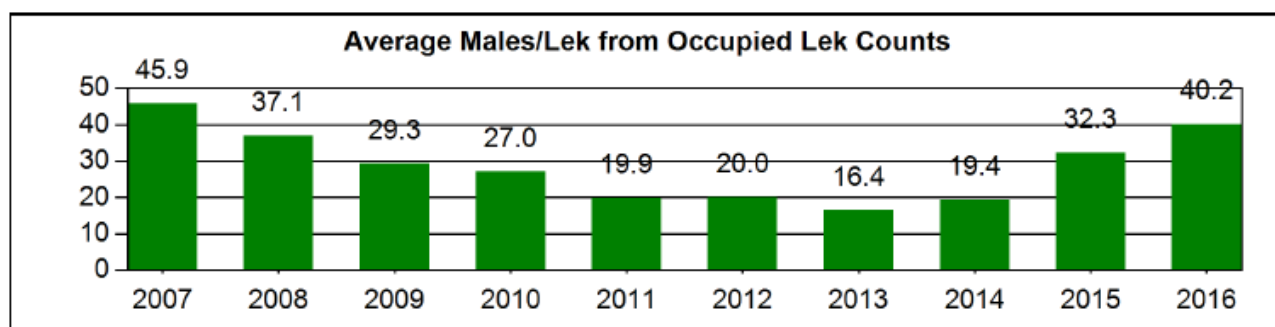
\*From 1992-1995, an average of 33 leks were checked each year.

\*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 increased significantly over the past three years based on the mean maximum number of males observed per counted lek (Figure 6). The average number of males observed per count lek last peaked in 2006 (mean = 63), and subsequently declined each year to a nadir of 16.4 in 2013. Male lek attendance has since increased, with the average number of peak males observed per count lek increasing to 40.2 in 2016. 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, 2007 – 2016.



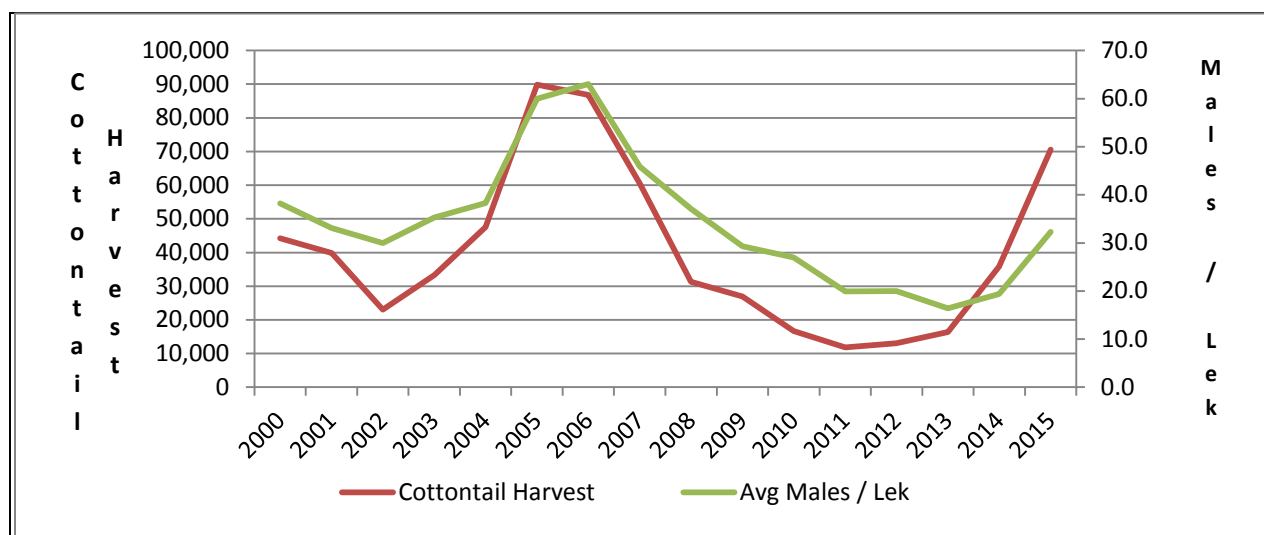
### ***Productivity***

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 and sample sizes are low. 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 within the BHSBLWG area, chick productivity was excellent in 2014 with an observed 2.2 chicks per hen, which allowed for significant population increase. However, chick production declined in 2015 to 1.1 chicks per hen, which indicates this population will likely decrease in the near future. 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). Based on male lek attendance data, sage-grouse populations increased through 2016 in the BHSBLWG area. Although the 2015 ratio of chicks per hen in the wing barrel data is below what is generally needed for population maintenance and/or growth, the effects of poor chick production/survival will not manifest immediately in terms of lek attendance as this population has been growing in recent years. Reasons for the decline in brood productivity/survival in 2015 are unknown. Cold wet weather following peak hatch may have led to some chick mortality, although this cannot be quantified.

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 three years. Within the BHSBLWG area, both sage-grouse populations and cottontail rabbit densities increased through 2006, subsequently declined, and are now increasing (Figure 7). 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. 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 three years. Although outside of this reporting period, WGFD personnel observations indicate cottontail densities continued to be extremely high during the summer and fall of 2016.

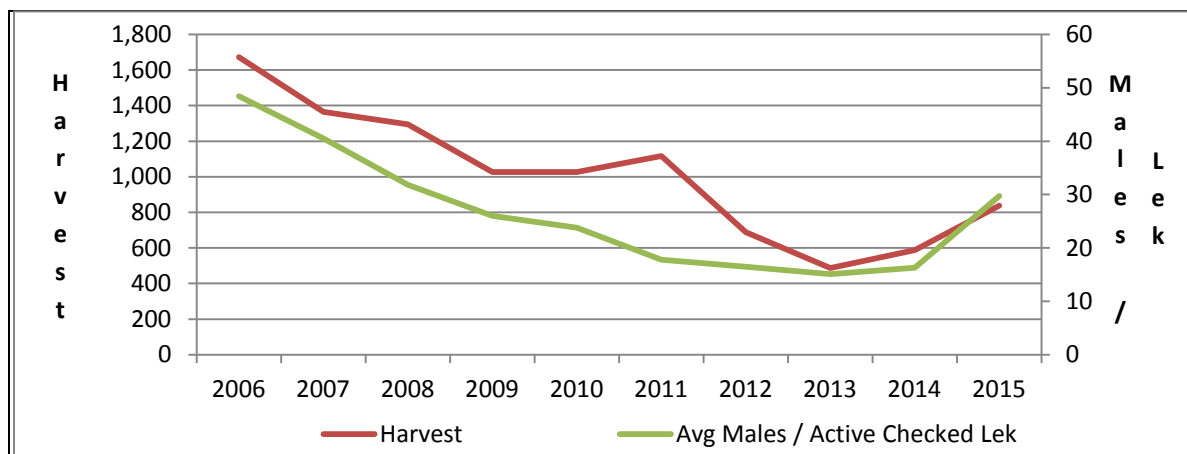
Figure 7. Statewide Wyoming Cottontail Harvest and Average Males/Lek (BHSBLWG), 2000 – 2015.



### 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 2015, harvest increased to 837 sage-grouse in the BHSBLWG area as this population has increased over the past 3 years. 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, 2006 – 2015.



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).

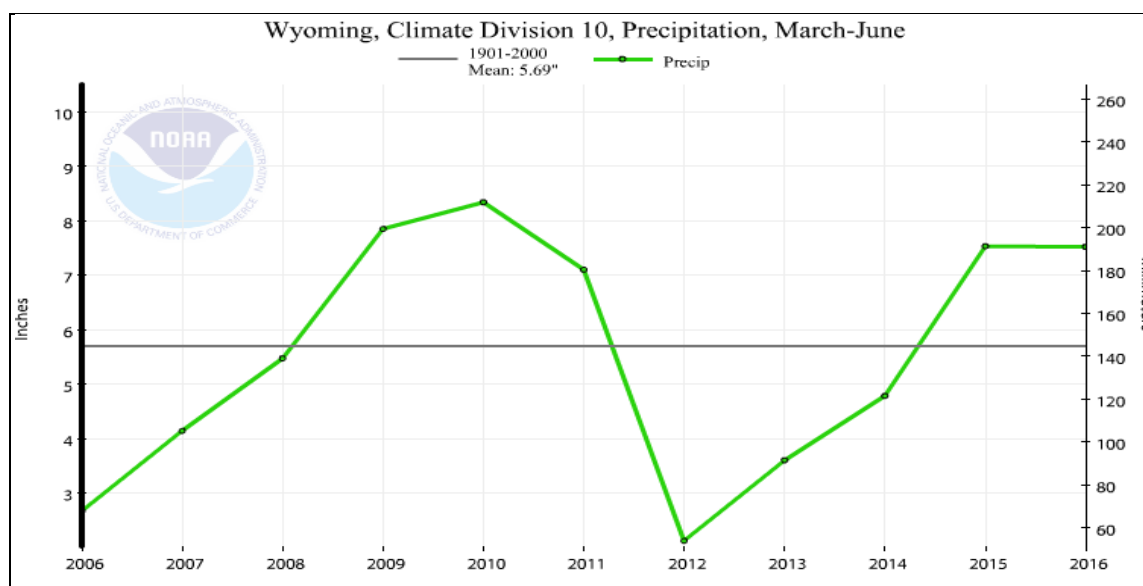
### ***Habitat***

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 2015 (Figure 9). This resulted in excellent sagebrush leader growth and herbaceous vegetation production in 2015, which benefitted rangeland health within sagebrush communities. Reasons for decreased chick production / survival in 2015 are unknown as no abnormally cold, wet weather conditions prevailed during the peak hatching period. The spring of 2016 also experienced fairly wet conditions, which will certainly benefit sagebrush ecosystems over the coming year.

Figure 9. NOAA Precipitation Data for the Upper North Platte drainage, Wyoming Climate Division 10, 2006-2015 (<http://www.ncdc.noaa.gov/cag/time-series/us>).



### *Special Studies*

Western EcoSystems Technology, Inc. provided a final completion report on the effects of wind energy development on sage-grouse habitat selection and population demographics for the Simpson Ridge Wind Energy Project, Carbon County, Wyoming (LeBeau et al. 2016). 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 continued through 2015. 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) with additional publications in preparation.

### *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 three 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](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.**

<b>Project Name</b>	<b>Budget Biennium</b>	<b>Conservation Funding</b>	<b>Project Description</b>	<b>Partners</b>
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 deterrents 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
GSG Educational Exhibit	2017-18	\$3,325 approved	Sagebrush ecosystem education program for schools	Audubon
Audubon Sagebrush Explorers Education	2017-18	\$17,500 approved	Sagebrush ecosystem education program for schools and museums	Audubon
Response of GSG to Treatments*	2017-18	\$40,000 approved	Research to determine sage-grouse demographic and habitat use response to sagebrush treatments	University of Wyoming (Dr. Jeff Beck)
Habitat Quality Relative to Predators*	2017-18	\$20,000 approved	Research to determine sage-grouse demographic and habitat use response to differing predator densities	University of Wyoming (Dr. Jon Dinkins)
Stonehouse Cheatgrass Treatment	2017-18	\$2,500 approved	Experimentally treat cheatgrass with bio-control (bacteria) in sage-grouse habitat to promote rangeland health and restore perennial grass cover and forb production	WGFD

Schnoor Cheatgrass Treatment	2017-18	\$2,500 approved	Experimentally treat cheatgrass with bio-control (bacteria) in sage-grouse habitat to promote rangeland health and restore perennial grass cover and forb production	WGFD
Sandhills Cheatgrass Treatment	2017-18	\$2,500 approved	Experimentally treat cheatgrass with bio-control (bacteria) in sage-grouse habitat to promote rangeland health and restore perennial grass cover and forb production	WGFD
Seepie Springs Sagebrush Thinning	2017-18	\$19,750 approved	Mechanically treat dense high canopy coverage sagebrush in snow accumulation zones to open canopy and promote brood rearing habitat	WGFD
Natrona County Cheatgrass Treatment	2017-18	\$17,925 approved	Treat cheatgrass in sage-grouse habitat to promote rangeland health and restore perennial grass cover and forb production	BLM
Bates Juniper Treatment	2017-18	\$20,000 approved	Mechanically (with some fire) thin juniper to enhance watershed function and promote herbaceous forage production in key sage-grouse habitats	BLM

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

Big Horn Basin  
Sage-Grouse  
Job Completion Report  
2015

June 2015-May 2016

Leslie Schreiber  
Wyoming Game & Fish Dept.  
Cody Region

# Cody Region Sage-Grouse Job Completion Report

Conservation Plan Area: **Big Horn Basin**

Period Covered: **6/1/2015 – 5/31/2016**

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. In September 2015, the USFWS issued a decision finding that sage-grouse were not warranted for listing under the Endangered Species Act.

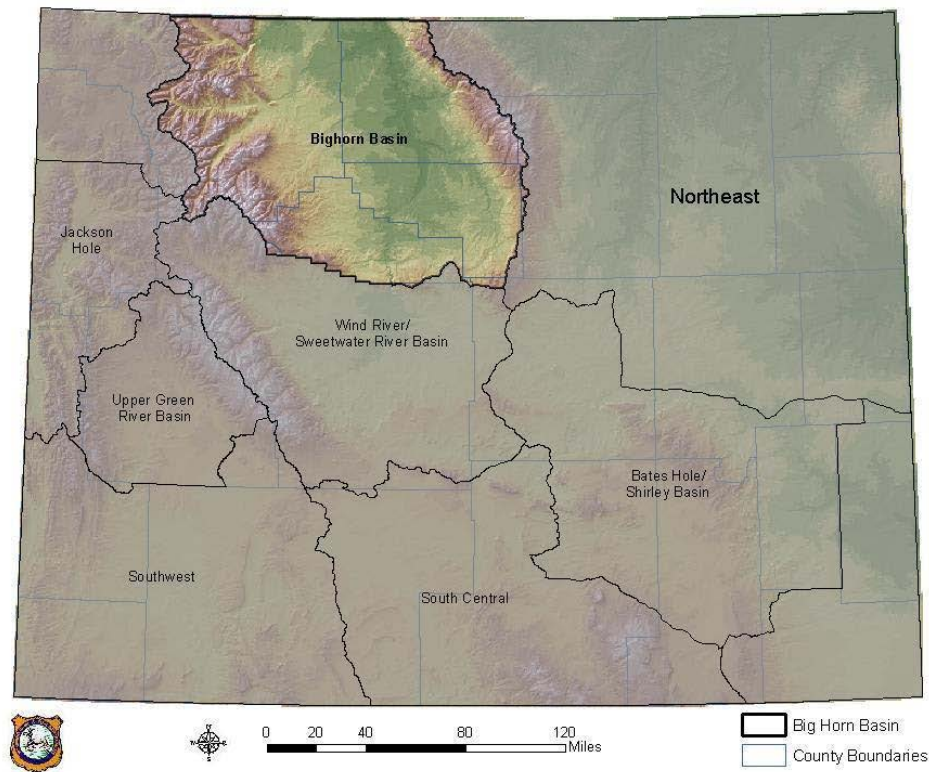
This report summarizes conservation efforts and data collected on sage-grouse in the Big Horn Basin during the 2015 biological year (1 June 2015 – 31 May 2016), including lek surveys conducted during the 2016 breeding season.

## 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. 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 2016, 307 sage-grouse leks are known to occur in the conservation area with 252 leks known to be occupied and 29 leks known to be unoccupied (Table 1). Undetermined leks ( $n=26$ ) 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).

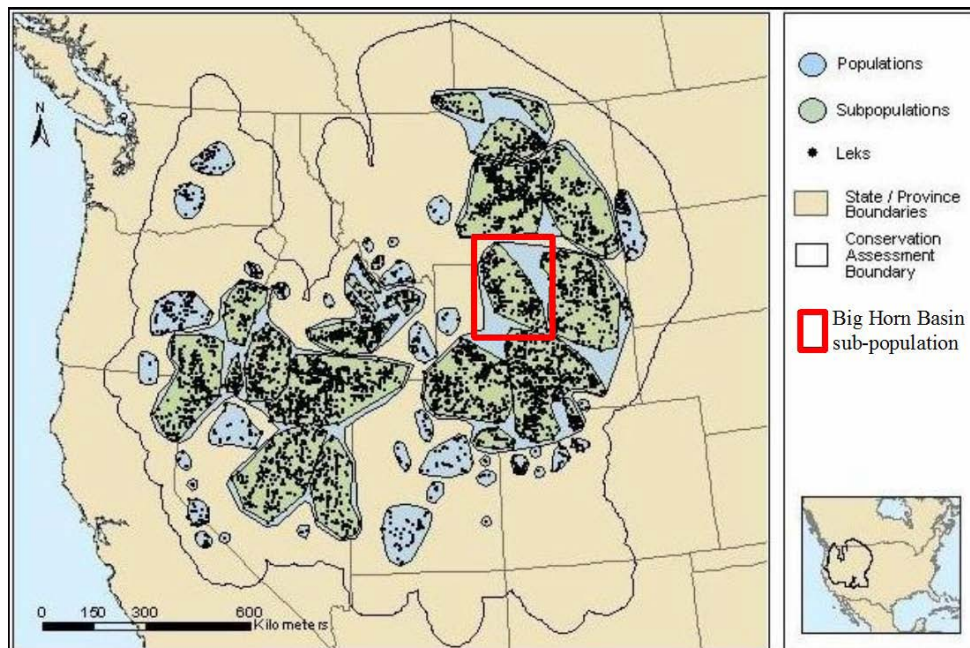


Table 1. Lek classifications in the Big Horn Basin by activity, ownership and geopolitical boundaries, 2016.

Region	Number	Percent	Working Group	Number	Percent
Cody	307	100.0	Big Horn Basin	307	100.0
Classification	Number	Percent	BLM Office	Number	Percent
Occupied	252	82.1	Cody	113	36.8
Undetermined	26	8.5	Worland	194	63.2
Unoccupied	29	9.4			
Biologist	Number	Percent	Warden	Number	Percent
Cody	84	27.4	Greybull	23	7.5
Greybull	52	16.9	Lovell	30	9.8
Worland	171	55.7	Meeteetse	32	10.4
			North Cody	24	7.8
			Powell	13	4.2
			South Cody	28	9.1
			Ten Sleep	53	17.3
			Thermopolis	45	14.7
			Worland	59	19.2
County	Number	Percent	Land Status	Number	Percent
Big Horn	48	15.6	BLM	206	67.1
Hot Springs	58	18.9	BOR	3	1.0
Park	103	33.6	Private	78	25.4
Washakie	98	31.9	State	20	6.5
Management Area	Number	Percent	Lek Status	Number	Percent
B	307	100.0	Active	189	61.6
			Inactive	60	19.5
			Unknown	58	18.9

## 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 Handbook of Biological Techniques (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  $\geq 1$  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 2016, 86 leks were counted in the Basin, resulting in an average of 30.1 males per lek (Table 2a). We surveyed 138 leks (2007-16 average=113; Table 2b), for a total of 224 leks checked during the 2016 season (2007-16 average=181; 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 continued rising in 2016 to 26.7 males, up from 21.6 males 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 24 in 2015 to 26 in 2016. We attribute this increase to personnel expending greater effort to classify the lek as active or inactive. The number of active leks (n=171) and the number of inactive leks (n=26) are the highest in the last 10 years, but the number of unknown leks (n=27) is average (Table 2d). With 3 years of data indicating an increase in sage-grouse abundance, the negative trend from 2007-2013 has been reversed (Figure 4).

Table 2 (a-d). Lek attendance summary of occupied<sup>1</sup> leks in the Big Horn Basin, 2007-2016.

**a. Leks Counted**

Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek <sup>2</sup>
2007	204	72	35	1901	28.4
2008	217	96	44	2083	24.8
2009	218	74	34	1717	25.6
2010	223	74	33	1495	21.7
2011	231	64	28	905	16.2
2012	234	53	23	816	16.7
2013	236	42	18	501	12.5
2014	234	68	29	824	14.2
2015	246	53	22	1108	26.4
2016	253	86	34	2230	30.1

**b. Leks Surveyed**

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek <sup>2</sup>
2007	204	82	40	1550	22.1
2008	217	79	36	1121	16.7
2009	218	95	44	1244	18.6
2010	223	109	49	1243	15.0
2011	231	121	52	989	12.8
2012	234	126	54	777	8.8
2013	236	148	63	750	8.2
2014	234	90	38	517	9.2
2015	246	139	57	2266	20.2
2016	253	138	55	2013	23.7

**c. Leks Checked**

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek <sup>2</sup>
2007	204	154	75	3451	25.2
2008	217	175	81	3204	21.2
2009	218	169	78	2961	22.1
2010	223	183	82	2738	18.0
2011	231	185	80	1894	14.2
2012	234	179	76	1593	11.6
2013	236	190	81	1251	9.5
2014	234	158	68	1341	11.8
2015	246	192	78	3374	21.9
2016	253	224	89	4243	26.7

**d. Lek Status**

Year	Active	Inactive <sup>3</sup>	Unknown	Known Status	Percent Active	Percent Inactive
2007	136	4	14	140	97.1	2.9
2008	148	6	21	154	96.1	3.9
2009	130	10	29	140	92.9	7.1
2010	146	8	29	154	94.8	5.2
2011	130	9	46	139	93.5	6.5
2012	144	6	29	150	96.0	4.0
2013	133	7	50	140	95.0	5.0
2014	116	22	20	138	84.1	15.9
2015	155	24	13	179	86.6	13.4
2016	171	26	27	197	86.8	13.2

<sup>1</sup>Occupied – Active during previous 10 years (see official definitions in Christiansen 2012)

<sup>2</sup>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.

<sup>3</sup>Inactive – Confirmed no birds/sign present (see official definitions in Christiansen 2012)

Figure 3. Average number of male sage-grouse observed per lek in the Big Horn Basin by counts, surveys and all observations, and percent active and inactive leks from total leks checked, 2007-16.



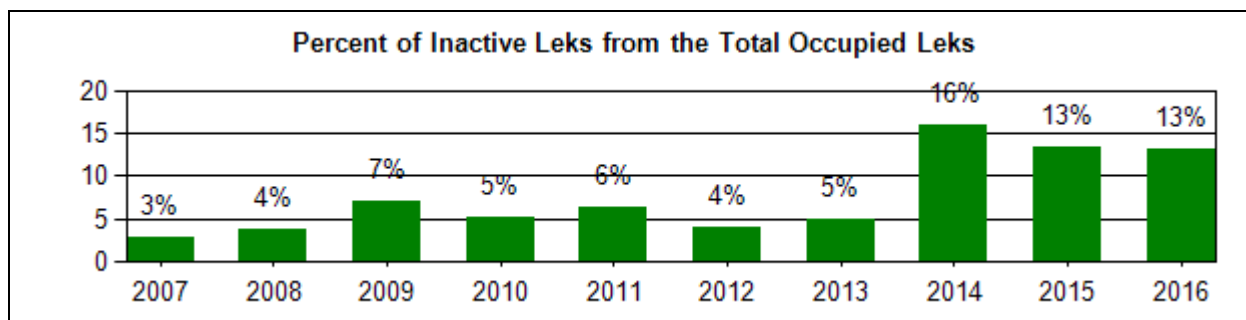
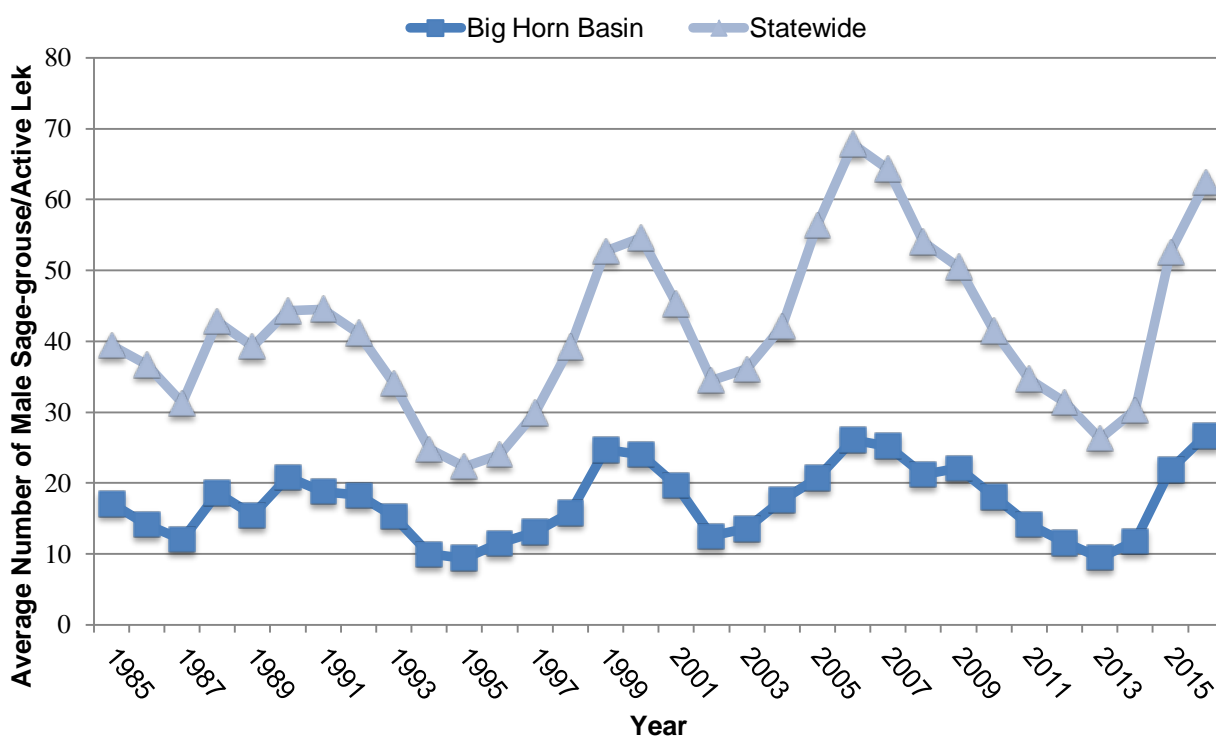


Figure 4. Trends in average male attendance for all lek observations in the Big Horn Basin and statewide, 1985-2016.



**Production surveys** Eight sage-grouse broods were documented in 2016 (Table 3). Sample sizes (number of groups observed) from 2011-2016 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 by field personnel, because sage-grouse brood data is opportunistically collected while performing other duties during July and August. A direct connection between effort (time spent surveying for broods) and number of broods observed was presented 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.

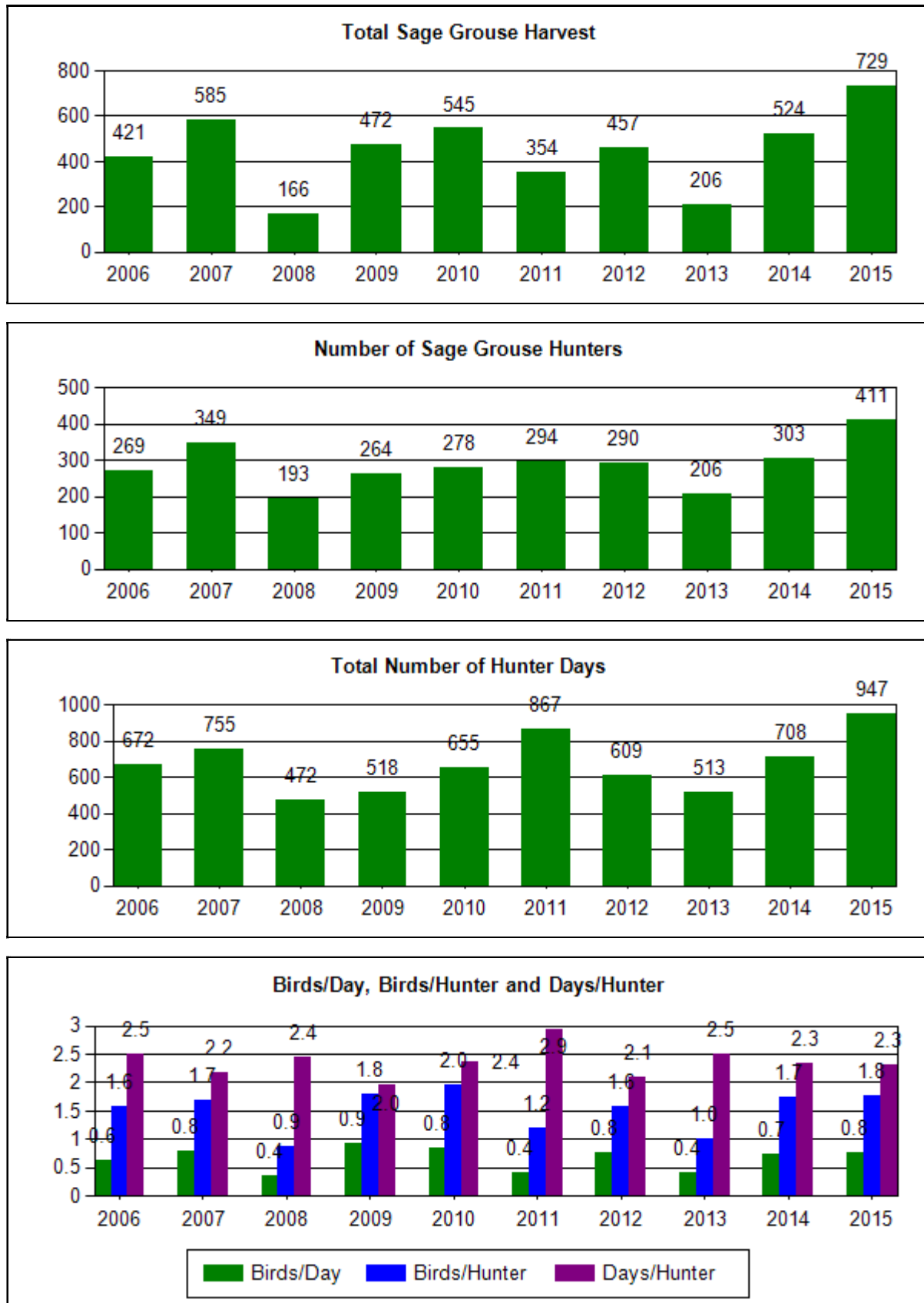
Table 3. Brood survey data collected by Wyoming Game & Fish Department personnel in the Bighorn Basin, 2001-16.

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
2016	8	21	5	2.6	4.2
<b>2001-15 average</b>	<b>17.6</b>	<b>72.3</b>	<b>32.4</b>	<b>3.9</b>	<b>2.5</b>

**Hunting season and harvest** The opening day of the sage-grouse hunting season was moved from 1 September to the third Saturday in September in 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) from 1982-94 and about 15 days from 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 have 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 (2006-2015), hunters averaged 1.5 birds/hunter and 2.4 days/hunter. In 2015, 411 hunters in the Big Horn Basin harvested 729 sage-grouse (1.8 birds/hunter); spending 947 hunter-days afield (2.3 days/hunter) during the 12-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 similar effort in 2014 and 2015 (2.3 days/hunter).

Figure 6. Sage-grouse hunting statistics for the Big Horn Basin, 2006-15.



## 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 (Table 4). 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 Wyoming's Core Area Policy are also available at this website.

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 field work was completed in 2015. Data analysis and writing took place in 2016, and the final progress report was submitted (Appendix). Orning and Young (2012, 2012a) started a multiphase sage-grouse predation project focusing on coyote predation. This completed project documented predation levels on nests, broods, and adult hens at several sites in the Basin (Orning 2013). Next, Dr. James Taylor (USDA-APHIS) investigated raven predation in the Basin, specifically focusing on sage-grouse nest depredation by ravens (Appendix; Taylor 2016, Taylor and Holt 2016). Meeteetsee Conservation District is conducting raven predation research in 2017.

Table 4. Big Horn Basin 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/ approved	Mechanical juniper removal from sage-grouse habitat	BLM, Wyoming Office of State Lands, private landowner	Approved and on-going
186 - Response of SG to sagebrush treatments Phase III	2015-16	Big Horn Basin + 5 other LWGs	\$211,404 (\$894,096 to date)	\$211,404 requested; 182,000 approved	Continuing research to determine sage-grouse demographic and habitat use response to sagebrush treatments	University of Wyoming, Kelly Ornith. Research Fund, BLM, WY Reclamation & Restoration Center, WWNRT	Approved and On-going

## CONCLUSIONS & RECOMMENDATIONS

Sage-grouse populations in the Basin experienced a low in the population cycle from 2007-2013, but 2016's data confirms 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 area mapping 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, farmers, energy companies, and other landowners whenever possible on sage-grouse habitat (especially early brood-rearing) and water development projects.
- Assist the Bighorn National Forest with prescribed burning plans targeting sage-grouse habitats on the Bighorn National Forest.

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Northeast  
Sage-Grouse  
Job Completion Report  
2015

June 2015-May 2016

Dan Thiele  
Wyoming Game & Fish Dept.  
Sheridan Region

# Sage Grouse Job Completion Report

Year: 2007 - 2016, 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)
2007	390	107	27	2036	26.1
2008	405	127	31	1934	20.4
2009	408	148	36	1135	10.8
2010	407	179	44	1561	13.7
2011	414	174	42	1134	11.7
2012	419	243	58	1862	12.8
2013	412	109	26	714	10.3
2014	410	200	49	934	9.5
2015	401	192	48	1930	16.2
2016	399	173	43	1947	20.1

### b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2007	390	253	65	3438	20.2
2008	405	235	58	2190	15.8
2009	408	218	53	1346	11.8
2010	407	177	43	636	7.9
2011	414	189	46	652	8.2
2012	419	148	35	476	9.5
2013	412	250	61	941	8.5
2014	410	163	40	706	9.8
2015	401	145	36	1062	15.6
2016	399	178	45	1650	19.2

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

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

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

## Sage Grouse Job Completion Report

Year: 2007 - 2016, 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)
2007	390	360	92	5474	22.1
2008	405	362	89	4124	17.6
2009	408	366	90	2481	11.3
2010	407	356	87	2197	11.3
2011	414	363	88	1786	10.1
2012	419	391	93	2338	12.0
2013	412	359	87	1655	9.2
2014	410	363	89	1640	9.6
2015	401	337	84	2992	16.0
2016	399	351	88	3597	19.7

#### d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2007	250	59	51	309	80.9	19.1
2008	235	82	45	317	74.1	25.9
2009	221	81	64	302	73.2	26.8
2010	200	108	48	308	64.9	35.1
2011	184	111	68	295	62.4	37.6
2012	201	115	75	316	63.6	36.4
2013	182	121	56	303	60.1	39.9
2014	172	134	57	306	56.2	43.8
2015	190	91	56	281	67.6	32.4
2016	189	117	45	306	61.8	38.2

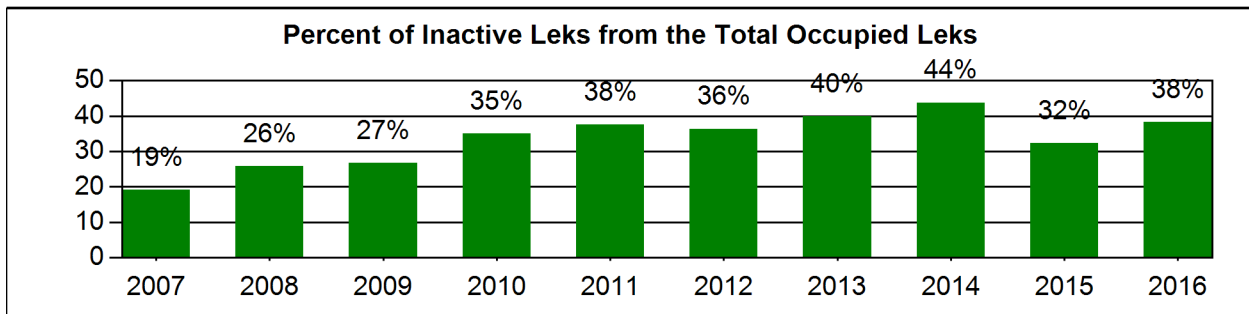
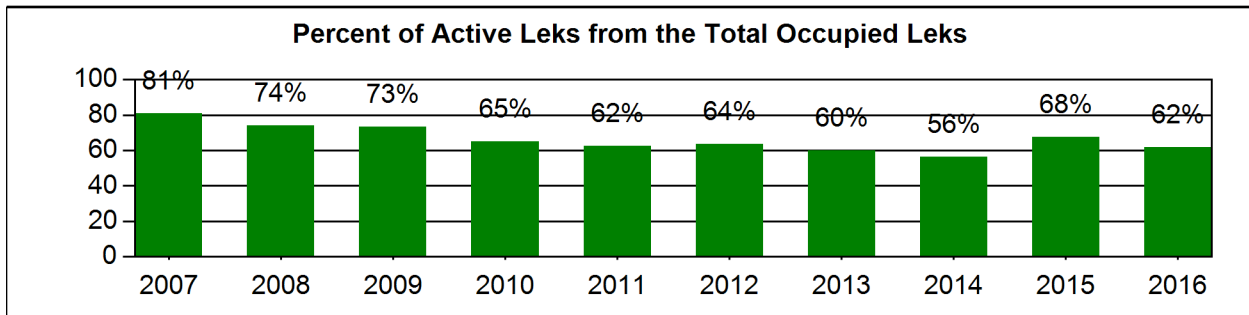
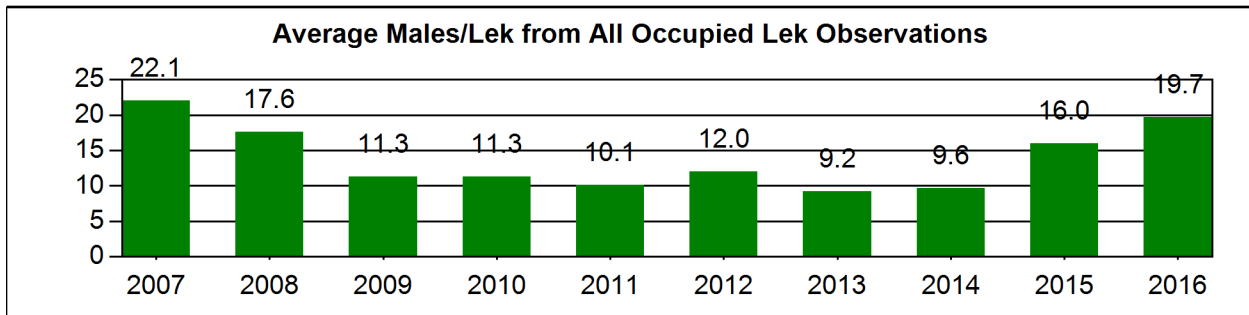
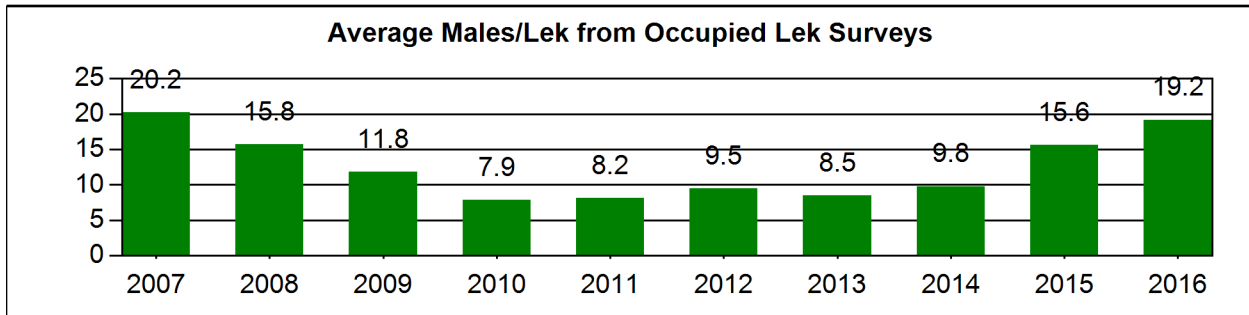
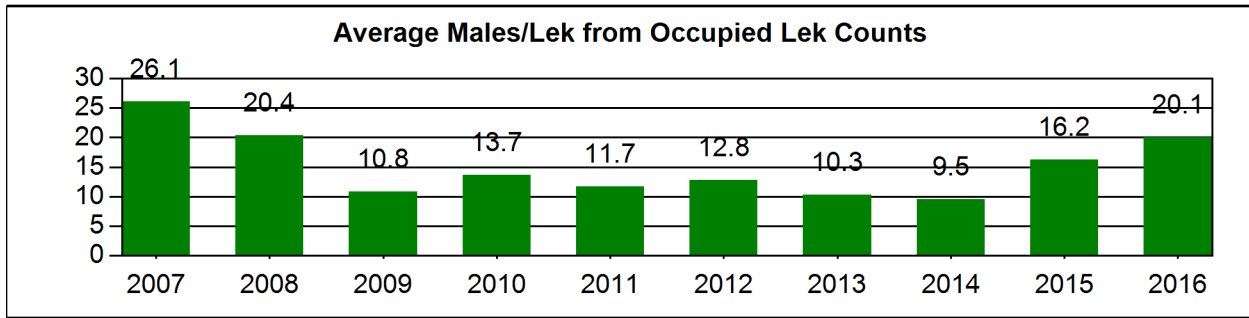
1) Occupied - Active during previous 10 years (see official definitions)

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

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

# Sage Grouse Occupied Lek Attendance Summary

Year: 2007 - 2016, Working Group: Northeast



## Sage Grouse Job Completion Report

Year: 2006 - 2015, Working Group: Northeast

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### 4. Sage Grouse Hunting Seasons and Harvest Data

#### a. Season

Year	Season Start	Season End	Length	Bag/Possesion Limit
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-20	Sep-22	3	2/4
2015	Sep-19	Sep-21	3	2/4

#### b. Harvest

Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
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
2015	314	228	400	0.8	1.4	1.8
Avg	<b>258</b>	<b>190</b>	<b>367</b>	<b>0.7</b>	<b>1.2</b>	<b>2.0</b>

# 2015 JOB COMPLETION REPORT

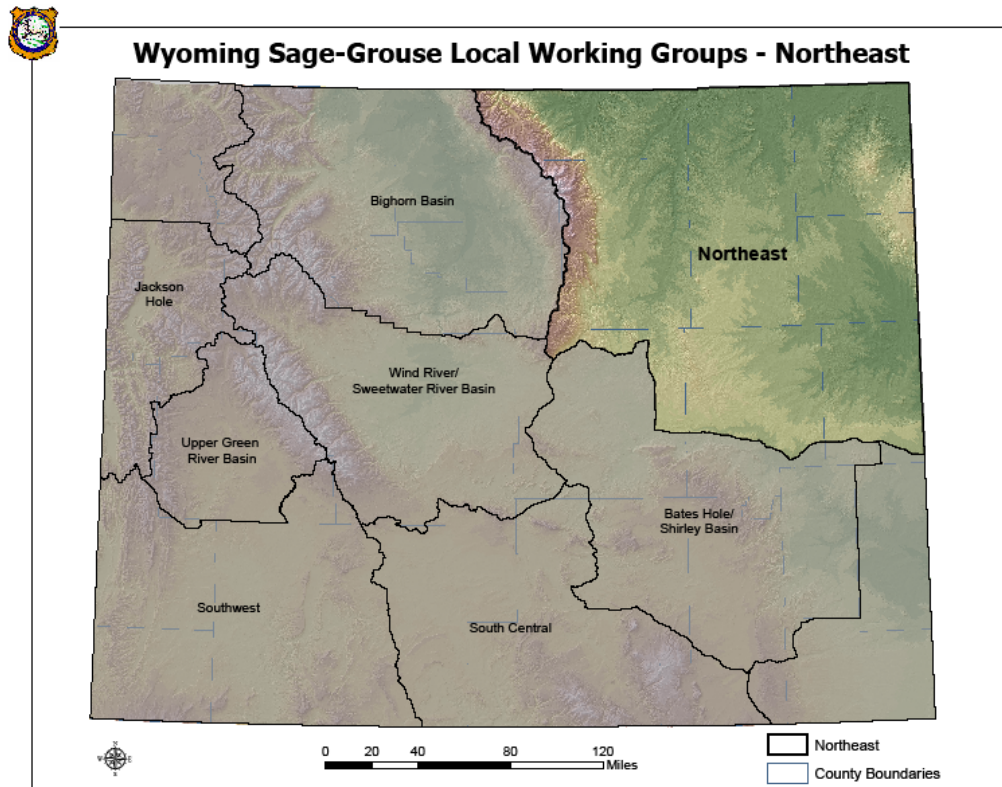
## Narrative

SPECIES: **Sage-grouse**  
DAU NAME: **Northeast Wyoming Working Group**  
Period Covered: **6/1/2015 – 5/31/2016**  
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.

