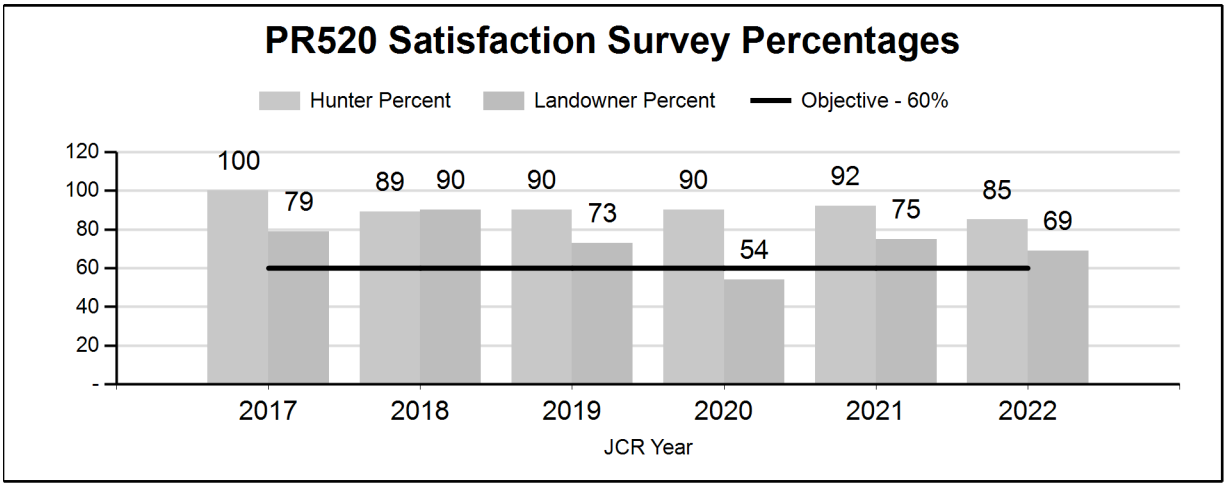
2022 - JCR Evaluation Form

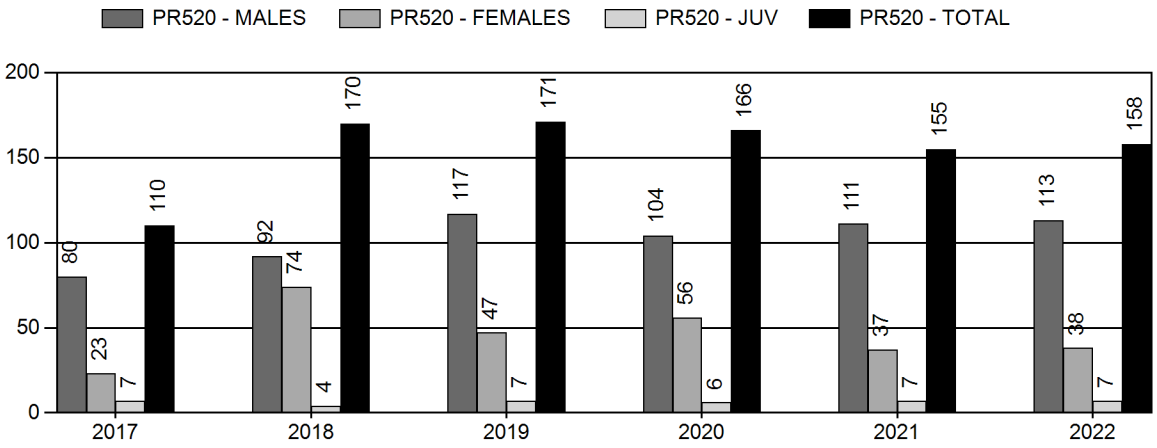
SPECIES: Pronghorn
PERIOD: 6/1/2022 - 5/31/2023
HERD: PR520 - CHALK BLUFFS
HUNT AREAS: 111
PREPARED BY: KEATON WEBER

	2017 - 2021 Average	2022	2023 Proposed
Hunter Satisfaction Percent	92%	85%	85%
Landowner Satisfaction Percent	73%	69%	70%
Harvest:	154	158	150
Hunters:	160	155	150
Hunter Success:	96%	102%	100 %
Active Licenses:	187	179	180
Active License Success:	82%	88%	83 %
Recreation Days:	602	589	500
Days Per Animal:	3.9	3.7	3.3
Males per 100 Females:	46	25	
Juveniles per 100 Females	61	30	

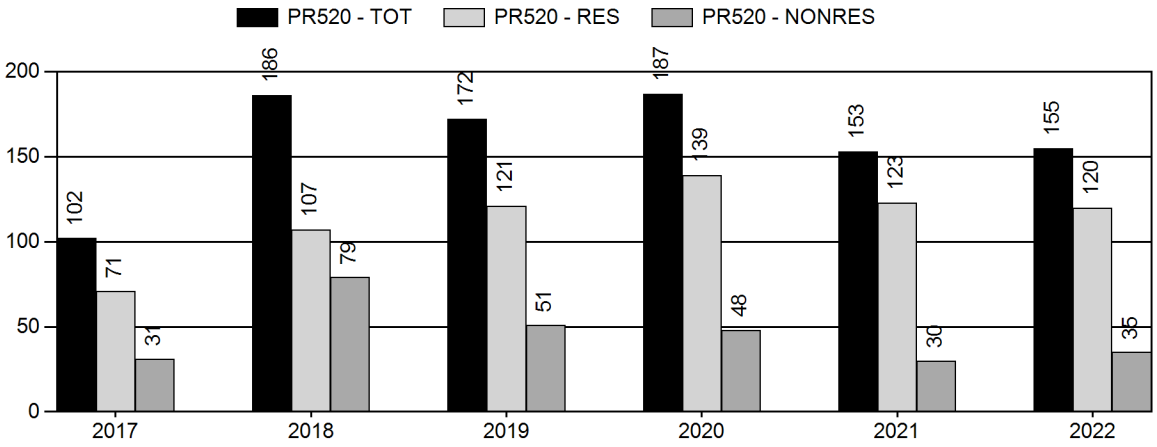
Satisfaction Based Objective	60%
Management Strategy:	Private Land
Percent population is above (+) or (-) objective:	17%
Number of years population has been + or - objective in recent trend:	0



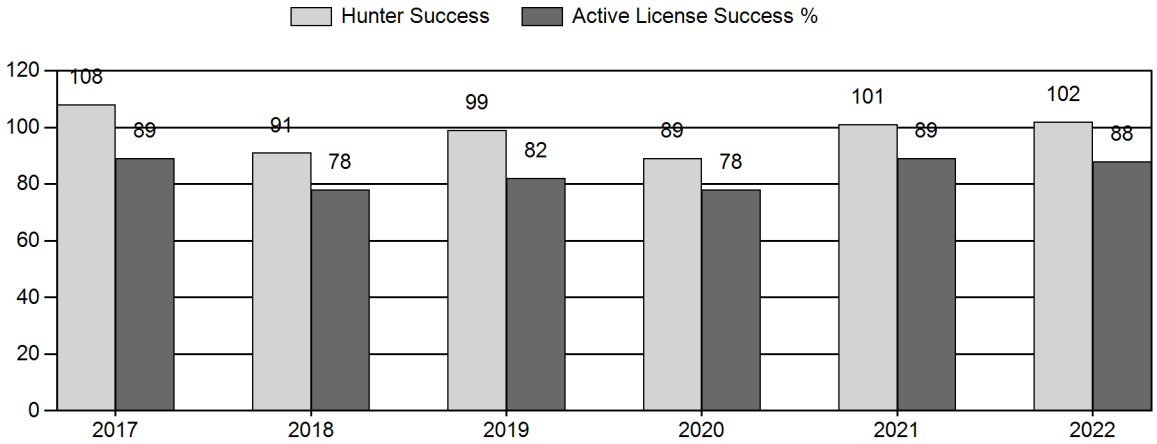
Harvest



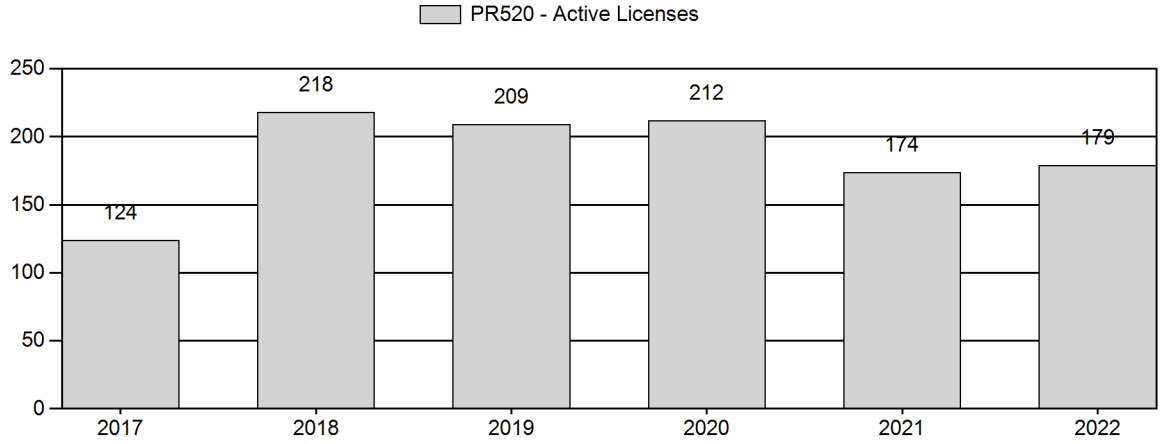
Number of Hunters



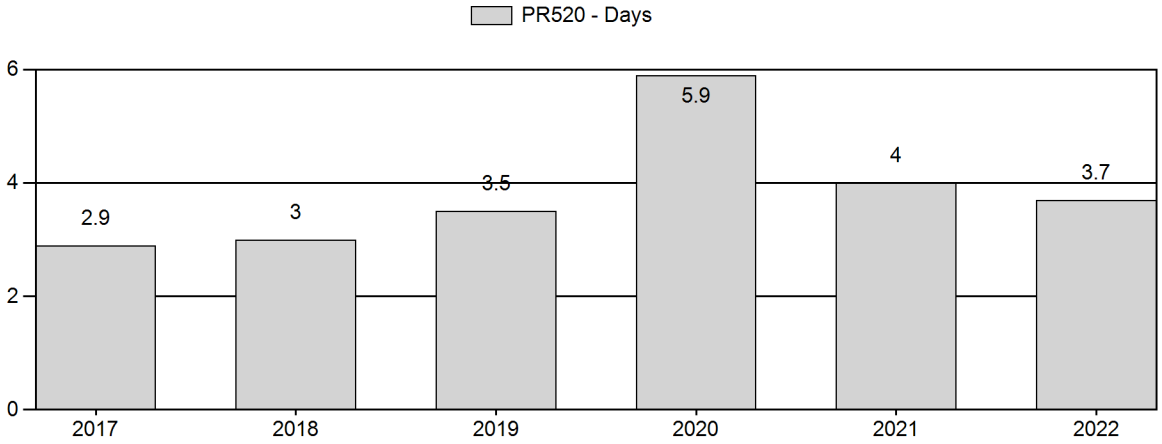
Harvest Success



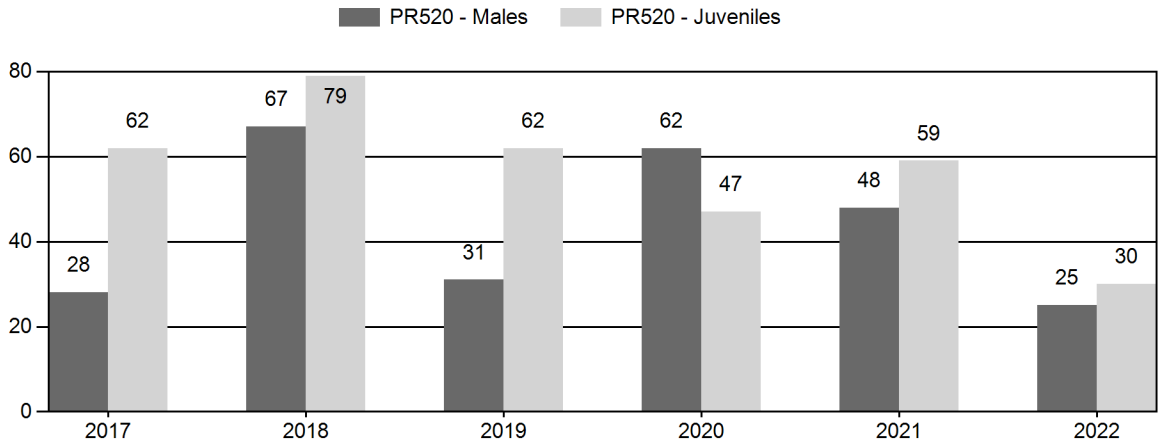
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2023 Hunting Seasons
Chalk Bluffs Pronghorn Herd Unit (PR520)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
111	1	Aug. 15	Sept. 19	Sept. 20	Oct. 14	150	Any antelope
111	1			Oct. 15	Dec. 31		Doe or fawn
111	6	Aug. 15	Sept. 19	Sept. 20	Dec. 31	50	Doe or fawn

2022 Hunter Satisfaction: 85% Satisfied, 11% Neutral, 4 % Dissatisfied
2022 Landowner Satisfaction: 23% Above Desired Levels, 69% At Desired Levels, 8% Below Desired Levels

2023 Management Summary

1.) Hunting Season Evaluation: The 2023 season is designed to provide opportunity while maintaining a hunter and landowner satisfaction of 60%. The season will continue to run through December 31 for doe and fawn pronghorn to reduce damage situations from pronghorn that migrate from Colorado as the season progresses. Access continues to be an issue with this herd unit so managers are cognizant of monitoring the satisfaction level of hunters (which is well above desired objective levels) along with success and effort trends to determine license structure. Based on those factors is does not appear a change in season structure is warranted at this time. In 2023, 88% of licenses available were active. The majority of those hunters were overwhelmingly satisfied with their hunt (85% satisfied). For the past several years hunter satisfaction has remained high. It appears that the majority of hunters who are applying for this license have access secured prior to their hunt. This herd is struggling with poor fawn survival due to multiple years of severe drought and a severe blizzard hit the I-25 corridor from the Colorado state line to Casper in March 2021. Because of the increased mortality and poor fawn survival, doe/fawn licenses will remain at 50.

