Mule Deer Monitoring in the Pinedale Anticline Project Area

2013 Annual Report Update

Prepared for:

Pinedale Anticline Project Office (PAPO)
P.O. Box 768, Pinedale, WY 82941

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WEST Inc.

NATURAL RESOURCES ◆ SCIENTIFIC SOLUTIONS

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SUGGESTED CITATION

Sawyer, H. and R. Nielson. 2013. Mule deer monitoring in the Pinedale Anticline Project Area: 2013 Annual Report Update. Western Ecosystems Technology, Inc., Laramie, WY.

SECTION I: Wildlife monitoring and mitigation matrix

OVERVIEW

As part of the record of decision for natural gas exploration and development in the Pinedale Anticline Project Area (PAPA), the Bureau of Land Management (BLM) developed a Wildlife Monitoring and Mitigation Matrix (WMMM) that provides direction for development-phase wildlife monitoring (BLM 2008). For mule deer, the WMMM was intended to identify monitoring parameters that allow changes in mule deer abundance to be quantitatively assessed. Monitoring was intended to be consistent with previous efforts that began in 2001 (Sawyer et al. 2009*a*), such that comparisons across years could be made. The WMMM specifies that mitigation measures will be triggered if a 15% decline in mule deer abundance is detected in any year relative to the Sublette herd unit, using the average of population estimates from winter's 2004-05 and 2005-06 as the baseline (BLM 2008). Here, we report monitoring results for the winter of 2012-13, where population estimates indicate the Sublette herd unit has declined more than the Mesa portion of the herd unit, since the baseline.

METHODS

Abundance

We estimated abundance in the Mesa portion of the PAPA using aerial counts similar to Freddy et al. (2004), where 1-mi^2 quadrat units were systematically sampled by helicopter (Fig. 1). The sampling frame was 68 mi^2 and reflected the relative size of the winter range. In past years, 50% (*n*=34) of the quadrats were flown, however beginning in 2010, the number of sampled quadrats increased to 46 in an effort to increase precision of abundance estimates. A real-time flight path was traced into the on-board global positioning system (GPS) and once the perimeter of the quadrat was established, all mule deer within the quadrat were counted. Although group size and vegetative cover may influence probability of detection (Samuel et al. 1987), we did not correct for potential visibility bias because the study area did not contain forest vegetation; rather it was characterized by homogenous sagebrush stands and snow cover. Further, when survey areas contain large numbers of animals that are widely distributed, recognition of individual groups may be nearly impossible, and thus attempting to determine visibility correction factors for groups is not feasible in these situations (Samuel et al. 1987). We used equations from Thompson et al. (1998) to calculate abundance and variance estimates.

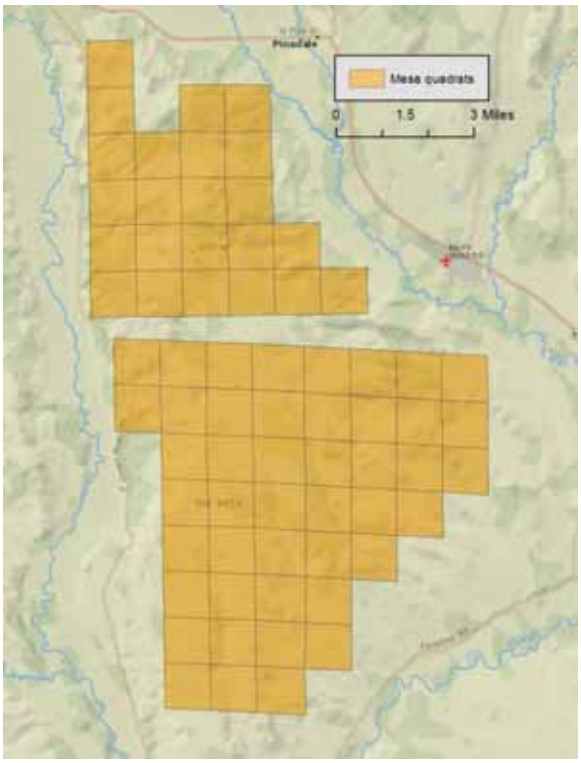

Figure 1. Location of 1-mi^2 quadrats in Mesa study area (*n*=68).