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, since 2008, 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.

Following a lengthy process, in September 2015, the U.S. Fish and Wildlife Service issued a decision of "not warranted" for listing greater sage-grouse as threatened or endangered under the Endangered Species Act. This means the State of Wyoming maintains management authority over sage-grouse in Wyoming and management emphasis focuses on implementation of the core area strategy. In its decision document, the Service specifically cited Wyoming's Core Area Strategy as a mechanism that, if implemented as envisioned, should ensure conservation of sage-grouse in Wyoming and therefore help preclude the need for a future listing. The Service plans to reexamine the issue after five years (2020) to ensure planned conservation efforts are implemented and the status of the species remains unwarranted for listing. The decision document can be viewed at: <https://www.fws.gov/greatersagegrouse/>.

## WEATHER

Weather during the past biological year (June 2015 – May 2016) was slightly dryer and warmer on average due to above average winter temperatures (Figures 2 and 3). Precipitation was below average for the first time in two years. Spring 2015 precipitation was very good as May and June rainfall was 168% of average. April 2016 precipitation was more than one inch above average. However that was mitigated by below average May precipitation. The average temperature was more than 2.5° above normal.

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.

Figure 2. 2015 Bio-Year: Monthly Precipitation Data (in), Wyoming Climate Division 5.

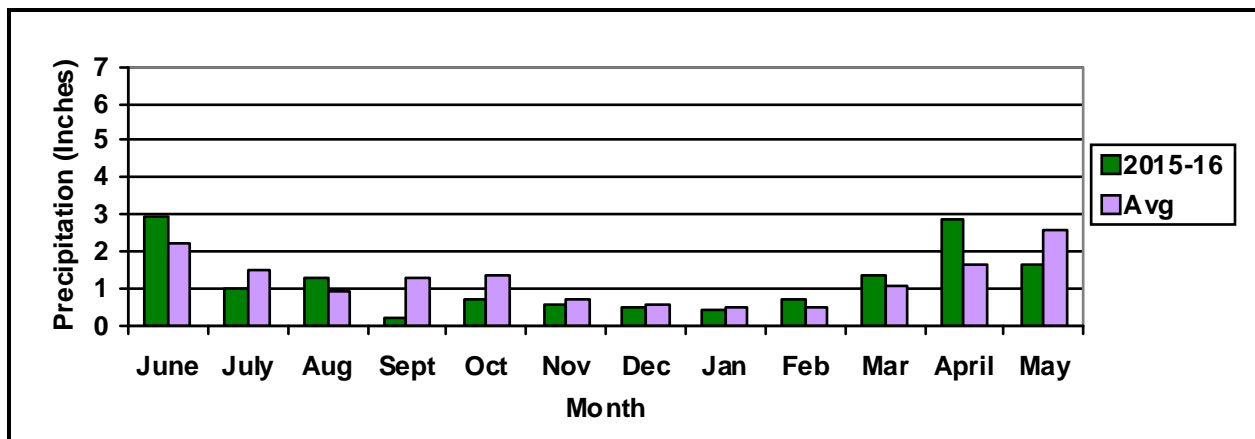
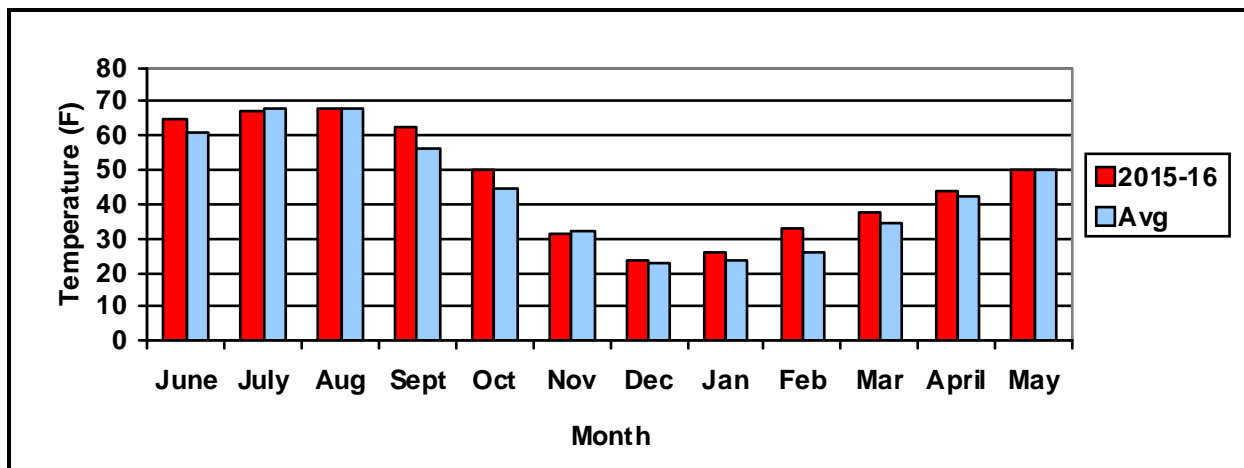


Figure 3. 2015 Bio-Year: Monthly Temperature Data (°F), Wyoming Climate Division 5.



## MONITORING 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

One West Nile virus (WNV) mortality was reported for northeast Wyoming in August 2015; a bird from Campbell County submitted for testing by a consulting firm. 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

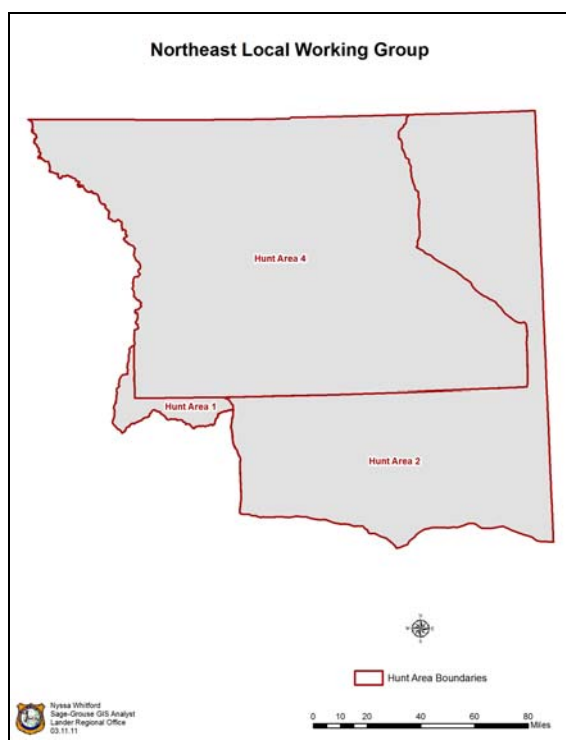
The Northeast Working Group area is comprised of Hunt Area 4 and portions of Hunt Areas 1 and 2 (Figure 4). A very small amount of Hunt Area 1 occurs in the southwestern most extent of the Area while Hunt Area 2 is closed to hunting. In Hunt Area 4, a very conservative hunting season was implemented 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 3,600 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).

The 2015 harvest survey indicated that 314 sage-grouse were harvested by 228 hunters who spent a total of 400 days hunting during the Hunt Area 4 three day season. The average number of birds harvested per hunter day was 0.8. The average number of sage-grouse harvested per hunter was 1.4 and the average number of days hunted was 1.8.

The 2015 sage-grouse harvest was more than double the 123 birds harvested in 2014 and well above the 27 birds harvested in 2013. The 2015 harvest was the highest harvest since 405 birds were harvested during the 2012 hunting season. The conservative harvest was the fourth highest for the last 10 years and likely reflects public awareness that bird numbers have been trending up in recent years. 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 (2006-2015) is 258 birds, with harvest ranging from a low of 27 birds in 2013 to a high of 532 birds in 2007. More than 2,500 birds were harvested as recently as 2000 when a 16 day season was in place. Hunter numbers over the last ten years have ranged from 82 hunters in 2014 to 297 hunters in 2006. Hunter days more than doubled from 2014 but were well below the 1,649 days logged in 2005.

Figure 4. Northeast Wyoming Sage-grouse Hunt Areas.



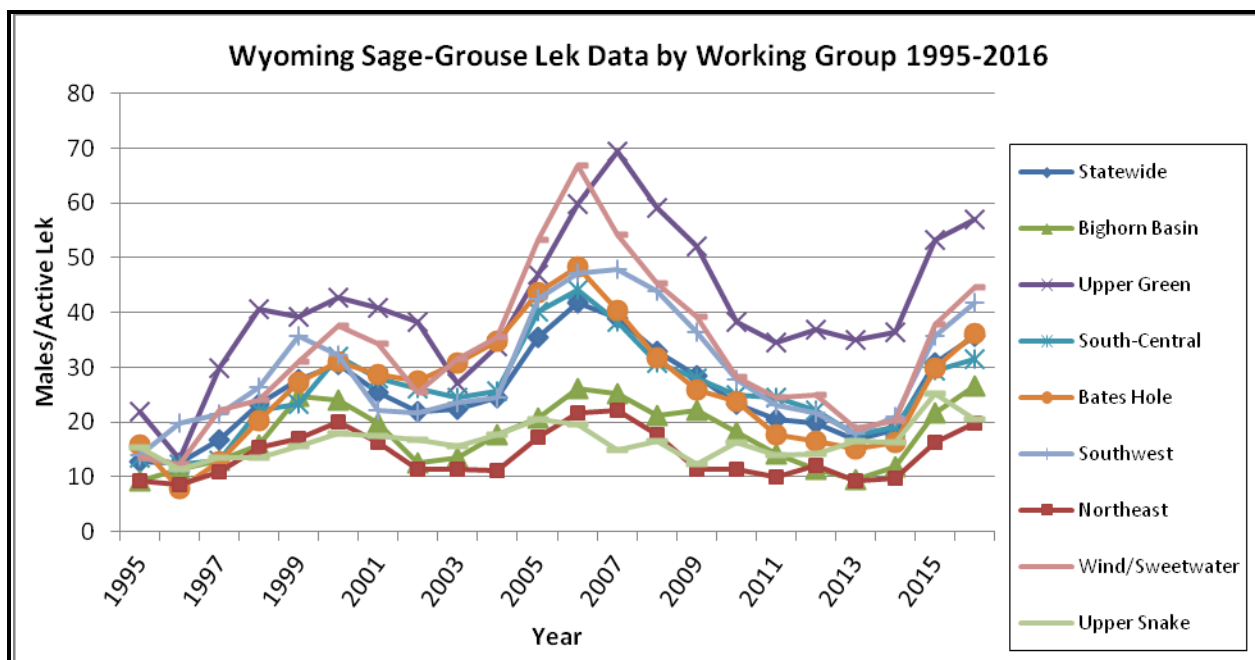
In past years a limited number of sage-grouse wings were collected during the hunting season, primarily in the eastern portion of the Area. Sample sizes were small due to the low harvest and the difficulty to strategically place enough collection barrels along the many roads and highways within the Area. 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 2015 hunting season.

### Lek Monitoring

Northeast Wyoming has the lowest average male lek attendance in the state, averaging 19 males per active lek in 2016 compared to the statewide average of 36 males per active lek (Figure 5). Most leks in northeast Wyoming are small with less than 20 males. In years when grouse are at the peak of their population cycle less than 10% of the active leks have greater than 50 males at peak count. Fourteen leks exceeded 50 males in 2016 with the largest being 86 males.

Average male lek attendance in northeast Wyoming has decreased significantly over the years. Figure 6 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.

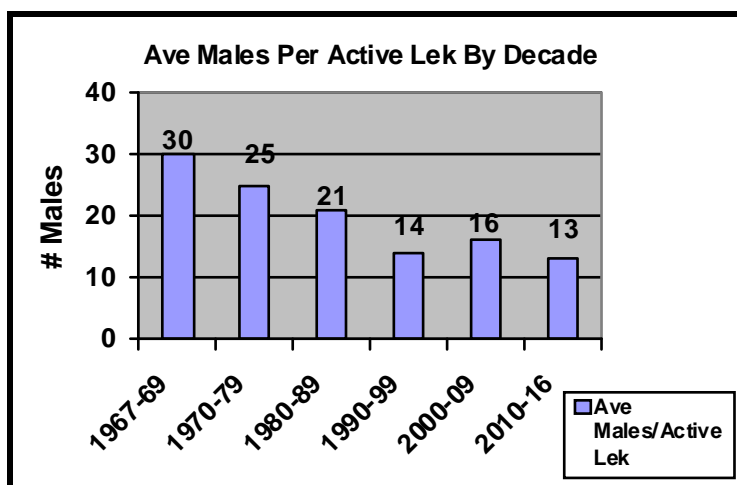
Figure 5. Wyoming Statewide and Local Working Group Area Lek Attendance Trends.



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.

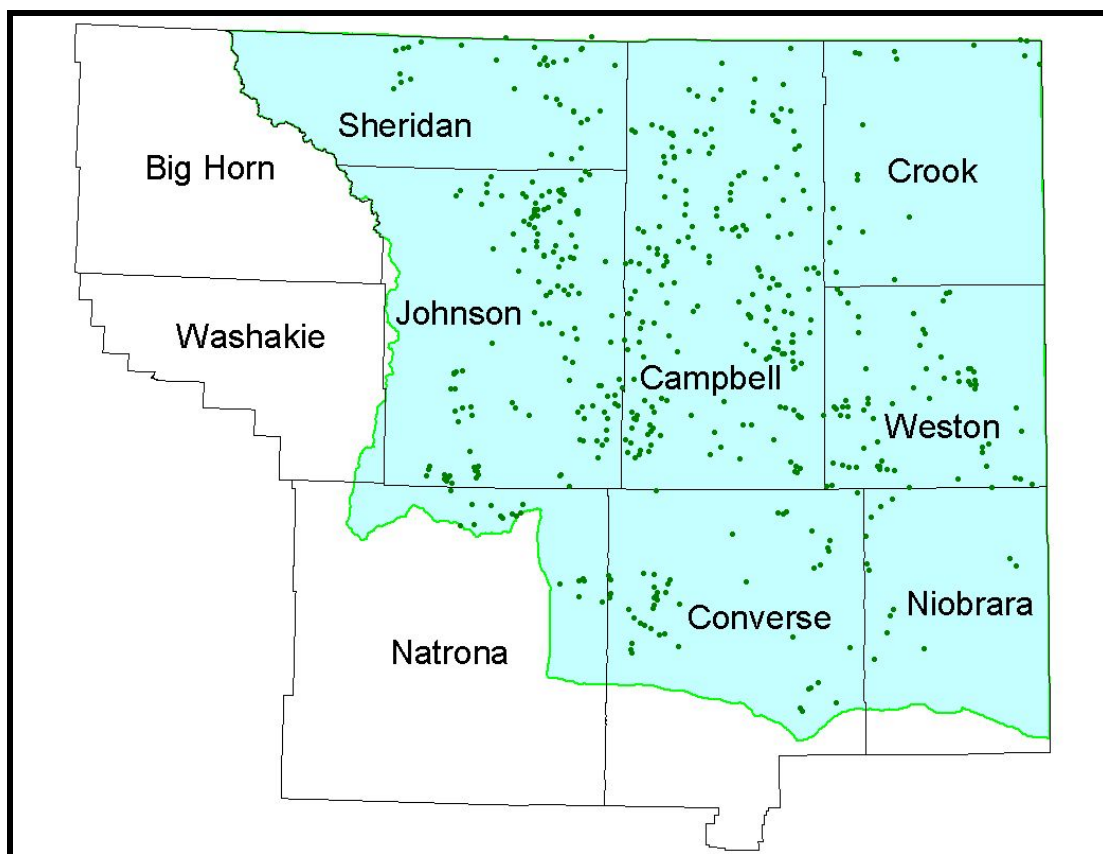
Sage-grouse lek monitoring efforts are accomplished through lek counts, lek surveys and searches for new leks. The Sheridan Region received additional funds from the Bureau of Land Management for sage-grouse surveys for the fifteenth consecutive year. This funding was used for aerial surveys to monitor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

Figure 6. Average Number of Males per Active Lek by Decade for Northeast Wyoming Leks.



Following the 2016 lek monitoring period there are 564 documented leks in the NEWLWGA distributed over various land ownership and management authority boundaries (Figure 7 and Table 1). Of this total, 396 are classified as occupied leks. The 396 occupied leks is less than the 564 total leks because unoccupied leks (abandoned or destroyed) are not considered potentially active. During the 2016 breeding season 173 leks were counted, representing 43% of known occupied leks (JCR Table 1a). The average number of males per active lek from lek counts was 20.1. This is up from the 16.2 males/active lek in 2015 and 9.5 males/active lek in 2014. The 2016 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 7. 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 351 leks or 88% of the known occupied leks (JCR Table 1c). The average number of males/active lek was 19.7 compared to 16.0 males/active lek in 2015. The 2016 average attendance represents a 23% increase from last year. For the 10-year period, 2007-2016, the number of males/active lek has ranged from 9.2 in 2013 to 22.1 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 86 males. The three leks with the highest number of males were the Boxelder Draw Lek with 86 males, Watsabaugh I Lek with 85 males and the

Cooper Lek with 80 males. No lek has exceeded 100 males since 2007. The median peak male attendance was 15 males, up from 12 males in 2015.

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

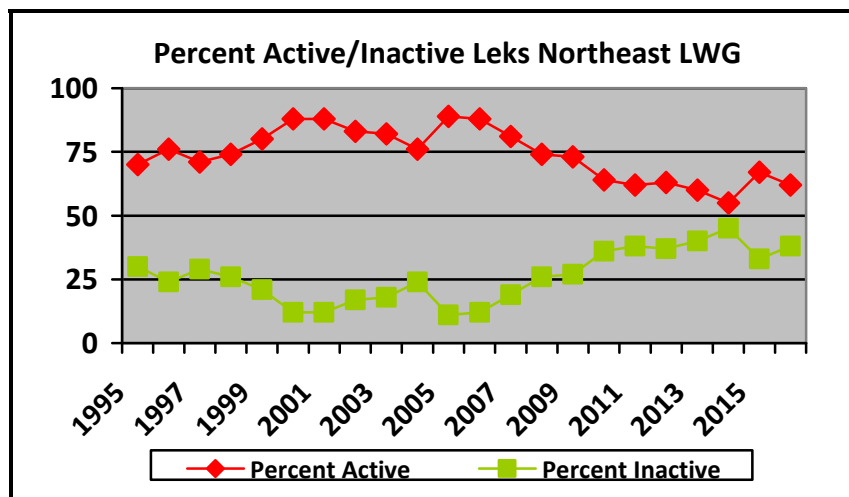
<b>Region</b>	<b>Number</b>	<b>Percent</b>	<b>Working Group</b>	<b>Number</b>	<b>Percent</b>
Casper	152	27.0%	Northeast	564	100.0%
Sheridan	412	73.0%			
<b>Classification</b>	<b>Number</b>	<b>Percent</b>	<b>BLM Office</b>	<b>Number</b>	<b>Percent</b>
Occupied	396	70.2%	Buffalo	373	66.1%
Unoccupied	102	18.1%	Casper	73	12.9%
Undetermined	66	11.7%	Newcastle	118	20.9%
<b>Biologist</b>	<b>Number</b>	<b>Percent</b>	<b>Game Warden</b>	<b>Number</b>	<b>Percent</b>
Buffalo	73	12.9%	Buffalo	73	12.9%
Casper	14	2.5%	Dayton	24	4.3%
Douglas	60	10.6%	Douglas	26	4.6%
Gillette	250	44.3%	East Casper	5	0.9%
Newcastle	78	13.8%	Glenrock	30	5.3%
Sheridan	89	15.8%	Kaycee	59	10.5%
			Lusk	21	3.7%
			Moorcroft	70	12.4%
			Newcastle	63	11.2%
			North Gillette	67	11.9%
			Sheridan	13	2.3%
			South Gillette	106	18.8%
			Sundance	6	1.1%
			West Casper	1	0.2%
<b>County</b>	<b>Number</b>	<b>Percent</b>	<b>Land Status</b>	<b>Number</b>	<b>Percent</b>
Bighorn, MT	1	0.2%	BLM	51	9.0%
Campbell	198	35.1%	Private	440	78.0%
Carter, MT	1	0.2%	State	37	6.6%
Converse	57	10.1%	US Forest Service	36	6.4%
Crook	24	4.3%			
Johnson	138	24.5%			
Natrona	16	2.8%			
Niobrara	21	3.7%			
Powder River, MT	1	0.2%			
Sheridan	35	6.2%			
Weston	72	12.8%			
<b>Management Area</b>	<b>Number</b>	<b>Percent</b>			
C	564	100.0%			

In total, there were 1,253 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. In areas of energy development where companies are required to conduct wildlife surveys, a large number of leks were being surveyed more than the required number of times because one or more companies with neighboring leases would survey the same leks due to monitoring buffers extend beyond their respective leases. This problem was most prevalent in the CBNG fields where monitoring buffers of Plan of Development (POD) boundaries overlap adjacent leases 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 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 average lek size alone.

Figure 8. Trends in Active and Inactive Leks, 1995-2015.



Lek status as determined from lek counts and lek surveys shows 306 leks with confirmed lek status. Sixty-two 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. One hundred seventeen leks (38%) 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 2015, 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 8). In 2016, the percentage of active leks decreased even though the average males per active lek increased. 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=45) 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 (20.7 vs 18.4) but confirmed lek activity is notably higher in core areas (71% vs. 54%). This suggests the core area policy may be successful at maintaining lek persistence. However, it should be noted that core areas in Northeast Wyoming do not encompass all priority habitats which likely contributes to the discrepancy in average

male lek attendance figures. Some inconsistencies remain in complying with monitoring protocol and monitoring some leks on a regular basis. Some leks have not been documented as active in many years which may be due to inaccurate locations based on legal descriptions. Continued efforts at determining the exact location and status of these leks are needed. As birds on a lek are observed, UTM coordinates are recorded using GPS. GPS locations for lek sites should make future surveys more efficient even with changes in personnel. Furthermore, with the high amount of activity around leks in areas of 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 9. Northeast Wyoming Working Group Male Sage-grouse Lek Attendance 1967- 2016.

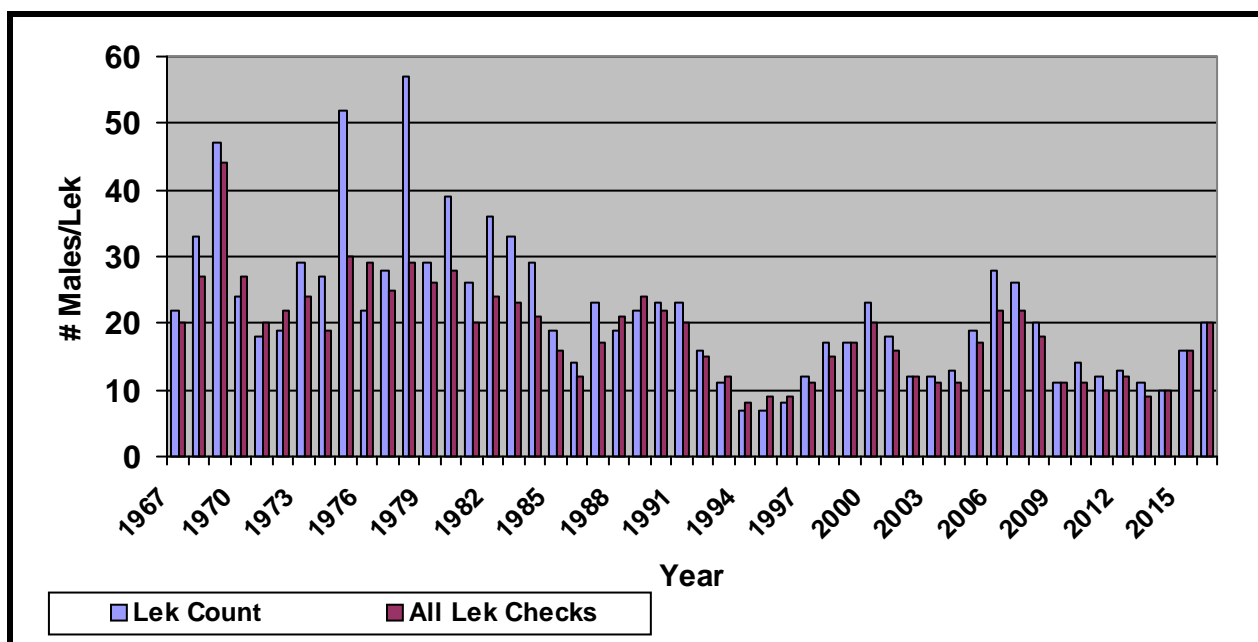


Figure 9 shows the average number of males/active lek for lek counts and all lek monitoring (counts and surveys) combined from 1967 to 2016 for the NEWLWGA. If the average number of males/active lek is reflective of the sage-grouse population, the trend suggests about a 10-year cycle of periodic highs and lows. Of concern, however, is that with the exception of the most recent cycle, subsequent peaks in the average male lek attendance are usually lower than the previous peak. Additionally, periodic lows in the average male attendance are generally

lower than the previous low. The long term trend suggests a steadily declining sage-grouse population.

It appears that sage-grouse numbers reached a new peak in 2006 and 2007, exceeding the previous peak in 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 reflect the declining phase of the cycle, rivaling that observed from 1994 through 1997. The increased male lek attendance documented in 2015 and 2016 has ended the decline.

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 and proportion of active leks has declined.

## HABITAT

### Habitat Conditions

Habitat conditions in 2015 were very good following above normal spring 2015 precipitation. The Palmer Drought Index, a measure of long-term meteorological conditions, showed climate divisions in northeast Wyoming were moderate to extremely moist by July 2015. Spring rains promoted improved habitat conditions and extended spring green-up into July. Excellent residual forage remained through the season and shrub surveys showed good leader production. However, below normal precipitation through the remainder of the calendar year decreased the Palmer Drought Index to mid-range in all climate divisions by May 2016

### Habitat Impacts

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 20<sup>th</sup> century. An unprecedented energy boom began in the Powder River Basin in the late 1990's with the exploration and development of 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 2016, the Wyoming Oil and Gas Conservation Commission reported that 6,123 producing wells yielded 13,146,505 Mcf of methane gas (WOGCC 2016). Federal mineral leases provided for 74% of the production while fee leases accounted for 19% and State leases 7%. In addition to producing wells there are 8,736 shut in wells. This compares to May 2015 when 7,710 producing wells yielded 17,256,299 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.

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 2015, counties comprising the NEWLWG had 188 oil wells started (spud) including 157 horizontal wells and 2 directional wells (WOGCC 2016). Drilling for natural gas was limited to 6 wells, all of which were horizontal wells. Exploration utilizing horizontal drilling has increased markedly from 10 wells in 2007 to 365 wells in 2014 after which activity decreased to 158 wells in 2015. 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.

#### Northeast Local Working Group Threats Identification

Sage-grouse are influenced by many factors, both individually and cumulatively. Habitat loss and fragmentation, direct mortality and disturbance affect sage-grouse populations. In 2006, 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 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,

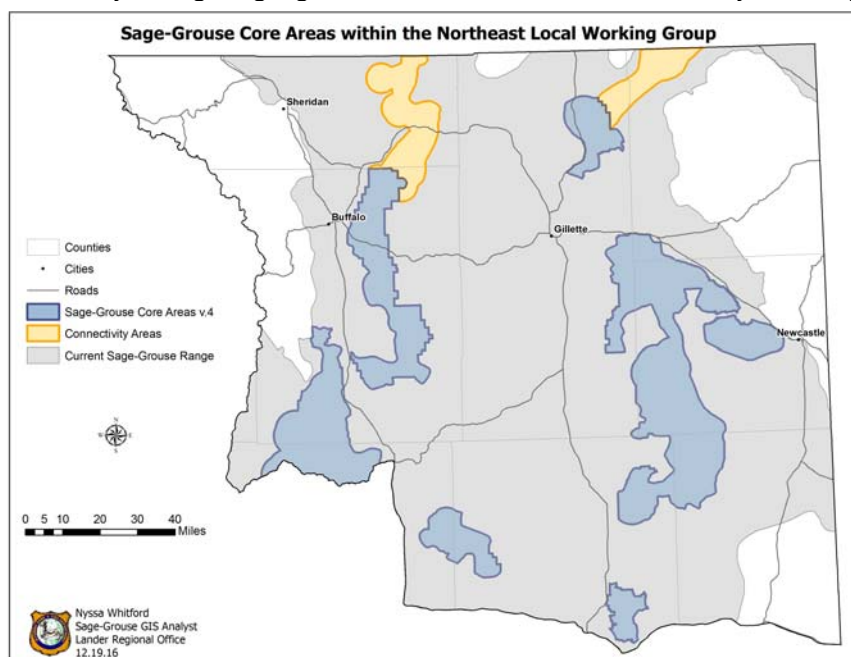
gas and CBNG development, vegetation management, invasive plants, local residential land use, and livestock grazing would be most effective in benefiting sage-grouse.

### Wyoming Core Area Strategy

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. 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 with the goal of precluding the need to list sage-grouse under the Endangered Species Act. The current Executive Order (2015-4) was signed by Governor Mead in July of 2015. The Executive Order is available at: <https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management>.

Core areas (Figure 10) were designated with the objective of identifying habitats that supported most of Wyoming's sage-grouse. Statewide, core areas account for approximately 36% of the current sage-grouse range while encompassing leks with 78% of the 2012-2014 peak males. However, in the NEWSGLWGA, core areas were designated based on CBNG development patterns along with lek density data thereby encompassing leks supporting only 49% of the 2012-2014 peak males.

Figure 10. Northeast Wyoming Sage-grouse Core Area and Connectivity Areas (version 4).



### Powder River Basin Restoration Program

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

- 420 acres of conifer encroachment removed by the Montana Conservation Corp.
- Two unpermitted reservoirs were reclaimed to help manage mosquito habitat/West Nile virus for a total of 6 reservoirs reclaimed.

- Planted about 200 sagebrush seedlings in the Buffalo Core Area
- 3,500 acres of cheat grass treatment - 2,500 acres in the Buffalo Core Area and 1,000 acres in the Newcastle Core Area

### Douglas Core Area

Sage-grouse lek attendance within the Douglas Core Area (DCA) totaled 50 males in 2016. This was a decrease from the 53 males in 2015, but well above the 31 and 11 males in 2014 and 2013, respectively. One lek was re-classified as unoccupied since there have been no birds observed on the site for over 10 years. There are now five occupied leks in the DCA, three of which were active in 2016.

The DCA has experienced a substantial increase in energy development over the past five 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 FY2016 within the NEWSGLWG area consisted of seven contracts totaling 90,412 acres.

- Campbell County – 2 contracts for 14,387 acres
- Converse County – 1 contract for 4,237 acres
- Crook County – no contracts
- Johnson County – 2 contracts for 35,750 acres
- Niobrara County – no contracts
- Natrona County - 1 contract for 32,826 acres
- Sheridan County – 1 contract for 3,212 acres
- Weston County – no contracts

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

Table 2. Northeast 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
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
185 - WY Core Area Habitat Condition Assessment	2015-16	Statewide	\$654,072	\$119,502 requested; \$68,000 approved	RSF modeling to assess sagebrush habitat conditions at multiple scales and the response of sage-grouse to changes in conditions	Audubon Rockies, TNC, Yellowstone Ecological Research Center, Governor's SG Implementation Team	Approved
193 – Half-meter NAIP Imagery Acquisition	2015-16	Bates Hole-Shirley Basin, Northeast, South-Central, Southwest, Upper Green River	\$348,000	Open request; \$63,000 approved	Half-meter (high resolution) imagery for use in the DDCT process	15 federal, state and county agencies	Approved and on-going

## 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>.

Projects funded with the NEWSGLWG allocation of the FY 2015-16 Wyoming Sage-grouse Conservation Fund dollars included six projects, including four projects specific to northeast Wyoming and two projects involving multiple working groups (Table 2).

The Working Group held one meeting during the reporting period. The group filled two open positions on the Group, received updates on completed and proposed research and discussed soliciting projects for funding through the Wyoming Sage-grouse Conservation Fund.

### 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 upon conservation actions on their property to remove or reduce threats to the sage-grouse.

For the reporting period, 66,204 acres were added while 7,843 acres were removed from CCAA's. The increased acres resulted from three new participants and one existing participant added additional acres. One participant removed land from an agreement. The USFWS now has 12 participants with 187,178 acres in five counties within the NEWLWGA enrolled into CCAA's (Table 3). The agreements include 122,878 acres of core area habitat and 20,348 acres of connectivity area habitat.

Table 3. U.S. Fish and Wildlife CCAA Sign-ups.

County	Sign-ups	Total Acres	Core Acres	Connectivity Acres	Core and Connectivity Area
Campbell	3	11,298	2,920	0	North Gillette Core
Converse	1	2,000	1,880	0	North Glenrock Core
Crook	1	24,196	0	20,348	North Gillette Connectivity
Johnson	4	72,659	53,223	0	Buffalo Core
Natrona	4	77,025	64,855	0	Natrona Core
Niobrara	0	0	0	0	
Sheridan	0	0	0	0	
Weston	0	0	0	0	
<b>TOTAL</b>	<b>12*</b>	<b>187,178</b>	<b>122,878</b>	<b>20,348</b>	

\*Sign-ups can cover more than one county.

## 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. Continue to 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. Continue to 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. Continue to coordinate with the BLM and industry to minimize the number of visits to leks during lek monitoring efforts.
4. Continue WNV monitoring.
5. Continue to 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 2017 for lek searches and surveys. All leks should be checked at least once every three years. All leks should be recorded in UTM's (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 WGFD 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. Better document wintering sage-grouse locations and develop a seasonal range map for sage-grouse for the Working Group Area.
12. Continue to map lek perimeters to ensure adequate buffer distance in protecting leks.

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South-Central  
Sage-Grouse  
Job Completion Report 2015

June 2015-May 2016

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, 2015 – May 31, 2016**

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).

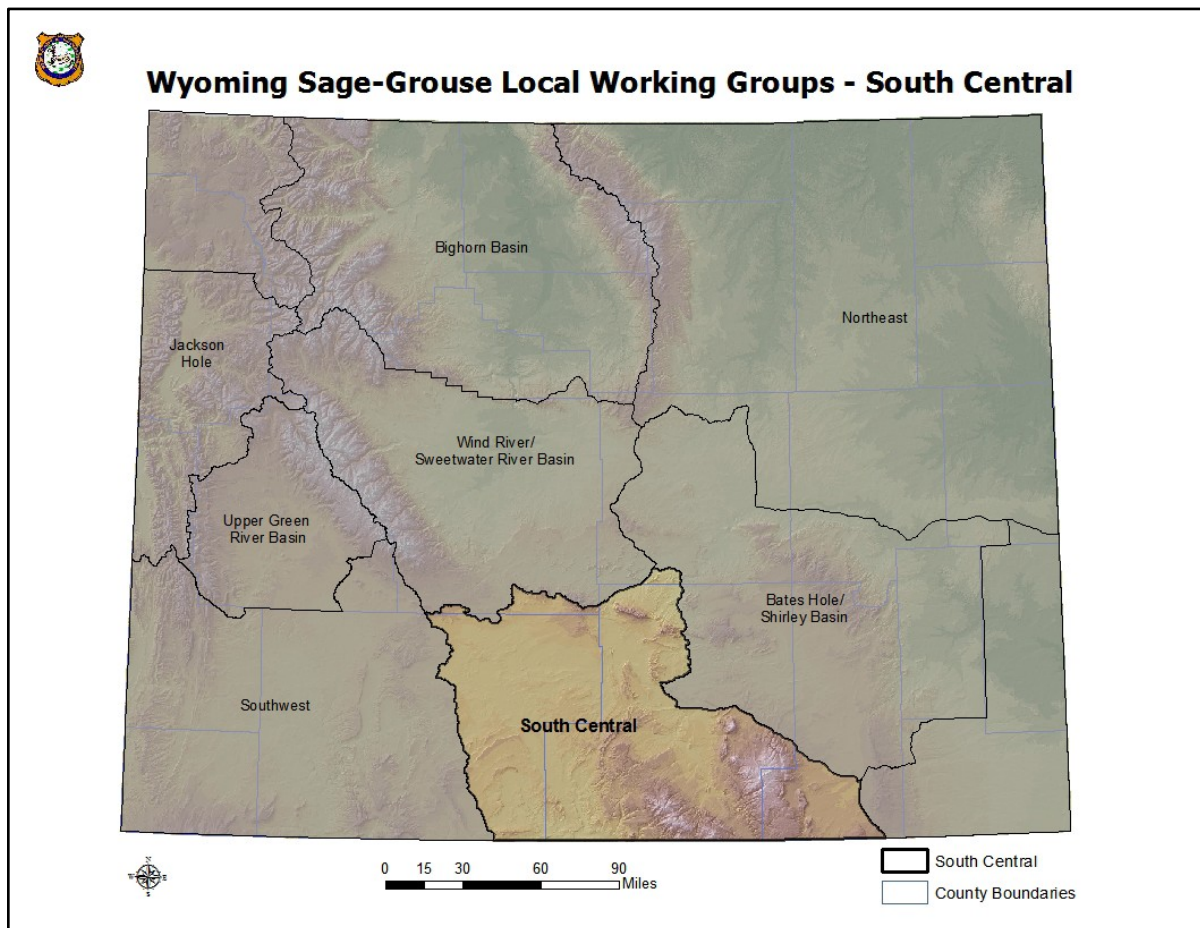


Figure 1. South Central Conservation Area in Wyoming.

