

2015 - JCR Evaluation Form

SPECIES: Mule Deer

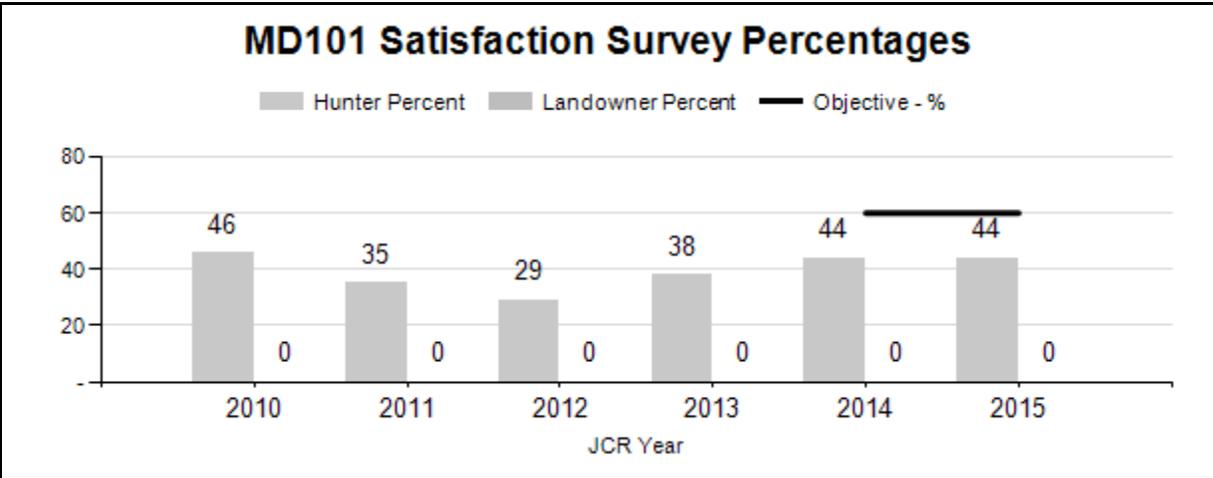
PERIOD: 6/1/2015 - 5/31/2016

HERD: MD101 - TARGHEE

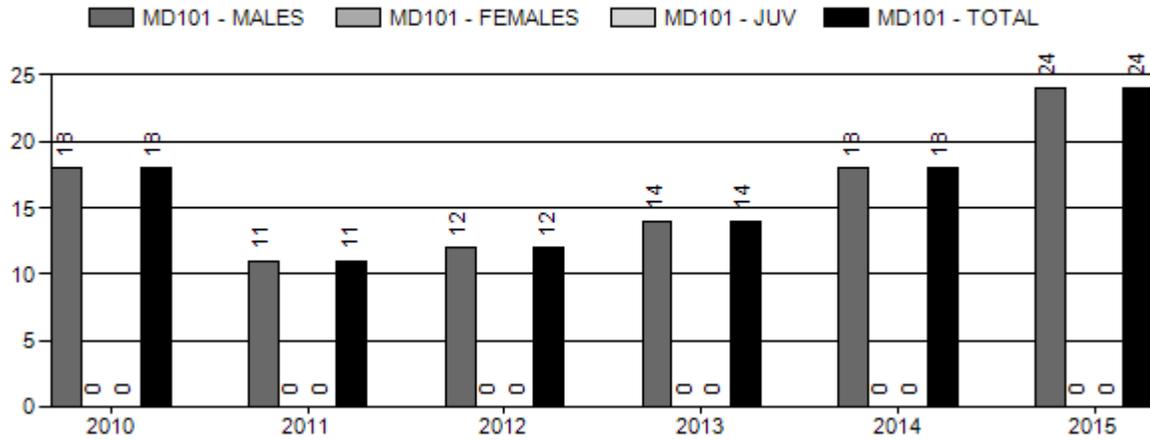
HUNT AREAS: 149

PREPARED BY: ALYSON
COURTEMANCH

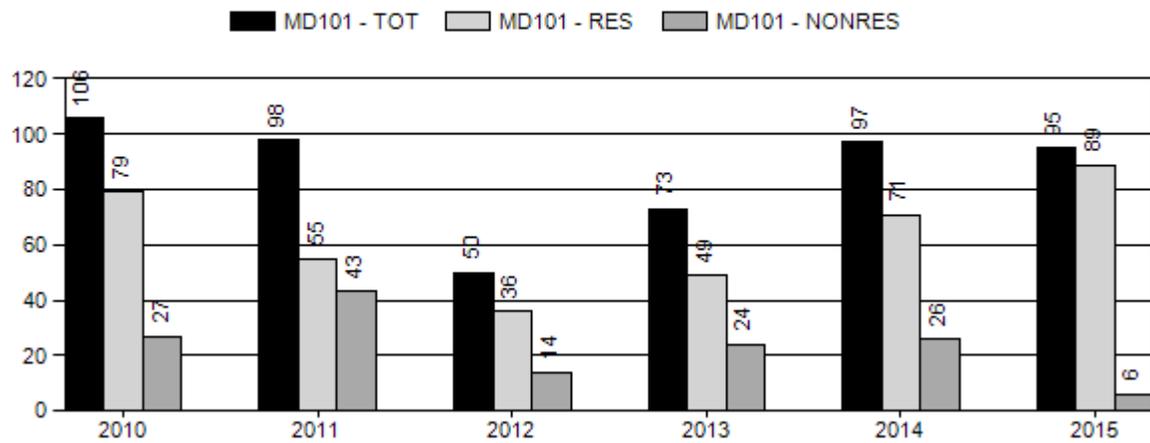
	<u>2010 - 2014 Average</u>	<u>2015</u>	<u>2016 Proposed</u>
Hunter Satisfaction Percent	40%	40%	60%
Landowner Satisfaction Percent	N/A	N/A	N/A
Harvest:	15	24	30
Hunters:	85	95	100
Hunter Success:	18%	25%	30 %
Active Licenses:	85	95	100
Active License Success:	18%	25%	30 %
Recreation Days:	490	329	350
Days Per Animal:	32.7	13.7	11.7
Males per 100 Females:	0	0	
Juveniles per 100 Females	0	0	
Satisfaction Based Objective			60%
Management Strategy:			Recreational
Percent population is above (+) or (-) objective:			N/A%
Number of years population has been + or - objective in recent trend:			0



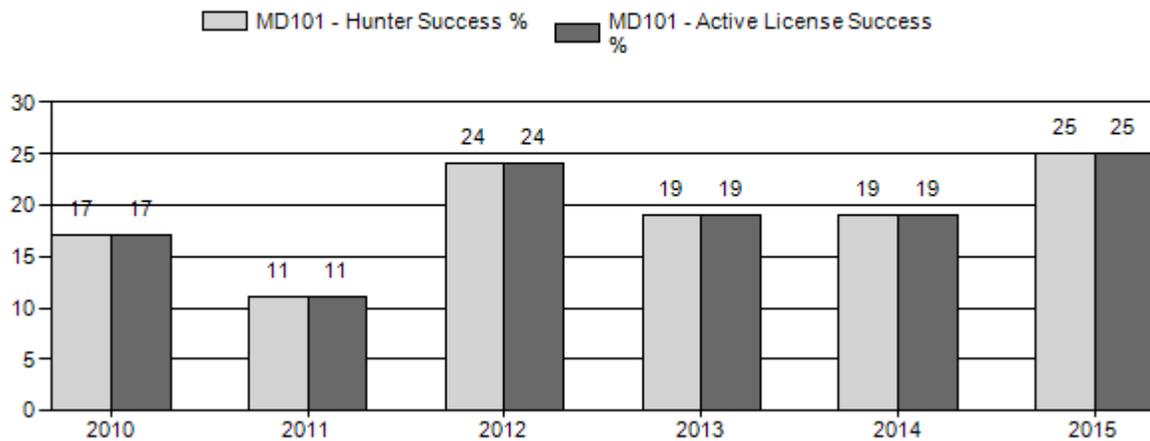
Harvest



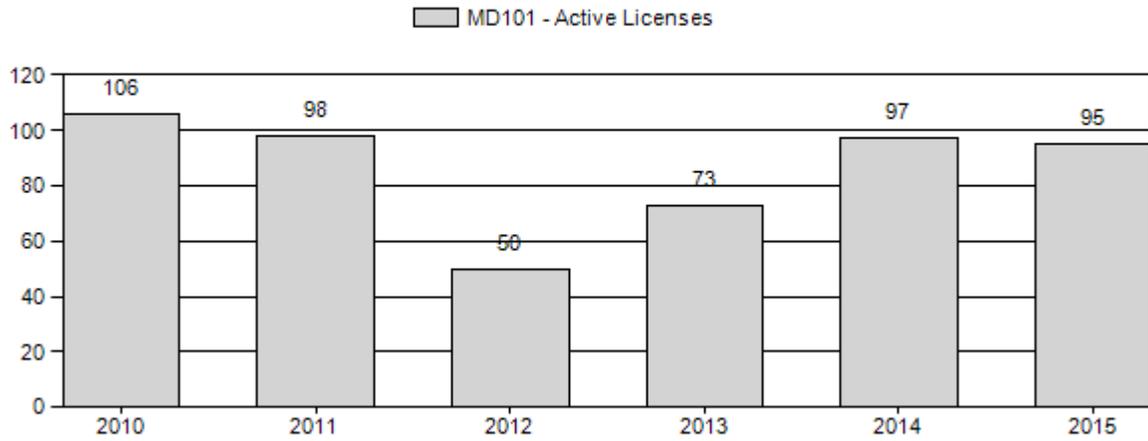
Number of Hunters



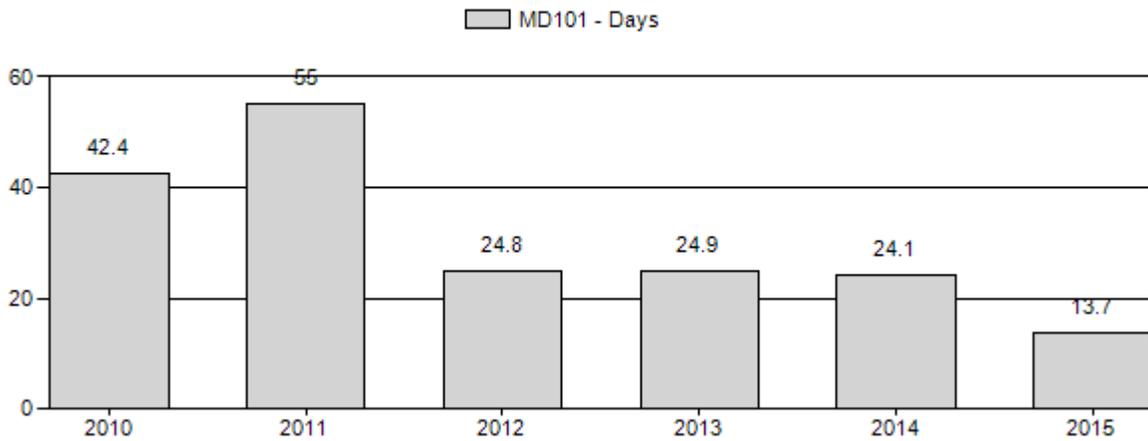
Harvest Success



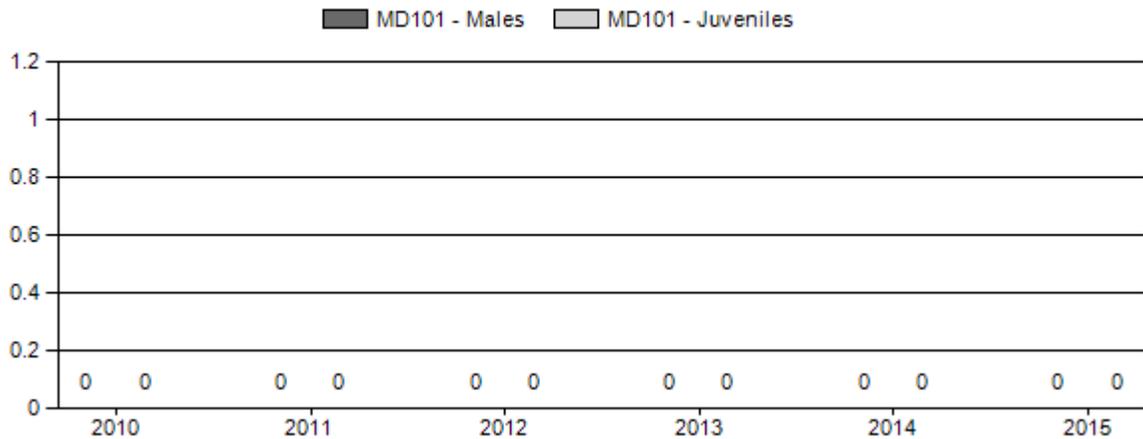
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



**2016 -HUNTING SEASONS
TARGHEE MULE DEER HERD (MD101)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
149		Sep. 15	Oct. 7		General	Antlered mule deer or any white-tailed deer
149	8	Sep. 15	Nov. 30	50	Limited quota	Doe or fawn white-tailed deer

Special Archery Seasons

Hunt Area	Season Dates	
	Opens	Closes
149	Sep. 1	Sep. 14

Management Evaluation

Management Strategy: Recreational

Population Objective Type: Hunter Satisfaction

Primary Objective: Achieve a 3-year average of $\geq 60\%$ of hunters indicating they are “satisfied” or “very satisfied” on the harvest survey.

Secondary Objective: Achieve a 3-year average of $\geq 15\%$ harvest success.

The Wyoming Game and Fish Department (WGFD) proposed changing the objective for the Targhee Mule Deer Herd from a postseason population objective to a hunter satisfaction objective in 2014. The objective change was needed because the herd is rarely surveyed due to budget priorities elsewhere and spreadsheet models do not appear to adequately simulate observed population trends. In addition, the interstate nature of the herd poses additional challenges to population surveys and management. A hunter satisfaction objective was adopted in 2014 after public review, and included a primary and secondary objective (listed above). The region did not adopt a landowner satisfaction objective because the majority of the herd unit is located on public lands.

In 2015, 44% of hunters indicated they were “satisfied” or “very satisfied” with hunting in the Targhee Mule Deer Herd (n=27 respondents). The average satisfaction for the past 3 years is

42% (Fig. 1). Therefore, the herd is currently below its primary objective of $\geq 60\%$ hunter satisfaction.

In 2015, 25% of hunters were successful in the Targhee Mule Deer Herd (Fig. 2). The 3-year average of hunter success is 21%. Therefore, the herd is meeting the secondary objective of an average of $\geq 15\%$ harvest success over 3 years.

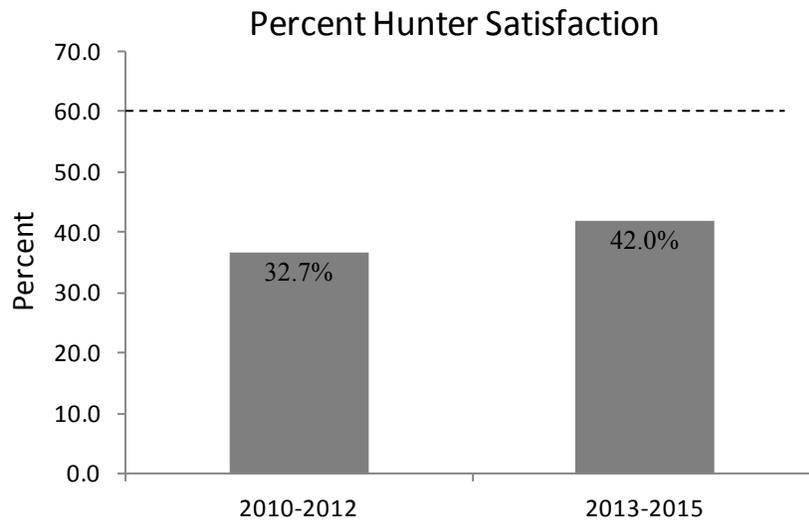


Fig. 1. Percent of hunters indicating they are “satisfied” or “very satisfied” with hunting in the Targhee Mule Deer Herd on WGFD’s annual harvest survey, 2010-2015. Dashed line indicates the objective of $\geq 60\%$.