As requested by PAPO, we compared abundance estimates in the Mesa with those estimated by the Wyoming Game and Fish Department (WGFD) for the entire Sublette herd unit. We note that using the herd unit as a reference area is of limited value because the reference area should not contain the treatment area (PAPA), as the treatment will affect what is observed in the reference. Thus, the comparison does not allow potential treatment effects (e.g., gas development) to be discerned from the reference area. Additionally, the WGFD herd unit estimates were based on POPII models that estimate population size from doe to fawn ratios, hunter success, winter severity, and adult survival. The WGFD herd estimates were not based on actual counts and do not have any measure of precision. Beginning in 2012, the WGFD switched from POPII to a "spreadsheet" model developed in Colorado. At this point, it is unclear how POPII and spreadsheet model estimates compare to one another.

RESULTS

Abundance

The WMMM considers changes in mule deer abundance on the Mesa using a baseline of 2,856, derived by averaging the winters of 2004-05 (2,818) and 2005-06 (2,894). The baseline for the reference area (Sublette herd unit) was identified as 27,254 in the WMMM (BLM 2008). The mitigation threshold (15%) was determined by calculating the observed population change in the Mesa from the baseline to present, and comparing that to the population change observed in the reference area during the same time period (Table 1). Between the baseline winter and 2012-13, mule deer abundance on the Mesa declined 7%, whereas the Sublette herd unit declined by 19%.

Table 1. Mule deer abundance estimates, standard errors (SE), and percent change for the Mesa and Sublette herd unit, baseline winter through 2012-13.

Winter	Mesa			Sublette Herd Unit			Threshold Exceeded?
	Estimate	SE	% Change	Estimate	SE	% Change	
baseline*	2,856*	n/a	baseline*	27,254	n/a	baseline	baseline
2006-07	3,156	470	+10%	26,470	n/a	-3%	NO
2007-08	3,638	424	+27%	31,200	n/a	+14%	NO
2008-09	3,850	322	+35%	28,700	n/a	+5%	NO
2009-10	2,088	325	-27%	26,060	n/a	-4%	YES
2010-11	2,318	212	-19%	26,162	n/a	-4%	YES
2011-12	2,553	210	-11%	20,825	n/a	-23%	NO
2012-13	2,652	220	-7%	21,969	n/a	-19%	NO

* Note: the record of decision (ROD; BLM 2008) uses 2,856 as the baseline and was derived from the average of 2004-05 and 2005-06 estimates.

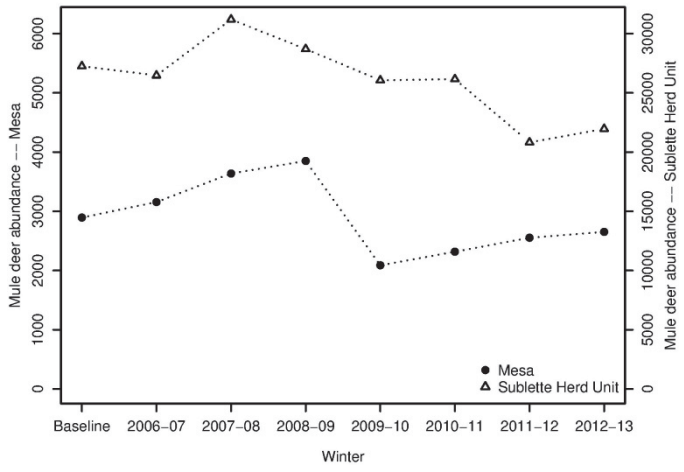

Figure 2. Mule deer abundance estimates for the Mesa and Sublette herd unit, baseline winter through 2012-13.