2.) Management Objective Review: In 2023, the Chalk Bluffs pronghorn herd unit was up for objective review. For the past 5 years, the Chalk Bluffs herd unit has had been under Private Land Management strategy and will remain under a Private Land management strategy. Managers reviewed the past five year's population metrics, landowner satisfaction results, weather, and habitat data and determined there current management strategy is still the best way to manage this herd unit. This herd unit will be up for objective review in 2028.

3.) Weather and Habitat: Precipitation events throughout the Spring and Summer were sporadic at best and covered very small geographic areas. NOAA weather station data from Cheyenne, Wyoming, reported a 39% decline from average in annual precipitation in 2022. According to NOAA's U.S. Drought Monitor, the herd unit fell within the extreme drought category this year. Marginal habitat conditions exist for pronghorn in this herd unit. The majority of lands in this area have been converted to cropland or face continued pressure of being converted to housing developments on the outskirts of Cheyenne

2022 - JCR Evaluation Form

SPECIES: Pronghorn

PERIOD: 6/1/2022 - 5/31/2023

HERD: PR521 - HAWK SPRINGS

HUNT AREAS: 34

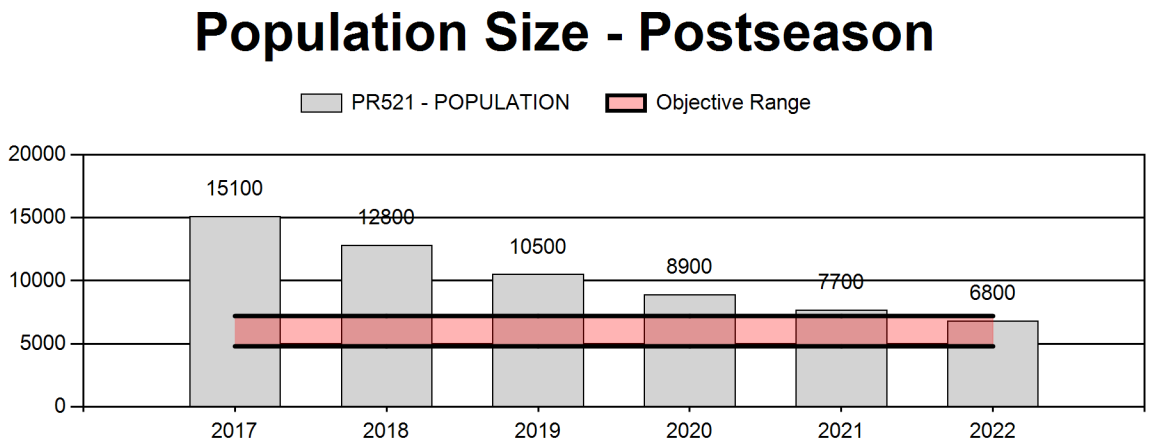
PREPARED BY: KEATON WEBER

	2017 - 2021 Average	2022	2023 Proposed
Population:	11,000	6,800	6,600
Harvest:	905	377	400
Hunters:	1,163	553	550
Hunter Success:	78%	68%	73%
Active Licenses:	1,204	566	600
Active License Success:	75%	67%	67%
Recreation Days:	4,376	1,965	3,170
Days Per Animal:	4.8	5.2	7.9
Males per 100 Females	41	42	
Juveniles per 100 Females	38	36	

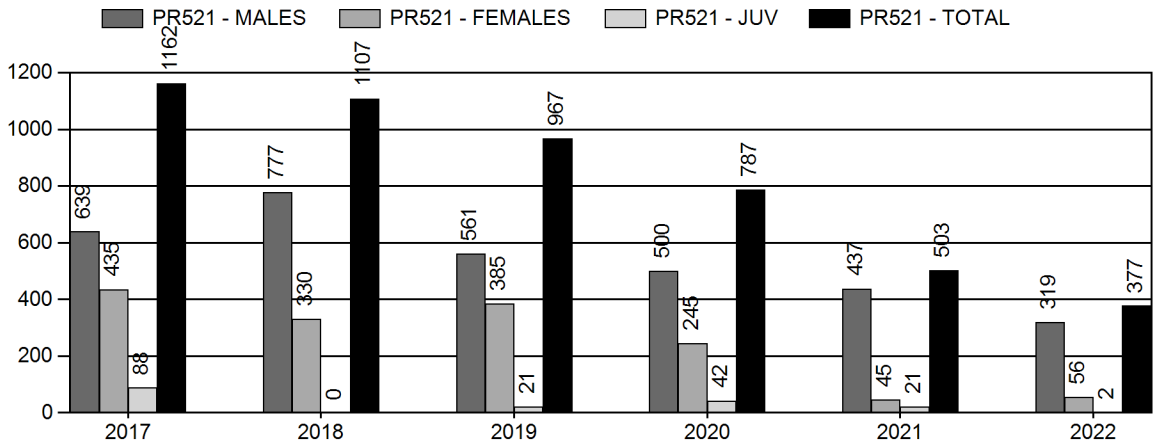
Population Objective (± 20%) :	6000 (4800 - 7200)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	13%
Number of years population has been + or - objective in recent trend:	7
Model Date:	3/2/2023

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

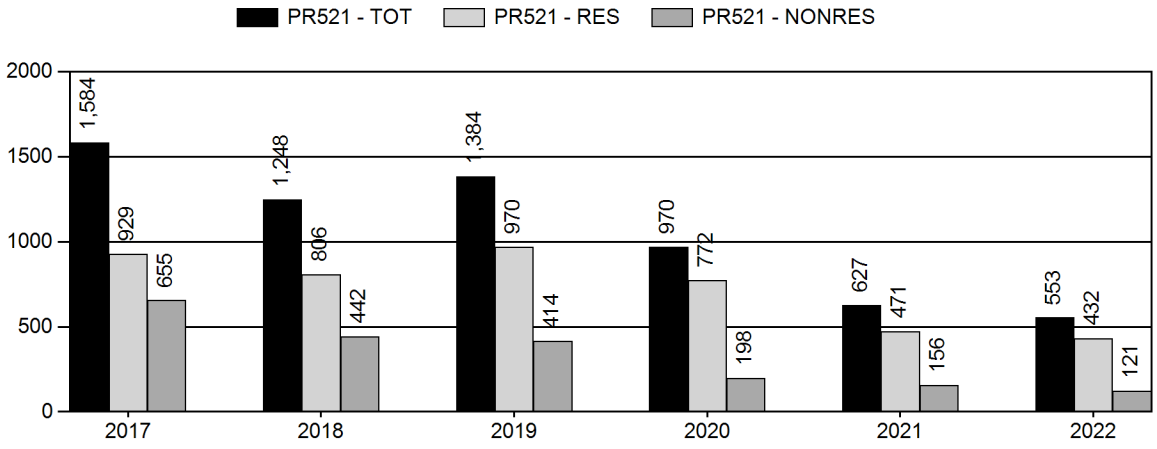
	JCR Year	Proposed
Females ≥ 1 year old:	4%	4%
Males ≥ 1 year old:	15%	15%
Proposed change in post-season population:	-11%	-3%



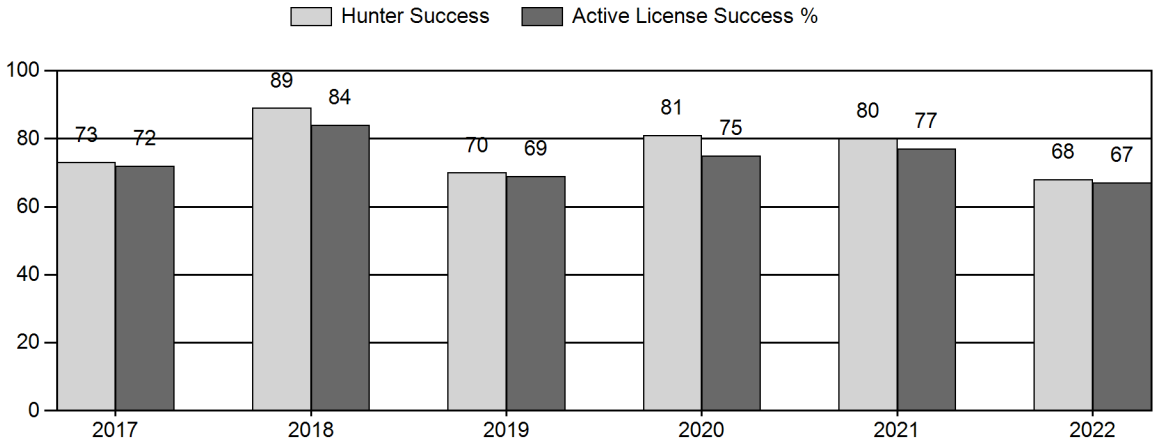
Harvest



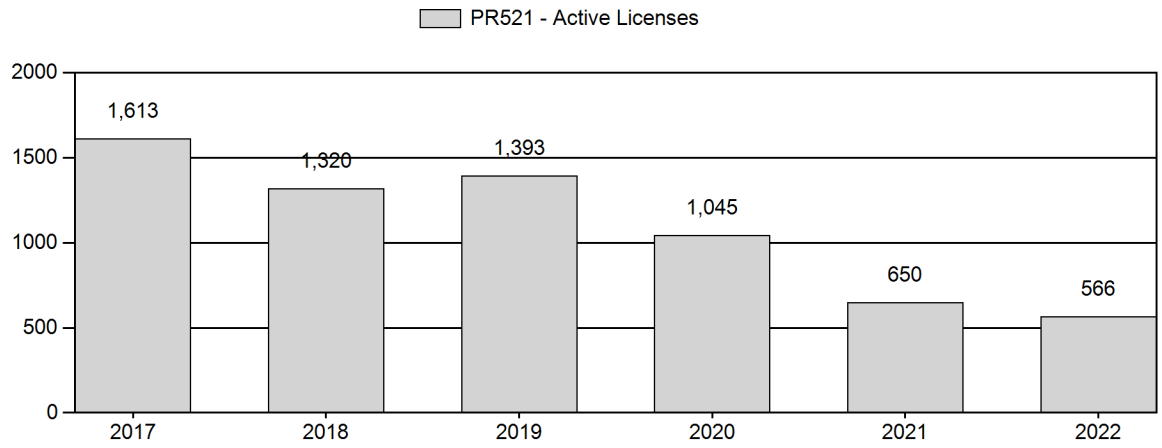
Number of Hunters



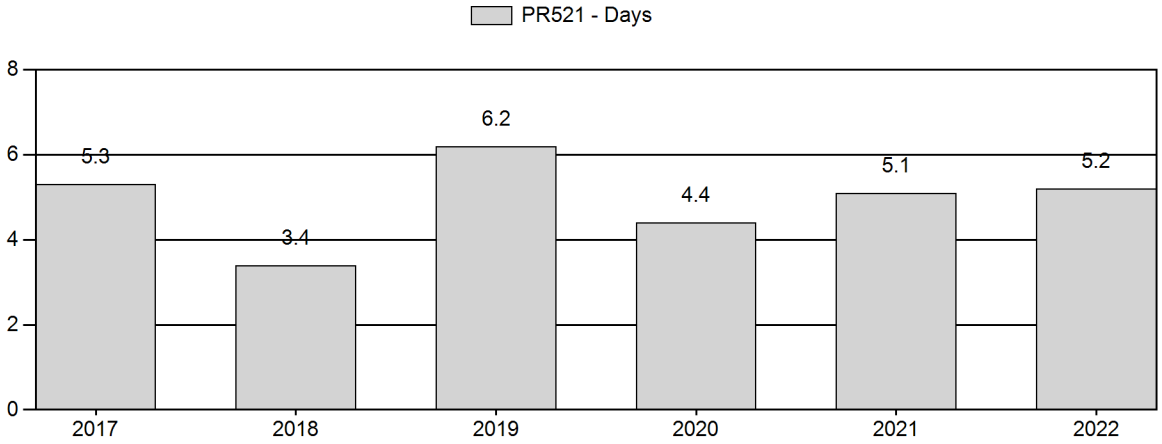
Harvest Success



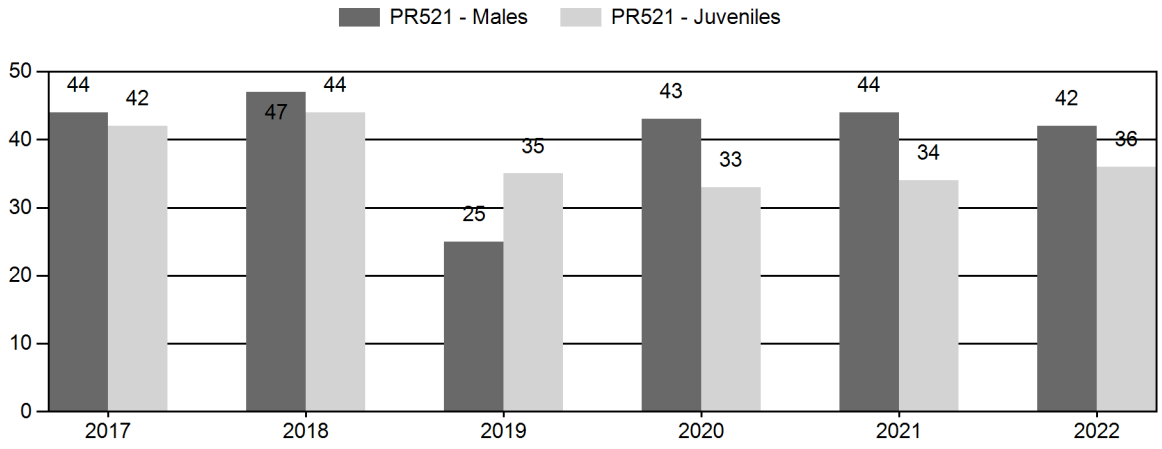
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2023 Hunting Seasons
Hawk Springs Pronghorn Herd Unit (PR521)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
34	1	Aug. 15	Sept. 19	Sept. 20	Oct. 14	600	Any antelope
34	6	Aug. 15	Sept. 19	Sept. 20	Dec. 31	50	Doe or fawn