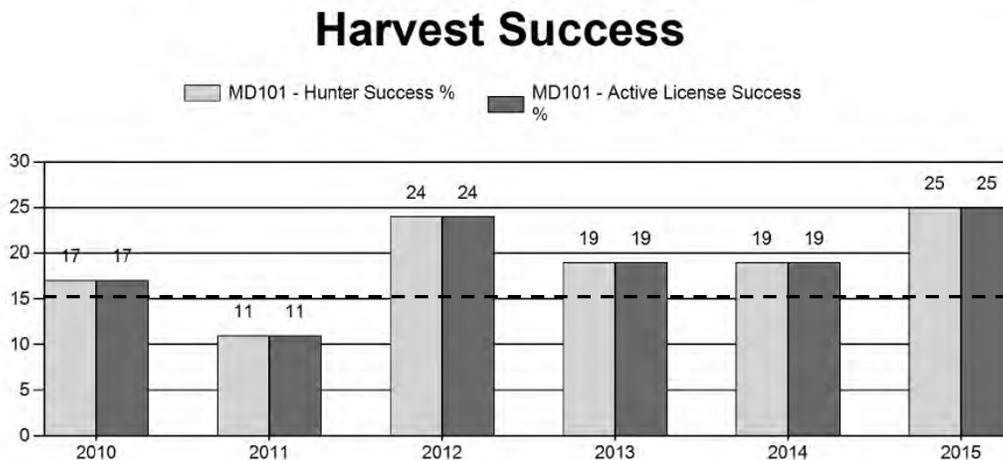


Fig. 2. Harvest success rates in the Targhee Mule Deer Herd for 2010-2015. Dashed line indicates the objective of $\geq 15\%$ harvest success.

Herd Unit Issues

Post-season classification surveys are not flown in this herd due to budget constraints. However, mule deer were opportunistically recorded during an aerial survey of the Targhee bighorn sheep herd in March 2015. Fifteen mule deer were observed. Many of the historical winter ranges for the Targhee Herd have been converted to agriculture and residential development in Idaho. Winter ranges that remain are primarily low elevation mountain shrub and aspen communities in Wyoming and riparian areas in Idaho along the Teton River. Many of the mountain shrub and aspen communities along the state line are old and decadent and are being encroached by conifers. More restrictive hunting seasons have been implemented to allow this population to increase and increase hunter success. Beginning in 2015, a Type 8 doe/fawn white-tailed deer license was added to the hunt area due to several private landowners expressing interest in controlling white-tailed deer numbers.

Weather

Spring and summer 2015 produced consistent moisture, leading to good forage production. Fall was relatively mild with no significant snowfall until mid-December. By early February, low elevation slopes were beginning to melt out. At the time of the mid-winter survey, winter precipitation was reported at 91% of normal in the Snake River Basin. Please refer to the following web sites for specific weather station data.

<http://www.wrds.uwyo.edu/wrds/nrcs/snowprec/snowprec.html> and
<http://www.ncdc.noaa.gov/oa/climate/research/prelim/drought/pdiimage.html>

Habitat

There are several historical vegetation transects in mule deer winter ranges, but they have not been monitored in the past 5 years. Several habitat improvement projects are being planned in this herd unit, including the Hill Creek Prescribed Burn, which is scheduled for completion in 2016. In addition, a habitat treatment in Teton Canyon is currently in the planning stages to improve mountain shrub and aspen communities for mule deer. The WGFD is assisting Caribou-Targhee National Forest (CTNF) with vegetation monitoring in aspen stands pre and post-treatment. Please refer to the 2015 Annual Report Strategic Habitat Plan Accomplishments for Jackson Region habitat improvement project summaries (<https://wgfd.wyo.gov/Habitat/Habitat-Plans/Strategic-Habitat-Plan-Annual-Reports>).

Field Data

No field data were collected in the Targhee Herd Unit during the 2015 biological year.

Harvest Data

Based on harvest statistics, the density of mule deer in the Targhee Herd continues to be a concern. Although the secondary objective of an average of $\geq 15\%$ harvest success over 3 years is being met, most hunters are not satisfied with their hunting experience. The average days to harvest was 13.7 in 2015. This is the lowest in the past 6 years. Ninety-five hunters participated in the mule deer hunt and 24 deer were harvested. The number of hunters peaked in 1983 when 575 hunters participated in this hunt.

A new Type 8 white-tailed deer doe/fawn license was offered beginning in 2015 with 50 licenses. Twenty-five hunters utilized this license in 2015 to harvest 14 deer (56% success). Since the majority of white-tailed deer occur on private land, access is likely a limiting factor for white-tailed deer harvest. This license will be offered again in 2016.

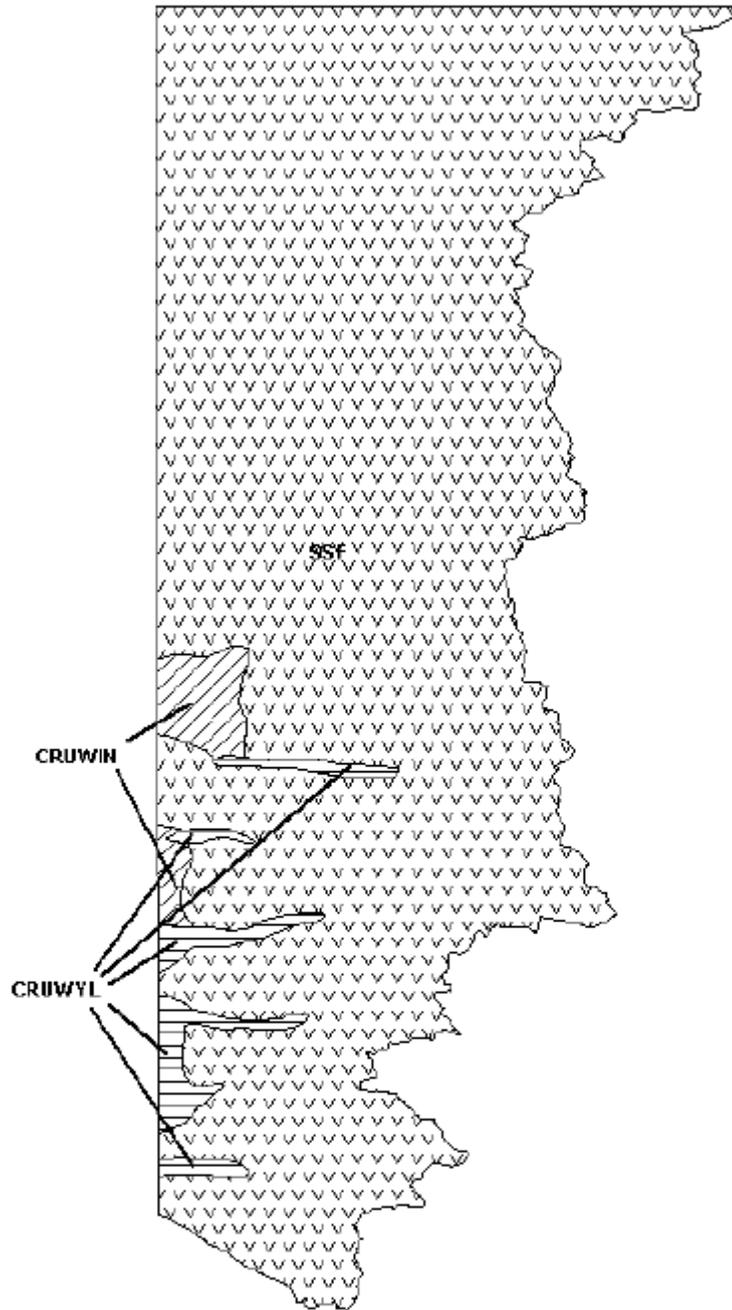
Population

This population likely declined following liberal hunting seasons in Idaho. Data are limited for this population and spreadsheet models do not simulate observed trends. Mule deer winter and transitional ranges in Wyoming are dominated by older age class shrubs and conifer-encroached aspen stands. Many mountain shrub communities are decadent, with plants reaching over 10 feet in height, well above a mule deer's browse zone.

Management Summary

Due to the "interstate" nature of this mule deer population, managing this herd is difficult. Observations of deer along the state line indicate this population remains at a low density even though hunting seasons are conservative. There are no changes planned for the 2016 mule deer hunting season. Antlered deer seasons will close on October 7 to coincide with hunt season closures in adjacent hunt areas east of Jackson. Hunting seasons in Area 149 have minimal impact on this herd and it is likely that more harvest occurs in Idaho than Wyoming. The WGFD continues to work closely with CTNF to develop habitat improvement projects for mule deer and other big game species. In addition, WGFD plans to work more closely with IDFG beginning in 2016 on management issues related to mule deer.

Several private landowners have expressed interest in expanded white-tailed deer hunting opportunities in Hunt Area 149. Therefore, a new Type 8 license was offered beginning in 2015 for doe or fawn white-tailed deer with 50 licenses. Twenty-five hunters utilized this license in 2015 to harvest 14 deer (56% success). Since the majority of white-tailed deer occur on private land, access is likely a limiting factor for white-tailed deer harvest. White-tailed deer licenses will help maintain low densities to prevent competition with mule deer, reduce damage to private lands, and create additional deer hunting options in this area.



**Mule Deer (MD101) - Targhee
HA 149
Revised - 7/87**



2015 - JCR Evaluation Form

SPECIES: Mule Deer

PERIOD: 6/1/2015 - 5/31/2016

HERD: MD131 - WYOMING RANGE

HUNT AREAS: 134-135, 143-145

PREPARED BY: GARY FRALICK

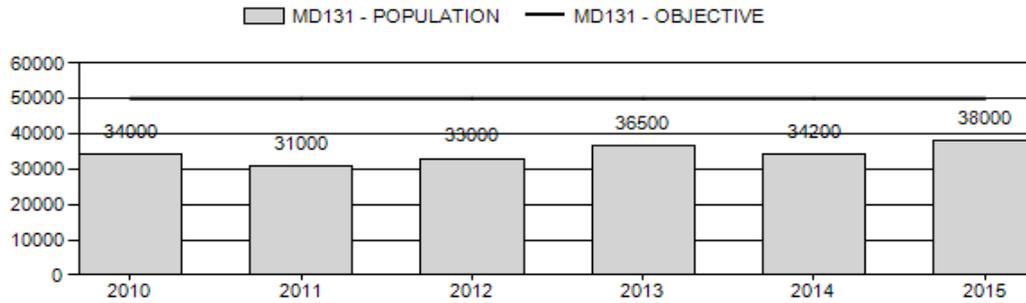
	<u>2010 - 2014 Average</u>	<u>2015</u>	<u>2016 Proposed</u>
Population:	33,740	38,000	38,000
Harvest:	2,296	3,189	2,600
Hunters:	5,513	6,588	6,315
Hunter Success:	42%	48%	41 %
Active Licenses:	5,513	6,588	6,315
Active License Success:	42%	48%	41 %
Recreation Days:	30,261	36,134	34,879
Days Per Animal:	13.2	11.3	13.4
Males per 100 Females	38	39	
Juveniles per 100 Females	68	61	

Population Objective (± 20%) : 50000 (40000 - 60000)
 Management Strategy: Special
 Percent population is above (+) or below (-) objective: -24%
 Number of years population has been + or - objective in recent trend: 23
 Model Date: 2/23/2016

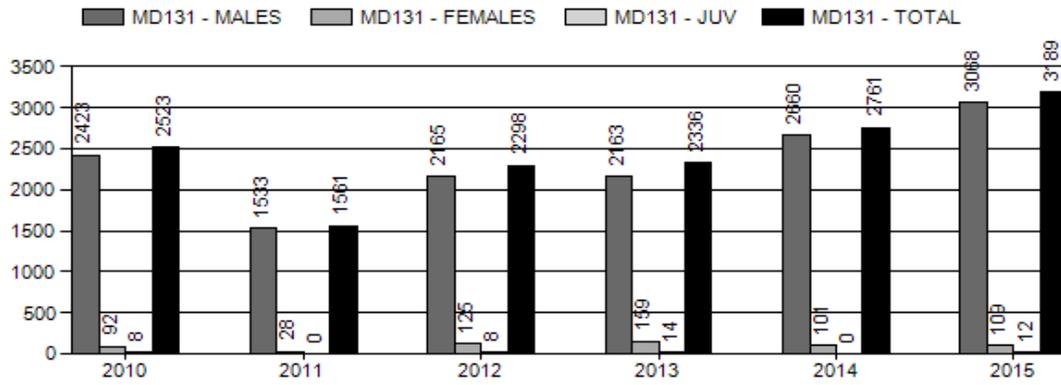
Proposed harvest rates (percent of pre-season estimate for each sex/age group):

	<u>JCR Year</u>	<u>Proposed</u>
Females ≥ 1 year old:	7%	6%
Males ≥ 1 year old:	31%	31%
Juveniles (< 1 year old):	0%	0%
Total:	7%	8%
Proposed change in post-season population:	1%	1%

