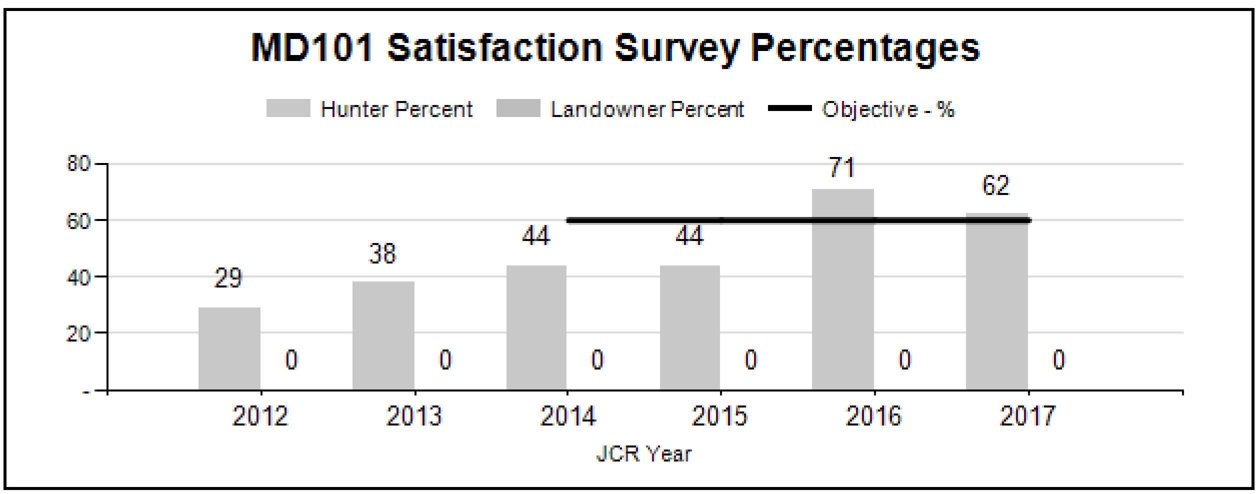
2017 - JCR Evaluation Form

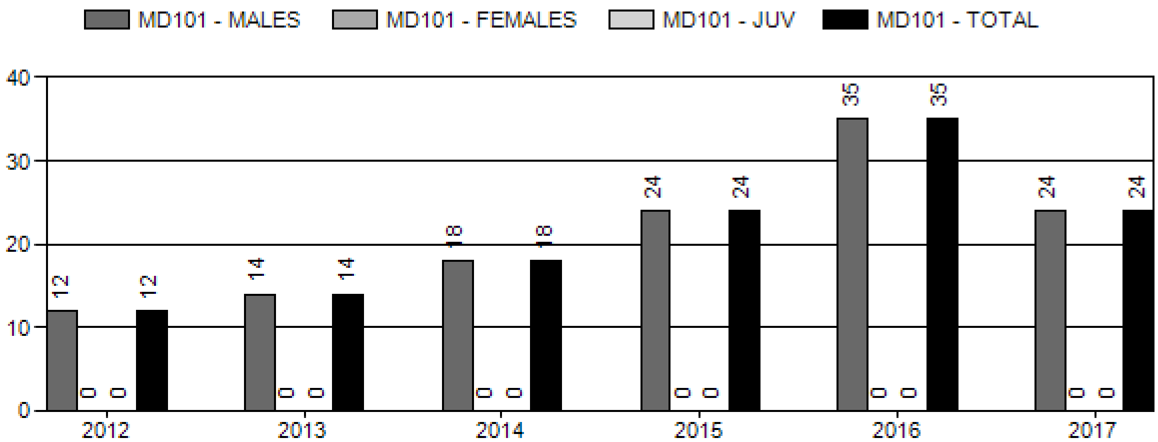
SPECIES: Mule Deer
PERIOD: 6/1/2017 - 5/31/2018
HERD: MD101 - TARGHEE
HUNT AREAS: 149
PREPARED BY: ALYSON COURTEMANCH

	2012 - 2016 Average	2017	2018 Proposed
Hunter Satisfaction Percent	48%	48%	65%
Landowner Satisfaction Percent	NA	NA	NA
Harvest:	21	24	30
Hunters:	83	87	100
Hunter Success:	25%	28%	30%
Active Licenses:	83	87	100
Active License Success:	25%	28%	30%
Recreation Days:	407	441	400
Days Per Animal:	19.4	18.4	13.3
Males per 100 Females:	0	0	
Juveniles per 100 Females	0	0	

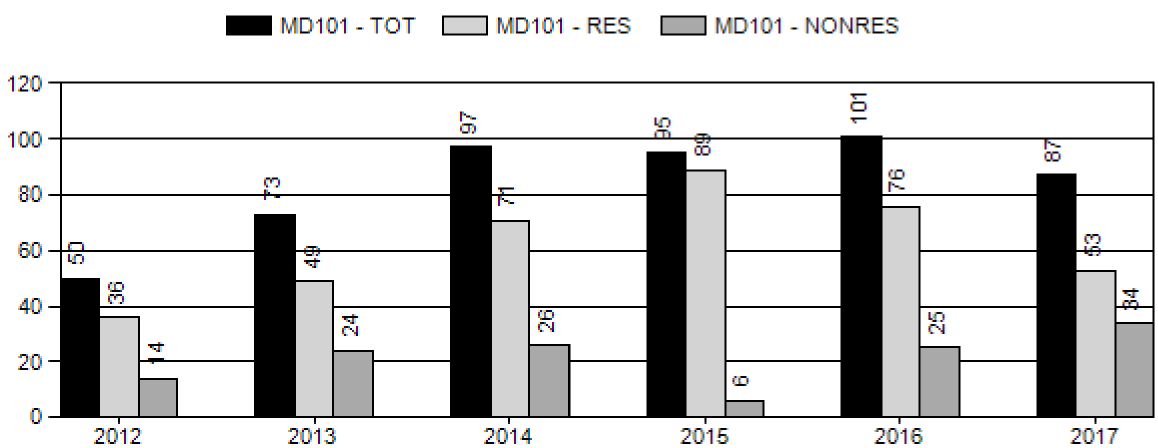
Satisfaction Based Objective	60%
Management Strategy:	Recreational
Percent population is above (+) or (-) objective:	N/A%
Number of years population has been + or - objective in recent trend:	0



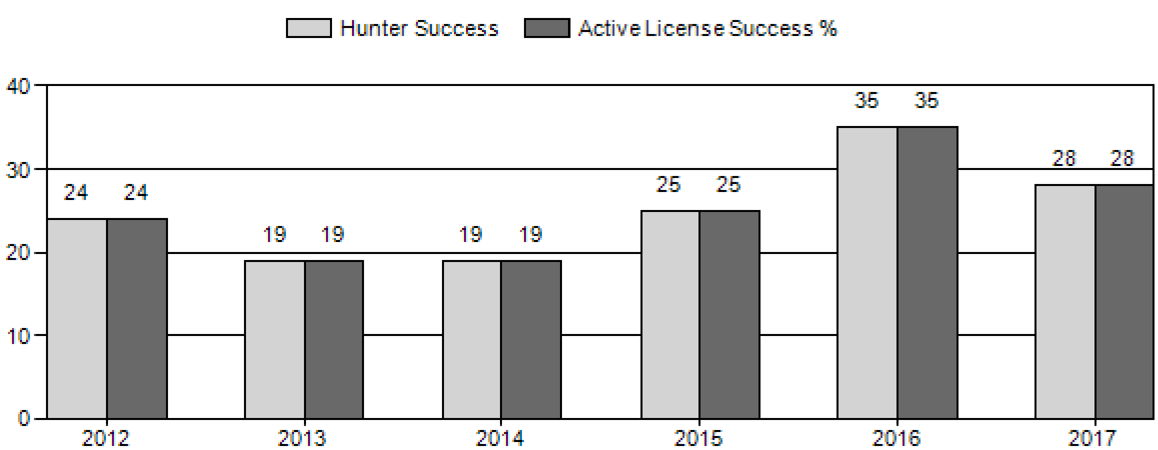
Harvest



Number of Active Licenses



Harvest Success



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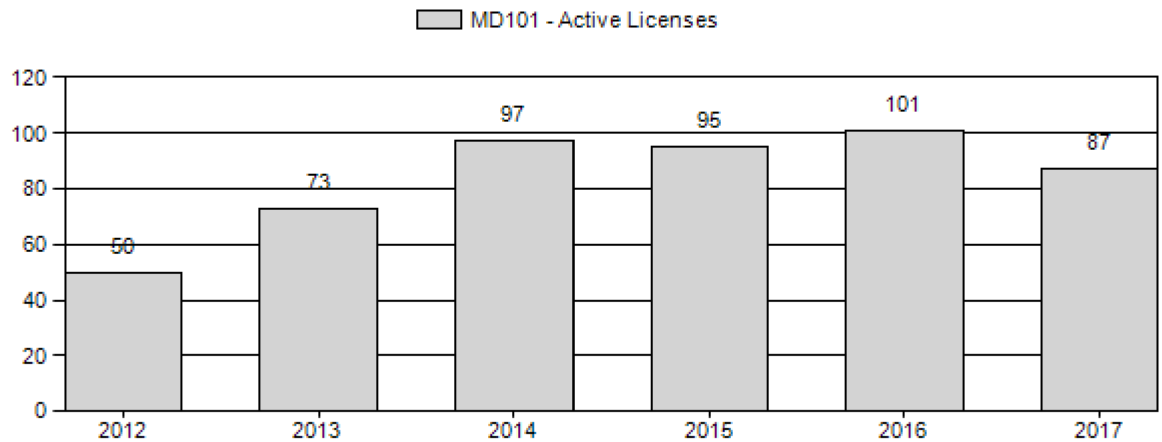
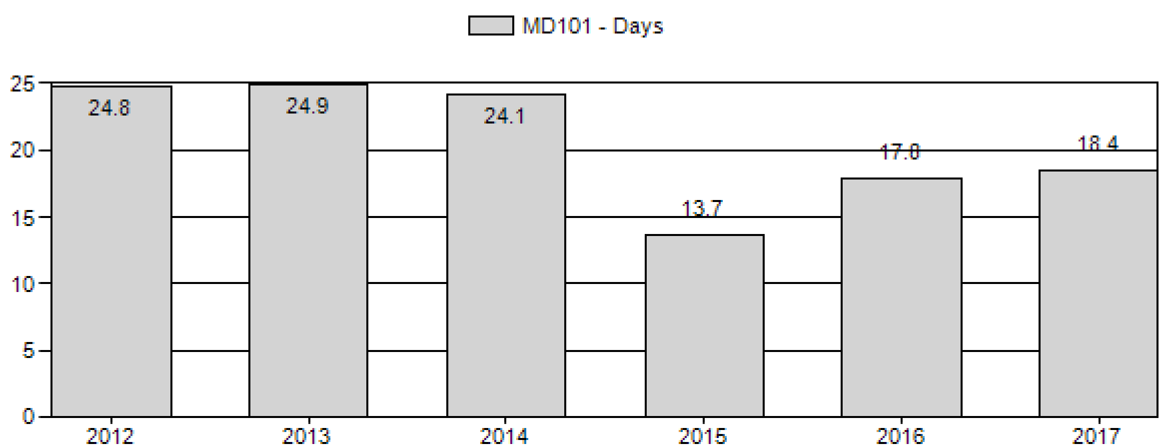
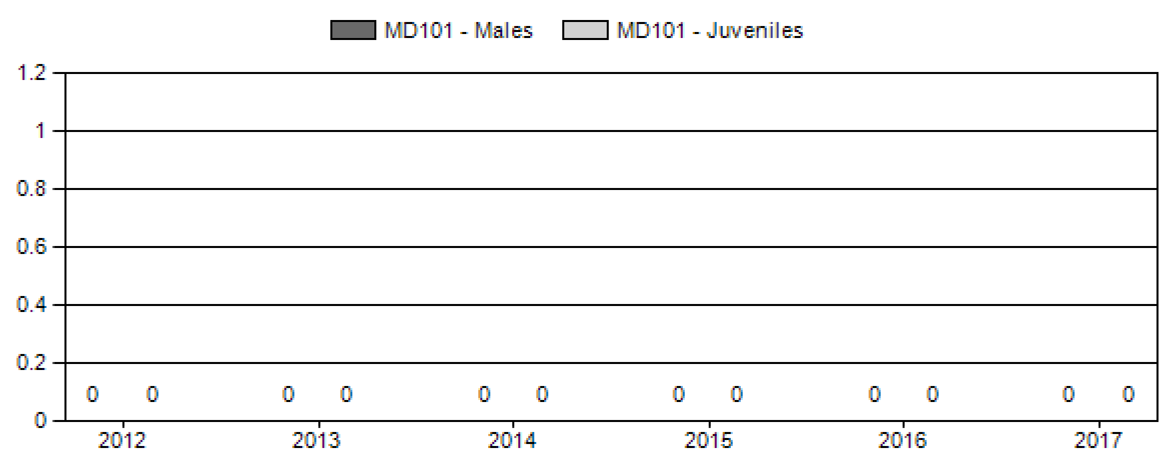


Days per Animal Harvested



Postseason Animals per 100 Females



2018 HUNTING SEASONS
TARGHEE MULE DEER HERD (MD101)

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
149		Sep. 15	Oct. 6		General	Antlered mule deer three (3) points or more on either antler or any white-tailed deer
	3	Sep. 15	Nov. 30	15	Limited quota	Any white-tailed deer
	8	Sep. 15	Nov. 30	50	Limited quota	Doe or fawn white-tailed deer
149	Archery	Sep. 1	Sep. 14			Refer to Section 3 of this Chapter

Management Evaluation

Current Hunter/Landowner Satisfaction Management Objective:
Primary Objective: Achieve a 3-year average of ≥ 60% of hunters indicating they are "satisfied" or "very satisfied" on the harvest survey.
Secondary Objective: Achieve a 3-year average of ≥ 15% harvest success.
Management Strategy: Recreational
2017 Hunter Satisfaction Estimate: 62%
2017 Hunter Success: 28%
Most Recent 3-Year Running Average Hunter Satisfaction Estimate: 59%
Most Recent 3-Year Running Average Hunter Success: 29%

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 since the majority of the herd winters in Idaho. 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 2017, 62% of hunters indicated they were "satisfied" or "very satisfied" with hunting in the Targhee Mule Deer Herd (n=26 respondents). The average satisfaction for the past 3 years is 59%. Therefore, the herd is currently below its primary objective of ≥ 60% hunter satisfaction. However, it is promising to see that hunter satisfaction has been increasing in recent years.

In 2017, 28% of hunters were successful in the Targhee Mule Deer Herd. The 3-year average of hunter success is 29%. Therefore, the herd is meeting the secondary objective of an average of ≥ 15% harvest success over 3 years.

Herd Unit Issues

Post-season classification surveys are not flown in this herd due to budget constraints. 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. In 2017, a Type 3 any white-tailed deer license was also added.

Weather

Spring and summer 2017 produced average moisture. The area received unusually early and deep snow at higher elevations in September and October. Higher elevations in the mountains had snowpack at or above average this winter, however, the winter was exceptionally mild at lower elevations in the valleys around Jackson Hole. Mule deer experienced a relatively mild winter, especially compared to the severe winter of 2016/2017. The winter snowpack was reported at 119% of average in the Snake River Basin in late February. 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 2018. 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 2017 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 2017 biological year.

Harvest Data

Based on harvest statistics, the density of mule deer in the Targhee Herd continues to be a concern. However, there has been a promising trend in the last 3 years of increased hunter success in this herd unit. 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 (although hunter satisfaction was higher in 2016 (71%) and 2017 (62%)). The average days to harvest was 18.4 in 2017, indicating that it is difficult for hunters to find deer. Eighty-seven hunters participated in the mule deer hunt and 24 mule deer were harvested. In addition, 4 hunters harvested white-tailed deer with general licenses.

A new Type 8 white-tailed deer doe/fawn license was offered beginning in 2015 with 50 licenses. Thirty hunters utilized this license in 2017 to harvest 9 does (30% success). Since the majority of white-tailed deer occur on private land, access is likely a limiting factor for white-tailed deer harvest. Six hunters utilized the new Type 3 license in 2017 to harvest 4 white-tailed deer (67% success). These licenses will be offered again in 2018.

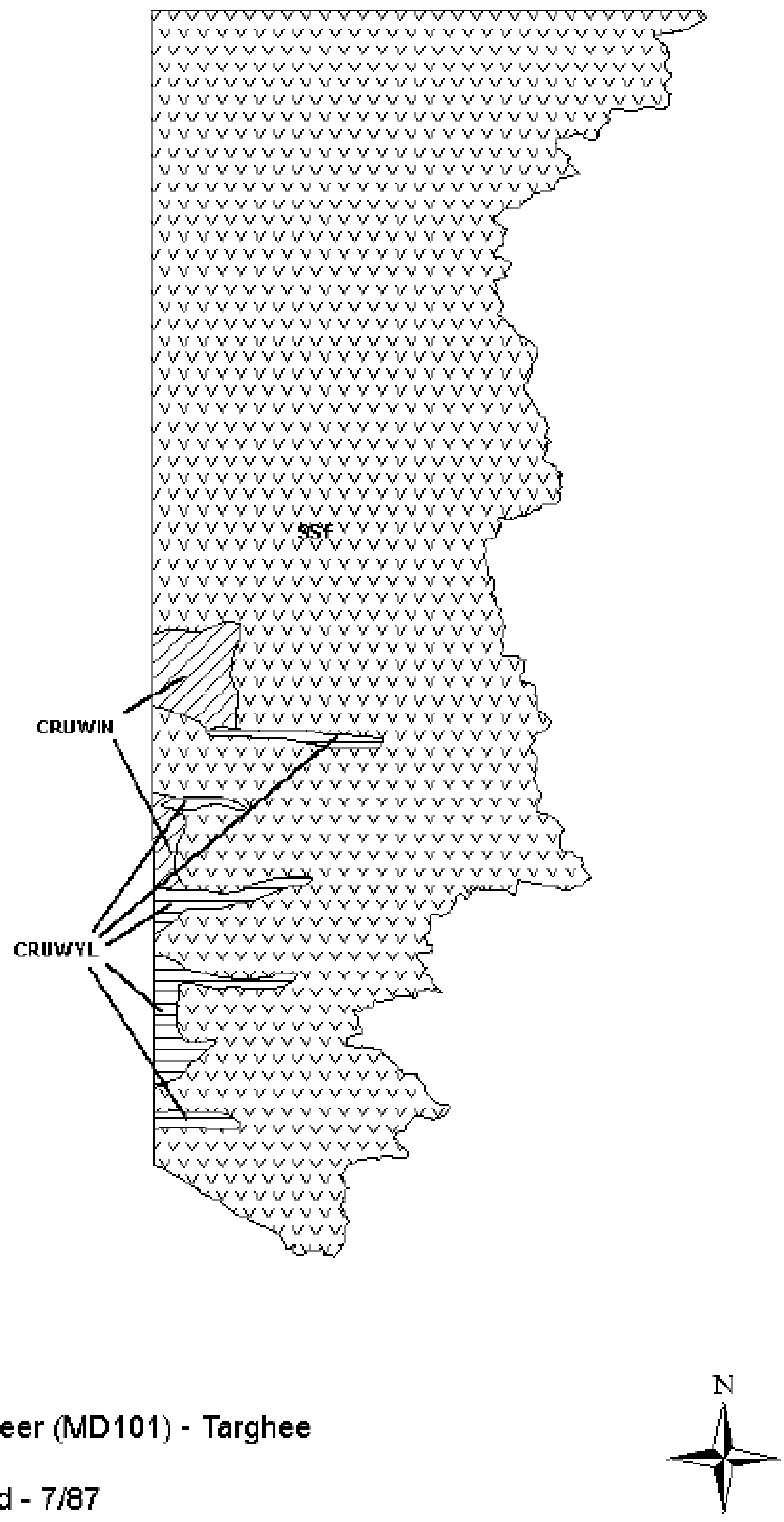
Population

This population likely declined following liberal hunting seasons in Idaho. Data are limited for this population. 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. Antlered mule deer seasons will close on October 6 to coincide with hunt season closures adjacent to Jackson.

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. Fifteen Type 3 licenses valid for any white-tailed deer were offered beginning in 2017. This is in response to a growing white-tailed deer population near private lands in the herd unit and requests by the public for additional license types. 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

2017 - JCR Evaluation Form

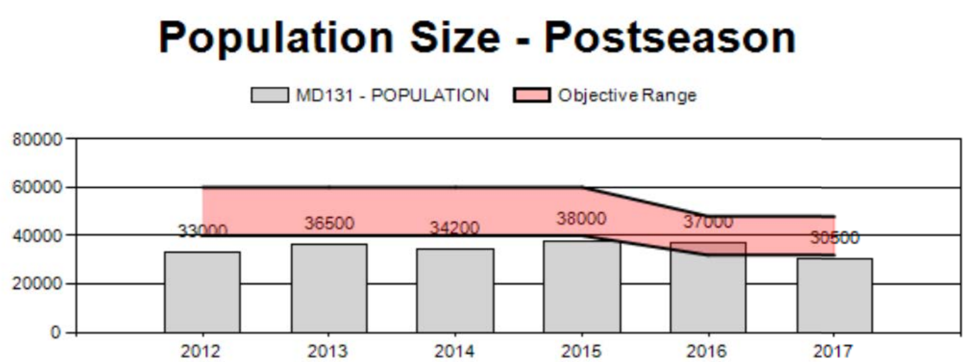
SPECIES: Mule Deer	PERIOD: 6/1/2017 - 5/31/2018
HERD: MD131 - WYOMING RANGE	
HUNT AREAS: 134-135, 143-145	PREPARED BY: GARY FRALICK

	2012 - 2016 Average	2017	2018 Proposed
Population:	35,740	30,500	29,100
Harvest:	2,808	1,355	1,228
Hunters:	5,965	4,971	5,315
Hunter Success:	47%	27%	23%
Active Licenses:	5,965	4,971	5,315
Active License Success:	47%	27%	23%
Recreation Days:	32,171	26,863	29,651
Days Per Animal:	11.5	19.8	24.1
Males per 100 Females	38	29	
Juveniles per 100 Females	66	54	

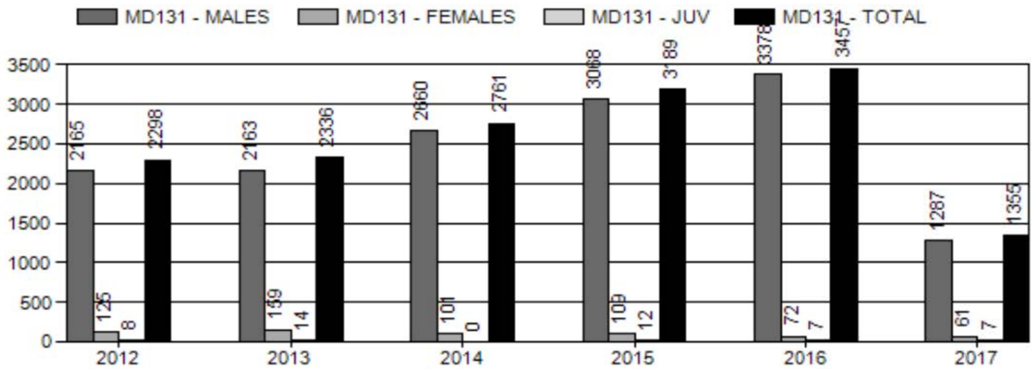
Population Objective (± 20%) :	40000 (32000 - 48000)
Management Strategy:	Special
Percent population is above (+) or below (-) objective:	-23.8%
Number of years population has been + or - objective in recent trend:	0
Model Date:	03/04/2018

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

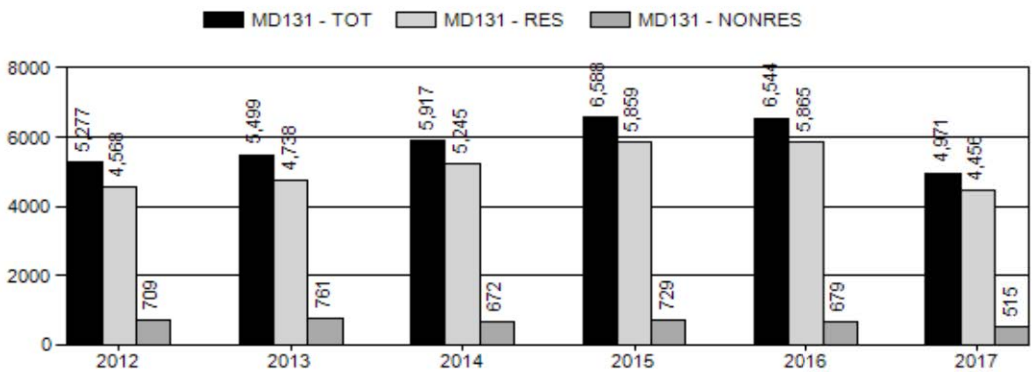
	JCR Year	Proposed
Females ≥ 1 year old:	1%	4%
Males ≥ 1 year old:	21%	19%
Total:	5%	4%
Proposed change in post-season population:	-22%	-4%