2022 Hunter Satisfaction: 70% Satisfied, 23% Neutral, 7% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: Type 1 and Type 6 licenses have drastically been reduced since 2019 to address a population that has experience poor fawn recruitment for five consecutive years (5-year average = 36 fawns per 100 does) and a decrease in hunter success. Hunter success has declined in 2022 to 68%. The five year average for hunter success is 78%. Since 2019, the Type 1 licenses have been reduced by 40% and the Type 6 licenses have been reduced by 92%. This year's population models indicate that this herd is still in decline due to the consecutive years of extremely poor fawn recruitment. Due to the drastic reductions in licenses over the previous 4 year, managers do not plan to make any license quota changes this year and will closely monitor population metrics for improvements before increasing licenses again. A lengthy doe/fawn season opportunity is still in place to address isolated damage situations throughout the herd unit. Hunter success is dependent upon a robust population to help distribute pronghorn throughout the herd unit so hunters can take advantage of the limited access. In 2022, the percentage of buck's harvested > 1 year old was 16%. This is likely attributed to the poor fawn recruitment and population decline in previous years. The 3 year average of buck's harvested > 1 year old is 16%. At this time, this herd cannot withstand an increase in buck harvests due to population decline and extremely poor fawn recruitment for consecutive years.

2.) Management Objective Review: In 2023, the Hawk Springs pronghorn herd unit was up for objective review. Managers reviewed the past five year's population metrics, hunter satisfaction results, weather, and habitat data and determined the current management strategy of recreational management with an objective of 6,000 is still warranted. This herd unit will be up for objective review again in 2028.

3.) Research: Managers of the Hawk Springs Herd Unit have expressed concern for this herd's recent poor performance. There is speculation that habitat quality has degraded significantly enough to a point that it is lacking the proper nutrient requirements for lactating does to sustain a fawn to weaning age. In particular the condition of lands enrolled into USDA's Conservation Reserve Program (CRP) are of concern as far as forage productivity and diversity. A grant was submitted to the USDA in 2020 for a 3-year survival study and was not granted. Managers will continue to further investigate the relationship between habitat use, parturition areas, survival and condition of CRP in southeast Wyoming.

4.) Weather and Habitat Data: Precipitation in Hunt Area 34 was below normal for the biological year. NOAA weather station data from sites in Cheyenne and Torrington documented a decrease in annual precipitation 39% and 55% from average. According to NOAA's U.S. Drought Monitor, the herd unit fell within the severe to extreme drought category in 2022. Early senescence of vegetation in this herd unit likely contributed to poor herd performance. Continued poor fawn survival in this herd unit may be partially attributed to poor mid to late summer forage quality, particularly in areas lacking vegetative diversity, including dryland cropland and introduced cool season grass pastures and CRP enrolled lands.

Pronghorn depend on non-native vegetation for much of their year-round nutritional requirements due to native rangelands being converted to dryland croplands in this herd unit. Most CRP stands are in poor condition, lacking vegetative diversity, and are primarily dominated by cool season introduced grass species

5). Population Modeling: In 2021, WGFD managers began using PopR integrated population models (IPM) to estimate population indices for mule deer and pronghorn. The bio-year 2022 postseason population estimate for this herd unit from the PopR IPM was approximately 6,800 (CL = 6,200-7,700) pronghorn.

2022 - JCR Evaluation Form

SPECIES: Pronghorn

PERIOD: 6/1/2022 - 5/31/2023

HERD: PR522 - MEADOWDALE

HUNT AREAS: 11

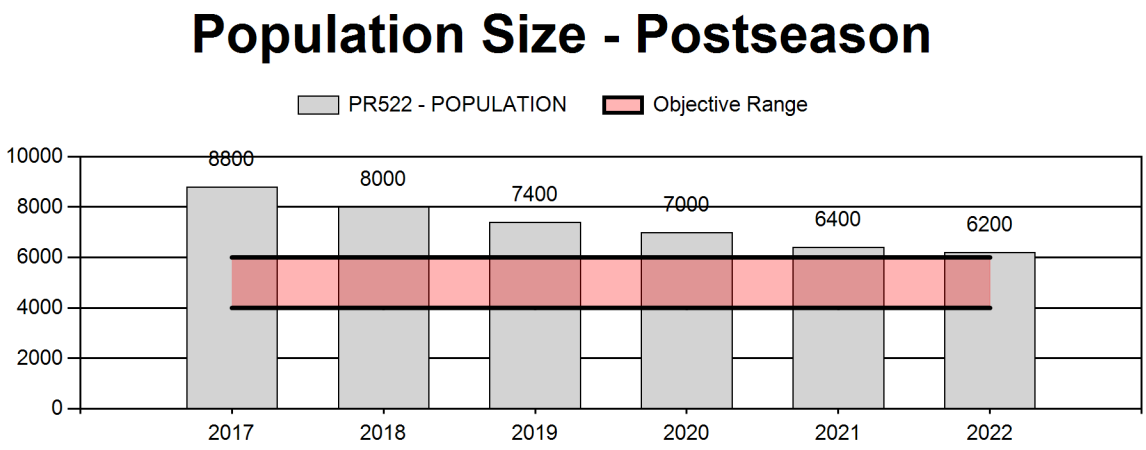
PREPARED BY: KEATON WEBER

	2017 - 2021 Average	2022	2023 Proposed
Population:	7,520	6,200	6,300
Harvest:	603	287	300
Hunters:	687	410	400
Hunter Success:	88%	70%	75%
Active Licenses:	740	442	450
Active License Success:	81%	65%	67%
Recreation Days:	2,425	1,762	1,700
Days Per Animal:	4.0	6.1	5.7
Males per 100 Females	35	34	
Juveniles per 100 Females	37	41	

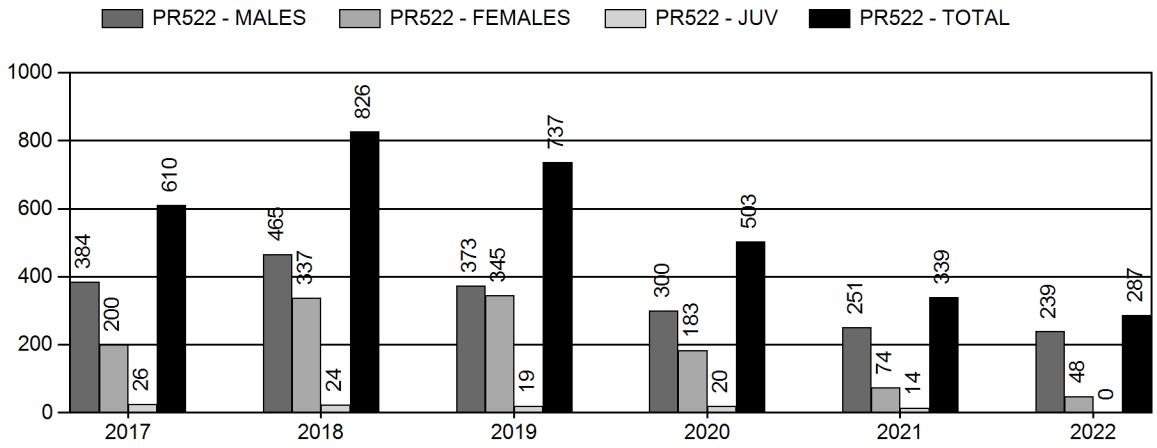
Population Objective (± 20%) :	5000 (4000 - 6000)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	24%
Number of years population has been + or - objective in recent trend:	9
Model Date:	3/2/2023

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

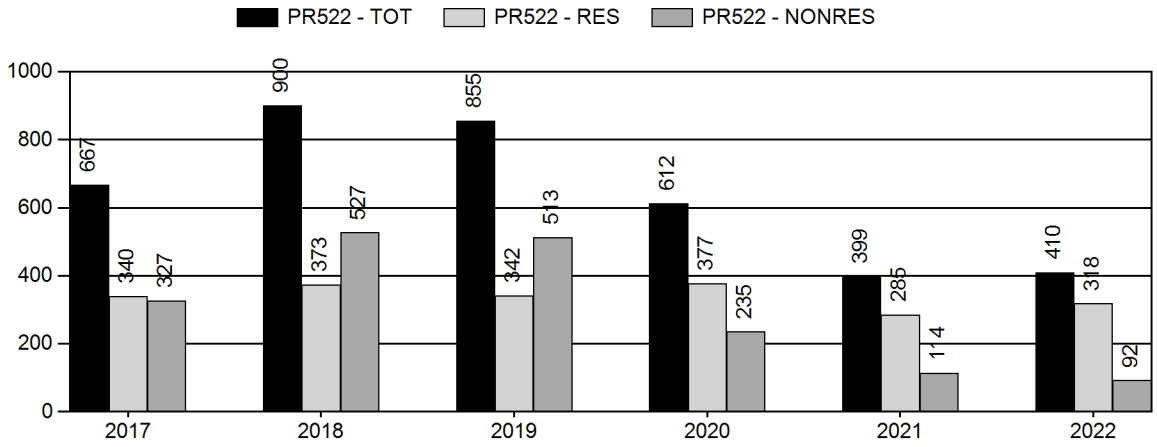
	JCR Year	Proposed
Females ≥ 1 year old:	2%	2%
Males ≥ 1 year old:	13%	13%
Proposed change in post-season population:	-3%	+2%