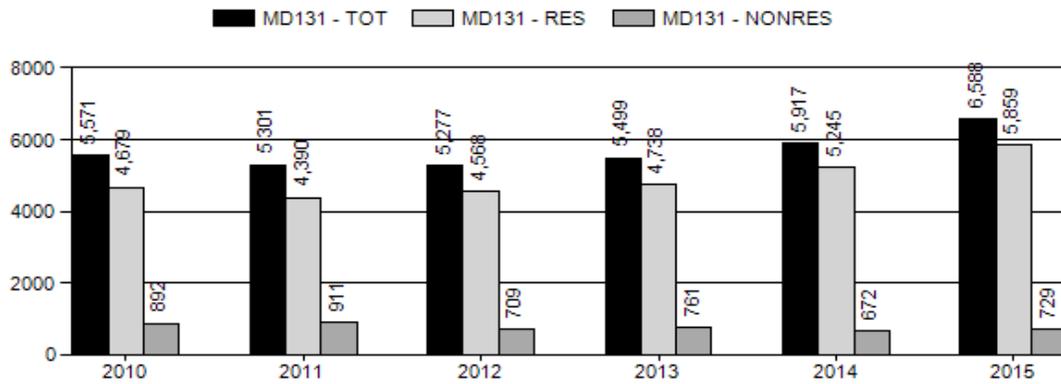
Population Size - Postseason



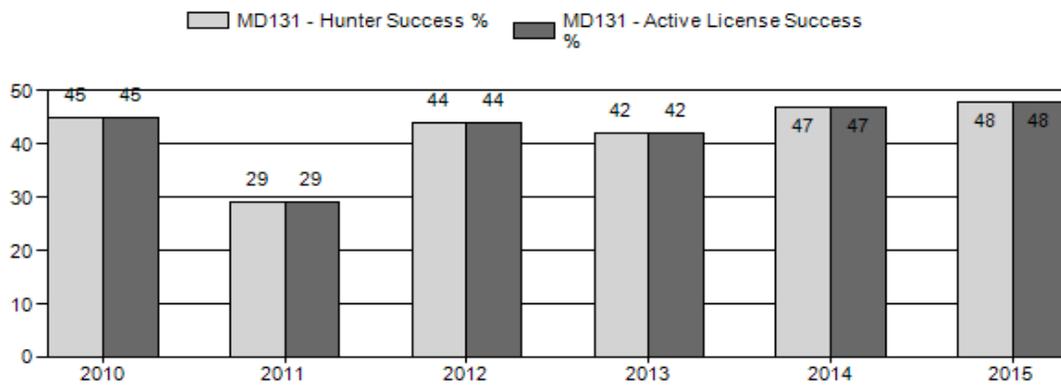
Harvest



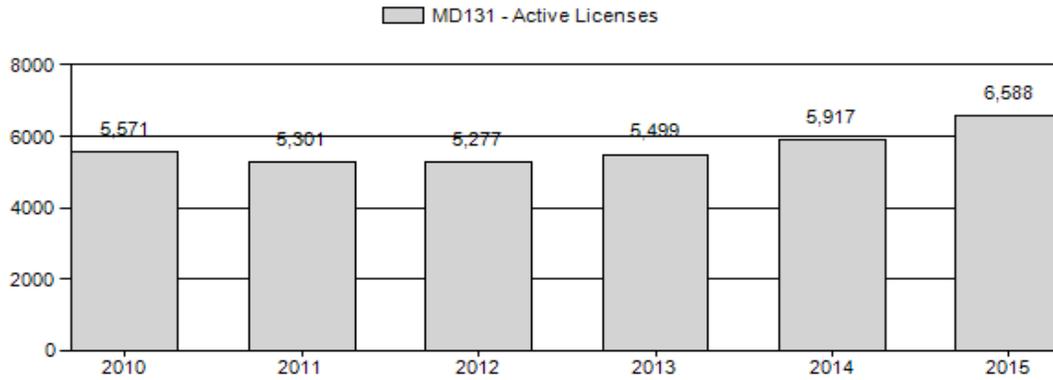
Number of Hunters



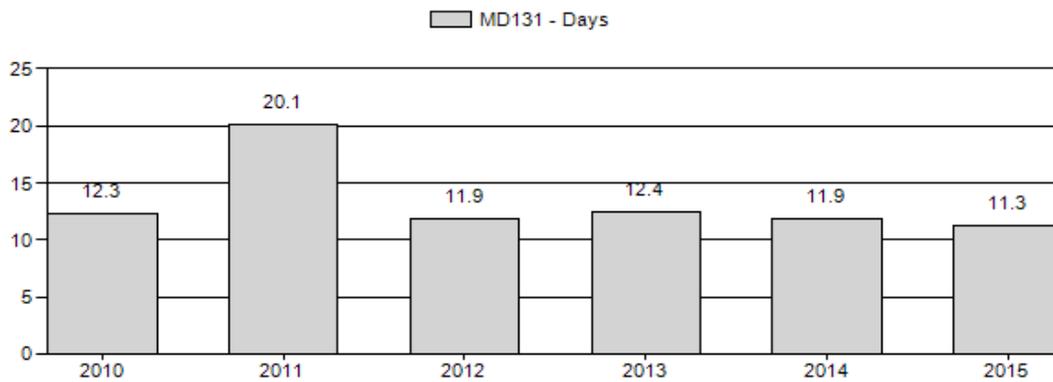
Harvest Success



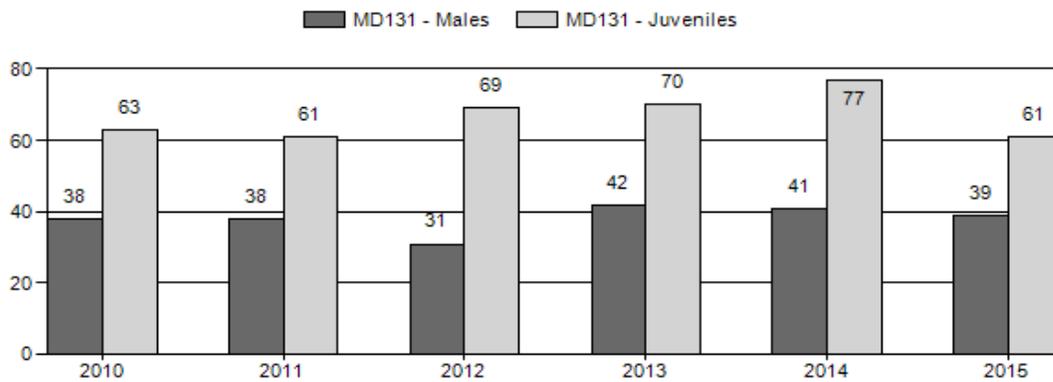
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2010 - 2015 Postseason Classification Summary

for Mule Deer Herd MD131 - WYOMING RANGE

Year	Post Pop	MALES							FEMALES		JUVENILES		Tot Cls	Cls Obj	Males to 100 Females				Young to		
		Ylg	2+ Cls 1	2+ Cls 2	2+ Cls 3	2+ UnCls	Total	%	Total	%	Total	%			Yng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2010	34,000	494	0	0	0	688	1,182	19%	3,124	50%	1960	31%	6266	1265	16	22	38	± 1	63	± 2	46
2011	31,000	340	0	0	0	998	1,338	19%	3,563	50%	2173	31%	7074	1224	10	28	38	± 1	61	± 2	44
2012	33,000	251	0	0	0	439	690	15%	2,256	50%	1556	35%	4502	1325	11	19	31	± 2	69	± 3	53
2013	36,500	544	0	0	0	704	1,248	20%	2,946	47%	2065	33%	6259	1376	18	24	42	± 2	70	± 2	49
2014	34,200	582	627	428	274	0	1,313	19%	3,239	46%	2478	35%	7030	1232	18	23	41	± 2	77	± 2	54
2015	38,000	672	408	308	158	0	1,546	20%	3,830	50%	2,381	30%	7,857	1300	17	22	39	± 1	61	± 2	43

**2016 HUNTING SEASONS
WYOMING RANGE MULE DEER HERD (MD131)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
134		Oct. 1	Oct. 14		General	Antlered mule deer three (3) points or more on either antler or any white-tailed deer
135		Oct. 1	Oct. 14		General	Antlered mule deer or any white-tailed deer
143		Sep. 15	Oct. 7		General	Antlered mule deer or any white-tailed deer
144		Sep. 15	Oct. 7		General	Antlered mule deer or any white-tailed deer
145		Sep.15	Oct. 7		General	Antlered mule deer or any white-tailed deer
145	3	Nov. 1	Nov. 30	60	Limited quota	Any white-tailed deer
145	3	Dec. 1	Jan. 31			Unused Area 145 Type 3 licenses valid for doe or fawn white-tailed deer
134, 135		Sep. 1	Sep. 30			Archery only – REFER TO SECTION 3
143, 144, 145		Sep. 1	Sep. 14			Archery only - REFER TO SECTION 3

REGION G NONRESIDENT QUOTA – 600 LICENSES

SUMMARY OF PROPOSED CHANGES BY LICENSE NUMBER

Area	License Type	Change from 2015
Herd Unit Total		No Net Change

Management Evaluation

Current Postseason Population Management Objective: 50,000

Management Strategy: Special

2015 Postseason Population Estimate: ~38,000

2016 Proposed Postseason Population Estimate: ~38,000

The population objective for Wyoming Range mule deer herd is 50,000 deer. The management strategy is special and the objective and management strategy were last revised in 1994. The current population estimate is approximately 38,000 deer. The population objective will be reviewed in 2016 (APPENDIX A).

Herd Unit Issues

The population objective for Wyoming Range mule deer herd is 50,000 deer. The management strategy is special management. The objective and management strategy were last revised in 1994. The current population estimate is approximately 38,000 deer.

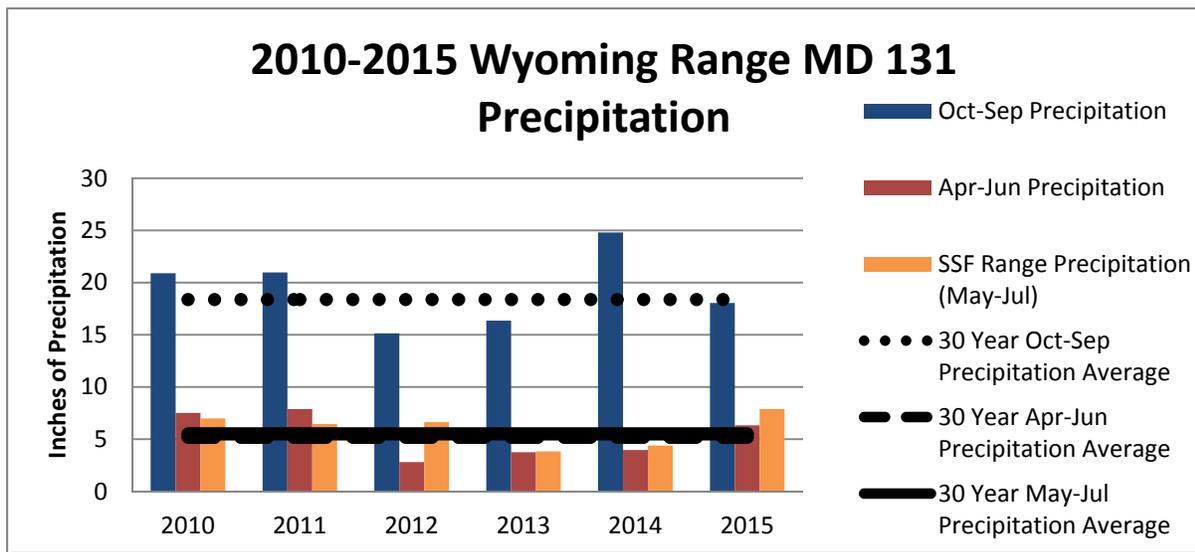
Management strategies since 1993 emphasized hunting antlered deer in an effort to promote population growth. Antlered deer hunts occur in mid-September and early October throughout the herd unit. Hunt seasons close in the northern hunt areas prior to the onset of the annual fall migration in order to minimize vulnerability of bucks that migrate from subalpine summer ranges to sagebrush winter ranges in the Upper Green River Basin. Sustained population growth has been difficult to achieve because of high overwinter mortality approximately every 3 years on crucial winter ranges, low vigor and productivity of important winter range browse, and reduced fawn survival and recruitment.

The Wyoming Range Mule Deer Project was launched in March 2013. The overall goal of this research project is to address important research and management needs indentified by the Wyoming Mule Deer Initiative and Wyoming Range Mule Deer Initiative. An important aspect of this research is to investigate the nutritional relationships between mule deer population dynamics, energy development and disturbance, habitat conditions, and climate to provide a mechanistic approach to monitoring and management of mule deer (Appendix B). A planned approach is to integrate data on nutritional condition, forage production and utilization, and

population performance to understand factors regulating Wyoming Range mule deer and the ability of the current habitat to support mule deer. In addition, there is an opportunity to address secondary objectives including nutritional contributions of winter and summer ranges, factors affecting reproduction, identification of habitats of nutritional and reproductive importance to mule deer, timing and delineation of important migration routes, and direct assessment of the effects of energy development on nutrition and survival of mule deer (Monteith et al. 2012).

In March 2015, Phase II of the Wyoming Range Mule Deer Project was initiated. The Phase II segment of the project focused on measuring survival and cause-specific mortality of mule deer fawns to quantify the relative roles of habitat, nutrition, and predation on recruitment of young (Monteith 2015, Appendix B). Specific objectives of this project quantified the effects of predation and other mortality factors on survival of young mule deer, and provided a relative assessment of the effect of juvenile mortality on the annual population dynamic.

Weather



Precipitation

Overall precipitation from October 2014 through September 2015 was near average when averaged across the entire herd unit. The general characteristics included a relatively dry winter followed by above average summer precipitation. Fortunately, growing season (April through June) precipitation was above average which resulted in good vegetation production across all ranges.

Winter Severity

The 2015-2016 winter was very mild with above average temperatures and below average snow accumulation on winter ranges. This will be the third winter in a row of good over-winter survival for fawns and adults which influences the overall population trend. High elevation mountain ranges have received snow levels that are closer to average. The Upper Green River

Basin is 92% of median, Lower Green River Basin is 97% of median, and Upper Bear River Basin is 92% of median as of March 15, 2016.

Habitat

Sagebrush and other shrubs produced excellent leader growth in 2015 which provided a good quantify of forage on winter ranges. High temperatures and a lighter snowpack have allowed migrating wildlife to move off of crucial winter ranges earlier than normal in spring of 2016 and will likely result in grass and forb green-up earlier than most years.

Habitat Significant Events

Habitat treatments were conducted as part of the Wyoming Range Mule Deer Habitat Project on BLM land in 2015 including: 2519 acres Lawson aerator sagebrush thinning, 770 acres of sagebrush mowing, 357 acres of aspen mechanical preparation for future burning, 2,500 acres of cheatgrass herbicide spraying, and 1 water reservoir renovated to assist with livestock rest. More information can be obtained by reading the Pinedale Region report in the 2015 Strategic Habitat Plan Annual Report. There were no significant wildfires in 2015 in this herd unit.

Habitat Monitoring

Winter Range Shrub transects (Figures 1 and 2) were only monitored on four true mountain mahogany transects in 2015 by Department personnel.

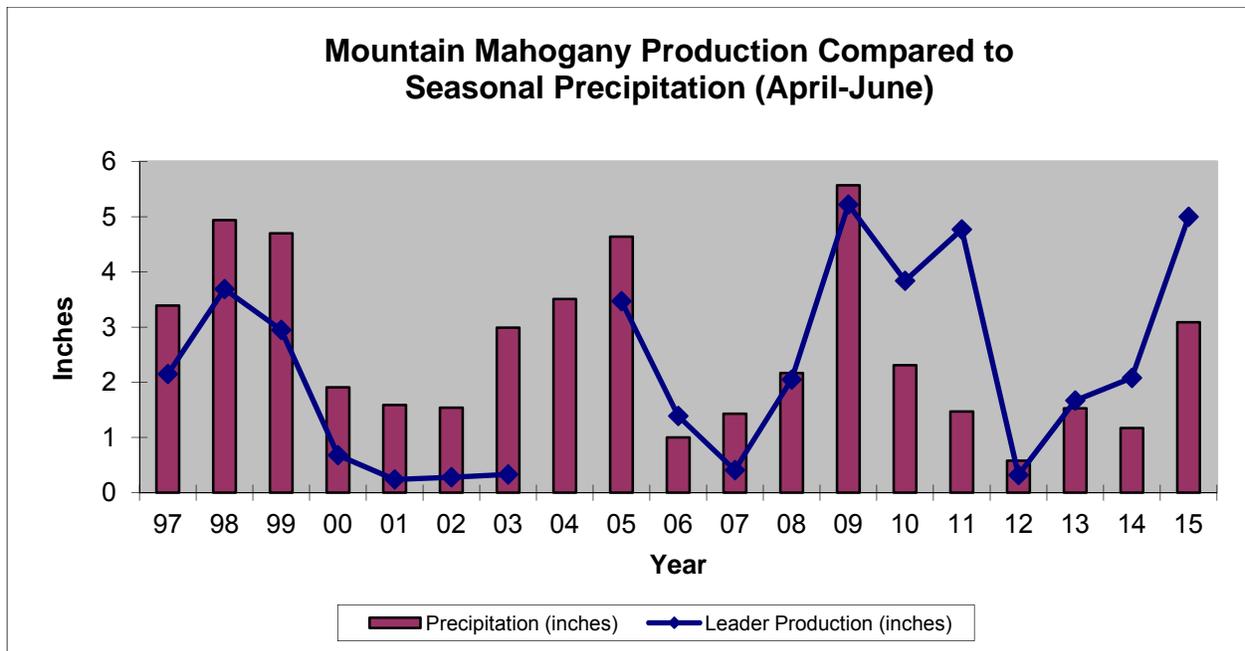


Figure 1. A summary of mountain mahogany production, Wyoming Range mule deer herd, 1997-2015.

Additionally, 100 sagebrush transects were monitored in the herd by University of Wyoming graduate student Samantha Dwinnell as part of her research with Dr. Kevin Monteith (Figure 2). These data were collected on North Winter Range (LaBarge/Calpet, n=50), South winter range (Cokeville-Kemmerer, n=50) and Pinedale Anticline Project Area (PAPA, Mesa, n=50).

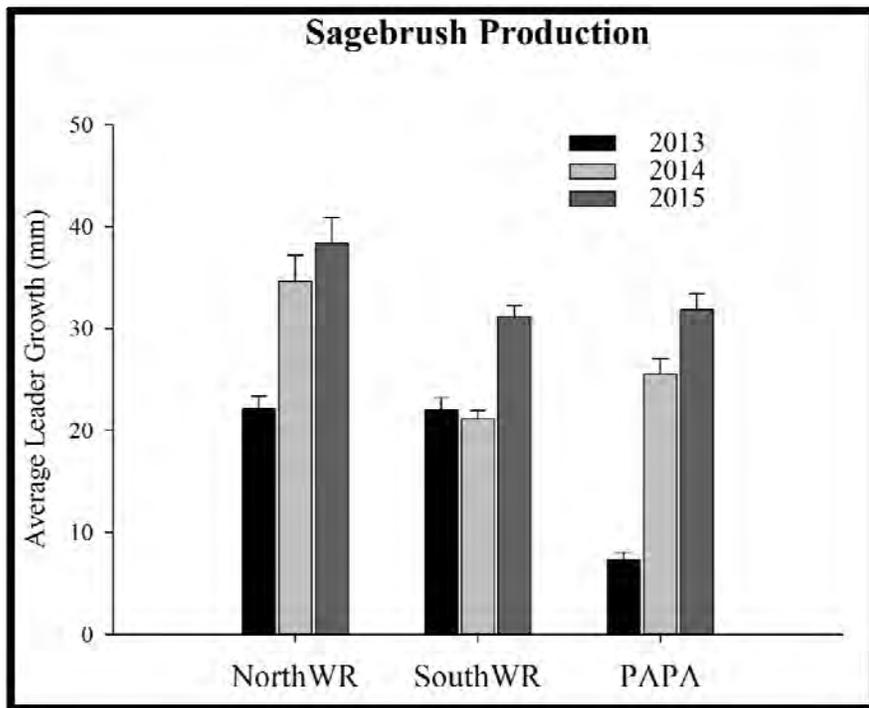


Figure 2. A summary of sagebrush production on Wyoming Range mule deer winter ranges, 2013-2015.

