2012-13 Greater Sage-grouse

Annual Report

Pinedale Anticline Project Area

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OVERVIEW

The 2008 Final Supplemental Environmental Impact Statement Record of Decision for the Pinedale Anticline Oil and Gas Exploration and Development Project (BLM 2008) includes a Wildlife Monitoring and Mitigation Matrix (WMMM) that identifies key wildlife species to be monitored and specific changes that require mitigation (Appendix A, Table 1). For greater sage-grouse, the WMMM is designed to quantitatively identify changes in greater sage-grouse populations within the Pinedale Anticline Project Area (PAPA). The WMMM defines criteria for monitoring greater sage-grouse and outlines mitigation responses if specified thresholds or triggers are met. Six lek complexes are monitored annually for changes specified in the WMMM (Appendix A, Figure 1). Lek attendance by male greater sage-grouse, number of active leks, winter concentration area use and noise are all monitored. Monitoring results indicate a threshold was met in 2012 and 2013. In 2012 and 2013, the Duke's Triangle complex saw a 50% decline in active leks, exceeding the threshold of a 30% decline in number of active leks in a single development area complex compared to 2007 baseline data.

MATRIX THRESHOLD CRITERIA

There are several measurements used to evaluate the matrix thresholds (or triggers) for greater sage-grouse. A trigger can be met in any one of the following components.

Active Leks Threshold

The matrix threshold of a 30% decline in total number of active leks within the development area has two comparisons that can be made with this component:

1. The total number of active leks in the three combined development area complexes is compared to the 2007 baseline for the combined development area complexes.
2. The number of active leks in a single development area complex is compared to the 2007 baseline data for that lek complex.

Number of Peak Males Threshold

The matrix threshold of a 30% decline in peak male numbers has two comparisons for this component:

1. A 30% decline in peak male numbers within the entire development area is compared to the entire combined reference area total. The change is derived by comparing the current year total to the prior 2-year average in annual peak male numbers within the entire combined development area. The percent change from the development area is then compared to the percent change within the entire combined reference area.
2. A 30% decline in peak male numbers within an individual development area complex compared to the entire combined reference area. The change is derived by comparing the current year total to the prior 2-year average in annual peak male numbers within each single development area complex. The percent change from a single development area

complex is then compared to the percent change within the entire combined reference area.

Winter Habitat Use Threshold

The trigger for a decline in habitat area use may be met when measurements detect an average 15% per year decline in the amount of winter concentration habitat area used over 2-years as compared to the entire combined reference areas and when combined with a concurrent average of 30% decline in peak number of males over 2-years compared to the entire combined reference areas.

Noise Threshold

Noise is measured by evaluating decibel levels at development area leks. A trigger is met when noise exceeding 10 dBA above background (39 dBA, BLM 2000) when measured from the edge of the lek, is combined with a concurrent average of 30% decline in peak number of male birds over 2 years compared to the entire combined reference area numbers.

SURVEY METHODS

Monitoring follows the Wyoming Game and Fish Department (WGFD) protocols from the Handbook of Biological Techniques (Emmerich et al 2007). Leks may be classified as active or inactive based on the current year activity and, occupied or unoccupied based on a 10 year activity status (Appendix A). Lek counts are attempted on all occupied leks. Newly discovered leks are added to the PAPA WMMM analysis the year they are discovered.

Unoccupied, destroyed or abandoned leks are not monitored annually but are searched following WGFD protocols for monitoring inactive leks. Lek searches are conducted as necessary to determine whether an unoccupied lek status has changed. Leks that meet the WGFD management status for unoccupied, destroyed or abandoned are not included in the analysis.

Lek counts were conducted at 7-10 day intervals during the breeding season (April – May). Leks were monitored via ground counts during morning hours, beginning generally ½ hour before sunrise. Counts were made at least 3 times during the breeding season counting male and female grouse separately. The highest male count was included in the final analysis.

Lek searches were conducted in the development and reference areas in an effort to identify new leks or leks that may have moved. Searches were conducted both aerially and on the ground using WGFD protocols. Aerial searches were conducted using fixed-wing aircraft, flown following north south transects at 1 km to 1.5 km (0.6 - 0.9 mi) intervals. Flights were conducted during early morning hours on calm clear days between ½ hour before sunrise and up to 1 hour after sunrise at about 100-150 meters (300-450 ft.) above the ground. Ground searches began 1 hour before sunrise and up to 2 hours after sunrise and were conducted by driving along roads throughout the entire complex area. Stops occurred at approximately ½ mile to 1 mile intervals to listen for the sounds of displaying grouse and to scan the area with binoculars.

Winter concentration data collection included aerial surveys following WGFD protocols. Surveys were conducted using a helicopter flying transects spaced at 1 mile or less intervals looking for grouse and tracks in the snow from 300 feet or lower elevation above ground.

Noise protocols were prepared for the PAPO as recommended by the WY CFWRU and monitoring resumed in 2013. Noise monitoring results are available in a separate noise monitoring report.