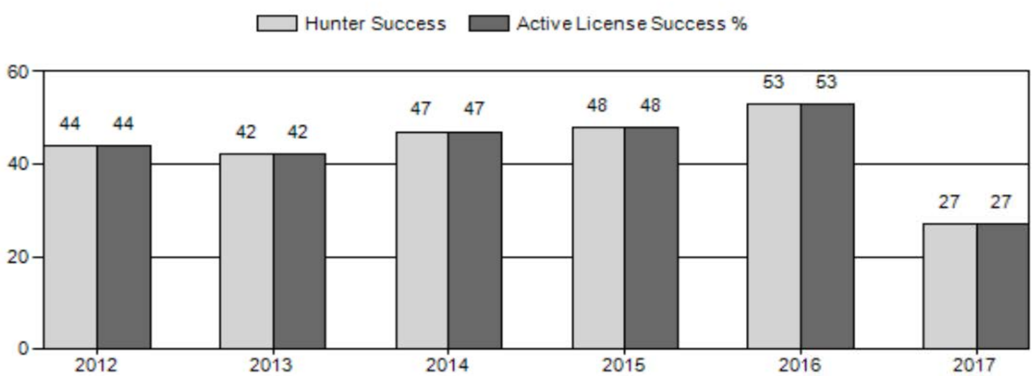
Harvest



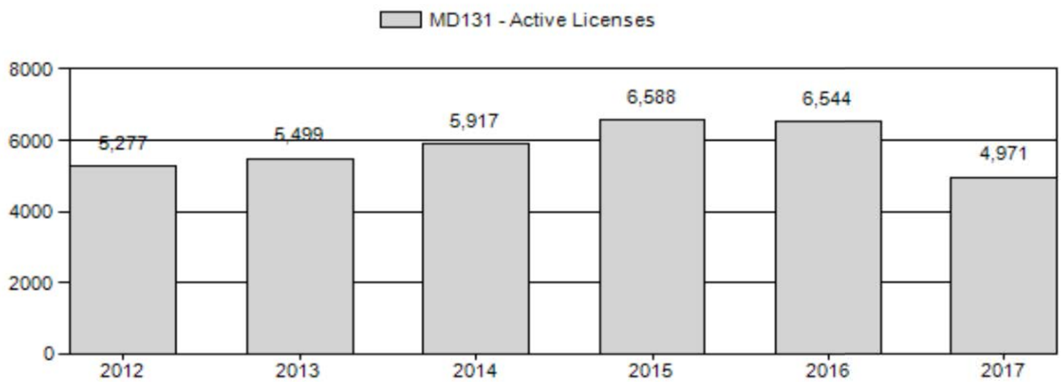
Number of Active Licenses



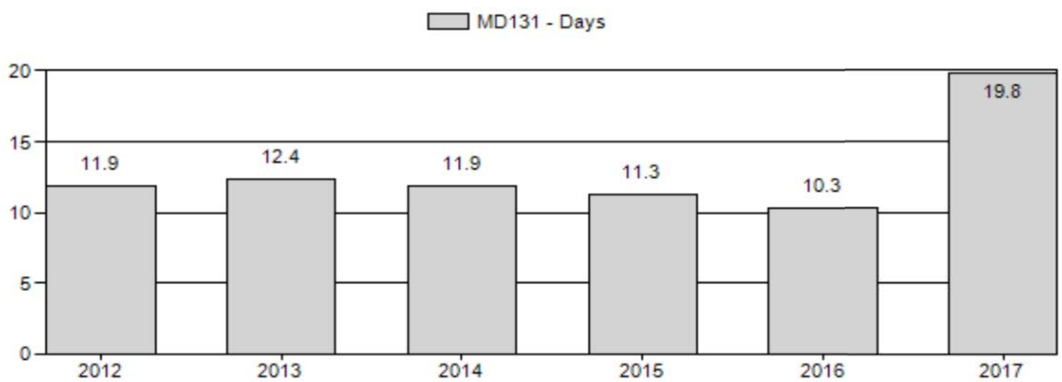
Harvest Success



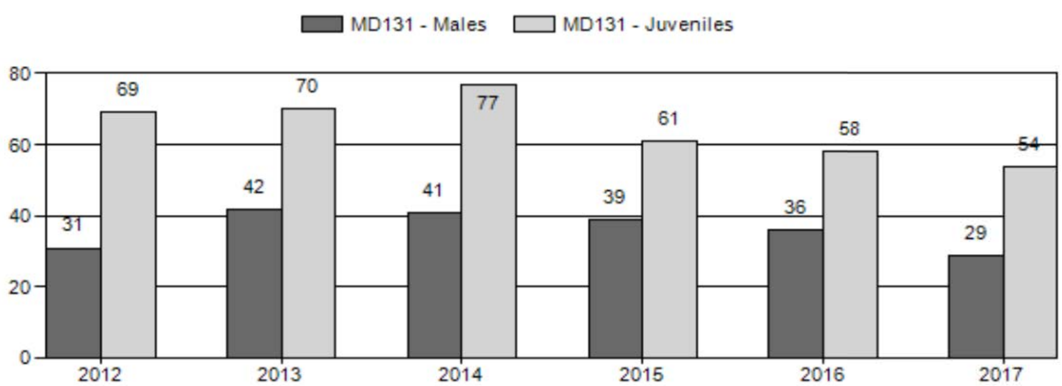
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2012 - 2017 Postseason Classification Summary

for Mule Deer Herd MD131 - WYOMING RANGE

		MALES							FEMALES		JUVENILES				Males to 100 Females				Young to		
Year	Post Pop	Ylg	2+ Cls 1	2+ Cls 2	2+ Cls 3	2+ UnCls	Total	%	Total	%	Total	%	Tot Cls	Cls Obj	Ylng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2012	33,000	251	0	0	0	439	690	15%	2,256	50%	1,556	35%	4,502	0	11	19	31	± 2	69	± 3	53
2013	36,500	544	0	0	0	704	1,248	20%	2,946	47%	2,065	33%	6,259	0	18	24	42	± 2	70	± 2	49
2014	34,200	582	627	428	274	0	1,313	19%	3,239	46%	2,478	35%	7,030	0	18	23	41	± 2	77	± 2	54
2015	38,000	672	408	308	158	0	1,546	20%	3,930	50%	2,381	30%	7,857	0	17	22	39	± 1	61	± 2	43
2016	37,000	533	420	303	107	0	1,363	18%	3,810	52%	2,220	30%	7,393	0	14	22	36	± 1	58	± 2	43
2017	30,500	172	428	281	74	0	955	16%	3,324	55%	1,791	30%	6,070	0	5	24	29	± 1	54	± 2	42

2018 HUNTING SEASONS
WYOMING RANGE MULE DEER HERD (MD131)

Hunt Area	Type	Season Dates Opens	Season Dates Closes	Quota	License	Limitations
134		Oct. 1	Oct. 10		General	Antlered mule deer three (3) points or more on either antler or any white-tailed deer
135		Oct. 1	Oct. 10		General	Antlered mule deer three (3) points or more on either antler or any white-tailed deer
143		Sep. 15	Oct. 6		General	Antlered mule deer three (3) points or more on either antler or any white-tailed deer
144		Sep. 15	Oct. 6		General	Antlered mule deer three (3) points or more on either antler or any white-tailed deer
145		Sep.15	Oct. 6.		General	Antlered mule deer three (3) points or more on either antler or any white-tailed deer
145	3	Sep. 15	Nov. 15	50	Limited quota	Any white-tailed deer
145	3	Nov. 16	Jan. 31			Antlerless white-tailed deer
134, 135		Sep. 1	Sep. 30			Archery only – Refer to Section 3 of this Chapter
143, 144, 145		Sep. 1	Sep. 14			Archery only - Refer to Section 3 of this Chapter

REGION G NON-RESIDENT QUOTA - 400 LICENSES

SUMMARY OF PROPOSED CHANGES BY LICENSE NUMBER

Area	**License Type**	**Change from 2017**
Region G	NR Region G	No Change
Herd Unit Total		No Change

Management Evaluation
Current Postseason Population Management Objective: 40,000
Management Strategy: Special
2017 Postseason Population Estimate: 30,500
2018 Proposed Postseason Population Estimate: 29,100

The management objective was revised in 2016. The current population objective for Wyoming Range mule deer herd is 40,000 deer. The management strategy is special.

In February 2018 the first ever animal abundance survey was conducted in this herd unit. A total of 25,317 deer were counted on Wyoming Range winter ranges (North: Big Piney/LaBarge and Salt River - 10,074 deer, 40% of sample; South: Kemmerer/Cokeville/Evanston - 15,243 deer, 60% of sample). The sightabilty correction factor added 3,757 deer, or 13% of the population estimate. Approximately 87% of the deer estimated in the Wyoming Range mule deer herd were counted by observers. The total population estimate is 29,074 deer. At 90% Confidence the range is 28,606 – 29,542 deer.

The spreadsheet model was updated with current year's classification and harvest data, annual survival estimates for adult does and fawns, and the 2018 sightability estimate. Based on these parameters and observed data, the 2017 posthunt population estimate is 30,500 deer. The projected 2018 posthunt population is approximately 29,100 deer.

Herd Unit Issues

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. Hunting 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 that are located along the east slope of the Wyoming Range. Sustained population growth has been difficult because of the frequency of high overwinter mortality 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 A). 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 (Appendix A). 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 2016 through September 2017 was significantly above average when averaged across the entire herd unit (Figure 1). The general characteristics included an extremely wet winter followed by below average spring precipitation. Although growing season (April through June) precipitation was below average, lingering effects of significant winter precipitation and delayed melting of snow resulted in great vegetation production across all seasonal ranges.

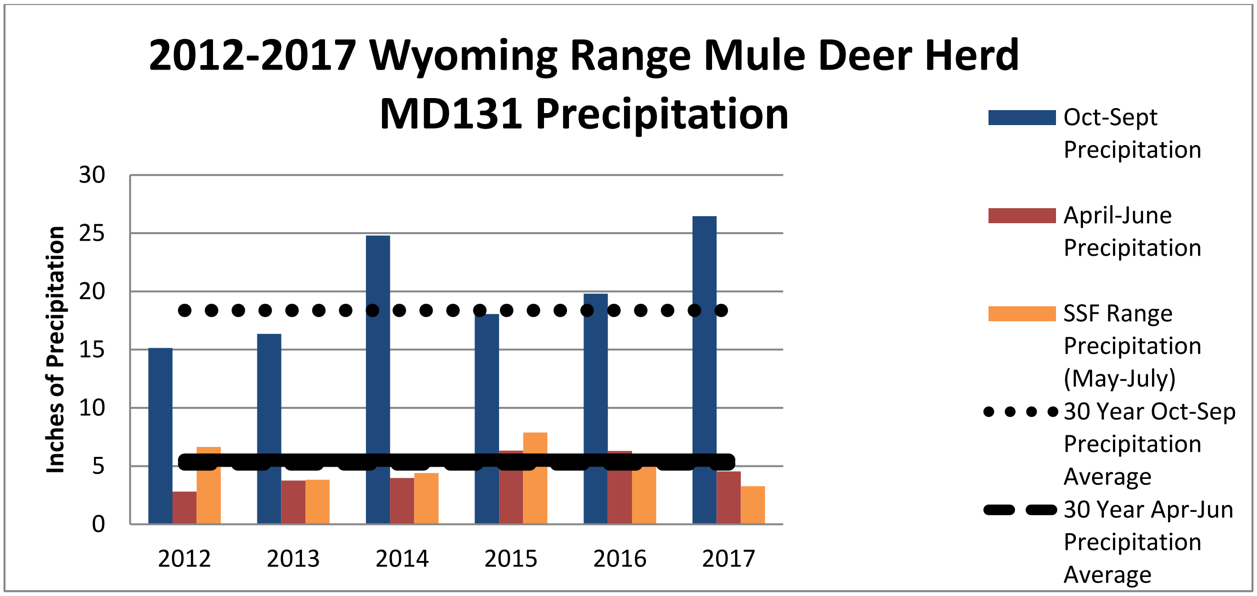


Figure 1. Precipitation levels at select sites in the Wyoming Range Mule Deer Herd, 2012-2017.

Winter Severity

The 2017-2018 winter was very light with little snow accumulation and mild temperatures on winter ranges. Body condition data collected in the Wyoming Range mule deer herd on doe mule deer indicated fawn and adult survival were likely to be very high when change in ratio classifications are conducted in spring 2018, and it was. The mild conditions in 2017-2018 follow the extreme winter of 2016-2017 which resulted in significant mortality across all age classes, but particularly fawns. High elevation mountain ranges have received snow levels near or slightly above average. As of March 1, 2018, the Upper Green River Basin is at 120% Snow Water Equivalent (SWE), the Lower Green River Basin is at 87% SWE, the Smith's and Thomas Fork Basins are at 85% SWE, and Upper Bear River Basin is at 78% SWE.

Habitat

Sagebrush and other shrubs produced excellent leader growth in 2017 which provided a good quantity of forage on winter ranges. These shrubs were largely available with minimal snow cover. Mild snow conditions allowed some deer to stay on transitional habitat most of the winter, and prompted others to leave winter ranges as early as the first week of March.

Habitat

Significant Events

Habitat treatments were conducted at several locations in 2017 throughout the herd unit. The Wyoming Range Mule Deer Habitat Project accomplishments for 2017 include: 3,175 acres of sagebrush mowing, 778 acres of aspen mechanical preparation (slashing and cut-pile), 707 acres of prescribed burning aspen, 6,242 acres of cheatgrass herbicide application, 1,730 acres of cheatgrass hand grubbing, and four livestock riders hired to manage livestock distribution post-treatment in specific project areas. Generally, vegetation has responded very well to disturbance with increased aspen density in the prescribed burn, improved leader length on sagebrush plants, increased production of herbaceous species, reduction of cheatgrass, and establishment of seeded species in treatments. More detailed information can be obtained by reading the Pinedale Region report in the 2017 Strategic Habitat Plan Annual Report.

Habitat Monitoring

Leader production in 2017 for True Mountain Mahogany increased from an average of 4.14 inches in 2016 to 5.13 inches across the five transects that were monitored. Other shrub species within habitat treatments are also being monitored and are discussed in more detail in the 2017 SHP Report (Figure 2).

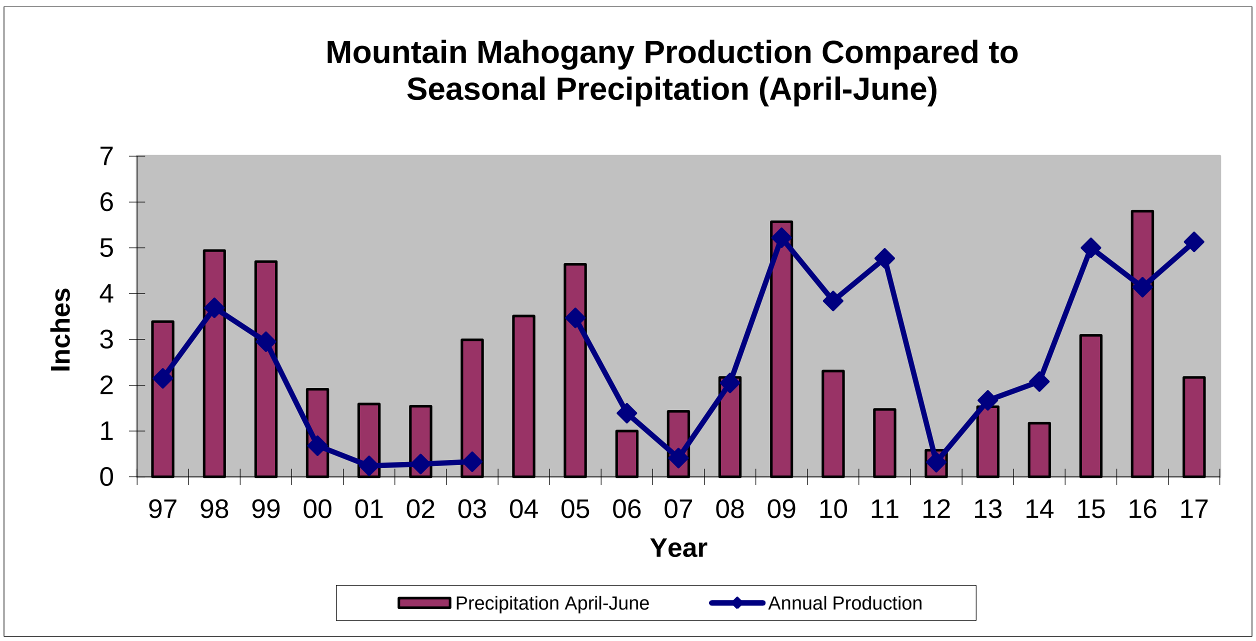


Figure 2. A depiction of true mountain mahogany production and April-June precipitation, Wyoming Range mule deer herd, 1997 – 2017.

Rapid Habitat Assessments

In 2017, Department personnel initiated the Rapid Habitat Assessment methodology to survey important mule deer habitats. This method strives to capture large-scale habitat quality metrics to better understand how the habitat is providing for the current population of mule deer. The overall end result of this effort will be to provide a standardized habitat component to discussions about how mule deer objectives should or should not be adjusted based on the general concept of carrying capacity. In 2017, 1,568 acres of Aspen RHAs and 465 acres of

Rangeland RHAs were completed in the Wyoming Range Mule Deer herd by personnel in the Pinedale and Green River Regions.

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, in addition to other factors identified by research associated with the Wyoming Range Mule Deer Project continues to suppress 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 (Appendix B). 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. 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 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 and 2016.

Adult survival has exceeded 70% during the period from 2013 – 2015. During the same three year 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. During 2015 and 2016 fall recruitment 55% and 59% of the radio-collared fawns marked in June were recruited to winter range in November, respectively.

During the winter 2016-17, the highest estimated loss of mule deer occurred in the Wyoming Range (Appendix B). Results of the Wyoming Range mule deer project indicate that 100% of all neonatal fawns radio-collared in May and June 2016 had perished. Approximately 56% of the fawns died from the time of collaring in May/June 2016 to December 2016. The surviving research fawns, 44%, died during the winter (Appendix B). Approximately 37% of the radio-collared does 2+ years died during the 2017 winter (Appendix B). Fall fawn recruitment was estimated at 51% in 2017.

During the winter 2017-18 one of the highest survival rates of radio-collared does and fawns occurred in the Wyoming Range (Appendix C). In a period of one year, over-winter survival of radio-collared does and fawns transitioned from the lowest in 2017 to the highest in 2018. Over-winter monitoring of radio-collared does indicated that 100% of all radio-collared does survived the 2017-18 winter. Similarly high survival was documented for fawns collared in June 2017. Approximately 93% of all neonatal fawns radio-collared since May and June 2017 survived the current winter (Appendix C).

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. In 2016 and 2017,   the proportion of fawns:100 does was the lowest since 1993 in Hunt Area 143 (Appendix D). The 2016 doe:fawn ratio was 50 fawns:100 does, while 45 fawns:100 does were observed in 2017. Body condition of pregnant does that arrive on winter ranges and depart in the spring is one of the primary determinants of fawn viability and survival.

Despite lower fawn survival and recruitment, 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.   Since 2009 buck:doe 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. The buck:doe ratio was 36 bucks:100 does in 2016. The effects of the 2016-2017 winter had a dramatic effect on overall buck:doe ratios observed in 2017. The 29 buck:100 does observed in 2017 was only the second time since 1993 that the buck:doe ratio dipped below the management minimum of 30 buck:100 does (Appendix D).

On 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.

Since 1988, early winter and spring herd composition surveys have been conducted to compare relative losses of fawns through the winter based on the change in fawn:100 adults ratios. The percent change between the December and April fawn:adult ratios are used to provide a relative index of over-winter mule deer mortality.

Extreme winter mortality has been documented approximately every three years based on the annual estimated percentage of fawns lost during winter. Those years with the highest estimated fawn morality are provided in Appendix E. Since 1988, the highest estimated fawn loss loss was in 2018 when the annual change in ratio metric indicated that approximately 86% of the 2016 juvenile cohort was lost during winter. Prior to 2017 and subsequent to the 2011 winter, there was a five-year period, 2012 – 2016, when over-winter survival was estimated at the highest levels observed over the last 34 years.

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. 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 increased from 48% in 2015 to 53% in 2016. A total of 3,457 mule deer where harvested in 2016, while, in comparison 3,189 deer were harvested in 2015. Hunter success and number of total deer harvested have attained levels not observed since the early 1990s and 2001 hunting seasons. During the 2014 and 2015 hunting seasons a total of 101 and 109 fawns were harvested, respectively. Doe harvest accounted for 4% and 3% of the total herd unit harvest during 2014 and 2015, respectively. In 2016, 72 does were harvested which accounted for only 2% of the herd unit's total harvest. Nonresident hunters harvested 13% of the total deer harvest in 2016. Nonresidents accounted for 11% of the total harvest in Areas 135, 143-145.

Population

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=110). This model tracks observed buck:100 doe ratios extremely well.

During the period from February 6 – 17, 2018 a comprehensive animal abundance survey was completed for the first time in the Wyoming Range mule deer herd (Appendix F). Two helicopters, a Bell 47 and a Bell 407 Long Ranger, were utilized to conduct the survey over 68 count blocks on the south winter ranges (Kemmerer, Cokeville, Evanston) and 22 count blocks on north winter ranges (Salt River, Big Piney, LaBarge). Approximately 1,657 square miles were surveyed (Appendix F).

A total of 25,317 deer were counted on Wyoming Range winter ranges (North: Big Piney/LaBarge and Salt River - 10,074 deer, 40% of sample; South: Kemmerer, Cokeville, Evanston - 15,243 deer, 60% of sample; Table l). The sightabilty correction factor added 3,757 deer, or 13% of the population estimate. Approximately 87% of the deer estimated in the Wyoming Range mule deer herd were counted by observers. The total population estimate is 29,074 deer. At 90% Confidence the range is 28,606 – 29,542 deer. A total of approximately 133 hours were flown at a cost of $133,000.

Table 1. A summary of total deer counted by hunt area and wildlife region during a sightability abundance survey, Wyoming Range mule deer herd, February, 2018.

Hunt Area	Raw Count
138	1,616
143	7,053
145	1,405
Jackson-Pinedale Total	10,074
134	8,923
135	4,509
168	566
UT	1,246
Green River Total	15,244
Herd Unit total	25,318

Management Summary

The population remains below the ± 20% management threshold of the population objective. The 2018 hunting season is designed to promote population growth and retain bucks in the posthunt population by closing hunting seasons prior to the onset of the fall migration and prior to the influx of elk hunters onto herd unit summer/fall ranges in preparation for the October 15 hunting season opener. The hunting seasons are designed to remain conservative because of the extremely high winter mortality noted during the previous winter, postseason buck:doe ratios that were below the management minimum of 30 buck:100 does, a population below the ±20% management threshold, and a public sentiment that requests a conservative management approach. Additionally, Nonresident Region G licenses will remain at 400 licenses.

The hunting season in Hunt Area 134 is proposed to increase the number of days from 8 days to 10 days of general season antlered deer only hunting, with a continuation of the added restriction that only antlered deer with three points or more on either antler may be taken. Consequently the hunting season dates in Area 134 will run October 1 – October 10. In Hunt Area 135, the season will be lengthened from October 6 to October 10, with the added restriction that only antlered deer may be taken with three points or more on either antler will continued from 2017 seasons. The increase in length of the seasons in Areas 134 and 135 is an attempt to return hunting season structure to historical closing dates. Both areas typically offered closing dates between October 8 and October 14, which also encompassed at least one weekend of hunting opportunity. The 2017 hunt season was the first year in at least 20 years in which Area 135 did not offer at least one weekend of hunting opportunity. Perhaps more importantly, the additional days of hunting recreation in 2018 will not adversely impact buck ratios, the annual population dynamic or overall survival of the adult female, or reproductive, segment of the population. Perhaps just as important in the deer management program in southwest Wyoming is the increase in hunting recreation in Area 135 will likely mitigate the displacement of hunters into other surrounding areas (i.e. Area 134) that was observed in 2017. An extended season may also disperse hunters over a longer period of time, and thereby reduce hunter congestion in 2018 in other southwestern

Wyoming hunt areas. Moreover, a significant number of publics throughout southern Lincoln County and Uinta County request that deer seasons provide at least one weekend of hunting opportunity.