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.

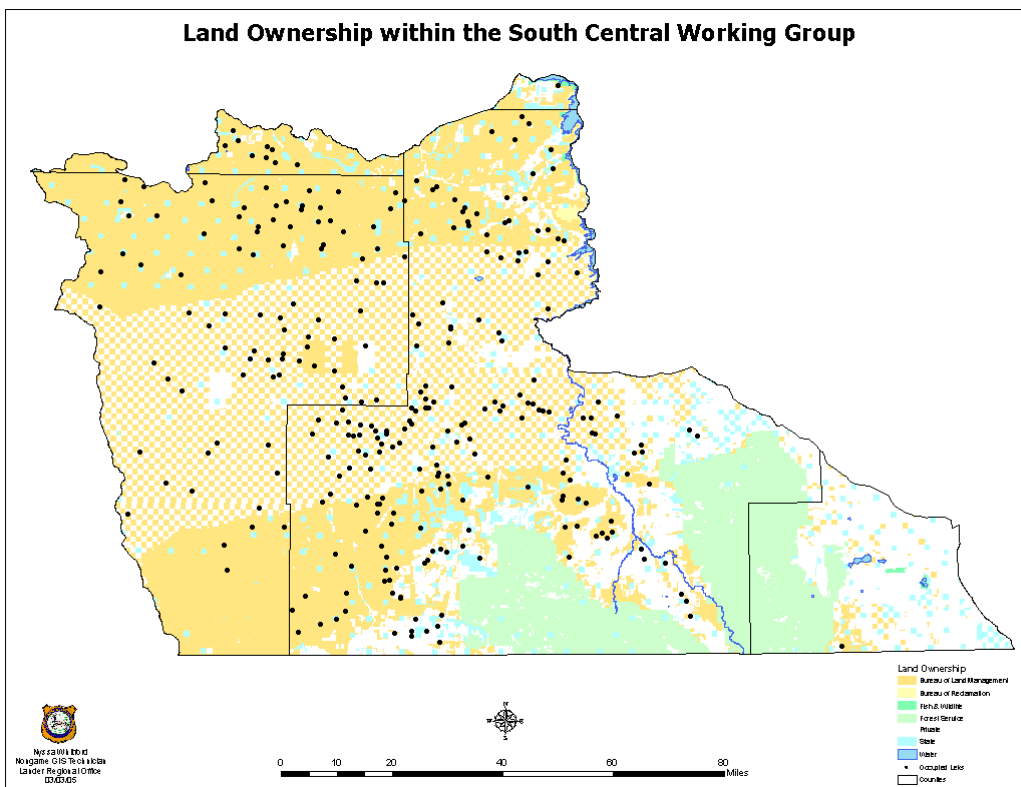


Figure 2. Landownership and sage-grouse leks locations within the South Central Conservation Area of Wyoming.

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.

In bio-year 2015 (June 1, 2015 – May 31, 2016), there were 292 occupied leks in the SCCA. Of these, 266 were monitored. From these monitoring efforts it was determined 194 leks were active; producing an average peak males/lek ratio of 31.6 males.

The 2014 upland harvest survey indicated 457 hunters spent 963 days to harvest 776 sage-grouse in the SCCA. Analyses of wing data from hunter harvested sage-grouse indicated the proportion of chicks in the harvest was 1.4 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 collection (Figure 3). These divisions correspond to major watersheds within the state. Wyoming's Climatic Division 10, the Upper Platte, covers much of the SCCA.

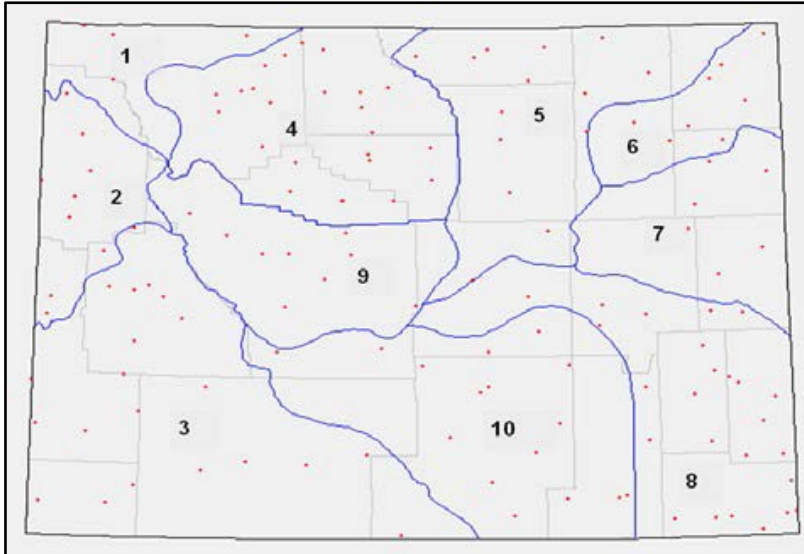


Figure 3. NCDC/NOAA, State of Wyoming Climate Division Map.

Temperature and precipitation data was obtained for Division 10 from NCDC/NOAA's website, <https://www.ncdc.noaa.gov/cag/> to illustrate weather conditions during bio-year 2015 (Figures 4 and 5). These figures also include data from April and May of bio-year 2014 to describe the weather conditions immediately preceding bio-year 2015 during the strutting and nesting season. Monthly mean temperatures in bio-year 2015 were slightly cooler than the 50-year monthly means. Precipitation in May of 2015, primarily received in the form of very moist snow, was 250% of the 50-year monthly mean. Mediocre chick survival indicated by the analysis of sage-grouse wings collected from hunters in the fall of 2015 was considered to have been caused by the May 2015 precipitation rate (see the Harvest section of this report). Some sage-grouse hens likely had to re-nest or they may have abandoned nesting activities entirely. This precipitation may have directly affected survival rates for early hatchlings as well. Otherwise, relatively favorable weather conditions were experienced in Division 10 throughout the remainder of bio-year 2015.

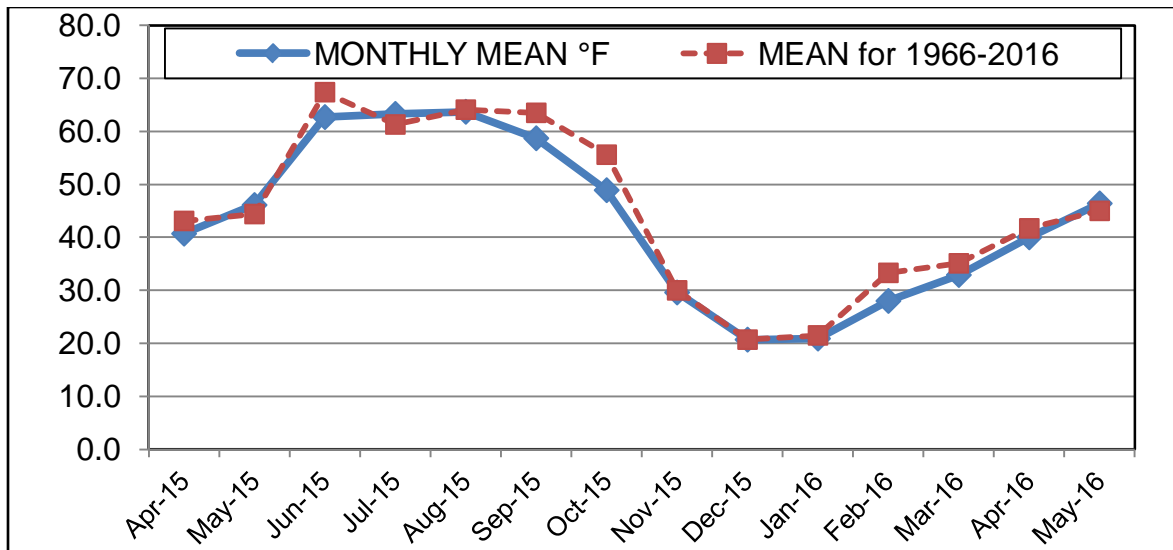


Figure 4. Mean monthly temperatures compared to the 50-year monthly mean temperatures for Wyoming's climate Division 10.

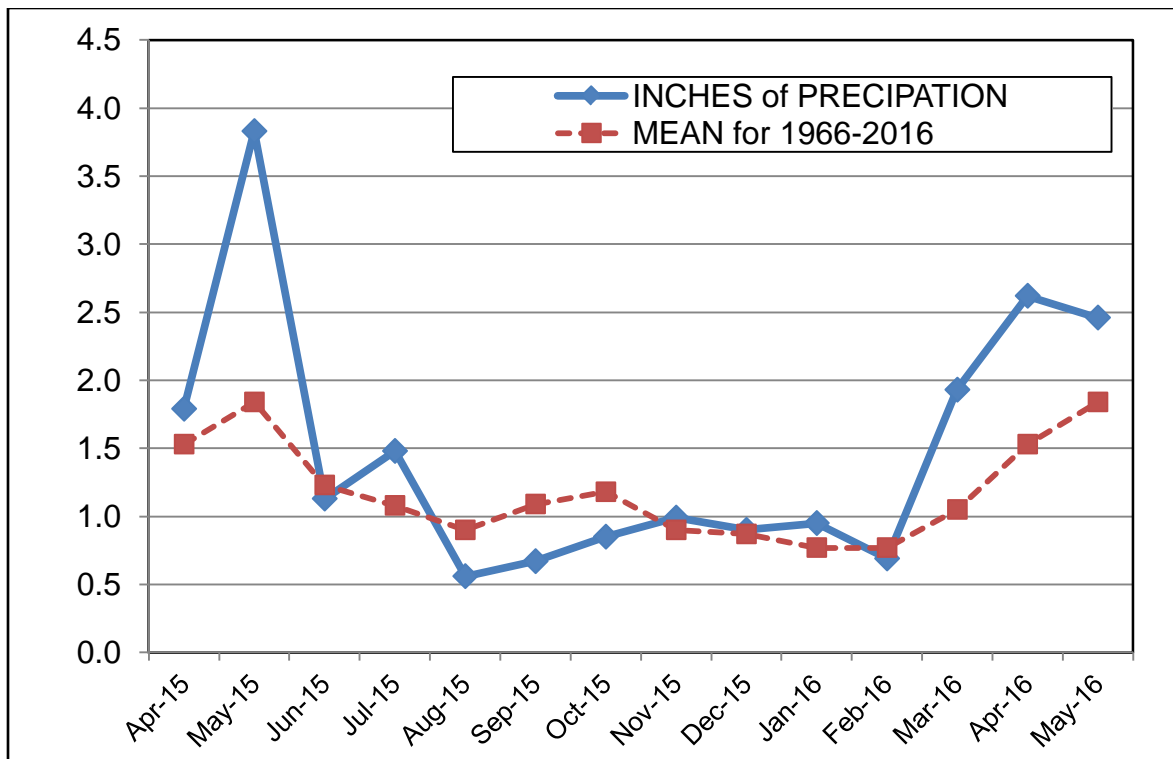


Figure 5. Monthly precipitation compared to the 50-year monthly mean precipitation rates for Wyoming's climate Division 10.

## **Habitat**

Much of the sage-grouse habitat in the SCCA is comprised of a relatively 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 sagebrush 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. Lek monitoring techniques are described in Christiansen (2012). Wyoming Game and Fish Department (WGFD) and BLM personnel, environmental consultants, and volunteers monitored 266 leks in the spring of 2016. This represented checking 91% of the occupied status leks in the SCCA. This rate of effort remained the same as in 2015. The 2007-2016 mean of leks checked annually was 87%. The proportion of leks checked in the spring of 2016 was more than 3% greater than the 10-year average.

Since only occupied leks were 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 considered inactive remained at 23% in 2016. The average peak male/lek for active leks increased 5% from 29.2 in 2015 to 31.6 in 2016. 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. However, 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 determine actual lek status.

In 2016, the peak male lek attendance totaled 5,943 males in the SCCA. This was a 14% increase from 2015. The males/lek average was 31.6. Although the average males/lek was greater in 2016 than in 2015, it was not as remarkable as the annual increase of 54% in the average males/lek observed in 2015. However, it was still the greatest observed average since 2007 in the SCCA.

This greater average males/lek ratio was assumed to be an artifact of the excellent chick survival observed in bio-year 2013. The 2016 males/lek average was 2.7% above the average (n=27.9) for the previous 10 years. Count monitored leks averaged 40.0 males/lek, compared to 27.9 males/lek for survey monitored leks. The current observed increase in male attendance rate is within the observed rates 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.

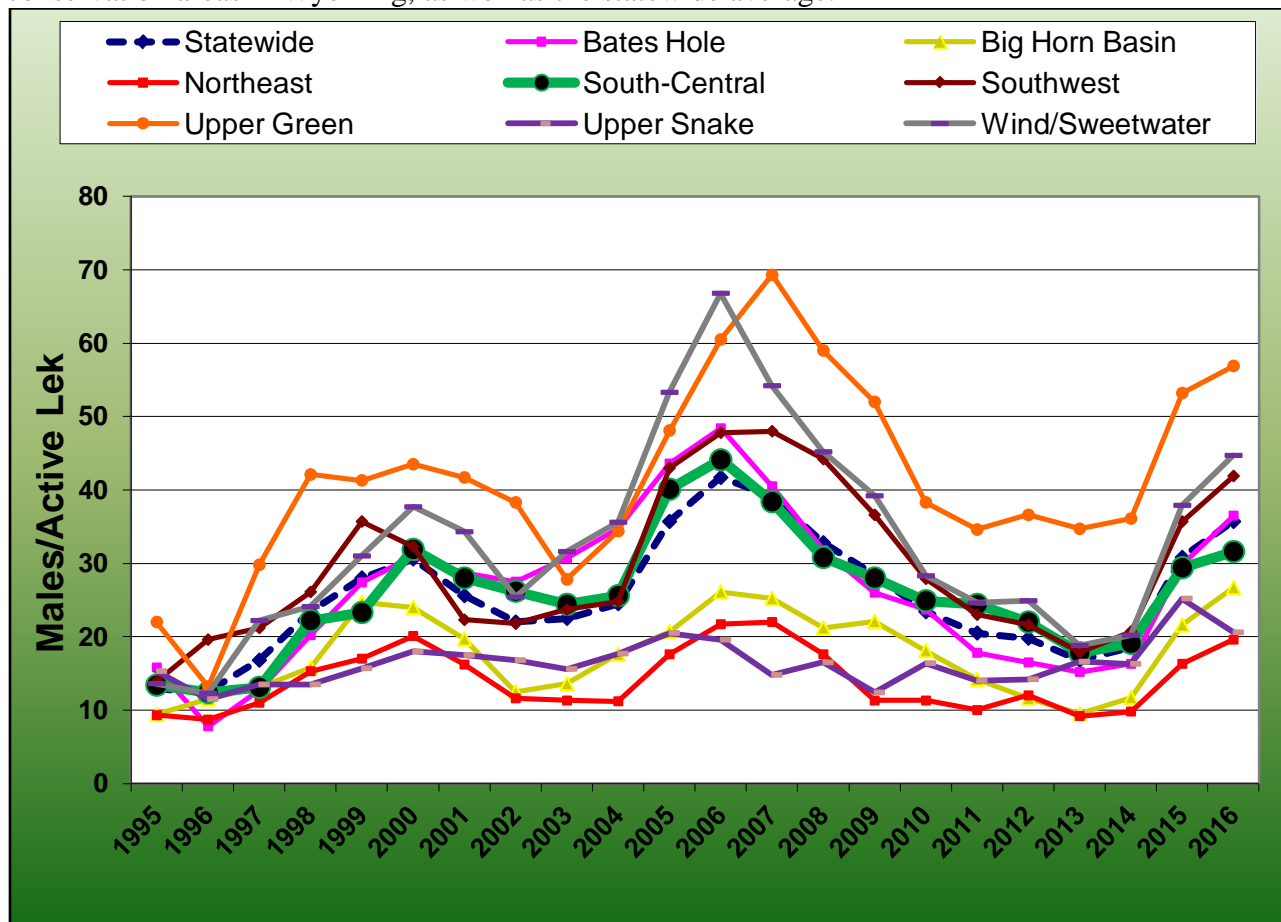


Figure 4. 1995-2016 Average peak male sage-grouse lek attendance, by Conservation Area and statewide, Wyoming.

## Harvest

Weather conditions during the 2015 hunting season were conducive to hunters being able to access sage-grouse habitat within the SCCA. Tables and graphs describing hunting season structure, annual harvest and subsequent wing survey analyses are provided in Appendix A. The 2015 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 2015 upland harvest survey indicated 457 hunters spent 963 days to harvest 776 sage-grouse in the SCCA. This equals approximately 0.8 birds/day, 1.7 birds/hunter, and 2.1 days/hunter. Both birds/day and birds/hunter rates increased

from the 2014 hunting season. Compared to the 2014 season results, when hunting regulations were similar with the exception of 1 less day in the 2014 season length, 2015 hunter numbers increased by 14%, the birds/day increased 12%; while the days/hunter decreased by 12%. Generally, during the past 10 years, overall harvest appeared to be correlated to hunter numbers and sage-grouse abundance.

Hunter-harvested sage-grouse wings have been collected annually and used for estimating productivity. Wings were collected in barrels set out 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 2015 hunting season WGFD collected 192 wings from wing barrels within the SCCA, which was 25% of the estimated harvest of 776. This was an increase of 32% when compared to the 146 wings collected in 2014, while harvest was estimated to have increased 21% in 2015. Age and sex composition of the wings indicated the proportion of chicks/hen decreased from 2.1 in 2014 to 1.4 in 2015, a decrease of 33%. This decrease was attributed to at least 2 severe late-winter storms which reduced nesting success and early chick survival in the SCCA. Statewide analyses of wing data from harvested sage-grouse have suggested chick/hen ratios of 1.4-1.7 typically results in relatively stable populations as determined by lek counts the following year. However, the male lek attendance rate in 2016 (bio-year 2015) increased. We attribute this to the excellent chick survival which was observed 2 years earlier in bio-year 2013.

## **Disease**

There were no cases of West Nile Virus documented in sage-grouse within the SCCA in bio-year 2015.

## **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 at the 7-Mile/Simpson Ridge area which is located within the Bates Hole/Shirley Basin Conservation Area was finalized in bio-year 2015. Principal investigators for the 7-Mile/Simpson Ridge project were WEST Inc., Wyoming Wildlife Consultants, Inc. and the University of Wyoming.

## **State and Federal Conservation Strategies**

Bio-year 2015 marked a very important period for the conservation of greater sage-grouse at both the state and the national levels.

In 2015, Wyoming Governor, Matt Mead, released Executive Order 2015-4 (EO 2015-4), Greater Sage-Grouse Core Area Protection. This document was developed to update and further clarify earlier executive orders which outlined the State's sage-grouse conservation efforts. A significant activity associated with EO 2015-4 was the review and revision of the sage-grouse Core area map. Compensatory mitigation was also recognized in EO 2015-4 as an acceptable conservation strategy.

The BLM and the USFS amended nine land-use plans and revised the Buffalo and Bighorn Basin plans to address threats to the greater sage-grouse in Wyoming. The BLM-USFS plans were developed consistent with the Wyoming Core Area Strategy. The plans apply varying levels of protections to Sagebrush Focal Areas, Priority Habitat Management Areas, and General Habitat Management Areas.

The US Department of Agriculture's Natural Resource Conservation Service (NRCS) continued to implement their national Sage-Grouse Initiative program (SGI) in the SCCA. This program was revised and re-tooled under the name of "Sage Grouse Initiative 2.0." Due to poor landowner participation in the SCCA, NRCS selected to not fill a local SGI coordinator position in the SCCA which was vacated during this period. Other NRCS staff in the SCCA worked to pursue SGI projects as opportunities presented themselves.

In September of 2015, U.S. Fish and Wildlife Service (FWS) concluded greater sage-grouse did not warrant protection under the Endangered Species Act (ESA). The decision was based in a collaborative, science-based strategy described as the largest land conservation effort in U.S. history. In its decision document, the Service specifically cited Wyoming's core area strategy as a mechanism that, if implemented as envisioned, should ensure conservation of sage-grouse in Wyoming and therefore help preclude the need for a future listing. The Service plans to reexamine the issue after five years (2020) to ensure planned conservation efforts are implemented and the status of the species remains unwarranted for listing. The decision document can be viewed at: <https://www.fws.gov/greatersagegrouse/>.

The FWS also continued to offer landowners an opportunity for 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 ESA. Landowner interest in enrolling in the CCAA program waned after the, "Not Warranted," listing decision was announced.

## **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

which is available at <https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management>. 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 2015, the SCLWG continued to support several ongoing sage-grouse conservation actions by allocating financial assistance, which was provided by the Wyoming Sage-Grouse Conservation Fund (Table 1). These projects are in addition to those listed in last year's report. Together these are the SCLWG projects supported by funds appropriated by the legislature for the 2015-16 biennium.

FY16 Recipient	Project	LWG Support
University of Wyoming, Dr. Beck	Response of greater sage-grouse to treatments in Wyoming big sagebrush	\$12,000
University of Wyoming, Dr. Meador	Evaluating threshold concepts for improving habitat through cheatgrass management	\$18,000

Table 1. Conservation actions supported by the South Central Local Working Group, bio-year 2015, Wyoming.

### Management Recommendations for the SCCA

1. Continue to monitor a minimum of 80% of the occupied leks in the SCCA.
2. Support WGFD and BLM efforts to address mitigation and reclamation issues.
3. Support research efforts to identify seasonal habitats, especially winter concentration habitat.
4. Coordinate with BLM and USFS to ensure habitat 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 habitat on private lands through mutually beneficial habitat projects.

### Literature Cited

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

## Sage Grouse Job Completion Report

Year: 2007 - 2016, 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)
2007	250	47	19	2090	48.6
2008	258	49	19	1683	37.4
2009	262	68	26	2021	33.7
2010	267	54	20	1528	33.2
2011	264	50	19	1272	31.0
2012	278	56	20	1490	28.1
2013	283	95	34	1662	21.9
2014	287	102	36	1607	21.4
2015	288	90	31	1915	32.5
2016	292	70	24	2320	40.0

#### b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2007	250	176	70	4523	35.1
2008	258	151	59	3085	28.0
2009	262	152	58	2648	24.7
2010	267	170	64	2849	21.9
2011	264	157	59	2460	22.0
2012	278	183	66	2215	19.1
2013	283	162	57	1564	14.9
2014	287	180	63	2019	17.7
2015	288	172	60	3174	27.6
2016	292	196	67	3623	27.9

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: 2007 - 2016, 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)
2007	250	223	89	6613	38.4
2008	258	200	78	4768	30.8
2009	262	220	84	4669	28.0
2010	267	224	84	4377	24.9
2011	264	207	78	3732	24.4
2012	278	239	86	3705	21.9
2013	283	257	91	3226	17.8
2014	287	282	98	3626	19.2
2015	288	262	91	5089	29.2
2016	292	266	91	5943	31.6

#### d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
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	180	31	28	211	85.3	14.7
2013	193	48	16	241	80.1	19.9
2014	197	78	7	275	71.6	28.4
2015	185	56	21	241	76.8	23.2
2016	194	59	13	253	76.7	23.3

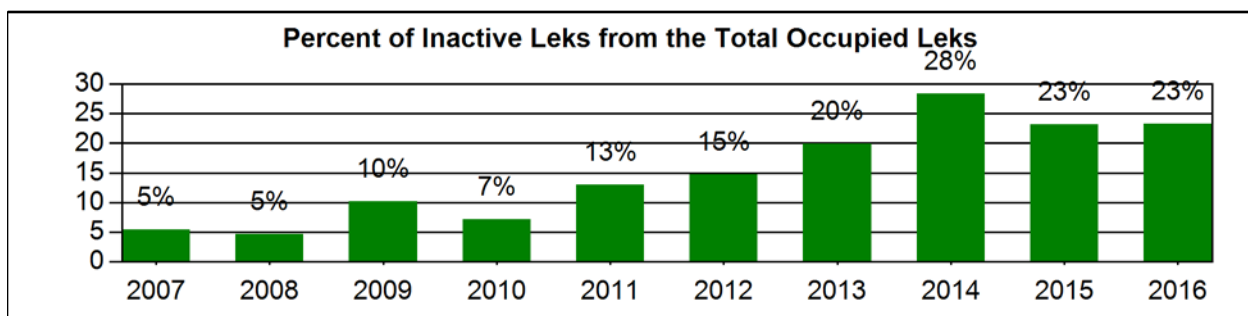
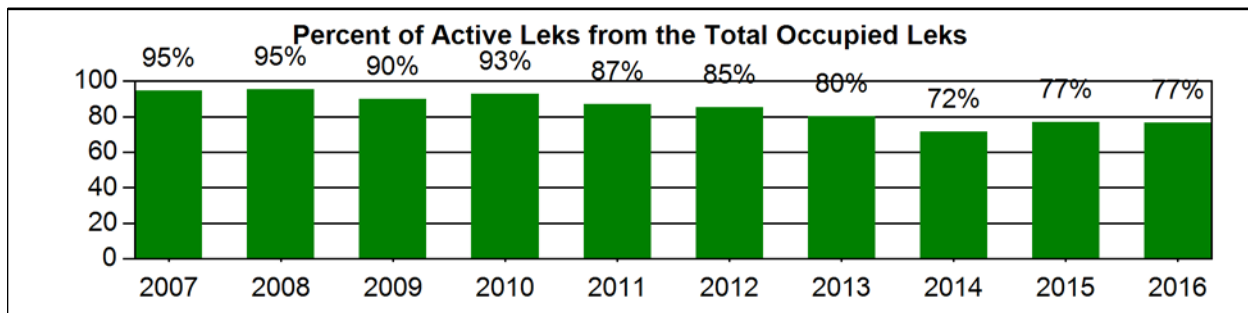
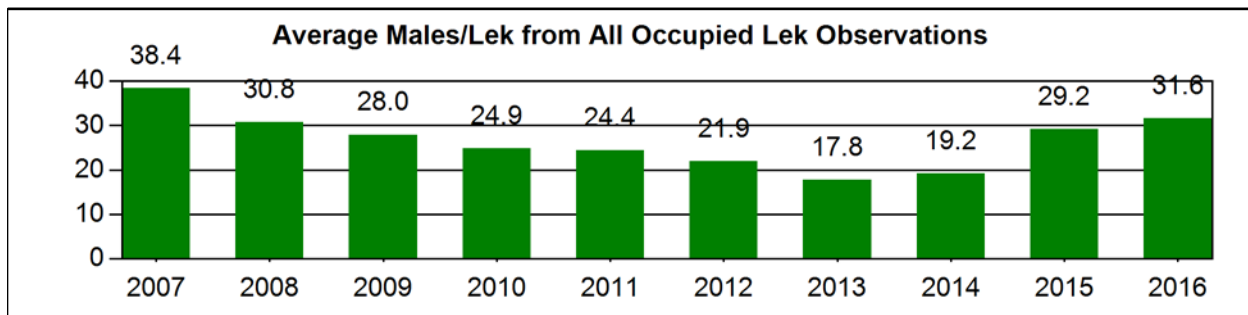
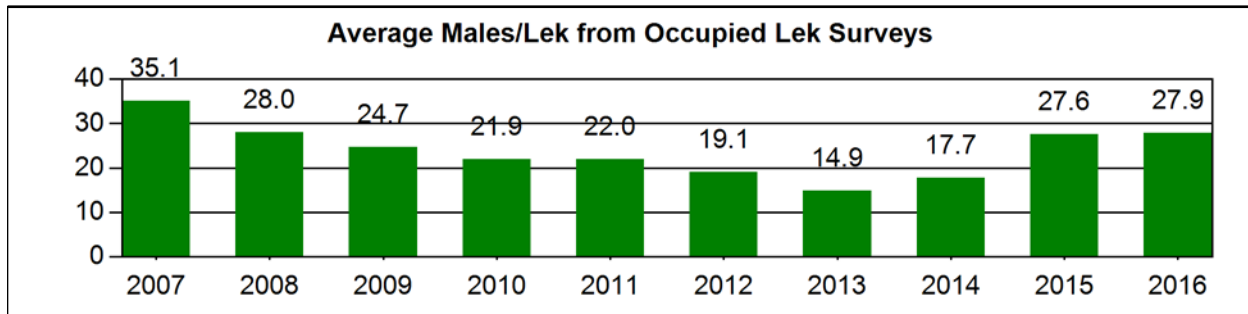
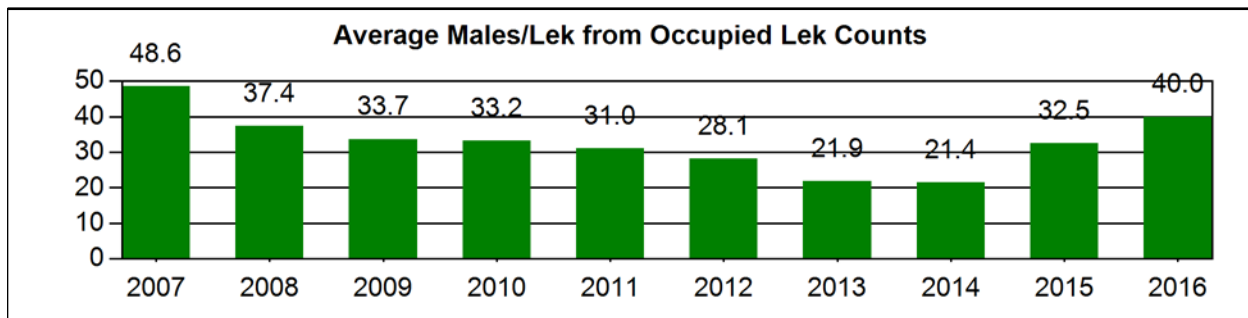
1) Occupied - Active during previous 10 years (see official definitions)

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

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

## Sage Grouse Occupied Lek Attendance Summary

Year: 2007 - 2016, Management Area: H, Working Group: South Central



## Sage Grouse Lek Characteristics

### Management Area: H, Working Group: South Central

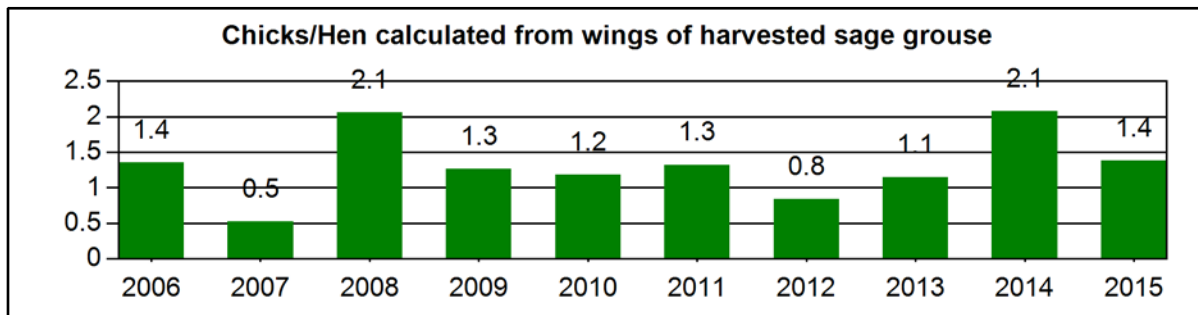
Region	Number	Percent	Working Group	Number	Percent
Green River	134	33.7	South Central	398	100.0
Lander	208	52.3			
Laramie	56	14.1			
Classification	Number	Percent	BLM Office	Number	Percent
Occupied	292	73.4	Casper	2	0.5
Undetermined	58	14.6	Lander	26	6.5
Unoccupied	48	12.1	Rawlins	353	88.7
			Rock Springs	17	4.3
Biologist	Number	Percent	Warden	Number	Percent
Baggs	121	30.4	Baggs	120	30.2
Green River	14	3.5	East Rawlins	103	25.9
Laramie	5	1.3	Elk Mountain	6	1.5
Saratoga	51	12.8	Lander	2	0.5
Sinclair	192	48.2	Rock Springs	14	3.5
South Lander	15	3.8	Saratoga	45	11.3
			South Laramie	5	1.3
			West Rawlins	103	25.9
County	Number	Percent	Land Status	Number	Percent
Albany	5	1.3	BLM	222	55.8
Carbon	262	65.8	Private	147	36.9
Fremont	13	3.3	State	28	7.0
Natrona	2	0.5	USFWS	1	0.3
Sweetwater	116	29.1			
Management Area	Number	Percent	Lek Status	Number	Percent
H	398	100.0	Active	208	52.3
			Inactive	139	34.9
			Unknown	51	12.8

## Sage Grouse Job Completion Report

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

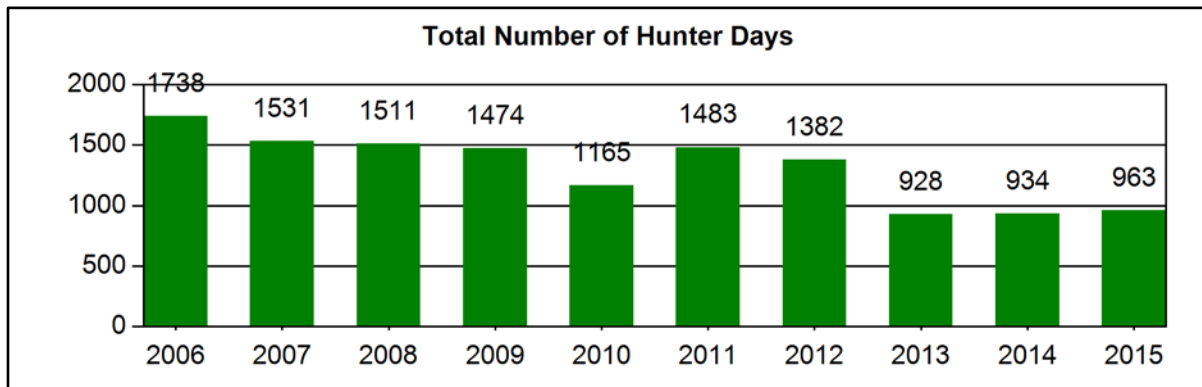
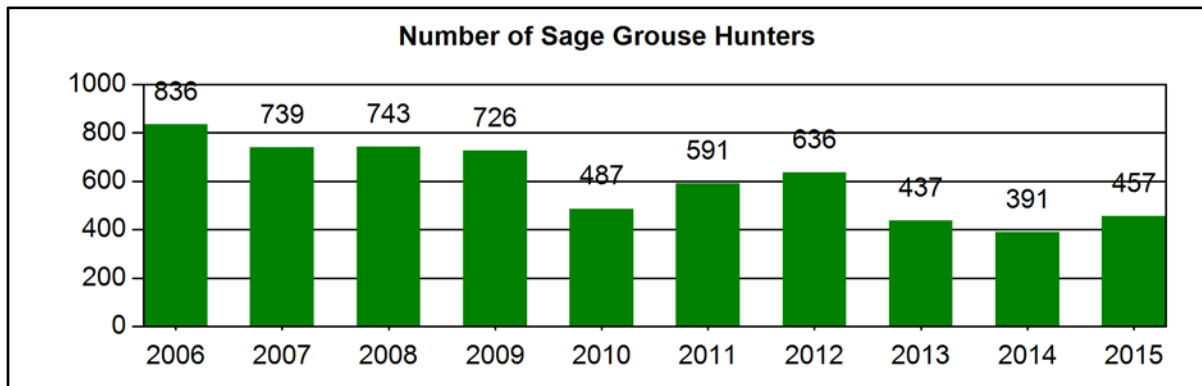
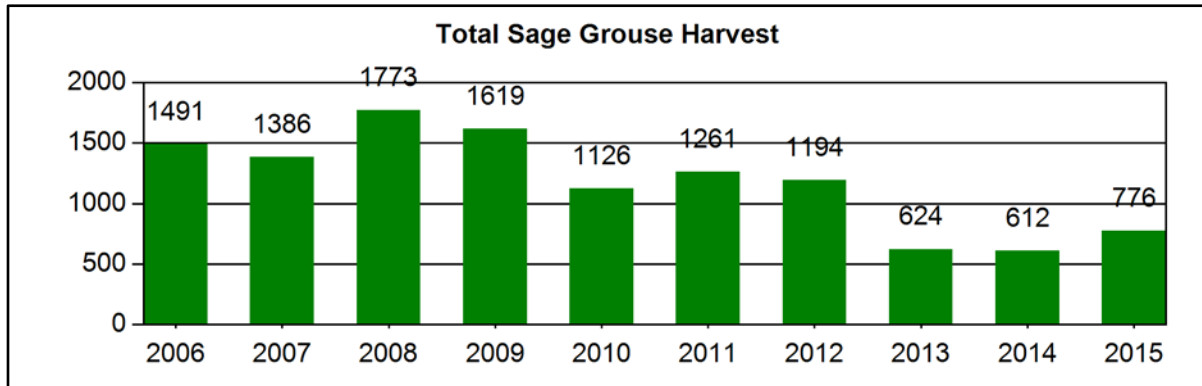
### 5. Composition of Harvest by Wing Analysis

Year	Sample Size	Percent Adult		Percent Yearling		Percent		Chicks/ Hens
		Male	Female	Male	Female	Male	Female	
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
2015	192	10.4	30.7	2.6	5.7	24.5	26.0	1.4



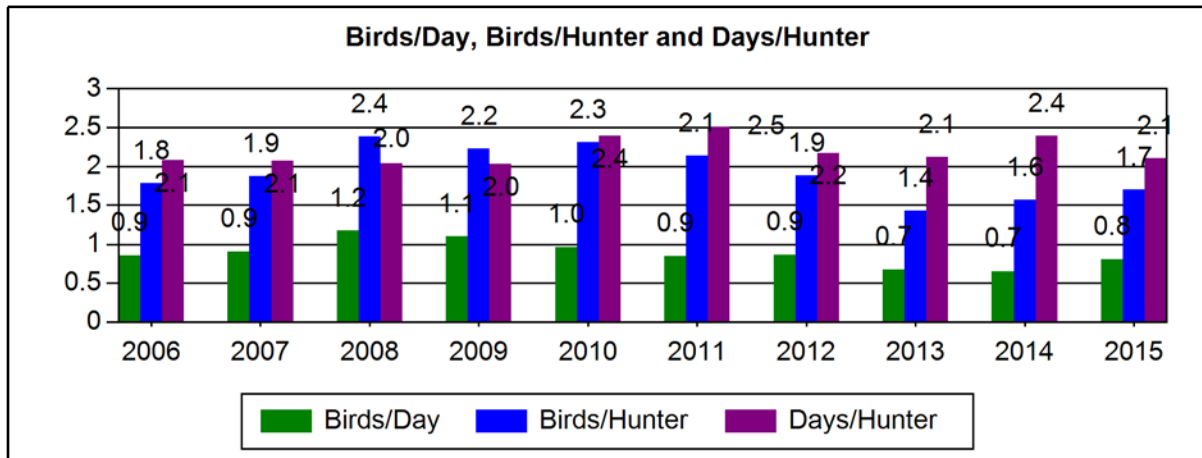
## Sage Grouse Harvest Summary

Management Area: H, Working Group: South Central



## Sage Grouse Harvest Summary

Management Area: H, Working Group: South Central

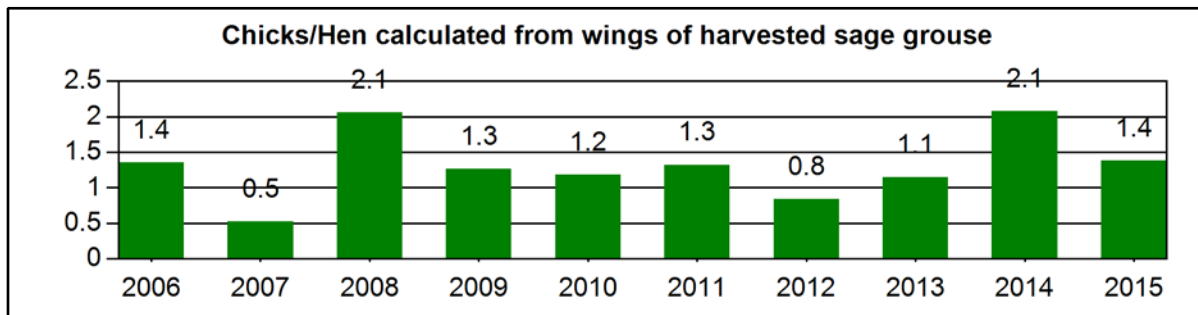


## Sage Grouse Job Completion Report

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

### 5. Composition of Harvest by Wing Analysis

Year	Sample Size	Percent Adult		Percent Yearling		Percent		Chicks/ Hens
		Male	Female	Male	Female	Male	Female	
2006	315	16.8	28.3	3.8	5.4	21.6	24.1	1.4
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Southwest

Sage-Grouse  
Job Completion Report  
2015

June 2015-May 2016

Patrick Burke  
Wyoming Game & Fish Dept.  
Green River Region

# 2015 Annual Sage-Grouse Job Completion Report

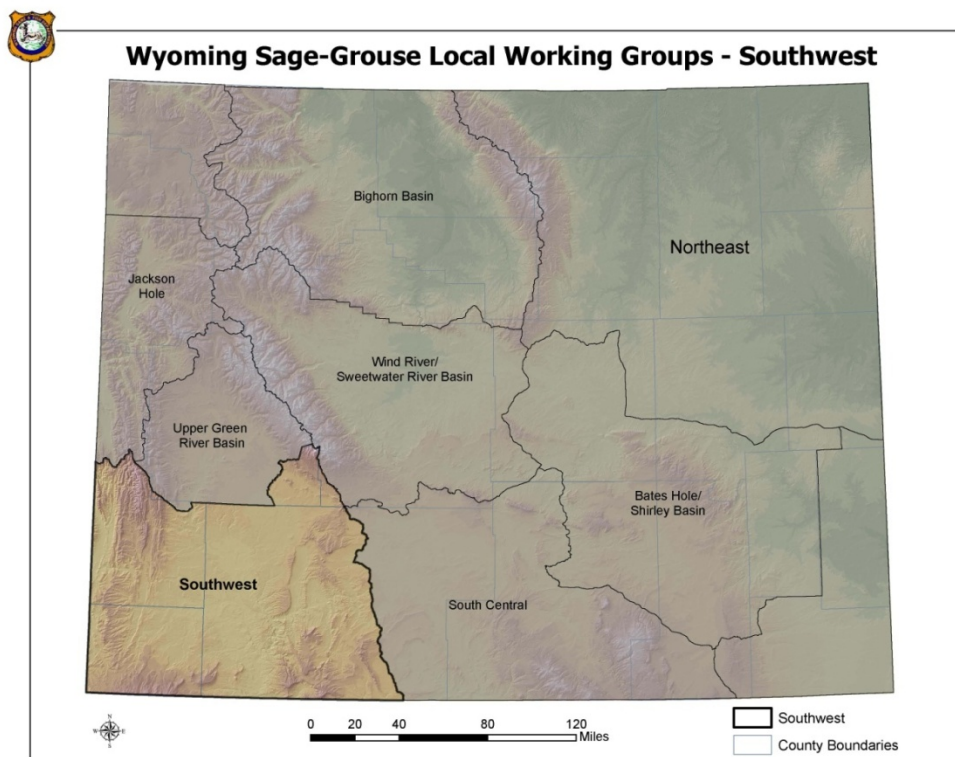
Conservation Plan Area: **Southwest**

Biological Year: **June 1, 2015 – May 31, 2016**

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, 2015-May 31, 2016, with comparisons made to the previous ten years of data.