RESULTS

In 2012 and 2013, monitoring included identifying the number of active leks and peak numbers of males attending leks (Appendix A, Table 2). Changes in the number of active leks within the development area were compared to 2007 baseline data as outlined in the WMMM. Specific changes that require mitigation include a 30% decline in total number of active leks or 30% decline in the number of leks in a single complex.

Total Number of Active Leks in Development Complexes Combined

In 2007, development area leks in 3 lek complexes (Mesa, Duke's Triangle and Yellowpoint) totaled 16 active leks. The total number of active leks within the development area declined to 13 leks in 2013 which equates to a 19% decline compared to the baseline year 2007 (Appendix B, Table 1).

Total Number of Active Leks in a Single Development Complex

For the number of active leks within a single complex, in 2007 the Mesa complex began with 6 active leks. In 2013, 6 active leks were reported for the Mesa complex resulting in no change in the number of leks compared to 2007. There were 2 active leks in the baseline year (2007) for the Duke's Triangle complex with 1 active lek in 2013, representing a 50% decline which exceeds the 30% threshold for the number of active leks in a single complex. The Yellowpoint complex had 8 active leks in the 2007 baseline year with 6 active leks in 2013 representing a 25% decline (Appendix B, Table 2).

The Matrix includes a provision as stated in Footnote 1: **"***If the number of leks decline but the bird numbers on* lek *complexes do not, the mitigation threshold would not be surpassed. If the number of leks does not decline but the bird numbers on lek complexes does decline, the mitigation threshold would be surpassed. If both numbers of leks and birds decline, the mitigation threshold would obviously be surpassed*" (PAPA ROD, Appendix B, pg.B3, footnote 1). The intent of the footnote is to insure a trigger would not be met if a lek or leks within one of the Development Area Complexes became inactive resulting in a 30% decline in active leks for that Complex and it could be demonstrated that the birds moved to another lek during the same time period, within that same Development Area Complex.

It was determined that the trigger for number of active leks within a single complex was met in 2012 and 2013 following a 50% decline in active leks for the Duke's Triangle Development Area Complex. Following guidance from Appendix B footnote 1, lek searches were conducted and it was determined that none of the Duke's Triangle leks had moved and no new leks were discovered within the entire complex. Since the number of leks did decline in the complex and there was no evidence the birds moved to another lek within the complex, the mitigation threshold was surpassed (Table 1).

Table 1. Duke's Triangle Complex annual peak male counts at occupied Leks and number of active Leks. Yellow highlight indicates percent decline greater than 30% threshold.

	DUKE'S TRANGLE COMPLEX PEAK MALE COUNTS AT OCCUPIED LEKS*				
Year	Big Fred Lek	Little Fred Lek	Lower Sand Springs Draw Lek	**Number of active leks within Duke's Triangle Complex**	**Percent change in active leks compared to 2007 baseline**
2006	***8***	***24***	***NA***	***2***	
2007	***0***	***24***	***10***	***2***	*0%*
2008	**2**	22	14	**3**	50%
2009	**0**	0	13	**1**	**-50%**
2010	**0**	30	18	**2**	0%
2011	**0**	9	18	**2**	0%
2012	**0**	0	20	**1**	**-50%**
2013	**0**	0	20	**1**	**-50%**

*Lek data provided by WGFD.

Peak Number of Males Attending Lek Complexes

The WMMM outlines monitoring a 2-year change in the number of males attending 3 development complexes and 3 adjacent reference area lek complexes (Appendix A, Figure 1). A decline of 30% in one of the development area complexes, when compared to the entire combined reference area, triggers mitigation. Data and calculations for these analyses can be found in Appendix B (Tables 3 thru 8).

Heavy snow conditions in 2011 made access to the East Fork complex difficult and agency personnel were not able to obtain counts for this area. Without data for 2011 it is not possible to calculate a 2-year average for this complex. For the purposes of analysis, this complex was not included in calculations.

Comparison of Entire Development Area with Combined Reference Area

In 2012, there was a 10% decline in peak males attending leks within the development area (Appendix B, Table 5) and a 21% decline in peak males attending leks within the reference area

(Appendix B, Table 8). The results indicate the reference area experienced an 11% greater decline than the development area in 2012.

In 2013, there was a 8% decline in peak males attending leks within the development area (Appendix B, Table 5) and a 4% decline in peak males attending leks within the reference area (Appendix B, Table 8). The results indicate the development area experienced a 4% greater decline than the reference area in 2013.

Comparison of Individual Development Area Complexes with Combined Reference Area

Individual complexes within the development area were compared to the combined reference area. A decline of 30% in the development area when compared to the combined reference areas triggers mitigation. Data and calculations for these analyses can be found in Appendix B (Tables 3 thru 8).

Mesa Complex

In 2012, the Mesa complex declined 11% in number of males attending leks within the complex (Appendix B, Table 5). The combined reference area decline of 21% in 2012 (Appendix B, Table 8) indicates the reference area had a 10% greater decline than the Mesa Complex. In 2013, the Mesa complex declined 15% (Appendix B, Table 5) while the combined reference area declined 4% (Appendix B, Table 8) indicating the Mesa complex had an 11% greater decline than the combined reference area.