Hunt Areas 143-145 will close on October 6 in 2018, and will also restrict the harvest of antlered mule deer to those with three points or more on either antler. This Antlered Point Restriction is a continuation from the 2017 hunting season. The October 6 closing date is same closing date as 2017. 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 that are more accessible to hunters. Season closure prior to this migration will ensure that overharvest of bucks does not occur. Shorter season dates in these areas is in response to public concerns regarding deer numbers following the severe 2017 winter. A shorter season in the northern three areas is an assurance that bucks are not taken during the migration and is supported by the hunting public.

In Area 145, a limited quota any white-tailed deer hunt will continue to allow hunters to take any white-tailed deer during a portion of the November hunting season. The number of Type 3 licenses will be maintained at 50 licenses, and the segment of the any white-tailed deer hunt will continue to be November 1 - November 15 for the 2018 hunt. Doe and fawn white-tailed deer may be taken from November 16 – December 31. Public concerns have focused on a general lack of access to suitable hunting locations and fewer white-tailed deer being observed in those areas. Also, there has been a decrease in reported chronic damages to stored crops on private property by landowners in recent years thereby resulting in the reduction in hunting opportunity for the Type 3 license.

The 2018 hunting seasons are projected to harvest approximately 1,200 deer. The population is projected to remain essentially unchanged from 2017 levels, and should number close to 29,100 deer following the 2018 hunting seasons.

APPENDIX A

Nutritional carrying capacity and factors limiting population growth of mule deer in the Wyoming Range

Wyoming Cooperative Fish and Wildlife Research Unit
Wyoming Game and Fish Department
University of Wyoming
2013

PROJECT TITLE
Nutritional carrying capacity and factors limiting population growth of mule deer in the Wyoming Range

PRINCIPLE INVESTIGATORS
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DURATION: 1 July 2012 – 30 June 2016

INTRODUCTION

Concerns over population performance and factors limiting population growth have heightened in recent decades in response to near ubiquitous declines in the abundance of mule deer (*Odocoileus hemionus*) throughout much of the West. Factors responsible for such declines remain largely speculative and controversial (deVos et al. 2003); however, recent comprehensive research has identified habitat quality and winter severity as important factors that are currently limiting mule deer in the Intermountain West (Bishop et al. 2009, Hurley et al. 2011). In response to concerns of mule deer populations in Wyoming, in 2007, 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. Prior to the acceptance of the MDI, the Wyoming Range mule deer herd was a top priority for the development of a management plan according to the MDI. The first of the herd-specific management plans, the *Wyoming Range Mule Deer Initiative* (WRMDI), was finalized in 2011 following a collaborative public input process. The proposed research we describe here stems directly from research and management issues identified by the Mule Deer Working Group in the WRMDI, and we have proposed to conduct this research on Wyoming Range mule deer because of its priority status and controversy behind its population dynamics.

The marked decline of this deer population following the 1992-93 winter, and the near absence of any substantial recovery, has engaged the WGFD in controversy regarding management and herd unit objectives. 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. Given current population trends, severity of winters, and deteriorating range conditions, it has become apparent that the habitat is not capable of supporting the current herd unit objective. Nevertheless, identifying the current capacity of the habitat to support mule deer in the Wyoming Range has been a persistent management challenge. Habitat conditions on both winter and summer range occupied by Wyoming Range mule deer have been deteriorating as a result of both drought and land-use practices. Declines in snowpack and rising spring temperatures have been pronounced in recent decades across much of the Rocky Mountains (Westerling et al. 2006, Pederson et al. 2011); both of which have a negative effect on forage quality and abundance, thereby influencing carrying capacity.

PRIMARY OBJECTIVE

The overall goal of this research project is to address important research and management needs indentified by the MDI and WRMDI. **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 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, we have the 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.

BENEFITS

The impetus behind this project follows from questions underlying the population dynamics of the Wyoming Range mule deer herd, and was formulated to meet multiple objectives outlined by the Mule Deer Working Group in the *Wyoming Mule Deer Initiative*, and the herd-unit specific *Wyoming Range Mule Deer Initiative* (WRMDI). Our proposed study will meet objectives under 5 of the 6 management issues identified in the WRMDI which was finalized in 2011, including but not limited to:

• Estimate the nutritional capacity of existing habitat available to mule deer in the Wyoming Range to evaluate whether revision of the current population objective of 50,000 wintering mule deer is warranted.

• Characterize existing habitat conditions with respect to population density by implementing a nutritionally based approach to estimating carrying capacity that could be applied to other herd units in Wyoming.

• Link habitat use with vital rates and nutritional processes will help identify vegetation communities and habitat treatments most beneficial for mule deer to enhance mule deer populations as wells as identifying effective mitigation strategies.

• Assess the nutritional capacity for survival and reproduction will help characterize the potential effects of predation on mule deer, as well as the benefits of predator control efforts already in place.

• Evaluate patterns of mule deer migration will delineate important mule deer migration corridors, and provide predictive models for timing of seasonal migration to identify critical migration periods.

• Evaluate the physiological effects of oil and gas development will help to quantify the direct and indirect effects of habitat loss and disturbance on mule deer in the Wyoming Range, as well as identifying habitat manipulations that are likely to be most effective in mitigating the effects of energy development.

• Results of this research project will be presented in public forums in conjunction with the public input process, and by way of other venues to inform the public and stakeholders of issues facing Wyoming Range mule deer as well as management strategies likely to be most beneficial to the mule deer population.

APPENDIX B

HAUB SCHOOL OF ENVIRONMENT AND NATURAL RESOURCES

Wyoming Range Mule Deer Project

Summer 2017 Update

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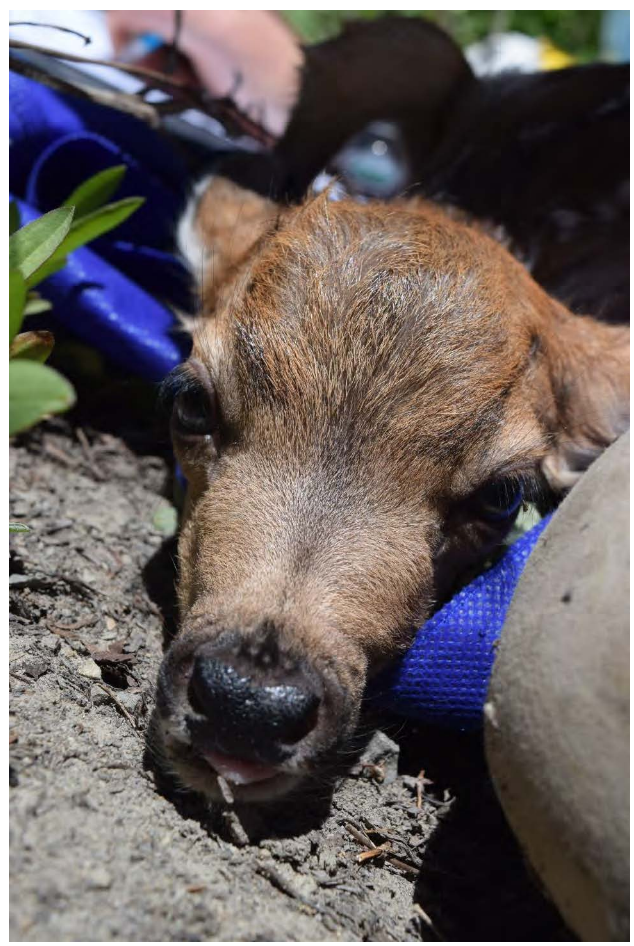
PROJECT BACKGROUND

The Wyoming Range Mule Deer Project was initiated in March 2013. The overarching goal of the project is to investigate the nutritional relationships among habitat conditions, climate, and behavior to understand how these factors interact to regulate population performance. Since the initiation of the project, we have tracked and monitored the survival, behaviors, reproduction, and habitat conditions of 164 female, adult mule deer of the Wyoming Range. In March 2015, we expanded our research efforts to include evaluation of survival and cause-specific mortality of fawns belonging to our collared mule deer. This component of the project is aimed at unraveling the relative contributions of habitat, maternal nutrition, and predation on survival of young mule deer—a study that is the first of it's kind in Wyoming. This update will report on some of our accomplishments and preliminary findings of adult survival and reproduction and will highlight the breadth of factors that contribute to fawn mortality in western Wyoming. So far, our research has gleaned invaluable insight into what regulates population performance of this iconic population, and we aim to further refine our understanding of the factors that affect the population with continued, robust data collection on various aspects of mule deer ecology, including nutrition and habitat contributions, predation, migration, reproduction, and survival.



WINTER 2016/2017

Adult Survival

This last winter of 2016/2017 proved to be a tough one for mule deer. Conditions on winter ranges for Wyoming Range mule deer were severe with snowpack levels exceeding 200% and numerous days of sub-zero weather. These harsh winter conditions strongly affected winter survival and only 63% of our collared adults survived from November until summer 2017 (compared with >90% in years past). Older animals and animals that entered winter in poor condition were more susceptible to succumbing to winter exposure (Figure 1).

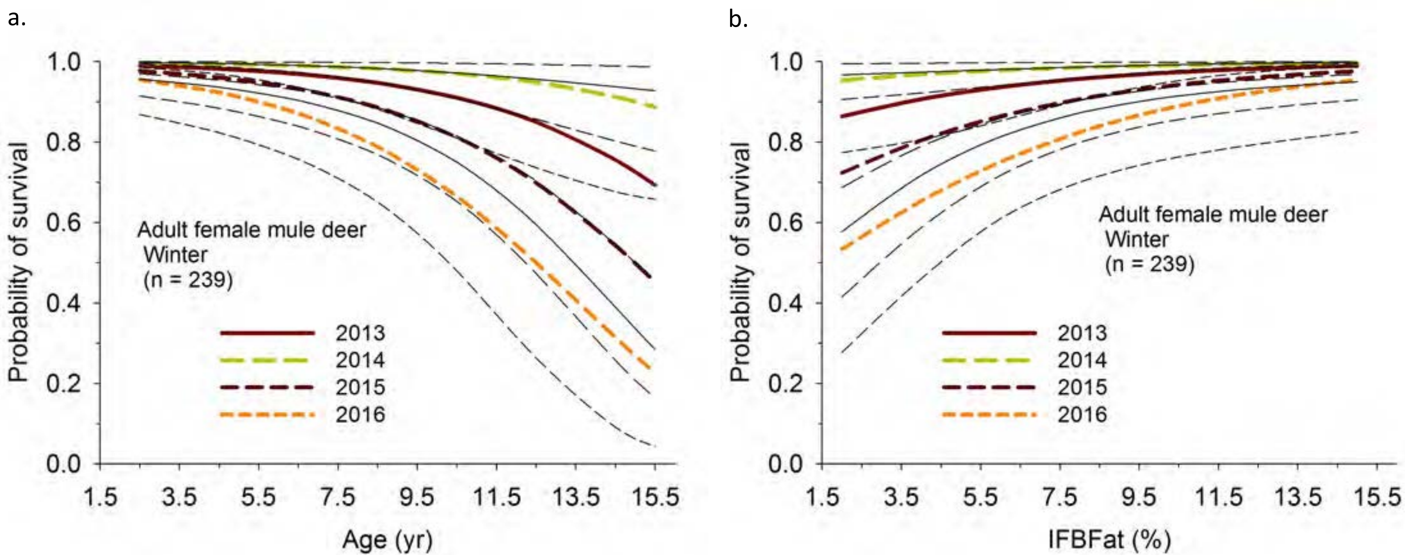


Figure 1. The effects of age (a) and December body fat (IFBFat %; b) on the probability of survival overwinter. Probability of survival decreases as animals get older and as the % body fat (IFBFat %) in December decreases.

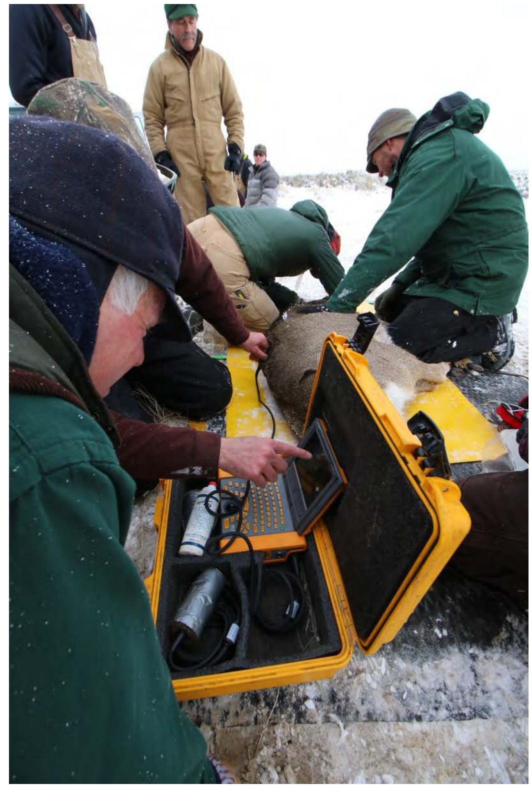
Fawn Survival

Winter conditions tend to have the greatest effect on survival of fawns and this winter was no exception. We observed 100% mortality of the fawns we collared in summer 2016 and had survived to the beginning of winter. Mortality rates of that caliber can have substantial repercussions on population dynamics because the majority of an entire cohort of deer is gone. Although these numbers are staggering, winter die-offs like the one observed this winter do occasionally occur and populations do eventually rebound. We have now found ourselves with a unique opportunity to evaluate how mule deer populations rebound from harsh winters.

We retrieved all remains of mortalities of collared fawns. Whole carcasses were submitted to the Wyoming State Veterinary Lab and WGFD Wildlife Health Laboratory for necropsy.

MARCH 2017 ADULT CAPTURES

Since March 2013, we have recaptured collared mule deer as they enter winter ranges in December and before they leave winter ranges in March. This has allowed us to track changes in nutritional condition and reproductive status of animals.



We use ultrasonography to measure % body fat and evaluate pregnancy of collared mule deer.

Nutritional Condition

Nutritional condition in March 2017, measured as % body fat, was the lowest we have observed in our research (averaging 1.8% ± 0.25; Figure 2). Although it is rare to see animals in this poor of condition, it was expected given the severity of the winter.

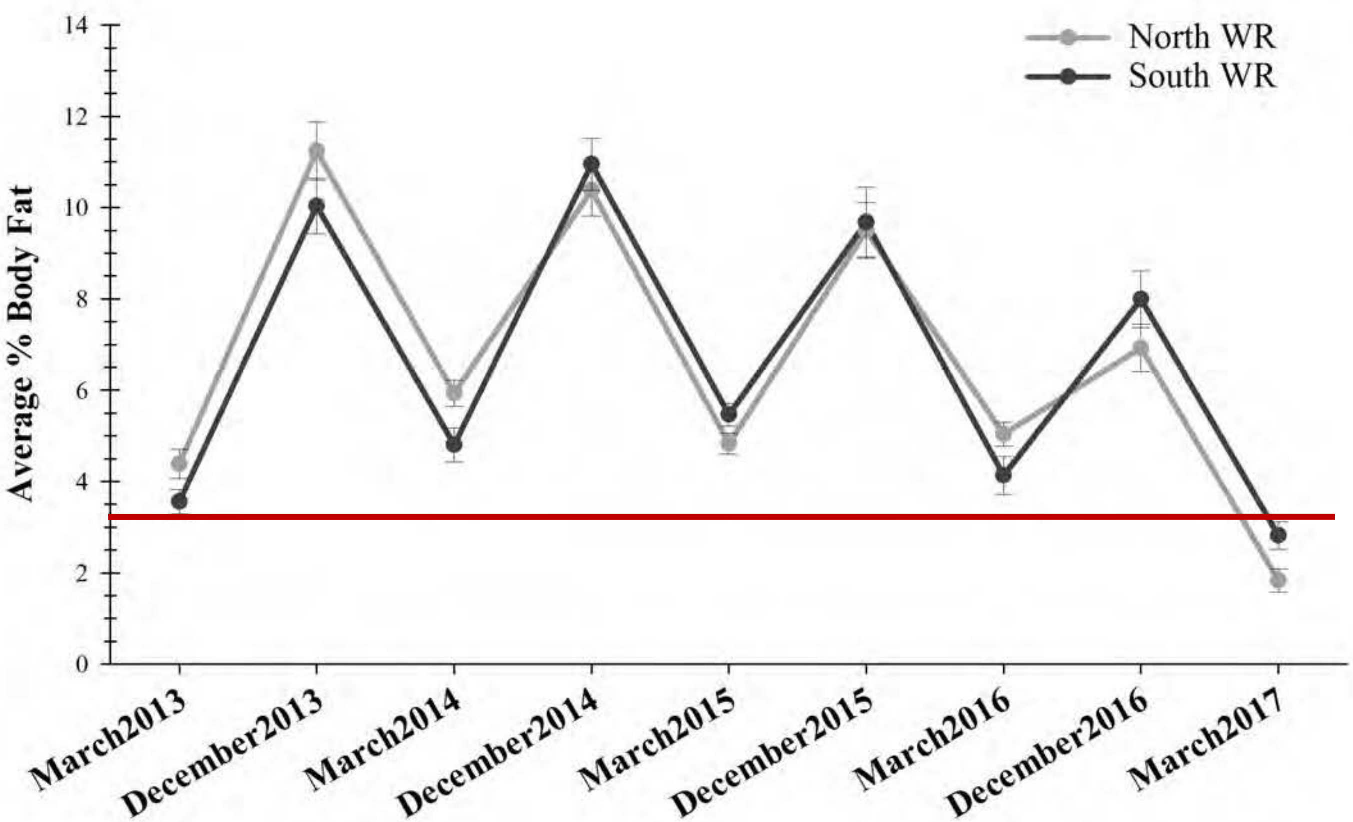


Figure 2. Average % body fat of adult, female mule deer on North (near Big Piney,WY) and South (near Cokeville and Evanston, WY) winter ranges for Wyoming Range mule deer. Deer were in significantly poorer shape in March 2017 than any other year.

Pregnancy

Despite extremely poor nutritional condition of animals this March, fetal rates among winter ranges were comparable to the preceding 4 years (Figure 3) and pregnancy rates remained high. Interestingly, average eye diameter of fetuses was lower in March 2017 (14.0 ± 0.18) than in previous years (15.3 ± 0.11; Figure 4). Fetal eye diameter is a measure of fetal development and is often used to estimate the timing of birth.

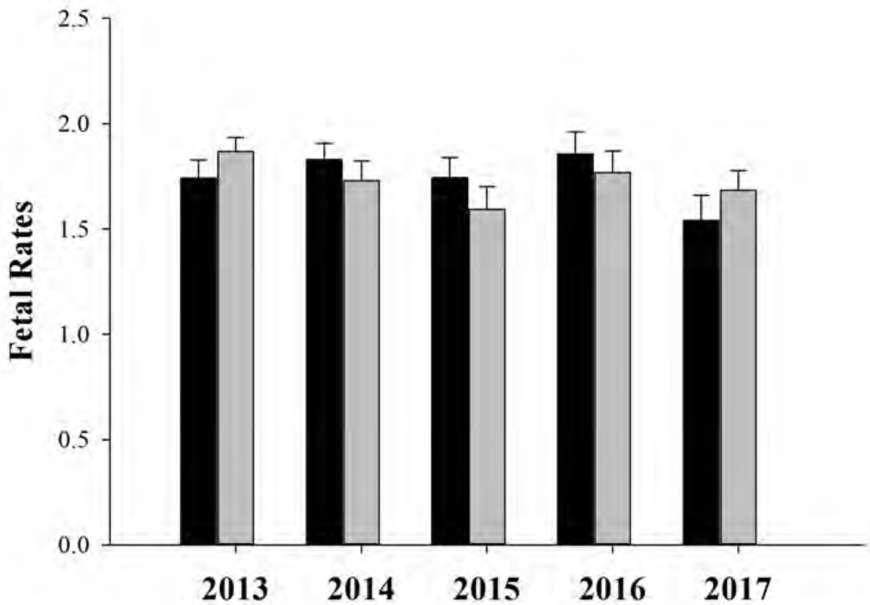


Figure 3. Fetal rates (average number of fetuses per pregnant animal) did not differ among years—despite severe winter conditions.

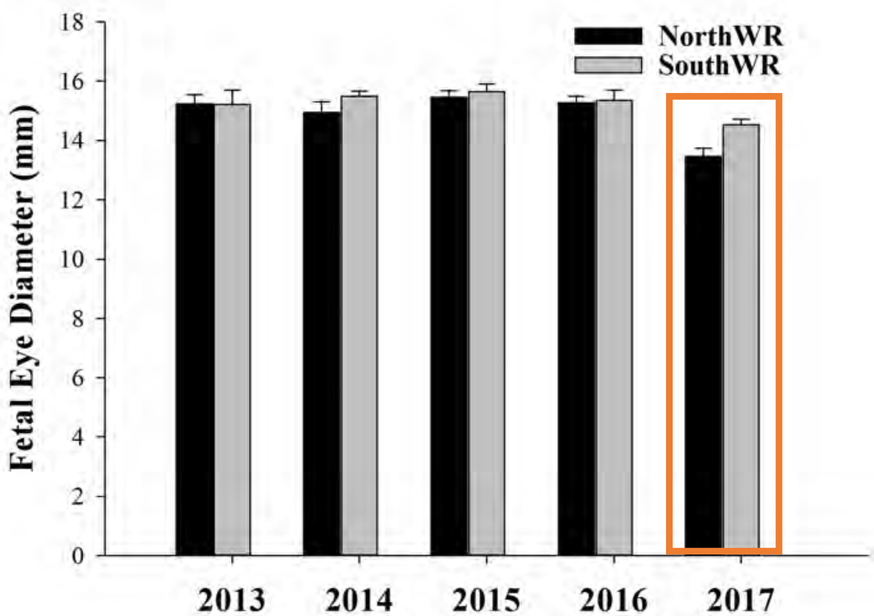
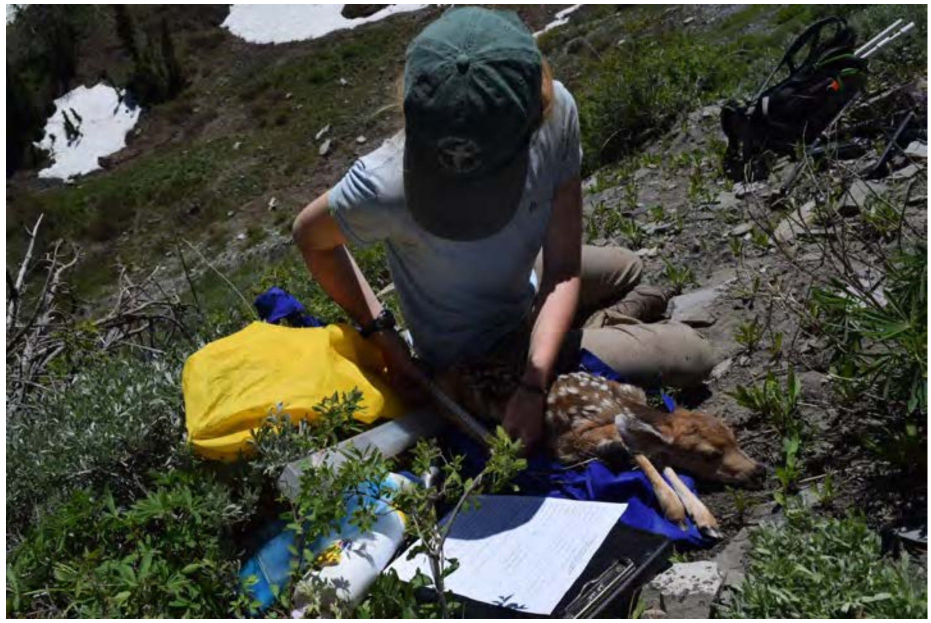


Figure 4. Average fetal eye diameter measured in March of each year. Fetal eye diameter was significantly smaller in March 2017 compared with any other year.