For additional site specific habitat information, please refer to the 2015 Annual Report Strategic Habitat Plan Accomplishments, for the Pinedale Region habitat improvement project summaries (<http://wgfd.wyo.gov/web2011/wildlife-1000708.aspx>).

Field Data

The Wyoming Range deer herd has been unable to sustain population growth for more than 3 consecutive years since the early 1990s. Normal to high over-winter mortality has suppressed this population’s ability to sustain growth because of poor survival and recruitment of fawns.

Since the initiation of the Wyoming Range Mule Deer Project, radio-collared adult does have provided an index of two important metrics: adult survival and fetal rates. Phase II – the fawn survival component of the project, was implemented in 2015 to provide an over assessment of annual fawn survival. During 2015 an important, but previously unknown, mortality factor was

discovered in this deer herd. The disease, Adenovirus Hemorrhagic Disease (AHD) was determined to be a cause of mortality for radio-collared newborn fawns and un-collared fawns as old as 5 months old throughout the herd unit. Although the impact to the annual population dynamic is unknown at this time, it is suspected that AHD, in addition to predation and malnutrition, played an important role in the mortality of a substantial percentage of fawns born in 2015.

Adult survival has exceeded 70% over the last three years; during the same period fetal rates have averaged 1.6 fetuses/doe. An on-going effort to monitor population dynamics with posthunt herd composition surveys provides an assessment of buck recruitment and fawn production and survival.

The primary issue affecting the population dynamic of the northern segment of the herd, is the general decline in productivity and survival of fawns prior to their arrival on, and subsequent departure from, the LaBarge/Big Piney winter ranges (Area 143). During the 5-year period from 1996-2000, an average of 82 fawns:100 does were observed on this winter range. During a subsequent 5-years period (2011-2015), the average fawn:100 does ratio was 62:100. Body condition of pregnant does that arrive on winter ranges and depart in the spring is one of the primary determinants of fawn production and survival.

Buck:doe ratios have met or exceeded the special management objective of 30-45 bucks:100 does in the posthunt population over the last 7 years. Moderate to high overwinter survival has ensured recruitment of 1.5+ year old bucks. Despite lower fawn survival and recruitment, buck ratios have met management goals of 30-45 bucks in the posthunt population. Since 2009 buck:does ratios have exceeded 40:100 in two of the last seven years. On the LaBarge winter ranges buck:doe ratios averaged 42 bucks:100 since 2010. The highest buck ratio achieved in at least 20 years was in 2013 when 46 bucks:100 does were observed on the LaBarge winter ranges.

On herd unit winter as well as summer ranges, low fawn recruitment is of concern, and is believed to be related to habitat conditions, nutritional condition of doe deer, effects of winter severity, predation, and because of the recent findings of the Phase II fawn survival component, the prevalence of disease. Poor browse production related to persistent drought, and an increase in decadent and over-mature forage plants on crucial winter ranges are factors that dictate over-winter deer survival during mild and open winters. Additional factors are the declining vigor, and an increase in dead and decadent aspen communities in parturition and summer ranges. The condition of aspen communities is believed to contribute to the declining neonatal fawn survival and recruitment.

Harvest

Hunting seasons since 1993 have been designed to allow 7-14 days of hunting in the southern areas (Areas 134,135) and 16-23 days of hunting in the northern areas (Areas 143-145). Antlered only hunting, and the near absence of antlerless harvest has failed to produce the sustained population increase since the late 1990s. Nonresident licenses were reduced to 600 licenses for Region G beginning in 2012. Observed buck:doe ratios totaled 42 bucks :100 does in

2013, which is the highest observed buck:doe ratio since 1991. A conservative management approach of closing hunting seasons prior to the annual fall migration in the northern hunt areas has ensured that trophy class bucks continue to be recruited into the posthunt population.

Hunter success was estimated at 48% in 2015. A total of 3189 deer were estimated to have been harvested. In 2014 success was 47%, while 2760 deer harvested. Hunter success and total deer harvested have been the highest levels reported since the late 1990s and early 2000s. A total of 101 does and 109 does were harvested in 2014 and 2015 respectively. Nonresidents accounted 14% of the total estimated harvest in the herd unit.

Population

The population trend has increased over the last 5 years, although only minimally. The “Time Sensitive Juvenile – Constant Adult Mortality Rate” (TSJ,CA) spreadsheet model was used to derive the post season population estimate. The TSJ,CA model showed the best overall fit compared to the suite of available models (Fit=1, Relative AICc=116). This model tracks observed buck:100 doe ratios extremely well.

Management Summary

The population remains below the objective. The 2016 hunting season is designed to promote population growth and retain bucks in the posthunt population by closing hunt seasons prior to the onset of the fall migration. Nonresident Region G licenses will remain at 600 licenses. The 2016 season in Hunt Areas 134 and 135 will allow 14 days of general season antlered deer hunting, with the added restriction that antlered deer with three points or more on either antler may be taken in Areas 134. Both areas will allow the take of any white-tailed deer.

Hunt Areas 143-145 will close on October 7 in 2016, and offer hunters the opportunity to harvest antlered mule deer or any white-tailed deer. The 2016 closing date is similar to the 2014 and 2015 closing date. The October portion of the hunting season in the northern areas will close prior to the onset of the fall migration which typically begins in late September; it is during the fall migration that bucks are most vulnerable when snow accumulations at higher elevations force deer to into areas more accessible to hunters. Season closure prior to this migration will ensure that overharvest of bucks does not occur.

In Area 145, a limited quota any white-tailed deer hunt will allow hunters to take any white-tailed deer during the November portion of the hunting season, and doe or fawn white-tailed deer in an area where chronic damages to stored crops on private property have been occurring.

The 2016 hunting seasons are projected to harvest approximately 2600 deer. The population should be maintained at approximately 38,000 deer following the 2016 hunting seasons.

APPENDIX A

WYOMING RANGE MULE DEER HERD AND POPULATION OBJECTIVE REVIEW

Prepared by: Gary L. Fralick, Thayne & Big Piney Wildlife Biologist

POPULATION OBJECTIVE REVIEW

There have been several significant management changes since the delineation of the Wyoming Range herd unit (Figure 1). These changes have been primarily associated with development and implementation of population objectives. Population estimates, and the associated objectives, were derived from POP2 computer program modeling efforts (Bartholow 1999) and spreadsheet models for ungulate population data (White and Lubow 2002).

The initial population objective for the Wyoming Range herd was established at 30,000 deer in approximately 1974. This objective was provided by field managers based on winter habitat capability and on-the-ground estimates at the time. This objective remained in effect until 1985.

In 1985, the population objective was increased from 30,000 deer to 38,000 mule deer. The reason for this population objective correction was the re-alignment of herd unit boundaries for the West Green River (HA 135, 136, 137), Carter Lease (HA134), Lincoln (HA 144,145), and Sublette deer herds (HA 142,143) in 1981 that resulted in revisions to the population model parameters (Lockman 1981). The population objective of 38,000 deer guided management efforts until 1993.

A public attitude survey was conducted during the winter 1993-1994 in western Wyoming communities to assess public support for the current objective of 38,000 (Fralick 1993). The results of this attitude survey, based largely on widespread public dissatisfaction with the deer management program, compelled the Department to implement an interim population objective revision from 38,000 to 50,000 deer in 1994 (Fralick 1993a).

Since 1994 the population objective has been 50,000 deer. The implementation of the Wyoming Range Mule Deer Initiative in 2010 and 2011 drew considerable public comment that pertained to a comprehensive review of management of the deer herd. An important segment of the herd review pertained to the public discussion regarding the population objective and the need to re-evaluate the objective to reflect current biological and environmental conditions. In 2015, the Department responded to the public's request to re-evaluate the population Wyoming Range objective and the formal review process was initiated in January 2016.

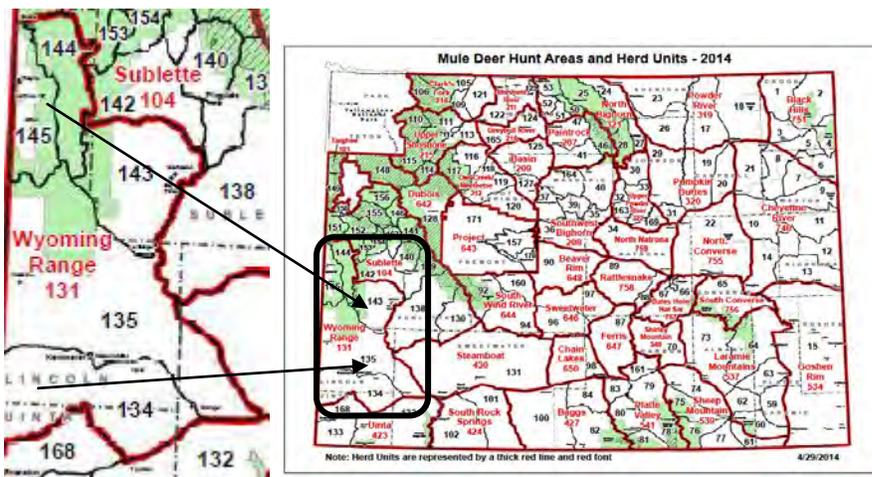


Figure 1. The Wyoming Range Mule Deer Herd, Hunt Areas 134, 135, 143-145.

Population

The population objective for Wyoming Range mule deer herd is 50,000 deer. The management strategy is special management. The objective and was last revised in 1994. The current population estimate is approximately 38,000 deer (Figure 2).

The Wyoming Range deer herd has been unable to sustain population growth for more than 3 consecutive years since 2006 (Figure 2). Normal to high over-winter mortality has suppressed this population's ability to sustain growth because of poor survival and recruitment of fawns, yearlings, and substantial losses to the 2+-year old age classes. Normal to severe winter mortality was observed during the winters of 2005-06, 2007-08, and 2010-2011.

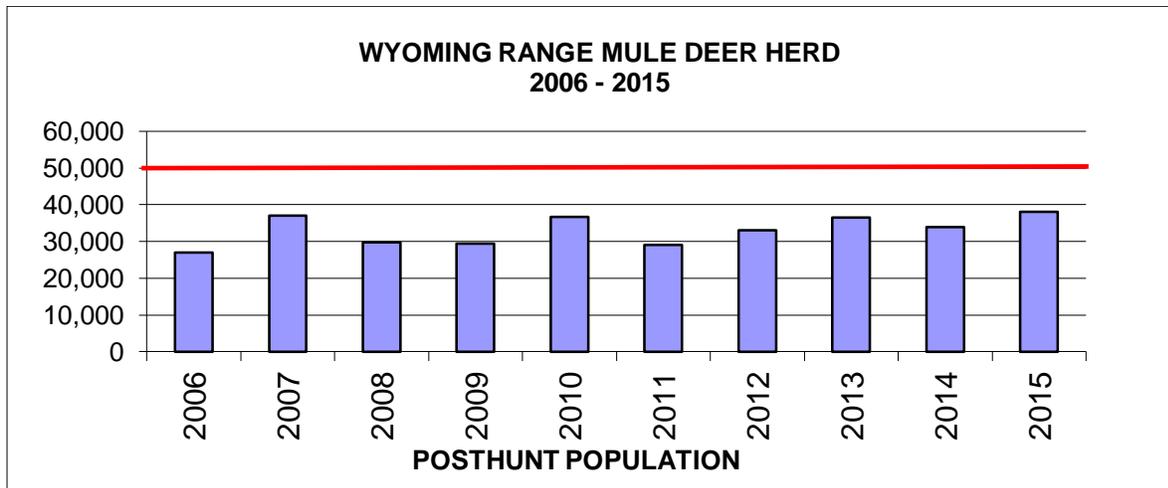


Figure 2. A depiction of posthunt population estimates and the associated population objective (N=50,000), Wyoming Range mule deer herd, 2006 – 2015.

Current Management Strategy

Management strategies since 2006 emphasized hunting antlered deer in an effort to promote population growth. Antlered deer hunts occur in mid-September and early October throughout the herd unit (Fralick 2007). Hunt seasons close in the northern hunt areas prior to the onset of the annual fall migration in order to minimize vulnerability of bucks that migrate from subalpine summer ranges to sagebrush winter ranges in the Upper Green River Basin. Hunt seasons in the southern hunt areas typically close prior to the elk hunt opener on October 15 in order to reduce vulnerability of bucks to hunter harvest concurrent with the elk hunt. Sustained population growth has been difficult because of the frequency of high overwinter mortality every 3 years.

Hunter numbers, primarily resident hunters, have increased herd unit wide since 2006 (Figure 3). The Department initiated a decrease in the number of nonresident licenses in Region G in 2011. Nonresident Region G licenses were reduced from 800 to 600 licenses and have remained at that level since 2011. In response to generally higher overwinter survival of the antlered 2+-year old cohort and exceptional antler production, resident hunters have comprised a higher percentage of the total hunter population in the Wyoming Range.

In 2006, a total of 4747 hunters indicated they hunted in the Wyoming Range. Resident hunters accounted for 77% of the total hunter numbers in that year, while nonresidents accounted for 23% of the herd unit's hunters. In comparison, hunter numbers have, in general, steadily increased since 2006. In 2015 an estimated 6588 total hunters indicated they hunted the Wyoming Range. During the current year resident hunters accounted for 89% (n=5859) of the herd unit's hunters, while nonresident hunters comprised 11% (n=729). The substantial decrease in nonresidents from 2006 to 2015 is due to two years when the Department initiated decreases in the number of licenses issued to nonresidents. In 2007 and 2011 the Department decreased the number of licenses issued in those years from 1000 to 800 licenses and 800 to 600 licenses in Region G, respectively.

Active Licenses

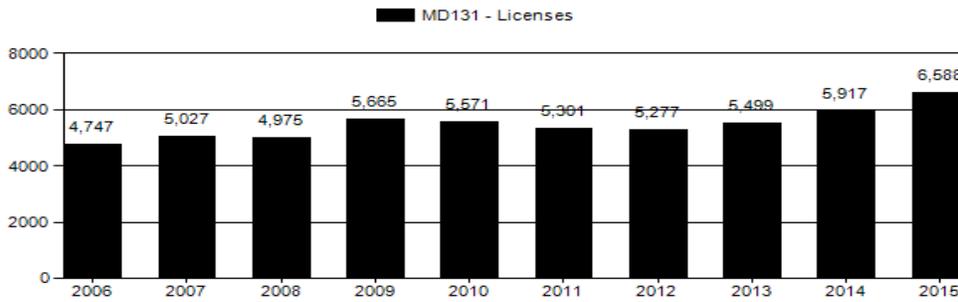


Figure 3. A summary of active hunt licenses, Wyoming Range mule deer herd, 2006 – 2015.

Concurrent with the general increase in hunter numbers has been an upward trend in the annual harvest (Figure 4). A 41% increase in harvest has occurred during this evaluation period; harvest has increased from 1873 deer in 2006 to 3189 deer in 2015. Interestingly, antlerless harvest has increased from 65 antlerless deer in 2008 to 121 does and fawns taken in 2015; this is a 46% increase. The highest annual percentage of antlerless deer harvested was 7% in 2013. Antlered deer harvest typically comprises the majority of the annual harvest, ranging from 100% of the total harvest in 2006 to 96% in 2015. The lowest percentage of antlered deer harvest was in 2013 when 93% of the annual harvest was comprised on antlered deer.

Harvest

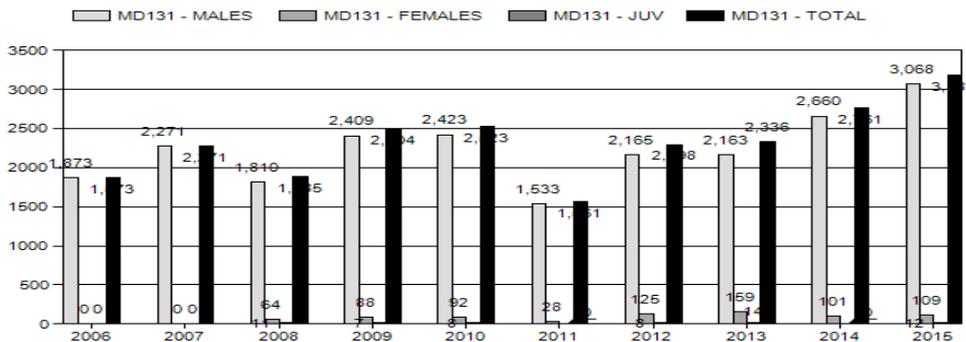


Figure 4. A summary of the annual mule deer harvest, Wyoming Range mule deer herd, 2006 – 2015.