Duke's Triangle

The Duke's Triangle complex experienced a 47% decline in 2012 (Appendix B, Table 5). Compared with the reference area decline of 21% in 2012 (Appendix B, Table 8) the Duke's Triangle development area complex declined by 26% more than the reference areas. In 2013, the Duke's Triangle complex declined 17% (Appendix B, Table 5) while the combined reference area experienced a 4% (Appendix B, Table 8) decline indicating the Duke's Triangle complex had an 13% greater decline than the combined reference area.

Yellowpoint

The 2012 analysis compared a 5% increase in the Yellowpoint complex (Appendix B, Table 5) compared to the 21% decline in the combined reference areas (Appendix B, Table 8). As a result, the reference area declined by 26% more than the Yellowpoint development area. In 2013, the Yellowpoint complex had a 12% increase (Appendix B, Table 5) while the reference area experienced a 4% decrease (Appendix B, Table 8). As a result, the reference area declined by 16% more than the Yellowpoint development area complex.

LEK SEARCHES

In 2012 aerial searches were conducted in the Speedway and East Fork reference complex areas along with the Dukes Triangle and Yellowpoint development complex areas with ground searches occurring in the remaining complexes. In 2013, aerial searches were conducted in the Ryegrass reference complex and the Duke's Triangle development complex. Ground searches also occurred in the Duke's Triangle complex and the remaining complexes (Mesa, Yellowpoint, Speedway and East Fork). No new or relocated leks were discovered in either year from aerial or ground searches.

WINTER CONCENTRATION AREAS

In 2012, aerial surveys were conducted for wintering greater sage-grouse from January 21st - January 24th and in 2013 from January 18th –January 25th. Continued aerial winter surveys are planned for another 2-3 years until refinements to existing greater sage-grouse winter use maps can be made (Appendix C, Figure 1). Once the concentration areas are better defined monitoring protocols will be developed to assess if a 30% decline in winter habitat use has occurred.

NOISE MONITORING

No noise data was collected in 2011 or 2012 as a result of the WY CFWRU recommendation to develop appropriate protocols. The protocol was finalized in 2012 and noise data was collected in 2013. The results of the 2013 noise monitoring can be found in a separate report.

LITERATURE CITED

Bureau of Land Management [BLM]. 2000. Record of Decision: Final Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project. Pinedale Field Office, Wyoming.

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Emmerich. J., R. Guenzel, L. Jahnke, B. Kroger, J. Nemick, B. Rudd, and T. Woolley. 2007. Chapter 1: Pronghorn (*Antilocapra americana*). Pages 1-1 to 1-59 in S.A. Tessmann (ed). Handbook of Biological Techniques: third edition. Wyoming Game and Fish Department. Cheyenne, WY.