**Figure 1.** Wyoming Local Sage-Grouse Working Group Boundaries

Range-wide sage-grouse populations have experienced declines and loss of sagebrush habitats upon which sage-grouse depend. In response, there has been an increased emphasis on sage-grouse data collection over the last two decades. These monitoring efforts suggest 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 never fell back to their 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 result 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 and 2013, which resulted in decreased chick to hen ratios, suggesting a continuation of overall population declines. However, in 2014 much improved chick production and survival, evidenced by higher proportions of chicks to adult hens in hunter submitted wings resulted in higher lek attendance numbers in throughout the SWSGCA in 2015 and 2016.

In addition to the impacts that drought 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 are no longer being actively pursued, the potential for negative impacts to sage-grouse populations 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 impact 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. 2014a/b, Peebles 2015).

## **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 in 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.

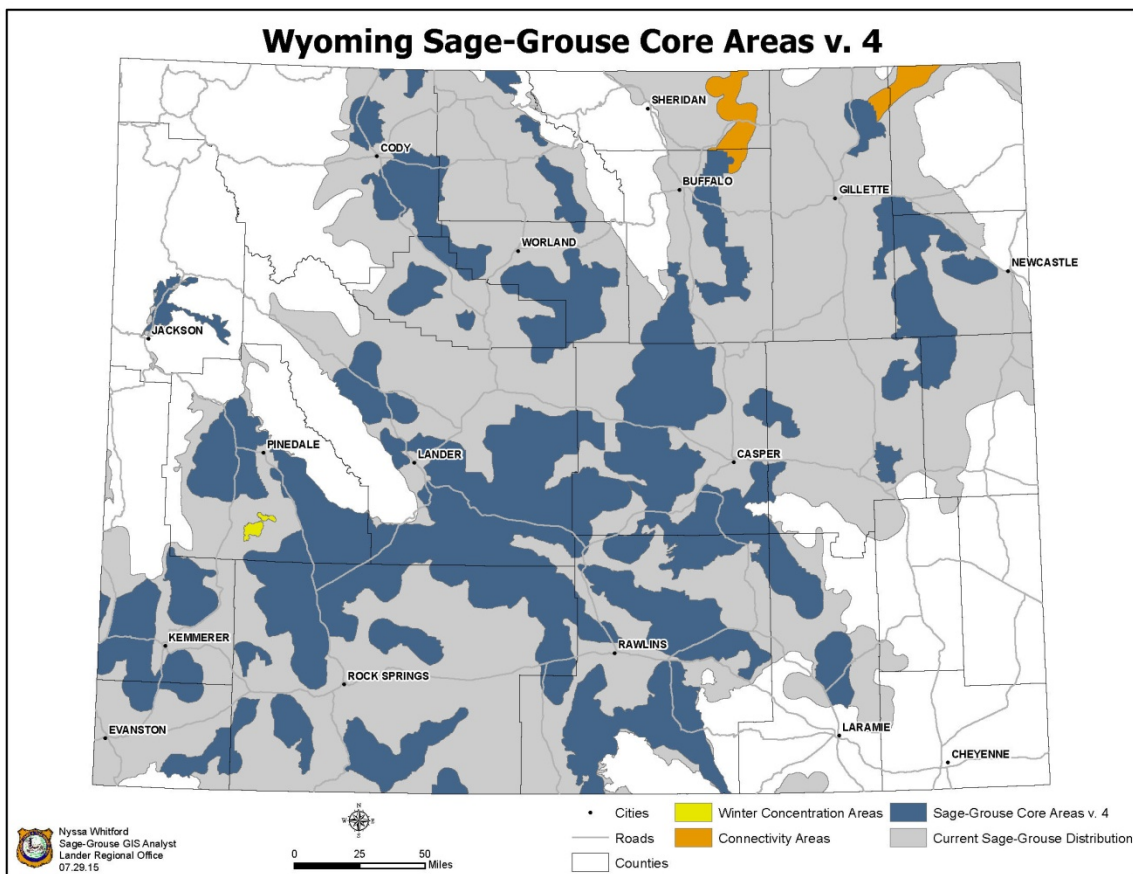
Following the 2010 "warranted but precluded" listing decision by the U.S. Fish & Wildlife Service, Freudenthal reconvened the SGIT and tasked them to update the core area map and strategy using the most recent data. The SGIT, with the assistance of the local working groups, prepared these updates and 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. Governor Mead issued a new Sage-Grouse Core Area Protection Executive Order on July 29, 2015. Executive Order 2011-5 is appended to the Statewide JCR and is also available at <https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management>. The current core areas are shown in Figure 2.



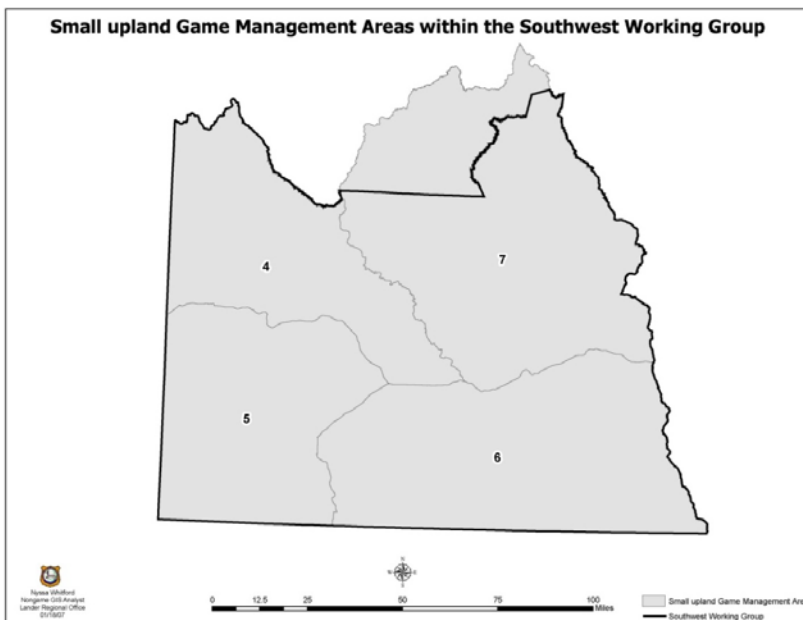
**Figure 2.** Wyoming sage grouse core areas Version 4.

## 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 that 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 WGFH Handbook of Biological Techniques (Christiansen 2012), which is largely based on Connelly et al (2003).

## RESULTS

### Lek Monitoring

A total of 325 occupied leks were known to exist in the SWSGCA during the 2016 lekking season. Of these 325 occupied leks, 299 of them were checked in 2016, with 94 of those checks being lek counts with three or more visits during the breeding season, with the remaining 205 checks consisting of lek surveys where less than three lek visits were made during the breeding season.

Of the 299 lek visits to known lek sites in the SWSGCA conducted in 2016, 256 of them were documented as being active, 28 were classified as being inactive and 15 leks were of unknown or undetermined status. All lek monitoring data from 2016, along with data from the past ten years for comparison are summarized in Appendix B Tables 1 a-d and JCR Data Figures 2 a-e.

Because of the quantity of leks in the SWSGCA, data collection efforts have 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 in an area.

Since only “occupied” leks are being reported on Appendix B 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 can be safely assumed that not all leks in the area have been located, 3) sage-grouse populations can exhibit cyclic patterns over approximately a decade long period, 4) the effects of un-located or un-monitored leks that have become inactive cannot be quantified or qualified, and 5) lek sites may shift over time. Both the number of leks and the number of males attending these leks must be quantified in order to estimate population trend.

The average number of males per active lek for all leks checked (both counted and surveyed) during the 2016 lekking season was 41.9 males per active lek. This is a 17% increase from the 35.7 males per active lek observed in 2015, and above the 10 year average of 32.4 males per active lek; but still below the 48 males per lek observed in 2007. The average number of males in attendance on the 94 count leks in 2016 was 44.0 males per lek. This number is a major increase from low numbers seen in 2013 and 2014, and is the highest observed since 2008, and above the 10-year average of 40 males per count lek. For the 205 leks that were surveyed in 2016, the average lek had 40.6 males in attendance, which is above the recent average and the highest observed since 2007.

It is important to note that data collection efforts have increased considerably since the early 2000's. In 2000, only 63% of known occupied leks were checked, but in 2016, 92% of the

known 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 total sage-grouse population size in a statistically significant way. However, the increased male per lek averages in recent years along with improved chick per hen ratios in hunter submitted wings indicates the sage-grouse population in southwest Wyoming had been slightly increasing during this reporting period.

## **Harvest**

The 2015 hunting season for sage-grouse in the SWSGCA ran from September 19 to September 30 and allowed for a daily take of 2 birds with a limit of 4 grouse in possession (Appendix B Table 2 a). The 2015 season was consistent with how the season has been run since 2002 when the season opening date was moved to the third Saturday in September and the daily bag limit was reduced to 2 birds and a possession limit of 4 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 2015 hunting seasons. Note that for 2006-2009 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 (Figure 3). 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 SWSGCA report.

Based on harvest survey estimates, 1,586 hunters harvested 4,479 sage-grouse during the 2015 hunting season (Appendix B Table 2 b and Figures 2 a-d). This is well above the 2,645 birds reported harvested in 2014 and also well above the 10 year average harvest of 3,791 birds. The 2015 harvest is the highest estimated harvest since 2006 when 5,019 birds were taken. Taking into account the differences in how harvest estimates were reported under the old Management Area system, 2015's harvest was probably the largest harvest in the SWSGCA in recent history. 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, weather conditions, and hunter participation levels over that period.

Wings are collected each hunting season via voluntary hunter submission to allow for the determination of the sex and age of harvested birds. Successful hunters submitted 860 grouse wings from the 2015 hunting season (Appendix B Table 3). This represents just over 19% of the estimated total harvest for 2015, which is right in line with the ten-year average submission rate of 18%, but down from the 2011 submission rate, when over one-quarter of the estimated harvest was submitted for age analysis.

The most important ratio obtained from the wing analysis is the chick to hen ratio; this ratio provides a general indication of chick recruitment. 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.

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 2015 hunting season was 1.8 chicks/hen (Appendix B Table 3 and Figure 3). This ratio suggests a stable to weakly increasing grouse population. This observed chick:hen ratio corresponds well with the increased male lek attendance seen in the spring of 2016.

## **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.

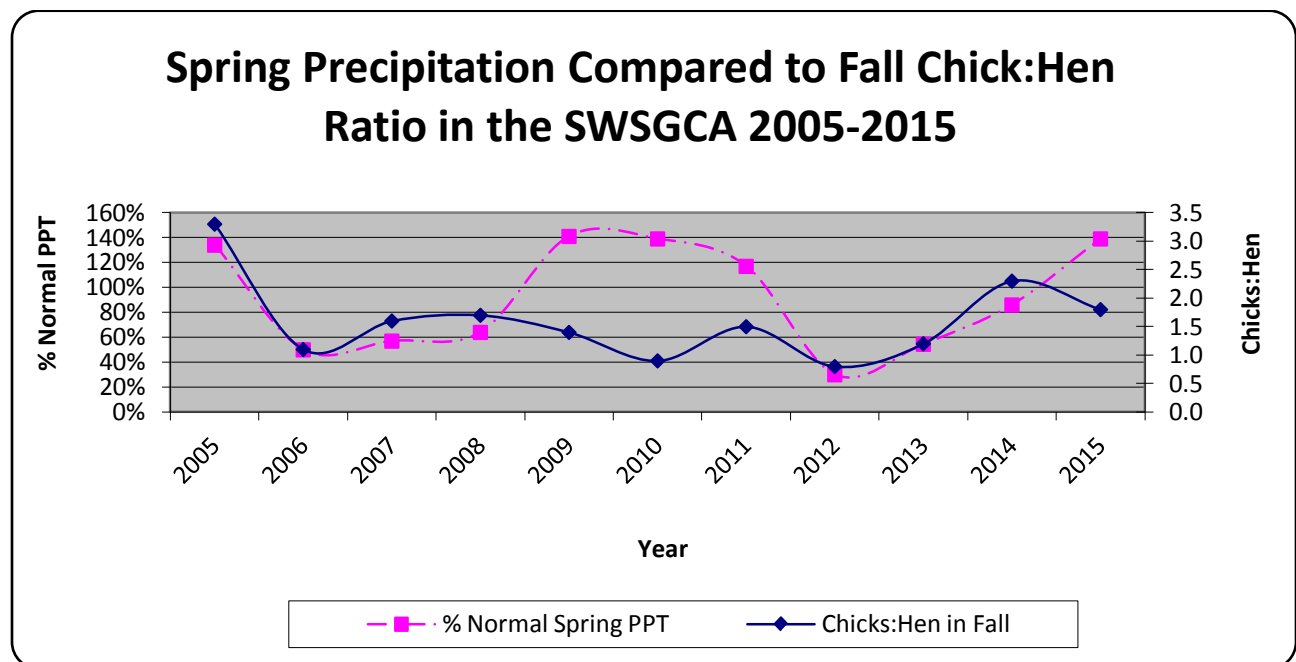
Winter weather has not been shown to be a limiting factor to sage-grouse except in areas with persistent snow cover that is deep enough to limit sagebrush availability. This condition is rarely present in the SWSGCA even during the above average winter of 2010-2011.

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. However, periods of prolonged cold, wet weather may have adverse effects on hatching success, plant and insect phenology and production and chick survival.

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 86% of normal it was enough moisture to result in improved chick survival in 2014. The better than average spring time precipitation observed in 2015 of 139% of average did not, however result in as high of chick to hen ratios as would have been expected. Many areas of the state experienced heavy precipitation and even flooding in May 2016 potentially reducing nesting success and chick survival.

**Table 1.** Spring precipitation compared to fall chick:hen ratios in the SWSGCA 2005-2015. 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	86%	2.3
2015	139%	1.8



**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 new leks are still being located in the SWSGCA, we believe that the majority of the currently occupied leks have been documented, however important other seasonal habitats such as winter concentration areas and especially nesting/early brood-rearing 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 the 2015-16 biennium.

Table 2. Projects funded in part by the SWSGLWG, 2015–16 biennium.

<b>Project Name</b>	<b>Project Description</b>	<b>Partners</b>
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
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
WY Core Area Habitat Condition Assessment	RSF modeling to assess sagebrush habitat conditions at multiple scales and the response of sage-grouse to changes in conditions	Audubon Rockies, TNC, Yellowstone Ecological Research Center, Governor's SG Implementation Team
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
Half-meter NAIP Imagery Acquisition	Half-meter (high resolution) imagery for use in the DDCT process	15 federal, state and county agencies
South LaBarge Weeds	Invasive weed control	Sublette County Weed & Pest, Sublette County Cheatgrass Task Force, BLM

## **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.

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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. 2014a. 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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## **CURRENT RESEARCH IN THE SWSGCA**

Utah State University continues to study the effectiveness of common raven control in southern Wyoming.

## RECOMMENDATIONS

- 1) Identify important seasonal habitats, especially brood rearing areas.
- 2) Continue to implement provisions of the Governor's executive order for sage-grouse core area management.
- 3) Continue implementation of 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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# Appendix A: Sage Grouse Job Completion Report

Year: 2007 - 2016, 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)
2007	256	69	27	3914	58.4
2008	266	69	26	4284	63.0
2009	283	71	25	2651	40.2
2010	289	78	27	2214	30.8
2011	299	73	24	1855	26.9
2012	306	82	27	1720	23.2
2013	313	117	37	1955	19.4
2014	315	97	31	1613	19.9
2015	318	70	22	2197	34.9
2016	325	94	29	3743	44.0

**b. Leks Surveyed**

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
2007	256	174	68	5779	43.1
2008	266	149	56	4021	33.5
2009	283	189	67	5485	35.4
2010	289	183	63	3753	26.6
2011	299	166	56	2893	21.3
2012	306	185	60	2880	20.9
2013	313	178	57	2254	16.9
2014	315	193	61	3177	21.2
2015	318	218	69	6111	35.9
2016	325	205	63	6178	40.6

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)

# Appendix A: Sage Grouse Job Completion Report

Year: 2007 - 2016, Working Group: Southwest

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

**c. Leks Checked**

Year	Occupied	Checked	Percent Checked	Peak Males	Avg Males / Active Lek (2)
2007	256	243	95	9693	48.2
2008	266	218	82	8305	44.2
2009	283	260	92	8136	36.8
2010	289	261	90	5967	28.0
2011	299	239	80	4748	23.2
2012	306	267	87	4600	21.7
2013	313	295	94	4209	18.0
2014	315	290	92	4790	20.7
2015	318	288	91	8308	35.7
2016	325	299	92	9921	41.9

**d. Lek Status**

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
2007	214	18	11	232	92.2	7.8
2008	196	13	9	209	93.8	6.2
2009	232	18	10	250	92.8	7.2
2010	225	13	23	238	94.5	5.5
2011	219	6	14	225	97.3	2.7
2012	228	25	14	253	90.1	9.9
2013	243	30	22	273	89.0	11.0
2014	234	26	27	260	90.0	10.0
2015	244	22	22	266	91.7	8.3
2016	256	28	15	284	90.1	9.9

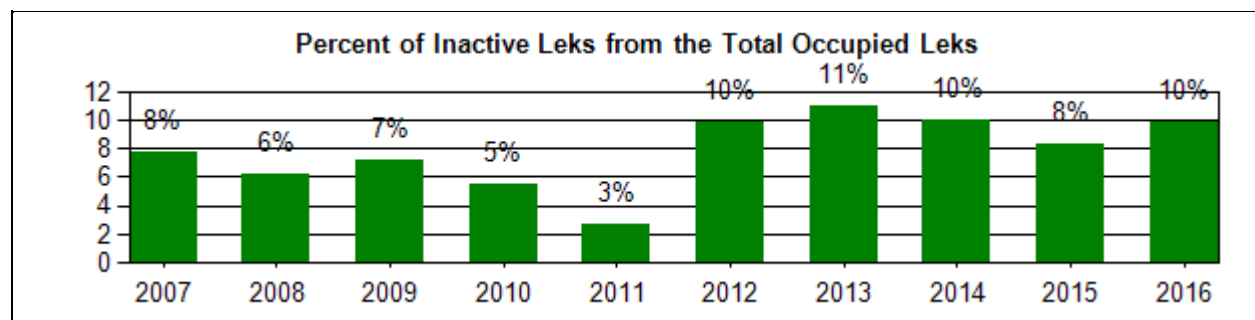
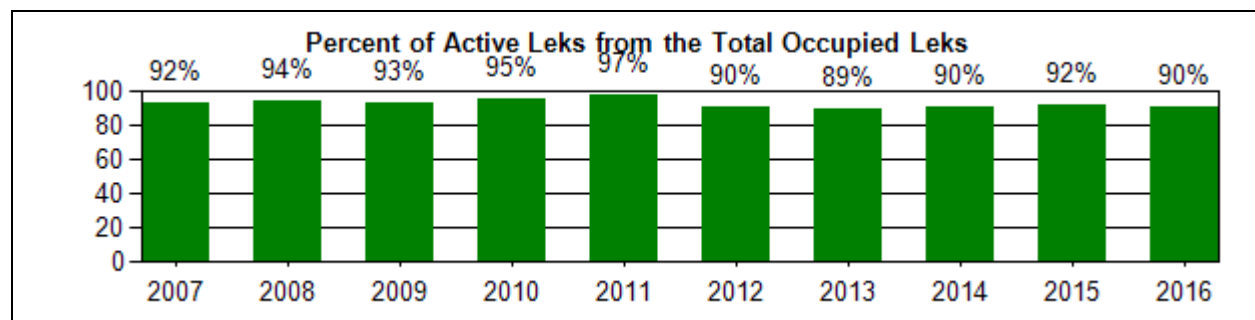
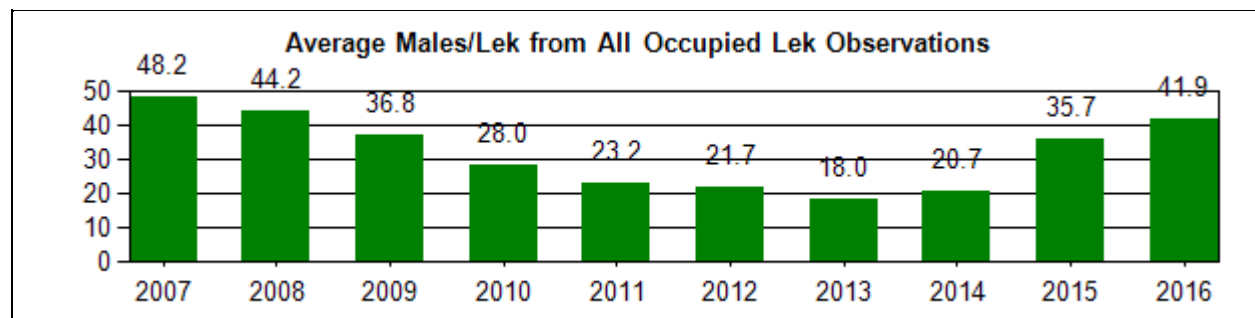
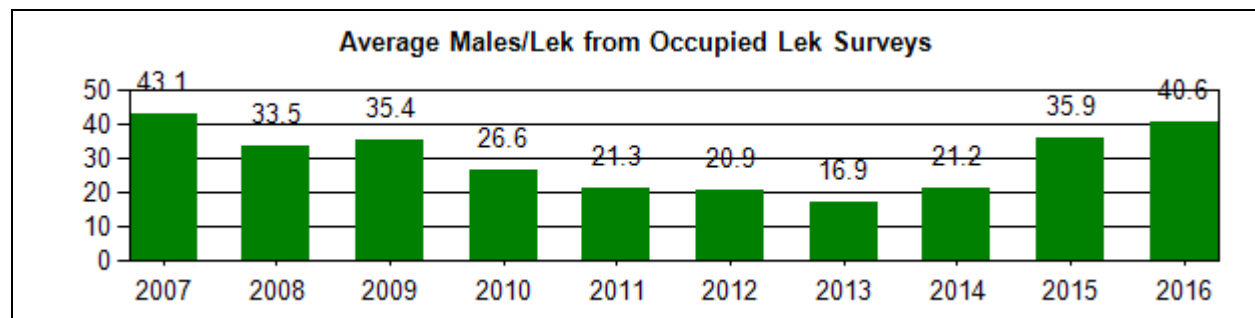
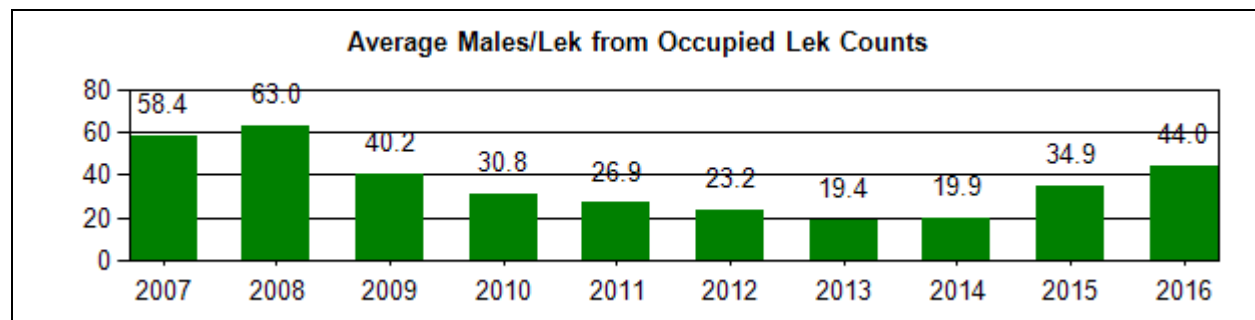
1) Occupied - Active during previous 10 years (see official definitions)

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: 2007 - 2016, Working Group: Southwest



# Sage Grouse Lek Characteristics

## Working Group: Southwest

Region	Number	Percent
Green River	387	87.8
Pinedale	54	12.2

Classification	Number	Percent
Occupied	326	73.9
Undetermined	15	3.4
Unoccupied	100	22.7

Biologist	Number	Percent
Green River	165	37.4
Mountain View	222	50.3
Pinedale	53	12.0
South Lander	1	0.2

County	Number	Percent
Fremont	4	0.9
Lincoln	129	29.3
Sublette	34	7.7
Sweetwater	209	47.4
Uinta	65	14.7

Management Area	Number	Percent
G	441	100.0

Working Group	Number	Percent
Southwest	441	100.0

BLM Office	Number	Percent
Kemmerer	192	43.5
Pinedale	11	2.5
Rawlins	4	0.9
Rock Springs	234	53.1

Warden	Number	Percent
Cokeville	56	12.7
Evanston	34	7.7
Green River	73	16.6
Kemmerer	63	14.3
Mountain View	51	11.6
Rock Springs	110	24.9
South Pinedale	54	12.2

Land Status	Number	Percent
BLM	306	69.4
BOR	15	3.4
National Park	2	0.5
Private	103	23.4
State	14	3.2
USFS	1	0.2

Lek Status	Number	Percent
Active	278	63.0
Inactive	73	16.6
Unknown	90	20.4

# Sage Grouse Job Completion Report

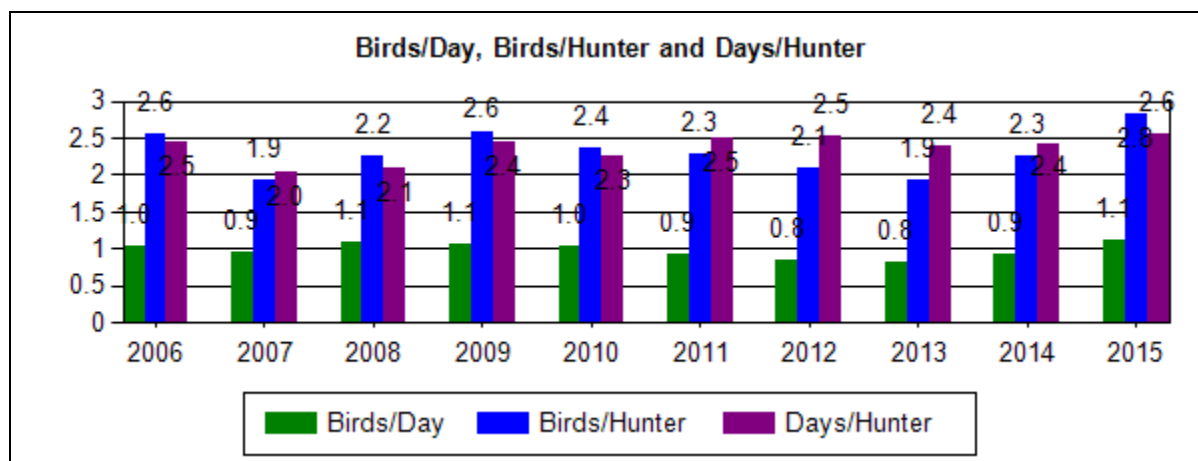
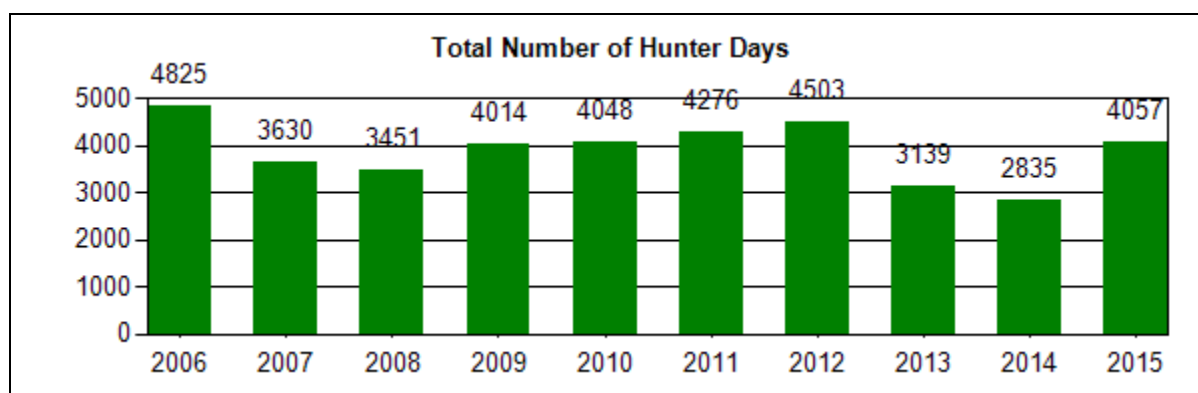
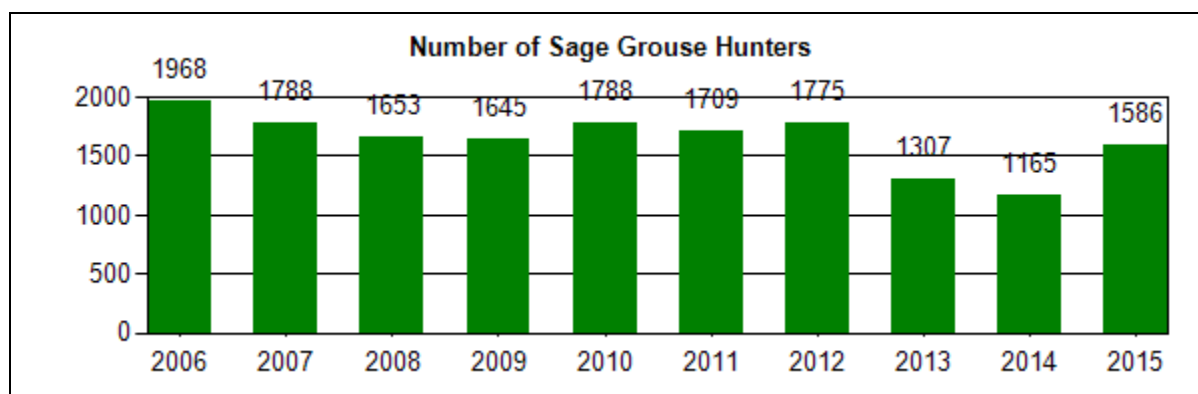
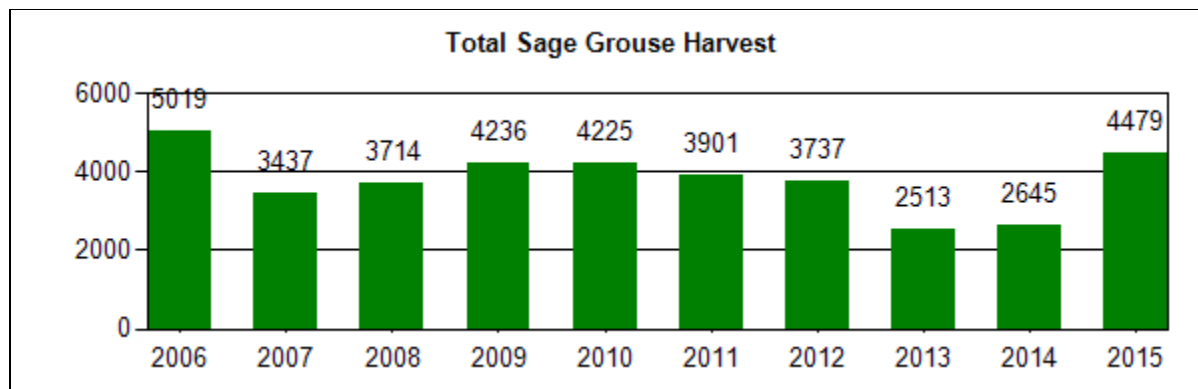
Year: 2006 - 2015, Working Group: Southwest

**Table 2. Sage Grouse Hunting Seasons and Harvest Data**

a. Season	Year	Season Start	Season End	Length	Bag/Possession Limit		
	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		
	2015	Sep-19	Sep-30	12	2/4		
	Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
	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
	2015	4479	1586	4057	1.1	2.8	2.6
	Avg	3,791	1,638	3,878	1.0	2.3	2.4

# Figures 2 a-d. Sage Grouse Harvest Summary

Working Group: Southwest



# Sage Grouse Job Completion Report

Year: 2006 - 2015, 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	
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
2015	860	13.5	25.1	3.1	4.3	27.4	26.5	1.8

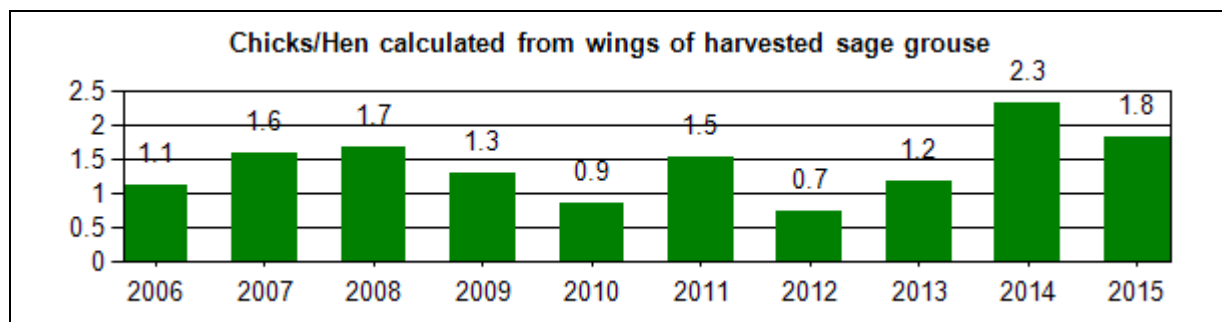


Figure 3. Chicks/hen 2006-2015 in SWSGCA.

Upper Green River Basin  
Sage-Grouse  
Job Completion Report  
2015

June 2015-May 2016

Dean Clause  
Wyoming Game & Fish  
Dept.  
Pinedale Region

## Narrative

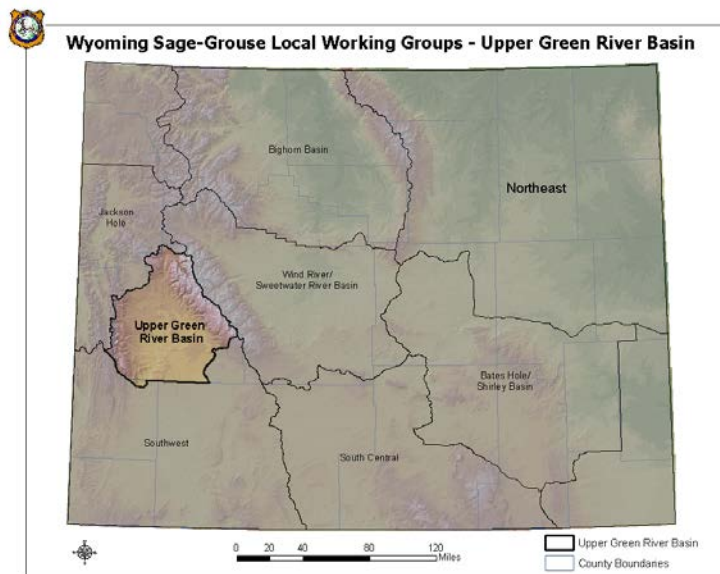
Conservation Plan Area: **Upper Green River Basin**

Period Covered: **6/1/2015 – 5/31/2016**

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 2015 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 (82%), with fewer leks found on private (12%), and state (6%) 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; although most leks within close proximity to one another typically get visited on the same morning and therefore probably do meet the requirements for lek complex counts. Besides arbitrary delineation of lek complexes in the past based on geographic area, efforts have not been using actual male movements to map lek complexes, and therefore individual lek complexes are unknown at this time.

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, most areas within the Upper Green River Basin have been surveyed to document important sage-grouse wintering areas. These surveys have been conducted aerially with a helicopter during January/February using stratified transects at approximately 1 minute (~1 mile) intervals or less to document sign and live observations of grouse. These aerial surveys, along with other existing data, are very useful baseline information to identify important winter grouse habitats for future management decisions.

Weather data (particularly precipitation data) is 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. 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 157 leks are currently documented in the UGRBWGA. These leks are classified as follows; 137 occupied, 20 unoccupied, and 0 undetermined. During 2016, a total of 134 occupied leks (99%) were checked (survey or count). Lek monitoring efforts in 2016 primarily focused on counts (86%) over surveys (14%). Results from the counts and surveys showed that 82% of the leks were active and 18% were inactive. The average number of males/lek for all active leks increased to 57 in 2016, compared to the past three years of 53 in 2015, 36 in 2014, and 35 in 2013. This results in an 8% increase compared to 2015 and a 64% increase compared to 2013 (Figure 1).