Since the initiation of the Wyoming Range Mule Deer Project (Appendix A), radio-collared adult does have provided an index of two important metrics: adult survival and fetal rates. Phase II – the fawn survival component of the project, was implemented in 2015 to provide an assessment of annual fawn survival. During 2015 an important, but previously unknown, mortality factor was discovered in this deer herd. The disease, Adenovirus Hemorrhagic Disease (AHD) was determined to be responsible for killing radio-collared newborn fawns and un-collared fawns as old as 5 months old throughout the herd unit. Although the impact to the overall population is unknown at this time, it is presumed that AHD, in addition to predation and malnutrition, played an important role in the mortality of a substantial percentage of fawns born in 2015.

Adult survival has exceeded 70% over the last three years; during the same period fetal rates have averaged 1.6 fetuses/doe. An on-going effort to monitor population dynamics with posthunt herd composition surveys provides an assessment of buck recruitment and fawn production and survival.

One of the primary issue affecting the population of mule deer in the northern segment of the herd is the general decline in productivity and survival of fawns prior to their arrival and subsequent departure from winter ranges in the LaBarge/Big Piney areas (Hunt Area 143). During the 5-year period from 1996-2000, an average of 82

fawns:100 does were observed on this winter range. During a subsequent 5-years period (2011-2015), the average fawn:100 does ratio was 62:100.

Buck:doe ratios have met or exceeded the special management objective of 30-45 bucks:100 does in the posthunt population over the last 7 years. Normal to high overwinter survival has ensured recruitment of 1.5+ year old bucks. Despite low fawn survival and recruitment, buck ratios have met management goals of 30-45 bucks in the posthunt population. Since 2009 buck:does ratios have exceeded 40:100 in two of the last seven years. On the LaBarge winter ranges buck:doe ratios averaged 42 bucks:100 since 2010. The highest buck ratio achieved in at least 20 years was in 2013 when 46 bucks:100 does were observed on the LaBarge winter ranges.

Habitat Conditions

The Wyoming Range mule deer herd includes a wide variety of vegetation communities and habitat conditions across two mountain ranges and the sage-brush basins to the south and east that is used as winter range. Winter ranges are dominated by Wyoming big sagebrush, saltbush, greasewood, and include pockets of mountain shrubs such as true mountain mahogany and serviceberry.

In general the condition of shrubs on winter range is poor and is dominated by severely hedged old age plants with little annual production. For this reason, mule deer are typically on a negative nutritional plane and losing body fat throughout the winter season. Winter range conditions have not changed greatly in the last 10-15 years, with the exception of additional oil and gas infrastructure in the LaBarge area, a few relatively small-scale habitat treatments and expansion of cheatgrass into many southern aspects and places that have experienced recent disturbance. Drought has also played a role on winter ranges in the last 15 years. Old age shrubs are not able to generate annual leader production as well as young plants when resources are scarce.

Summer and transitional ranges are located in the Salt and Wyoming Ranges. These areas are certainly more productive than winter ranges, but could provide higher quality habitat for mule deer. The primary management concerns involve late succession conditions in aspen, mountain shrubs and conifer communities as well as degraded condition of tall forb rangelands that are used heavily by mule deer for high quality forage in summer months.

Recent large-scale wildfires such as the Fontenelle Wildfire (2012) and changes in land management have potential to benefit mule deer in future years. Additionally, a significant effort has been placed on treating shrub and aspen stands on the east slope of the Wyoming Range in order to set back succession and improve habitat quality for many generations to come.

On herd unit winter as well as summer ranges, low fawn recruitment is of concern, and is believed to be related to habitat conditions, nutritional condition of doe deer, effects of winter severity, predation, and because of the recent findings of the Phase II fawn survival component, the prevalence of disease. Poor browse production related to persistent drought, and an increase in decadent and over-mature forage plants on crucial winter ranges are some of the factors that dictate over-winter deer survival during mild and open winters. Additional factors are the declining vigor, and an increase in dead and decadent aspen communities in parturition and summer ranges. The condition of aspen communities is believed to contribute to declining neonatal fawn survival and recruitment.

Hunter Satisfaction

Hunter satisfaction and approval of mule deer management is an essential element in determining the level of support for the current review of the population objective (Figures 4 and 5). In order to assess hunter satisfaction throughout the herd unit, two hunt areas that represent differing management strategies were selected to evaluate hunter experience. Hunt Area 135 was selected because in most years over 50% of the herd unit's hunter and annual harvest occurs in this area (Figure 4). The season dates in Area 135 typically open on October 1 and close on/before October 14. In contrast, Hunt Area 144 (Figure 5) typically opens on September 15 and closes on/before October 7 prior to the onset of the fall migration. In most years, Area 144 accounts for approximately 23% - 27% of the herd unit's annual harvest and hunter numbers.

Hunters were queried during the annual posthunt review to rate their approval of the Department's management of this deer herd from 2011 - 2015. Hunters were asked to choose one of five categories (*Very Satisfied, Satisfied,*

Neutral, Dissatisfied, Very Dissatisfied) to describe their deer hunting experience. The hunter satisfaction ratings recorded in Hunt Area 135 (Figure 3) and Hunt Area 144 (Figure 4) reflect a positive sentiment of a management strategy that has garnered widespread public approval throughout the herd unit.

The relative increase in annual hunter satisfaction reflects a positive experience following the high winter mortality and population decline during and after the 2011 winter. Since that time, deer hunters in the Green River Region’s Hunt Area 135 have rated their annual hunting experience in an increasingly positive manner (Figure 3). The lowest approval rating of 33% is very likely a result of the effects of the severe mortality observed during 2011 winter, while a 63% approval reported in 2015 ranks among the highest ratings in this hunt area in the last 15 years.

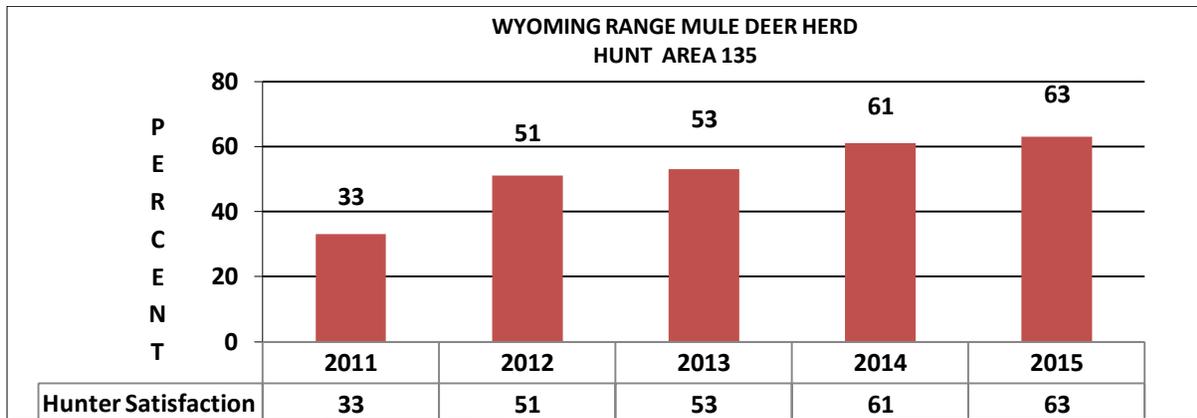


Figure 4. Percent of hunters who rated their hunting experience as *Very Satisfied and Satisfied*, Hunt Area 135 Wyoming Range mule deer herd, 2011 – 2015, (N=3,632 hunters).

The Greys River area, Hunt Area 144, is highly touted for its trophy class buck hunting opportunity (Figure 5). Since 2011 those hunters that pursued bucks expressed a sentiment that is consistent throughout the herd unit. The immediate effects of extreme overwinter mortality following the 2011 winter are reflected in a lower hunter approval rating. However, during the subsequent four years, hunter satisfaction increased annually as a result of higher overwinter survival of all age classes. Consequently, hunter approval and support of the Department’s deer management strategy is depicted at some of the highest levels in over 20 years.

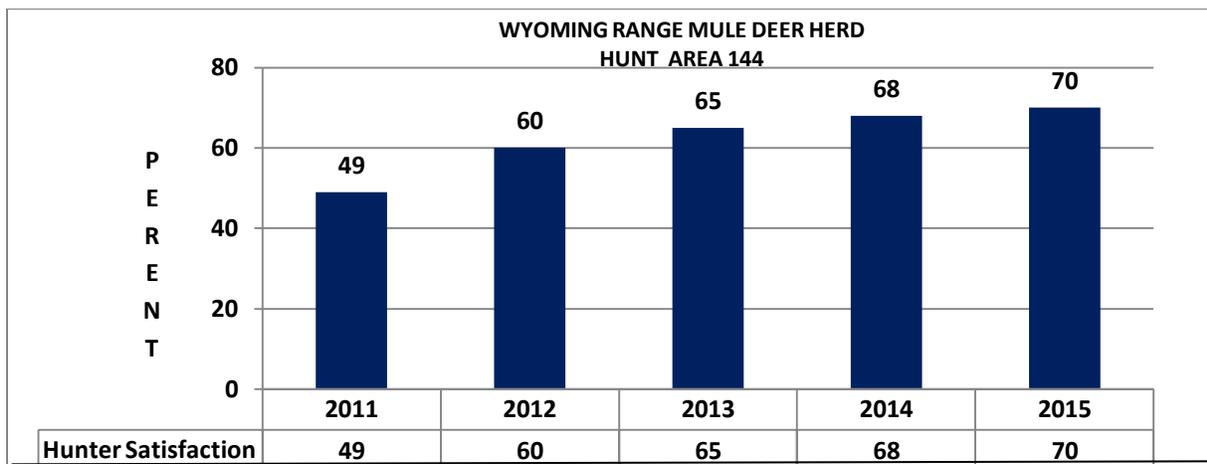


Figure 5. Percent of hunters who rated their hunting experience as *Very Satisfied and Satisfied*, Hunt Area 144, Wyoming Range mule deer herd, 2011 – 2015 (N=1,551 hunters).

PROPOSED PRIMARY AND SECONDARY OBJECTIVES FOR THE WYOMING RANGE MULE DEER HERD AND SPECIAL MANGEMENT STRATEGY

Managers propose decreasing the population objective for the Wyoming Range mule deer herd from 50,000 to 40,000 deer. The proposed decrease in the population objective is an effort to manage the population at a level that reflects the current biological capacity of the deer herd and the environmental conditions that the population is dependent upon.

The proposed objective of 40,000 deer is based on the preliminary findings of the Wyoming Range Mule Deer Project – Phase I and Phase II, the ability of the current habitat conditions to support a lower number of mule deer, the widespread public support of the current mule deer management strategy, and the need for the population objective to reflect current and projected environmental conditions that may exist for the next five (5) years.

Primary Objective

The proposed primary objective for the Wyoming Range mule deer herd is to manage for a postseason population objective of 40,000 deer. The objective will encompass the range of $\pm 20\%$ (32,000 – 48,000) of the current year's posthunt population estimate in order to provide managers the guidance to design hunting seasons for the upcoming year.

Secondary Objective

The management criterion for the Wyoming Range mule deer herd is Special Management. Parameters for the Special Management designation are proposed as secondary objectives and include:

Maintain a posthunt buck:doe ratio of 30-45 bucks:100 does;

Maintain the percent males in annual harvest $\geq 70\%$;

Maintain the percent females in the annual harvest $\leq 30\%$; and,

Maintain the percent harvest of yearling males in the annual harvest at $\leq 35\%$.

LANDOWNER, AGENCY AND PUBLIC INVOLVEMENT

The Wyoming Range mule deer herd objective review was discussed during public meetings in the Jackson and Pinedale regions during the 2016 Mule Deer Initiative Public meetings in Pinedale, Marbleton, and Thayne January 5-7, 2016. Similar meetings were held in Kemmerer and Green River on January 11 and 12, 2016. These meetings were held in Pinedale (formal meeting format, 15 people in attendance); Marbleton (formal meeting format, 13 people in attendance); Thayne (formal meeting format, 35 people in attendance). Public attendance in Kemmerer and Green River was recorded as 16 and 18 people, respectively.

On March 2, 2016, the Department presented a preliminary assessment of proposed 2016 Big Game Hunting Seasons to the Jackson Hole Outfitters and Guides Association. Included in this presentation was a brief discussion of the Wyoming Range mule deer herd management, proposed 2016 hunting seasons, and the upcoming review of the Wyoming Range population objective in March – May, 2016. Approximately 30 outfitters and guides were in attendance.

Regional personnel discussed the mule deer objective review on March 3, 2016 in LaBarge, and it was at that time the proposed revised objective was agreed to 40,000 deer.

The Wyoming Range population objective was presented to the Bridger-Teton National Forest personnel during the annual WGFD/USFS coordination in Jackson on March 17, 2016.

During 2016 big game hunting season public meetings and open houses in Marbleton (March 14; 2 people), Thayne (March 15, 17 people), Pinedale (March 16; 14 people), and Jackson (March 17; 35 people) the Wyoming Range mule deer population objective review was presented for public review.

Additional big game population review public meetings were held in Jackson and Pinedale on April 25, 2016, Kemmerer on April 27, and Green River on April 28, 2016.

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The Wyoming Range Mule Deer Project: Interim Report



UNIVERSITY
OF WYOMING



MONTEITH SHOP

WYOMING COOPERATIVE FISH
& WILDLIFE RESEARCH UNIT

Nutritional Ecology of Mule Deer

Concerns over population performance of mule deer (*Odocoileus hemionus*) have heightened in recent decades in response to near ubiquitous declines in abundance followed by stagnation in population growth throughout much of the West. Although a wealth of research has been conducted to identify what is preventing populations from growing, controversy remains, in part because population dynamics are complex and studies rarely are able to address the multitude of factors that can affect populations.



At the foundational level, individuals and populations ultimately require the resources necessary to fuel growth and reproduction. Consequently, the food and habitat requirements for individuals must be satisfied before other potentially limiting factors will matter—nutrition is the fundamental building block of populations. In essence, without necessary habitat and nutrition to support the metabolic demands of survival and reproduction necessary to sustain population growth, targeted management actions focused on other factors are futile. Understanding the habitat potential to support population growth is the first step towards identifying what factors are ultimately responsible for regulating population dynamics.

The physiological adaptations that deer use to survive in a variable environment, such as storing excess energy as excess fat, can be used as a lens to examine the relationship between habitat conditions and population size. Deer undergo seasonal changes in nutritional condition (i.e., body fat) that reflect the corresponding changes in food quality and availability, and metabolic demand. By relying on body stores, specifically body fat, deer can survive nutritional bottlenecks associated with winter conditions and increase their ability to provision offspring during summer. Nutritional condition itself is a direct measure of energy acquisition and debt experienced by an individual. Consequently, an animal's nutritional condition is a direct product of its environment, and offers us a unique lens to measure the quality and adequacy of an individual's or a population's habitat.



Nutritional condition represents the mechanistic link between forage quality and availability relative to the density of the population (i.e., resource limitation), thereby creating a framework to understand factors regulating population growth. Advances in the application of ultrasonograph technology to study big game allows researchers to measure the nutritional condition (% body fat) of live animals, making the linkage between habitat, nutrition and population growth possible.

Project Overview



In response to concerns about mule deer populations in Wyoming, the Wyoming Game and Fish Commission adopted the *Wyoming Mule Deer Initiative* (MDI) with the intent to develop individual management plans or strategies for key herd units based on overarching goals and objectives. Separately, the Mule Deer Working Group (2007) recognized that the “*Success and implementation of these plans will depend upon our ability to identify limiting factors to mule deer populations and their habitats*”. Of particular concern is the Wyoming Range mule deer herd in western-central Wyoming — one of the largest mule deer herds in the state and a premier destination for mule deer hunting in the country.

The Wyoming Range mule deer population (MD131) has undergone dynamic changes in recent decades from a population high of >50,000 in the late 1980s, to a sustained population of ~30,000 during the last decade (Fig. 1). Despite conservative harvest

focused on the antlered portion of the population with limited to no harvest of females, the population has failed to recover to the herd unit objective of 50,000 animals. Therefore, the question remains as to whether current habitat conditions can viably support growth in this herd, and if the great abundance of deer experienced in the late 1980s is a realistic expectation. Nevertheless, identifying the current capacity of the habitat to support mule deer in the Wyoming Range or other places has been a persistent management challenge.