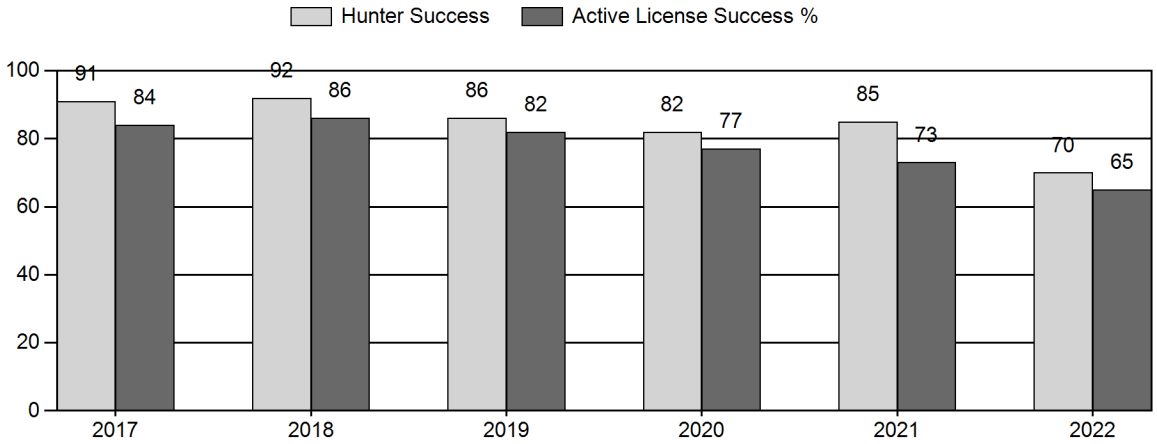
Harvest



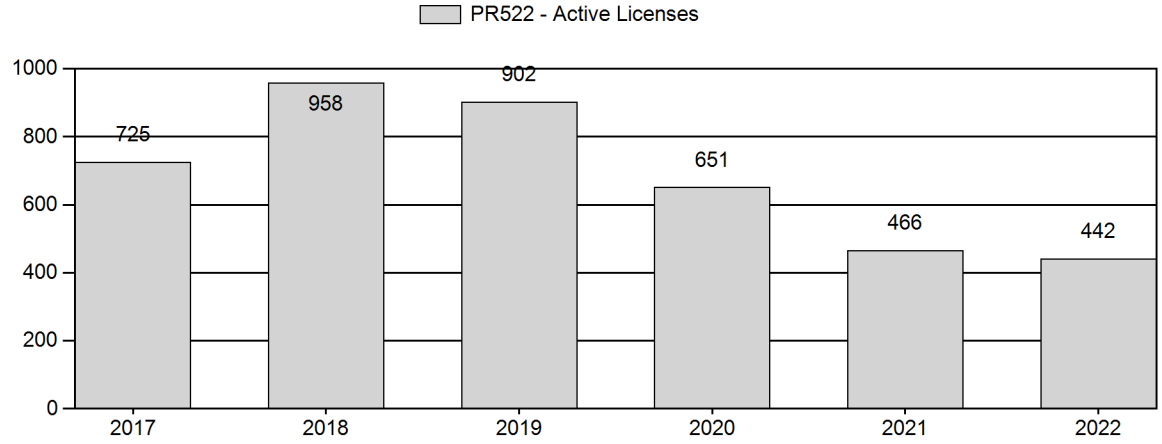
Number of Hunters



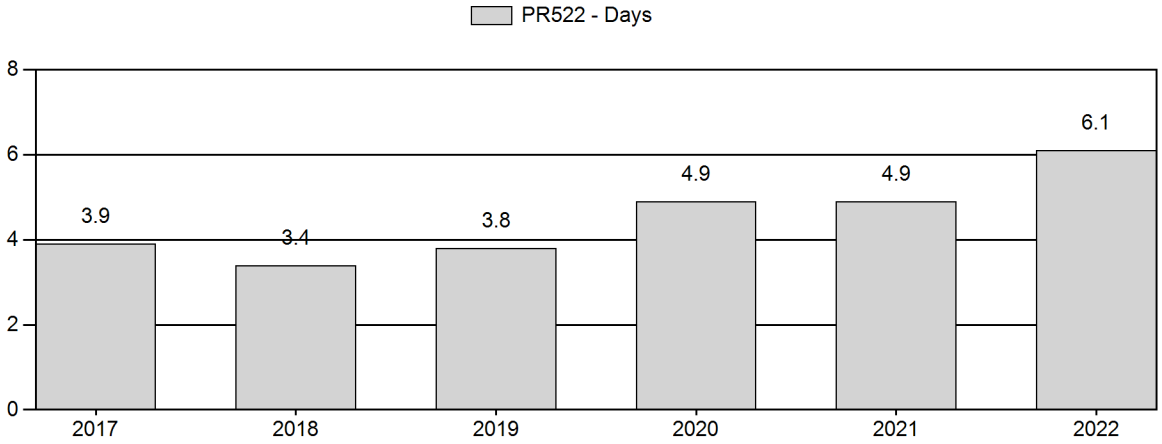
Harvest Success



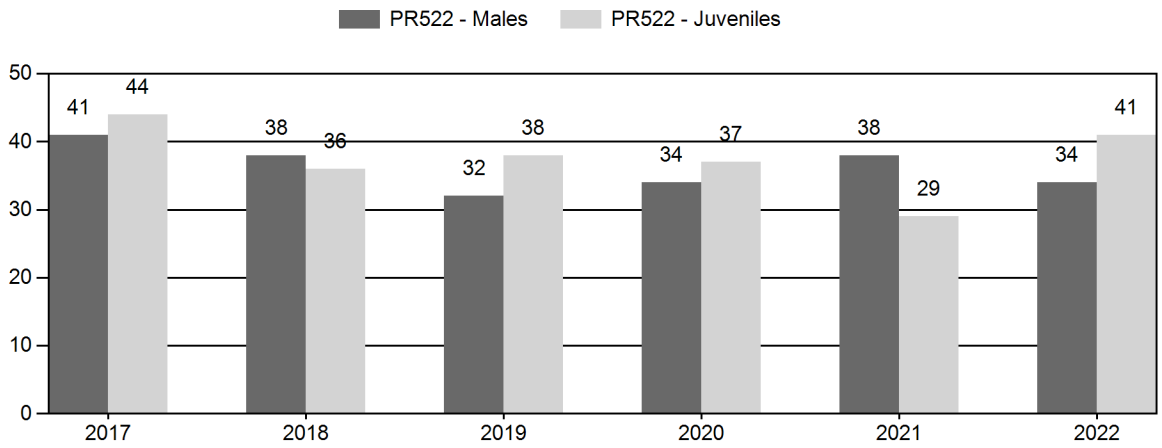
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2023 Hunting Seasons
Meadowdale Pronghorn Herd Unit (PR522)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
11	1	Aug. 15	Sept. 30	Oct. 1	Oct. 31	400	Any antelope
11	6	Aug. 15	Sept. 30	Oct. 1	Oct. 31	100	Doe or fawn

2022 Hunter Satisfaction: 73% Satisfied, 14% Neutral, 13% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The 2023 season structure will stay the same as the 2022 season. Since 2019, Type 1 and Type 6 licenses have drastically been reduced to address extremely poor fawn recruitment, low buck ratios, and overall population decline. Specifically, Type 1 licenses have been reduced by 28% and Type 6 licenses have been reduced by 75%. Despite these license reductions, this herd still continues to struggle as a result of poor fawn recruitment and survival (5-year average fawn ratio = 36 fawns per 100 does). Buck ratios are still within recreational management guidelines of 30-59 bucks per 100 does, but is trending towards the lower ratio limits (5 year average buck ratio = 35 bucks per 100 does). Due to the reductions of licenses within the previous years, managers will continue to monitor harvest metrics, herd composition data and independent density estimates for improvements prior to increasing hunting opportunity. Harvest metrics support simulated estimates that this herd is decreasing. Hunter success decreased from 85% in 2021 to 70% in 2022. In 2022, the percentage of buck's harvested > 1 year old was 13% and the 3 year average is 14%. Poor adult buck harvest is likely attributed to the poor fawn recruitment and population decline in the previous years.

2.) Management Objective Review: In 2023, the Meadowdale pronghorn herd unit was up for objective review. Managers reviewed the past five year's population metrics, landowner satisfaction results, weather, and habitat data and determined there current management strategy is still the best way to manage this herd unit. This herd unit will be up for objective review again in 2028.

3.) Weather and Habitat Data: Precipitation in Hunt Area 11 was well below normal for the biological year. Early spring precipitation occurred during April and May, but rain events decreased in frequency and amounts in early June. Precipitation events throughout the remainder of the summer were sporadic and covered very small geographic areas. Annual precipitation data collected in Torrington and Douglas documented a 55% and 26% decline from long term averages in 2022. According to NOAA's U.S. Drought Monitor, this area fell into the severe drought category in 2022.

5). Population Modeling: In 2021, WGFD managers began using PopR integrated population models (IPM) to estimate population indices for mule deer and pronghorn. The bio-year 2022

postseason population estimate for this herd unit from the PopR IPM was approximately 6,200 (CL = 5,400-7,300) pronghorn.

2022 - JCR Evaluation Form

SPECIES: Pronghorn
PERIOD: 6/1/2022 - 5/31/2023

HERD: PR523 - IRON MOUNTAIN

HUNT AREAS: 38
PREPARED BY: LEE KNOX

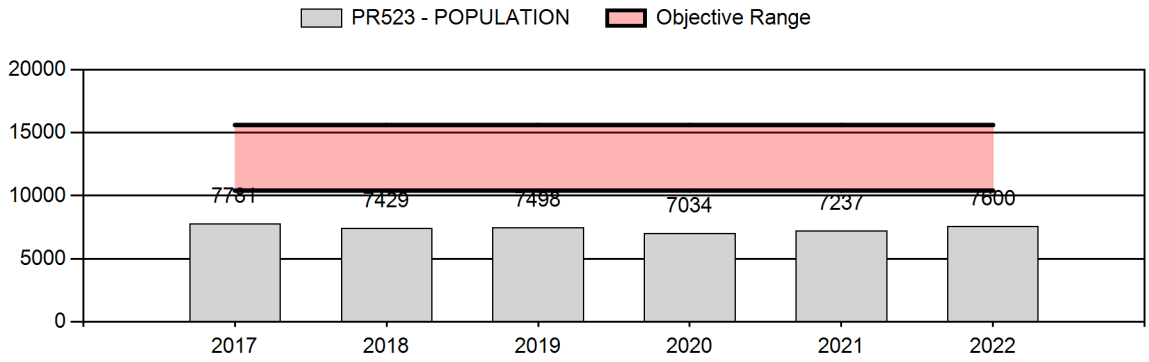
	2017 - 2021 Average	2022	2023 Proposed
Population:	7,396	7,600	8,400
Harvest:	1,027	569	580
Hunters:	1,326	694	700
Hunter Success:	77%	82%	83%
Active Licenses:	1,366	700	700
Active License Success:	75%	81%	83%
Recreation Days:	5,451	2,222	2,200
Days Per Animal:	5.3	3.9	3.8
Males per 100 Females	48	39	
Juveniles per 100 Females	52	47	

Population Objective (± 20%) :	13000 (10400 - 15600)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	-41.5%
Number of years population has been + or - objective in recent trend:	4
Model Date:	2/18/2023

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

	JCR Year	Proposed
Females ≥ 1 year old:	2%	2%
Males ≥ 1 year old:	26%	26%
Proposed change in post-season population:	5%	11%

Population Size - Postseason



2023 Hunting Seasons
Iron Mountain Pronghorn (PR523)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
38	1	Aug. 15	Oct. 4	Oct. 5	Oct. 31	400	Any antelope
38	2	Aug. 15	Oct. 4	Oct. 5	Nov. 30	400	Any antelope south of Wyoming Highway 34
38	6	Aug. 15	Oct. 4	Nov. 1	Dec. 31	25	Doe or fawn

2022 Hunter Satisfaction: 89% Satisfied, 7% Neutral, 4% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The management strategy is recreational management which prescribes for a buck ratio of 30 to 59:100 does. The Iron Mountain pronghorn herd is declining due to poor fawn recruitment due to prolonged drought conditions. The last three years fawn ratios have been at historically lows with 40:100 does in 2020, 42:100 in 2021, and 47:100 in 2022. Buck ratios are 39:100 does in 2022, below the five year average of 46:100. The decline in buck ratios is likely due to missing age classes from previous hard winters in 2018 and 2019. Yearling buck ratios increased form 5:100 does in 2021, to 11:100 does in 2022, but still below the five year average of 14 yearling bucks per 100 does. The low yearling buck ratio is an indication that along with poor fawn recruitment in August, fawn over winter survival has been low. Significant changes were made to the season structure in 2021 and 2022 to address poor fawn recruitment, and the population being 40% below the population objective. The 2023 season will remain status quo so that we can better evaluate the effects those changes may have.

Male harvest rates were 26% in 2022 and predicted to be 26% in 2023, meeting the goal of 25% male harvest in recreationally managed herds.

2.) Management Objective Review: The current objective was set at 13,000 in 1997. The management objective was last reviewed in 2019, and the next review will be in 2024.

3.) Habitat: Precipitation in Hunt Area 38 was below normal for the biological year. Areas in the northernmost portions of the herd unit did receive closer to normal precipitation in the more mountainous areas. NOAA weather station data from Laramie documented a 37% decrease, and Cheyenne a 39% decrease in precipitation from average annual precipitation. According to NOAA's U.S. Drought Monitor, the area encompassing this herd unit fell into the severe drought category in 2022.

4.) Population Modeling: The bio-year 2022 postseason population estimate from the PopR IPM was approximately 7,700 (CL = 7,600 – 8,400) pronghorn. The working model was run using 10

years of harvest and classification data and number of licenses as the effort variable. Adult survival was constant while reproduction and juvenile survival was time varying. The Department replaced the WGFD spreadsheet model with the PopR IPM in bio-year 2021.

2022 - JCR Evaluation Form

SPECIES: Pronghorn
PERIOD: 6/1/2022 - 5/31/2023

HERD: PR524 - DWYER

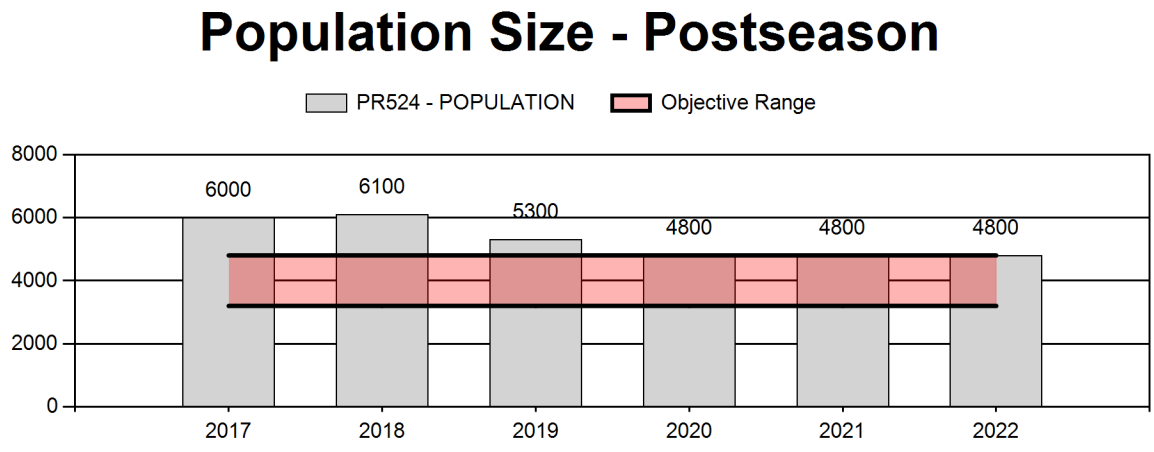
HUNT AREAS: 103
PREPARED BY: KEATON WEBER

	2017 - 2021 Average	2022	2023 Proposed
Population:	5,400	4,800	5,000
Harvest:	570	204	200
Hunters:	702	201	250
Hunter Success:	81%	101%	80%
Active Licenses:	749	252	250
Active License Success:	76%	81%	80%
Recreation Days:	2,379	911	900
Days Per Animal:	4.2	4.5	4.5
Males per 100 Females	42	18	
Juveniles per 100 Females	37	34	