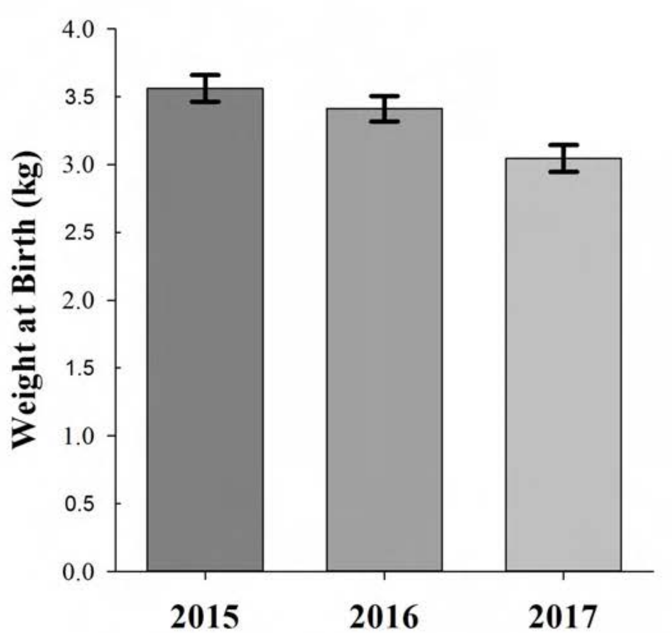
FAWN SURVIVAL



Fawn Capture and Collaring

Since March 2015, we have been capturing and collaring fawns of our collared adults to evaluate what factor most influence fawn survival. Fawns are located using a vaginal implanted transmitter (VIT) deployed in pregnant females that is expelled at birth. Once fawns are located, we then capture, radio-collare, and collecte a suite physical data (e.g., body weight). We then monitored daily survival of collared fawns. Over the three summers, we have tracked the survival of 194 mule deer fawns throughout the Wyoming Range.

	2015	2016	2017 - So Far
Number of Fawns Tracked	58	70	66
Summer Mortality	45%	56%	44%
Median Birthdate	June 10	June 13	June 16
Average Weight at Birth	3.56 (± 0.098)	3.41 (±0.093)	3.04 (±0.099)



Newborn fawns caught in 2017 were significantly lighter than newborn fawns caught in previous years (Figure 5). This was of little surprise because of the overall poor nutritional condition of pregnant females and the smaller eye diameter of fetuses measured in March 2017. With this information, we are now in a position to better evaluate the influence of birth weight and maternal condition on summer survival of fawns.

Figure 5. Average weight of fawns captured <48hours from birth. Fawns were significantly lighter in 2017 compared with the previous two years.

Cause-Specific Mortality of Fawns

To evaluate cause-specific mortality of fawns, we track daily survival of all fawns captured over the course of the summer. When a mortality is detected, we immediately investigate the event to ensure an accurate assessment of the cause of mortality. There is a breadth of various causes for fawn mortality including predation, disease, malnutrition, drowning, hypothermia, vehicle-collision, and just getting caught up in vegetation. The proportion of fawns that die because of the aforementioned causes varies from year to year (Figure 6).

So far, in summer 2017, 30% of mortalities were because fawns were stillborn. Currently, this is leading cause of death for fawns in 2017, but that will inevitably change as the summer progresses and more fawns die of other causes such as disease and predation.

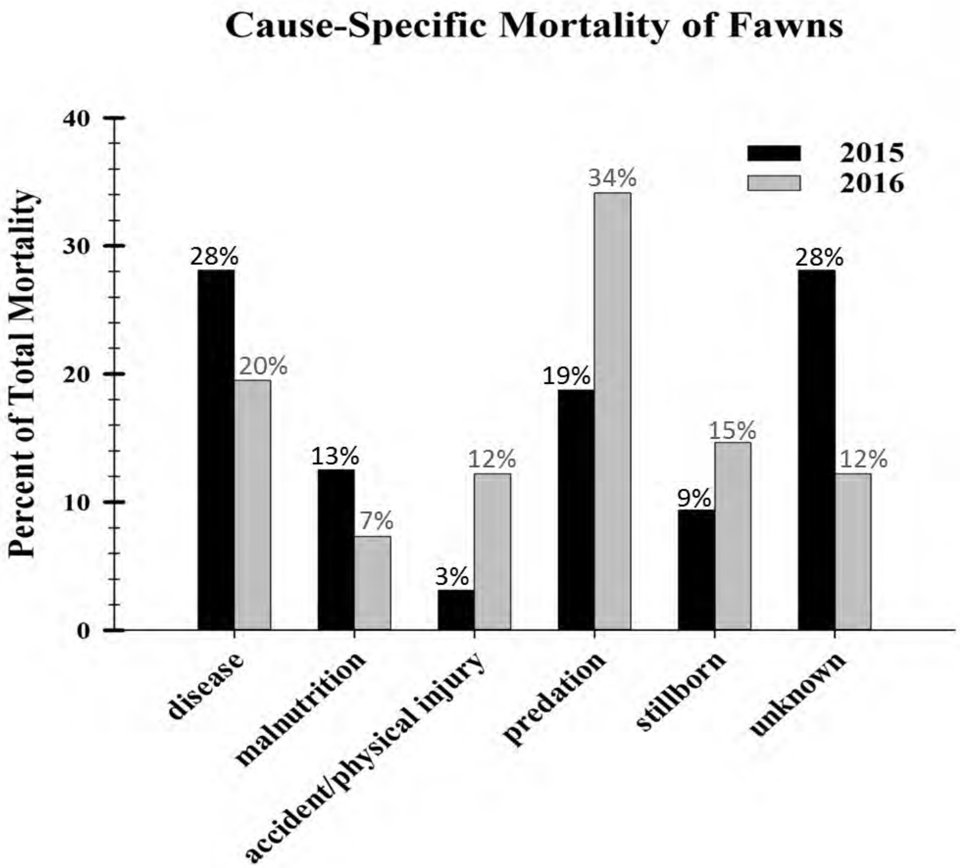


Figure 6. The relative occurrences of various causes of mortality for mule deer fawns.

Cause of Mortality: Malnutrition

Cause of Mortality: Predation

Habitat and Maternal Conditions

The condition of a female and the habitat conditions she experiences in the summer may be very important in predicting and understanding fawn survival – especially in understanding the influence of malnutrition and disease on fawn survival. Therefore, we are evaluating forage and habitat conditions within summer home ranges of collared deer. Specifically, we are measuring habitat structure and forage availability of known locations of use by collared adults that gave birth to fawns. We will then couple these data with information on maternal condition (i.e., nutritional condition) and evaluate the influence on fawn survival.

FUTURE RESEARCH EFFORTS

Throughout summer and winter of 2017, we will continue our research efforts aimed at elucidating the relative influence of predation, climate, and habitat conditions on fawn survival in the Wyoming Range. The severe winter conditions of 2017 will provide us with a unique opportunity to evaluate how severe winter weather may influence the ability of females to subsequently rear young, and thus, provide valuable insight into the factors that regulate population growth and examine the prospects for recovery of this cherished herd.

Project Partners and Funders

The Wyoming Range Deer Project is a collaborative partnership in inception, development, operations, and funding. Without all the active partners, this work would not be possible. Funds have been provided by the Wyoming Game and Fish Department, Wyoming Game and Fish Commission, Wyoming Wildlife and Natural Resource Trust, Muley Fanatic Foundation, Bureau of Land Management, Knobloch Family Foundation, U.S. Geological Survey, National Science Foundation, Wyoming Governor's Big Game License Coalition, Boone and Crockett Club, Animal Damage Management Board, Ridgeline Energy Atlantic Power, Bowhunters of Wyoming, and the Wyoming Outfitters and Guides Association. Special thanks to the Wyoming Game and Fish Department, Bureau of Land Management, and Wyoming State Veterinary Lab for assistance with logistics, lab analyses, and fieldwork. Also, thanks to the Cokeville Meadows National Wildlife Refuge and U.S. Forest Service for providing field housing.

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APPENDIX C

HAUB SCHOOL OF ENVIRONMENT AND NATURAL RESOURCES

Wyoming Range Mule Deer Project

Winter 2017-18 Update

D.E.E.R. PROJECT

DEER-ELK ECOLOGY RESEARCH

MONTEITH SHOP

HAUB SCHOOL OF ENVIRONMENT & NATURAL RESOURCES

WYOMING COOPERATIVE FISH & WILDLIFE RESEARCH UNIT

UW UNIVERSITY OF WYOMING

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WYOMING RANGE MULE DEER PROJECT

Project Background

In recent decades, mule deer abundance throughout the West has struggled to reach historic numbers, and Wyoming is no exception to the nearly ubiquitous trend of population declines. In response to concerns of mule deer populations in Wyoming, in 2007, the Wyoming Game and Fish Commission adopted the *Wyoming Mule Deer Initiative* (MDI) with the intent to develop individual management plans for key populations. Of particular concern was the Wyoming Range mule deer population in western 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 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 much of the last decade (Fig. 1). Consequently, the Wyoming Range mule deer population was identified as a top priority for the development of a management plan according to the MDI. The first of the population-specific management plans, the *Wyoming Range Mule Deer Initiative* (WRMDI), was finalized in 2011 following a collaborative public input process. To direct development of an effective management plan, it was recognized by the Mule Deer Working Group (2007) that the *"Success and implementation of these plans will depend upon our ability to identify limiting factors to mule deer populations and their habitats"*. Accordingly, the Wyoming Range Mule Deer Project was initiated 2013 to address the need for research in identifying the factors that regulate the Wyoming Range mule deer population.

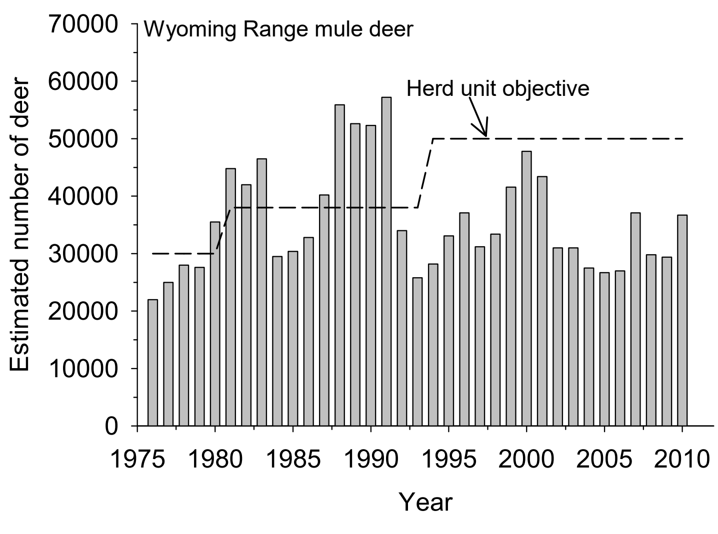


Figure 1. Estimated population size of the Wyoming Range mule deer herd relative to herd unit objective, 1976-2010.

The overarching goal of the Wyoming Range Mule Deer Project is to investigate the nutritional relationships among habitat conditions, climate, and behavior to understand how these factors interact to regulate population performance. We initiated the project in March 2013 with the capture of 70 adult, female mule deer on two discrete winter ranges for migratory, Wyoming Range mule deer (Fig. 2). In summer 2015, we initiated Phase II of the Wyoming Range Mule

Deer Project that focuses on survival and cause-specific mortality of neonate mule deer. Since the initiation of the project, we have tracked and monitored the survival, behaviors, reproduction, and habitat conditions of 202 adult female and 195 juvenile mule deer of the Wyoming Range. This update highlights some of our many discoveries on mule deer ecology since the initiation of the project.

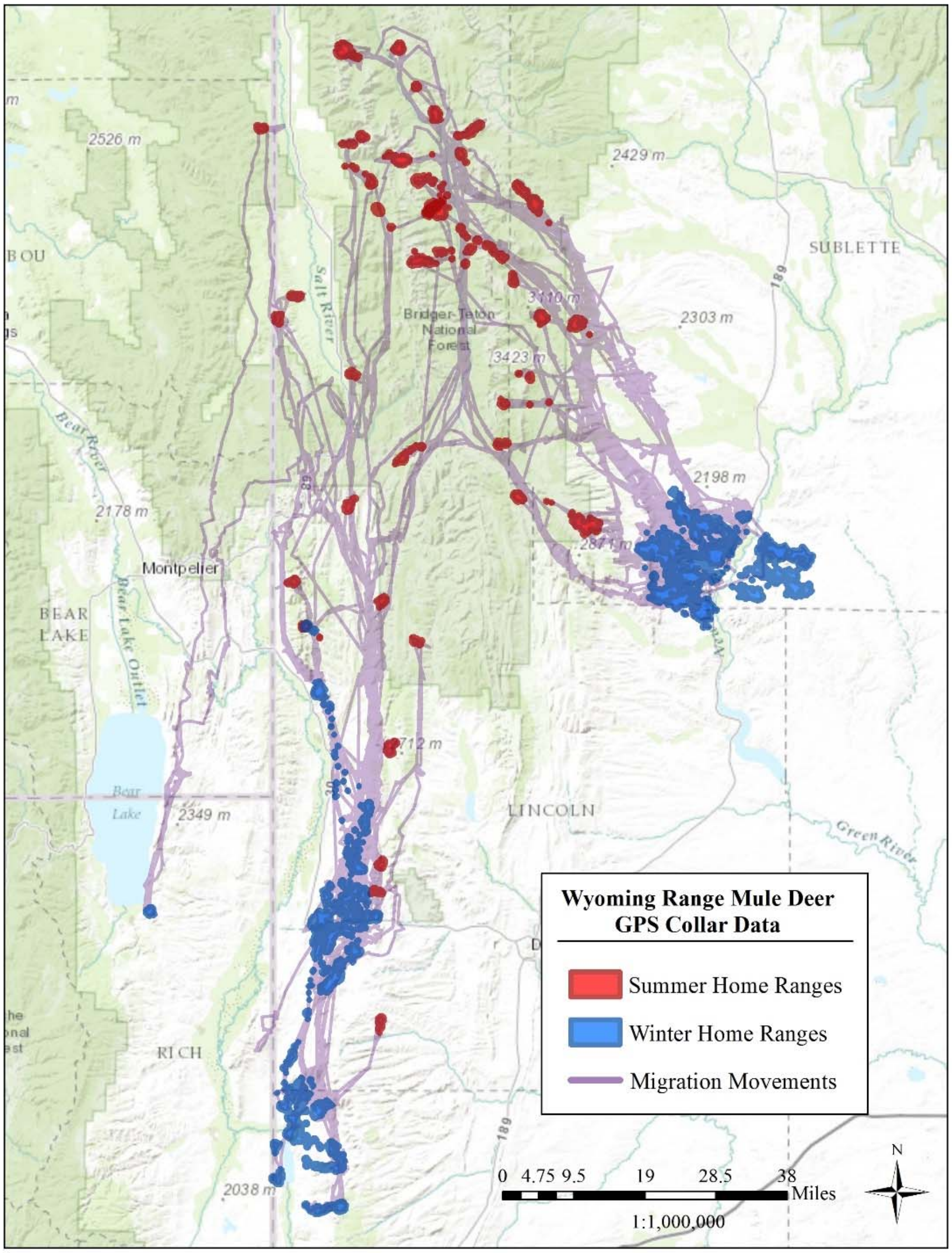


Figure 2. Winter and summer home ranges (based on 95% Kernel Utilization Distribution of GPS collar data) as well as migration movements of Wyoming Range mule deer.

A Nutritional Ecology Framework: Linking the Individual to the Population

Using a nutritional ecology framework, we aim to evaluate how conditions of all seasonal ranges mule deer encounter throughout the year—ranges used during summer, winter, and migration—affect individual animals. Using this unique approach, we can develop a comprehensive understanding of how the connections individual mule deer have with their environments influences population dynamics.

Mule Deer Capture

Since March 2013, we have captured and recaptured 202 adult, female mule deer. Upon each capture, in addition to fitting each animal with a GPS collar, we collect a suite of data on individual animals including age, nutritional condition, morphometry, and pregnancy. Animals are recaptured each spring (in March) and autumn (in December) to monitor longitudinal changes in nutritional condition and reproduction. In doing this, we can link various life-history characteristics with behaviors and habitat conditions of individual animals.

Nutritional Condition

At each capture event, we use ultrasonography to measure fat reserves (i.e., % body fat). By recapturing collared mule deer and measuring body fat each autumn and spring, we are able to track changes in nutritional condition between summer and winter seasons.

Although most animals lost fat in the winter and gained fat in the summer, the rate at which fat reserves increased or decreased varied widely among individual animals (Fig. 3). A suite of factors can influence fat dynamics between winter and summer seasons, but availability of food on seasonal ranges and number of fawns a female raises have the greatest effect on fat dynamics.

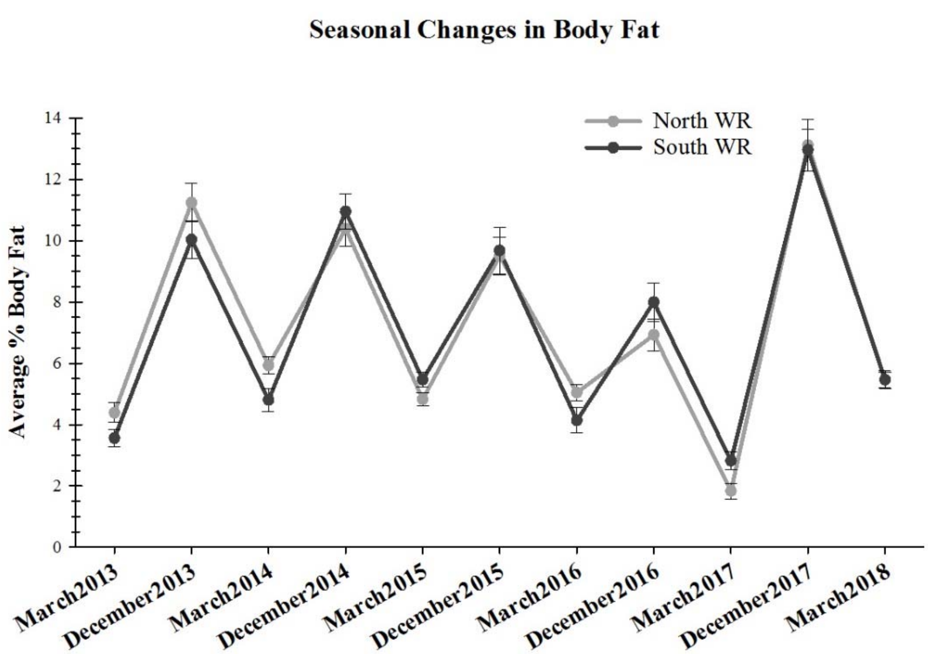


Figure 3. Average % body fat of adult, female mule deer on North (near Big Piney, WY) and South (near Cokeville and Evanston, WY) winter ranges for Wyoming Range mule deer.

Reproduction

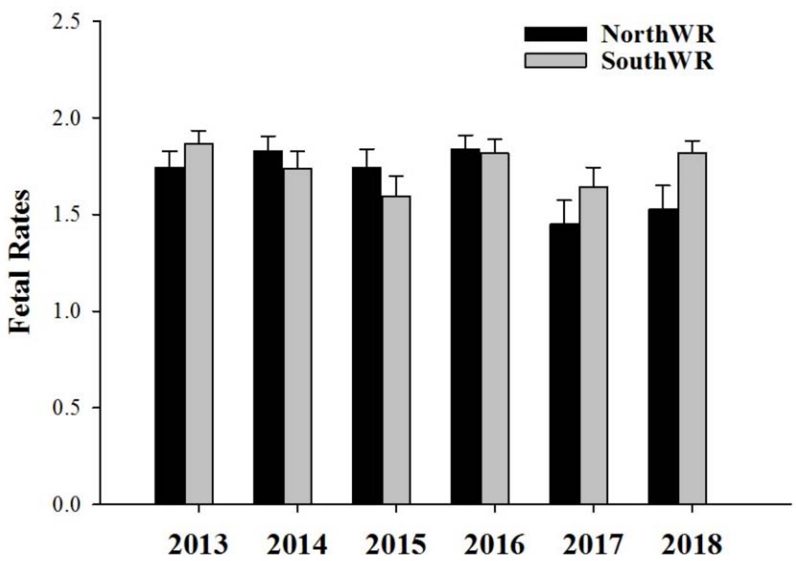


Figure 4. Fetal rates (average number of fetuses per pregnant animal) on North (near Big Piney, WY) and South (near Cokeville and Evanston, WY) winter ranges for Wyoming Range mule deer in 2013-2018.

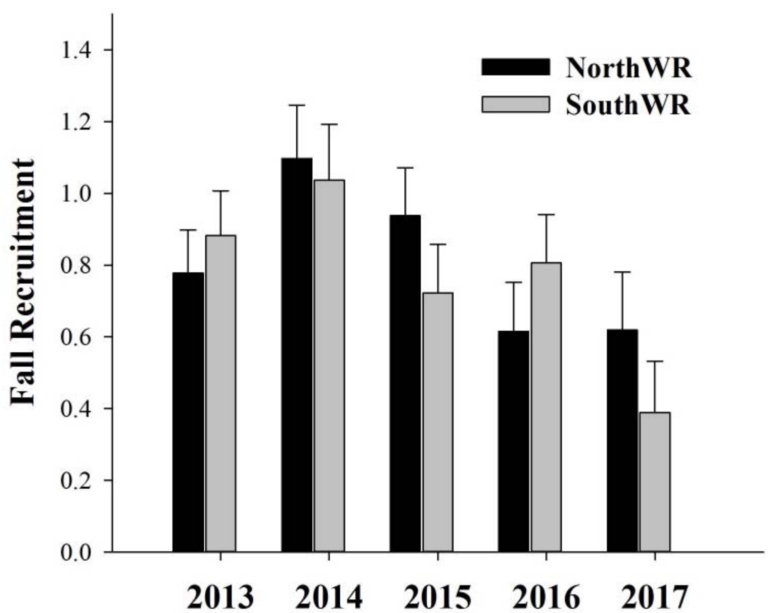


Figure 5. Recruitment rates on North (near Big Piney, WY) and South (near Cokeville and Evanston, WY) winter ranges for Wyoming Range mule deer in 2013-2017.

Reproductive success of individual animals greatly influences population dynamics; therefore, we closely monitor pregnancy and recruitment of young for each of our study animals. We use ultrasonography to monitor pregnancy rates of our study animals during spring capture events. Each autumn, as animals arrive to winter range, we evaluate fall recruitment using on-the-ground observations of the number of fawns at heel of our collared adults.

Pregnancy rates among mule deer of the Wyoming Range were typically high and ranged between 90-99%. Furthermore, most animals were pregnant with twins each year resulting in relatively high fetal rates (average number of fetuses per pregnant animal was 1.71 ± 0.03 across years; Fig. 4). Although fetal rates tended to be high, recruitment of young tended to be low. Since 2013, approximately half of the potential fawns born in early summer survived to autumn, and fall recruitment averaged 0.83 ± 0.05 fawns per collared female for Wyoming Range mule deer 2013-2016 but dropped to 0.51 ± 0.11 in 2017, following severe winter conditions of 2016/2017 (Fig. 5).

Disentangling the Relative Role of Predation, Habitat, Climate, and Disease on Fawn Survival

Fawn Capture

In March 2015, we initiated Phase II of the Wyoming Range Mule Deer Project by recapturing collared deer and deploying a vaginal implant transmitter (VIT) in pregnant females. VITs were used to indicate where and when birth occurred. Once birth events were identified, we captured and collared fawns born to our collared females as well as fawns that were found opportunistically throughout the Wyoming Range. Since 2015, we have successfully tracked 194 fawns and have been continually monitoring their survival.

	2015	2016	2017
Number of Fawns Tracked	58	70	67
Median Birthdate	June 10	June 13	June 17
Summer Mortality	45%	56%	52%
Winter Mortality	10%	44%	7%
Total Mortality	55%	100%	NA

Cause-Specific Mortality of Fawns

To evaluate cause-specific mortality of fawns, we tracked daily survival of all fawns captured 2015 – 2017. When a mortality was detected, we immediately investigated the event to ensure an accurate assessment of the cause of mortality. There was a breadth of various causes for fawn mortality including predation, disease, malnutrition, drowning, hypothermia, vehicle-collision, and just being caught in vegetation. The proportion of fawns that died because of the aforementioned causes varied from year to year (Fig. 7).