SECTION II: Resource selection modeling

OVERVIEW

While not part of the WMMM, but in support of the mule deer monitoring effort, we attempt to maintain a sample (~30 animals) of GPS-collared deer in both the Mesa and Ryegrass-Soapholes areas to document movements and help ensure abundance estimates are not influenced by movements of animals between the two areas (i.e., marked animals occupy their respective winter ranges when we conduct counts). The GPS data provide additional opportunity to examine winter habitat use patterns and update migration routes for the Mesa and Ryegrass-Soapholes sub-populations, which have been reported annually since the WMMM was implemented (e.g., Sawyer and Nielson 2011). However, in an effort to reduce costs and take advantage of improved GPS technology, the GPS collars will now remain on animals 2.5 years, rather than dropping off after only 1 year of deployment. Thus, complete GPS data will not be available until 2014 to update the habitat use analysis.

METHODS

Capture and Collaring

We captured 32 adult female mule deer in January 2012 and equipped them with store-on-board GPS collars. Capture efforts were split between the Mesa (n=19) and Ryegrass-Soapholes (n=13). We attempted to sample deer in proportion to their relative abundance across both winter ranges. Collars were programmed to collect locations every 2 hours during non-summer months and every 5 hours during summer (June 15 – September 15). Collars were equipped with release mechanisms designed to drop the collar off the animal on April 1, 2014. Accordingly, complete data for habitat use analyses will not be available until 2014. During the 2012-13 winter we captured another 11 deer, including 7 collars redeployed from dead animals and 4 new collars.

Habitat use

Habitat use analysis will not be completed until 2014, when GPS collars are recovered from marked animals.

SECTION III: Long-term mule deer trends in Pinedale Anticline and Ryegrass-Soapholes

OVERVIEW

As part of the record of decision for natural gas exploration and development in the Pinedale Anticline Project Area (PAPA), the Bureau of Land Management (BLM) developed a Wildlife Monitoring and Mitigation Matrix (WMMM) that provides direction for development-phase wildlife monitoring (BLM 2008). For mule deer, the WMMM was intended to identify monitoring parameters that allow changes in mule deer abundance since 2006 to be quantitatively assessed. However, mule deer monitoring began in 2001 (Sawyer et al. 2009), following the original record of decision (BLM 2000). While not a component of the WMMM, here we report the long-term trends in mule deer abundance in the PAPA, as they are important for understanding the population dynamics of the Sublette deer herd in relation to gas development. Long-term trends indicate that mule deer have declined at higher rates in the Mesa portion of the PAPA compared to the larger Sublette herd unit and nearby Ryegrass-Soapholes area.

METHODS

Abundance

We estimated abundance in the Mesa and Ryegrass-Soapholes areas using aerial counts similar to Freddy et al. (2004), where 1-mi^2 quadrat units were systematically sampled by helicopter (Fig. 3). The sampling frame was 68 mi^2 in the Mesa and 33 mi^2 in the Ryegrass-Soapholes and reflected the relative size of each winter range. In past years, 50% of the quadrats in each area were flown (i.e., 34 in Mesa, 17 in Ryegrass-Soapholes). Beginning in 2010, the PAPO increased the number of sampled quadrats to 46 in the Mesa and 23 in the Ryegrass-Soapholes in an effort to increase precision of abundance estimates. A real-time flight path was traced into the on-board global positioning system (GPS) and once the perimeter of the quadrat was established, all mule deer within the quadrat were counted. Although group size and vegetative cover may influence probability of detection (Samuel et al. 1987), we did not correct for potential visibility bias because the study areas did not contain forest vegetation; rather they were characterized by homogenous sagebrush stands and snow cover. Further, when survey areas contain large numbers of animals that are widely distributed, recognition of individual groups may be nearly impossible, and thus attempting to determine visibility correction factors for groups is not feasible in these situations (Samuel et al. 1987). We used equations from Thompson et al. (1998) to calculate abundance and variance estimates.