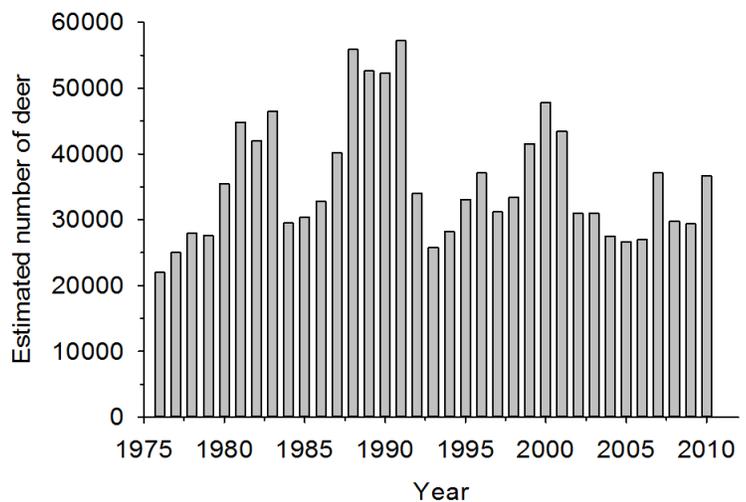


Figure 1. Population trend of Wyoming Range mule deer over 35 years.

The overall goal of the Wyoming Range Mule

Deer Project is to address important research and management needs identified by the Mule Deer Working Group in the MDI and Wyoming Range Mule Deer Initiative. **Overall, we seek to investigate the nutritional relationships between mule deer population dynamics, energy development and disturbance, habitat conditions, and climate to provide a mechanistic approach to monitoring and management of mule deer.**

Our overall approach is to mesh data on nutritional condition, forage production and utilization, and population performance to understand factors regulating Wyoming Range mule deer and the ability of the current habitat to support mule deer. In addition, funding for this primary objective provides the opportunity to address multiple secondary objectives including nutritional contributions of seasonal ranges, factors affecting reproduction, identification of habitats of nutritional and reproductive importance to mule deer, timing and delineation of important migration routes, and direct assessment of the effects of energy development on nutrition and survival of mule deer.

Mule Deer Capture

We initiated our research in March 2013 with an initial capture of 70, female mule deer that were fitted with GPS radiocollars. Since the project's initiation, we have recaptured the same cohort of deer each December and March via helicopter net-gunning — the safest and most efficacious way to capture and recapture radiocollared deer. At each capture event, new deer are also fitted with GPS radio-collars to replace mortalities. By recapturing our study animals as they enter winter ranges in December and leave winter ranges in March, we are able to use field ultrasonography to track seasonal changes in nutritional condition (i.e., fat reserves) and reproductive status. Fat measured in December yields insight into the contributions of summer range, the costs of reproduction, and the fat reserves an animal has to aid in winter survival. Measurements of fat in March reveal the nutritional contributions of winter range, and the fat reserves an animal has to aid in provisioning offspring. In addition, we use ultrasonography to assess pregnancy status and fetal rates each March.



GPS radiocollars have yielded detailed data about the habitats that deer use throughout the year, and has allowed delineation of migration routes that connect the critical winter and summer ranges that heretofore were little known (Fig. 2). Migration routes have ranged from very short distance migrations or range shifts of <5 miles, to long distances of >115 miles. GPS data will be used to delineate key migration routes, evaluate habitat conditions on seasonal ranges, and understand movements and habitat selection across the landscape throughout the year.



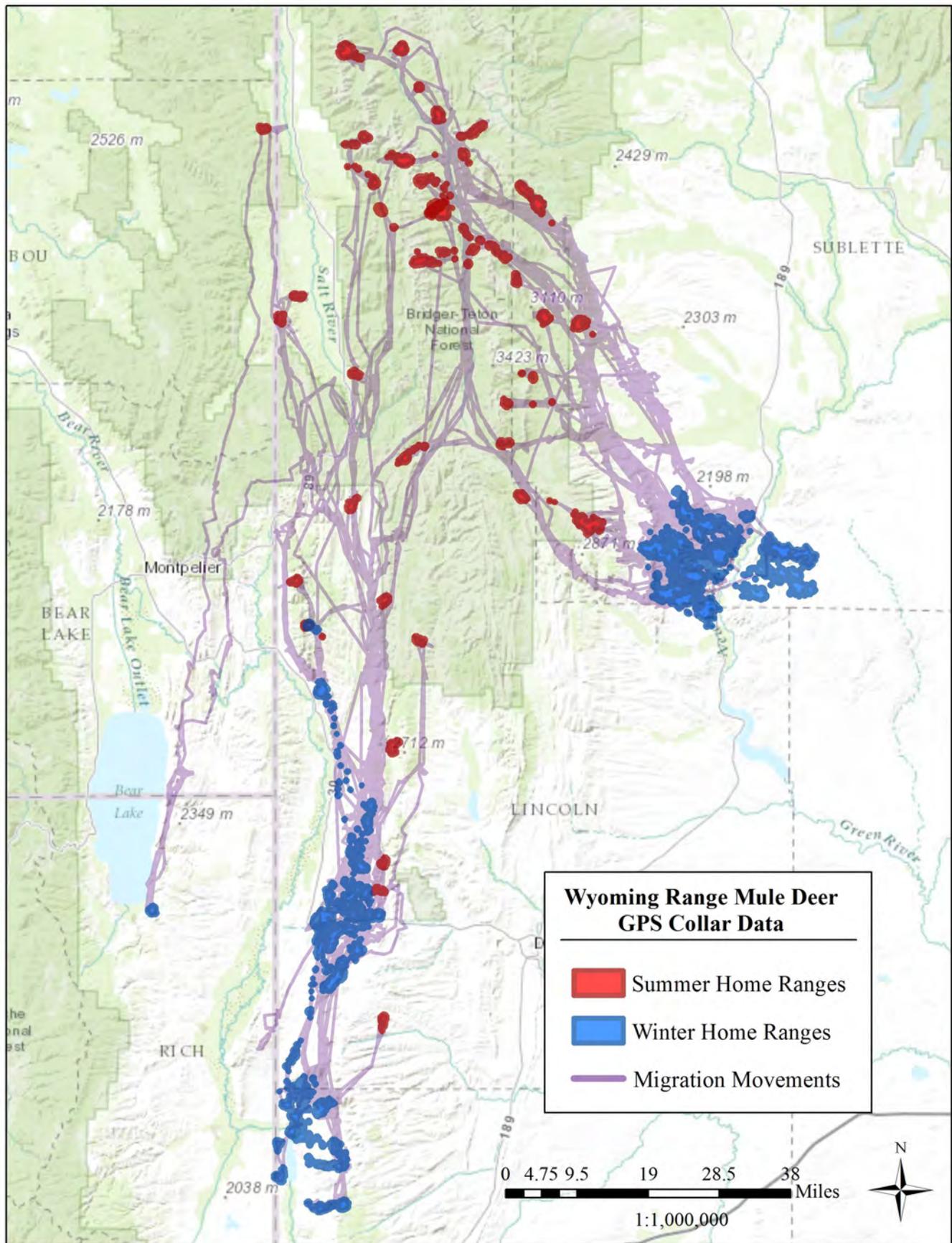


Figure 2. Map displaying the GPS collar data from 2013 used to delineate winter and summer home ranges and migration movements.

Habitat Condition

Conditions on winter range, summer range, or during migration comprise the annual resources that deer experience. If the quality on one of these critical habitats is limiting, it can effect survival and reproduction at other times of the year. We are measuring components of habitat condition across all of these seasonal ranges to better understand key habitat requirements for mule deer in this range and what factors are limiting. Our on-the-ground assessment of habitat conditions allow us to link the conditions of the landscape with the behavior, nutritional condition, reproduction, and survival of Wyoming Range mule deer.

Winter Range—To quantify potential indirect habitat loss due to human disturbance associated with energy development, we measured sagebrush production (i.e., annual leader growth) at 150 locations throughout winter ranges before deer arrive on winter ranges. After deer leave winter ranges, these sites were revisited to measure winter utilization (i.e., % browsed). We monitored changes in production and utilization of sagebrush over three years in order to capture inter-annual variability in availability of sagebrush. We also used remotely sensed data on location and density of infrastructure associated with energy development to evaluate the potential effects human disturbance may have on habitat condition.

Summer Range and Migration Routes— Using fecal samples, plant clipping and vegetation surveys, we will reconstruct diet composition of deer, availability of forage, and quality of forage that deer use on summer ranges and during migration. This information is aimed at understanding how and why animals time their migratory movements, and evaluating how forage quality influences an individual's ability to support reproduction.



1. Vegetation measurements – used to assess composition and availability of forage plants through time.



2. Fecal samples –used to assess the diet composition of mule deer.



3. Plant clippings – used to evaluate temporal changes in digestibility, available protein, and toxins.

Migration

Deer are a lot like goldilocks, they prefer to eat plants at a very specific life stage (not too old and not too young). This way, they can access the most digestible and nutrient rich food, which should ultimately result in enhanced nutritional condition.



Too Young—
Not enough
biomass

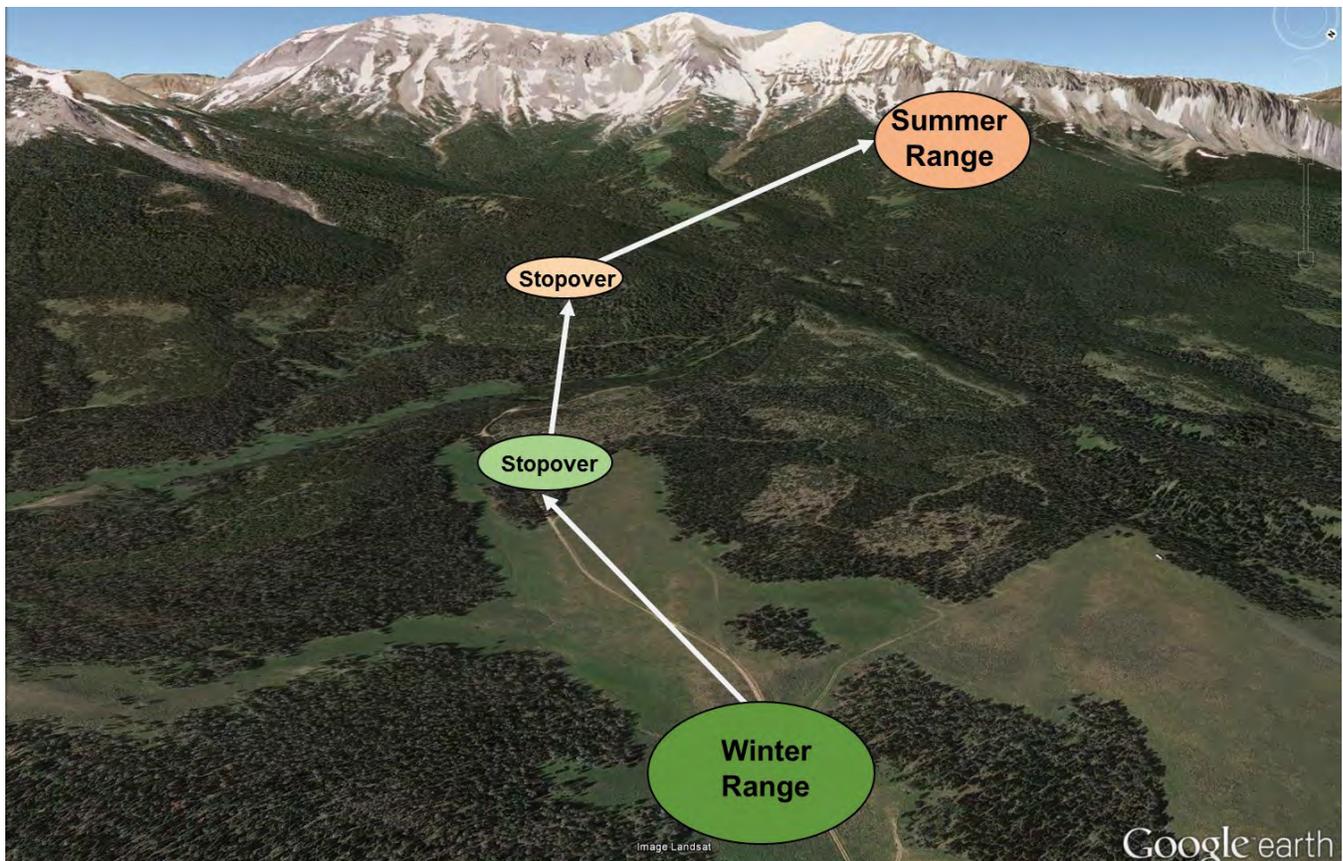


Just Right—
Easy to digest
High in nutrients



Too Old—
Build up of defense
compounds
Hard to digest

Spring green up, when plants are young and highly digestible, provides high-quality forage for deer. By migrating along an elevational gradient from low elevation winter range to high elevation summer range, deer can follow the “green-up” stage of plants that are most nutritious. Our research indicates that deer follow the green up of plants, which we call “surfing the green wave”. This research indicates that surfing the green wave is a fundamental behavior that influences migration and the forging benefit of migration, thereby emphasizing the importance of migration routes to deer not only as a means to move between seasonal ranges but also as a way to enhance resource gain in spring—a critical time for reproduction.



Drought and Migration

We linked GPS data which measures deer movements in the spring with data on spring green-up, measured via satellite imagery. Essentially, from orbiting satellites we evaluate the photosynthetic activity (plant growth) across the landscape. With these data, we are studying how deer move in response to green-up during migration and how the forage they experience during migration affects survival and reproduction. We are also interested in understanding how drought effects green-up and the subsequent habitat quality of migratory corridors.

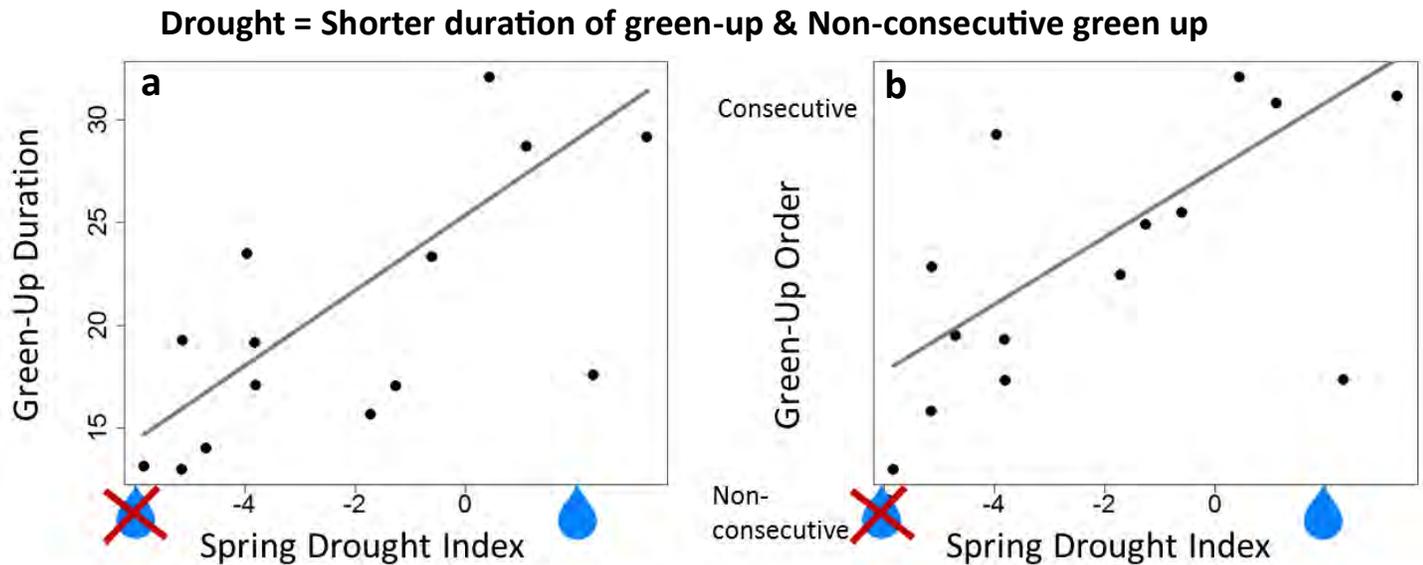


Figure 3. (a) Duration of green-up is shorter in drought years when compared with wet years. (b) Green-up along migration routes is more consecutive (sequentially order along the migration route) in wet years than in dry years.