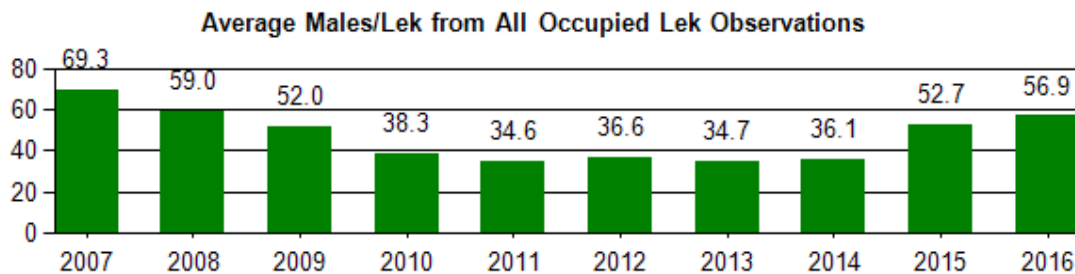


Figure 1. Average Peak Male Sage-grouse Lek Attendance 2007-2016, UGRBWG Area.

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 2015-2016 (Figure 1). The 2016 peak male lek attendance is 18% lower compared to the previous peak in 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) and drought 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 16 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 (56 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 (1997-2016). These leks were tracked from 1997 through 2016 to represent population trends (Figure 2). This trend in average peak males/active lek suggests a stable grouse population from 1997-2001, declining through 2003, increasing through 2007, declining through 2010, stabilizing from 2012 -2014 and increasing in 2015-2016. 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.

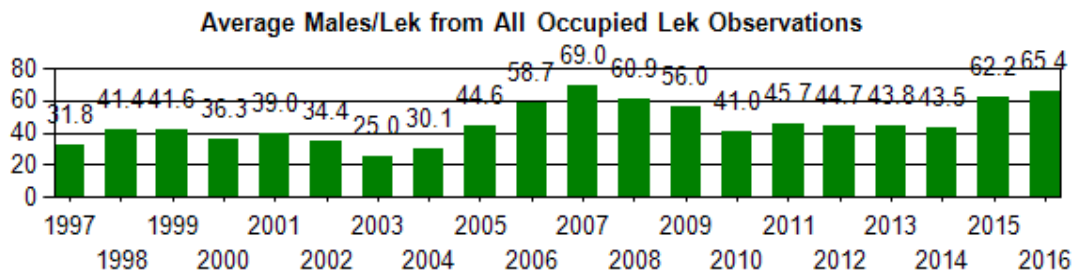


Figure 2. Average Peak Male Sage-grouse Lek Attendance 1997-2016 using only leks known in 1997, UGRBWG Area.

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 1997-2016 (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 2016. Of the 11 occupied leks, 11

were checked in 2016 resulting in 5 (45%) of those leks being active. The average peak number of males/lek for these 11 occupied leks showed a 35% increase from 1997-2015, 2% decline from 2007-2016, and a 40% increase from 2015 to 2016 (Figure 3).

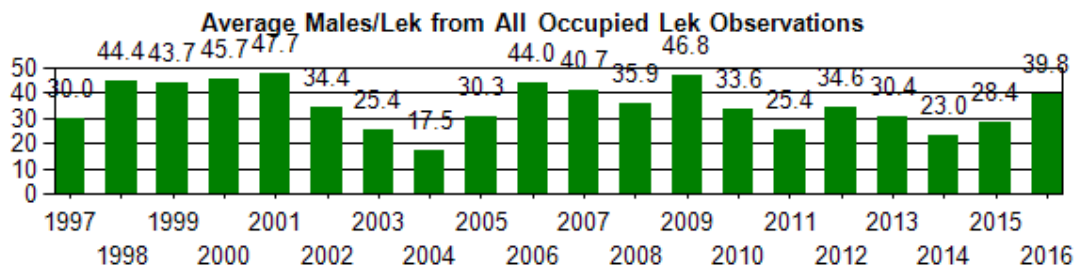


Figure 3. Average Peak Male Sage-grouse Lek Attendance 1997-2016, Disturbed Leks.

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 2016. Of the 114 occupied leks, 111 were checked in 2016 resulting in 92 (84%) of those leks being active. The average peak number of males/lek for these occupied leks showed 106% increase from 1997-2015, 16% decline from 2007-2015, and a 8% increase from 2015 to 2016 (Figure 4).

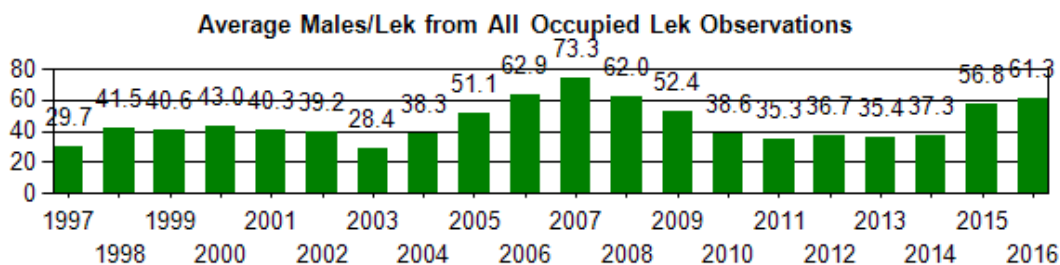


Figure 4. Average Peak Male Sage-grouse Lek Attendance 1997-2016, Undisturbed Leks.

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 2015-2016 (Figures 3 & 4). 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 lower number of leks in the Disturbed data results in more erratic male lek trends. The 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 2016 (occupied leks only). The Undisturbed Leks show activity levels changing very little with an average of 81% (1997-2001) to 84% by 2016, 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).

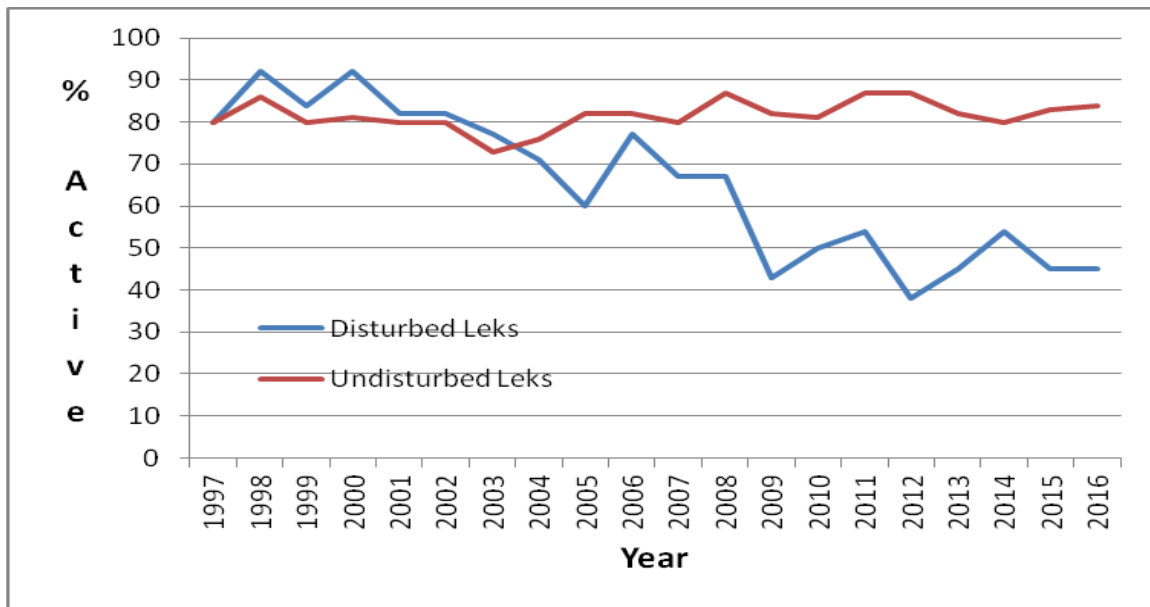


Figure 5. Proportion of active leks 1997-2016, Disturbed Leaks versus Undisturbed Leaks.

#### Population Trends and Estimates

No reliable population estimate have be made from data collected during 2016 (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 followed by a slight increase in 2016 indicates a population growth. 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 2015 sage-grouse season was September 19 through September 30, a 12-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 2015 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) was developed in 2010, where SGMA D covers all of the UGRBWGA and has been reported that way since 2010.

The 2015 harvest survey estimated that 500 hunters bagged 1205 sage grouse and spent 1129 days hunting. The average number of birds per day was 1.1, the average number of birds per hunter was 2.4, and the number of days spent hunting per hunter was 2.3 during 2015. Overall, harvest and harvest rates haven't changed much during the past 5 years, except for the lower harvest rates in 2013 (Figure 6). Harvest survey data indicates there had been a decline in hunter participation during the previous 3-years, with an increase in 2015. 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 to 781 hunters per year.

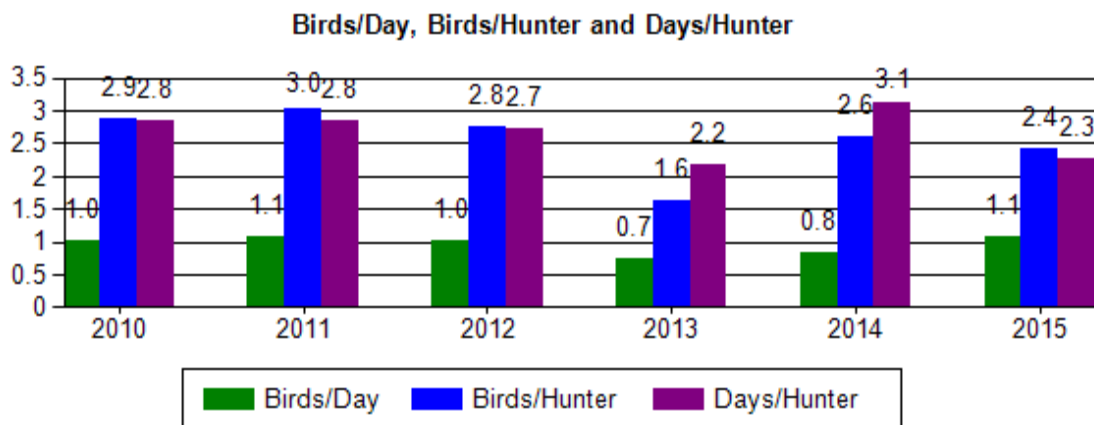


Figure 6. Sage grouse harvest rates 2010-2015 in SGMA D.

### Wing Collections

Eighteen sage-grouse wing barrels were distributed throughout Sublette County in 2015 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 482 sage-grouse wings were collected from barrels in the UGRBWGA during 2015, higher than the 337 wings collected during 2014. 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 482 wings collected in 2015, 53% were juvenile birds, indicating a higher proportion of harvest on juveniles compared to 2013 and 2014. The overall composition of wings in 2015 indicated a ratio of 1.6 chicks/hen (adult and yearling females), higher than 1.0 chicks/hen in 2014 and 0.8 chicks/hen in 2013 and the highest chicks/hen ratio since 2005. Prior to 2015, wing collections indicated poor chick survival (chicks/hen ratio at or below 1.0) in four of the past five years. The good chick production of 1.4 chicks/hen during 2011 can be credited with keeping grouse number somewhat stable 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 broadly correlated with chick production in the UGRBWGA.

### Winter Distribution Surveys

No winter sage grouse surveys were conducted during the 2015-2016 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 previously identified winter concentration areas (WCA). Although, WCA have been identified throughout the UGRBWG Area, the Sage Grouse Implementation Team (SGIT) has only recognized one area located in the Alkali Draw & Alkali Creek Area as of 2016.

### 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 2013-2016 (Figure 7) and should correlate to forage production during that year. A graph comparing 3-month (April-June) average temperatures (Figure 8) for years 2013-2016 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 2013 and 2014, and above average during 2015 and 2016 (Figure 7). 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 at or above average for the 3-month period of April-June for 2013-2016 (Figure 8). 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 resulted in improved nest success and chick survival during 2015, and improved male lek counts in 2016.

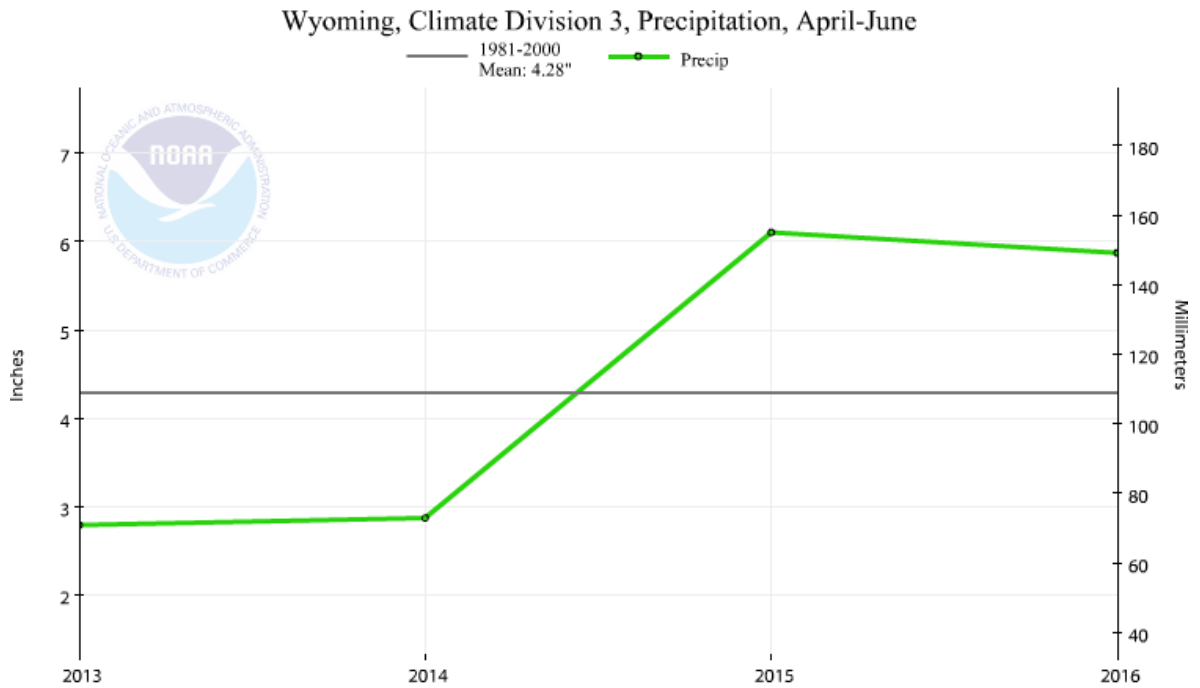


Figure 7. 3-month average (April-June) precipitation for years 2013-2016.

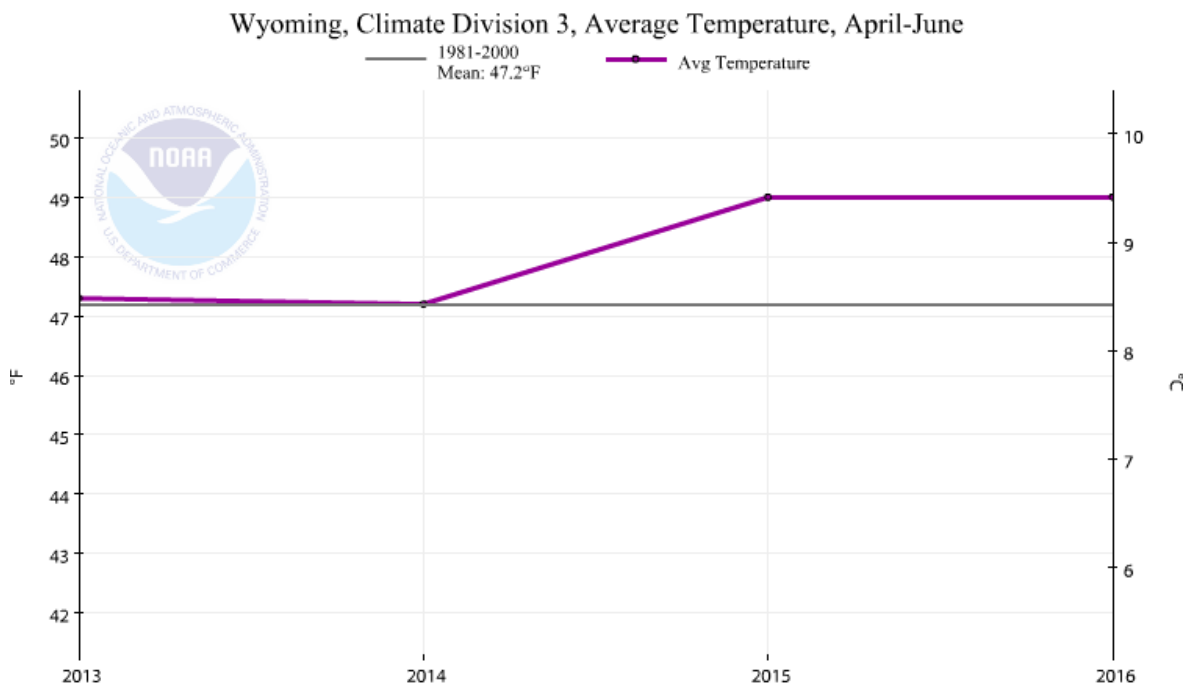


Figure 8. 3-month average (April-June) temperature for years 2013-2016.

## **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 attendance 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.

Revisions to the core area map and/or updates to the strategy were made in 2010, 2011, 2013 and 2015 based on new information. The current Executive Order (2015-4) was signed by Governor Mead in July of 2015 making further modifications to core areas, policy, protections measures, and definitions. The Executive Order is available at: <https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management>

In the Upper Green River Basin the 2015 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 based on additional action by the SGIT.

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 FWS. 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. Legal challenges have been made to these amendments by various plaintiffs in several states, including Wyoming.

Following a lengthy process, in September 2015, the U.S. Fish and Wildlife Service issued a decision of "not warranted" for listing greater sage-grouse as threatened or endangered under the Endangered Species Act. This means the State of Wyoming maintains management authority over sage-grouse in Wyoming and management emphasis focuses on implementation of the core area strategy. In its decision document, the Service specifically cited Wyoming's core area strategy as a mechanism that, if implemented as envisioned, should ensure conservation of sage-grouse in Wyoming and therefore help preclude the need for a future listing. The Service plans to reexamine the issue after five years (2020) to ensure planned conservation efforts are implemented and the status of the species remains unwarranted for listing. The decision document can be viewed at: <https://www.fws.gov/greatersagegrouse/> .

## **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 soil, 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 "soil-eating" areas in describing winter habitat selection by sage-grouse. Currently, within the Upper Green River Basin researchers have identified 24 confirmed locations of geophagy behavior. An additional 20 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 has been collected and tested at each confirmed location and compared to soil at random locations in order to identify the potential target mineral or compound responsible for the behavior. Soil tests indicate higher sodium, pH, and clay content at the documented geophagy sites. 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 soil-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 <https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management> ). 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 <https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management>. A new appropriation of State monies was approved for sage grouse projects during 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 2015 Sage-Grouse Job Completion Report (June 2015 thru May 2016) 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, increased significantly in 2015, and followed by a slight in 2016. 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 146% increase in the peak number of males per lek from 2003 to 2007 as males increased from 28 males/lek to 69 males/lek. This trend reversed after 2007, as the number of males/lek declined by 48% dropping to 36 males/lek by spring of 2014. During 2015, lek counts showed a 47% (53 males/lek) increase followed by an 8% increase in 2016. 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, declining from 2007-2014, and increasing in 2015-2016, 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 2008-2015 wing collections ranged from 31% to 45% of the reported harvest. The sample size increased in 2015 and wing collections accounted for 40% 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, some correlation exists between trends in wing sample sizes and harvest, and provides 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 (2011-2015) the chicks/hen ratio has varied from 0.8 to 1.6 and averaging 1.1 chicks/hen. The improved chick survival documented during the past two years has resulted in an overall male lek attendance increase of 58% since 2014.

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 from 2007-2014. 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 2015-2016 winter and 2016 spring conditions were very similar to the previous year with dry winter and wet spring conditions.

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 localized 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 where possible.

### **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.

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.

Fedy, B. C. and C. L. Aldridge. 2011. The importance of within-year repeated counts and the influence of scale on long-term monitoring of sage-grouse. *Journal of Wildlife Management* 75(5): 1022-1033.

## Sage Grouse Job Completion Report

Year: 2007 - 2016, 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)
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	134	109	81	4667	53.6
2016	136	117	86	5229	55.0

#### b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
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	134	22	16	923	48.6
2016	136	17	13	856	71.3

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: 2007 - 2016, 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)
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	134	131	98	5590	52.7
2016	136	134	99	6085	56.9

#### d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
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	106	25	0	131	80.9	19.1
2016	108	23	3	131	82.4	17.6

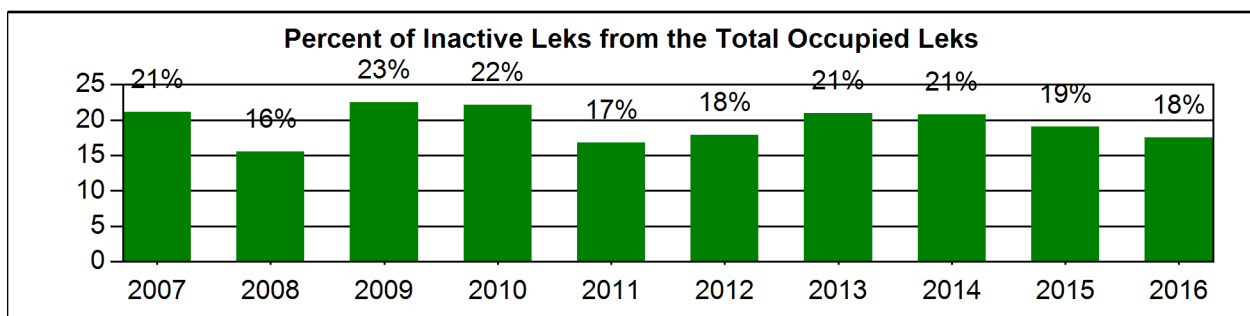
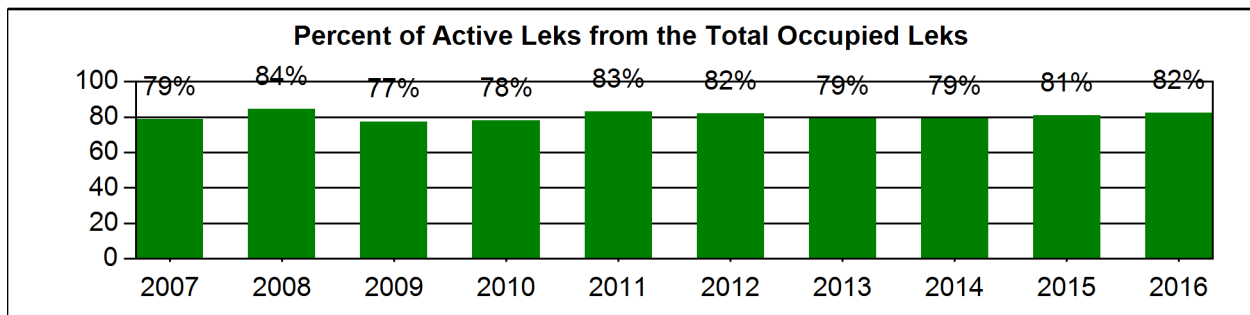
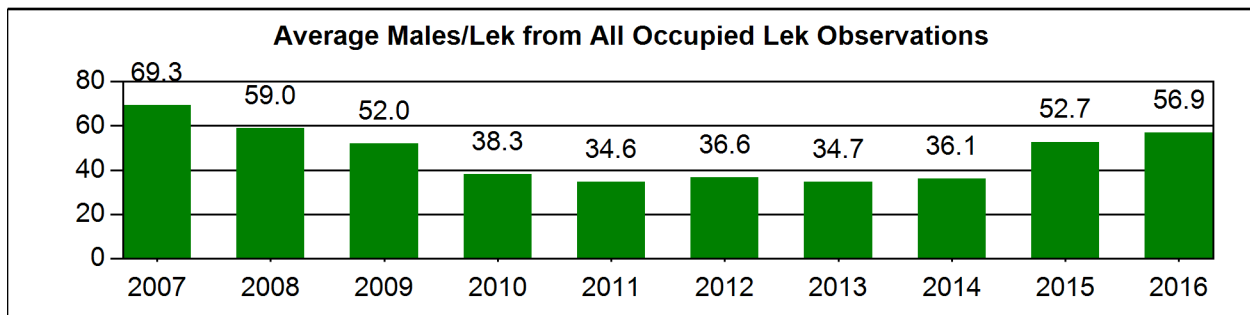
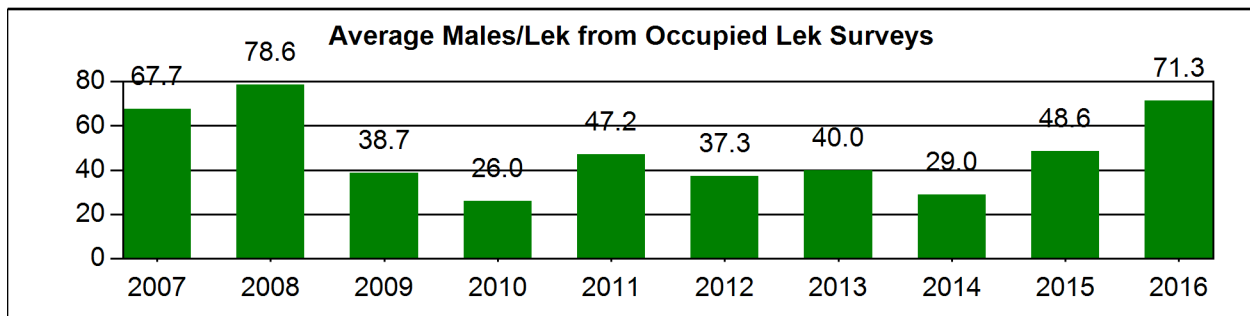
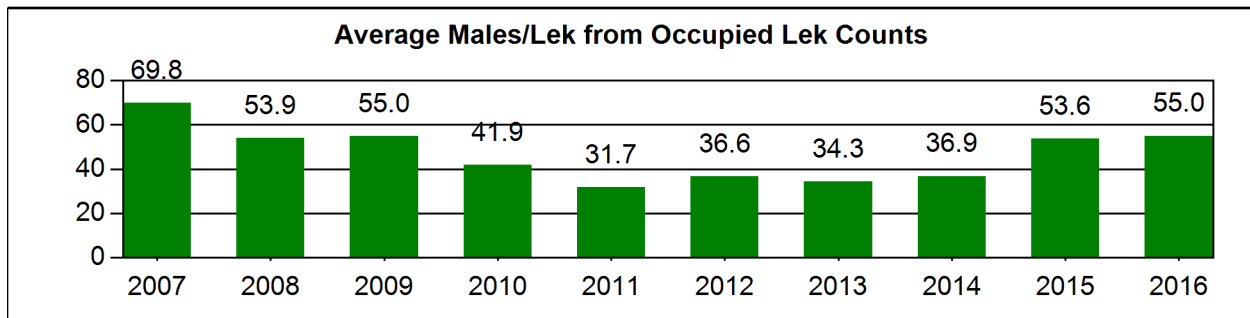
1) Occupied - Active during previous 10 years (see official definitions)

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: 2007 - 2016, Management Area: D, Working Group: Upper Green River



## Sage Grouse Lek Characteristics

### Management Area: D, Working Group: Upper Green River

Region	Number	Percent
Pinedale	157	100.0

Classification	Number	Percent
Occupied	137	87.3
Unoccupied	20	12.7

Biologist	Number	Percent
Pinedale	90	57.3
Thayne	67	42.7

County	Number	Percent
Lincoln	2	1.3
Sublette	155	98.7

Management Area	Number	Percent
D	157	100.0

Working Group	Number	Percent
Upper Green River	157	100.0

BLM Office	Number	Percent
Pinedale	145	92.4
Rock Springs	12	7.6

Warden	Number	Percent
Big Piney	79	50.3
North Pinedale	23	14.6
South Pinedale	55	35.0

Land Status	Number	Percent
BLM	129	82.2
Private	18	11.5
State	10	6.4

Lek Status	Number	Percent
Active	109	69.4
Inactive	45	28.7
Unknown	3	1.9

## Sage Grouse Job Completion Report

Year: 2006 - 2015, 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
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
2015	Sep-19	Sep-30	12	2/4

#### b. Harvest

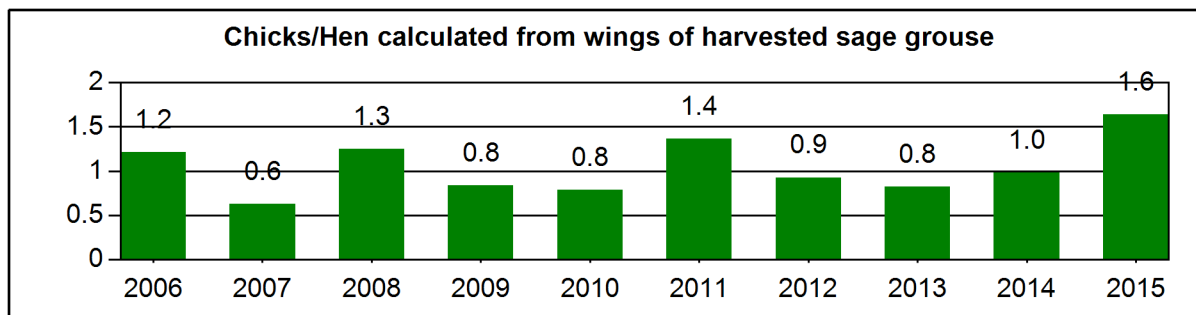
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2006	2132	781	1885	1.1	2.7	2.4
2007	1297	564	1300	1.0	2.3	2.3
2008	1109	453	1116	1.0	2.4	2.5
2009	1203	460	1177	1.0	2.6	2.6
2010	1510	526	1497	1.0	2.9	2.8
2011	1720	565	1605	1.1	3.0	2.8
2012	1320	476	1296	1.0	2.8	2.7
2013	628	387	848	0.7	1.6	2.2
2014	1056	406	1266	0.8	2.6	3.1
2015	1205	500	1129	1.1	2.4	2.3
Avg	1,318	512	1,312	1.0	2.5	2.6

## Sage Grouse Job Completion Report

Year: 2006 - 2015, 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	
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
2015	482	12.4	27.0	2.1	5.4	24.7	28.4	1.6



## Sage Grouse Wing Analysis Summary

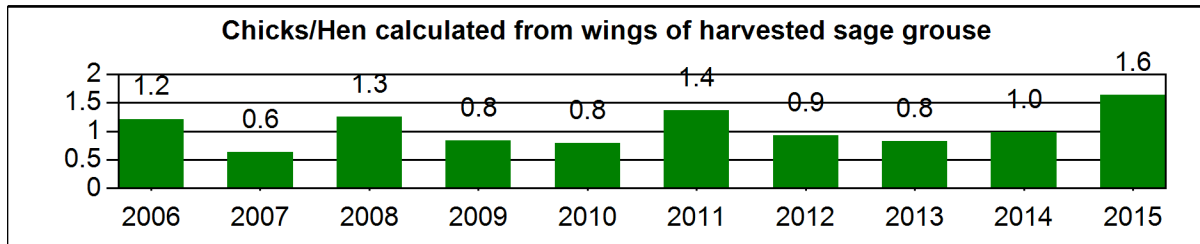
**Year: 2015, Management Area: D, Working Group: Upper Green River**

Adult Males:	60	% of All Wings:	12.4
Adult Females:	130	% of All Wings:	27.0
Adult Unknown:	0	% of All Wings:	0.0
Total Adults:	190		
Yearling Males:	10	% of All Wings:	2.1
Yearling Females:	26	% of All Wings:	5.4
Yearling Unknown:	0	% of All Wings:	0.0
Total Yearlings:	36		
Chick Males:	119	% of All Wings:	24.7
Chick Females:	137	% of All Wings:	28.4
Chick Unknown:	0	% of All Wings:	0.0
Total Chicks:	256		
Unknown Sex/Age:	0		
<b>Total for all Sex/Age Groups:</b>	<b>482</b>		
Chick Males:	119	% of All Chicks	46.5
Yearling Males:	10	% of Adult and Yearling Males	14.3
Adult Males:	60	% of Adult and Yearling Males	85.7
Adult and Yearling Males:	70	% of Adults and Yearlings	31.0
Total Males:	189	% of All Sex/Age Groups	39.2
Chick Females:	137	% of All Chicks	53.5
Yearling Females:	26	% of Adult and Yearling Females	16.7
Adult Females:	130	% of Adult and Yearling Females	83.3
Adult and Yearling Females:	156	% of Adults and Yearlings	69.0
Total Females:	293	% of All Sex/Age Groups	60.8
Chicks:	256	% of All Wings:	53.1
Yearlings:	36	% of All Wings:	7.5
Adults:	190	% of All Wings:	39.4
Chicks/Hen	1.6		

## Sage Grouse Wing Analysis Summary

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

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Upper Snake River Basin

Sage-Grouse  
Job Completion Report  
2015

June 2015-May 2016

Alyson Courtemanch  
Wyoming Game & Fish Dept.  
Jackson Region

**Species:** Sage-Grouse

**Period Covered:** June 1, 2015 – May 31, 2016

**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 may follow 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 5 years. The counts in 2016 were the second highest recorded since 1994 (22.3 average peak males per lek). This is second only to last year's average of 25.2 average peak males per lek.

Notably, the Beacon lek switched from occupied to unoccupied in 2016 since no males have been observed strutting on this lek since 2006 (10 years). In 2016, male attendance at the RKO lek increased substantially with a high count of 48, compared to 21 in 2015 and 8 in 2014. The Breakneck Flats lek also had the highest count ever recorded of 34 males. The Moulton lek had a peak of 70 males this year, compared to 103 in 2015.

## **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](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.

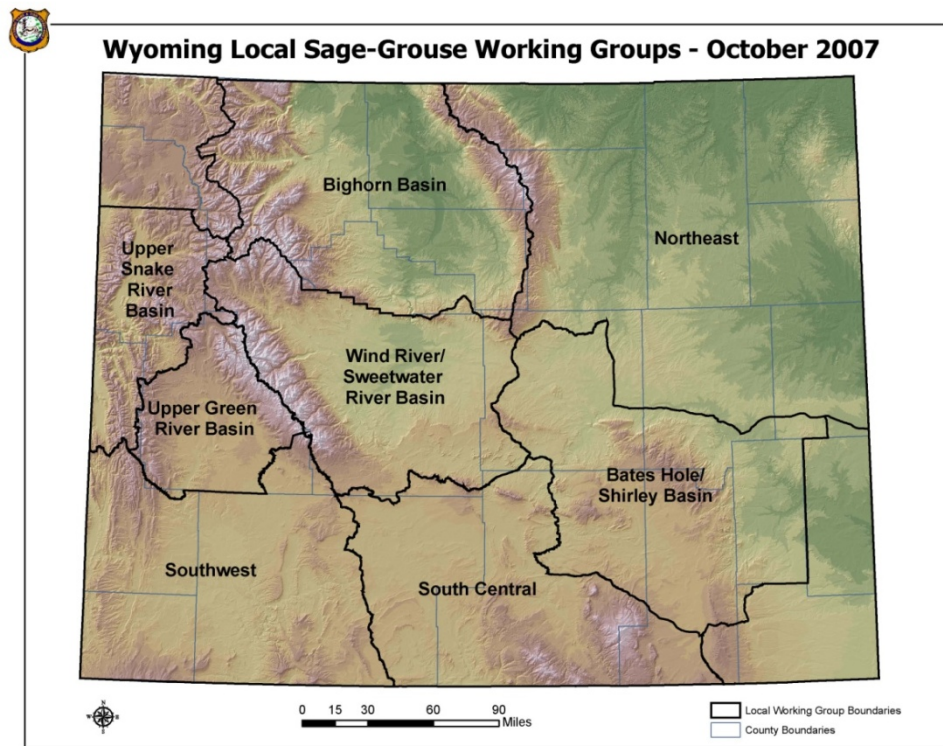


Figure 1. Wyoming local sage-grouse working group boundaries.

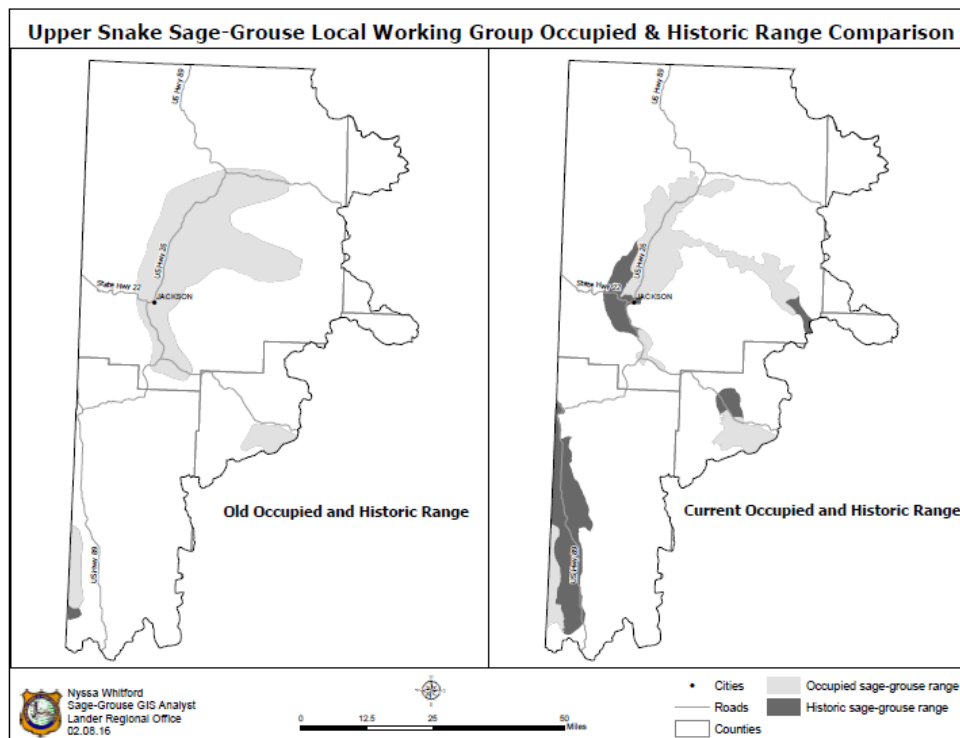


Figure 2. Comparison of the former and the revised occupied and historic range map for the Upper Snake River Basin, WY.

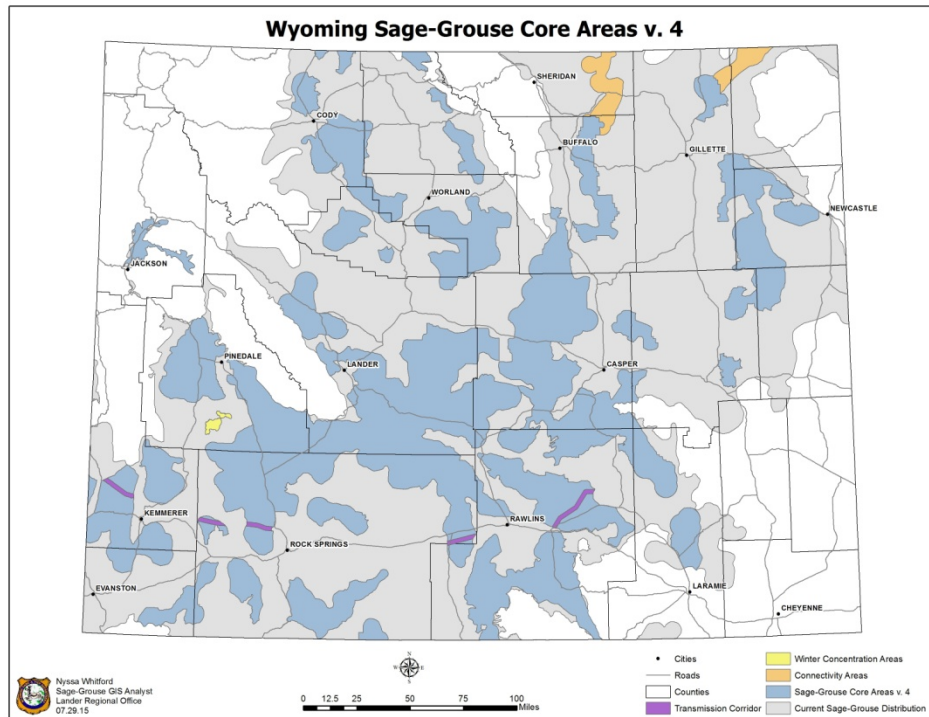


Figure 3. Wyoming Sage-Grouse Core and Connectivity Areas, revised in 2015.