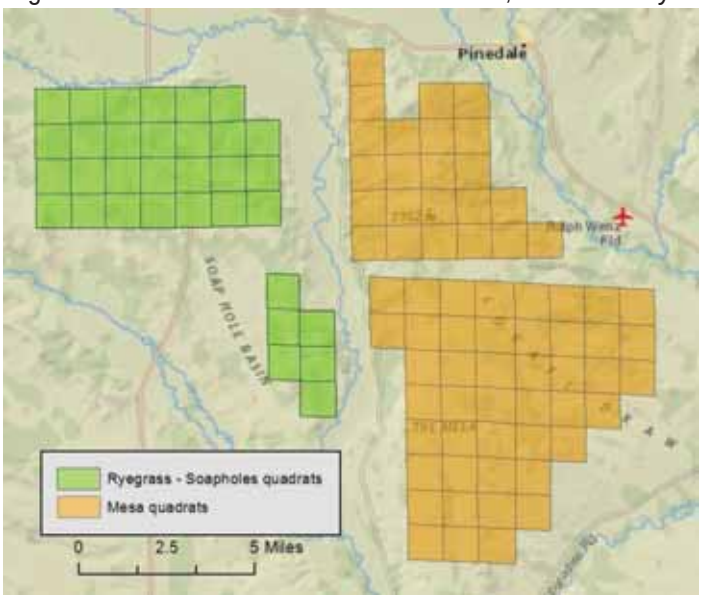

Figure 3. Location of 1-mi^2 quadrats in Mesa (*n*=68) and Ryegrass-Soapholes (*n*=33).

In contrast to the WMMM in Section I, where population estimates from one year were compared to another year, here we used regression analysis to examine population trends through time. This type of analysis is more likely to reflect true changes in population because it is not as sensitive to natural year-to-year variation in abundance. We used a weighted linear regression to account for differences in annual variation in the estimates of abundance.

RESULTS

Abundance

Mesa: We conducted aerial surveys in the Mesa during the winters of 2001-02 through 2012-13 (Table 2). A weighted regression analysis revealed a negative trend over the 12-year period (*Abundance in the Mesa* = 4211 – 157[*year*], *P* = 0.01) with an average decline of 157 deer per year (Fig. 4). Based on the 12-year weighted regression trend, deer abundance declined 42% from 2001 to 2012.

Sublette Herd Unit: During the same time period, WGFD population estimates for the larger Sublette herd unit suggest deer numbers declined less than those observed in the Mesa (Table 2 and Fig. 5). Regression analysis indicated a negative trend over the 12-year period (*Abundance in Sublette herd unit* = 34840 - 1040[*year*], *P* = <0.001), with an average decrease of 1,040 deer per year. The 12-year regression trend indicates deer abundance declined by 33% (Fig. 5).

Ryegrass-Soapholes: As another comparison, we conducted aerial surveys west of the Mesa in the Ryegrass-Soapholes area, beginning in 2006 (Table 2). Consistent with other average and mild winters, GPS data to date indicate that Ryegrass-Soapholes mule deer rarely intermix with Mesa deer. A weighted regression analysis revealed no positive or negative trend across the 7-year period (*Abundance in Ryegrass-Soapholes* = 1420 + 5[*year*], *P* = 0.95; Fig. 6).

Table 2. Mule deer abundance estimates and standard errors (SE) for the Mesa, Sublette Herd Unit, and Ryegrass-Soapholes, winters 2001-02 through 2011-12.