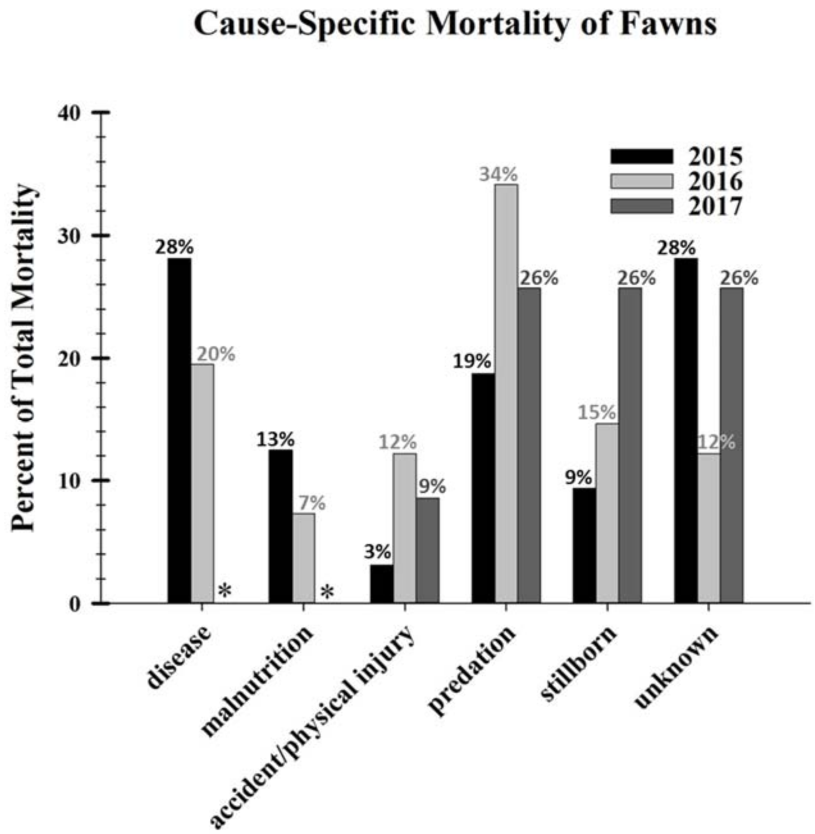


Figure 7. The relative occurrences of various causes of mortality for mule deer fawns of the Wyoming Range in 2015-2017. Asterisks indicate lab results from 2017 that are still pending.

In 2015, disease was the leading cause of death and accounted for 28% of all mortalities. The most prevalent disease adenovirus hemorrhagic disease (AHD). AHD is a viral disease that can cause internal hemorrhaging and pulmonary edema. Although AHD was detected in mule deer populations before, it was not previously known to be a major mortality factor in Wyoming. Nevertheless, the discovery of AHD in the Wyoming Range mule deer population has been motivation for further research into the epidemiology of AHD. We are still awaiting necropsy results from the Wyoming State Vet Lab from samples collected from fawn mortalities in 2017; therefore, the relative influence of various causes of mortality—specifically, disease and malnutrition—on fawn mortality is still pending. Regardless, 26% of mortalities in 2017 were because fawns were stillborn. Currently, this ties with predation as the leading cause of death for fawns in 2017.

Habitat and Maternal Conditions

The condition of a female and the habitat conditions she experiences in the summer may be very important in predicting and understanding fawn survival—especially in understanding the influence of malnutrition and disease on fawn survival. Therefore, we are coupling data on summer habitat conditions with information on maternal condition (i.e., nutritional condition) to evaluate how it influences fawn survival.

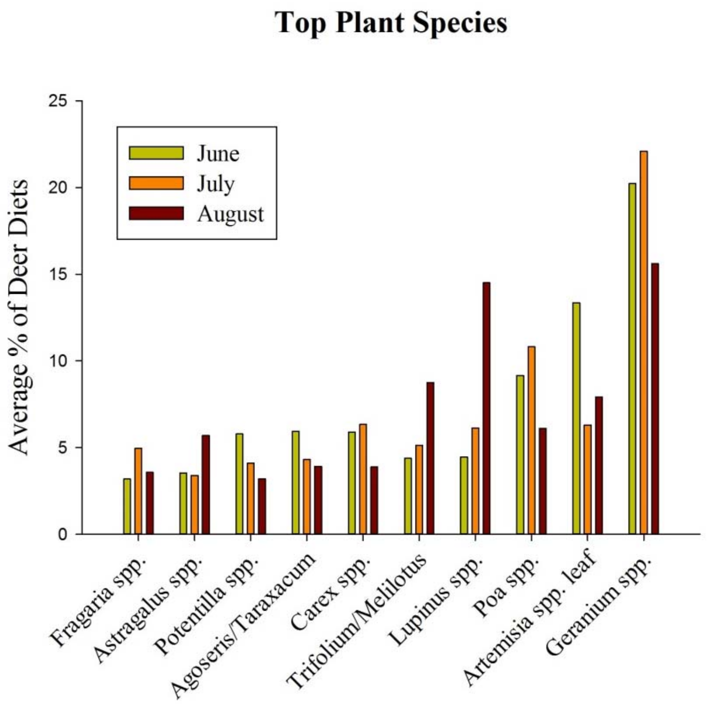


Figure 8. The top ten plant genera within diets (according to the average % of diets comprised of each plant genera) of Wyoming Range mule deer. Diet composition was evaluated in June, July, and August of 2013 and 2014.

Since 2013, we have evaluated the quality and availability of plants within the diets of Wyoming Range mule deer during summer. To assess mule deer diets, we collected fecal samples from summer home ranges of collared deer and used microhistology to identify plant species within their diets (Fig. 8) in summer 2013 and 2014. Based on frequency of plants within mule deer diets, we then collected plant clippings that we analyzed for quality (e.g., crude protein and digestibility). We are now coupling data on diet quality with forage availability by quantifying the abundance of key forage species at known locations of collared mule deer throughout the summer.

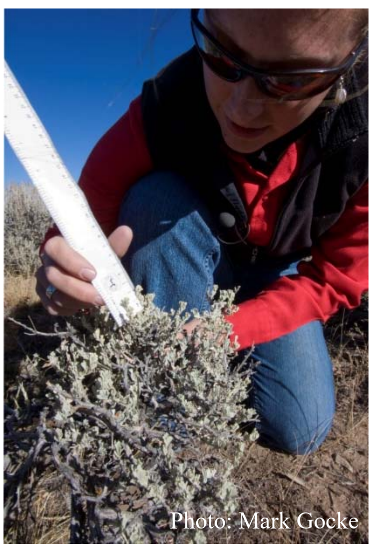


Photo: Mark Gocke

Effects of Winter Severity on Survival and Reproduction

Adult Winter Survival

Winter of 2016/2017 proved to be a tough on mule deer. Conditions on winter ranges for Wyoming Range mule deer were severe with snowpack levels exceeding 200% and numerous days of sub-zero weather. These harsh winter conditions strongly affected winter survival and only 63% of our collared adults survived from November until summer 2017 (compared with >90% in years past). Older animals and animals that entered winter in poor condition were more susceptible to succumbing to winter exposure (Fig. 9).

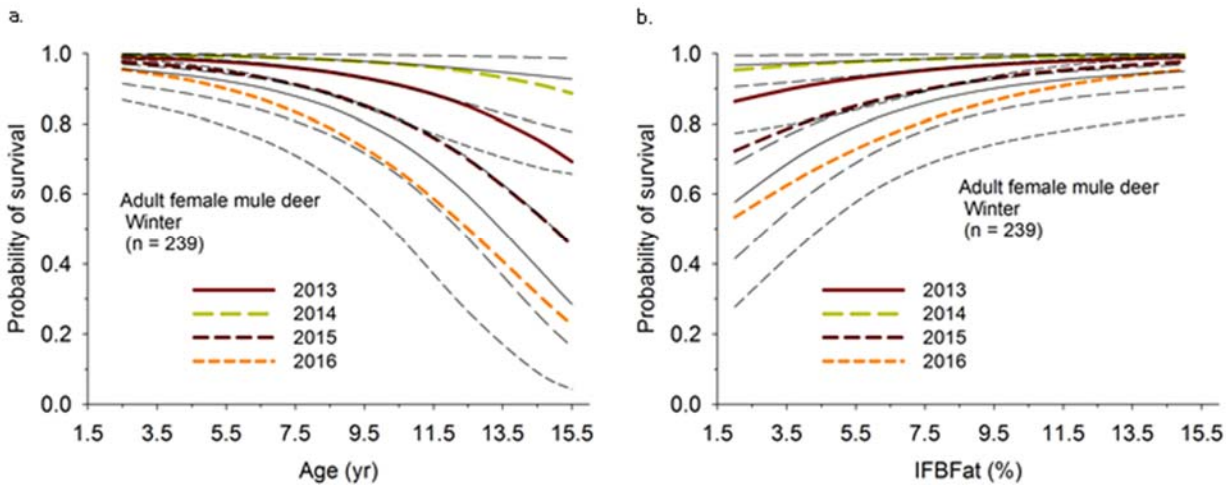


Figure 9. The effects of age (a) and December body fat (IFBFat %; b) on the probability of survival overwinter. Probability of survival decreased as animals aged and as the % body fat (IFBFat %) in December decreased.

Fawn Winter Survival

Winter conditions tend to have the greatest effect on survival of fawns, and this winter was no exception. We observed 100% mortality of the fawns we collared in summer 2016 (44% died overwinter). Mortality rates of that caliber can have substantial repercussions on population dynamics because the majority of an entire cohort of deer is gone. Although these numbers are staggering, winter die-offs, as the one observed this winter, do occasionally occur and populations do eventually rebound. We have now found ourselves with a unique opportunity to evaluate how mule deer populations rebound from harsh winters.

Nutritional Condition

Nutritional condition in March 2017, measured as % body fat, was the lowest we have observed in our research (2.3% in 2017 compared with 4.0–5.3% in 2013–2016; Fig. 10). Although it is rare to see animals in this poor of condition, it was surely a product of deep snow restricting access to forage and heightened energy expenditures associated with locomotion in deep snow and thermoregulation in plummeting temperatures.

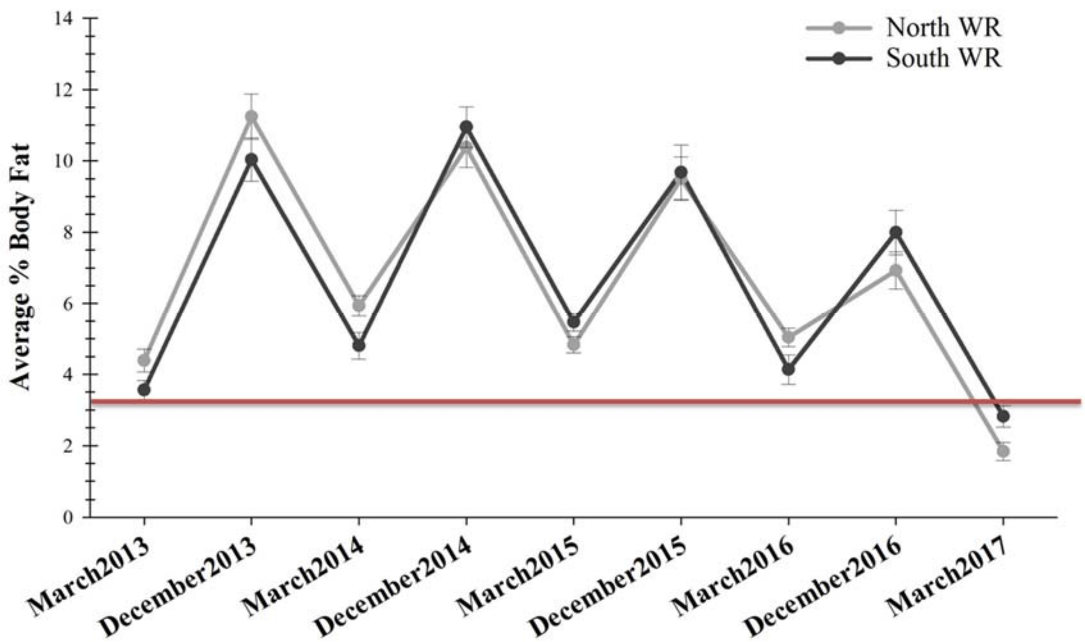


Figure 10. Average % body fat of adult, female mule deer on North (near Big Piney,WY) and South (near Cokeville and Evanston, WY) winter ranges for Wyoming Range mule deer in March 2013 – March 2017. Following the sever winter conditions of 2017, animals were in the worst nutritional condition recorded since the beginning of our research in 2013.

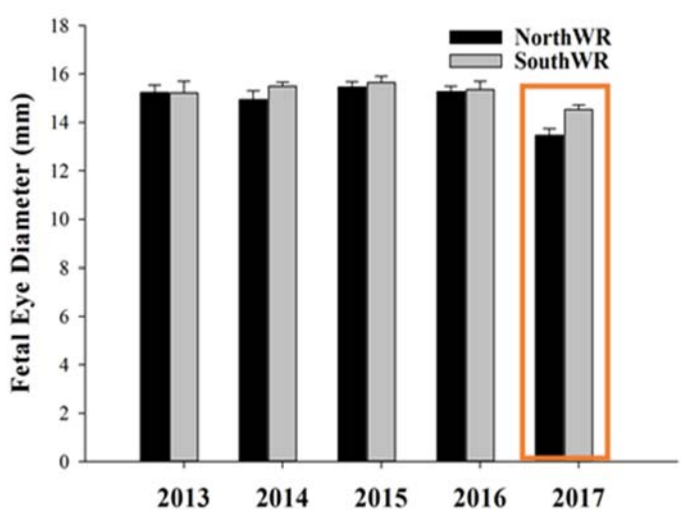


Figure 11. Average fetal eye diameter measured in March of each year. Fetal eye diameter was significantly smaller in March 2017 compared with any other year.

Pregnancy

Despite extremely poor nutritional condition of animals in March 2017, fetal rates among winter ranges were comparable to the preceding 4 years (Fig. 4) and pregnancy rates remained high. Interestingly, average eye diameter of fetuses was lower in March 2017 (14.0 ± 0.18) than in previous years (15.3 ± 0.11; Fig. 11). Fetal eye diameter is a measure of fetal development and is often used to estimate the timing of birth.

Carryover Effects

Newborn fawns caught in 2017 were significantly lighter than newborn fawns caught in previous years (Fig. 12). This was of little surprise because of the overall poor nutritional condition of pregnant females and the smaller eye diameter of fetuses measured in March 2017. With this information, we are now in a position to better evaluate the influence of birth weight and maternal condition on summer survival of fawns.

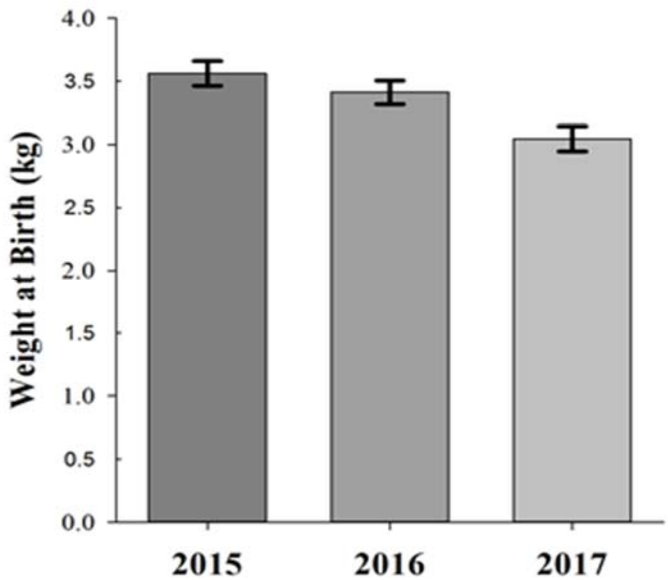


Figure 12. Average weight of fawns captured <48hours from birth. Fawns were significantly lighter in 2017 compared with the previous two years.

Population Benefits of Reduced Deer Density

Following the severe winter of 2016/2017, the Wyoming Range mule deer population had found itself in an interesting place. The high adult morality and depressed reproduction in the summer following undoubtedly resulted in decreased abundance of deer in the Wyoming Range. The silver lining to the decrease in the population is that population growth is often higher when abundance is low (Fig. 13). This is because deer populations are relieved from competition with other deer.

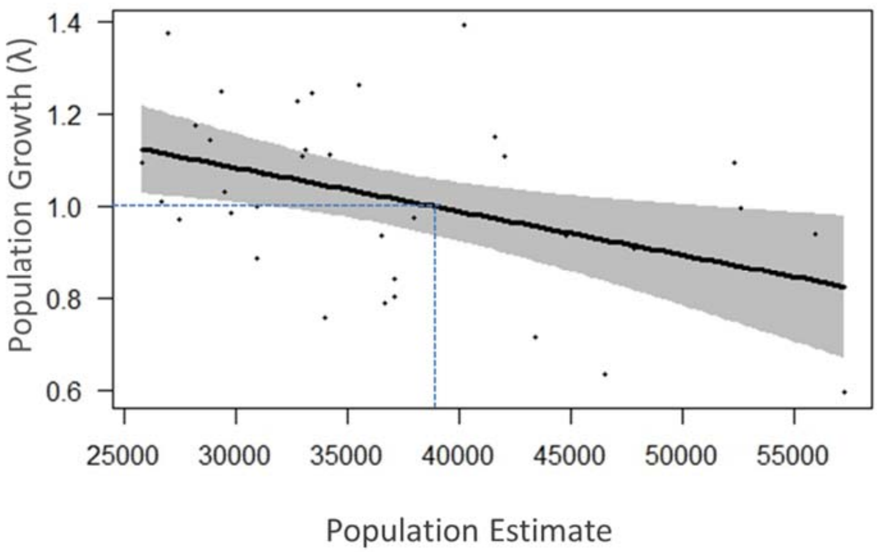


Figure 13. The relationship between population growth (λ) and estimated population abundance of Wyoming Range mule deer. As population abundance decreases, the growth rate (λ) of that population increases.

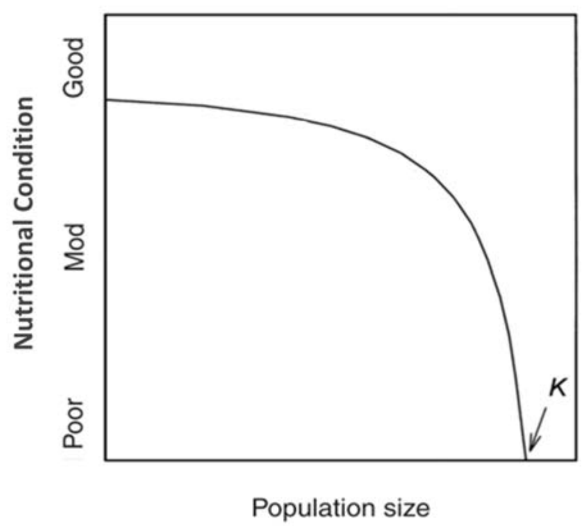


Figure 14. The relationship between population size and nutritional condition of ungulate populations. As population size increases and approaches carrying capacity (*K*), the overall nutritional condition of that population decreases (Kie et al. 2003).

As deer density decreases, per capita food increases. Consequently, populations at low abundance, relative to the carrying capacity (*K*) of their landscape, tend to be in overall better nutritional condition because each individual has access to more food (Fig. 14). Conversely, deer populations that are at or near carrying capacity tend to be in overall worse nutritional condition because deer are competing with other deer for food. Some of these trends were reflected in our longitudinal data of trends in fat dynamics since 2013, and deer were in the greatest nutritional condition we had observed in March 2017 (Fig. 15).

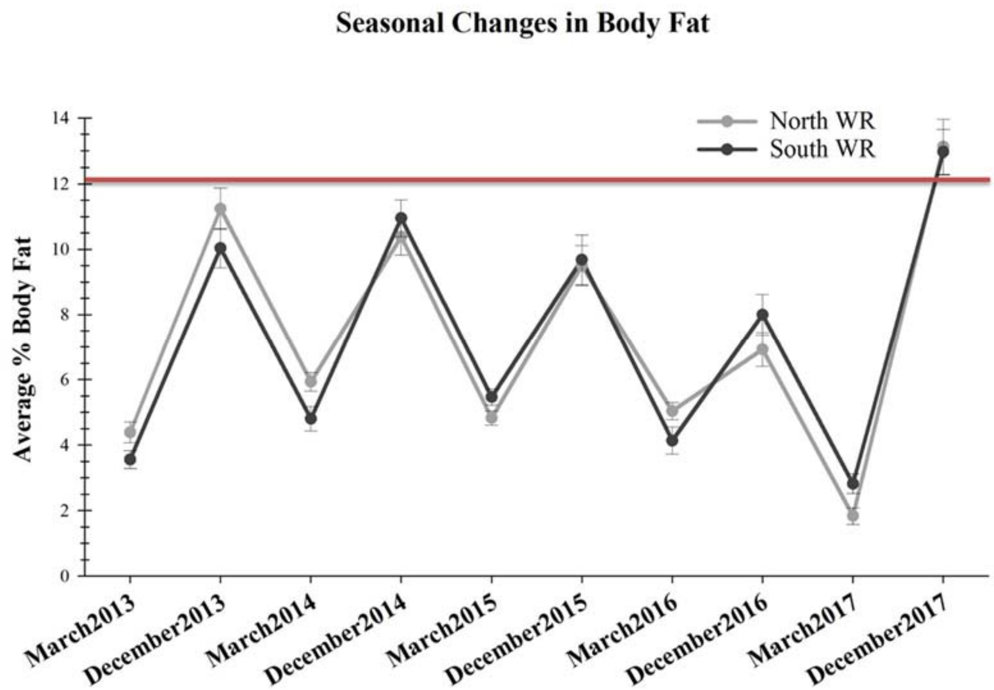


Figure 15. Average % body fat of adult, female Wyoming Range mule deer in March 2013 – March 2017. Following the population decline after the severe winter conditions of 2016/2017, animals were in the best nutritional condition recorded since our research began in March 2013. Essentially, the Wyoming Range mule deer population went from the worst nutritional condition to the best nutritional condition over a summer.

The nutritional condition of mom (i.e., maternal condition) can have life-long effects on her offspring. Previous research by Dr. Monteith (Monteith et al. 2009, *Journal of Mammalogy*) has shown that antler size of male deer is influenced more by maternal condition than genetics. Dr. Monteith, along with colleagues, observed that male fawns born to mothers in good maternal condition grew to be larger deer that exceeded the size of their fathers. Considering these research findings, Wyoming Range mule deer that can exploit their high nutritional condition (relative to previous years) observed in December 2017 may be better poised in allocating stored fat to fetal development and provisioning of young that are born in spring/early summer 2018. The summer of 2018 will be telling for the propensity for population growth and potential for large male deer in years to come.

A Positive Outlook for the Future

Overall survival throughout winter 2017/2018 was high (100% of collared adults and 93% of collared fawns survived), and in March 2018, we recaptured all surviving adult deer and their female offspring. Average % body fat in March 2018 was slightly higher than the overall average over the 6 years of our research (average of 5.46 ± 0.20% in March 2018 compared with overall study average of 4.46 ± 0.10% in March 2013-2018; Figure 3). Also, as would be expected for this population of mule deer, pregnancy rates and fetal rates were comparable to previous observations—94% of animals were pregnant and most were pregnant with twins (fetal rate was 1.68 ± 0.07, which is similar to the average throughout the study; figure 4).

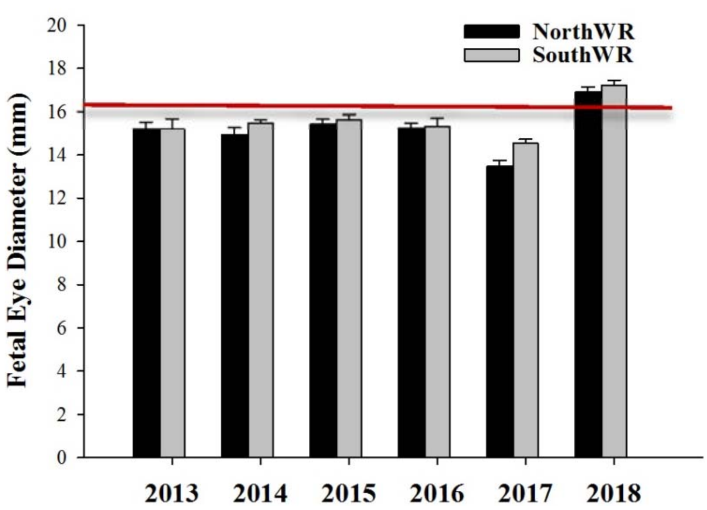


Figure 16. Average fetal eye diameter (mm) measured in March 2013-2018. Fetal eye diameter was significantly higher in 2018

Although nutritional condition and pregnancy in March 2018 were not significantly greater than what has been observed previously, we did observe notable differences in investment in reproduction throughout winter 2017/2018. More specifically, fetuses were significantly larger in March 2018 than in previous years (fetal eye diameter of 17.08 ± 0.16mm compared with a study average of 15.40 ± 0.09; figure 16), and fetuses were 22% larger in March 2018 than in March 2017. This increased investment in fetal development may be a direct result from the high fat stores that Wyoming Range mule deer had coming into the winter. We are excited to see how such investment in fetal development influences timing of birth and the size of young born in May and June.

Spring Migration Ecology of Mule Deer

At the largest spatial scale, migration is recognized as a strategy that allows migrants to exploit high-quality resources available on one seasonal range, while avoiding resource deficiencies on the other. Much less is known, however, about the fine scale movement behaviors that animals make during migration. This portion of the Wyoming Range Mule Deer Project aims to understand the importance of food resources available during migration, and how the habitat quality of migratory routes influences survival and reproduction of migratory mule deer in the Wyoming Range.