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 1990 through 2016. 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 USBCA 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. Twelve leks are considered to be occupied (active at least one year during the past 10 years) and four appear to be unoccupied historical leks within the plan area (3 Bar H/Circle EW, Antelope Flats, McBride, and Beacon). The Beacon lek switched to unoccupied this year since no birds have been observed since 2006. 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. 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 from 2008 - present.

During research activities in 2008, a lek was located in the Potholes 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 48 males in 2016.

Of the 16 leks in the USRBCA, 15 were monitored in 2016. Ten leks had grouse present and five leks did not (Airport Pit, Antelope Flats, McBride, Simpson, and Beacon). Circle EW was one lek not checked in 2016.

It should 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.

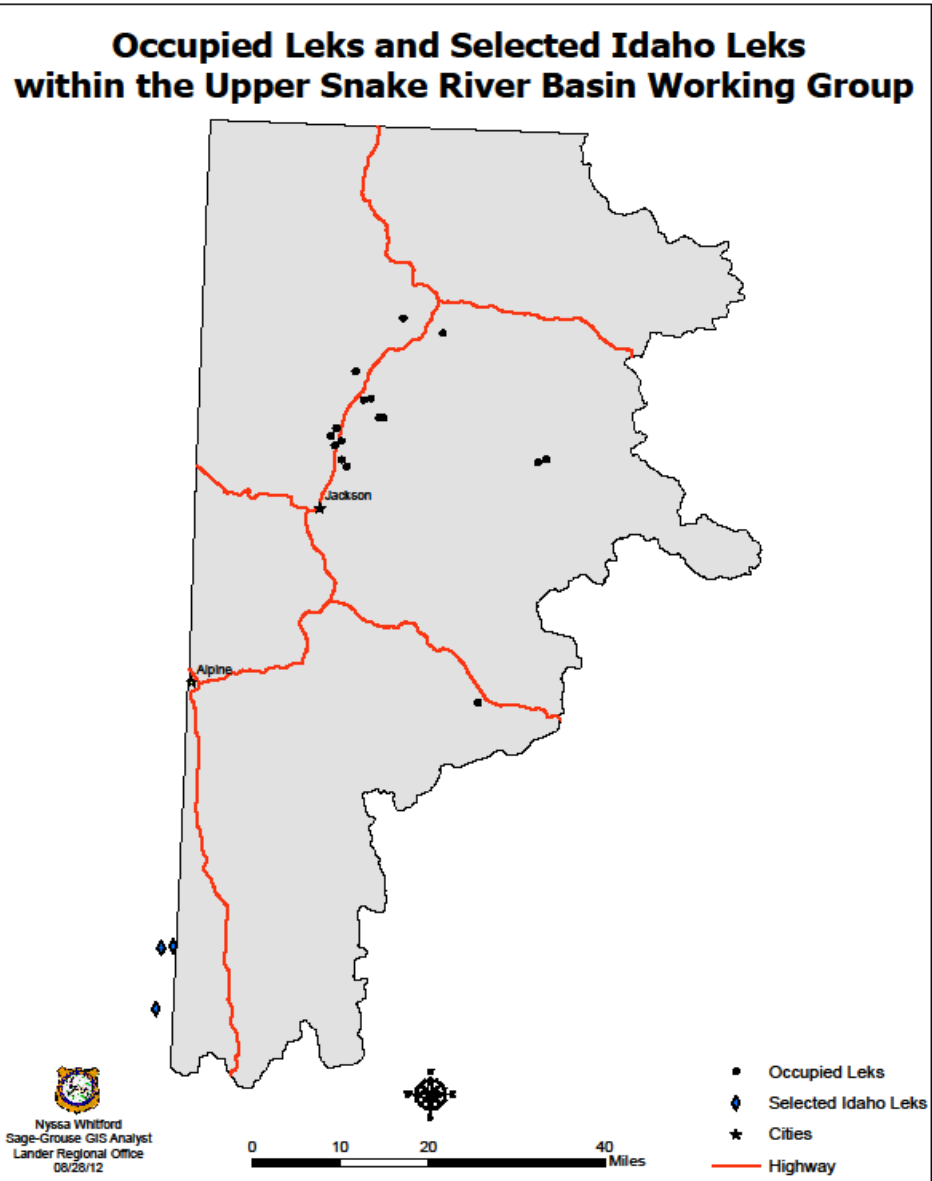


Figure 4. Occupied leks in the Upper Snake River Basin Working Group Area and adjacent selected leks in Idaho.

Table 1. Maximum male counts at sage-grouse leks in the Upper Snake River Basin Conservation Area, 1990-2016. NC denotes “not checked”,

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
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
2016	7	0	0	NC	0	0	70	6	13	18	7	0	34	8	48	12	223	22.3

\*\*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 7 years have showed an increasing trend, with a slight decrease in 2016 (Figure 5). The average peak males per lek in 2016 was the second 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.

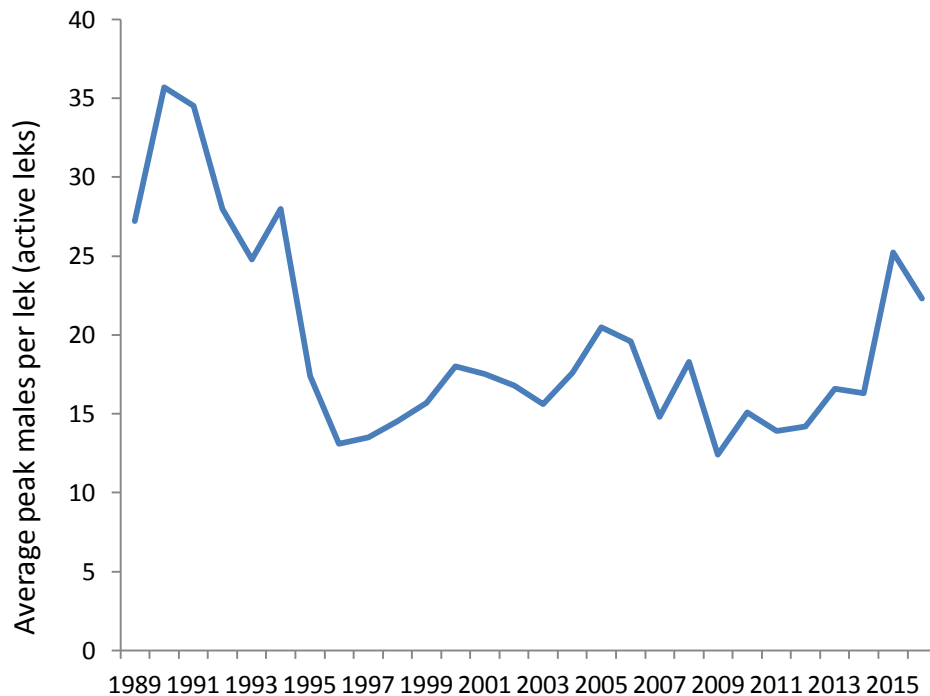


Figure 5. Average peak male counts for active leks in the Upper Snake River Basin Conservation Area, 1989-2016.

Table 2. Lek attendance and peak males for occupied leks in the USRBCA 2007 - 2016.

Leks Counted						
	Year	Occupied	Counted	Percent Counted	Peak Males	Avg Males / Active Lek (2)
	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
	2016	15	15	100	227	20.6

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 not 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 suggest 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). In 2016, the peak number of males was 223, very close to the 227 number observed last year. 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 2016, 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. 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 added to core and other minor modifications based on habitat. The updated core area map for the USRBCA is shown in Figure 6. The current Executive Order and Core Area Policy can be found on the WGFD website and attached to the Statewide JCR.

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 during this reporting period.

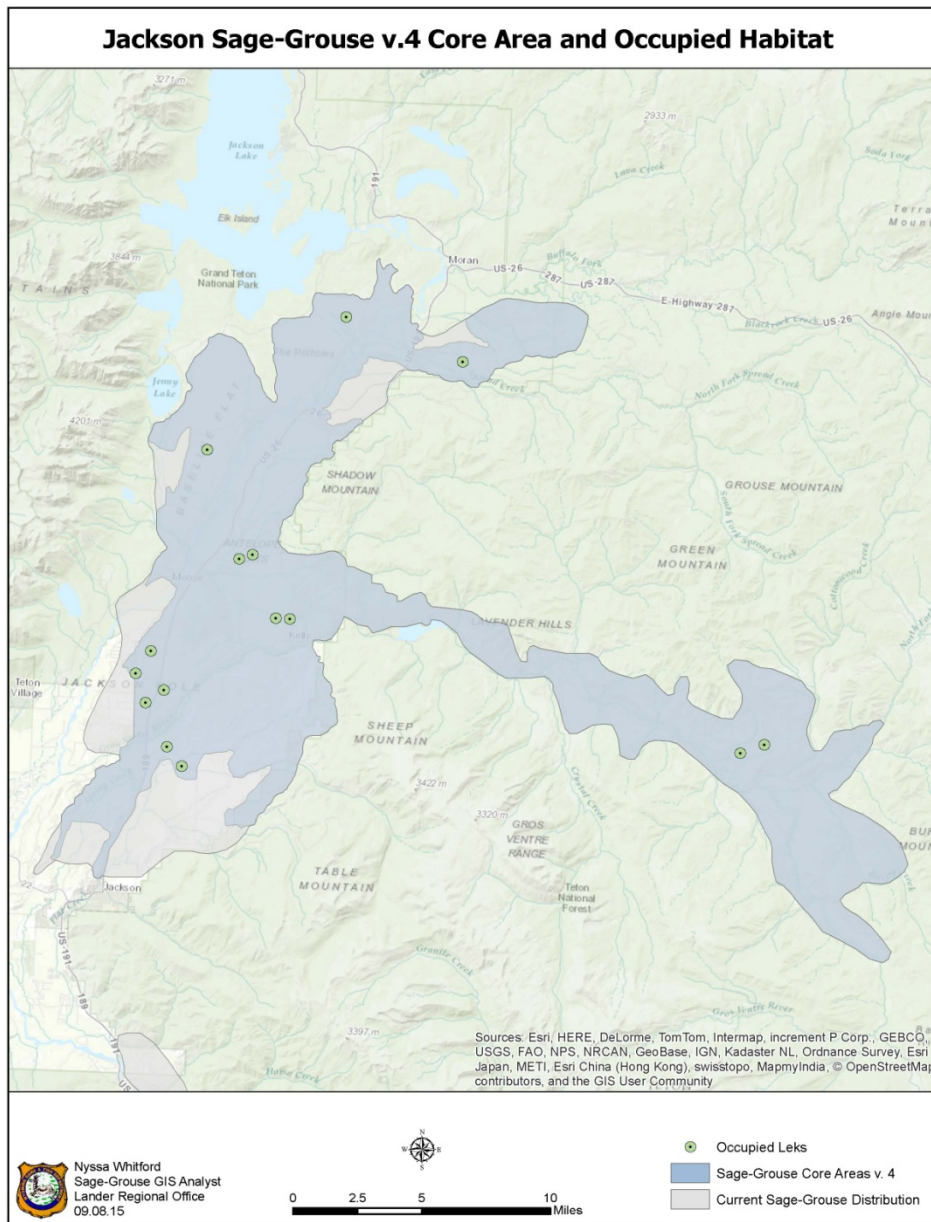


Figure 6. Updated sage-grouse leks and Core Areas (V.4) in the USRBCA.

## 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. This process is currently ongoing.

#### 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.

#### **Past Research Projects**

Patterson, R.L. 1952. The sage grouse in Wyoming. Sage Books, Denver, Colorado, USA.

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Courtemanch, A., Chong, G., and S. Kilpatrick. 2007. A remote sensing analysis of sage-grouse winter habitat in Grand Teton National Park and Bridger-Teton National Forest, Wyoming. Completion Report. Available in Appendix 3 in Upper Snake River Basin Sage-Grouse Working Group Plan: [http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SG\\_USR\\_CONSERVPLAN0005529.pdf](http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SG_USR_CONSERVPLAN0005529.pdf)

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Bedrosian, B., R. Crandall, and D. Craighead. 2010. Jackson Hole Sage-grouse Project Completion Report: 2007-2009. Craighead Beringia South, P.O. Box 147, Kelly, WY 83011.

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 and 2016 may be the result of increased over winter survival and good chick production.

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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Wind River - Sweetwater River  
Basins  
Sage-Grouse  
Job Completion Report  
2015

June 2015 - May 2016

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, 2015 – May 31, 2016**

Prepared by: **Stan Harter, South Lander Wildlife Biologist**

## Introduction

The Wind River/Sweetwater River Conservation Area (WRSRCA) encompasses just over 10,000 mi<sup>2</sup>, 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.

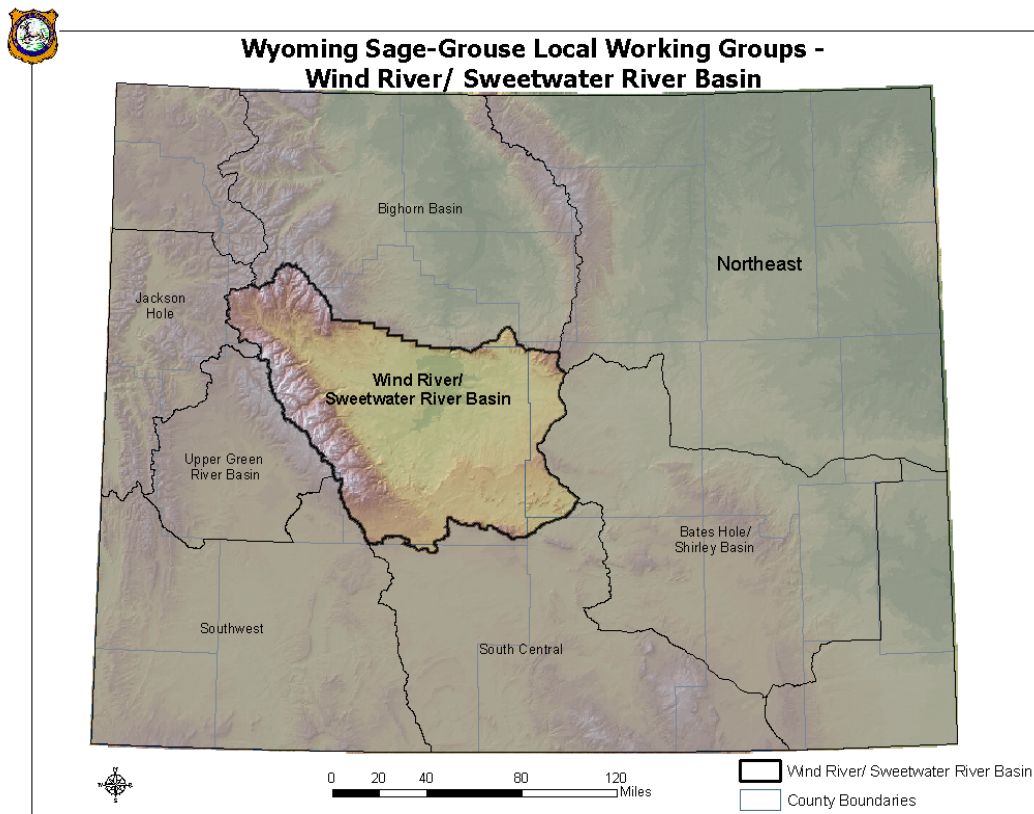


Figure 1. The Wind River/Sweetwater River Conservation Area within Wyoming.

## 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. Known occupied sage-grouse leks within the WRSRCA are predominantly located on public lands (Bureau of Land Management (BLM) – 56.8% and Bureau of Reclamation (BOR) – 1.6%), or tribal lands on the Wind River Reservation (WRR) – 24.5%. Private lands contain 11.3% of known leks with the remaining 5.8% located on Wyoming State Trust lands (Figure 2 and Appendix 1).

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>

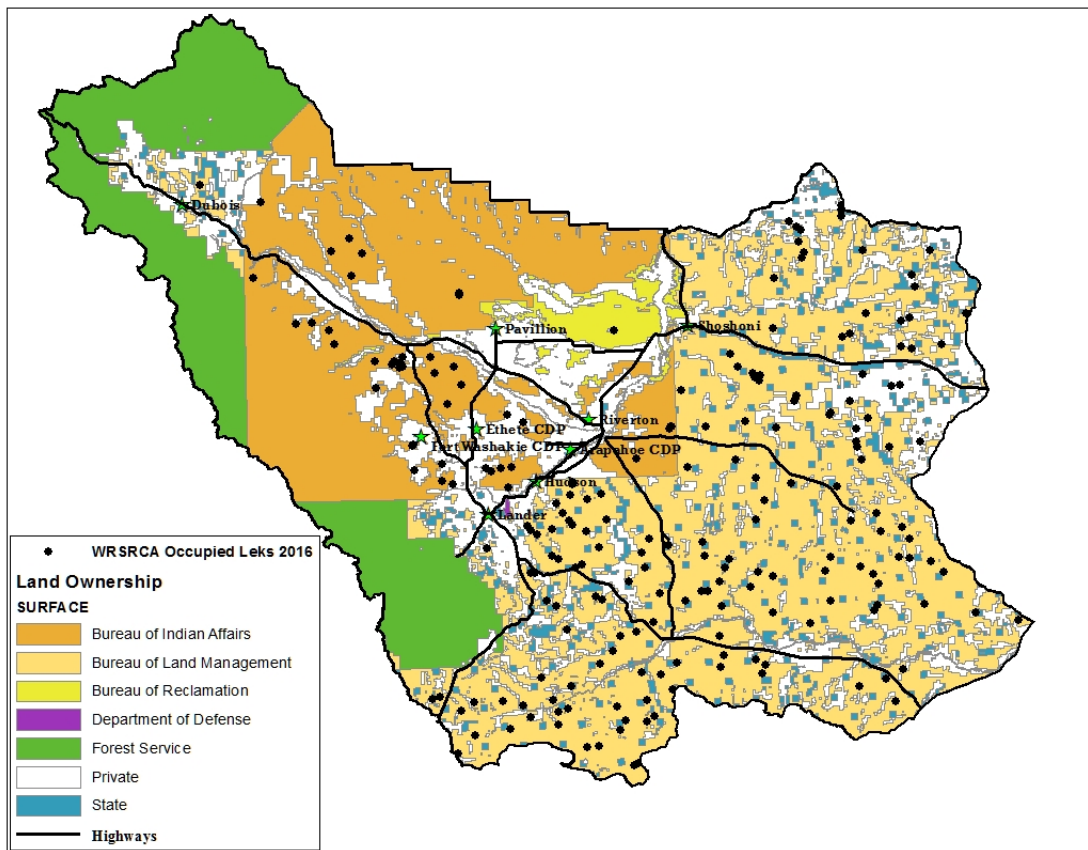


Figure 2. Land ownership within the WRSRCA (dots = 2016 occupied leks). Source: WGFD, BLM.

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.

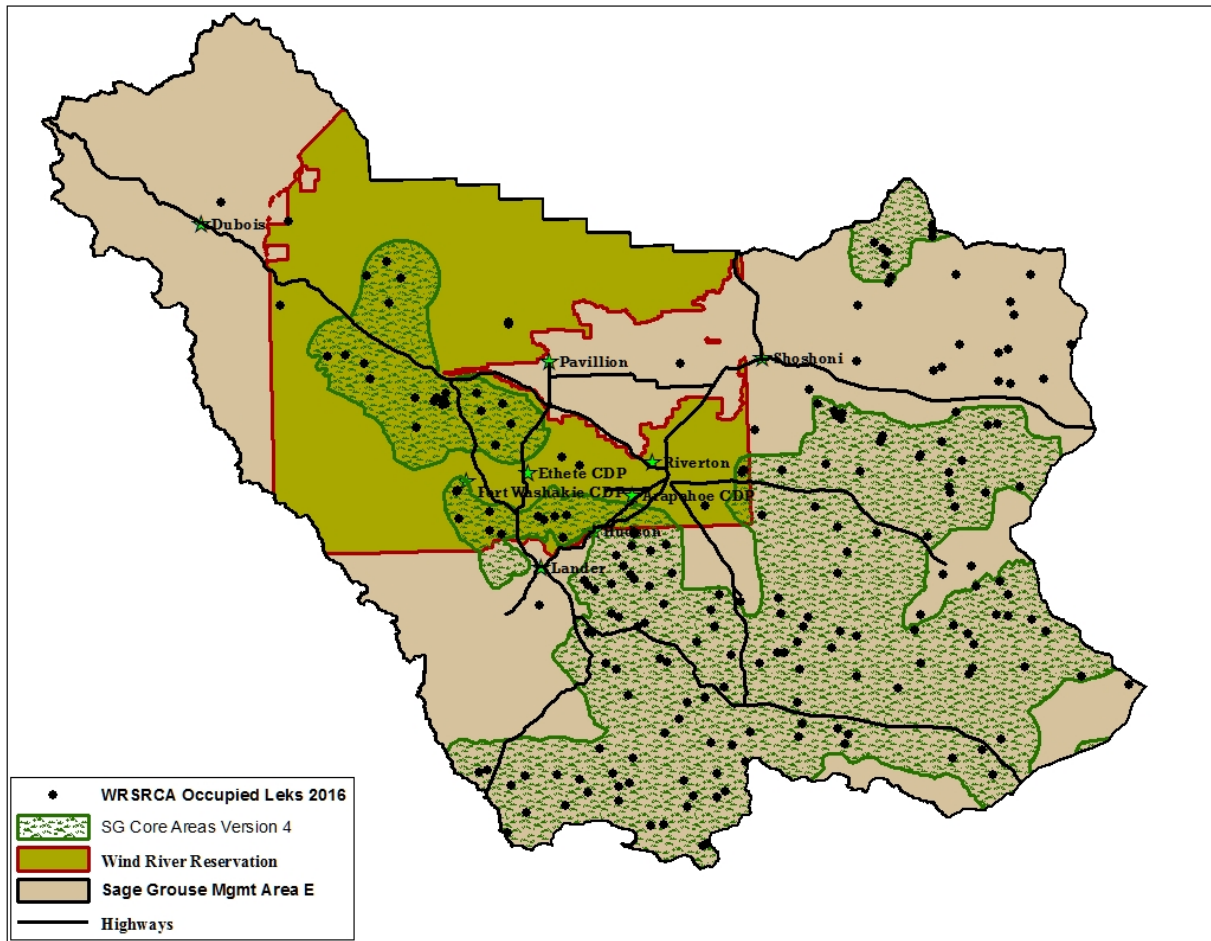


Figure 3. WGFD upland game bird management areas, core areas, and occupied leks within WRSRCA (dots= leks). Source WGFD.

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

In 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. In July 2015, Governor Mead signed Executive Order 2015-4 (replacing 2011-5 and 2013-3) which included Version 4 of the Core Area strategy (Figure 3) which adopted some, but not all of the modifications recommended by the WRSR LWG. The Wyoming Game and Fish Department and Commission maintains management authority over greater sage grouse 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)**

The U.S. Fish and Wildlife Service issued a 12-month finding that greater sage-grouse was warranted for listing in 2010 (75 FR 13910, March 23, 2010). Following a lengthy process, in September 2015, the U.S. Fish and Wildlife Service issued a decision of “not warranted” for listing greater sage-grouse as threatened or endangered under the Endangered Species Act. This means the State of Wyoming maintains management authority over sage-grouse in Wyoming and management emphasis focuses on implementation of the core area strategy. In its decision document, the Service specifically cited Wyoming’s core area strategy as a mechanism that, if implemented as envisioned, should ensure conservation of sage-grouse in Wyoming and therefore help preclude the need for a future listing. The Service plans to reexamine the issue after five years (2020) to ensure planned conservation efforts are implemented and the status of the species remains unwarranted for listing. The decision document can be viewed at: <https://www.fws.gov/greatersagegrouse/> .

### **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 in effect as of May 31, 2016 was distributed in March of 2012 (WY-IM 2012-019), with a new IM expected in response to Wyoming Executive Order 2015-4. 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, Rock Springs and Worland Field Offices. The Lander and Worland Field Offices have revised their resource management plans (RMP) which 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 the Lander RMP revision was released on June 26, 2014 and the Worland RMP revision was signed on September 21, 2015, with the Casper RMP amendment expected to be completed soon. The Rock Springs Field Office has initiated efforts to revise the Green River RMP (August 1997) with anticipation of a ROD in 2019.

### **Natural Resources Conservation Service (NRCS)**

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>

**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.

## **Sage-grouse 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).

## **Results**

### **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 solely by average lek size.

Average female lek attendance is not 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 - 2016**

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 215 known occupied leks within the conservation area in 2016, along with 30 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 129 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 3 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, 199 were checked in 2016 by WGFD, BLM, USFWS, and Shoshone-Arapahoe Tribal Fish and Game (SATFG), assisted by several researchers, consultants, and volunteers. Of those checked, 97 were counted and 102 were surveyed. Of the 175 leks where status was confirmed, 165 (94.3%) were active and 10 (5.7%) were inactive, with a greater proportion in active status than the average since 2007.

Average male lek attendance for all leks checked increased from 37.0 in 2015 to 44.7 in 2016. Average annual maximum male attendance at count leks increased from 43.5 in 2015 to 54.0 in 2016, which is 35% above the average since 2007 (40.0), and 29% below the peak in 2006 (76.0).

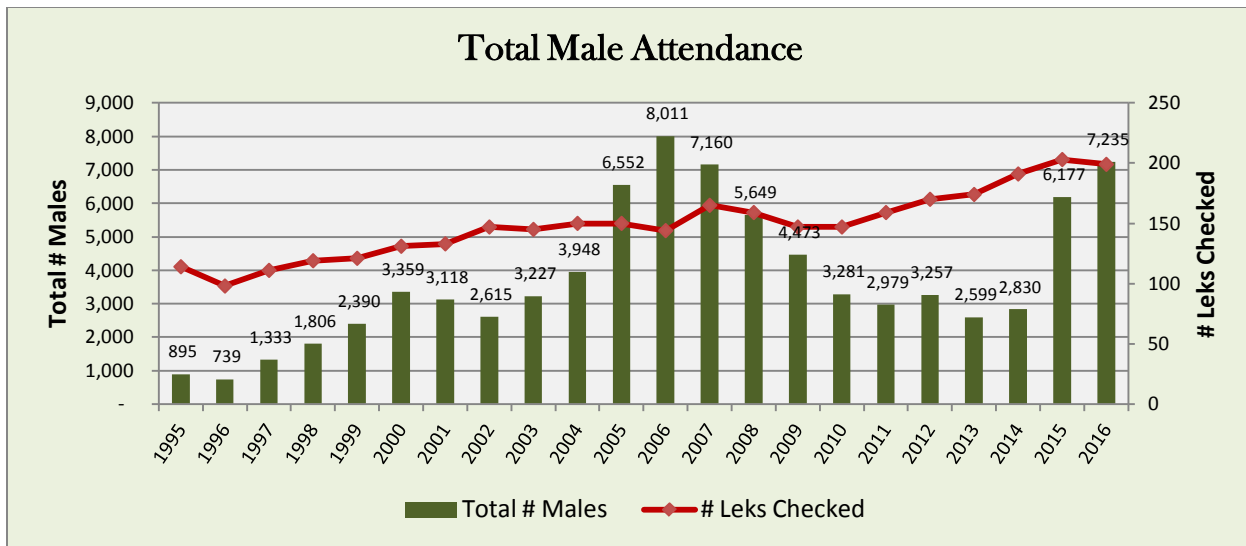


Figure 4. Total male attendance at all leks within the Wind River/Sweetwater River Conservation Area, 1995–2016.

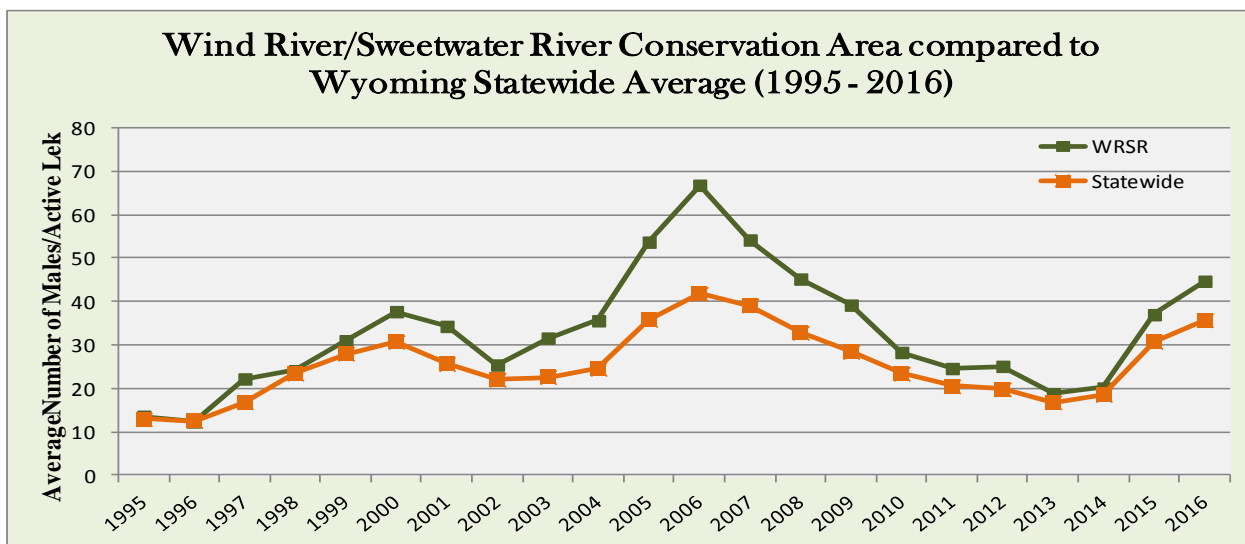


Figure 5. Average male lek attendance (all leks checked) in WRSRCA relative to Wyoming statewide trends, 1995 –2016.

### **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 2016, 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 typically provide significant wing data, due to a relatively high number of sage-grouse hunters in the area. Wing data are summarized for the WRSRCA for hunting seasons 2006 – 2015 and reported in detail for 2015 (Appendix 1). Wings collected from hunter harvested birds during the 2015 hunting season yielded an average brood size of 2.0 chicks per

hen. This was the highest average brood size since 2006, indicating chick survival was quite good when compared with the average of 1.3 chicks per hen over the last 10 years, and 2.5 times higher than the low productivity of 0.8 chicks/hen observed in 2012. Population growth typically requires 1.7 chicks/hen or more based on historic statewide averages, which is confirmed with lek attendance increases in 2016 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 is minimal and are not included in these data.

Sage-grouse hunting season was 12 days long in 2015, keeping opening day on the 3<sup>rd</sup> Saturday in September (Sept. 19 – 30). Hunter numbers declined by 4.5%, but sage grouse harvest increased by 39.5%, compared with 2014) 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 2006 (Appendix 1, Table 4b).

### **Weather**

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). 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.

Following a period of intense drought, precipitation has improved substantially since fall 2013, leading to improved habitat conditions, increased chick survival, and subsequent increases in lek attendance over the past 3 years as seen in Appendix 1.

Data provided by the Western Regional Climate Center (<http://www.wrcc.dri.edu/summary/Climsmwy.html>) indicate precipitation was 140% above average in Lander and 80% above average in Jeffrey City for the first four months of 2016, with record-breaking rain falling in the first week of May, which probably led to excellent summer forage conditions, but may have also reduced nesting success and chick survival in summer 2016. If so, lek attendance may decline in 2017.

### **Habitat (Current and Historic)**

Long-term sage-grouse habitat conditions have 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/Inventory**

No habitat monitoring transects were measured in 2015. Habitat monitoring is discussed in past WRSRCA JCRs, and in the 2007 WRSRCA Local Sage Grouse Conservation Plan and 2014 Addendum. Recently developed “Rapid Habitat Assessments” will be implemented as appropriate to develop a baseline from which to gauge overall habitat condition across the landscapes of the WRSRCA.

### **Winter Habitat Survey**

Limited winter observations were collected in 2015-16, mostly as opportunistic observations during deer, elk, and moose classifications flights or random ground surveys. Winter habitat use has been 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. GPS and VHF winter data from the Jeffrey City study area were utilized in development of a predictive winter habitat model by the University of Wyoming (Smith, et al. 2016) as described in the research section later in this report.

### **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”**

No new treatments occurred during 2015, however post-treatment monitoring is ongoing, as summarized in the research section later in this report and in their annual report found in Appendix 2.

#### **South Hudson-Government Draw Noxious Weed Survey and Treatment**

Fremont County Weed and Pest (FCWP) staff and a third party contractor successfully treated, mapped, and monitored invasive weeds in the project treatment area. Within the areas effected totaling over 12,500 acres, 1,100 acres of invasive weeds were treated with herbicide (500 acres in 2015 and 600 acres in 2016). 197 new locations of invasive Canada thistle, leafy spurge, musk thistle, Russian knapweed, Russian olive, saltcedar, whitetop, field bindweed, black henbane, and perennial pepperweed were identified. A total of 30,400 new acres are now considered mapped within this project area. Contractor and FCWP treatment efforts in 2015 were focused on four draws with limited weed pressure, but a high degree of importance to limit spread north and east of the Hudson-Atlantic City Rd just southeast of Hudson, WY. FCWP crews also treated other known infestations and spread corridors within the project area. Additional treatment details and maps are included in Appendix 3.

### 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 2015. However, a few properties are being considered for easements within the WRSRCA. 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. Studies conducted prior to 2016 were 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 through March 2014. A collection of current sage-grouse research being conducted in Wyoming is compiled annually by Dr. Jeff Beck at the University of Wyoming and is included in the annual statewide sage-grouse JCR. Abstracts for studies conducted in or directly pertaining to the WRSRCA in 2015-16 follow. Citations for published works are included at the end of this report.

#### ***Response of Greater Sage-grouse to Treatments in Wyoming Big Sagebrush – LeVan, University of Wyoming, et al (2015 Annual Report is included as Appendix 2)***

**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 = 444 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, 2011–2016.

Parameter	Pre-treatment			Post-treatment		
	2011	2012	2013	2014	2015	2016
Nests ( <i>n</i> ) <sup>1</sup>	23 (3)	58 (4)	85 (0)	106 (15)	83 (11)	104 (8)
Nest success (%)	26.1	44.8	55.3	50.9	35.4	40.4
Brood success (%)	66.6	68.0	53.3	77.7	53.6	41.5
Chicks per marked female	0.45	0.70	1.10	1.41	0.65	0.54

<sup>1</sup>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 – Smith, et al – University of Wyoming and Forbey, et al. – Boise State University***

**ABSTRACT:** Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) is the most abundant subspecies of big sagebrush and has been treated through chemical application, mechanical treatments, and prescribed burning to improve habitat conditions for greater sage-grouse (*Centrocercus urophasianus*). 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 wildlife. The purpose of our research was to identify how mowing and Spike® 20P treatments intended to reduce sagebrush canopy cover influenced dietary quality of Wyoming big sagebrush in central Wyoming. Two study areas were mowed in January and February 2014 and Spike® was applied in two study areas in May 2014. We constructed 6 exclosures in each of 4 study areas (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 2013–2015. Samples were analyzed for crude protein and plant secondary metabolites known to influence dietary selection of sagebrush by sage-grouse and other sagebrush occurring species. Our results suggest that mowing and Spike® 20P treatments may slightly increase crude protein concentrations directly after treatments without immediate changes in plant secondary metabolites. Future work should evaluate not only how treatments influence sage-grouse habitat use and reproductive success, but how treatments influence other wildlife species in fragile sagebrush ecosystems.

***Does Wyoming's Core Area Policy Protect Winter Habitats for Greater Sage Grouse? – Smith, et al. – University of Wyoming (2016)***

**ABSTRACT:** Conservation reserves established to protect important habitat for wildlife species are used world-wide as a wildlife conservation measure. Effective reserves must adequately protect year-round habitats to maintain wildlife populations. Wyoming's Sage-Grouse Core Area policy was established to protect breeding habitats for greater sage-grouse (*Centrocercus urophasianus*). Protecting only one important seasonal habitat could result in loss or degradation of other important habitats and potential declines in local populations. The purpose of our study was to identify the timing of winter habitat use, the extent which individuals breeding in

Core Areas used winter habitats, and develop resource selection functions to assess effectiveness of Core Areas in conserving sage-grouse winter habitats in portions of 5 Core Areas in central and north-central Wyoming during winters 2011–2015. We found that use of winter habitats occurred over a longer period than current Core Area winter timing stipulations and a substantial amount of winter habitat outside of Core Areas was used by individuals that bred in Core Areas, particularly in smaller Core Areas. Resource selection functions for each study area indicated that sage-grouse were selecting habitats in response to landscapes dominated by big sagebrush and flatter topography similar to other research on sage-grouse winter habitat selection. The substantial portion of sage-grouse locations and predicted probability of selection during winter outside small Core Areas illustrate that winter requirements for sage-grouse are not adequately met by existing Core Areas. Consequently, further considerations for identifying and managing important winter sage-grouse habitats under Wyoming's Core Area policy are warranted.

***Fitness Consequences of Migration Strategy and Seasonal Habitat Protections for Greater Sage-Grouse - Dinkins, et al – University of Wyoming (In Review)***

**ABSTRACT:** Our study delineated seasonal habitats and assessed differential fitness related to seasonal habitat use and migration strategy for greater sage-grouse (*Centrocercus urophasianus*; hereafter “sage-grouse”). We also evaluated benefits gained for sage-grouse through the implementation of the Wyoming Core Area Strategy relative to habitat protection and differences in nest, brood, and annual female survival. We compared the proportion of seasonal habitats within eight Core Areas using 7,692 summer and 1,488 winter sage-grouse locations to generate kernel density contours from 585 female sage-grouse, 2008–2015. The proportion of summer and winter habitats that overlapped Core Areas was 0.69 of summer and 0.50 of winter habitat within a Core Area. We found no differences in nest or brood survival among migration strategies or within and outside Core Areas. Female survival was higher in winter with the lowest risk of death occurring during winter in Core Areas. Higher temperature and lower snow water equivalent during breeding season and fall were detrimental to female survival. Greater proportion of summer use within winter habitat resulted in lower risk of death highlighting year-round benefits of winter habitat. Our results indicate that Core Areas (as delineated) were not the most direct way to protect winter habitat for sage-grouse.

***Examining the Effects of Noise from Energy Development on the Breeding Biology of the Greater Sage-Grouse (Centrocercus Urophasianus) – Patricelli, Hooper, et al. - 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. We are also collaborating to examine how field-measures of noise at leks relate to lek trends at leks in the Pinedale Anticline.