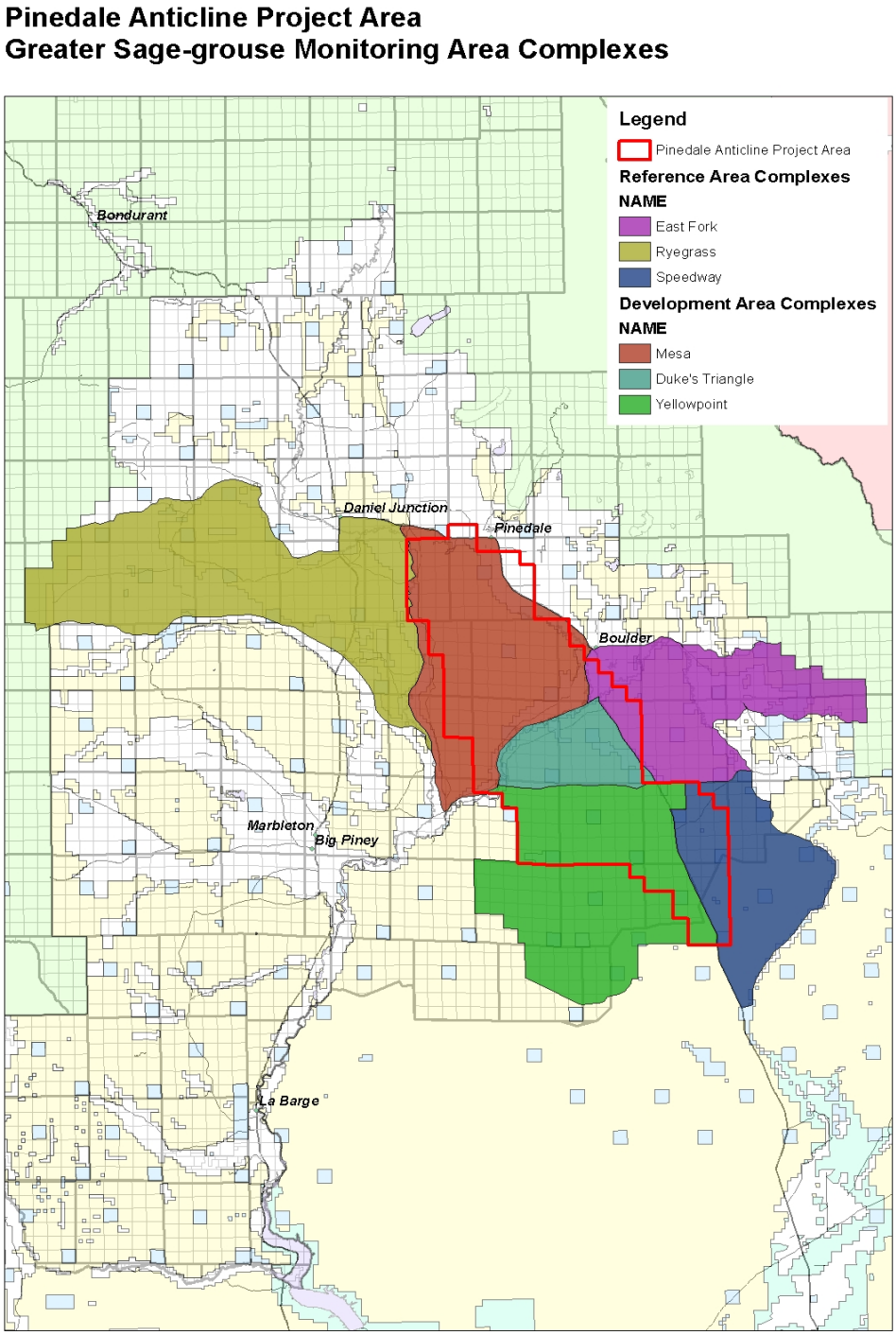
Appendix A

Appendix A.

Table 1. Wildlife Monitoring and Mitigation Matrix from Appendix B 2008 PAPA ROD, as modified in 2011.

Species	Criteria	Method	Changes that will be monitored	Specific Changes Requiring Mitigation	Mitigation Responses
Sage Grouse	Number of active leks in identified lek complexes	Lek counts according to protocol	Active use on 70% of total current leks; Active use on 70% of leks in each complex (the development area complexes include the Mesa, Duke's Triangle, and Yellow Point complexes) compared to 2007 data	30% decline in total number of active leks, or 30% decline in the number of leks in a single complex	Select mitigation response sequentially as listed below, implement most useful and feasible and monitor results over sufficiently adequate time for the level of impact described by current monitoring.
	Peak numbers of males attending lek complexes	Lek counts according to protocol	Total average 2-year change in numbers of males attending development area lek complexes (the Mesa, Duke's Triangle, or Yellow Point lek complex), compared to the East Fork, Speedway, or Ryegrass reference lek complexes	Average of 30% decline in numbers over 2 years compared to reference area	Select mitigation response sequentially as listed below, implement most useful and feasible and monitor results over sufficiently adequate time for the level of impact described by current monitoring.
	Winter concentration area use	Monitoring according to protocol	Change in winter concentration area use compared to reference area (once initial data is available), and a concurrent change in the total average 2 year numbers of males attending development area lek complexes (the Mesa, Duke's Triangle or Yellow Point lek complex), compared to the East Fork, Speedway, or Ryegrass reference lek complexes	Average of 15% per year decline in amount of winter habitat used over 2 years compared to reference areas, and a concurrent average of 30% decline in numbers over 2 years compared to reference area	Select mitigation response sequentially as listed below, implement most useful and feasible and monitor results over sufficiently adequate time for the level of impact described by current monitoring.
	Noise levels	Decibel monitoring from March 1-May 15 at lek sites	Noise levels demonstrated to impact peak lek use by male sage-grouse and a concurrent change in the total average 2-year numbers of males attending development area lek complexes (the Mesa, Duke's Triangle, or Yellow Point lek complex), compared to the East Fork, Speedway, or Ryegrass reference lek complexes	Decibel levels at the lek more than 10 dBA above background measured from the edge of the lek (2000 ROD, p.27), and a concurrent average of 30% decline in peak numbers of male birds over 2 years vs. reference area.	Select mitigation response sequentially as listed below, implement most useful and feasible and monitor results over sufficiently adequate time for the level of impact described by current monitoring.
Footnote 1. If the number of leks decline but the bird numbers on lek complexes do not, the mitigation threshold would not be surpassed. If the number of leks does not decline but the bird numbers on lek complexes does decline, the mitigation threshold would be surpassed. If both numbers of leks and birds decline, the mitigation threshold would obviously be surpassed					

Figure 1. Greater Sage-grouse Monitoring Project Area



Wyoming Sage-Grouse Definitions:

(Revised 02/09/2010)

The following definitions have been adopted for the purposes of collecting and reporting sage-grouse 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 observations of two or more male sage-grouse engaged in courtship displays. Before adding the suspected lek to the database, it must be confirmed by an additional observation made during the appropriate time of day, during the strutting season. Sign of strutting activity (tracks, droppings, feathers) can also be used to confirm a suspected lek. Sub-dominant males may display on itinerant (temporary) strutting areas during population peaks. Such areas usually fail to become established leks. Therefore, a site where small numbers of males (<5) are observed strutting should be confirmed active for two years before adding the site to the lek database.