Spring migration is a critical time for migrants, in which they must recover from harsh winter conditions and prepare for upcoming reproductive costs. It is hypothesized that movement from low elevation winter ranges to high elevation summer ranges, allows migrants to extend the amount of time they are exposed to young, highly palatable forage. Following a wave of newly emergent, high-quality forage along elevational gradients, is known as “surfing the green wave”. This project will investigate the role of the migration route as critical habitat, with the aim to better understand the importance of migration as well as to inform management strategies to protect migration in the Wyoming Range and beyond.

Project Objectives

1. Test the green wave hypothesis in migratory mule deer and explore the source of individual variability in green-wave surfing (Completed, see below).

2. Investigate the influence of drought on green-wave surfing (In progress).

3. Understand the relative importance of green-wave surfing to fitness (In progress).

Testing the Green Wave Hypothesis

Deer should select plants that are at intermediate growth stages (i.e. not too old or not too young) because plants which are greening up are both easy to digest and available in large enough quantities to maximize energetic gains. If deer surf a wave of plant green-up, then the timing of their movements during spring migration should be perfectly matched with the timing of peak green-up in plants. When we tested this prediction, this is indeed what we found (Figure 1). We noticed, however, that there was a lot of variability in the green-wave surfing ability of individuals. To further investigate the source of this difference in green-wave surfing we considered how the progression of the green-wave across individual routes may differ. We found that some routes had long, easy to follow gradients in plant green-up, while other routes had short, rapid and difficult to follow gradients in plant green-up. Together this difference in the amount of time when green-up was available along a migration route (i.e. the green-up duration) and the gradient of green-up from winter range to summer range (i.e. the order of green-up), which we refer to as the "greenscape", largely explained the differences in green-wave surfing across individual deer using different migration routes.

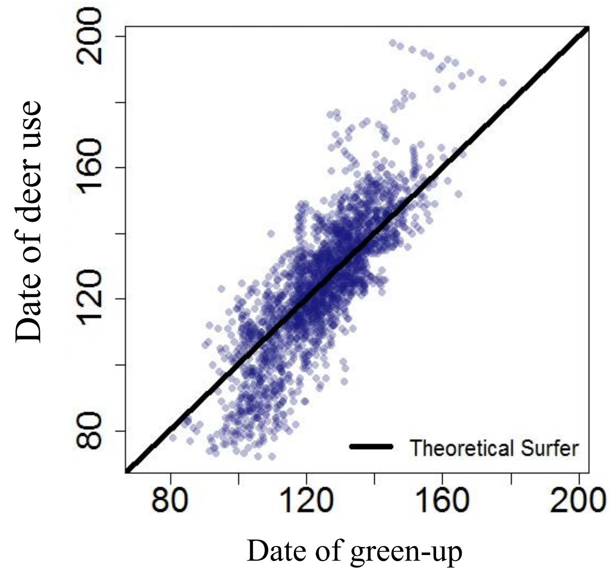


Figure 16. Evidence for green-wave surfing by mule deer in the Wyoming Range. The black line represents the theoretical prediction of a perfect match between the date of green-up and the date of deer use. Data points fall close to this line, suggesting that in general deer are surfing the green wave.

What have we learned?

- Green wave surfing is key to the foraging benefit of migration.
- The migration route provides critical habitat.
- Timing is key, thus activities that may alter the ability of deer to exploit the green wave should be avoided or minimized during the spring migration period.
- The greenscape (i.e. the duration and order of green-up along a migration route) determines the quality of a route.

This research is published! For more information, see:

Aikens, E.O., M. J. Kauffman, J. A. Merkle, S. P. H. Dwinnell, G. L. Fralick, and K. L. Monteith. 2017. The greenscape shapes surfing of resource waves in a large migratory herbivore. *Ecology Letters* 20:741-750.

The Rose Petal Project

While seasonal migration occurs in diverse animals and habitats, large ungulate migrations are some of the most spectacular wildlife events in the world. Migration is crucial to maintaining large, robust populations of large ungulates, and the western US boasts many populations of migratory ungulates, such as pronghorn (*Antilocapra americana*), elk (*Cervus elaphus*), moose (*Alces alces*), and mule deer (*Odocoileus hemionus*). Among ungulate migrations, mule deer migrations are extraordinary because animals can migrate extensive distances (up to 260 km) over extremely rugged terrain. Despite being able to travel all over a landscape, mule deer tend to move over this rugged terrain using the same migratory routes and seasonal ranges year after year, yet the question remains: how do mule deer know how to migrate?

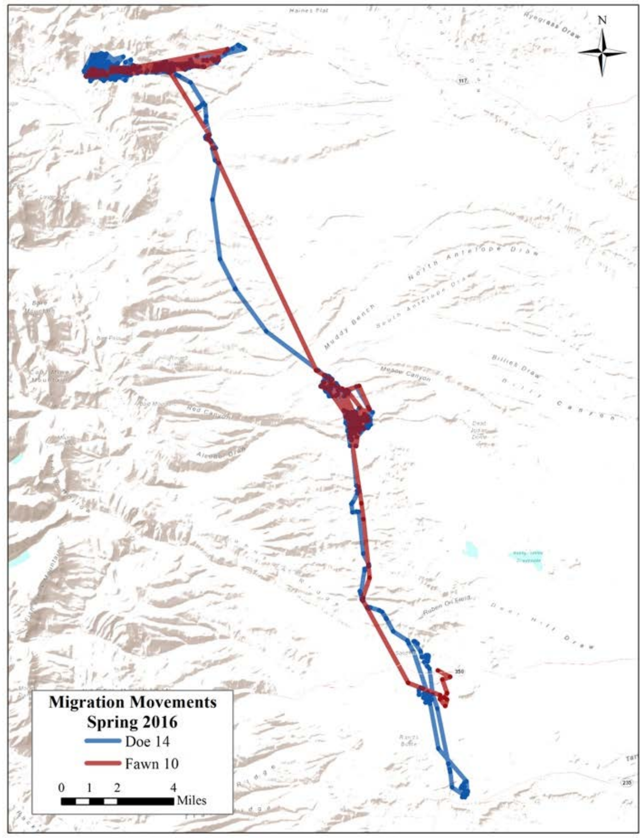
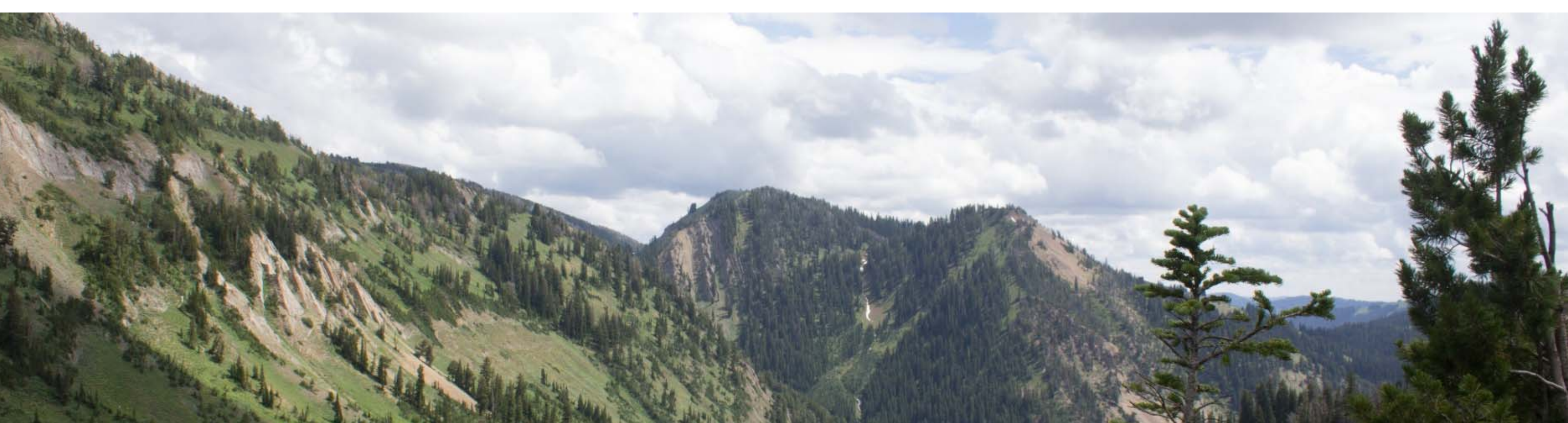


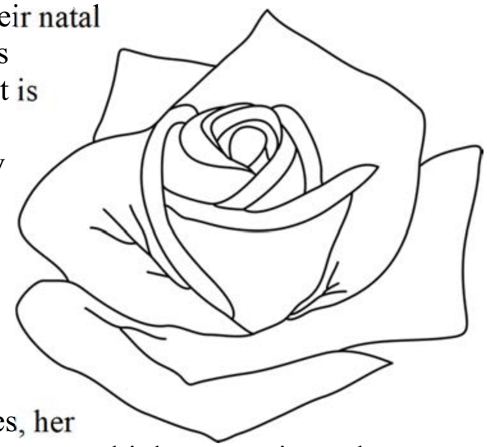
Fig 17. Paired migratory movements of mother (blue) and daughter (red) mule deer in Wyoming, USA. The migration paths of mother and daughter overlap considerably, and warrant investigation of the role of cultural inheritance in shaping migratory behaviors.
Credit: S. Dwinnell.

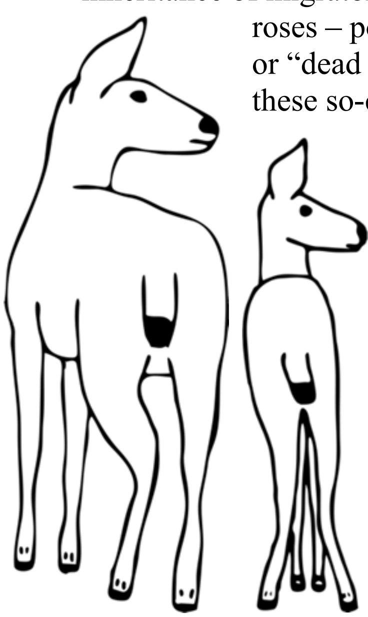
Ungulates may know how to migrate if information on migratory traits (e.g., timing to initiate migration, rate of movement, migration path, seasonal range characteristics) is passed down from parent to offspring. Two potential mechanism could facilitate this transmission from parent to offspring: genetic inheritance and cultural inheritance. While genetics may underpin migratory traits in some bird species, whether genetics underpin ungulate migration remains to be discovered. Additionally, migratory traits may be passed from mother to offspring if offspring migrate alongside and learn the behaviors of the mother – in other words, through cultural inheritance. Depending on the mechanism responsible for determining the transmission of migratory traits, we may need to alter our management strategies to ensure robust deer populations. Before we can understand these mechanisms, however, we need to test an overlooked assumption: that migration is passed from generation to generation at all, regardless of the mechanism responsible.



In mule deer, managers and scientists currently assume that mothers migrate with their newborn offspring from summer range to winter range, and return with their offspring to summer range the following spring (Fig. 1). The transmission of migratory traits (through either genetic or cultural inheritance) could allow parents to pass information about already successful or familiar habitats and routes to their offspring. While scientists have largely overlooked the transmission of migratory behaviors from parent to offspring, studying whether information is transmitted across generations has huge ramifications for understanding the ontogeny – or development – of migratory behaviors.

In addition to being fascinating, understanding the ontogeny of migration could change how we manage populations of migratory mule deer and other migratory ungulates. Because the females in many species of ungulates do not disperse far from their natal range, clusters of closely related females will form when mothers successfully raise offspring. This behavior of spatial arrangement is deemed the *rose petal hypothesis*, and results in clusters of mule deer families while they are on summer range. Passing migratory behaviors from parent to offspring could have population-level consequences if inherited behaviors constrain the habitat which family lineages can access. For example, if a mother mule deer transmits information about high-quality habitat to her daughter, that daughter may be more successful at having and raising offspring of her own. Alternatively, if a mother transmits information that leads her daughter to low-quality seasonal ranges, her daughter may have lower reproductive success. When combined over multiple generations, the inheritance of migratory traits of differing quality could produce differences in the sizes of these roses – potentially creating areas analogous to mule deer "hot spots" (robust rose) or "dead zones" (dilapidated rose). Identifying the migratory traits that result in these so-called "hot spots" could provide managers with information about which individuals, management areas, or behaviors to prioritize.





Are migratory traits transmitted from mother to daughter?

We aim to identify whether migratory traits are transmitted from generation to generation in mule deer. We expect that if migratory traits are transmitted, offspring will display migratory traits (e.g., migration timing, rate of movement, migration route, and quality of seasonal ranges) resembling their mothers (Fig. 2a).

To test whether migratory traits are transmitted, we will compare migration characteristics among and between mother-daughter pairs of Wyoming Range mule deer fitted with GPS collars. We began collaring efforts in 2016, and expect to collar approximately 50 mother-daughter pairs by the end of the project. We will use a suite of analyses including movement coordinate index, linear regression, and utilization distribution overlap index to quantify similarities between mother-offspring migratory traits.

What are the population consequences of transmitting migratory traits?

If migratory traits are transmitted, lineages may be constrained in the habitat they can occupy, such that transmission of certain combinations of migratory traits will lead to differential reproduction and local density. We expect founding mothers that inherit access to advantageous habitat will successfully raise more offspring over their lifetime, while mothers that inherit access to low-quality habitat will raise fewer offspring (Fig. 2b). Differences in reproduction, and the resulting differences in local density, may then influence landscape-scale spatial distribution.

To test whether the inheritance of migration traits has consequences of mule deer populations, we will compare local density around each collared female with mother-offspring migration trait similarities. We will determine local density by searching for fecal samples along belt transects centered around the summer range of each collared mother-daughter pair. Using genetic information extracted from fecal pellets, we will determine individual identification and genetic relatedness to the collared female. We will then test whether similarities in migration traits between mother and offspring influence local density.

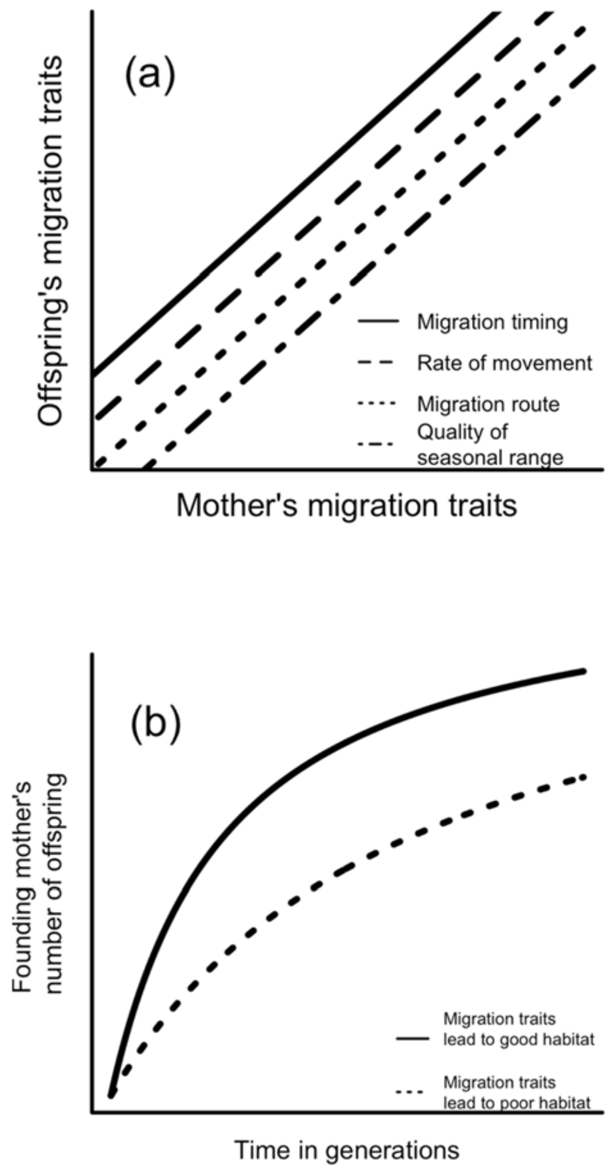


Fig. 18. Predictions associated with the cultural inheritance hypothesis (a) and the population consequences hypothesis (b).

Management implications

Despite the importance of migration to many ungulate species, anthropogenic change is rapidly altering landscapes and, consequently, migratory behaviors. Halting or altering migratory behaviors could impact ungulate population trajectories by rendering segments of seasonal habitats unused, ultimately constraining species abundance, occupancy, and distribution. Because migration strategies developed under past conditions, properly managing ungulates in a rapidly changing world relies on characterizing the factors shaping migratory traits and the subsequent population ramifications.

Future Directions

The effects of the 2016-17 winter has been distressing, but we now are uniquely poised to document the long-term effects severe winters and understand the factors that will influence population recovery from the devastating losses. We have been extremely fortunate to have been conducting research on this herd, not only through the course of this harsh winter, but for several years prior, which will yield the data to address questions associated with how severe winters may affect mule deer herds throughout the state. With dramatic reductions in density, forage resources available per individual should be bolstered and thus, nutritional condition, reproductive success, and survival may well all respond very favorably. Nevertheless, with lower deer density compared with recent decades, the role of predators in this population also may change in either positive or negative ways. The marked decline of the Wyoming Range deer population following the 1992-93 winter, and the near absence of any substantial recovery thereafter, also begs the question to what extent recovery will occur given historic patterns. Regardless, the overwhelming management desire is for recovery, and our aim is to document recovery and the mechanisms that underpin it.

The overall goal of our continued work in the Wyoming Range will be to build on our understanding of the nutritional and population ecology of this herd to document the carryover effects of the severe winter of 2016-17, and how and to what extent the population will rebound from the dramatic reduction in abundance. As before, our overall approach will continue to mesh data on nutritional condition, habitat condition, and population performance to understand factors regulating Wyoming Range mule deer and the ability of the current habitat to support mule deer—with now a distinct reduction in density, habitat and density-dependent feedbacks onto the population should illuminate ever more so than previously. Our approach will allow us to continue to elucidate the relative roles of habitat, nutrition, predation, and disease on the regulation of deer in western WY, and fully grasp the magnitude and extent of the effects of the transient, but clearly regulatory role of winter.

Partners

The Wyoming Range Deer Project is a collaborative partnership in inception, development, operations, and funding. Without all the active partners, this work would not be possible. Funds have been provided by the Wyoming Game and Fish Department, Wyoming Game and Fish Commission, Wyoming Wildlife and Natural Resource Trust, Muley Fanatic Foundation, Bureau of Land Management, Knobloch Family Foundation, U.S. Geological Survey, National Science Foundation, Wyoming Governor's Big Game License Coalition, Boone and Crockett Club, Animal Damage Management Board, Ridgeline Energy Atlantic Power, Bowhunters of Wyoming, and the Wyoming Outfitters and Guides Association. Special thanks to the Wyoming Game and Fish Department, Bureau of Land Management, and Wyoming State Veterinary Lab for assistance with logistics, lab analyses, and fieldwork. Also, thanks to the Cokeville Meadows National Wildlife Refuge and U.S. Forest Service for providing field housing.

Knobloch Family Foundation

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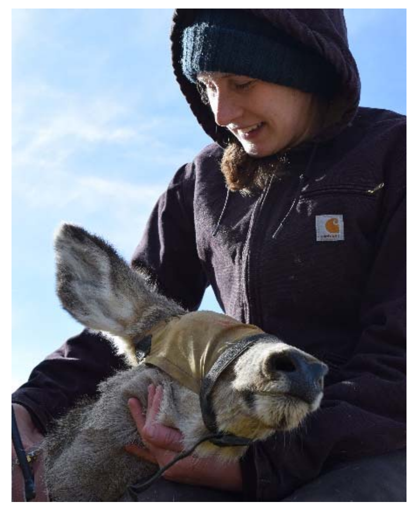
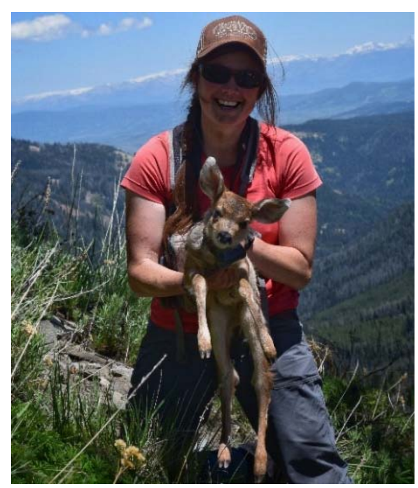
Kevin Monteith is an Assistant Professor of the Haub School of Environment and Natural Resources and the Wyoming Cooperative Fish and Wildlife Research Unit, Department of Zoology and Physiology at the University of Wyoming. After receiving his BSc and MSc in Wildlife and Fisheries Sciences from South Dakota State University, he went on to obtain his PhD in Biology from Idaho State University in 2011. Kevin's research program is focused on integrating nutritional ecology with intensive field studies of large ungulates to elucidate the mechanisms that underpin behavior, growth, reproductive allocation, predator-prey dynamics, and ultimately, the factors affecting population growth. Kevin and his graduate students are currently conducting research on most of Wyoming's large ungulates; topics are centered on establishing a protocol for habitat-based, sustainable management of ungulate populations, while investigating the effects of predation, habitat alteration, climate change, migration tactics, and novel disturbance.

Ellen Aikens



Ellen is a PhD candidate in the Program in Ecology at the University of Wyoming. Ellen is fascinated by animal movement, especially migration. Ellen plans to pursue a career in research, with a focus on the interface between fundamental research and applied conservation and management. Before coming to Wyoming, Ellen worked at the Smithsonian Conservation Biology Institute's GIS lab, where she analyzed remote sensing and GPS telemetry data for conservation research projects across the globe. Ellen is a recipient of the National Science Foundation Graduate Research Fellowship and the Berry Fellowship. Ellen earned her bachelor's degree in Biology and Environmental Studies from Ursinus College.

Samantha Dwinnell



Samantha Dwinnell is a Research Scientist with the Haub School of Environment and Natural Resources. Samantha is the first student to miraculously graduate (May 2017) with a MSc from the Monteith Shop. Immediately following her defense that was made successful through bribery, she foolishly convinced Dr. Monteith to hire her as a Research Scientist to manage the Wyoming Range Mule Deer Project. Samantha's graduate research was focused on the nutritional relationships among mule deer behavior, forage, and human disturbance. Currently, her research is focused on disentangling the relative influence of various factors that affect fawn survival. Although Samantha is most interested in research aimed at informing management and conservation of wildlife, she also dedicates research efforts into finding ways to mountain bike and ski without her boss knowing.

Rhiannon Jakopak

Rhiannon is currently a master's student in the Cooperative Fish and Wildlife Research Unit at the University of Wyoming. She received dual bachelor's degrees in Wildlife and Fisheries Biology and Management and Religious Studies at the University of Wyoming in 2016. She is broadly interested in population ecology and mammalogy, and more specifically interested in the processes regulating the distribution of species. Her master's project seeks to identify the factors which influence the development of migration and the subsequent population consequences.

Tayler LaSharr

Tayler LaSharr is a MSc student in the Cooperative Fish and Wildlife Research Unit. Tayler grew up in Phoenix, AZ and attended the University of Arizona where she obtained a BSc in Natural Resources with an emphasis in Conservation Biology and a minor in Chemistry in May of 2015. During her time at the University of Arizona, she studied life history tradeoffs in Western and Mountain Bluebirds and the effects of aggression in closely related species on habitat and range dynamics. In the summer of 2015, she began work in the Wyoming Cooperative Fish and Wildlife Research Unit as a technician on a fawn survival study of mule deer in the Wyoming Range. In the fall of 2015, she began work on her own research, which focuses on understanding the effects of harvest on horn size of mountain sheep. Following the completion of her MSc work in the spring of 2018, she will transition to a PhD working on a component of the Wyoming Range Mule Deer Project assessing population recovery following a severe winter.