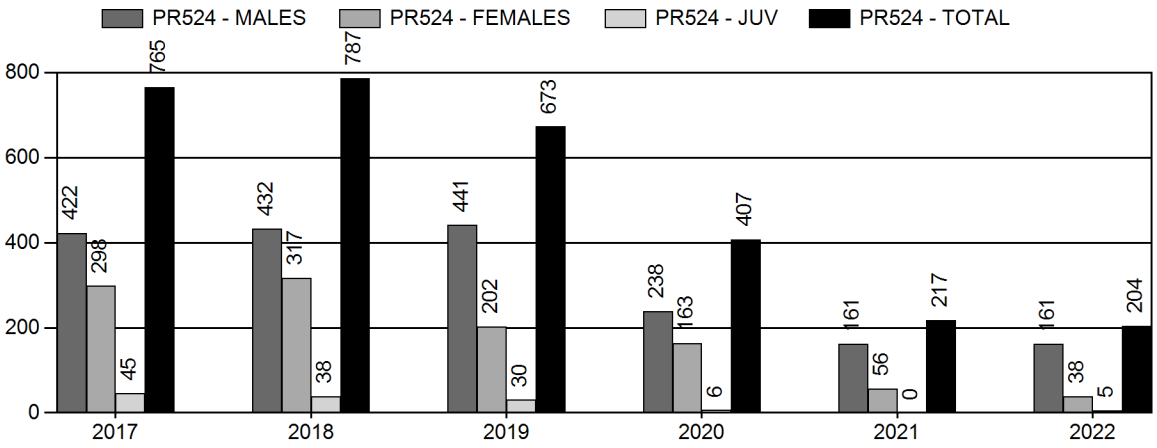
Population Objective (± 20%) :	4000 (3200 - 4800)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	20%
Number of years population has been + or - objective in recent trend:	16
Model Date:	3/2/2023

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

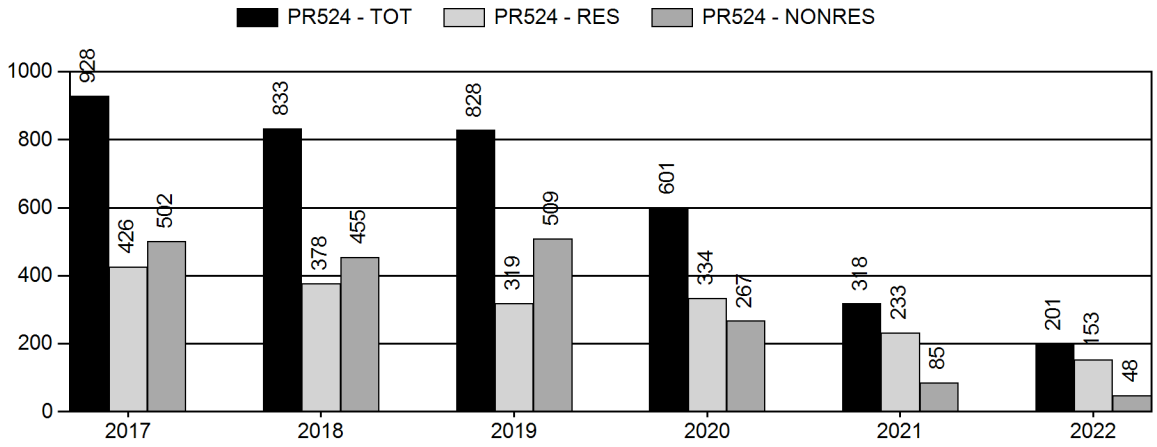
	JCR Year	Proposed
Females ≥ 1 year old:	3%	3%
Males ≥ 1 year old:	10%	11%
Proposed change in post-season population:	0%	+4%



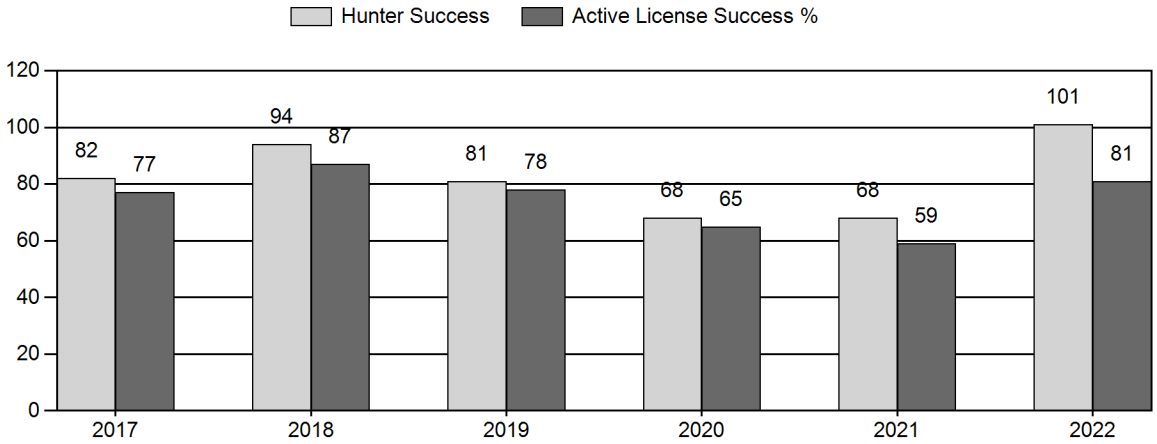
Harvest



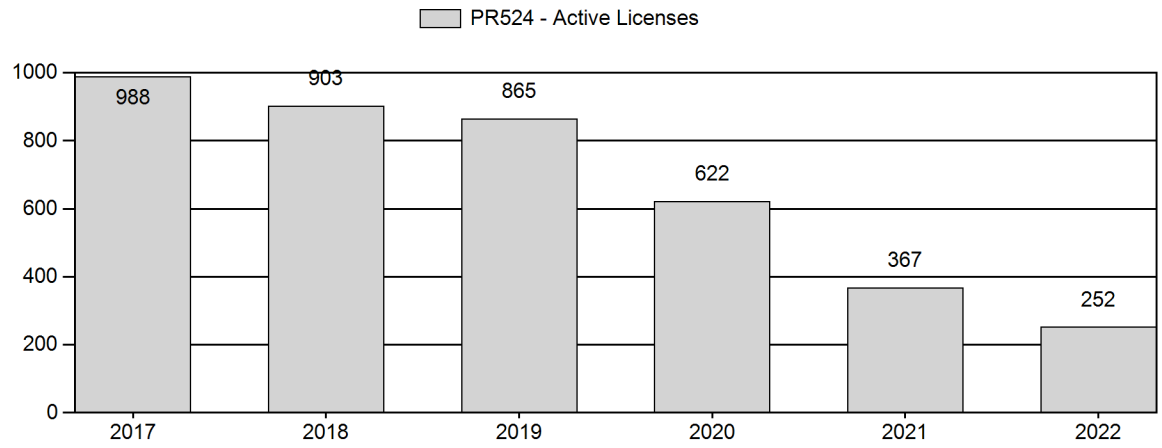
Number of Hunters



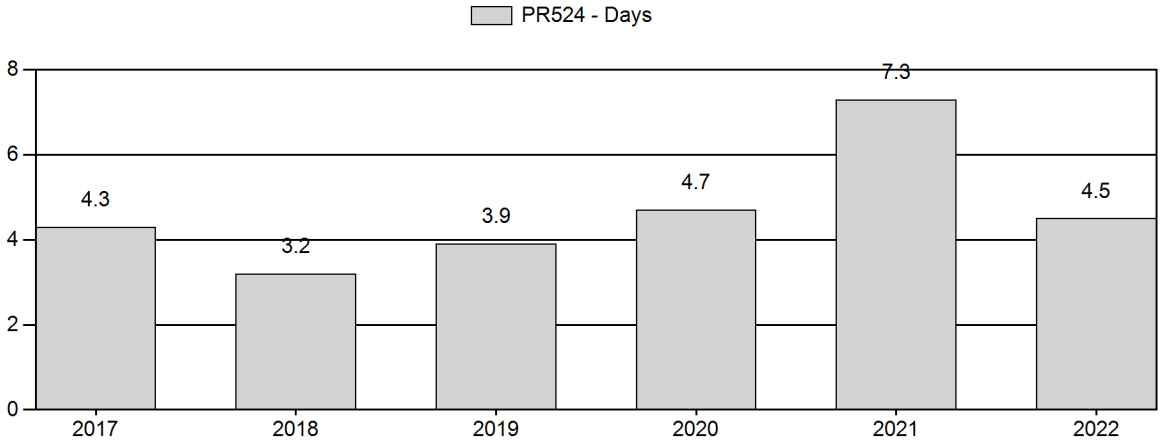
Harvest Success



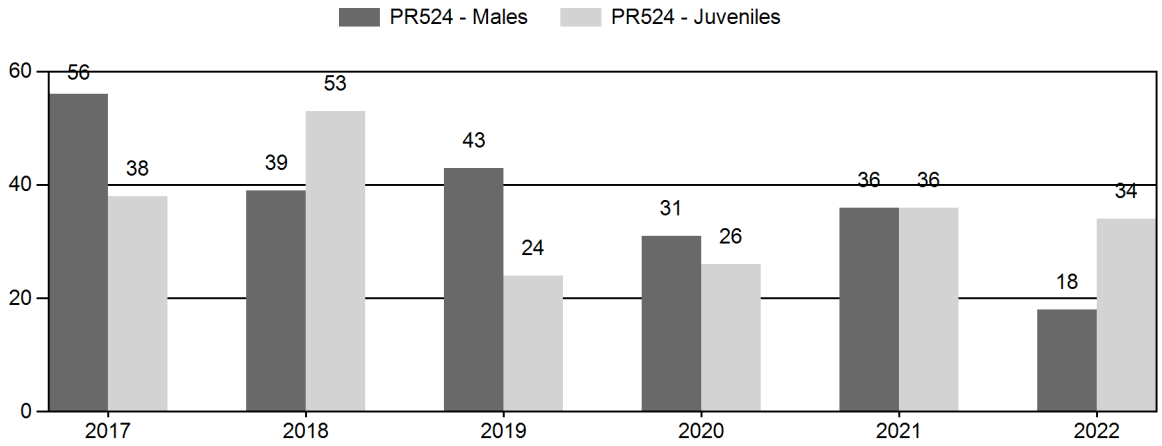
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2023 Hunting Seasons
Dwyer Pronghorn Herd Unit (PR524)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
103	1	Aug. 15	Oct. 4	Oct. 5	Oct. 31	250	Any antelope
103	6	Aug. 15	Oct. 4	Oct. 5	Nov. 30	50	Doe or fawn

2022 Hunter Satisfaction: 90% Satisfied, 6% Neutral, 4% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: Type 1 and Type 6 licenses have been drastically reduced since 2019 to address a population that has experienced poor fawn recruitment for five consecutive years (5 year average = 35 fawns per 100 does) and population decline. Despite buck ratios being low (5 year average = 33 bucks per 100 does), they are still within Recreational management guidelines of 30-59 bucks per 100 does and likely to increase with the current license quota. Reductions in licenses for the past 4 years have helped to stabilize the population to the point models simulations indicate a slight uptick in the population. There still continues to be isolated damage concerns so the Type 6 licenses are still needed, but at a much lower level than 3 year prior. Hunter success drastically increased from 59% (2021) to 81% (2022) which supports a decrease in licenses is not warranted. In 2022, the percentage of buck's harvested > 1 year old was 11% and the 3 year average is 13%. Poor adult buck harvest is likely attributed to the following: 1) excessive mortalities due to spring snow storm in 2021, 2) poor fawn recruitment over multiple years and 3) overall population decline in recent years. Given the current hunting structure and predicted fawn production, simulated efforts indicate this herd will rebound in the coming years, however, until then, an increase in license numbers is not warranted.

2.) Management Objective Review: The last time this herd unit's objective was reviewed was in 2019. The next objective review will take place in 2024.

3.) Weather and Habitat Data: Precipitation in this herd unit was well below normal in 2022. NOAA weather station data collected in Torrington and Douglas showed a 55% and 26% negative departure from average annual precipitation. According to NOAA's U.S. Drought Monitor, this area fell into the severe drought category in 2022. Habitat conditions closer to the mountain foothills were slightly better than lower elevations.

4). Population Modeling: In 2021, WGFD managers began using PopR integrated population models (IPM) to estimate population indices for mule deer and pronghorn. The bio-year 2022 postseason population estimate for this herd unit from the PopR IPM was approximately 4,800 (CL = 4,200-5,300) pronghorn.