Satellite Lek – A relatively small lek (usually less than 15 males) that develops within about 500 meters of a large lek 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 any associated satellites. Perimeters should be mapped by experienced observers using established protocols for all leks with larger leks receiving higher priority. Perimeters may vary over time as population levels or habitat and weather conditions change. However, changes to mapped perimeters should occur infrequently and only if grouse use consistently (2+ years) demonstrates the existing perimeter to be inaccurate. A point **within** the lek perimeter must be recorded or calculated as the identifying location for the lek. The point may be the geographic center of the perimeter polygon as calculated though a GIS exercise or a GPS point reflecting the center of breeding activity as typically witnessed on the lek.

Lek Complex - A lek or group of leks within 2.5 km (1.5 mi) of each other between which male sage-grouse may interchange from one day to the next.

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

- Conduct lek counts at 7-10 day intervals over a 3-4 week period after the peak of mating activity. Although mating typically peaks in early April in Wyoming, the number of males counted on a lek is usually greatest in late April or early May when attendance by yearling males increases.
- Conduct lek counts only from the ground. Aerial counts are not accurate and are not comparable to ground counts.
- Conduct counts 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 census of a group of leks that are relatively close and represent part or all of a single breeding population/sub-population. Leks should be counted on routes to facilitate repetition by other observers, increase the likelihood of recording satellite leks, and account for shifts in breeding birds if they occur. Lek routes should be established so that all leks along the route can be counted within 1.5 hours following the criteria listed under "Lek Count".

Lek Survey - Ideally, all sage-grouse leks would be counted annually. However, some breeding habitat is inaccessible during spring because of mud and snow, or the location of a lek is so remote it cannot be routinely counted. In other situations, topography or vegetation may prevent an accurate count from any vantage point. In addition, time and budget constraints often limit the number of leks that can be visited. Where lek counts are not feasible for any of these reasons, surveys are the only reliable means to monitor population trends. Lek surveys are designed principally to determine whether leks are active or inactive, requiring as few as one visit to a lek. Obtaining accurate counts of the numbers of males attending is not essential. Lek surveys involve substantially less effort and time than lek counts. They can also be done from a fixed-wing aircraft or helicopter. Lek surveys can be conducted from the initiation of strutting in early March until early-mid May, depending on the site and spring weather.

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

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

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

• **unknown** – Leks for which status as active or inactive has not been documented during the course of a strutting season. Except for those leks not scheduled for checks in a particular year, use of this status should be rare. Leks should be checked with enough visits to determine whether it is active or not. It is better to have two good checks every other year and confirm it "inactive" than to check it once every year, not see birds, but 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** – (Formerly "historical lek".) There are two types of unoccupied leks, "destroyed" and "abandoned." Unoccupied leks are not protected during surface disturbing activities.

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

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

• **undetermined lek** – Any lek that has not been documented active in the last ten years, but survey information is insufficient to designate the lek as unoccupied. Undetermined leks will be protected through prescribed management actions during surface disturbing activities until sufficient documentation is obtained to confirm the lek is unoccupied. Use of this status should be rare (see "unknown" above).

Winter Concentration Area - During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. Sage-grouse tend to select wintering sites where sagebrush is 10-14 inches above the snow. Sagebrush canopy cover utilized by sage-grouse above the snow may range from 10 to 30 percent. Foraging areas tend to be on flat to generally southwest facing slopes or on ridges where sagebrush height may be less than 10 inches but the snow is routinely blown clear by wind. When these conditions are met, sage-grouse typically gain weight over winter. In most cases winter is not considered limiting to sage-grouse. Under severe winter conditions grouse will often be restricted to tall stands of sagebrush often located on deeper soils in or near drainage basins. Under these conditions winter habitat may be limiting. On a landscape scale, winter habitats should allow sage-grouse access to sagebrush under all snow conditions.
Large numbers of sage-grouse have been documented to persistently use some specific areas which are characterized by the habitat features outlined above. These areas should be delineated as "winter concentration areas". Winter concentration areas do not include all winter habitats used by sage-grouse, nor are they limited to narrowly defined "severe winter relief" habitats. Delineation of these concentration areas is based on determination of the presence of winter habitat characteristics confirmed by repeated observations and sign of large numbers of sage-grouse. The definition of "large" is dependent on whether the overall population is large or small. In core population areas frequent observations of groups of 50+ sage-grouse meet the definition while in marginal populations group size may be 25+. Consultation and coordination with the WGFD is required when delineating winter concentration.

Table 2: Development and Reference Area Occupied Leks Monitored from 2007 to 2013.