Haub School of Environment and Natural Resources

Academic Programs | Biodiversity Institute | Ruckelshaus Institute

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APPENDIX D

Appendix D. Wyoming Range Mule Deer Herd, posthunt herd composition data, 2011-2017.										
							Ratio:100 Females			
2011	Yrlng Males	Adult Males	Total Males	Does	Fawns	Total	Yrlng Males	Adult Males	Total Males	Fawns
HA134	27	164	191	653	415	1259	4	25	29	63
HA135	53	317	370	1017	675	2062	5	31	36	66
HA143	260	517	777	1893	1083	3753	14	27	41	57
144/145	Survey conducted in February 2012					752				
TOTAL	340	998	1338	3563	2173	7826	9	28	37	61
2012										
HA134	55	103	158	635	404	1197	9	16	25	64
HA135	80	159	239	822	647	1708	10	19	29	79
HA143	116	177	293	799	505	1597	14	22	37	63
144/145	Survey conducted in February 2013					764				
TOTAL	251	439	690	2256	1556	5266	11	19	30	69
2013										
HA134	99	175	274	660	496	1430	15	26	41	75
HA135	145	203	348	913	672	1933	16	22	38	74
HA143	300	326	626	1373	897	2896	22	24	46	65
144/145	Survey conducted in March 2014					805				
TOTAL	544	704	1248	2946	2065	7064	18	24	42	70
2014										
HA134	100	138	238	565	466	1269	18	24	42	82
HA135	191	322	513	1386	1128	3027	14	23	37	81
HA143	291	271	562	1288	884	2734	22	21	43	68
144/145	Survey conducted in February 2015					1005				
TOTAL	582	731	1313	3239	2478	8035	18	22	40	76
2015										
HA134	81	173	254	737	406	1397	11	23	34	55
HA135	176	302	478	1188	828	2494	15	25	40	70
HA143	415	399	814	2005	1147	3966	21	20	41	57
144/145	Survey conducted in February 2016					440				
TOTAL	672	874	1546	3930	2381	8297	17	22	39	60
2016										
HA134	95	190	285	774	489	1549	12	24	36	63
HA135	182	380	562	1605	1008	3175	11	24	35	63
HA143	256	260	516	1430	723	2669	18	18	36	50
144/145	Survey conducted in February 2017					517				
TOTAL	533	830	1363	3809	2220	7910	14	22	36	58
2017										
HA134	14	153	167	672	389	1228	2	23	25	58
HA135	47	282	329	1105	701	2135	4	25	30	63
HA143	111	348	459	1547	701	2707	7	22	30	45
144/145	Survey to be conducted in February 2018					TBD				
TOTAL	172	783	955	3324	1791	6070	5	23	29	54

APPENDIX E

Appendix E. A comparison between December and April herd composition data, Wyoming Range Mule Deer Herd, 1992-2018.							
	No. Deer Classified				Change in Ratio		
	December		April		December	April	%
2017-18	Adults	Fawns	Adults	Fawns	Juv:100 Adults	Juv:100 Adults	Change
HA134	839	389	341	141	46.3	41.3	-10.7
HA135	1434	701	414	158	48.8	38.1	-21.9
HA143	2006	701	1261	430	34.9	34.0	-0.03
TOTAL	4279	1791	2016	729	41.8	36.1	-13.6
2016-17							
HA134	1059	489	344	27	46.1	7.8	-83.1
HA135	2167	1008	531	45	46.5	8.4	-82.0
HA143	1946	723	2142	113	37.1	5.3	-86.0
TOTAL	5172	2220	3017	185	42.9	6.1	-86.0
2015-16							
HA134	991	406	300	119	40.9	39.6	-3.2
HA135	1666	828	482	167	49.6	34.6	-30.2
HA143	2819	1147	1903	615	40.6	32.3	-20.4
TOTAL	5476	2381	2685	901	43.5	33.5	-25.7
2014-15							
HA134	803	466	103	76	58.0	73.7	+21.3
HA135	1899	1128	461	319	59.4	69.1	+14.0
HA143	1850	884	798	317	47.8	39.7	-16.9
TOTAL	1850	884	789	317	47.8	39.7	-16.9
2013-14							
HA134	934	496	121	53	53.1	Small Sample Size	Small Sample Size
HA135	1261	672	526	208	53.3	39.5	-25.8
HA143	1999	897	1431	486	44.8	33.9	-24.3
TOTAL	3260	1569	1957	694	48.1	35.5	-26.2
2012-13							
HA134	793	404	199	71	50.9	Small Sample Size	Small Sample Size
HA135	1061	647	254	95	60.9	37.4	-38.6
HA143	1092	505	1498	585	46.2	39.0	-15.6
TOTAL	2153	1152	1752	680	53.5	38.8	-27.4
2011-12							
HA134	844	415	NDR	NDR	49.2	No Data Reported	No Data Reported
HA135	1387	675	133	52	48.7	Small Sample Size	Small Sample Size
HA143	2670	1083	1046	375	40.6	35.8	-11.8
TOTAL	2670	1083	1046	375	40.6	35.8	-11.8
2010-11							
HA134	870	379	722	77	43.5	10.6	-75.6
HA135	1449	622	611	73	42.9	11.9	-72.2
HA143	1987	959	1069	227	48.2	21.2	-56.0
TOTAL	4306	1960	2402	377	45.5	15.6	-65.7
2009-10							
HA134	954	430	772	289	45.0	37.4	-16.8
HA135	1409	642	428	166	45.5	38.7	-14.9
HA143	2480	1177	1278	503	47.4	39.3	-17.0
TOTAL	4843	2249	2478	958	46.4	38.6	-16.8

Appendix E. A comparison between December and April herd composition data, Wyoming Range Mule Deer Herd, 1992-2018.

	No. Deer Classified				Change in Ratio		
	December		April		December	April	%
2008-09	Adults	Fawns	Adults	Fawns	Juv:100 Adults	Juv:100 Adults	Change
HA134	856	403	622	238	47.0	38.3	-18.5
HA135	1561	731	207	76	46.8	36.7	-21.6
HA143	2140	870	1415	522	40.6	36.9	-9.1
TOTAL	4557	2004	2244	836	44.8	37.3	-16.7
2007-08							
HA134	1225	736	787	171	60.0	21.7	-63.8
HA135	1198	657	565	137	54.8	24.2	-55.8
HA143	3122	1404	1315	525	44.9	39.9	-11.1
TOTAL	5545	2797	2667	833	50.4	31.2	-38.1
2006-07							
HA134	680	344	249	104	50.6	41.7	-17.6
HA135	844	462	444	191	54.7	43.0	-21.4
HA143	2253	1136	520	223	50.4	42.8	-15.1
TOTAL	3777	1942	1213	518	51.4	42.7	-16.9
2005-06							
HA134	732	442	391	174	60.4	44.5	-26.3
HA135	1075	644	435	157	59.9	36.1	-39.7
HA143	2279	1085	1177	413	47.6	35.1	-26.2
TOTAL	4086	2171	2003	744	53.1	37.1	-30.1
2004-05							
HA134	942	537	515	135	57.0	26.2	-54.0
HA135	854	534	790	232	62.5	29.4	-52.9
HA143	1750	893	1156	461	51.0	39.8	-21.9
TOTAL	3546	1964	2461	828	55.3	33.6	-39.2
2003-04							
HA134	760	457	146	21	60.1	14.4	-76.0
HA135	1148	625	587	149	54.4	25.3	-53.5
HA143	1490	788	880	195	52.8	22.1	-58.1
TOTAL	3398	1870	1613	365	55.0	22.6	-58.9
2002-03							
HA134	511	235	426	129	45.9	30.3	-33.9
HA135	1141	546	986	366	47.8	37.1	-22.4
HA143	1556	7767	1542	585	49.3	37.9	-23.1
TOTAL	3208	1548	2954	1080	48.2	36.6	-24.1
2001-02							
HA134	1051	478	468	59	45.5	12.6	-72.3
HA135	1535	704	902	174	45.8	19.3	-57.9
HA143	2453	1122	1456	474	45.7	32.5	-28.9
TOTAL	5039	2304	2826	707	45.7	25.0	-45.3

Appendix E. A comparison between December and April herd composition data, Wyoming Range Mule Deer Herd, 1992-2018.

	No. Deer Classified				Change in Ratio		
2000-01	December		April		December	April	% Change
	Adults		Fawns		Fawns	Juv:100 Adults	
HA134	572	305	256	76	53.3	29.6	-44.4
HA135	821	490	873	375	59.7	42.9	-28.1
HA143	2244	1358	1529	811	60.5	53.0	-12.4
144/45	215	137	83	42	63.0	50.6	-20.0
TOTAL	3852	2290	2741	1304	59.4	47.5	-20.0
1999-00							
HA135	936	460	559	242	49.1	43.3	-11.8
HA143	1570	934	1225	715	59.5	58.4	-00.1
TOTAL	3250	1816	1872	1009	55.6	53.6	-3.6
1998-99							
HA134	591	321	280	121	54.3	43.2	-20.4
HA135	908	513	416	178	56.5	42.7	-24.4
HA143	1921	1017	1224	540	52.9	44.1	-16.6
TOTAL	3420	1851	1920	839	54.1	43.7	-19.2
1997-98							
HA134	821	386	90	29	47.0	32.2	-31.5
HA135	1081	621	415	160	57.4	38.6	-32.8
HA143	1769	896	1528	648	50.7	32.4	-16.4
TOTAL	3671	1903	2033	837	51.8	41.2	-20.5
1996-97							
HA134	1092	570	217	25	72.6	11.5	-84.2
HA135	1601	867	231	82	75.7	35.5	-53.1
HA143	1221	791	1202	401	64.8	33.4	-48.5
TOTAL	3914	2228	1650	508	56.9	30.7	-46.0
1995-96							
HA134	431	228	334	106	54.2	31.7	-41.5
HA135	735	407	416	180	55.4	43.0	-22.4
HA143	1925	942	1369	483	48.9	35.3	-27.8
144/45	551	254	206	39	46.1	18.9	-59.0
TOTAL	3642	1831	2325	808	50.3	34.8	-30.8
1994-95							
HA134	1331	574	596	221	43.1	37.1	-13.9
HA135	434	245	489	219	56.5	44.8	-20.7
HA137	361	172	217	85	47.6	39.2	-17.6
HA143	1965	759	1189	514	38.6	43.2	+10.6
TOTAL	4742	2133	2491	1039	45.0	41.7	-7.3
1993-94							
HA134	564	202	318	88	35.8	27.7	-22.6
HA135	360	148	357	108	41.1	30.3	-26.3
HA137	229	64	254	79	27.9	31.1	+10.3
HA143	1165	395	957	301	33.9	31.5	-7.1
144/45	298	170	108	41	57.0	38.0	-33.3
TOTAL	2667	1002	1994	617	37.6	30.9	-17.8

Appendix E. A comparison between December and April herd composition data, Wyoming Range Mule Deer Herd, 1992-2018.

	No. Deer Classified				Change in Ratio		
1992-93	December		April		December	April	% Change
	Adults		Fawns		Fawns	Juv:100 Adults	
HA134	1089	530	190	21	48.7	11.1	-77.2
HA135	470	253	92	16	53.8	17.4	-67.7
HA143	1924	548	1281	251	28.5	19.6	-31.2
144/45	515	174	193	24	33.8	12.4	-63.3
TOTAL	4586	1782	1756	312	38.9	17.8	-54.2

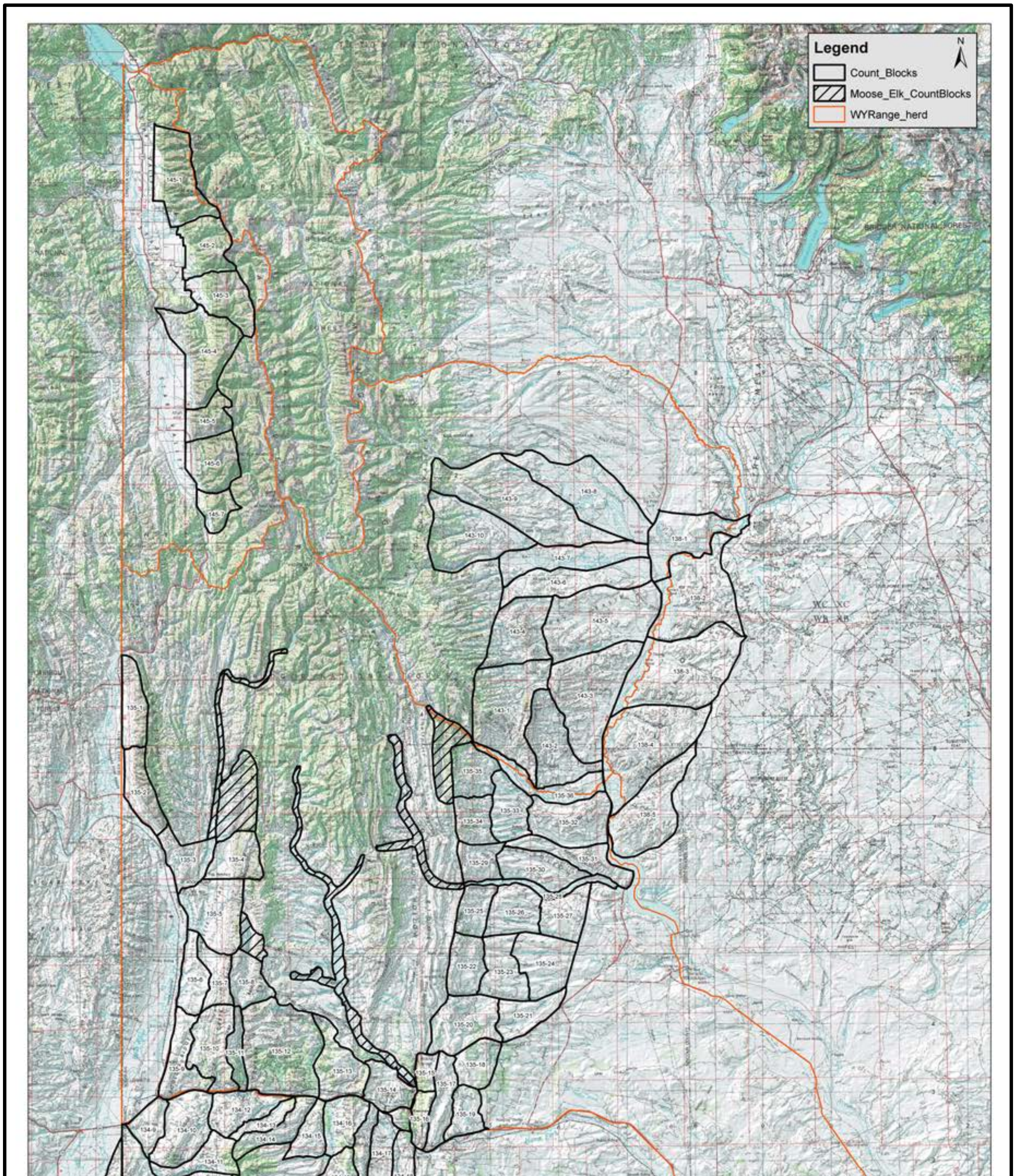
APPENDIX F

Wyoming Range Mule Deer Herd Sightability Survey

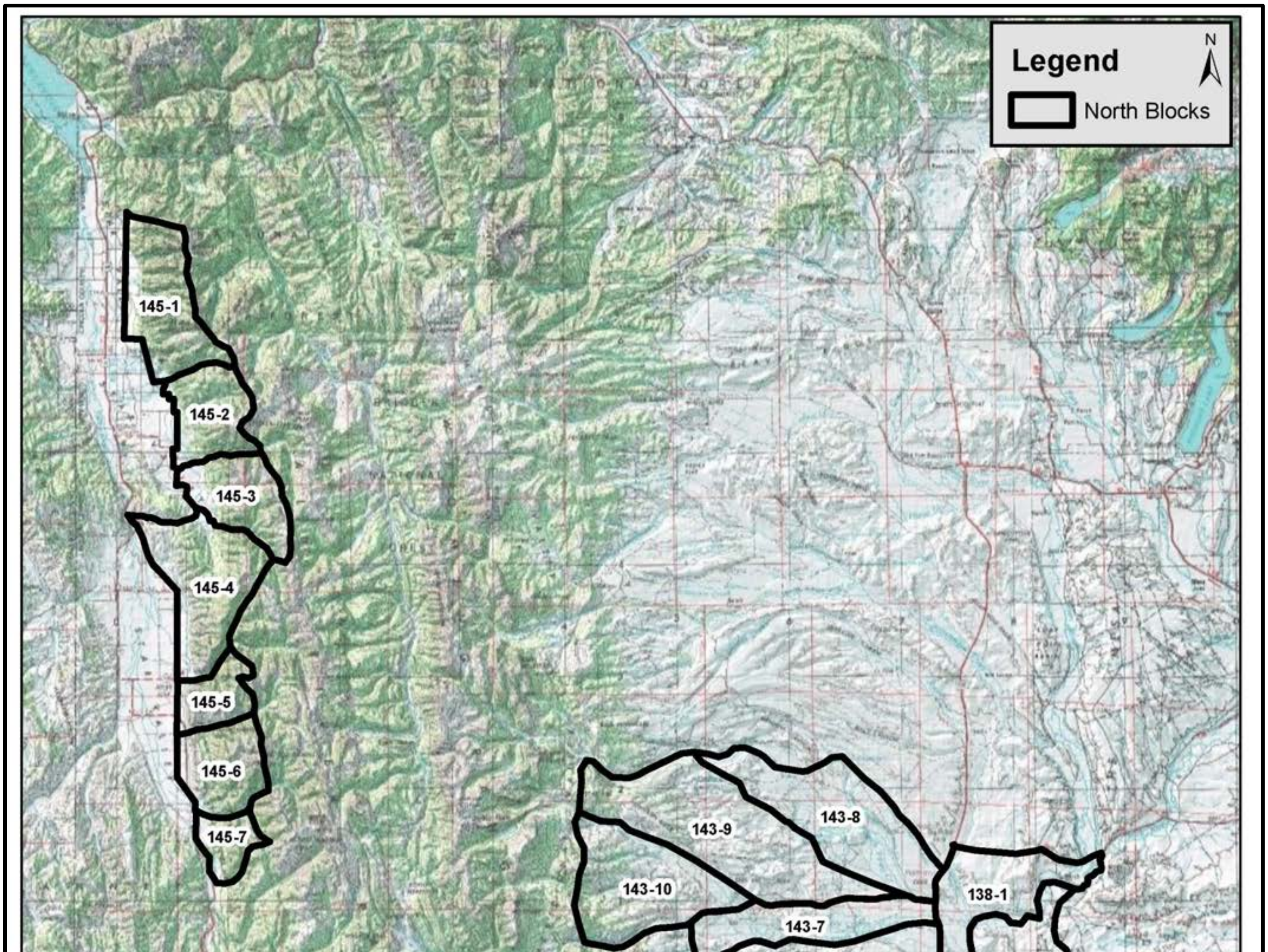
Count Blocks

February 2018

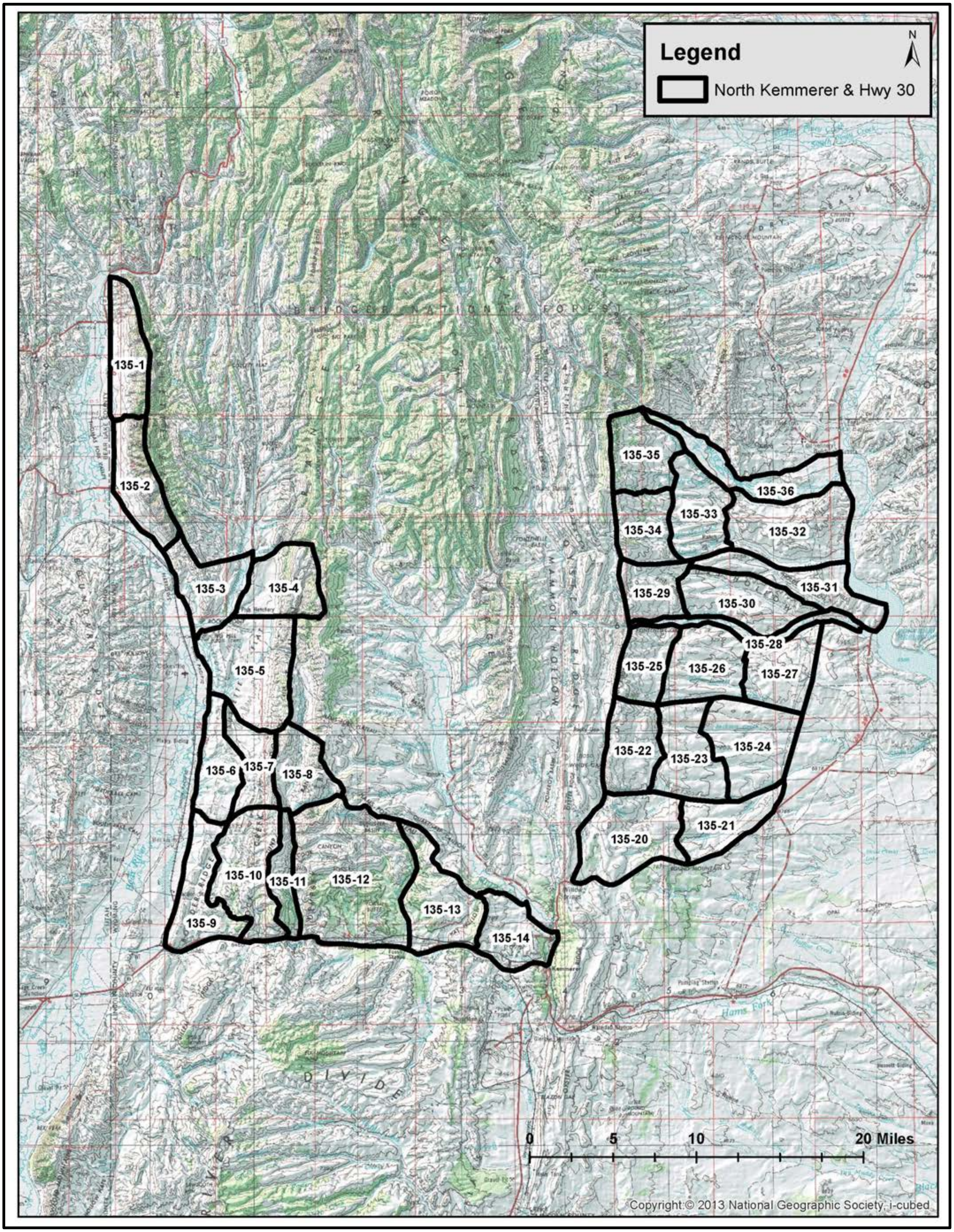
Overview Map



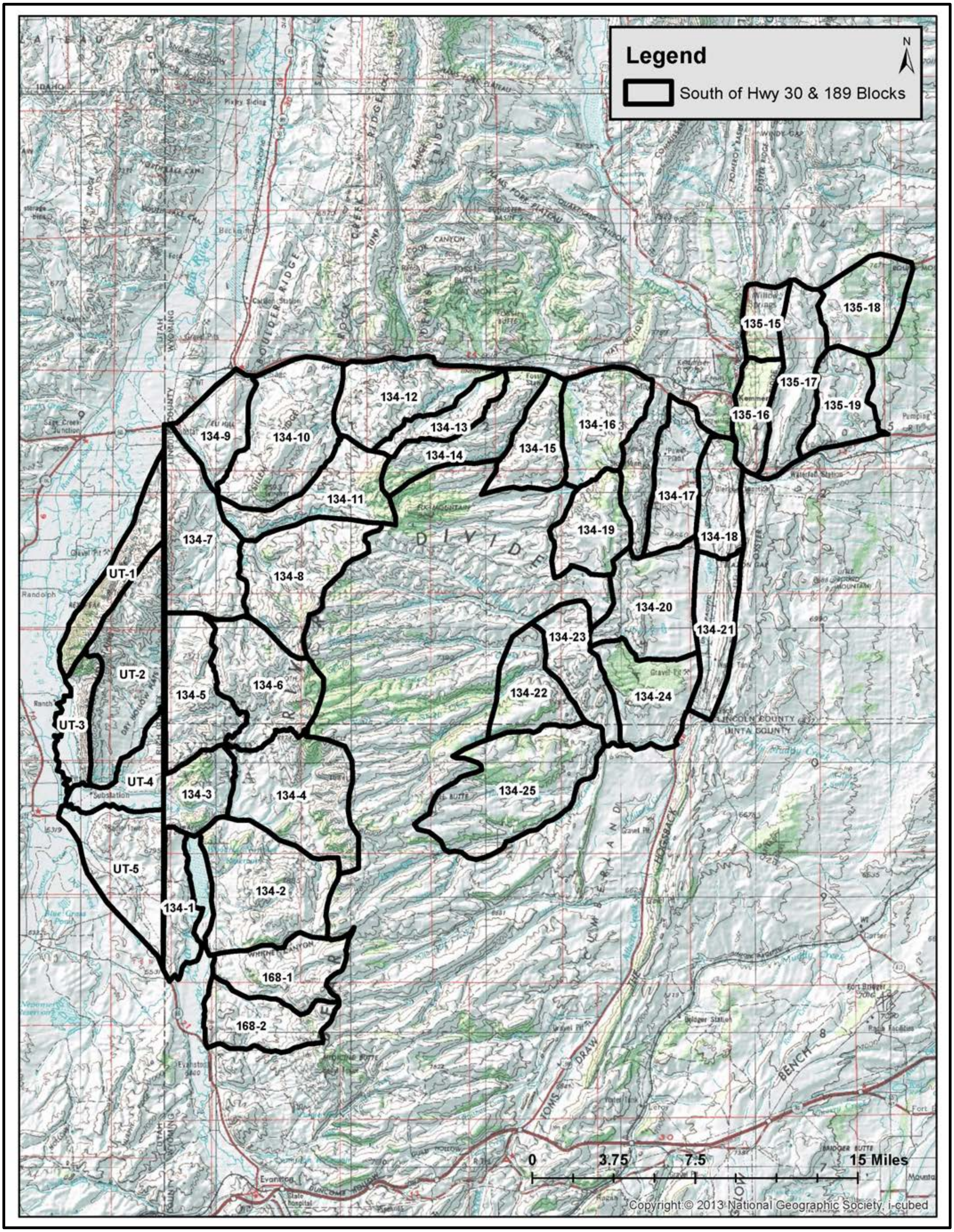
North Count Blocks **(Gary's Area of Coverage)**