Winter	Mesa		Sublette Herd Unit		Ryegrass - Soapholes	
	Estimate	SE	Estimate	SE	Estimate	SE
2001-02	5,228	820	34,700	n/a	--	--
2002-03	4,676	614	32,920	n/a	--	--
2003-04	3,564	395	34,020	n/a	--	--
2004-05	2,818	325	26,630	n/a	--	--
2005-06	2,894	311	27,254	n/a	--	--
2006-07	3,156	470	26,470	n/a	986	237
2007-08	3,638	424	31,200	n/a	1,106	260
2008-09	3,850	322	28,700	n/a	1,862	249
2009-10	2,088	325	26,060	n/a	2,223	201
2010-11	2,318	212	26,162	n/a	1,109	180
2011-12	2,553	210	20,825	n/a	1,727	165
2012-13	2,652	220	21,969	n/a	1,210	92

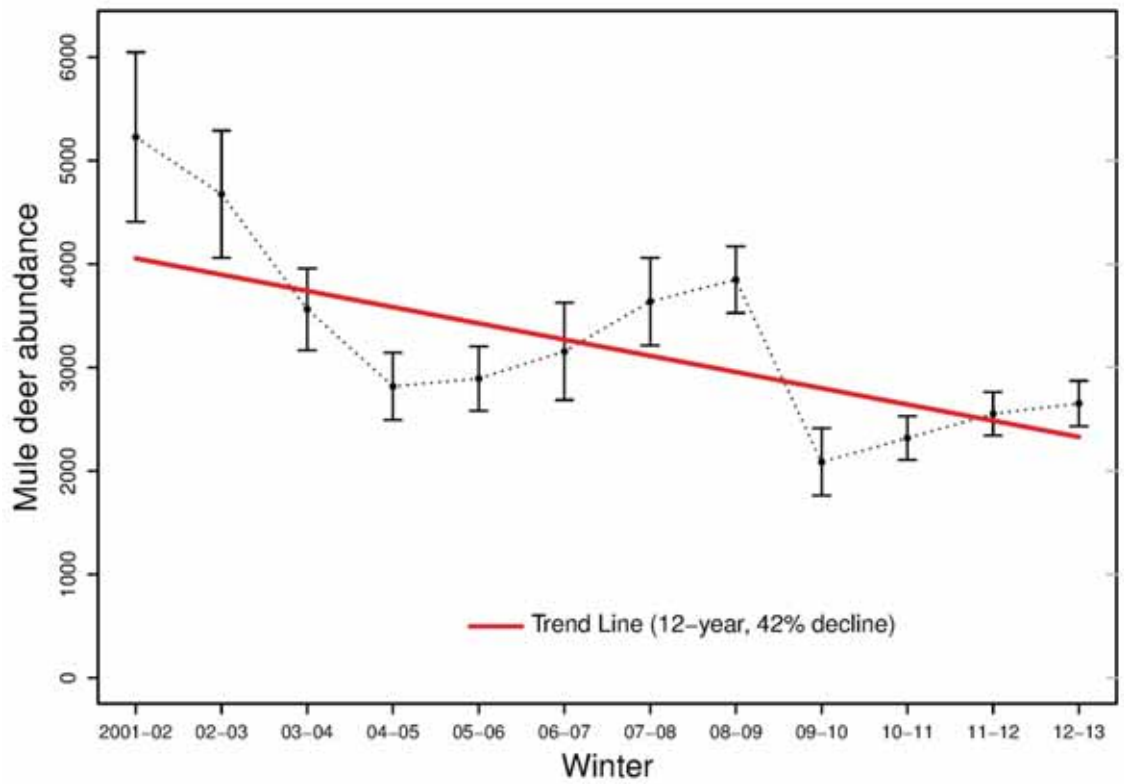

Figure 4. Mule deer abundance estimates (± SE) and 12-year negative trend for the Mesa.