## **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 2015.

## **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 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 (2016)****Working Group: Wind River/Sweetwater River**

Region	Number	Percent
Casper	2	0.8
Lander	191	74.3
WRIR	64	24.9

Classification	Number	Percent
Occupied	215	83.7
Undetermined	12	4.7
Unoccupied	30	11.7

Biologist	Number	Percent
WRR - USFWS	64	24.9
Casper	2	0.8
North Lander	67	26.1
Sinclair	1	0.4
South Lander	122	47.5
Worland	1	0.4

County	Number	Percent
Carbon	1	0.4
Fremont	228	88.7
Hot Springs	4	1.6
Natrona	23	8.9
Sweetwater	1	0.4

Management Area	Number	Percent
E	193	75.1
WR	64	24.9

Working Group	Number	Percent
Wind River/Sweetwater River	257	100.0

BLM Office	Number	Percent
Lander-WRR	64	24.9
Casper	12	4.7
Lander	172	66.9
Rock Springs	7	2.7
Worland	2	0.8

Warden	Number	Percent
Shoshone-Arapahoe Tribal	64	24.9
Dubois	1	0.4
Lander	72	28.0
North Riverton	27	10.5
South Riverton	59	23.0
West Casper	2	0.8
West Rawlins	32	12.5

Land Status	Number	Percent
BLM	146	56.8
BOR	4	1.6
Private	29	11.3
Reservation	63	24.5
State	15	5.8

Lek Status	Number	Percent
Active	173	67.3
Inactive	27	10.5
Unknown	57	22.2

# Sage Grouse Job Completion Report

Year: 2007 - 2016, 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)
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	202	101	50	1860	21.6
2015	217	117	54	4615	43.5
2016	212	97	46	4698	54.0

### b. Leks Surveyed

Year	Occupied	Surveyed	Percent Surveyed	Peak Males	Avg Males / Active Lek (2)
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	202	90	45	970	17.6
2015	217	86	40	1562	25.6
2016	212	102	48	2537	33.8

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

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

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

## Sage Grouse Job Completion Report

Year: 2007 - 2016, 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)
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	202	191	95	2830	20.1
2015	217	203	94	6177	37.0
2016	212	199	94	7235	44.7

#### d. Lek Status

Year	Active	Inactive (3)	Unknown	Known Status	Percent Active	Percent Inactive
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	142	22	27	164	86.6	13.4
2015	167	16	20	183	91.3	8.7
2016	165	10	24	175	94.3	5.7

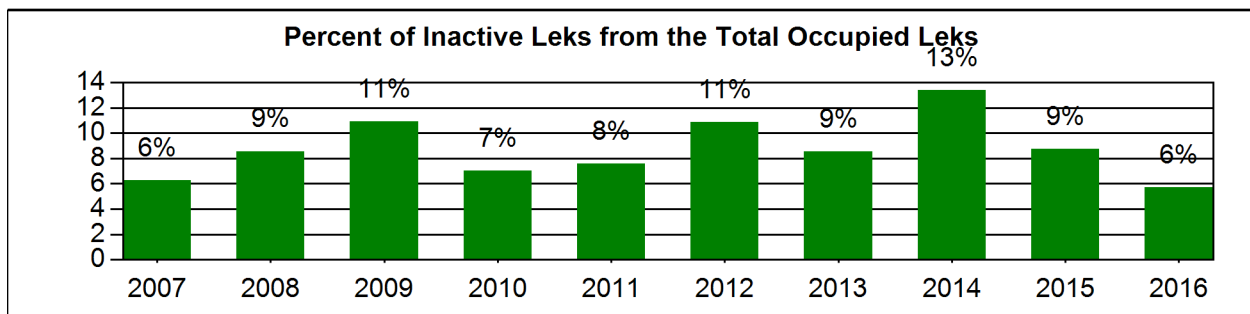
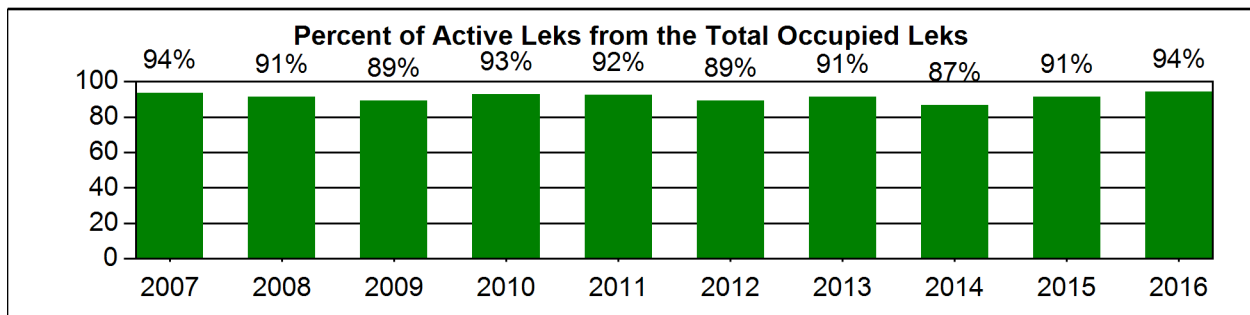
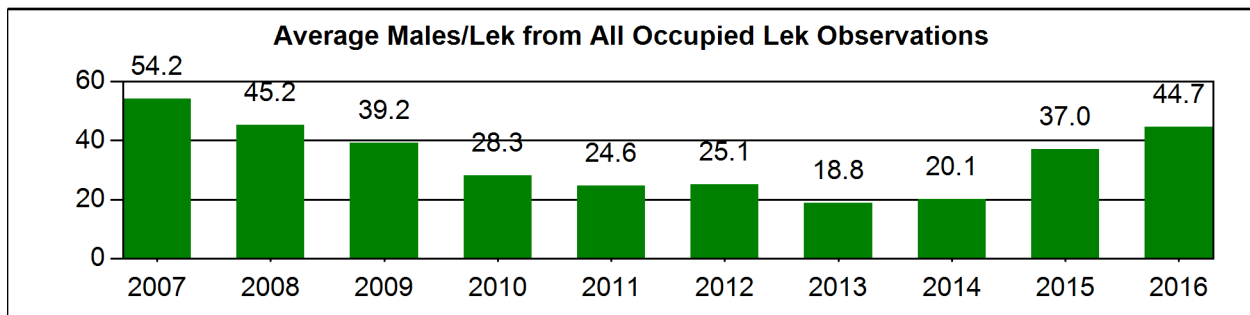
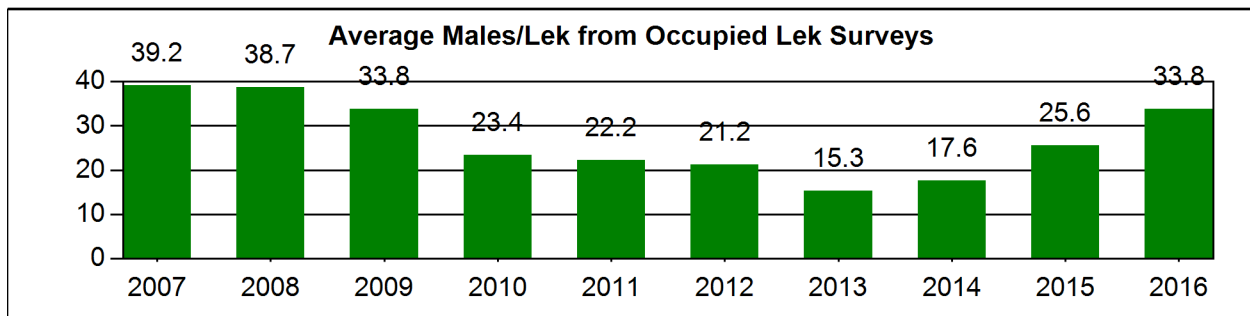
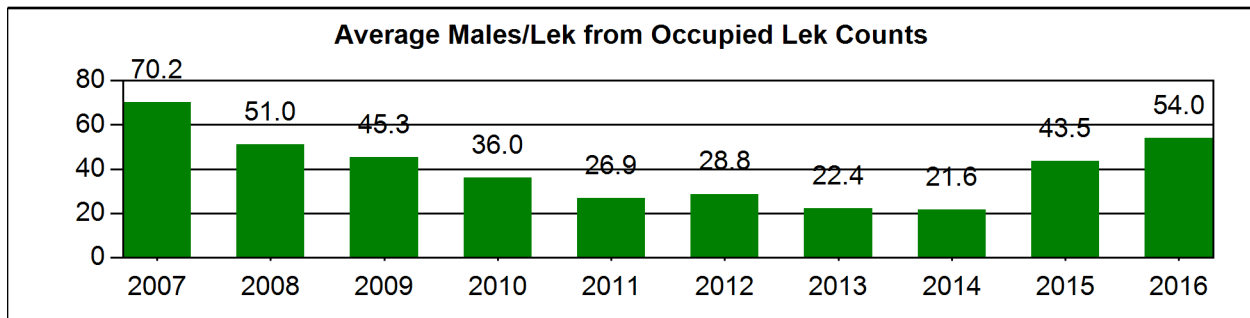
1) Occupied - Active during previous 10 years (see official definitions)

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: 2007 - 2016, Working Group: Wind River/Sweetwater River



## Sage Grouse Job Completion Report

Year: 2006 - 2015, 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
	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
	2015	Sep-19	Sep-30	12	2/4

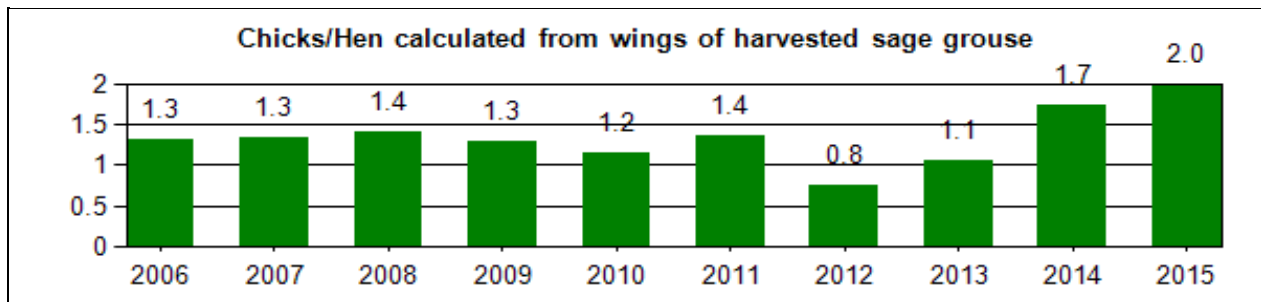
b. Harvest	Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
	2006	1710	558	1183	1.4	3.1	2.1
	2007	1776	788	1696	1.0	2.3	2.2
	2008	2144	863	2059	1.0	2.5	2.4
	2009	2295	875	2114	1.1	2.6	2.4
	2010	2495	1056	2866	0.9	2.4	2.7
	2011	1779	771	1801	1.0	2.3	2.3
	2012	2068	890	2296	0.9	2.3	2.6
	2013	1240	565	1325	0.9	2.2	2.3
	2014	1546	772	1853	0.8	2.0	2.4
	2015	2158	737	1846	1.2	2.9	2.5
	Avg	1,921	788	1,904	1.0	2.5	2.4

## Sage Grouse Job Completion Report

Year: 2006 - 2015, 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	
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
2015	513	11.3	21.2	5.3	6.6	21.4	34.1	2.0



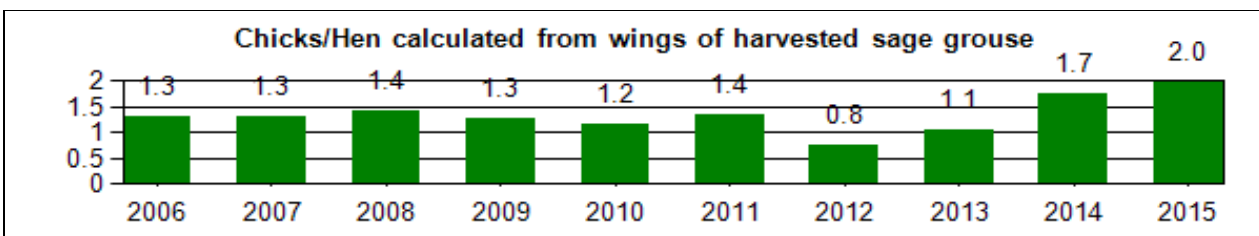
## Sage Grouse Wing Analysis Summary

**Year: 2015, Working Group: Wind River/Sweetwater River**

Adult Males:	58	% of All Wings:	11.3
Adult Females:	109	% of All Wings:	21.2
Adult Unknown:	0	% of All Wings:	0.0
Total Adults:	167		
Yearling Males:	27	% of All Wings:	5.3
Yearling Females:	34	% of All Wings:	6.6
Yearling Unknown:	0	% of All Wings:	0.0
Total Yearlings:	61		
Chick Males:	110	% of All Wings:	21.4
Chick Females:	175	% of All Wings:	34.1
Chick Unknown:	0	% of All Wings:	0.0
Total Chicks:	285		
Unknown Sex/Age:	0		
<b>Total for all Sex/Age Groups:</b>	<b>513</b>		

Chick Males:	110	% of All Chicks	38.6
Yearling Males:	27	% of Adult and Yearling Males	31.8
Adult Males:	58	% of Adult and Yearling Males	68.2
Adult and Yearling Males:	85	% of Adults and Yearlings	37.3
Total Males:	195	% of All Sex/Age Groups	38.0
Chick Females:	175	% of All Chicks	61.4
Yearling Females:	34	% of Adult and Yearling Females	23.8
Adult Females:	109	% of Adult and Yearling Females	76.2
Adult and Yearling Females:	143	% of Adults and Yearlings	62.7
Total Females:	318	% of All Sex/Age Groups	62.0

Chicks:	285	% of All Wings:	55.6
Yearlings:	61	% of All Wings:	11.9
Adults:	167	% of All Wings:	32.6
Chicks/Hen	2.0		



**2015 ANNUAL PROGRESS REPORT**  
**Response of Greater Sage-Grouse to Habitat Treatments in**  
**Wyoming Big Sagebrush**



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## INTRODUCTION

Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) is the most widely distributed subspecies of big sagebrush in the sagebrush biome (Beetle 1960, Knick et al. 2003), where it is used as habitat by sagebrush-occurring wildlife (Knick et al. 2003, Larrucea and Brussard 2008). Wyoming big sagebrush has been historically treated through chemical application, mechanical treatments, and prescribed burning to increase herbaceous forage species released from competition with sagebrush overstory (Beck et al. 2012). The same techniques that have been used in the past to provide more forage for livestock have been increasingly applied in attempts to improve habitat conditions for species such as greater sage-grouse (*Centrocercus urophasianus*). Objectives of many recent treatments are intended to rejuvenate sagebrush stands by killing older sagebrush plants to promote growth of younger sagebrush plants and increase herbaceous production providing additional food sources and herbaceous structural cover (Perryman et al. 2002, Dahlgren et al. 2006, Davies et al. 2009). However, vegetation response to different treatments varies. Wyoming big sagebrush experiences slow regeneration (25–100+ years to return to pre-treatment conditions; Baker 2006) following treatments and grass and forb cover and production typically return to pre-treatment conditions within a short time (i.e., 1-to-5 years) post treatment (Peek et al. 1979, Fischer et al. 1996, Hess and Beck 2012).

Information regarding sage-grouse use of treated areas is limited. Identification of specific habitat treatments that promote positive, negative, or neutral sage-grouse reproductive demographic response is necessary to evaluate the efficacy of sagebrush habitat treatments for sage-grouse and other wildlife species (Beck et al. 2012). Our first objective is to evaluate specific habitat treatments that influence sage-grouse reproductive demographic response. To obtain data to answer our first objective, we are monitoring adult female survival, nest success, and brood survival, before and after treatment in treated and untreated reference areas. As our study has progressed it has become obvious that it will be necessary to obtain information on grouse demographic parameters in multiple ways. In addition to adult female survival, nest success, and brood survival we will correlate chick diet composition obtained through stable isotope analysis from wing feathers with body mass and wing chord length (i.e., distance in mm from axial wing attachment with the body to the tip of the wing). The purpose of this analysis is to evaluate the relative ability of locations used by brood-rearing sage-grouse (first 5 weeks of life), random locations paired with those grouse locations, and habitat treatment areas near Jeffrey City, Wyoming to produce insects and forbs. Our ability to understand the relative capacity of treated sites to yield insects equivalent to the diet needs of sage-grouse chicks will provide further information to demonstrate the potential value of sagebrush treatments to sage-grouse.

The second objective of our study is to identify the spatial and temporal scales where habitat treatments identified in objective 1 are used proportionally equal to their availability (i.e., a neutral response) or more or less often than their availability in specified landscapes by sage-grouse during the nesting and brood-rearing periods. Fine-scale habitat information coupled with

demographic response rates will be imperative to answer these research questions. We will monitor VHF- and GPS-marked females at treatment and untreated reference sites to evaluate the extent that individually marked grouse use treatment locations. The demographic response of marked grouse will be correlated with their pattern of use of treatments to evaluate the relative value of habitat treatments to grouse. The relative use of treatment sites will provide information surrounding questions of scale and treatment type. This progress report summarizes phase 1 (pre-treatment phase; 2011–2013), phase 2 (treatment phase), and phase 3 (post-treatment phase; 2014–2015) of our study, with emphasis on the 2015 field season.

## STUDY AREA

Our study area encompasses ~2,978 km<sup>2</sup> (735,879 ac) in portions of Fremont and Natrona counties, Wyoming (Figure 1). The area includes approximately 81% Federal, 6.9% State, and 12.1% privately administered lands. Annual precipitation ranges from approximately 22.9 to 40.6 cm (9 to 16 in). Elevation ranges from 1642 to 2499 m. Important vegetation communities in the study area include Wyoming big sagebrush, mountain big sagebrush (*A. t. vaseyana*), basin big sagebrush (*A. t. tridentata*), silver sagebrush (*A. cana*), black sagebrush (*A. nova*), and greasewood (*Sarcobatus vermiculatus*). Major land uses during our study included livestock grazing and big game hunting. There is interest to resume uranium mining, once a major land use in the area.

## Habitat Treatments

Phase 2 of our study consisted of treating sagebrush (Spike® 20P [active ingredient, tebuthiuron] and mechanical mowing) in early brood-rearing habitats during winter and spring 2014. We used female early brood-rearing locations and areas that were predicted to have high early brood-rearing occurrence to identify 4 treatment study areas (2 Spike and 2 mowing treatments) and 2 reference study areas to evaluate the response of grouse to habitat treatments within a replicated study design (Figure 2). Detailed methods for identifying treatment study areas and specific locations of treatments within those study areas are found in our 2013 annual report. 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 (7/8/2011; WGFD 2011). The only exception to the WGFD protocols is that instead of grazing rest for 2 growing seasons after treatments, we installed exclosures to measure post-treatment vegetative response in the absence of grazing. This was necessitated by the fact that only 1 allotment in the 6 study areas has cross fencing and a rotational grazing system; the remaining 5 study areas occur in areas with season-long continuous grazing; thus, making evaluations of ungrazed post treatment vegetation responses impossible without exclosures. Therefore, we contracted with B and A Leasing of Greybull, Wyoming to install 12, 30 m x 60 m exclosures in mowed study areas and 12, 30 m x 80 m exclosures in Spike-treated study areas (exclosures constructed in herbicide-treated areas were larger to account for potential herbicide leaching into the untreated side) to serve as controls for livestock grazing. The general design of

these exclosures was to exclude a 30 x 30 m (0.22 ac) area of untreated sagebrush with an adjoining 30 x 30 m area excluding livestock grazing in treated sagebrush. The size of these exclosures provides a suitable areas within which we can evaluate 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 Wyoming Game and Fish Department and the University of Wyoming mowed approximately 489 ha (1,208 ac) of sagebrush habitats across 2 mowing treatment areas (Figure 3). Spike application occurred in early May 2014 (Figure 4). We contracted with Ag Flyers, Inc. of Torrington, Wyoming to apply 1 pound/ac (0.2 pounds/ac active ingredient), anticipating a 50% kill rate of sagebrush, to 607 ha (1,500 ac) across 2 study areas. Exclosures were erected in May 2014 following treatments.

## **METHODS**

### **Capturing and Monitoring**

We captured and radio-marked female sage-grouse from leks in spring by spot-lighting and hoop-netting (Giesen et al. 1982, Wakkinen et al. 1992). We used roosting locations of radio-marked adult females captured in spring to capture and radio-mark additional females in July and August each year. We aged females as juveniles or adults based on the shape and condition of the outermost wing primaries, and the outline of the primary tail feathers and coloration of undertail coverts (Eng 1955, Dalke et al. 1963). We attached radio transmitters (22 g, Model A4060; Advanced Telemetry Systems Incorporated, Isanti, MN, USA) to females with a PVC-covered wire necklace. We attached GPS transmitters (22-g PTT-100 Solar Argos/GPS PTT, Microwave Telemetry, Columbia, MD, USA) via rump mount beginning in our second field season (August 2012). We collected blood samples by clipping a vestigial toenail from a metatarsus and collecting blood drops on Whatman (2008) FTA micro cards; blood samples are being collected for future genetic analyses. Prior to release we weighed captured sage-grouse to the nearest 1 g and measured the wing chord length of the right wing to the nearest 1 mm. We began locating female sage-grouse weekly during late April each year with R-1000 hand-held receivers and 3-element Yagi antennas (Communication Specialists, Orange, CA, USA). Each spring we also employed fixed-wing aircraft flights to locate missing grouse. We recorded Universal Transverse Mercator (UTM) coordinates for ground and aerial grouse locations using a hand-held, 12-channel Global Positioning System (GPS) unit (Garmin; Garmin International, Olathe, KS, USA).

### **Adult Female Survival, Nesting, and Brood Parameters**

We located nests by circling the radio-marked females signal until the surveyor visually located the bird on a nest or isolated the nest location on the ground. To minimize human-induced nest depredation or nest abandonment, we subsequently monitored nests with triangulation from a distance of at least 50 m. Brood productivity and survival were measured at 35 days post-hatch

by night-time spotlight counts. To estimate survival rates for marked female grouse from 1 May to 1 August during each year, we employed the Kaplan-Meier product-limit survival estimator (Kaplan and Meier 1958) modified for staggered entry (Pollock et al. 1989). The variance estimator for these estimates followed that described by Greenwood (1926).

### **Chick Dietary Selection**

From 2013–2015 we sampled 4 locations (1 location per week) for each female sage-grouse with a brood during the first 4 weeks of the brood-rearing period to identify potential foraging locations for grouse broods. In addition, we collected vegetation and insect samples at locations within and adjacent to treated areas. In each of the 4 treatment study areas, we sampled 10 treated locations and 10 non-treated locations adjacent to treated sites (Figure 5). In each of our 2 reference study areas we sampled vegetation microhabitat characteristics at 10 locations. We established a sampling plot demarcated by 2, 30-m transects, intersecting the center of the sampling location and extending in each cardinal direction. We collected vegetation structural and ground cover data according to methods described below. We clipped perennial food forbs (see Kirol et al. 2012 for a list) within 4, 1 m<sup>2</sup> quadrats placed along each transect. Directly adjacent to each perennial food-forb quadrat, we placed an additional 1 m<sup>2</sup> quadrat for insect sampling. Quadrats used to sample insects were fitted with mesh window screen to prevent insect escapement. We used an insect vacuum (duration, 2 minutes per quadrat; Model 1612, The John W. Hock Company, Gainesville, FL, USA; Schrieber et al. 2015) to sample relative insect abundance in each quadrat. We used night-time spotlighting to count numbers of chicks with each hen on day 35 post-hatch. During that time we captured 2 chicks (if present) per brood and plucked the fifth secondary feather from each chick. We selected the fifth secondary wing feather because its growth begins slightly later than more distal secondary feathers and minimizes the influence of egg yolk nutrients on nutritional analysis (Romanoff 1944, Johnsgard 1983, Blomberg et al. 2013). At the time of capture we weighed each chick to the nearest 1 g and measured its wing chord length to the nearest 1 mm.

Forb and insect samples were dried in a forced-air drying oven at 60 C for 48 hours to obtain dry mass (Beck and Peek 2005). We are currently in the process of sorting insect samples from our 2015 sample. Once complete, we will compute the ratio (by weight) of forbs and insects at each site to estimate the proportional availability of each diet item by site for each year (2013–2015). For each feather sample we will measure  $\delta^{15}\text{N}$ , and  $\delta^{13}\text{C}$ . Analyses are performed at the University of Wyoming Stable Isotope Facility. Once analyzed, we will use a two-source mixing model to evaluate the proportional contribution of plants and invertebrates in the diet of each chick sage-grouse (Parnell et al. 2010). We will also correlate chick body condition (wing chord length and body mass) with the proportion of plants and invertebrates in chick diets as determined by feather isotope analysis as well as correlate chick body condition with relative availability of plants and invertebrates at brood-rearing locations. To assess diet selection by broods, we will use 95% Bailey's simultaneous confidence intervals (Bailey 1980) to compare the proportion of plants and invertebrates in the sage-grouse chick diet (measured from feather

isotope samples) with the proportional availability of plants and invertebrates at sites used by chicks.

### **Microhabitat Sampling**

We evaluated vegetation parameters, ground cover, and micro-topographic microhabitat characteristics at nest (2011–2015), brood-rearing locations (early and late brood rearing periods, 2011–2015), summer barren hen locations (2011–2012), treatment exclosure locations (2013–2015 for mowing exclosures; 2014–2015 for Spike exclosures), and within treated locations (2014–2015; treated, non-treated adjacent locations, and off-site non-treated locations). In addition, we sampled microhabitat characteristics at 1 dependent-random location for each nest (2011–2014), brood-rearing location (2011–2015), and summer barren hen location (2011–2012). Microhabitat characteristics were estimated along 2, perpendicular 30-m transects centered at each location following methods by Kirol et al. (2012). We sampled herbaceous and ground cover attributes using the Daubenmire (1959) technique in 20 x 50 cm quadrats ( $n = 17$  quadrats per location). We recorded shrub canopy cover with the line intercept method and computed percentage cover for each shrub species (Canfield 1941, Wambolt et al. 2006). We recorded shrub density by counting shrubs rooted within 1-m belt transects positioned along the right side of each 30-m transect and assessed visual obstruction (cm) using a Robel pole (Robel et al. 1970) placed in the center of each location (nest bowl or center of brood rearing, barren hen, or random location), recorded measurements at a distance of 5, 10, and 15 m at 1 m height from each cardinal direction, and averaged these 4 values to provide a single measure of visual obstruction at each location. We measured the droop height of current and residual grasses in each 20 x 50 cm quadrat and height of the tallest leader (excluding inflorescences) for each shrub encountered along each 30-m line transect.

We examined microhabitat at random locations at a random distance and direction 100–500 m from each paired grouse location (Aldridge and Boyce 2008). We began sampling nest microhabitat plots after the first successful hatch and, to the best of our ability, sampled all nest and paired random locations within 1 week of known nest fate. We sampled brood-rearing and barren hen microhabitat plots as soon as possible, typically no later than 1 week after identifying brood locations. Sampling at exclosure and treatment locations corresponded to the early brood-rearing period (late-May to Mid-June) in our study area. Comparisons of used and available microhabitats at nesting, brood-rearing, and barren female locations from 2011–2013 are found in our 2013 annual report.

We used repeated measures ANOVA to assess the short-term response of vegetation to mowing and herbicide treatments within exclosures. Repeated measures ANOVA tests for the main effects of treatment (treated and untreated portions of each exclosure) and time (2013–2015 in mowed exclosures; 2014 and 2015 in herbicide exclosures), as well as the interaction of treatment and time. A significant interaction ( $P \leq 0.05$ ) indicated that treated and untreated portions of each exclosure vary differently through time, suggesting an effect of treatment on

vegetation parameters. As phase 3 of our study progresses, we will continue to use a repeated measures design to assess change in vegetation structure and composition at exclosure and treatment sampling plots to evaluate the value of habitat treatments from the perspective of sage-grouse habitat requirements through time.

### **Sagebrush Nutritional Quality**

Prior to treatments in early winter 2013, we randomly selected 18 plants (with at least 6 plants less than 25.4 cm [10 in]) within the treated portion of each mowing exclosure to maximize the likelihood of at least 6 of these plants surviving (assuming less than a 50% kill outcome in treatments) and 12 plants (with at least 6 plants less than 25.4 cm) within the untreated portions of each of the 12 exclosures. We collected 5-8 sprigs from each selected sagebrush plant within each collection site by clipping the stems with pruning shears and minimizing damage to remaining leaves and stems. Each plant was marked with a metal plant tag to allow for long term monitoring of treatment effects on dietary quality of plants. Sagebrush samples were stored in a –20° F freezer. During 2013 we were unable to sample at herbicide exclosure locations because these locations were not yet confirmed during the sampling period.

We completed our third sampling period during November 2015. In the treated portion of each mowing exclosure, we collected vegetation from 6 previously sampled plants that survived treatment, plus an additional 6 plants in each treatment that were not sampled in the previous sampling period. In the same way, we collected sprigs from 6 plants that were sampled prior to treatment, and 6 plants that were not sampled during previous sampling periods in the un-treated portion of each mowing exclosure. Collection and analysis of new plants account for effects of clipping on diet quality. Recent analysis of the effect of repeat sampling of shrubs compared to new shrubs revealed that chemicals analyzed did not differ between plants, suggesting that clipping did not influence the chemical composition of individual plants (J. Forbey, Boise State University, personal communication). We can therefore sample independent and previously unsampled plants during future sampling events. Post-treatment sampling focused on collecting stems from plants containing new growth during the second winter season.

Of the original 18 plants sampled within the treated portions of exclosures, we will only analyze those plants that survived through the post-treatment sampling periods. We will combine the plants within each treatment (untreated or treated pair, repeated sample or new sample) within a treatment type to make a single composite sample for analysis. We will have 24 composite samples representing the same plants for the pretreatment, post-treatment first winter, and post-treatment second winter as well as 24 composite samples of new plants for the post-treatment first winter and second winter. We will then grind leaves from each composite sample in liquid nitrogen using a mortar and pestle, and then divide each sample into three subsamples. The first subsample will be used to quantify individual monoterpenes via headspace gas chromatography. The second subsample will be used in a colorimetric assay to quantify total phenolic concentrations. Individual phenolics will be quantified from the same sample using high pressure

liquid chromatography. Monoterpene and phenolic analyses are conducted in the Forbey Lab at Boise State University. The third subsample will be dried and analyzed for nitrogen using an elemental analyzer to quantify crude protein content.

We will use crude protein as a nutrient variable because it can affect herbivore foraging behavior and reproductive success (Matson 1980). Nutrient concentrations will be quantified as percentage of dry mass. We chose monoterpenes and phenolics as plant secondary metabolite variables because both classes of compounds exert deleterious effects (e.g., toxicity, increased energy expenditure, nutrient binding) on herbivores (Dearing et al. 2005) and occur in relatively high concentrations in sagebrush (Kelsey et al. 1982). To test the response of sagebrush dietary quality (e.g., crude protein or chemical defenses) to treatments, we will use a repeated measures 2-way ANOVA with treatment type (mowing or herbicide as the different conditions) and treatment within an enclosure (untreated or treatment) as the between-subjects effects and time (before and after treatment) as the within-subjects effect. We will also compare diet quality between plants that were sampled repeatedly and new plants within treatments using an ANOVA with plant type (repeat or new plant) as the between-subjects effect. Samples for the 2015 collection period are currently being processed at the Forbey Lab at Boise State University.

## **RESULTS**

### **Capturing and Monitoring**

We captured and radio-marked 385 female sage-grouse (78 in 2015) from spring 2011 through August 2015 (Table 1). We monitored 83 females during the 2015 field season. Number of females monitored reflects the number of collared individuals that were alive during the beginning of the nest initiation period each season (Late-April to Early May; Table 1). During the 2015 field seasons we recorded 729 ground points including nest, brood-rearing, and barren female locations, from radio marked females. From 1 August 2012 through 15 October 2015 we obtained 56,351 locations from 60 females equipped with rump-mounted GPS transmitters.

### **Adult Female Survival, Nesting, and Brood Parameters**

In 2015, 72 of 83 ( $90 \pm 2\%$  [SE]) radio-marked female sage-grouse survived from May through 1 August. We located 83 nests, which included 72 first nests and 11 re-nests. Twenty-three (31.9%) first nests were successful, 39 (54.2%) were depredated, and 10 (13.9%) were abandoned. Of the re-nesting attempts, 6 were successful (54.5%) and 5 were depredated (45.5%). Overall, apparent nest success was 35.4%. Hatch dates for successful nests ranged from 4 May to 26 June 2015. Of the 29 females with successful nests, 15 were alive and with broods 35 days post-hatch (53.6% apparent brood success). On average, there were 0.65 chicks per radio-marked female by day 35 post-hatch in 2015. Table 1 includes demographic parameters for phase-1 (2011–2013) and year 1 and 2 of phase 3 (2014 and 2015) of our study.

### **Chick Diet Selection**

In 2015, we collected vegetation and insect samples at 63 brood-rearing and 62 random brood locations and collected feathers from 28 chicks in 15 broods. To date, we have estimated dry mass for each forb and insect sample collected during 2013 and 2014. We began processing and sorting forb and insect samples from our 2015 field season in August. Feather samples from 2013–2015 are expected to be analyzed by the University of Wyoming Stable Isotope Facility by March 2016. If a strong correlation exists between feather samples and the relative proportion of herbaceous and insect foods at brood-rearing locations, this technique may provide a robust non-lethal method to determine sage-grouse diet selection. If the relative proportion of herbaceous and insect foods in chick wing feathers can be correlated with surrogates of demographic response (i.e., body condition as measured through body mass, and wing chord length) we may be better capable of understanding the role of diet selection on chick survivability. Specifically, through measuring forb and insect availability at grouse brooding sites, one can potentially evaluate the mix of foods that elicit positive responses in chick sage-grouse body condition. The relative availability of food items at grouse use locations can in turn be compared to those at other sites across a landscape to assess the ability of different sites to promote growth in sage-grouse chicks. A measure of body condition in relation to chick diet will provide a means to assess the relative value of foods provided across an array of sagebrush habitats for sage-grouse. The availability of food items can in turn be used to assess the ability of treatment sites to promote growth in sage-grouse chicks.

### **Exclosure Vegetation Sampling**

During 2015 we sampled the treated and un-treated portions of each exclosure location, which totaled 48 microhabitat samples. We also sampled 100 locations within treated, untreated, and off-site untreated microhabitat locations. For mowing exclosures, we found significant treatment x time interactions for the following shrub variables: total shrub cover, total shrub height, big sagebrush cover, big sagebrush height, and visual obstruction (Tables 2 and 3). This was expected as the mowing treatments directly reduced shrub cover and height, and the recovery of shrubs is slow following treatments (Baker 2006, Davies et al. 2009). Of the herbaceous microhabitat characteristics measured, we found perennial grass height, food forb cover, and non-food forb cover to have a significant treatment x time interaction at mowing exclosures. Preliminary results suggest that perennial grass height has generally increased in treated relative to un-treated portions of exclosures following mowing treatments. On the other hand, both food forb and non-food forb cover have generally decreased after two growing seasons in treated portions of each exclosure following mowing.

For Spike® 20P exclosures, we did not find significant treatment x time interactions for measured shrub variables, suggesting that herbicide treatments have not taken full effect (Tables 4 and 5). However, distinguishing between live and dead shrub cover would suggest that our expected kill rate of 50% is likely to be met. We found a significant treatment x time interaction

for residual grass height and food forb cover. Residual grass cover generally decreased in treated portions of Spike® 20P exclosures from 2014 to 2015, whereas food forb cover increased in treated relative to untreated portions of exclosures in Spike® 20P treated areas.

### **Sagebrush Nutritional Quality**

Analysis of the short term response (1 year following treatments) of sagebrush nutritional quality following mowing treatments revealed subtle changes in crude protein levels in treated plants. For crude protein, we did not detect a treatment or time affect, but there was a trend for time x treatment affect wherein after mowing, the control plants did not change, but the mowed plants slightly increased in crude protein (treatment crude protein =  $13.4 \pm 0.33$  % [SE] dry matter; untreated crude protein =  $12.6 \pm 0.28$  % [SE] dry matter). We did not detect an effect of mowing on total phenolic, coumarin, and monoterpene concentrations. Increased crude protein following mowing treatments is consistent with Davies et al. (2009) who found slight increases in crude protein levels up to 6 years following treatments in Wyoming big sagebrush in eastern Oregon. However, slight differences in crude protein levels between treated and untreated portions of mowing exclosures may not represent a meaningful change in crude protein levels for sage-grouse winter diets. Preliminary data suggests that there is little change in sagebrush nutritional quality immediately following treatments, but analysis of changes over longer time periods is necessary to assess the intermediate-term and long-term response of sagebrush nutritional quality following treatments. In addition, we are beginning to assess how herbicide treatments influence nutritional quality of sagebrush and will be able to compare herbicide and mowing treatments in the future.

### **FUTURE DIRECTION**

During 2016 we intend to maintain our sample of females equipped with VHF and GPS transmitters to achieve a goal of at least 100 VHF-marked and 47 GPS-marked grouse. We have received 35 new GPS transmitters that we will deploy in spring 2016. We will continue to monitor radio-marked female sage-grouse similar to previous years to determine reproductive demographic rates in treatment areas and off-site reference areas. We will sample microhabitat plots at sage-grouse use locations and paired-random locations, at exclosure sites, and at treatment and control locations that were demarcated in 2014. We plan to continue examining the ability of stable isotope analysis of sage-grouse chick feathers to infer diet selection and subsequent body condition. In addition, we will collect samples to assess the sagebrush nutritional quality of treated sagebrush habitats for at least one additional winter period. Once we collect information from our 2016 field season, we will evaluate the short-term demographic response of sage-grouse to treatments. As such, we will stratify our sample by females exposed to treatments (mowing, tebuthiuron, reference) to assess any changes in nest success, brood success, and adult survival as well as the relative use of treated areas by GPS-marked individuals. Additional field seasons will be required to assess the effects of space use and demographics on sage-grouse in tebuthiuron-treated study areas. Our study will continue beyond

2016 to assess longer-term influences of treatments on resource selection and demographic rates of sage-grouse.

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**Table 1.** Sample sizes and measured demographic rates for female sage-grouse during summers 2011–2015 in Fremont and Natrona counties, Wyoming, USA. Pre-treatment demographic rates spanned 2011–2013 and post-treatment demographic rates 2014 and 2015.

Parameter	Pre-treatment			Post-treatment	
	2011	2012	2013	2014	2015
Females monitored ( <i>n</i> )	32	80	101	102	83
Female survival (% $\pm$ SE)	78 $\pm$ 8	83 $\pm$ 4	79 $\pm$ 4	82 $\pm$ 4	90 $\pm$ 2
Nests ( <i>n</i> ) <sup>1</sup>	23 (3)	58 (4)	85 (0)	106 (15)	83 (11)
Nest success (%)	26.1	44.8	55.3	50.9	35.4
Broods monitored ( <i>n</i> ) <sup>2</sup>	6 (0)	25 (1)	46 (1)	45 (9)	29 (1)
Brood success (%)	66.6	68.0	53.3	77.7	53.6
Chicks per marked female	0.45	0.70	1.10	1.41	0.65

<sup>1</sup>Numbers in parentheses indicate number of re-nesting attempts.

<sup>2</sup>Numbers in parentheses indicate the number of broods that were masked due to inability to re-locate once hatched or transmitter failure.

**Table 2.** Mean habitat characteristics (SE) sampled in treated and un-treated portions of 6 exclosures at the Carmody Lake mowing treatment study areas during pre- (2013) and post-treatment (2014 and 2015) field seasons, Fremont County, Wyoming, USA.

Parameter	2013		2014		2015	
	Treated	Untreated	Treated	Untreated	Treated	Untreated
<b>Shrub Characteristics</b>						
Big sagebrush canopy cover (%)*	21.3 (1.3)	18.6 (1.2)	10.4 (1.3)	17.7 (1.9)	12.1 (1.2)	15.8 (1.1)
Big sagebrush height (cm)*	26.6 (2.4)	27.4 (1.3)	16.6 (0.8)	28.0 (1.7)	17.3 (1.2)	25.9 (2.0)
Big sagebrush density (no./m <sup>2</sup> )	1.7 (0.2)	1.4 (0.1)	1.3 (0.1)	1.4 (0.1)	1.4 (0.1)	1.6 (0.1)
Shrub canopy cover (%)*	21.9 (1.4)	19.0 (1.2)	11.1 (1.2)	18.2 (2.1)	13.6 (0.5)	17.4 (1.2)
Shrub height (cm)*	26.2 (2.4)	27.1 (1.4)	16.5 (0.8)	27.7 (1.8)	16.8 (1.1)	25.2 (2.2)
Shrub density (no./m <sup>2</sup> )	1.9 (0.2)	1.6 (0.2)	1.5 (0.1)	1.5 (0.1)	1.8 (0.2)	2.0 (0.1)
Visual obstruction (cm)*	22.9 (1.3)	18.1 (1.2)	17.1 (0.8)	22.2 (1.2)	17.4 (0.7)	26.6 (3.0)
<b>Grass Height (cm)</b>						
Perennial grass height*	14.0 (1.5)	9.3 (0.9)	28.8 (0.9)	31.5 (1.2)	41.8 (3.2)	35.3 (1.8)
Residual grass height	18.9 (1.3)	17.2 (1.2)	7.8 (0.7)	6.2 (0.6)	12.6 (1.1)	13.9 (1.5)
<b>Herbaceous Canopy Cover (%)</b>						
Annual grass	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Perennial grass	2.7 (0.3)	1.8 (0.3)	21.4 (3.5)	23.0 (3.1)	18.7 (1.1)	17.5 (1.1)
Residual grass	9.7 (1.0)	7.3 (1.5)	7.4 (2.3)	3.6 (1.9)	9.7 (0.8)	10.2 (1.6)
Food-forb*	0.8 (0.7)	0.7 (0.7)	4.9 (1.6)	6.7 (3.4)	6.0 (1.6)	9.7 (1.8)
Non-food forb*	0.0 (0.0)	0.4 (0.2)	0.9 (0.5)	1.1 (0.4)	1.3 (0.5)	2.8 (0.6)
<b>Ground Cover (%)</b>						
Bare ground*	39.8 (4.4)	39.8 (3.2)	26.2 (5.2)	24.8 (4.6)	33.2 (5.4)	21.6 (2.4)
Biological soil crust	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Cactus cover	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Gravel and rock	0.3 (0.2)	0.6 (0.3)	1.1 (0.3)	1.3 (0.7)	1.9 (0.9)	4.2 (0.7)
Litter	33.8 (3.1)	34.4 (4.1)	46.7 (4.2)	42.5 (1.7)	31.9 (2.3)	38.6 (2.8)

\*Indicates significant treatment x time interaction ( $P \leq 0.05$ )

**Table 3.** Mean habitat characteristics (SE) sampled in treated and un-treated portions of 6 exclosures at the Cedar Rim mowing treatment study areas during pre- (2013) and post-treatment (2014 and 2015) field seasons, Fremont County, Wyoming, USA.