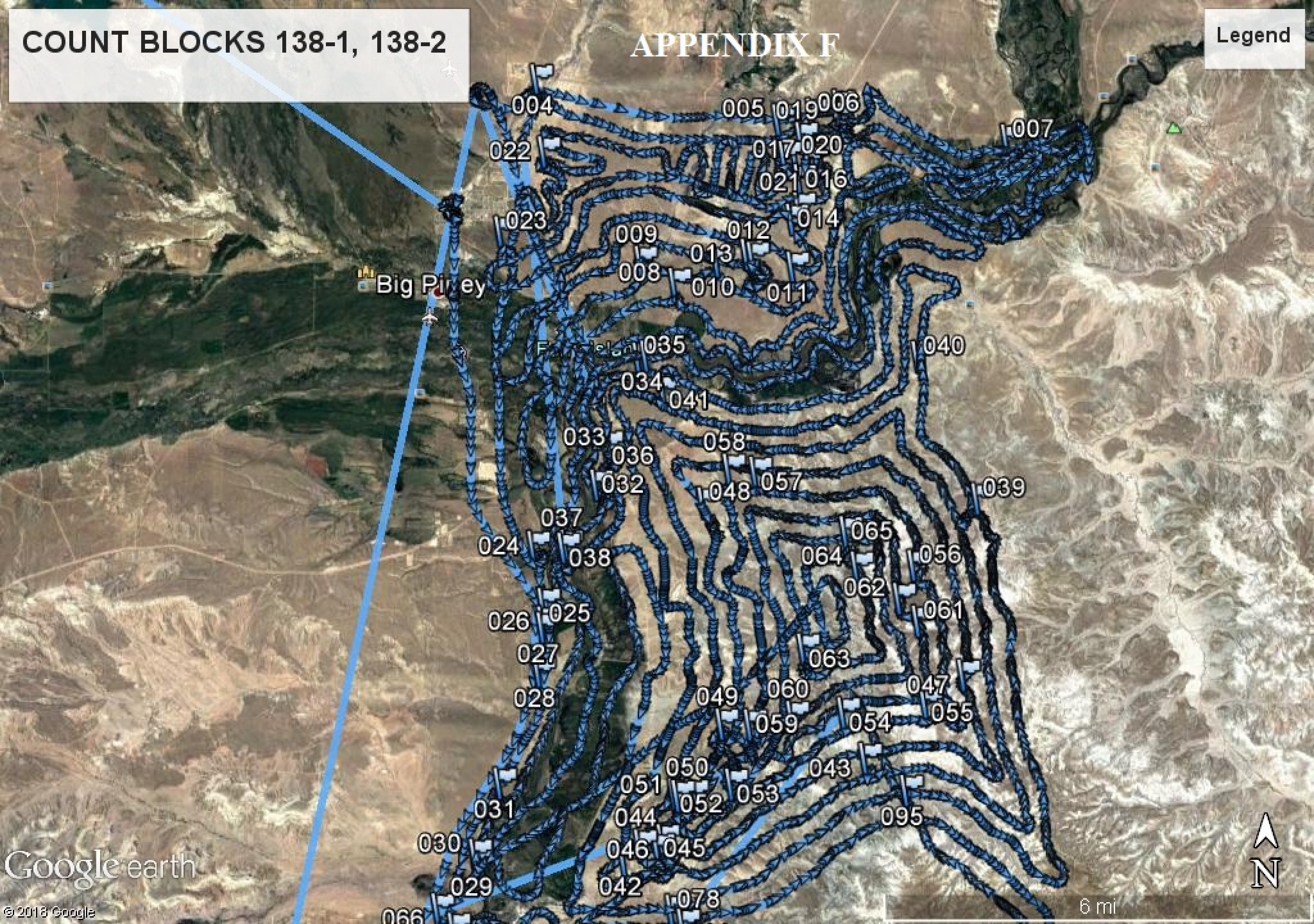
North of Kemmerer & Hwy 30 – Count Blocks



South of Hwy 30 & 189 – Count Blocks



APPENDIX F


COUNT BLOCKS 138-1, 138-2
Legend
Big Piney
004
005
019
006
007
022
017
020
021
016
023
014
012
009
013
008
010
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035
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Google earth
© 2018 Google
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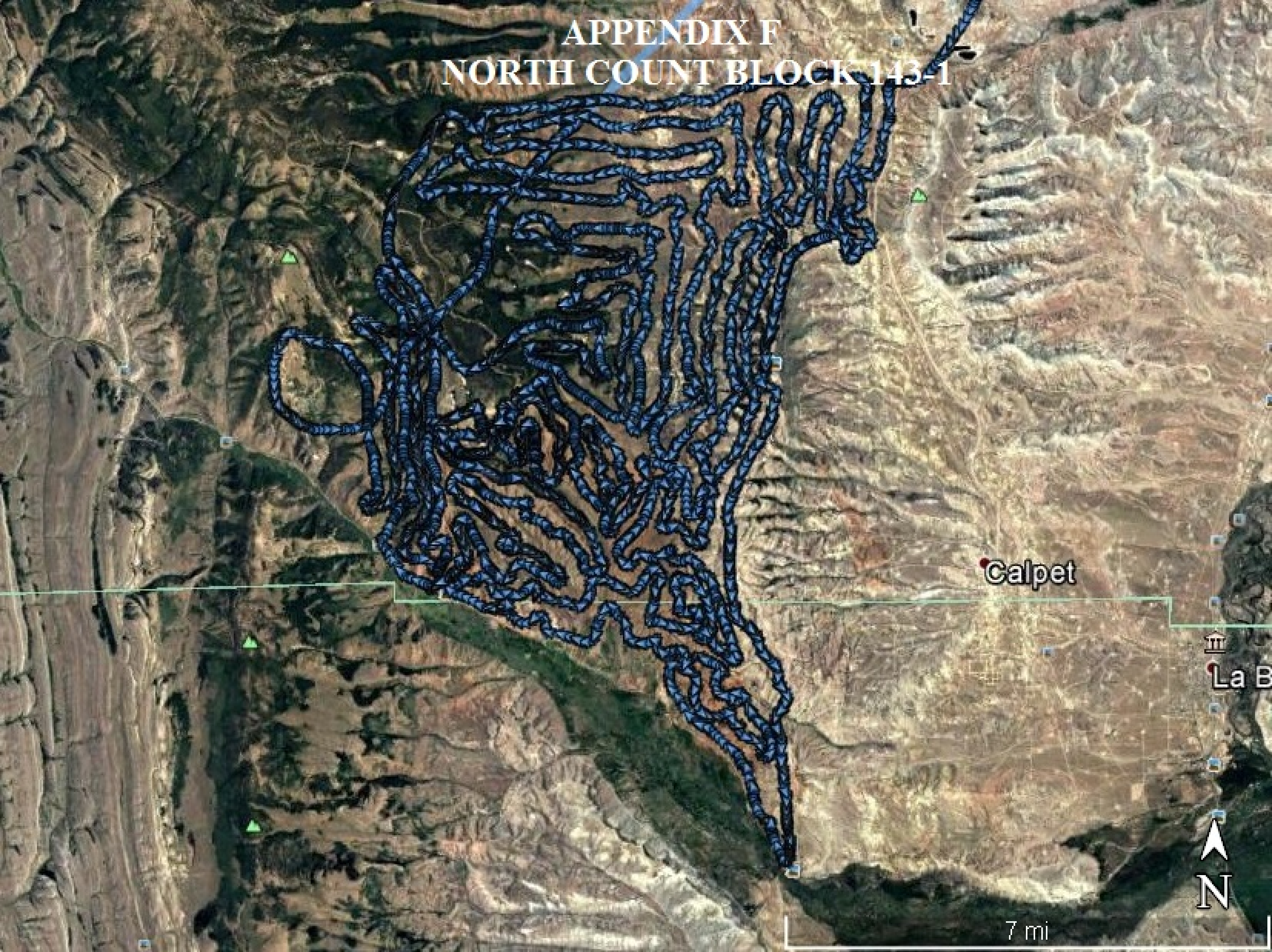
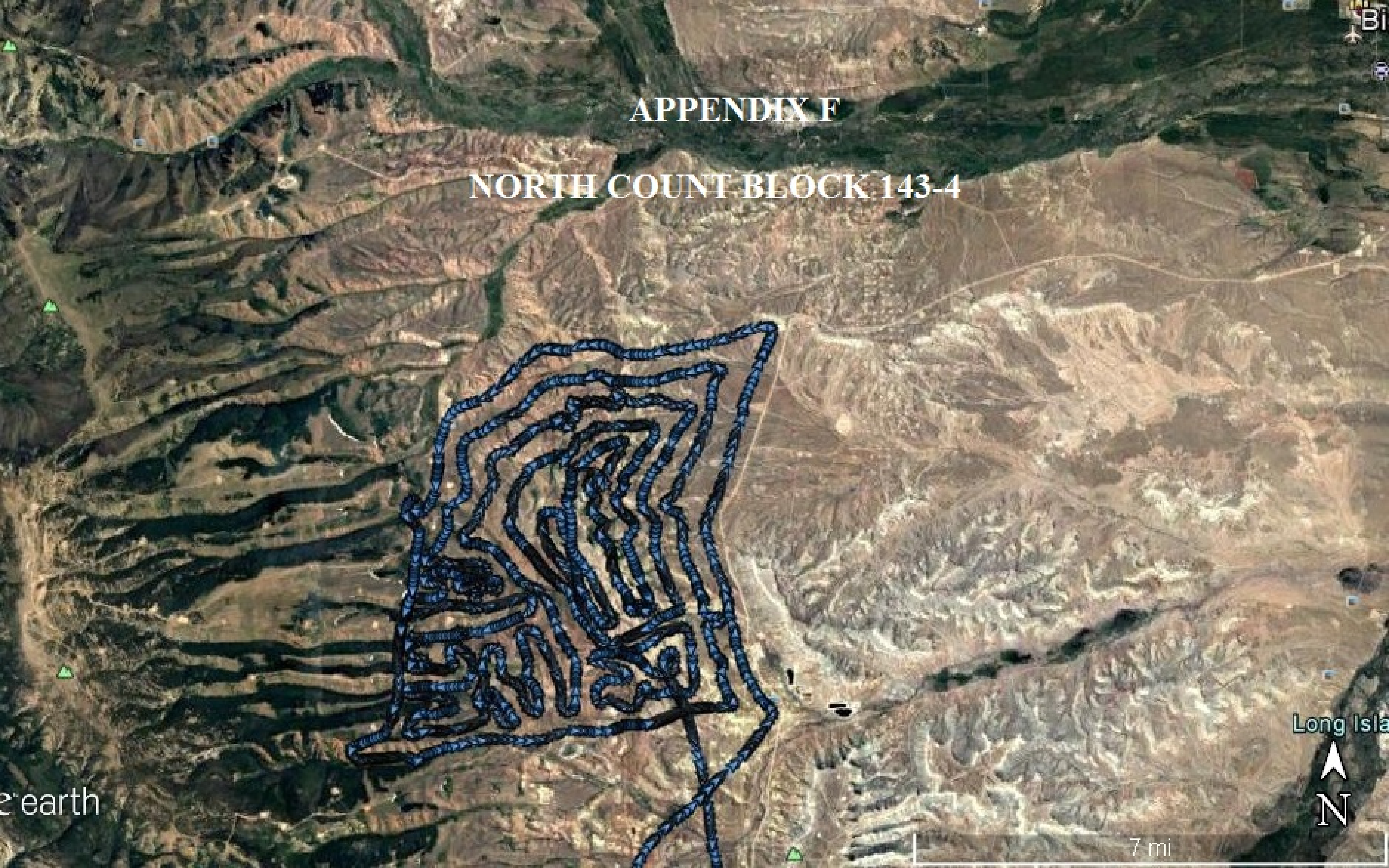
APPENDIX F
NORTH COUNT BLOCK 143-1

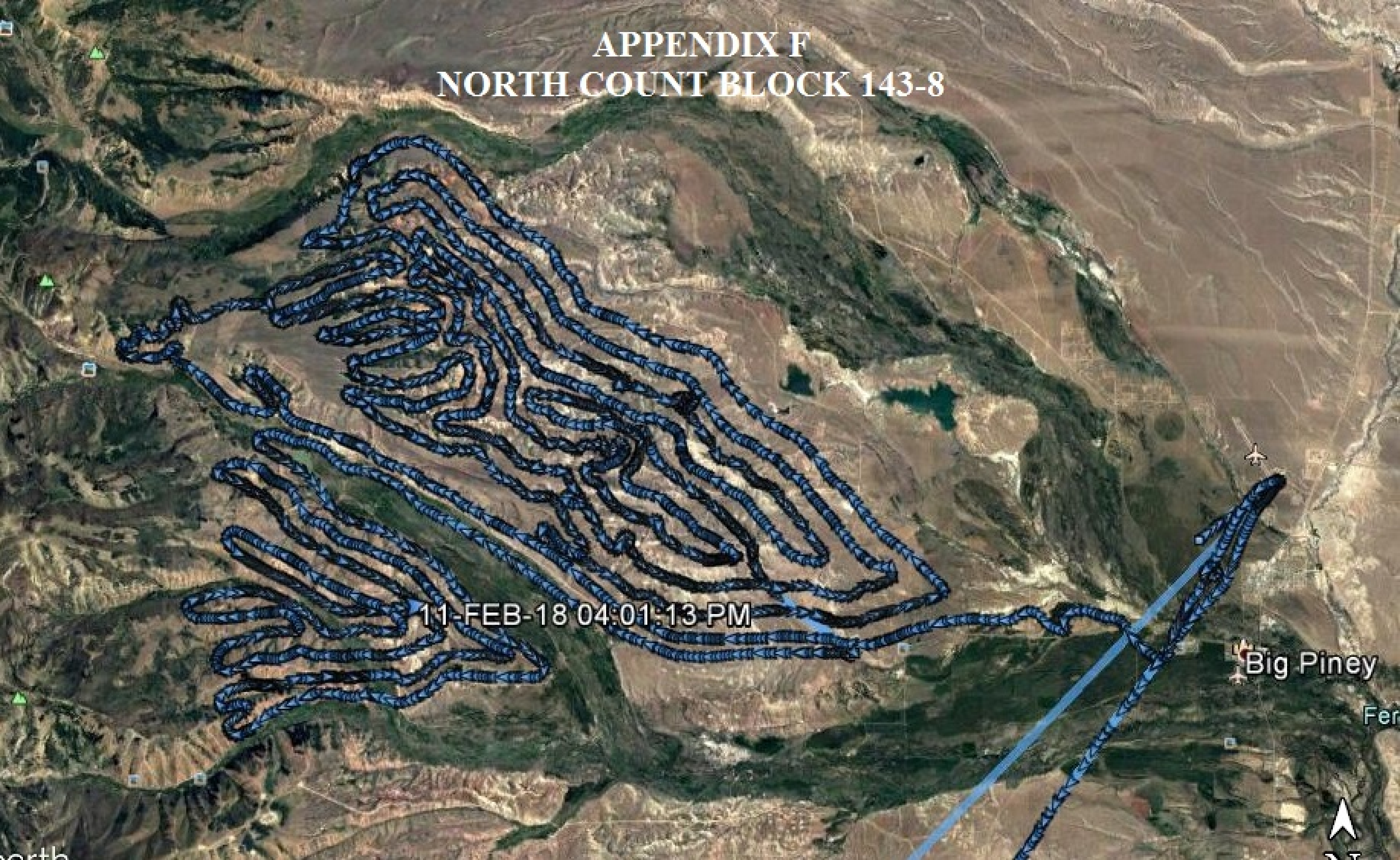


APPENDIX F

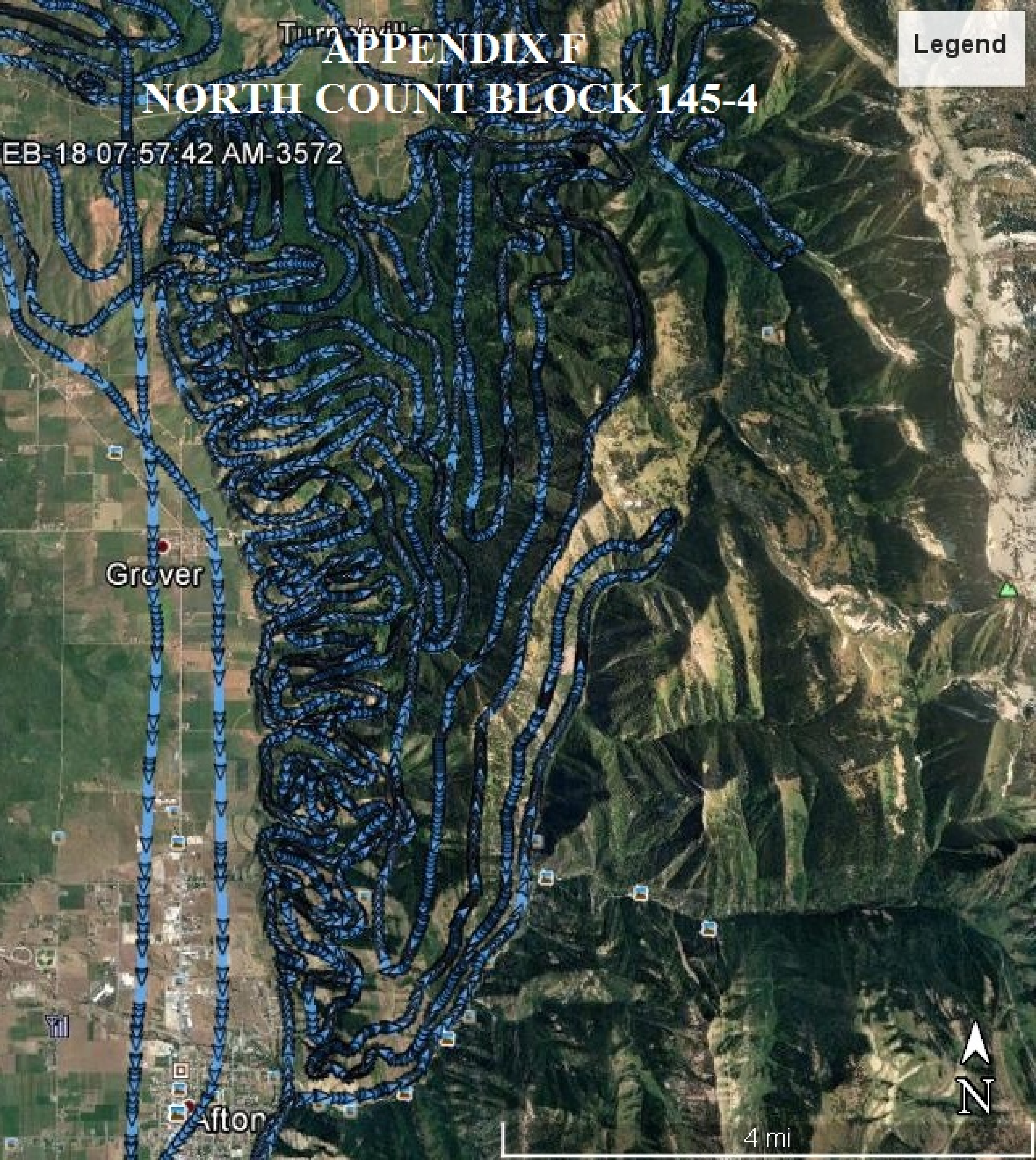
NORTH COUNT BLOCK 143-4

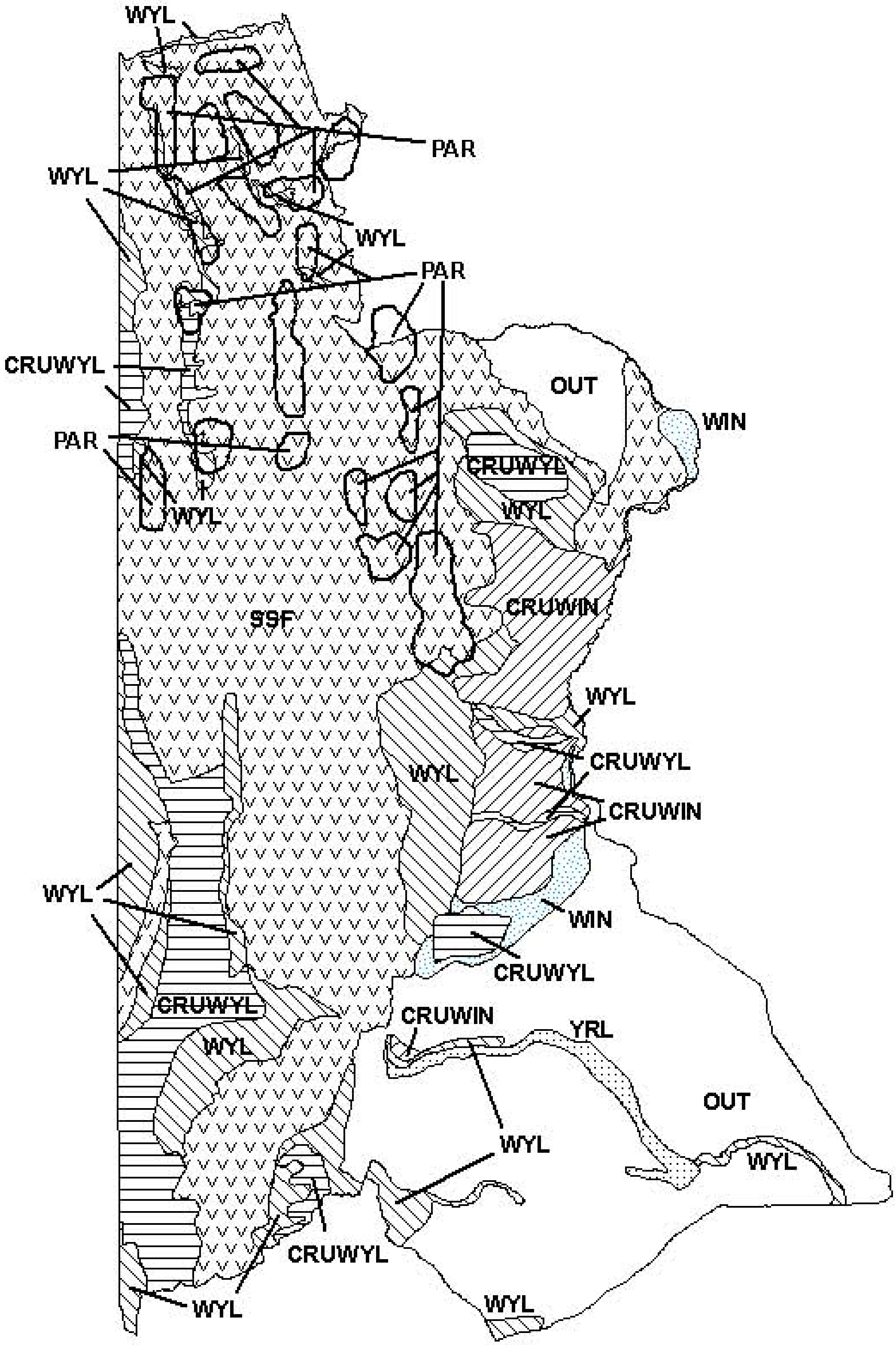


APPENDIX F
NORTH COUNT BLOCK 143-8



APPENDIX F
NORTH COUNT BLOCK 145-4





Mule Deer (MD131) - Wyoming Range
HA134, 135-137, 143-145, 147
Revised - 3/05