PAPA Leks –Annual Peak Number of Males								
	Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Development Area Complexes	Lek Name							
MESA	Bloom Reservoir	123	107	97	68	81	75	67
	Cat	24	19	2	9	3	2	3
	Lovatt Draw Reservoir	0	0	0	0	0	0	0
	Lovatt West	9	25	0	0	2	0	0
	Mesa Road 3	100	97	76	40	38	32	42
	Mesa Springs	0	0	0	0	0	0	0
	Oil Road Fork	184	154	156	105	93	72	53
	Pole Creek	0	0	0	0	0	0	0
	Two Buttes	99	88	86	82	87	79	64
	Tyler Draw North			21	25	35	36	40
DUKE'S TRIANGLE	Big Fred	**0**	2	0	0	0	0	0
	Little Fred	**24**	22	0	30	9	0	0
	Little Fred Satellite	**0**	0	0	NC	0	0	0
	Lower Sand Springs Draw	**10**	14	13	18	18	20	20
YELLOW POINT	Alkali Draw	**67**	37	23	29	29	19	26
	Prairie Dog	**39**	41	38	23	13	29	23
	Sand Draw 3	**5**	0	0	0	0	0	0
	Sand Draw Reservoir	**38**	24	19	19	12	13	12
	Shelter Cabin Reservoir	**74**	51	44	27	22	40	41
	South Rocks	**33**	41	40	25	22	28	26
	Stud Horse Butte E.	**4**	2	0	0	0	0	0
	The Rocks	**26**	24	9	11	0	0	0
	Little Saddle				33	21	21	23
Reference Area Complexes	Lek Name							
RYEGRASS	Brodie Burn	**2**	0	0	6	0	1	0
	Brodie Draw 1	**30**	18	19	8	14	10	20
	Brodie Draw 2	**18**	32	18	12	7	20	43
	Brodie Draw 3	**0**	2	1	4	0	0	0
	Cut Across	**0**	19	7	0	12	0	0
	Fear Ditch	**41**	42	21	18	37	23	43
	Fear Ditch Reservoir	**30**	4	20	19	24	11	10
	Grindstone Butte North					9	6	9
	Grindstone Draw	**33**	32	38	33	35	26	22
	Jewett Red Flat Reservoir	**82**	33	50	31	28	NC	24
	North Luman Ridge	**28**	27	7	2	4	0	0
	North Soapholes Creek	**16**	15	26	15	31	1	12
	Old Reservoir	**8**	19	60	2	6	0	0
	Onion Spring	**11**	2	0	0	2	7	0
	Onion Spring 2			38	38	21	54	50
	Ryegrass Draw	**81**	88	147	106	125	59	78
	Ryegrass Draw South	**NC**	69	49	35	38	41	49
	Ryegrass Reservoir	**7**	14	10	2	15	NC	0
	Ryegrass Road Fork	**42**	30	33	25	14	40	29
	Sommers	**37**	27	15	0	19	16	24
	South Luman Ridge	**44**	42	40	25	15	20	21
	South Soapholes Creek	**13**	21	6	0	1	0	0
	Upper Onion Creek	**164**	62	121	164	98	71	68
SPEEDWAY	Big John	**117**	96	80	73	63	56	65
	Darby	**104**	94	75	56	32	41	31
	Desert Reservoir	**226**	234	150	153	61	72	84
	Hole 2	**0**	0	0	18	17	25	18
	Mud Hole State	**235**	200	142	82	64	62	41
	Speedway	**132**	103	94	54	84	52	41
	Waterhole Draw	**120**	92	70	31	29	41	18
EAST FORK	Blown Out Reservoir	**216**	208	171	109	NC	87	84
	Fremont Butte Well 2A	**31**	14	16	12	NC	34	24
	Fremont Butte Well 2B	**27**	29	26	21	NC	21	26

Appendix B

Appendix B – Data and Calculations (*data is rounded to nearest whole number)

DEVELOPMENT AREA

Table 1. Combined development area complexes, number of active leks

Year	Combined Development Area Complexes Number of Active Leks*	Matrix Threshold: Percent change in active Leks compared to 2007
2007	*16*	
2008	16	0%
2009	13	-19%
2010	15	-6%
2011	15	-6%
2012	13	-19%
2013	13	-19%

***Lek data provided by WGFD.**

The percent change in active leks compared to the 2007 baseline year is calculated by taking the current year's number of active leks minus the number of active leks in 2007; divide this number by the number of active leks in 2007 and multiply by 100.

Example: to calculate the percent change in active leks in 2013 compared to 2007

$$\left(\frac{(13 - 16)}{16}\right) \text{X } 100 = -19\%$$

Table 2. Development area, number of active leks per single complex

Year	Mesa Complex Number of active Leks	Matrix Threshold: Percent change in active Leks compared to 2007
2007	*6*	
2008	6	0%
2009	6	0%
2010	6	0%
2011	7	17%
2012	6	0%
2013	6	0%
Year	**Duke's Triangle Complex Number of active Leks**	**Matrix Threshold: Percent change in active Leks compared to 2007 (red indicates threshold has been met)**
2007	*2*	
2008	3	50%
2009	1	-50%
2010	2	0%
2011	2	0%
2012	1	-50%
2013	1	-50%
Year	**Yellowpoint Complex Number of active Leks**	**Matrix Threshold: Percent change in active Leks compared to 2007**
2007	*8*	
2008	7	-13%
2009	6	-25%
2010	7	-13%
2011	6	-25%
2012	6	-25%
2013	6	-25%

The percent change in active leks compared to the 2007 baseline year is calculated by taking the current year's number of active leks minus the number of active leks in 2007; divide this number by the number of active leks in 2007 and multiply by 100.