Parameter	2013		2014		2015	
	Treated	Untreated	Treated	Untreated	Treated	Untreated
<b>Shrub Characteristics</b>						
Big sagebrush canopy cover (%)*	19.6 (1.5)	19.8 (1.0)	13.9 (1.4)	17.7 (1.7)	17.0 (1.7)	18.4 (0.9)
Big sagebrush height (cm)*	27.9 (2.3)	27.3 (2.0)	15.5 (1.0)	26.5 (1.0)	16.1 (1.3)	24.2 (1.6)
Big sagebrush density (no./m <sup>2</sup> )	2.0 (0.1)	2.0 (0.2)	2.0 (0.2)	1.7 (0.1)	1.8 (0.1)	2.0 (0.1)
Shrub canopy cover (%)*	20.1 (1.4)	20.2 (1.0)	14.2 (1.3)	18.2 (1.7)	18.0 (1.6)	19.2 (0.8)
Shrub height (cm)*	27.3 (2.1)	26.9 (1.9)	15.4 (1.1)	25.7 (0.5)	16.2 (1.2)	23.6 (1.4)
Shrub density (no./m <sup>2</sup> )	2.1 (0.1)	2.1 (0.2)	2.1 (0.3)	1.9 (0.2)	2.1 (0.2)	2.3 (0.1)
Visual obstruction (cm)*	16.0 (1.8)	19.9 (2.6)	17.5 (0.9)	24.0 (1.6)	18.5 (0.6)	23.3 (0.9)
<b>Grass Height (cm)</b>						
Perennial grass height*	11.4 (0.6)	11.3 (0.6)	24.2 (0.6)	26.1 (1.1)	38.8 (1.7)	33.0 (1.2)
Residual grass height	16.3 (1.3)	15.1 (0.9)	6.1 (0.3)	6.3 (0.6)	12.1 (1.3)	13.2 (1.1)
<b>Herbaceous Canopy Cover (%)</b>						
Annual grass	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Perennial grass	1.9 (0.5)	2.5 (0.6)	22.1 (3.9)	15.3 (3.3)	18.5 (1.1)	15.9 (0.8)
Residual grass	11.8 (2.7)	10.2 (1.6)	2.0 (0.6)	3.9 (1.7)	9.1 (0.7)	10.6 (1.3)
Food-forb*	0.6 (0.5)	0.1 (0.0)	1.9 (0.3)	0.9 (0.2)	2.8 (1.4)	6.8 (1.7)
Non-food forb*	0.6 (0.3)	0.7 (0.3)	0.8 (0.3)	0.6 (0.2)	0.8 (0.3)	4.2 (0.8)
<b>Ground Cover (%)</b>						
Bare ground	43.8 (1.9)	55.1 (0.4)	32.3 (6.3)	33.7 (4.3)	36.8 (3.7)	24.4 (1.7)
Biological soil crust	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Cactus cover	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Gravel and rock	5.5 (2.0)	6.4 (3.0)	4.3 (2.1)	6.4 (2.7)	4.4 (1.1)	8.7 (2.3)
Litter	34.6 (5.5)	25.2 (3.2)	44.5 (4.3)	30.5 (4.3)	33.4 (3.1)	40.5 (2.6)

\*Indicates significant treatment x time interaction ( $P \leq 0.05$ )

**Table 4.** Mean habitat characteristics (SE) sampled in treated and un-treated portions of 6 enclosures at the Black Mountain herbicide treatment study areas during post-treatment (2014 and 2015) field seasons, Natrona County, Wyoming, USA.

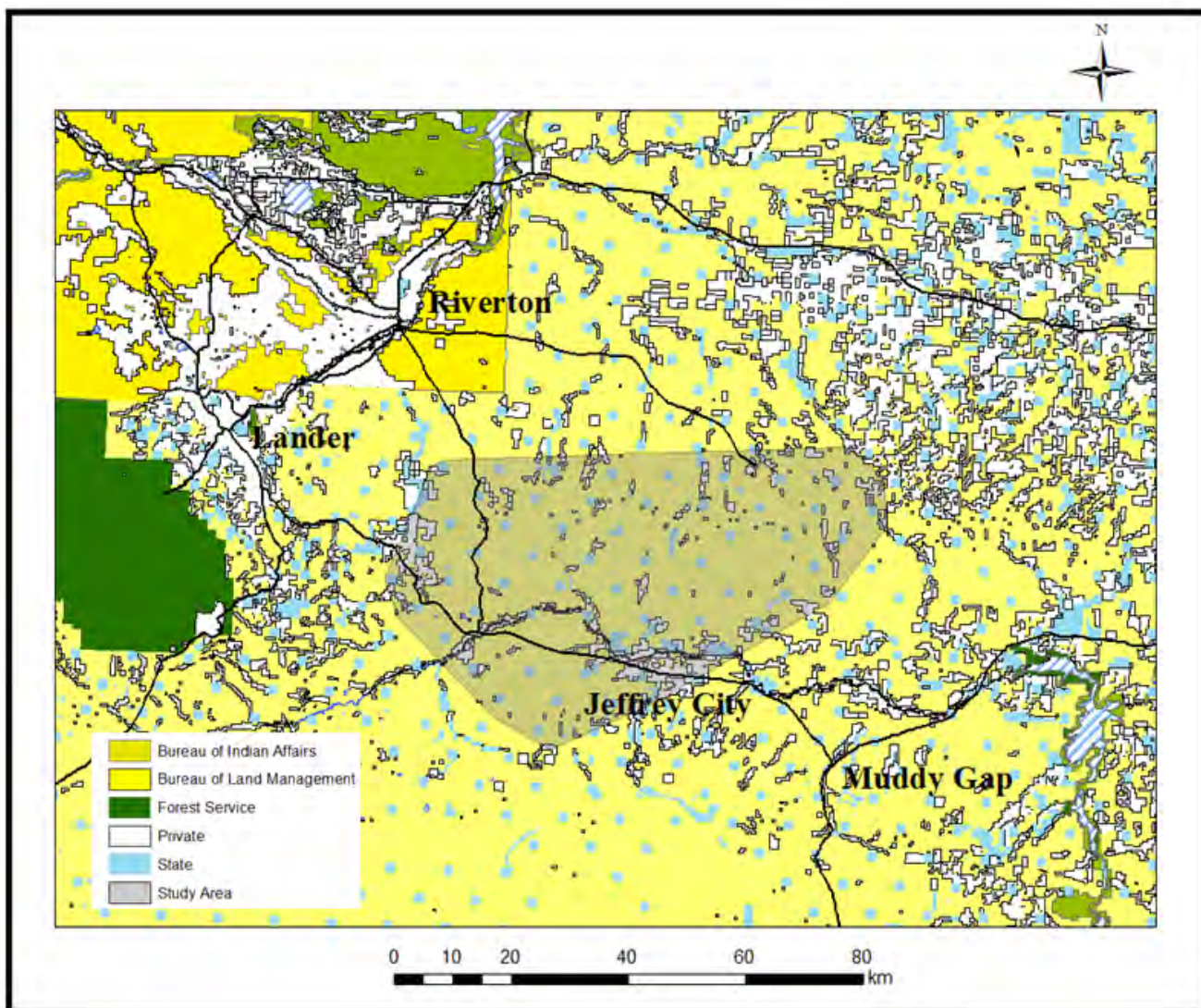
Parameter	2014		2015	
	Treated	Untreated	Treated	Untreated
<b>Shrub Characteristics</b>				
Big sagebrush canopy cover (%)	18.7 (3.1)	25.3 (4.0)	23.9 (5.4)	25.3 (4.5)
Big sagebrush height (cm)	23.9 (3.9)	34.6 (6.1)	23.7 (4.7)	31.8 (5.7)
Big sagebrush density (no./m <sup>2</sup> )	1.9 (0.1)	2.0 (0.2)	2.3 (0.2)	2.3 (0.1)
Shrub canopy cover (%)	22.5 (2.3)	26.0 (4.5)	25.5 (5.5)	27.3 (3.7)
Shrub height (cm)	22.9 (3.8)	34.1 (6.2)	23.2 (4.6)	30.9 (6.0)
Shrub density (no./m <sup>2</sup> )	2.4 (0.4)	2.1 (0.2)	2.7 (0.2)	2.7 (0.4)
Visual obstruction (cm)	25.6 (3.6)	43.3 (10.2)	21.4 (5.2)	36.4 (11.0)
<b>Grass Height (cm)</b>				
Perennial grass height	24.6 (1.0)	26.7 (1.5)	32.2 (1.2)	37.8 (1.8)
Residual grass height*	9.1 (0.7)	8.9 (0.5)	12.9 (2.7)	16.8 (2.6)
<b>Herbaceous Canopy Cover (%)</b>				
Annual grass	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Perennial grass	11.9 (2.1)	21.1 (2.5)	14.5 (1.1)	17.4 (1.2)
Residual grass	5.7 (1.4)	5.7 (1.2)	7.0 (1.6)	9.2 (1.1)
Food-forb*	3.5 (1.5)	11.0 (4.1)	4.4 (1.5)	7.2 (1.5)
Non-food forb	0.7 (0.2)	1.7 (1.1)	3.7 (1.6)	2.5 (0.9)
<b>Ground Cover (%)</b>				
Bare ground	29.0 (8.6)	15.6 (5.1)	31.9 (7.8)	18.3 (4.0)
Biological soil crust	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Cactus cover	0.2 (0.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Gravel and rock	17.8 (7.5)	12.9 (6.2)	14.5 (6.4)	11.4 (3.4)
Litter	40.0 (5.7)	48.8 (6.8)	33.2 (5.5)	41.6 (6.8)

\*Indicates significant treatment time interaction ( $P \leq 0.05$ )

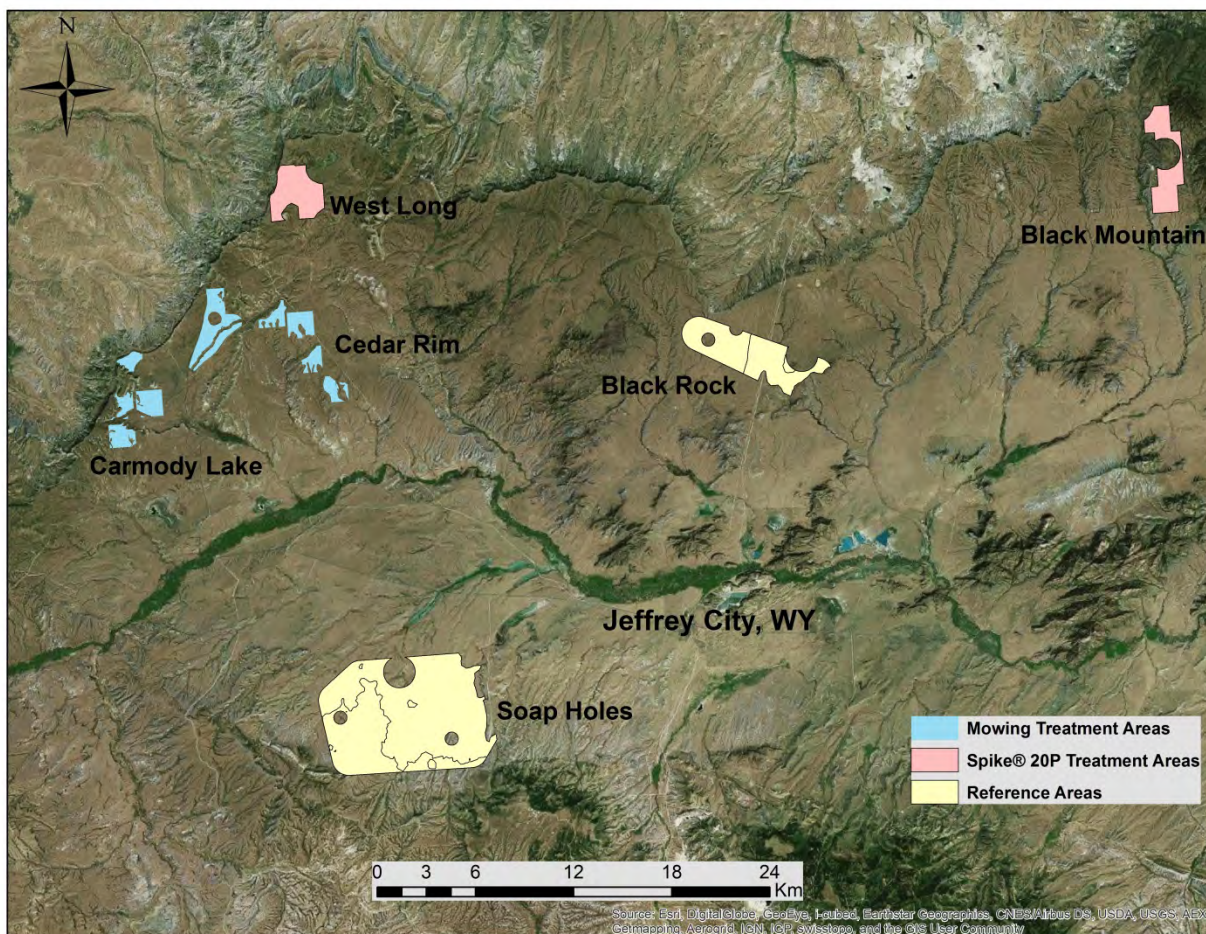
**Table 5.** Mean habitat characteristics (SE) sampled in treated and un-treated portions of 6 exclosures at the West Long herbicide treatment study areas during post-treatment (2014 and 2015) field seasons. Fremont County, Wyoming, USA.

Parameter	2014		2015	
	Treated	Untreated	Treated	Untreated
<b>Shrub Characteristics</b>				
Big sagebrush canopy cover (%)	24.8 (3.0)	25.2 (4.0)	23.4 (4.6)	30.5 (4.4)
Big sagebrush height (cm)	33.4 (3.5)	35.1 (3.8)	30.5 (3.3)	30.9 (3.5)
Big sagebrush density (no./m <sup>2</sup> )	1.9 (0.2)	1.9 (0.2)	2.2 (0.3)	1.9 (0.2)
Shrub canopy cover (%)	25.0 (2.9)	25.3 (3.9)	24.5 (4.2)	31.1 (4.2)
Shrub height (cm)	32.9 (3.6)	34.9 (3.9)	29.8 (3.5)	30.2 (3.7)
Shrub density (no./m <sup>2</sup> )	2.1 (0.2)	2.1 (0.2)	2.7 (0.2)	2.2 (0.1)
Visual obstruction (cm)	31.7 (4.5)	29.1 (4.1)	28.1 (4.1)	35.6 (5.2)
<b>Grass Height (cm)</b>				
Perennial grass height	31.3 (1.4)	30.1 (1.4)	35.9 (1.3)	24.5 (1.9)
Residual grass height*	6.4 (0.4)	6.4 (0.4)	14.4 (1.5)	28.2 (1.1)
<b>Herbaceous Canopy Cover (%)</b>				
Annual grass	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Perennial grass	21.9 (4.0)	27.1 (4.0)	15.8 (0.4)	17.2 (1.8)
Residual grass	4.4 (1.1)	1.9 (0.6)	9.8 (1.9)	12.0 (1.0)
Food-forb*	10.7 (2.5)	9.6 (1.7)	12.6 (2.5)	8.1 (2.1)
Non-food forb	0.8 (0.4)	2.5 (0.9)	0.9 (0.6)	1.1 (0.7)
<b>Ground Cover (%)</b>				
Bare ground	14.0 (5.5)	20.5 (7.9)	13.8 (3.2)	19.3 (2.8)
Biological soil crust	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Cactus cover	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Gravel and rock	0.5 (0.2)	0.4 (0.3)	2.3 (1.4)	1.2 (0.7)
Litter	58.0 (8.2)	44.5 (5.9)	54.8 (5.9)	36.2 (5.1)

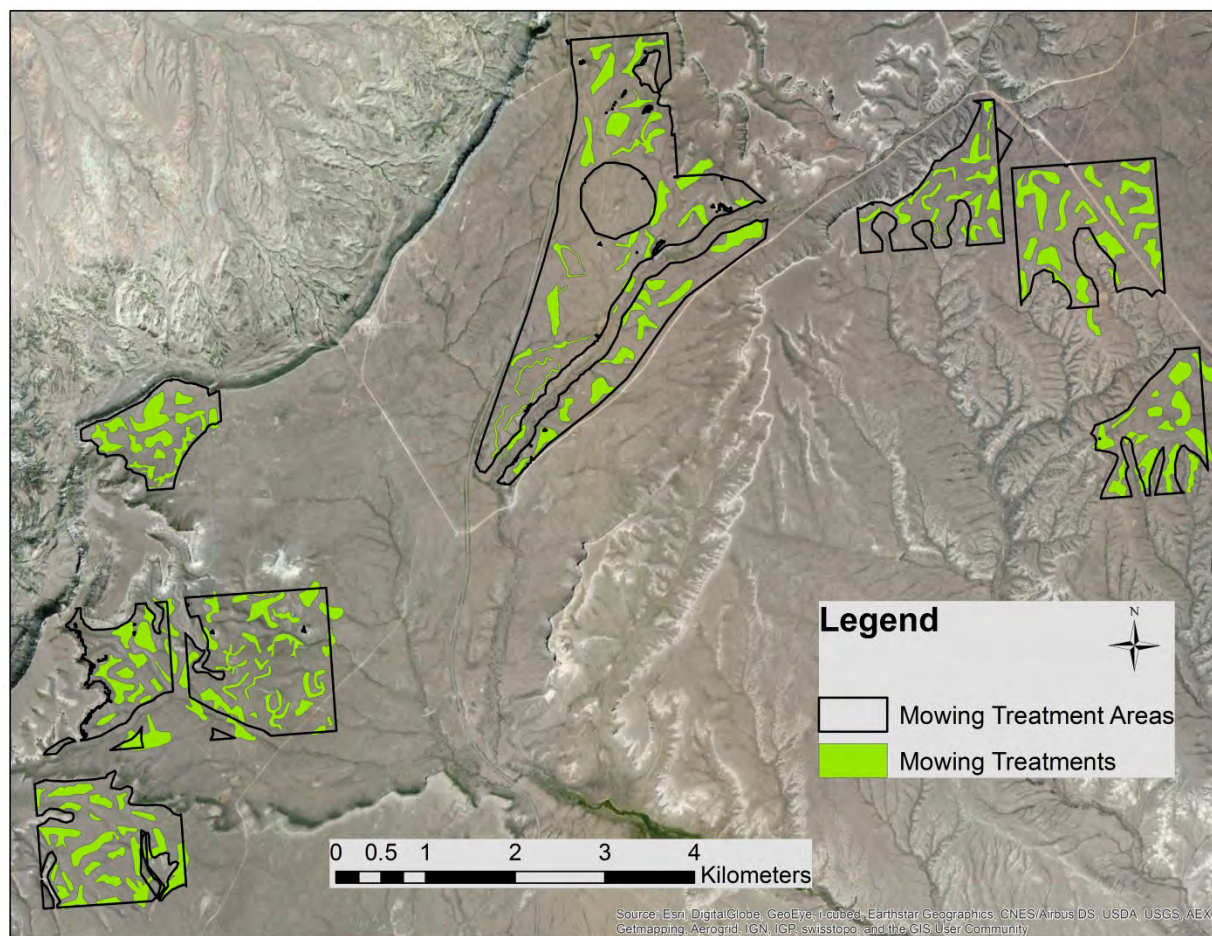
\*Indicates significant treatment time interaction ( $P \leq 0.05$ )



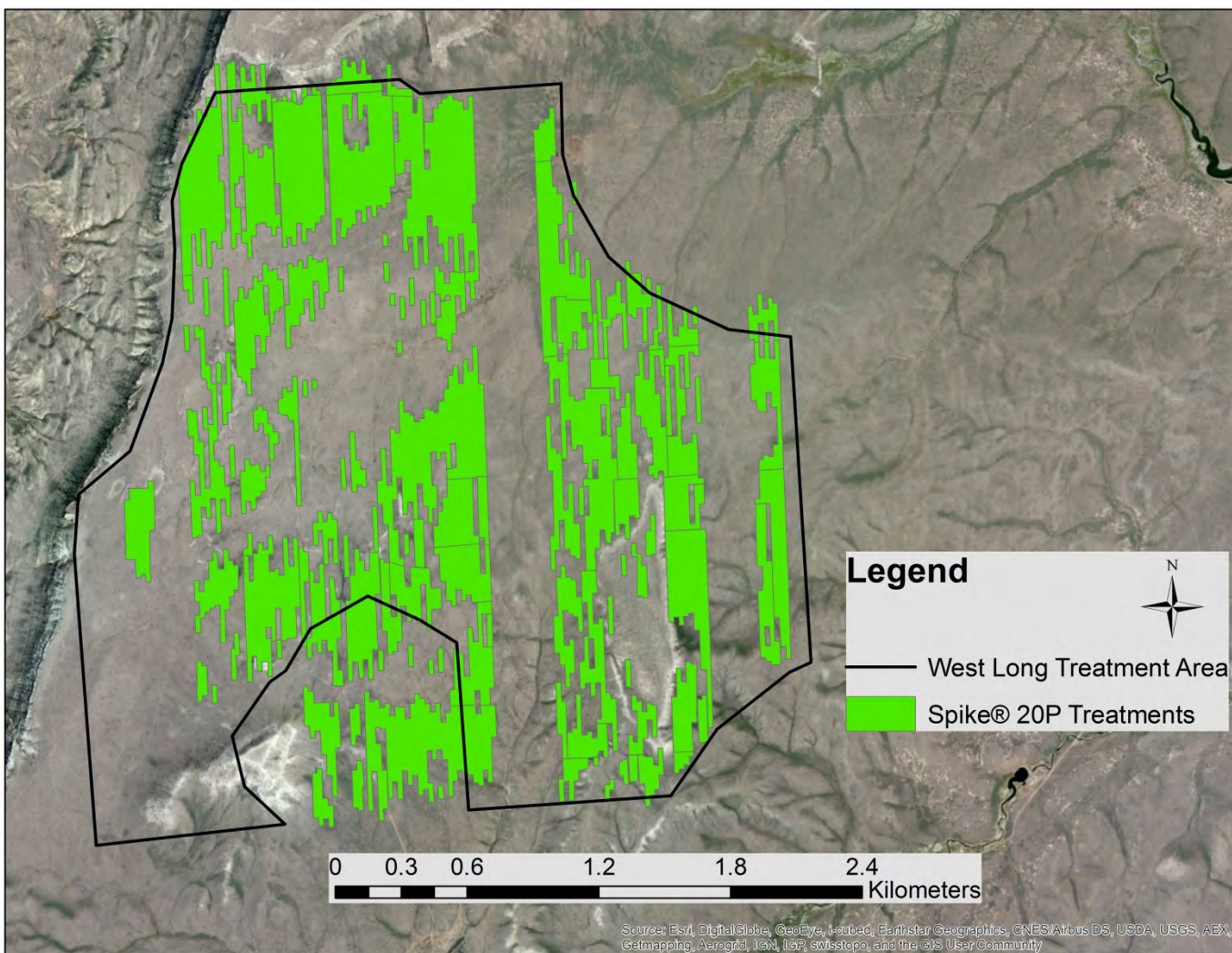
**Figure 1.** Study area location map (grey-shaded polygon), Fremont and Natrona counties, Wyoming, USA. The study area (2,978 km<sup>2</sup>) was defined as a 100% minimum convex polygon surrounding 1085 female sage-grouse radio-telemetry locations in May–August 2011 and 2012.



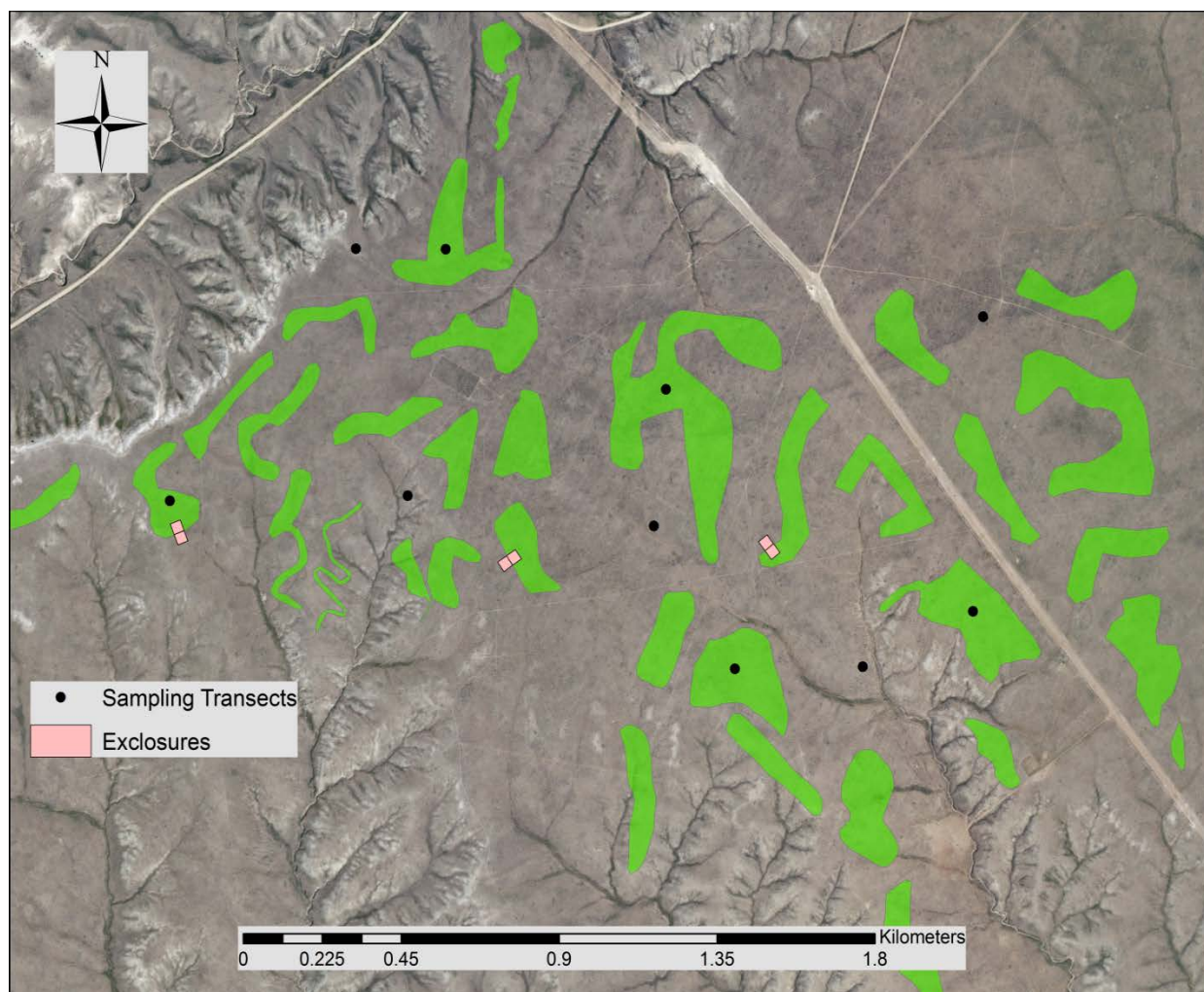
**Figure 2.** Location of 4 treatment study areas (2 Spike [Black Mountain and West Long] and 2 mowing treatments [Carmody Lake and Cedar Rim]) and 2 reference location study areas (Black Rock and Soap Holes), Fremont and Natrona counties, Wyoming, USA.



**Figure 3.** Example of mowed sagebrush habitat configuration in mowed polygons at Carmody Lake and Cedar Rim treatment study areas, Fremont County, Wyoming, USA. Approximately 489 ha (1,208 ac) of sagebrush habitats were mowed across two study areas during January and February 2014.



**Figure 4.** Example of the arrangement of sagebrush habitats treated with Spike® 20P at the West Long treatment area, Fremont County, Wyoming, USA. Approximately 607 ha (1,500 ac) of sagebrush habitats were treated with Spike® 20P across two study areas during May 2014.



**Figure 5.** Configuration of a subset of treatment sampling locations at the Cedar Rim treatment area (treated and non-treated locations adjacent to treatments) where microhabitat vegetation characteristics and sage-grouse chick diet availability were assessed, Fremont County, Wyoming, USA. These locations will be sampled yearly for the duration of our study.

## Appendix 3.

GF-FISCAL-20  
REV 09/14

### WYOMING GAME AND FISH DEPARTMENT GRANTEE CLOSEOUT REPORT

GRANT PROJECT TITLE: South Hudson-Government Draw Noxious Weed Survey and Treatment

GRANTEE NAME: Aaron Foster

GRANT REPORTING PERIOD: June 1, 2015 – September 30, 2016

GRANT SUMMARY COMPLETION REPORT (accomplishments of the project/intent and results):

During the 2015 and 2016 field seasons utilizing grant funds and matching contributions, Fremont County Weed and Pest (FCWP) staff and a third party contractor successfully treated, mapped, and monitored invasive weeds in the project treatment area. Within the areas effected totaling over 12,500 acres, 1100 acres of invasive weeds were treated with herbicide. 500 acres in 2015 and 600 acres in 2016. 197 new locations of invasive Canada thistle, leafy spurge, musk thistle, Russian knapweed, Russian olive, saltcedar, whitetop, field bindweed, black henbane, and perennial pepperweed were identified. A total of 30,400 new acres are now considered mapped within this project area. Contractor and FCWP treatment efforts in 2015 were focused on four draws with limited weed pressure, but a high degree of importance to limit spread north and east of the Hudson-Atlantic City Rd just southeast of Hudson, WY. FCWP crews also treated other known infestations and spread corridors within the project area. In 2016, the project area was reorganized into three zones. Zone one is the southern third of the project area. With the exception of some private land and uncertainty about cheatgrass, weed infestations within zone one are limited to high priority or small well defined infestations. FCWP crews targeted weed infestations in zone one utilizing funds from BLM, private land owners, and Fremont County Weed and Pest cost shares with landowners. Zone two is the eastern third of the project area. Zone two is where the eastward expansion of leafy spurge begins to diminish. Grant funds and BLM funds were used by FCWP crews to target all weed infestations within zone two. Zone three is the western portion of the project area and is the most severely impacted zone of the project area. Grant funds remaining after zone two was complete were directed to the eastern boundary of weed issues with in zone 3 working down draws to the west. BLM funds and state lands funds were also directed at weed control in zone three. Due to the severity of weed pressure within zone three, FCWP has applied for Wyoming Wildlife and Natural Resources Trust funds to aerial treat leafy spurge and cheatgrass. State highways within or boarding are included as part of the overall project. All efforts are a continuation from work done in 2014 and previous years. See the following maps for work completed withing the project area and the zones defined.

#### **Total Grant Funds 2015/2016**

Contractor Spraying \$8,485.70

FCWP Spraying \$10,525.22

FCWP Inventory \$11,989.08

Total \$31,000

#### **Total Matching Funds 2015/2016**

BLM \$18,506.86

FCWP Spraying, Mapping, Monitoring \$5,305.81

Private Landowners \$6,717.46

FCWP Cost Share with Landowners \$29,565.02

WY DOT \$14,864.07

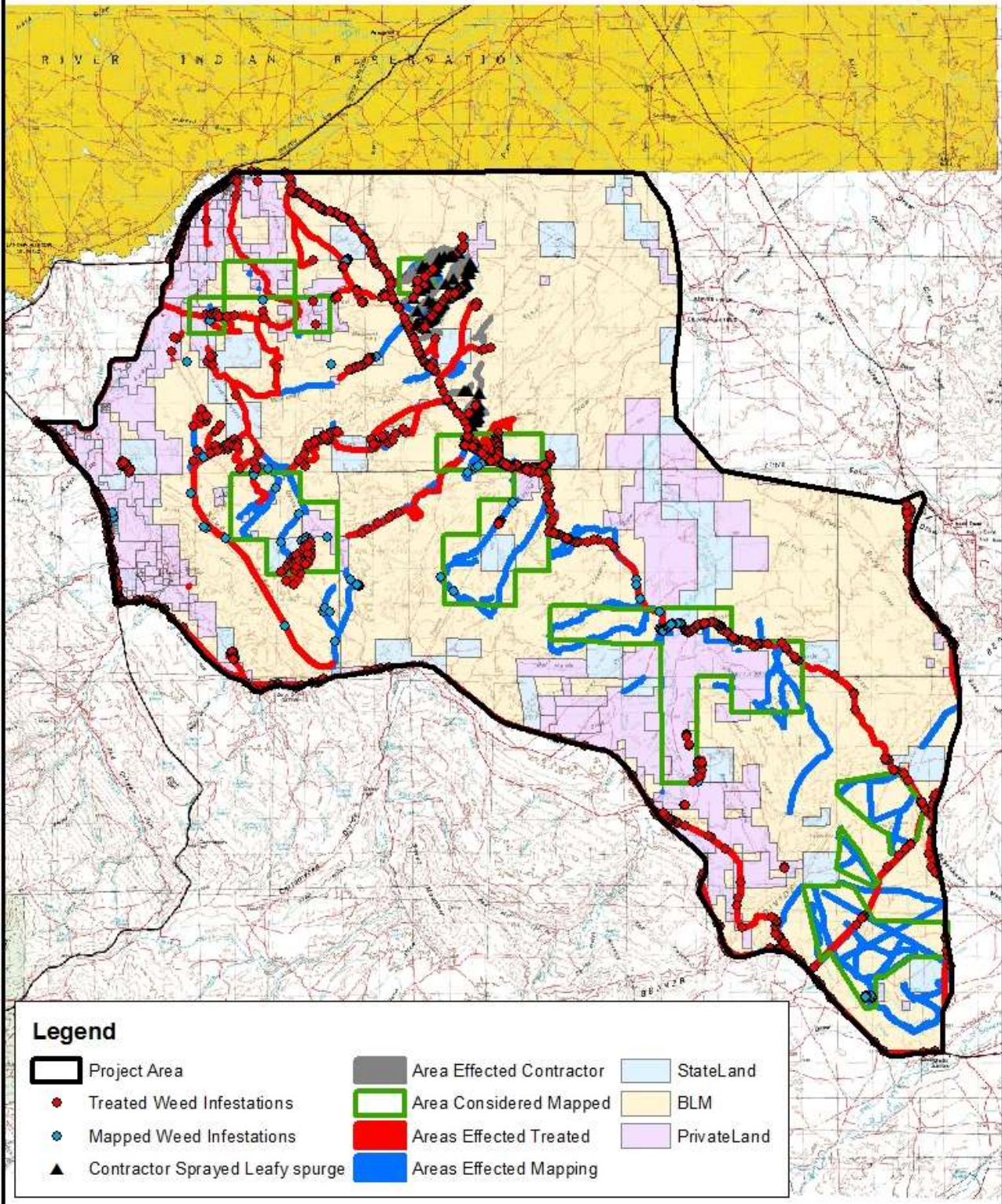
WY State Lands \$9,741.55

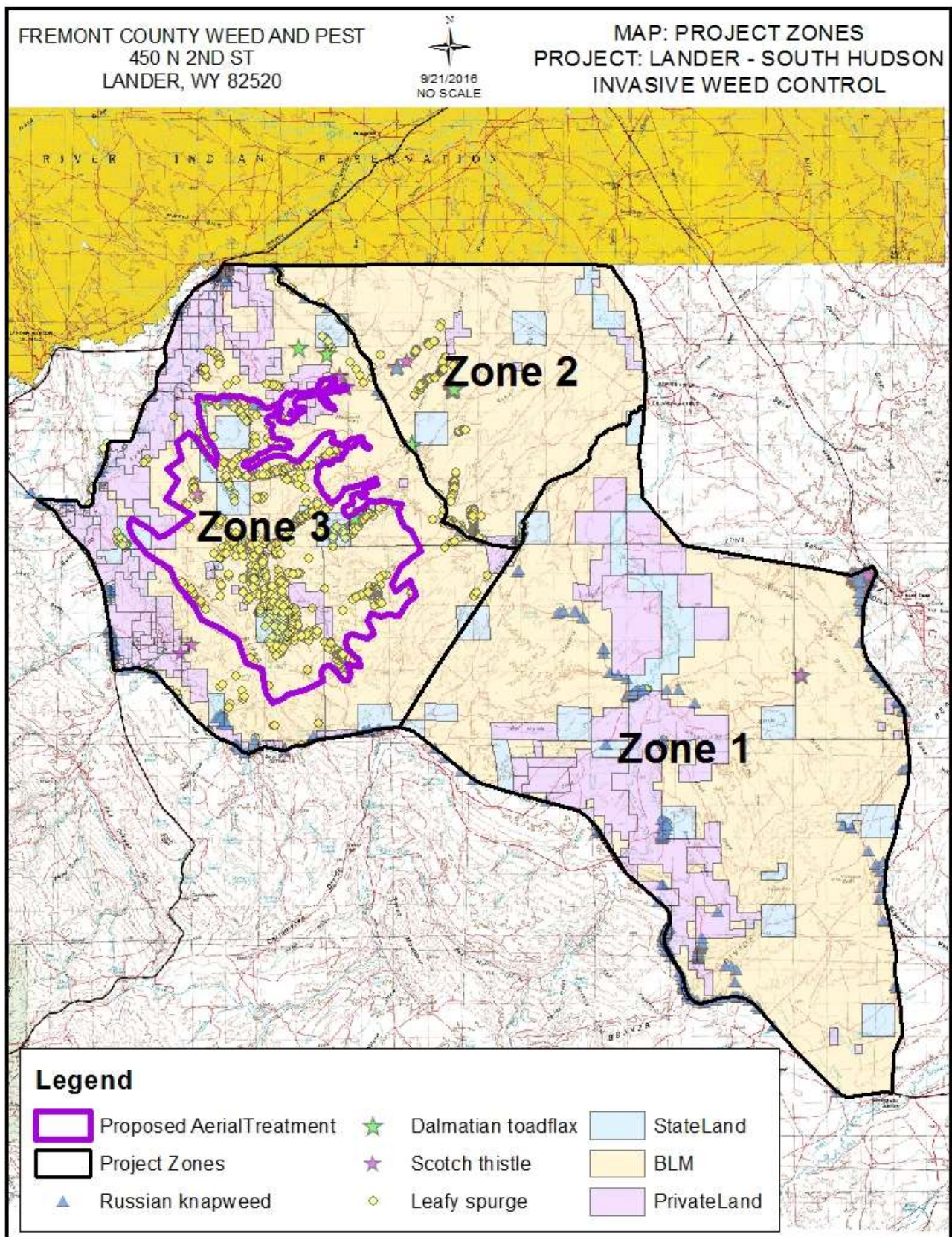
Total \$84,700.76

FREMONT COUNTY WEED AND PEST  
450 N 2ND ST  
LANDER, WY 82520



MAP: PROJECT REPORT 2015/16 WORK  
PROJECT: LANDER - SOUTH HUDSON  
INVASIVE WEED CONTROL





GRANT FUNDING PROVIDED BY  
WY GAME AND FISH: \$31,000

LESS FUNDS EXPENDED: \$31,000

UNEXPENDED BALANCE: \$0

GRANTEE'S RECORDS LOCATION: Aaron Foster  
CONTACT NAME  
450 N. 2<sup>nd</sup> St., Rm 325  
ADDRESS  
Lander WY 82520  
CITY, STATE ZIP  
307-332-1052  
Phone

CERTIFICATION:

\_\_\_\_\_  
SIGNATURE OF GRANTEE

\_\_\_\_\_  
DATE

*I certify that to the best of my knowledge and belief the information above is correct and that all outlays were made in accordance with the grant conditions or other agreement.*

FORM SHOULD BE COMPLETED AND RETURNED WITHIN NINETY (90) DAYS OF GRANT/PROJECT COMPLETION TO:

**WYOMING GAME AND FISH DEPARTMENT  
FISCAL DIVISION  
5400 BISHOP BOULEVARD  
CHEYENNE, WY 82006**