Our research shows that drought changes the way plants green up across the landscape (Fig. 3). As a result,

the amount of time that deer are exposed to high-quality forage (as indexed by a tracking score) is shorter in drought years, than in non-drought years (Fig. 4). The consequences of drought years modifying the presumed benefits of migration have yet to be documented, however, the hindered tracking of spring as it moves up the mountain surely holds some nutritional costs. Future research will be focused on identifying migratory routes or habitat types that may be buffered from drought. If such a buffer exist, they could be excellent targets for conservation.

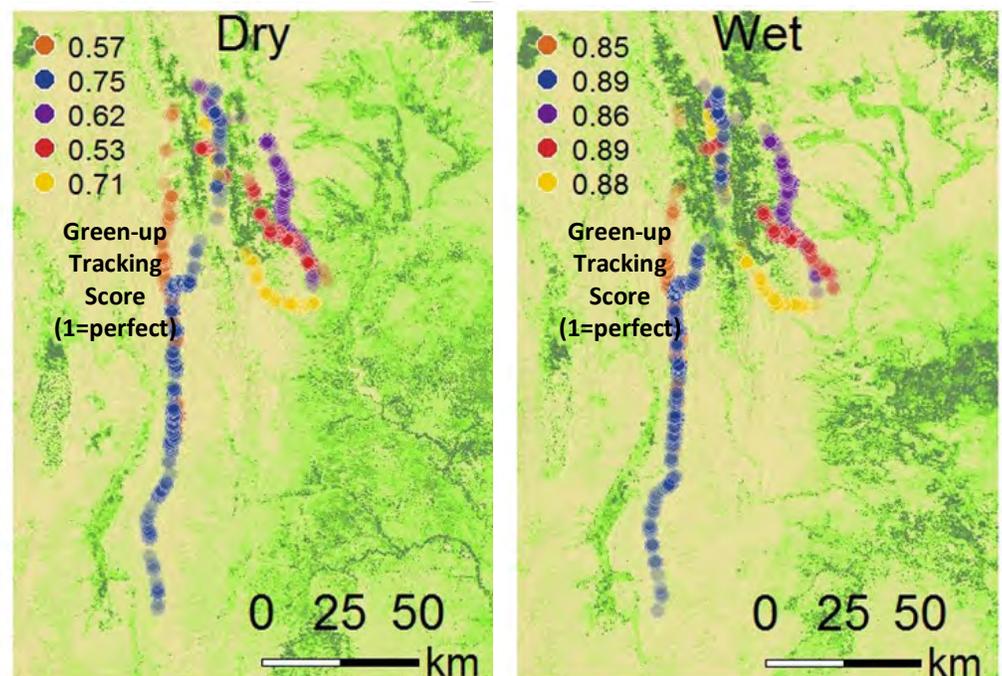


Figure 4. Comparison of green-up tracking scores for individual deer between a wet and a dry year. A score of 1 indicates a deer that has perfectly tracked the timing of green-up and presumably accessed the best quality forage.

Winter Habitat Conditions, Behavior, and Nutritional Condition

Energy development is widespread throughout western Wyoming and much has occurred on winter ranges for migratory mule deer. Although encroachment of human disturbance resulting from energy development can directly reduce available forage through habitat loss, human disturbance can invoke avoidance behavior and alter habitat selection and foraging behavior. Such behavioral responses may exacerbate the nutritional bottleneck inherent to winter ranges by further restricting access to and use of otherwise available forage. The effects of the resulting indirect habitat loss may far exceed that of direct habitat loss by magnifying the loss of available forage and further reducing the nutritional carrying capacity of winter ranges exposed to human disturbance.



To evaluate the effects of energy development on the nutritional carrying capacity of winter ranges for mule deer, we aim to 1) identify behavioral responses to human disturbance, 2) link behavior and habitat conditions – including exposure to human disturbance

– to nutritional condition (i.e., fat reserves over the winter), and 3) quantify indirect habitat loss by measuring forage availability and use on the landscape. Our approach entails coupling data collected from GPS collars and longitudinal changes in nutritional condition of individual mule deer with on-the-ground measurements of foraging conditions, human disturbance, and use of foraging patches. For this component of our research, we've targeted our efforts across three primary winter ranges with varying degrees of energy development (Fig. 5). Our study area includes winter ranges for Wyoming Range mule deer near Evanston and Cokeville (SouthWR) and west of Big Piney and LaBarge (NorthWR). We also included winter ranges on Pinedale Anticline Project Area (PAPA) into our study. Inclusion of winter ranges on PAPA and the mule deer population that occurs there allows us to compare effects among winter ranges with varying intensities of human disturbance resulting from energy development.

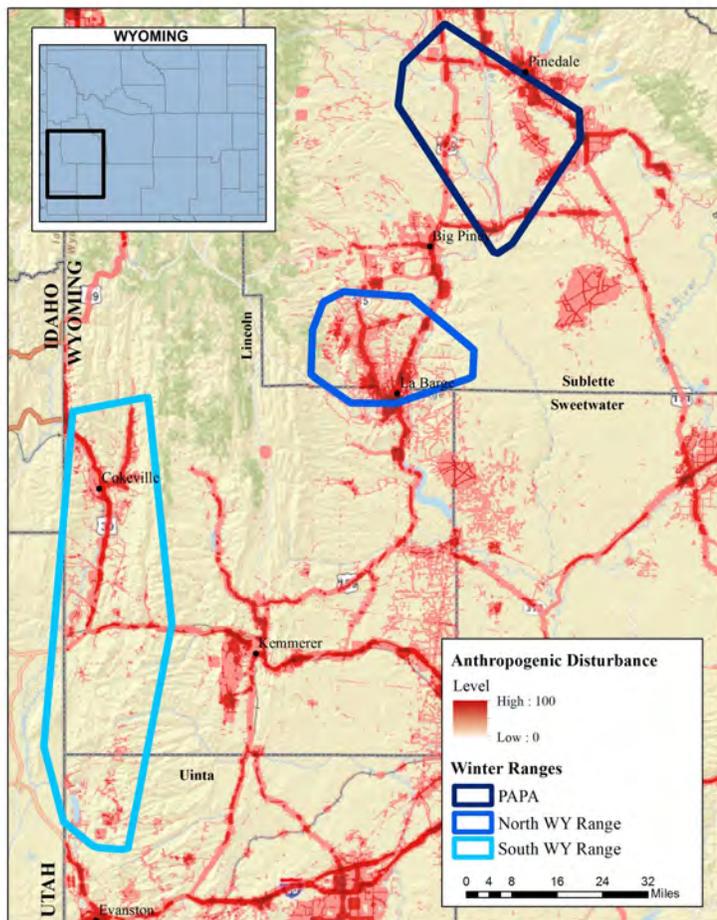


Figure 5. The study area including three winter ranges that vary in intensity of human disturbance.

Winter Habitat Conditions

Habitat conditions across the 3 winter ranges vary in both levels of human disturbance and forage production. Although the percent of the total infrastructure resulting from energy development covers less than 10% of the total habitat across all winter ranges (2.17% of 1,025,980km² on PAPA, 7.41% of 620,563km² on NorthWR, and 1.23% of 1,925,317km² on SouthWR), human activity as measured by traffic volumes is substantially higher on PAPA winter ranges when compared with NorthWR and SouthWR (Fig. 6). Furthermore, the average known age of development is far younger on PAPA than on NorthWR and SouthWR winter ranges (9 years, 31 years, and 22 years, respectively). Therefore time of exposure and intensity of human disturbance varies widely among winter ranges.

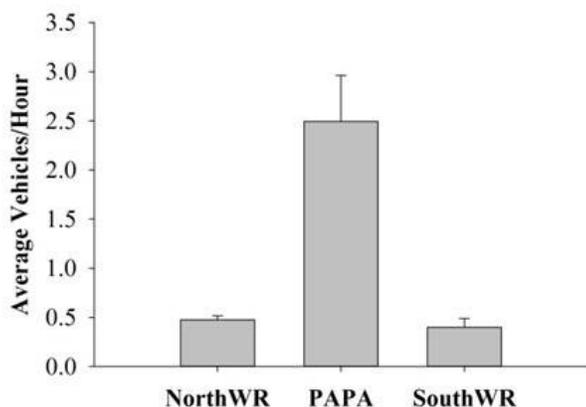


Figure 6. Traffic volumes across the three winter ranges.

Typical development on PAPA winter ranges.

Forage production varied among years and was closely correlated to precipitation throughout the growing season (Figs. 7 and 8). However, NorthWR winter ranges were consistently more productive in annual leader growth of sagebrush suggesting greater, relative availability of forage on NorthWR in comparison to SouthWR and PAPA.

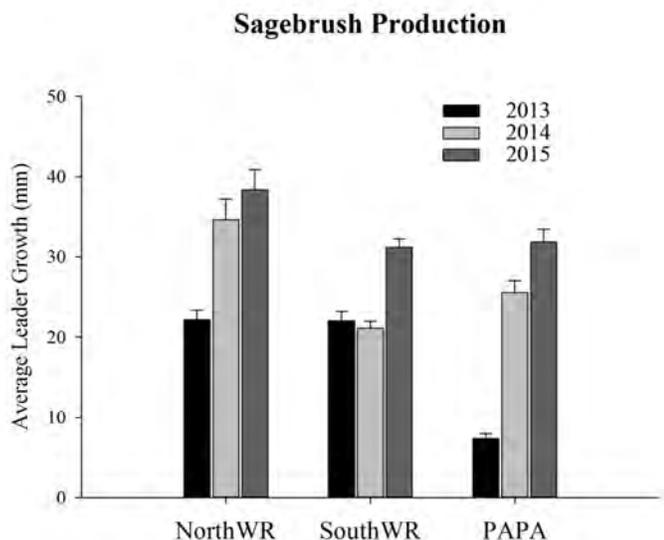


Figure 7. Annual averages of leader growth for each winter ranges among years.

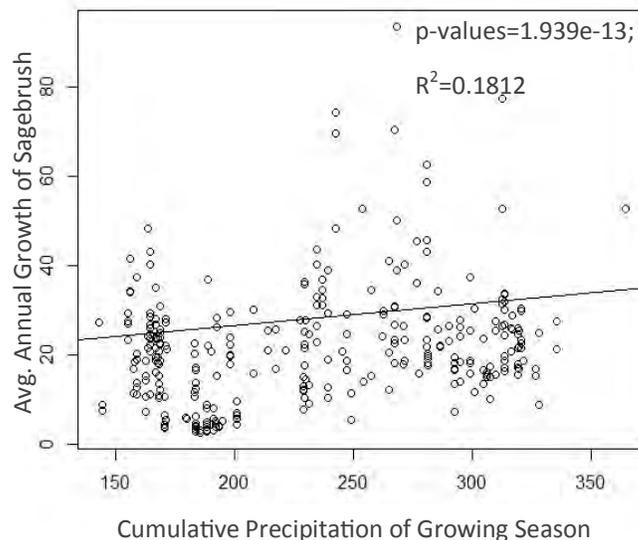


Figure 8. Positive relationship between annual growth of sagebrush and cumulative precipitation May—Sept.

Behavior

In assessing use of available sagebrush on winter ranges, our preliminary findings revealed that use of sagebrush increases with distance to energy development and is dependent on the amount of annual leader growth (Fig. 9). These findings suggest that although mule deer appear to be avoiding otherwise available forage near human disturbance, they are willing to forage in patches near human disturbance as long as the forage benefit is high. These findings offer evidence that avoidance of human disturbance is resulting in less use of otherwise available forage; however, the effects of this indirect habitat loss are potentially lessened in patches where production of leader growth in sagebrush is high.

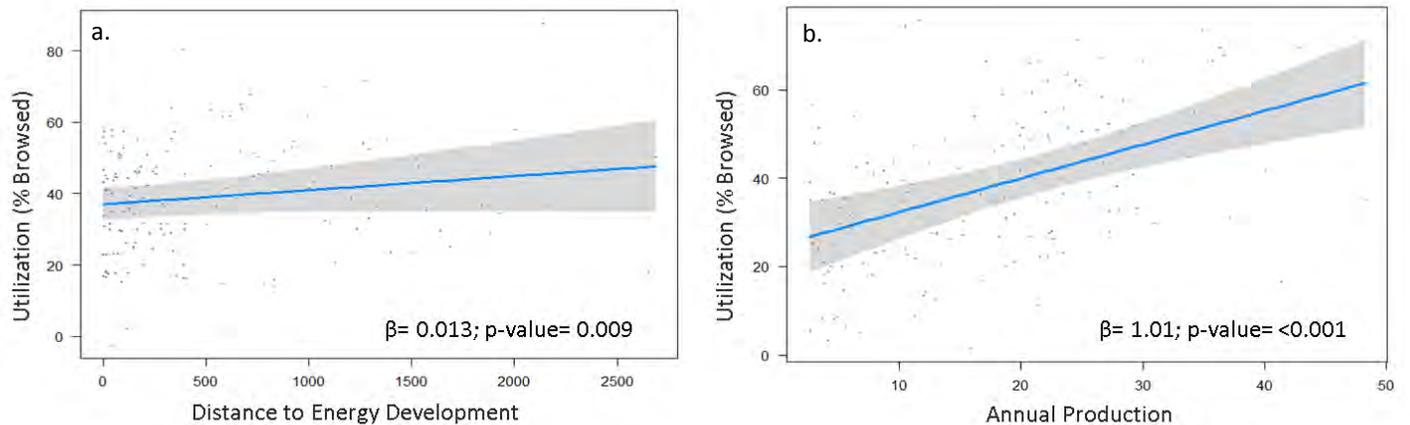


Figure 9. There is a positive relationship between use of foraging patches, (a) distance to development and (b) production (i.e., leader growth), but an interaction between distance to development and production reveals that the effect of distance to development is less when production is high.

Nutritional Condition

Although December body fat is often a strong predictor of fat loss over the winter months, our preliminary results show that mule deer populations on more productive winter ranges (i.e., winter ranges with higher annual leader growth of sagebrush), come out of winter in better nutritional condition (i.e., have more body fat in March; Fig. 10). This evidence suggests that forage availability on winter ranges may have effects on adult survival and reproduction that may carry-over into the summer months.

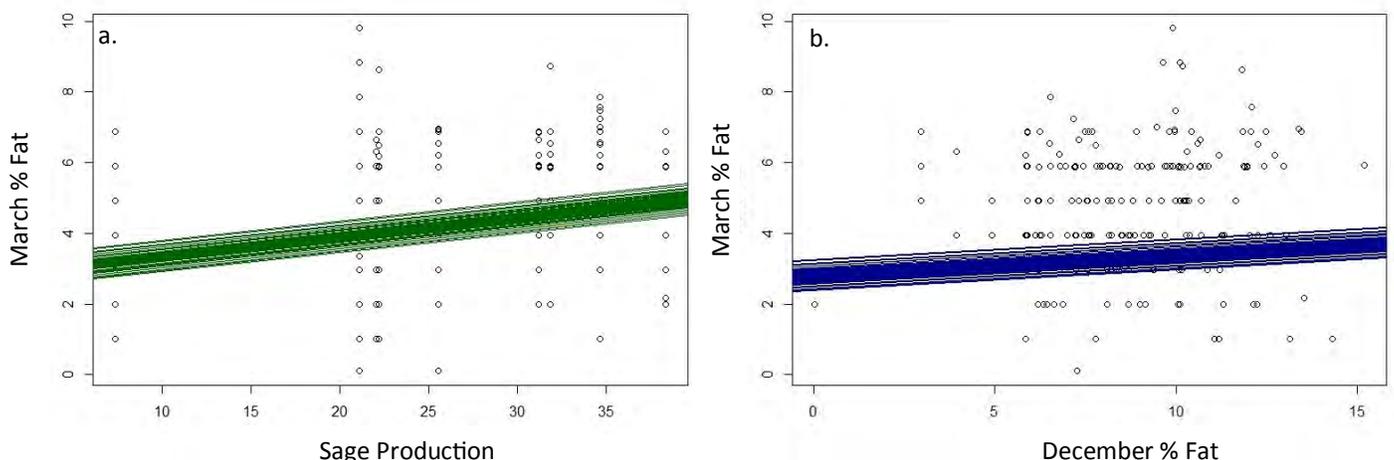


Figure 10. The best model for predicting fat at the end of winter resulted in a positive relationships between % fat in March, (a) sagebrush production on winter ranges, and (b) % fat in December.

Adult Survival

Survival of adult female ungulates is notoriously high, with little variation from year to year. Nevertheless, adult survival if suppressed, can have dramatic influences on population growth. We measured survival of adult females from our radiocollared sample during winter (Nov–Apr) and summer (May–Oct), beginning in May 2013.

Adult survival was relatively high (Fig. 11), but was lower when the study began in 2013 than during 2015. Also, survival during summer was slightly lower than that measured during winter—which conflicts with some current opinions. Average annual survival for the current duration of the study was 0.915.