2022 - JCR Evaluation Form

SPECIES: Pronghorn
PERIOD: 6/1/2022 - 5/31/2023

HERD: PR525 - MEDICINE BOW

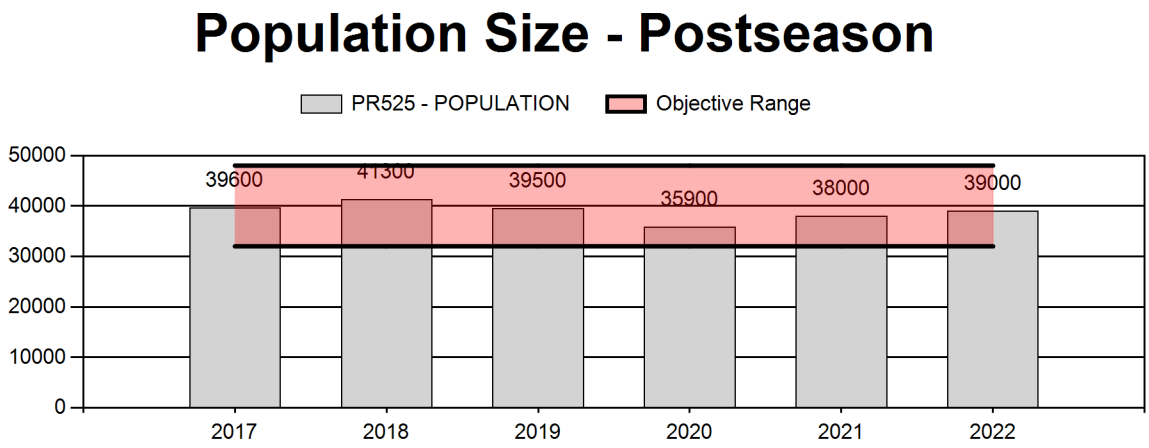
HUNT AREAS: 30-32, 42, 46-48
PREPARED BY: LEE KNOX

	2017 - 2021 Average	2022	2023 Proposed
Population:	38,860	39,000	39,500
Harvest:	3,274	2,901	3,000
Hunters:	3,617	3,127	3,200
Hunter Success:	91%	93%	94%
Active Licenses:	3,986	3,414	3,400
Active License Success:	82%	85%	88%
Recreation Days:	10,298	8,586	8,500
Days Per Animal:	3.1	3.0	2.8
Males per 100 Females	47	50	
Juveniles per 100 Females	68	67	

Population Objective (± 20%) :	40000 (32000 - 48000)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	-2.5%
Number of years population has been + or - objective in recent trend:	0
Model Date:	2/28/2023

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

	JCR Year	Proposed
Females ≥ 1 year old:	3%	3%
Males ≥ 1 year old:	22%	22%
Proposed change in post-season population:	1%	1%



2023 Hunting Seasons

Medicine Bow Pronghorn Herd Unit (PR525)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
30	1	Aug. 15	Oct. 4	Oct. 5	Oct. 31	400	Any antelope
30	6	Aug. 15	Oct. 4	Oct. 5	Oct. 31	50	Doe or fawn
31	1	Aug. 15	Sep. 24	Sep. 25	Oct. 31	75	Any antelope
32	1	Aug. 15	Sep. 24	Sep. 25	Oct. 31	600	Any antelope
32	6	Aug. 15	Sep. 24	Sep. 25	Oct. 31	400	Doe or fawn
32	7	Aug. 15	Sep. 24	Sep. 25	Oct. 31	100	Doe or fawn valid on or within one (1) mile of irrigated land
42	1	Aug. 15	Sep. 24	Sep. 25	Oct. 31	200	Any antelope
42	6	Aug. 15	Sep. 24	Sep. 25	Oct. 31	50	Doe or fawn
46	1	Aug. 15	Sep. 24	Sep. 25	Oct. 31	100	Any antelope
46	2	Aug. 15	Sep. 24	Oct. 5	Oct. 31	25	Any antelope
47	1	Aug. 15	Sep. 24	Sep. 25	Oct. 31	500	Any antelope
47	2	Aug. 15	Sep. 24	Oct. 5	Oct. 31	500	Any antelope
47	6	Aug. 15	Sep. 24	Sep. 25	Oct. 31	500	Doe or fawn
48	1	Aug. 15	Sep. 24	Sep. 25	Oct. 31	150	Any antelope
48	2	Aug. 15	Sep. 24	Oct. 5	Oct. 31	150	Any antelope
48	6	Aug. 15	Sep. 24	Sep. 25	Oct. 31	50	Doe or fawn

2022 Hunter Satisfaction: 87% Satisfied, 10% Neutral, 3% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The management strategy is recreational management which prescribes for a buck ratio of 30 to 59:100 does. The current population estimate of 39,000 pronghorn is at the current population objective of 40,000. However the effects of two hard winters and a persisting drought have reduced pronghorn numbers some areas in the Medicine Bow herd unit, with hunt areas 30, 31, 42, and 46, being the slowest to recover. Epizootic Hemorrhagic Disease (EHD) was also detected in several hunt areas in the herd unit in 2021 with varying levels of impacts. The northern portions of hunt areas 48 and 47 have rebounded quickly and absorb the majority of the harvest in Shirley Basin. If conditions continue to improve, more opportunity can be added in the future. Hunt area 42 is showing signs of population growth with fawn ratios in 2021 and 2022 at 70:100 does, but overall pronghorn numbers still remain low. Hunt area 46 is the most concerning with very low densities of pronghorn, and continued severe drought conditions. In hunt area 46, hunter success for type 1 and type 2 licenses were 77% and 74%, and the type 6 licenses was 61%. Type 6 license will be removed to help with public perception until the population improves. Hunt area 32 has mostly been unaffected by winter loss and drought, with the five year average fawn ratio of 76:100 does, and five year buck ratio of 54:100 does. Type 7 licenses will be decrease by 50 for a total of 100 licenses due to lack of private land issues.

Male harvest rates were 22% in 2021 and predicted to be 22% in 2022, shy of meeting the goal of 25% male harvest in recreationally managed herds. Increases were made for the 2022 season in hunt area 47 and 48 and increases will be made in hunt area 32 for the 2023 season.

2.) Management Objective review: The current objective was set at 40,000 in 2014. The management objective was last reviewed in 2019 and will be up for review again in 2024.

3.) Research: Wind energy development in Shirley Basin covers about 60,966 acres of crucial winter range habitat. The Department is currently working with the Wyoming Cooperative Fish and Wildlife Research Unit to better understand the effects of wind energy on pronghorn. Collars were deployed on March 20, 2018 on 80 doe pronghorn. Captures took place twice a year to maintain the sample size of 80 collared does. The project completed its finally collaring of animals in February.

4.) Habitat: Precipitation levels were below normal for the 2022 biological year. Early spring precipitation occurred during April and May, but quickly diminished in early June. Precipitation events throughout the remainder of the summer were sporadic and covered very small geographic areas. NOAA weather stations in Laramie and Rawlins recorded departures from average annual precipitation of 37% and 23% respectively. NOAA's U.S. Drought Monitor labeled the majority of this herd unit as experiencing abnormally dry to moderate drought conditions in 2022. Shrub conditions continue to be very poor, with this landscape being dominated by late seral shrub plant communities and continued overutilization by big game.

In Hunt Area 48, the RR316 wildlife burned 14,200 acres in spring, summer and fall pronghorn ranges in 2020. The burn will result in the loss of sagebrush habitats for decades. That being said, herbaceous plant recovery has been excellent in areas where livestock grazing deferment was incorporated post fire by land managers.

Proposed solar and wind energy developments could result in loss of pronghorn habitats and may impede pronghorn migration movements depending on final location of energy projects and associated infrastructure. The Department plans to work with conservation partners to improve habitats in uplands in Area 47 and Area 48 through construction of Zeedyk structures in ephemeral draws, which may improve summer forage quality and quantity available, resulting in better lactation for does and subsequent fawn survival. Partners were successful in securing funding from an energy mitigation fund to assist with this conservation effort in 2023. Site selection, structure design and planning, and construction will begin in spring 2023.

5.) Population Modeling: The bio-year 2022 postseason population estimate for this herd unit from the PopR IPM was approximately 39,000 (CL = 36,200 – 41,800). Harvest and classification data was used from 2000-2024, and the effort variable used was recreation days. The model Convergence was likely. The Department replaced the WGFD spreadsheet model with the PopR IPM in bio-year 2022.

2022 - JCR Evaluation Form

SPECIES: Pronghorn
PERIOD: 6/1/2022 - 5/31/2023

HERD: PR526 - COOPER LAKE

HUNT AREAS: 43
PREPARED BY: LEE KNOX

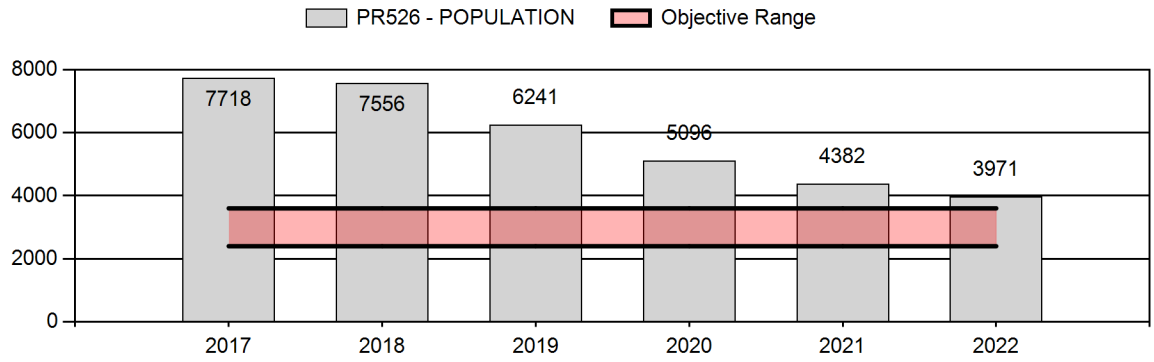
	2017 - 2021 Average	2022	2023 Proposed
Population:	6,199	3,971	4,349
Harvest:	793	245	200
Hunters:	1,007	334	225
Hunter Success:	79%	73%	89%
Active Licenses:	1,078	347	250
Active License Success:	74%	71%	80%
Recreation Days:	3,202	989	800
Days Per Animal:	4.0	4.0	4
Males per 100 Females	52	27	
Juveniles per 100 Females	78	55	

Population Objective (± 20%) :	3000 (2400 - 3600)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	32%
Number of years population has been + or - objective in recent trend:	5
Model Date:	2/17/2022

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

	JCR Year	Proposed
Females ≥ 1 year old:	8%	8%
Males ≥ 1 year old:	20%	20%
Proposed change in post-season population:	-9%	10%

Population Size - Postseason



2023 Hunting Seasons
Cooper Lake (PR526)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
43	1	Aug. 15	Sep. 14	Sep. 15	Oct. 31	250	Any antelope

2022 Hunter Satisfaction: 77% Satisfied, 16% Neutral, 7% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The management strategy is recreational management which prescribes for a buck ratio of 30 to 59:100 does. Cooper Lake is predominantly a private land herd. The majority of harvest comes from the Laramie River and Diamond Lake Hunter Management Areas. This herd is at objective, but has declined drastically due to persistent drought conditions as well as Epizootic Hemorrhagic Disease (EHD) in 2021, and is below desired social carrying capacity. Hunter success on type 1 licenses dropped below the five year average of 80% to 72% in 2022. Buck ratios in 2022 were 27:100 does, below the recreational management minimum of 30:100 does. Yearling buck ratios were at a five year low at 9:100 does, indicating we are seeing poor fawn recruitment into adult age classes. Fawn recruitment was at an all-time low at 55:100 does in 2022. Significant cuts were made in the 2022 season, but with low hunter success, and poor recruitment, type 1 licenses will be reduced by 100 licenses to 250, and type 6s will be removed for the 2023 season.

The male harvest rate for 2022 was 20%, and is predicted to be 20% in 2022, with a three running average of 22%. The predicted harvest rates do not meet the goal of $\geq$25% male harvest in recreational management herds, but given the low hunter success the last three seasons the reduction in licenses is justified.

2.) Management Objective Review: The current objective was set at 3,000 in 1986. The management objective was last reviewed in 2018. The Objective was reviewed in 2023, with an increase from 3,000 to 5,000 (Appendix A).

3.) Habitat: Precipitation levels were below normal for the 2022 biological year. Precipitation events in spring and early summer were minimal. A short window of vegetation green up occurred, with little herbaceous production witnessed. Monsoonal weather patterns hit the area in late July and early August, producing some heavy rains. Some green up of herbaceous forages occurred, but resulted in little additional production. Green up during this time period was better than what was witnessed in the spring. NOAA weather station data from Laramie indicated a departure from average annual precipitation of 37% in the hunt area. Westernmost regions of the hunt area did receive closer to normal precipitation. Annual precipitation has been below normal for 4 of the last 5 years. Seasonal water sources dried up in 2021 and remained that way in most of 2022. Through fall and early winter 2022, conditions remained mild, with no persistent snow accumulations that would restrict herbivory or trigger major movements of pronghorn. The herd unit was considered to be in the severe drought category according to the NOAA U.S. Drought Monitor in 2022.

4.) Population Modeling: The bio-year 2022 postseason population estimate for this herd unit from PopR IPM was approximately 3,970 (CL = 3,350 – 4,650) pronghorn. The effort variable for this model was days/harvest, and years of classification and harvest data used was 2010-2024. Model convergence is likely but not perfect. The Department replaced the WGFD spreadsheet model with the PopR IPM in bio-year 2021.

Appendix A

Objective Review

WYOMING GAME AND FISH DEPARTMENT

5400 Bishop Blvd. Cheyenne, WY 82006
Phone: (307) 777-4600 Fax: (307) 777-4699
wgfd.wyo.gov

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Mark Jolovich
Ashlee Lundvall

24 February 2023

MEMORANDUM

TO: Embere Hall

FROM: Lee Knox, Laramie Wildlife Biologist

COPY TO: Doug Brimeyer, Martin Hicks

SUBJECT: 2023 Herd Objective Review- Cooper Lake Pronghorn

The current population objective was set at 3,000 in 1986. The 2022 postseason population estimate for this herd unit from PopR IPM was approximately 3,970 (CL = 3,350 – 4,650) pronghorn. The last LT was flown in 2018 and estimated the population at 6,400 (CL = 4900-7800). This herd is typically highly productive, with the 10 year average fawn ratio of 82:100 does. We have managed this herd for maximum hunting opportunity, with a peak license issuance of 1,300 licenses valid in 2018. Landowners have always supported managing the population to the objective, and have provided the HMAs to do so. However following the winter of 2019 and then severe drought conditions from 2019-2022, the population has declined by nearly half, and is currently at the post season population objective. The current number of pronghorn in 2022 on the landscape is unacceptably low for landowners and the public. License issuance has been reduced to 250 total licenses in 2023. Drought conditions continue to suppress this population, but it is no longer social acceptable to issue licenses to manage pronghorn at the current levels.