Example: to calculate the percent change in active leks in the Duke's Triangle Complex in 2013 compared to 2007

$$\left(\frac{(1-2)}{2}\right) \text{ X } 100 = -50\%$$

Table 3: Peak Number of Males Attending Development Area Lek Complexes

Year	Mesa Complex: Annual peak male Lek attendance*	Dukes Triangle Complex: Annual peak male Lek attendance	Yellowpoint Complex: Annual peak male Lek attendance	Combined Development Area Complexes: Annual Peak Male Lek Attendance
2007	*539*	*34*	*286*	*859*
2008	490	38	220	748
2009	438	13	173	624
2010	329	48	167	544
2011	339	27	119	485
2012	296	20	150	466
2013	269	20	151	440

*Lek data provided by WGFD.

Table 4: Two-year Average Number of Males Attending Development Area Lek Complexes

Years Averaged	Mesa Complex: Running 2 - year Average peak male Lek attendance	Duke's Triangle: Running 2 - year Average peak male Lek attendance	Yellowpoint Complex: Running 2 - year Average peak male Lek attendance	Combined: Development Area Complexes Running 2 - year Average peak male Lek attendance
2006-2007	*558*	*31*	*261*	*850*
2007-2008	515	36	253	804
2008-2009	464	26	197	686
2009-2010	384	31	170	584
2010-2011	334	38	143	515
2011-2012	318	24	135	476
2012-2013	283	20	151	453

The two-year average is calculated by adding two consecutive years of the peak number of males attending the lek complex (Table 3) and dividing by 2.

Example: 2012-2013 average for Mesa Complex

$$\frac{(296 + 269)}{2} = 283$$

Table 5: Percent Change in Number of Males Attending Development Area Lek Complexes

Year	Mesa Complex: Matrix Threshold: Running 2-year average percent change in numbers of males attending development area lek complexes	Duke's Triangle Complex: Matrix Threshold: Running 2-year average percent change in numbers of males attending development area lek complexes	Yellowpoint Complex: Matrix Threshold: Running 2-year average percent change in numbers of males attending development area lek complexes	Combined Development Area Complexes Matrix Threshold: Running 2-year average percent change in numbers of males attending development area lek complexes
2007	***11%***	***0%***	***50%***	***21%***
2008	**-12%**	**23%**	**-16%**	**-12%**
2009	**-15%**	**-64%**	**-32%**	**-22%**
2010	**-29%**	**85%**	**-15%**	**-21%**
2011	**-12%**	**-13%**	**-30%**	**-17%**
2012	**-11%**	**-47%**	**5%**	**-10%**
2013	**-15%**	**-17%**	**12%**	**-8%**

The percent change in number of males attending development area lek complexes is calculated using the following calculation:

> The current year annual peak male attendance for a complex (Table 3) minus the previous two-year running average for that complex (Table 4); divide this number by the previous two-year running average for that complex (Table 4) and multiply by 100.
>
> Example: to calculate the 2013 percent change in the Mesa Complex:

$$\left(\frac{(269 - 318)}{318}\right) \text{X } 100 = -15\%$$

REFERENCE AREA

Table 6: Peak Number of Males Attending All Reference Area Lek Complexes

Year	Ryegrass Complex: Annual peak male Lek attendance*	East Fork Complex: Annual peak male Lek attendance	Speedway Complex: Annual peak male Lek attendance	Combined Reference Area Complexes Annual peak male Lek attendance
2007	*687*	*274*	*934*	*1895*
2008	598	251	819	1668
2009	726	213	611	1550
2010	545	142	467	1154
2011	555	NA*	350	NA
2012	406	142	349	897
2013	502	134	298	934

*Lek data provided by WGFD

Table 7: Average Number of Males Attending Reference Area Lek Complexes (excluding the East Fork Complex)

Years Averaged	Ryegrass Complex: Running 2 - year Average peak male Lek attendance	Speedway Complex: Running 2 - year Average peak male Lek attendance	Reference Area Complexes (Ryegrass and Speedway) Running 2 - year Average peak male Lek attendance
2006-2007	*572*	*908*	*1480*
2007-2008	643	877	1519
2008-2009	662	715	1377
2009-2010	636	539	1175
2010-2011	550	409	959
2011-2012	481	350	830
2012-2013	454	324	778

*Note: the East Fork complex was not included in the following calculations because data was not collected in 2011. Although the running two-year average could be calculated, it would not be possible to calculate the percent change since there is not a running two-year value for the years 2011-2012.

The two-year average is calculated by adding two consecutive years of the peak number of males attending the lek complex (Table 6) and dividing by 2.