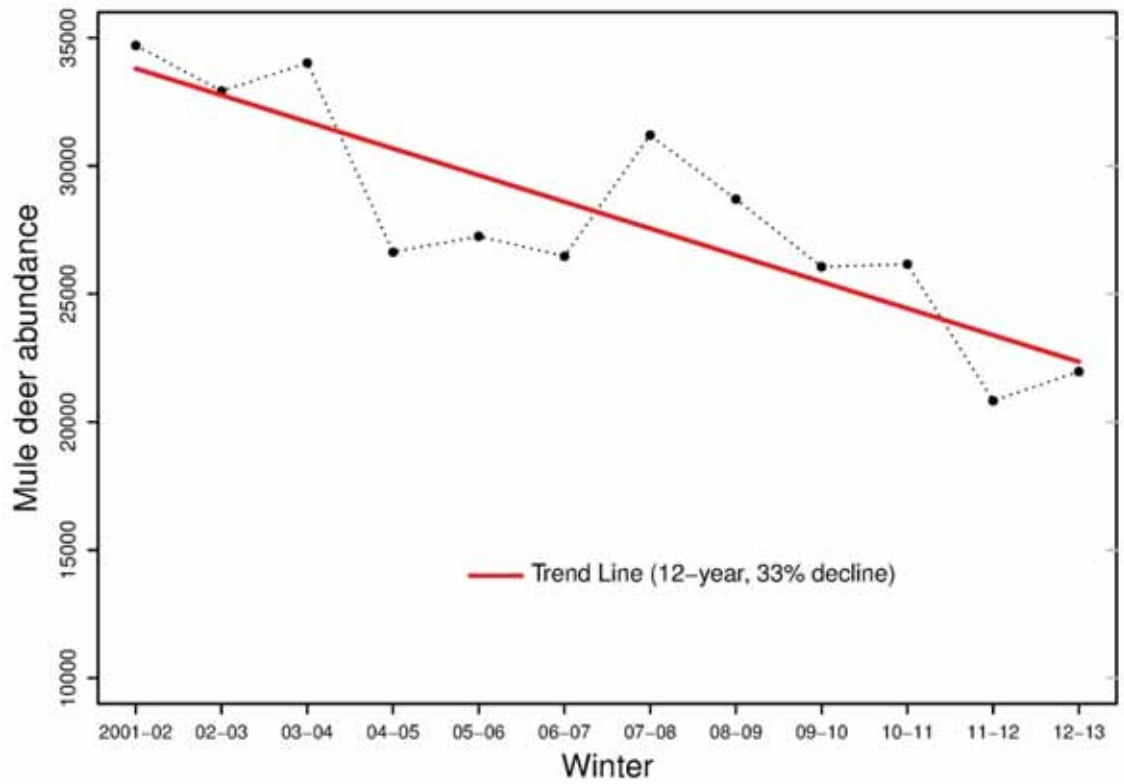

Figure 5. Mule deer abundance estimates and 12-year negative trend for the Sublette herd unit.