We propose increasing the population objective from 3,000 to 5,000 to better align with our modeled population estimates, and what is socially acceptable from the public. We have met with area landowners, and we plan to discuss this objective change during the 2023 public information gathering meetings. After those meetings, we will decide if additional outreach is necessary before proceeding with a final proposal to the Commission in July.

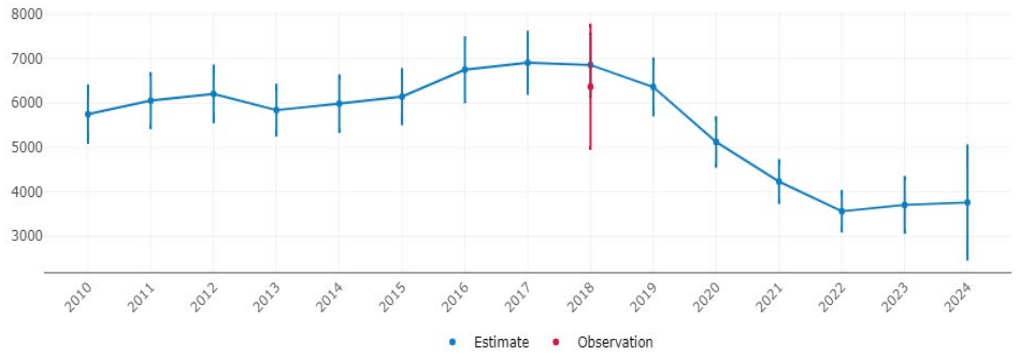


Figure 1. Post season population estimate from 2010-2024 in the Cooper Lake Pronghorn Herd Unit

2022 - JCR Evaluation Form

SPECIES: Pronghorn
PERIOD: 6/1/2022 - 5/31/2023

HERD: PR527 - CENTENNIAL

HUNT AREAS: 37, 44-45
PREPARED BY: LEE KNOX

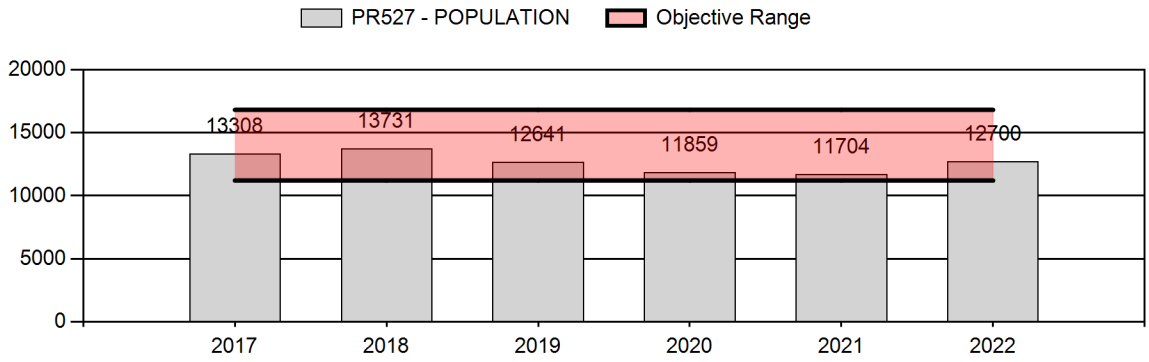
	2017 - 2021 Average	2022	2023 Proposed
Population:	12,649	12,700	14,000
Harvest:	989	767	800
Hunters:	1,134	824	850
Hunter Success:	87%	93%	94%
Active Licenses:	1,251	911	950
Active License Success:	79%	84%	84%
Recreation Days:	4,146	3,401	3,300
Days Per Animal:	4.2	4.4	4.1
Males per 100 Females	41	38	
Juveniles per 100 Females	53	63	

Population Objective (± 20%) :	14000 (11200 - 16800)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	-9.3%
Number of years population has been + or - objective in recent trend:	0
Model Date:	2/17/2023

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

	JCR Year	Proposed
Females ≥ 1 year old:	5%	5%
Males ≥ 1 year old:	19%	22%
Proposed change in post-season population:	1%	10%

Population Size - Postseason



2023 HUNTING SEASONS

Centennial Pronghorn Herd (PR527)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
37	1	Aug. 15	Sep. 19	Sep. 20	Oct. 14	400	Any antelope
37	6	Aug. 15	Sep. 19	Sep. 20	Oct. 14	100	Doe or fawn
44	1	Aug. 15	Sep. 14	Sep. 15	Oct. 31	75	Any antelope
45	1	Aug. 15	Sep. 14	Sep. 15	Oct. 31	550	Any antelope
45	6	Aug. 15	Sep. 14	Sep. 15	Oct. 31	50	Doe or fawn

2022 Hunter Satisfaction: 89% Satisfied, 9% Neutral, 2% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The management strategy is recreational management which prescribes for a buck ratio of 30 to 59:100 does. Buck ratios remain within management guidelines with a 3 year average of 38:100 does, as well as 38:100 does in 2022 (Appendix pending). Due to severe drought fawn ratios have remained low, with a five year average a 53:100 does. Fawn ratios in 2022 did increase above the five year average at 63:100 does, showing some signs of future population growth. Hunter success remains high in hunt area 45 and 37 at 90% and 88% respectively on on type 1 licenses, however hunter success remained low in hunt area 44 at 67%. Due to poor hunter success, hunt area 44 type 1 licenses will be decreased from 100 to 75, and type 6 licenses will be removed. With increased hunter success in hunt areas 37 and 45, both type 1s will be increased to provide more opportunity.

Male harvest rates were 19% in 2022 and predicted to be 19% in 2022. The three year average is 22%, shy of meeting the goal of 25% male harvest in recreationally managed herds. The 2022 IPM model predicted harvest ratios at 35% in 2019 and 32%. The centennial Herd Unit has interchange with Colorado and is not a closed unit. It has always been difficult to model this population in the past and it is likely we are in the ball park of 25%. We are increasing type 1 licenses in 37 and 45 and will reevaluate hunter success in 2024

2.) Management Objective review: The current objective was set at 14,000 in 1997. The management objective was last reviewed in 2018. We are maintaining this herd at the current objective and management strategy based on internal discussions and conversations with our constituents. We evaluated and considered population status and habitat data included in this document and a change is not warranted at this time. We will review this herd objective again in 2028; however, if the situation arises that a change is needed, we will review and submit a proposal as needed.

3.) Habitat Precipitation levels were below normal for the 2022 biological year. The NOAA weather station in Laramie received 37% less total precipitation for the year compared to average, with only 6.65 inches of total precipitation received. Precipitation events throughout the spring were sporadic and covered very small geographic areas. Mountain snowpack was near normal, but plains areas lacked spring moisture overall, resulting in little green up except in areas where

snowdrifts had lied. Late July and early August brought some monsoonal moisture patterns resulting in some green up of herbaceous vegetation, but offered little in the way of production. Private, irrigated lands become increasingly more important in drought periods. Portions of hunt area 45 have large irrigated hay fields and subirrigated pastures, offering some higher quality forage than dryland pastures. Higher doe:fawn ratios in areas where irrigation is present are evident, as forage quality may meet nutritional demands in late summer months. Through fall and early winter 2022, conditions remained mild, with no persistent snow accumulations that would restrict herbivory by pronghorn. Annual precipitation has been below normal in 4 of the last 5 years in this herd unit. The herd unit was considered to be in the severe to extreme drought categories according to the NOAA U.S. Drought Monitor for most of calendar year 2022.

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4.) Population Modeling: The Department replaced the WGFD spreadsheet model with the PopR IPM in bio-year 2022. The bio-year 2022 postseason population estimate for this herd unit from the PopR IPM was approximately 12,700 (CL = 11,600 – 14,000) pronghorn. Days/harvest was the effort variable and harvest and classification data was from years 2000-2024. Model convergence was pretty likely, but not perfect.

2022 - JCR Evaluation Form

SPECIES: Pronghorn
PERIOD: 6/1/2022 - 5/31/2023

HERD: PR528 - ELK MOUNTAIN

HUNT AREAS: 50
PREPARED BY: TEAL CUFAUDE

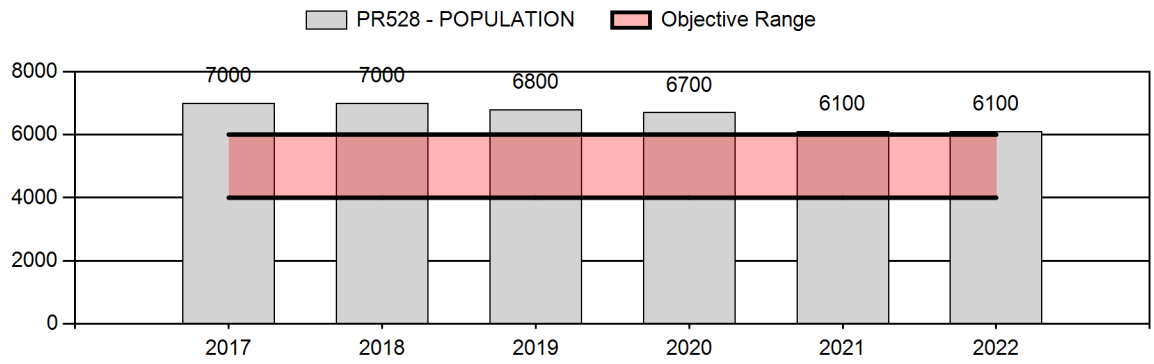
	2017 - 2021 Average	2022	2023 Proposed
Population:	6,720	6,100	6,200
Harvest:	388	371	370
Hunters:	408	425	400
Hunter Success:	95%	87%	92%
Active Licenses:	456	454	450
Active License Success:	85%	82%	82%
Recreation Days:	1,227	1,504	1,500
Days Per Animal:	3.2	4.1	4.1
Males per 100 Females	46	46	
Juveniles per 100 Females	46	47	

Population Objective (± 20%) :	5000 (4000 - 6000)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	22%
Number of years population has been + or - objective in recent trend:	1
Model Date:	03/05/2023

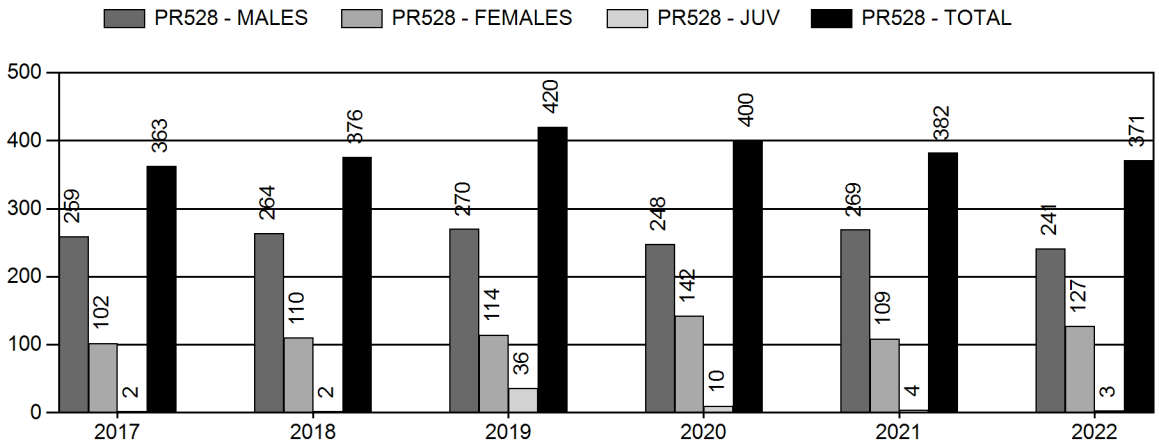
Proposed harvest rates (percent of pre-season estimate for each sex/age group):

	JCR Year	Proposed
Females ≥ 1 year old:	3%	3%
Males ≥ 1 year old:	19%	18%
Proposed change in post-season population:	-1%	4%