Seasonal survival was influence primarily by 2 factors, age and nutritional condition. During winter, age affected survival negatively, with older age classes having a lower probability of survival (Fig. 12). In contrast, during summer, nutritional condition of females as measured in March had a positive influence on summer survival, with females exiting winter in poor nutritional condition having a lower probability of surviving the summer than females in good nutritional condition in March (Fig. 13).

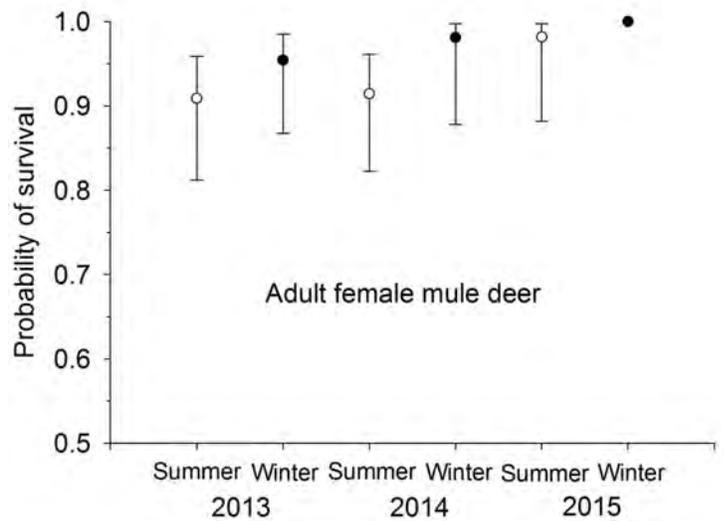


Figure 11: Survival of adult female mule deer in the Wyoming Range deer herd during winter (Nov–Apr) and summer (May–Oct) during 2013–2015.

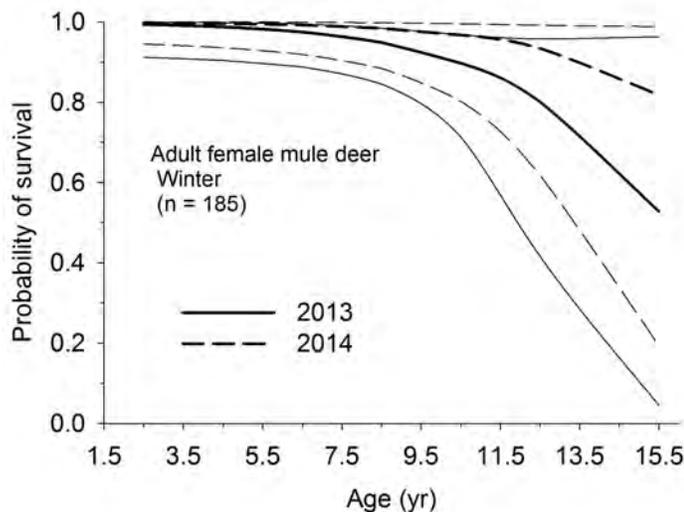


Figure 12: Probability of winter survival (Nov–Apr) as a function of age for adult female mule deer in the Wyoming Range herd during 2013 and 2015.

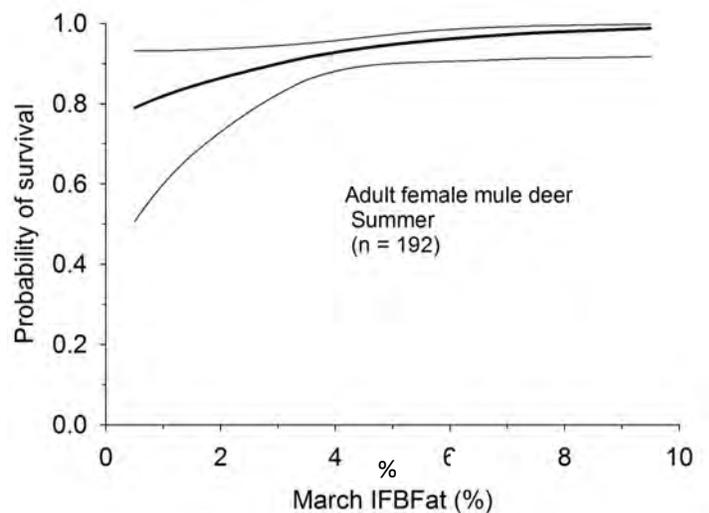


Figure 13: Probability of summer survival (May–Oct) as a function of March nutritional condition (% body fat) for adult female mule deer in the Wyoming Range herd during 2013 and 2015.

Reproduction

Pregnancy and fetal rates (number of young in utero) is typically high. That is, adult mule deer are rarely not pregnant, and most often, are carrying twins. The deer in the Wyoming Range fit this pattern. During our 3 years of monitoring thus far, pregnancy rates have consistently exceeded 95%, and fetal rates are about 1.7 fawns per female (Fig. 14). Therefore, reproductive rates are sufficiently high, and the key factor then, underpinning population dynamics that our work continues to explore is what determines survival and recruitment of young.

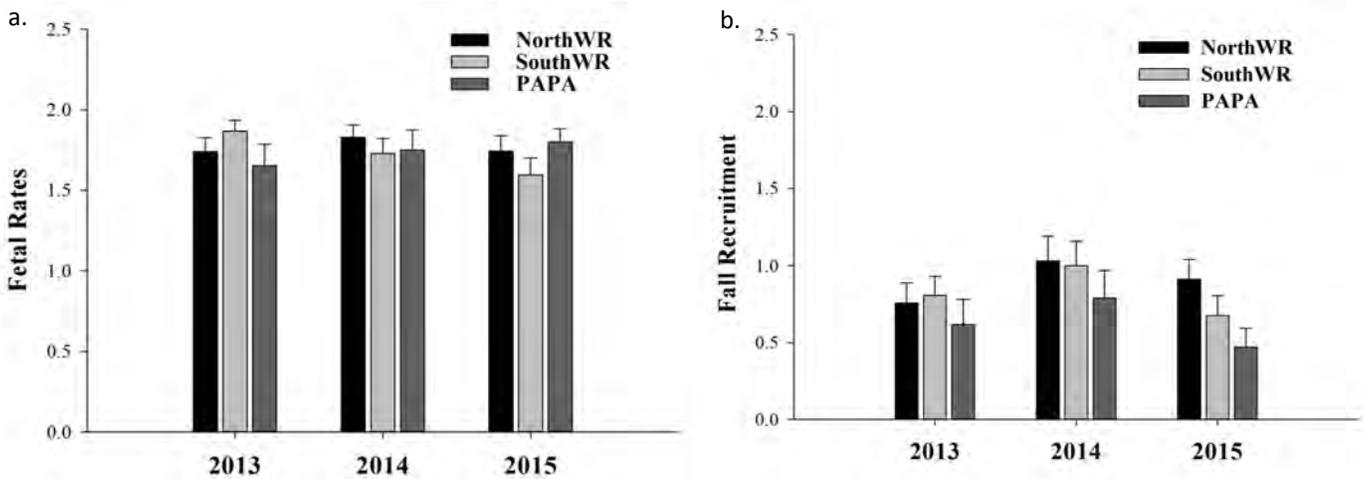


Figure 14: (a) Fetal rates (number of young in utero) and (b) recruitment rates (number of young at heel in December) for the north and south Wyoming Range deer herd and deer on the Pinedale Anticline Project Area during 2013–2015.

Producing and rearing young is energetically expensive, and comes at a cost to nutrition condition for female deer. The cost however, is mediated by environmental conditions and forage availability, as was evident in the apparent differences in nutritional condition of females in December for those that succeeded to rear 2 young in 2013 and 2014; costs of successful reproduction were much greater during the drought of 2013 as compared to the wet year of 2014 (Fig. 15).

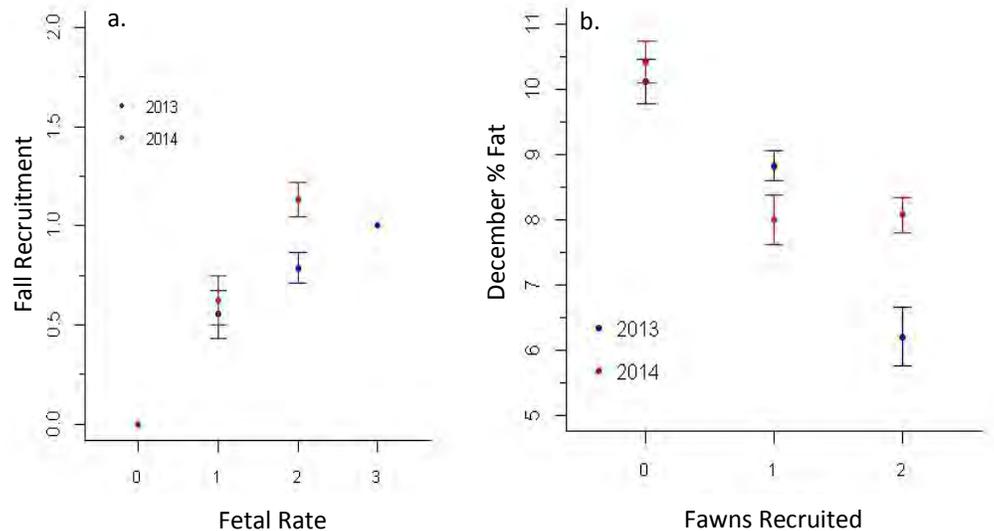


Figure 15: (a) Number of recruited young in December relative to number of fetuses in March, and (b) December % Fat relative to number of fawns recruited for adult female mule deer in the Wyoming Range herd during 2013 and 2014.

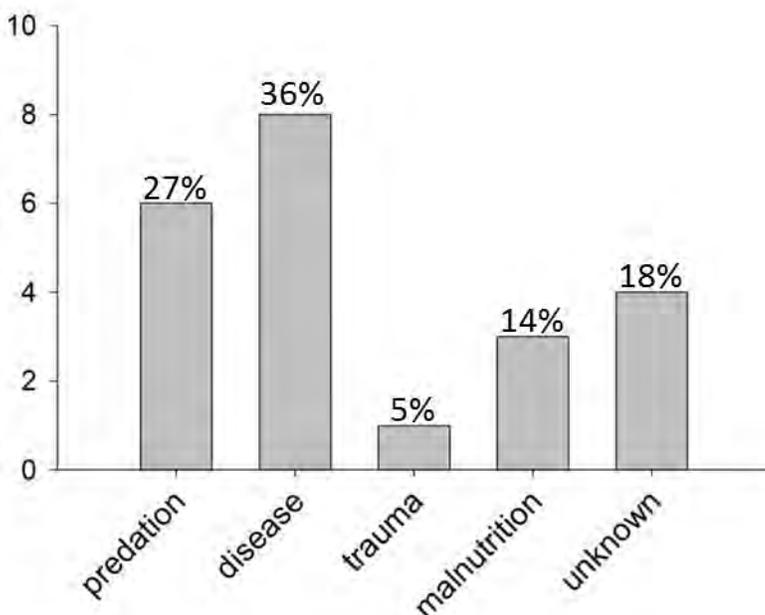
Fawn Survival

In March 2015, we initiated Phase II of the Wyoming Range Mule Deer Project aimed at identifying the relative role of factors that affect fawn survival by evaluating cause-specific mortality of young mule deer. This component of the project allowed us to exploit a unique research opportunity by enabling us to couple comprehensive research on adult demography, behavior, and habitat conditions with survival of young.



Data collection for Phase II entails fitting each radiocollared, adult deer that is pregnant in March with a vaginal implant transmitter (VIT). VITs provide us with information on the timing and location of birth; thus, enabling us to locate fawns that are collared and subsequently allowing us to monitor their daily survival and cause-specific mortality. We successfully collared and monitored 52 fawns throughout summer 2015. By November 2015, 42% of our collared fawns died due to predation, disease, trauma, malnutrition, or other unknown causes (Fig. 16).

Our first summer of data collection revealed some surprising results. Although predation is often the leading cause of mortality among mule deer fawns, we found that disease was the leading cause of mortality for fawns of the Wyoming Range in summer 2015. The most prevalent disease causing agent was adenovirus (accounting for 63% of disease-caused deaths). Adenovirus is a viral disease that can cause internal hemorrhaging and pulmonary edema. Although adenovirus has been detected in mule deer populations before, it was not known to be prevalent in Wyoming until our research detected it. Further work is necessary to understand what this disease means for Wyoming Range deer and will be a focus of our efforts in the upcoming year.



This is the typical condition of a fawn that died of adenovirus. Most were found fully intact and without any sign of predation or an obvious cause of death. Adenovirus was confirmed in these mortalities at the Wyoming State Veterinary Lab.

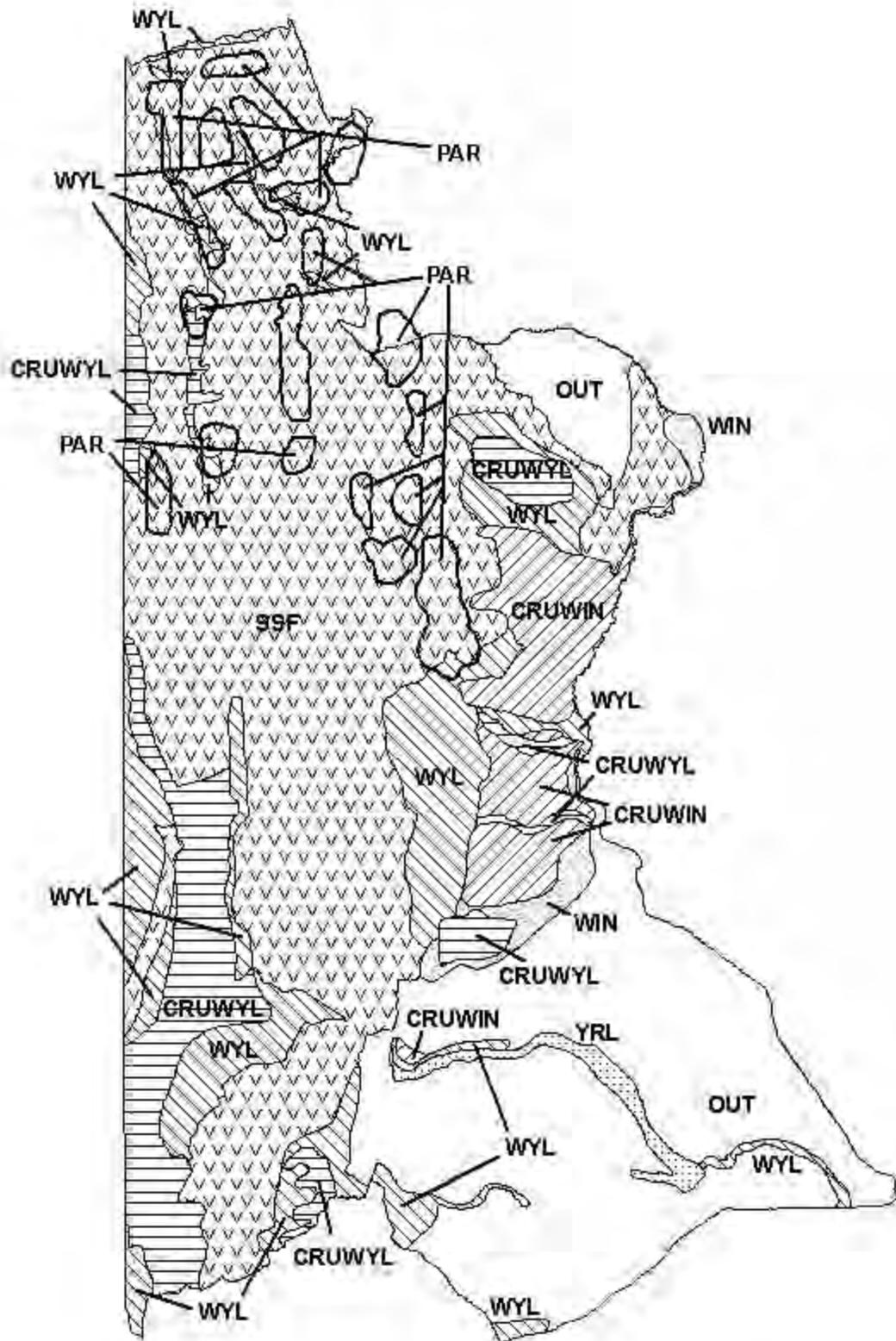
Figure 16. Causes of death for the 22 fawn mortalities detected throughout summer 2015.

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