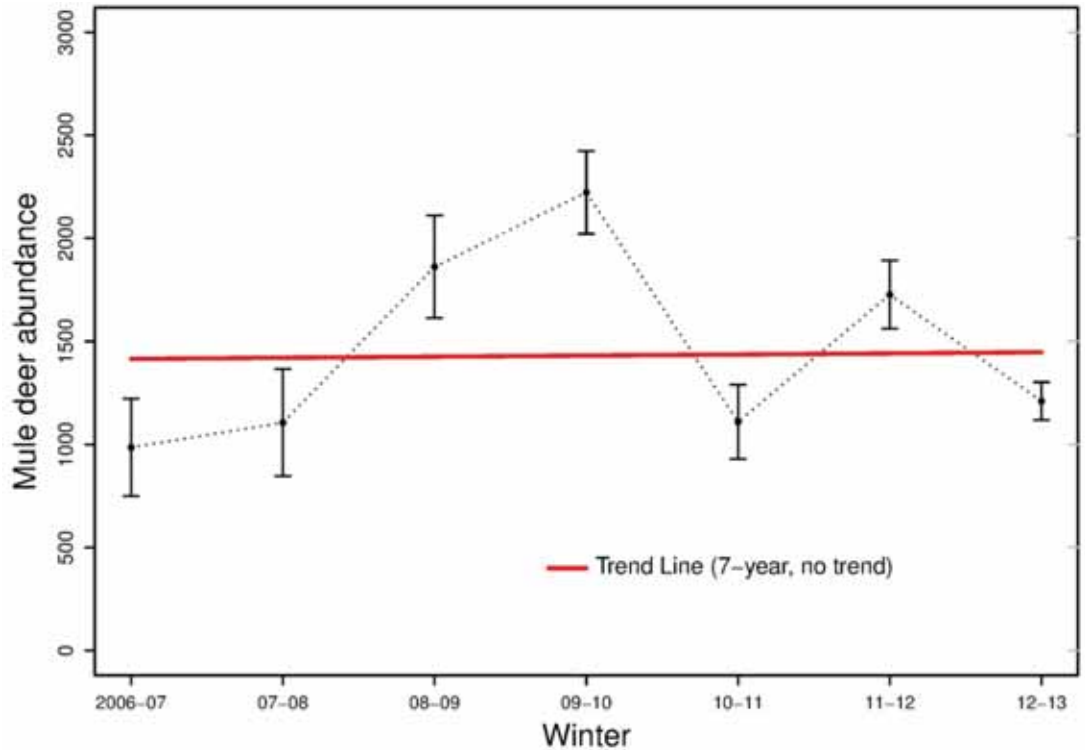

Figure 6. Mule deer abundance estimates (± SE) and 7-year trend line for the Ryegrass -Soapholes area. There is no positive or negative trend for the Ryegrass -Soapholes area.

DISCUSSION

Our task was to estimate mule deer abundance in the Mesa and compare population changes with those observed in the larger Sublette herd unit and an adjacent winter range with no gas development (i.e., Ryegrass-Soapholes area). Since large-scale gas development began (BLM 2000), the 12-year (2001-2012) trend in mule deer abundance on the Mesa shows an overall decline of 42%. This decline was concurrent with documented behavioral changes of mule deer avoiding well pads (Sawyer et al. 2006, 2009*a*, *b*). Of interest here is whether mule deer numbers declined at a similar rate in other portions of the Sublette herd unit. The PAPO requested that abundance in the Mesa be compared to population estimates modeled by the WGFD for the entire Sublette herd unit. The 12-year (2001-2012) trend in mule deer abundance for the entire herd unit indicated an overall decline of 33%. Because there was no variance estimate associated with the WGFD numbers, the precision or year to year variation in herd unit numbers is unknown. Nonetheless if we assume the herd estimates are reliable, then mule deer in the Mesa have declined at a higher rate compared to the larger herd unit. It is important to note that the Sublette herd unit contains the Mesa, so population trends in the Mesa can significantly influence those observed in the larger herd unit. Thus, the comparing the Mesa with the larger Sublette herd does not allow potential treatment effects (e.g., gas development) to be discerned.

As an additional comparison, the Ryegrass-Soapholes area was identified as a potential study area in 2006 because GPS data suggests minimal deer movement between the two areas when winter surveys are conducted. Comparison with the Ryegrass-Soapholes is advantageous because the same abundance estimations methods (quadrat counts) have been used there, and because of their close proximity, the two areas experience similar winter conditions. The 7-year population trend in the Ryegrass-Soapholes was stable, whereas the long-term Mesa trend continued to decline.

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WYOMING GAME AND FISH DEPARTMENT

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August 5, 2013

8-13-13

RECEIVED
AUG 5 2013
Pinedale Resource Area Office

Shane DeForest, Field Manager
Bureau of Land Management, Pinedale Field Office
1625 West Pine Street
Pinedale, WY 82941

Dear Mr. DeForest:

Earlier this year, the Wyoming Game and Fish Department (Department) changed the method used to estimate big game population size. The population model that had been used since the mid-1980s is no longer supported by current software. The new model provides statistically sound estimates and can be used to project population size for all time periods identified in the 2008 Record of Decision – Pinedale Anticline Oil and Gas Exploration and Development Project (ROD). This is of significance to the Bureau of Land Management (BLM), since the 2008 ROD requires monitoring annual population estimates for the Sublette Mule Deer herd unit under Appendix B – Wildlife Monitoring and Mitigation Matrix. Listed below are two tables comparing population estimates. Table 1 depicts the former POPII estimates and Table 2 displays estimates using the new spreadsheet model. Comparing the two tables you can see while the total herd unit estimates are lower in Table 2, using this model did not change when (2009-10 & 2010-11) the 2008 ROD Wildlife Matrix threshold was exceeded.

Table 1. Sublette Herd Unit with **POP II model** population estimates.

	Mesa			Sublette Herd Unit			
Winter	Estimate	SE	% Change	Estimate	SE	% Change	Threshold Exceeded?
2005-06*	2,856*	311	baseline*	27,254*	n/a	baseline	
2006-07	3,156	470	10%	26,470	n/a	-3%	NO
2007-08	3,638	424	27%	31,200	n/a	14%	NO
2008-09	3,850	322	35%	28,700	n/a	5%	NO
2009-10	2,088	325	-27%	26,060	n/a	-4%	YES
2010-11	2,318	212	-19%	26,162	n/a	-4%	YES
2011-12	2,553	210	-11%	20,825	n/a	-24%	NO
2012-13	2,652	220	-7%	NA	NA	NA	NA

*note: Baseline values are averages from published annual population estimates for two winters; 2004-2005 and 2005-2006.

Table 2. Sublette Herd Unit with **Spreadsheet model** population estimates.

Winter	Mesa			Sublette Herd Unit			Threshold Exceeded?
	Estimate	SE	% Change	Estimate	SE	% Change	
2005-06*	2,856*	311	baseline*	24,165*	n/a	Baseline*	
2006-07	3,156	470	10%	24,699	n/a	<1%	NO
2007-08	3,638	424	27%	27,200	n/a	13%	NO
2008-09	3,850	322	35%	26,732	n/a	11%	NO
2009-10	2,088	325	-27%	24,630	n/a	2%	YES
2010-11	2,318	212	-19%	23,426	n/a	-3%	YES
2011-12	2,553	210	-11%	20,652	n/a	-15%	NO
2012-13	2,652	220	-7%	21,969	n/a	-9%	NO

*note: Baseline values are averages from published annual population estimates for two winters; 2004-2005 and 2005-2006.

Tables 2 and 3 reflect the Department's official population estimates for the Sublette Mule Deer herd based on the new spreadsheet model. We request these tables be incorporated into the "*Mule Deer Monitoring in the Pinedale Anticline Project Area - 2013 Annual Report Update*" to reflect the most up-dated information for this mule deer herd.

Table 3. Mesa Treatment Area and Sublette Mule Deer Herd Unit single year population estimates; 2001-2002 to 2012-2013.

Winter	Mesa		Sublette Herd Unit		Ryegrass - Soapholes	
	Estimate	SE	Estimate	SE	Estimate	SE
2001-02	5,228	820	32,011	n/a	--	--
2002-03	4,676	614	28,881	n/a	--	--
2003-04	3,564	395	29,670	n/a	--	--
2004-05	2,818	325	24,115	n/a	--	--
2005-06	2,894	311	24,215	n/a	--	--
2006-07	3,156	470	24,699	n/a	986	237
2007-08	3,638	424	27,200	n/a	1,106	260
2008-09	3,850	322	26,732	n/a	1,862	249
2009-10	2,088	325	24,630	n/a	2,223	201
2010-11	2,318	212	23,426	n/a	1,109	180
2011-12	2,553	210	20,652	n/a	1,727	165
2012-13	2,652	220	21,969	n/a	1,210	92

Sincerely,

John Lund
Pinedale Regional Supervisor

JL/sgs

cc: Brian Nesvik
Tom Ryder
Scott Smith
Therese Hartman