Example: 2012-2013 average for Ryegrass Complex

$$\frac{(406 + 502)}{2} = 454$$

Table 8: Percent Change in Number of Males Attending Reference Area Lek Complexes (excluding the East Fork Complex)

Year	Ryegrass Complex: Matrix Threshold: Running 2-year average percent change in numbers of males attending development area lek complexes	Speedway Complex: Matrix Threshold: Running 2-year average percent change in numbers of males attending development area lek complexes	Ryegrass and Speedway Reference Area Complexes Matrix Threshold: Running 2-year average percent change in numbers of males attending development area lek complexes
2007	***66%***	***19%***	***35%***
2008	**5%**	**-10%**	**-4%**
2009	**13%**	**-30%**	**-12%**
2010	**-18%**	**-35%**	**-27%**
2011	**-13%**	**-35%**	**-23%**
2012	**-26%**	**-15%**	**-21%**
2013	**4%**	**-15%**	**-4%**

The percent change in number of males attending reference area lek complexes is calculated using the following calculation:

> The current year annual peak male attendance for a complex (Table 6) minus the previous two-year running average for that complex (Table 7); divide this number by the previous two-year running average for that complex (Table 7) and multiply by 100.
>
> Example: to calculate the 2013 percent change in the Ryegrass Complex:

$$\left(\frac{(502 - 481)}{481}\right) \text{X } 100 = 4\%$$

Appendix C

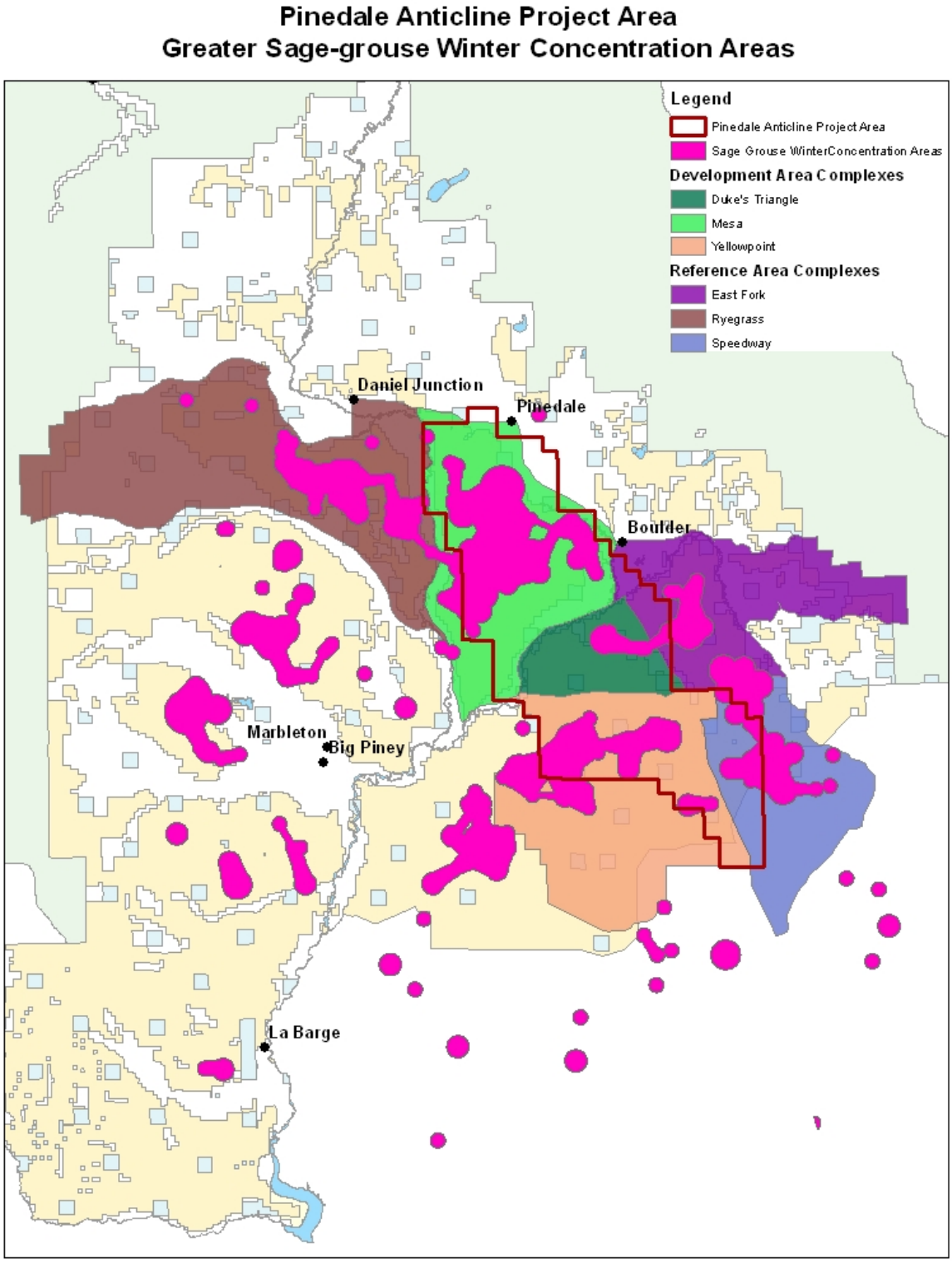



Figure 1. Sage-grouse winter concentration areas.