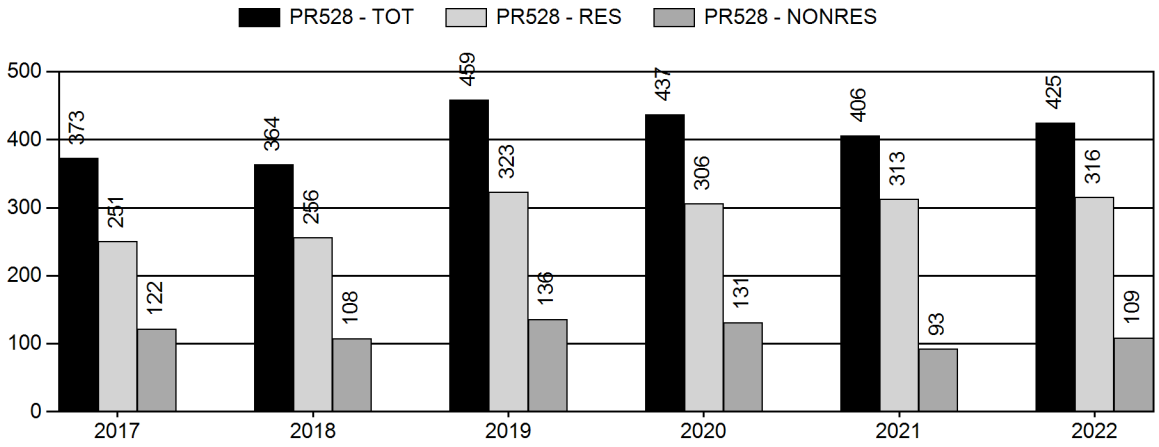
Population Size - Postseason



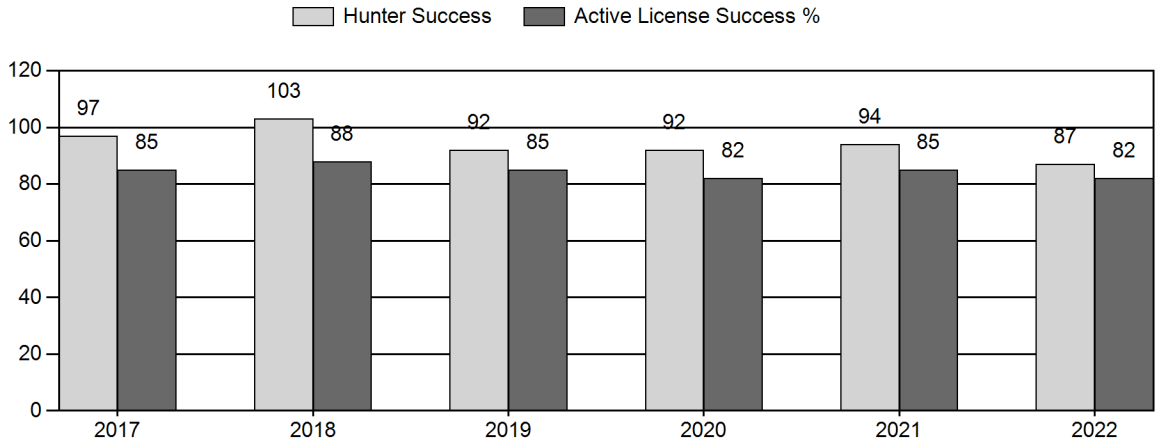
Harvest



Number of Hunters



Harvest Success



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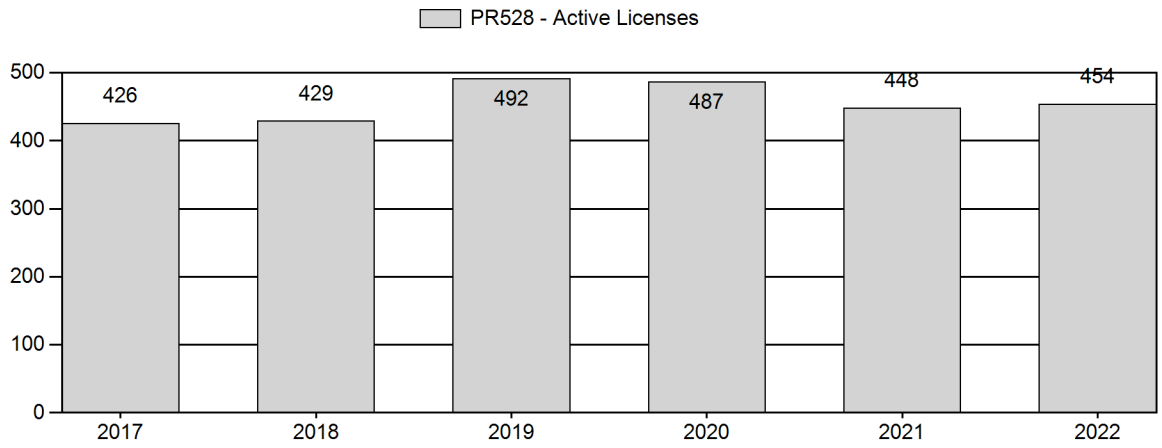
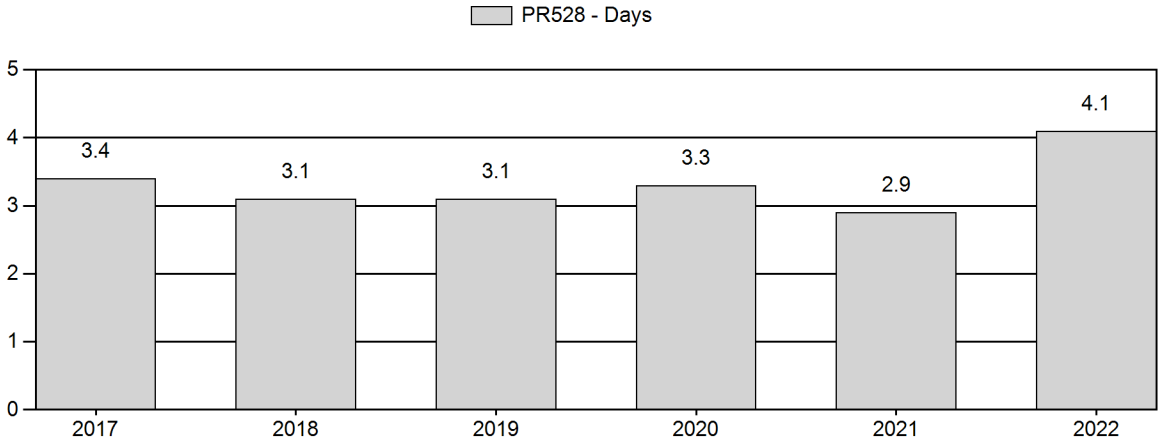
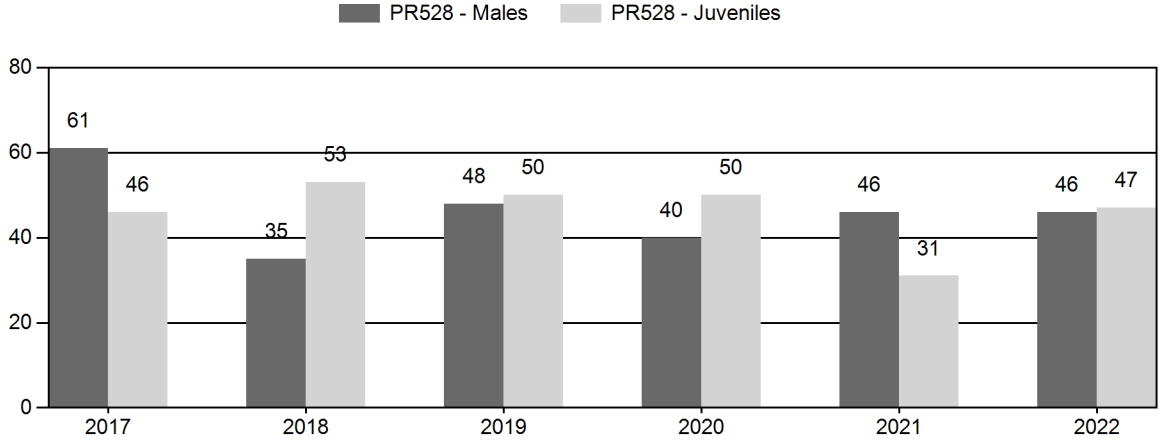


Days Per Animal Harvested



Preseason Animals per 100 Females



2023 Hunting Seasons
Elk Mountain Pronghorn (PR528)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
50	1	Aug. 15	Aug. 31	Sep. 16	Oct. 31	300	Any antelope
50	6	Aug. 15	Aug. 31	Sep. 16	Oct. 31	100	Doe or fawn
50	0			Sep. 1	Sep. 15	50	Any antelope, muzzle-loading firearms only

2022 Hunter Satisfaction: 91.5% Satisfied, 5.1% Neutral, 3.4% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The 2022 pre-season fawn to doe ratio (47/100) was lower than the ten-year average of 52/100, which indicated lower productivity. The 2022 pre-season buck to doe ratio (46/100) remained within the recreational management objective limits and the yearling buck to doe ratio (18/100) indicated good overwinter juvenile survival in 2021-22. Days to harvest (4.1) exceeded the ten-year average and hunter success (87.3%) was lower than the ten-year average. Hunter satisfaction increased slightly in 2022, however all other hunt metrics indicated pronghorn hunting was more challenging compared to previous years.

If type 1 and 0 hunter success remains unchanged or improves slightly in 2023, the harvest rate of bucks is projected to be 19% (three-year average= 18%). The PopR model may be overestimating total abundance and to meet 25% male harvest rates we would have needed to substantially increase type 1 or 0 licenses. These increases were not palatable given potential losses in pronghorn during winter 2022-23. We plan to re-evaluate buck license opportunity in relation to male harvest rate after the 2022 Line Transect survey.

A majority of this herd unit is comprised of private or "checkerboard" lands. Landowners expressed concern regarding reduced pronghorn numbers across the herd unit which is expected to further reduce private land access for pronghorn hunters.

Type 6 licenses were reduced in 2023 in response to low productivity for the second consecutive year, severe winter conditions, and anticipated poor juvenile and adult overwinter survival. The 2023 license allocation should allow for stabilizing pronghorn numbers near the upper end of the 5,000 (±20%) population objective range.

2.) Management Objective Review: The objective was last reviewed in 2019 and will be reviewed again in 2024.

3.) Weather/Habitat: Precipitation was below normal in 2022. Early spring precipitation occurred in April and May but diminished in frequency and quantity by early June. Late July and early August monsoonal moisture patterns resulted in some green-up of herbaceous vegetation, which

likely aided fawn rearing does in meeting nutritional demands. NOAA weather station data from Rawlins reported a 23% decline in average annual precipitation. The U.S. Drought Monitor categorized the area comprising hunt area 50 as having moderate to severe drought.

The Mullen Creek Fire (2020) burned approximately 176,800 acres in the Snowy Range Mountain, which includes the southern extent of hunt area 50. Over 10,300 acres were aerially treated with Rejuvra during the summer of 2021 to control cheatgrass infestations. In 2022, USFS, WGFD, and USGS completed a large-scale monitoring effort to evaluate herbicide efficacy one year post-treatment. Native, perennial grass recovery looks promising thus far. Plant species diversity was comparable pre- and post-treatment with the exception of a few native annual forbs. Cheatgrass was documented in areas where soil movement had occurred. Additionally, high densities of cheatgrass were documented within the no-spray buffer around the North Platte River. We will continue to monitor herbicide efficacy in 2023 and evaluate the need for retreatment. Due to high fire severity, some areas containing mixed mountain shrub stands experienced high levels of shrub mortality. We documented numerous antelope bitterbrush, serviceberry, and big sagebrush seedlings throughout the burn scar in 2022 which is a promising sign for shrub recovery. Several thousand mixed mountain shrub seedlings were planted west of the North Platte River in the fall of 2021 and 2022 by USFS, WGFD, and volunteers to aid in recovery.

Approximately 1.8 miles of hazardous fence was converted to wildlife-friendly design in hunt area 50. Additionally, the BLM removed approximately 763 acres of juniper that was encroaching in sagebrush communities in the Corral Creek area.

4.) Line Transect (LT) Survey: A LT survey was conducted to estimate pronghorn abundance at the end of biological year 2018. The end of biological year population estimate was 13,107 (95% CI= 9,847-17,445) pronghorn. A LT will be conducted at the end of biological year 2022.

5.) Population Modeling: In 2021, WGFD managers also began using PopR integrated population models (IPM) to estimate population indices for pronghorn. The 2022 post-season population estimate for this herd unit from the PopR IPM was approximately 6,100 (CL= 5,300-7,000) pronghorn.

2022 - JCR Evaluation Form

SPECIES: Pronghorn
PERIOD: 6/1/2022 - 5/31/2023

HERD: PR529 - BIG CREEK

HUNT AREAS: 51
PREPARED BY: TEAL CUFAUDE

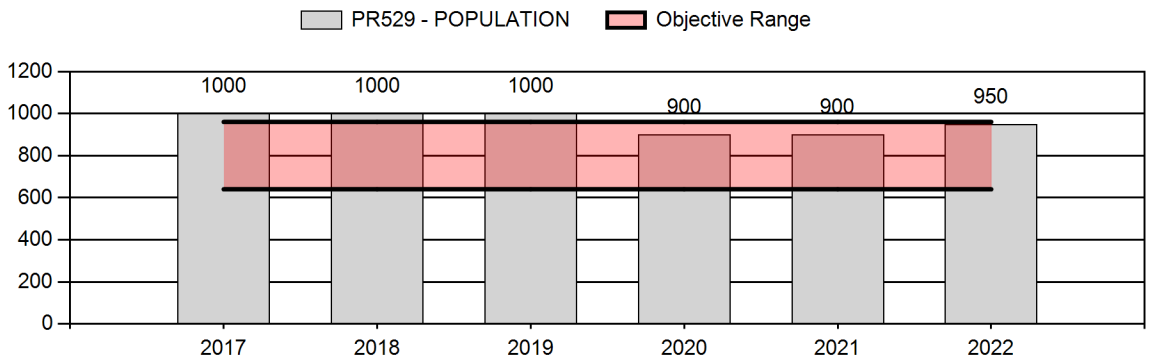
	2017 - 2021 Average	2022	2023 Proposed
Population:	960	950	900
Harvest:	164	122	122
Hunters:	176	128	125
Hunter Success:	93%	95%	98 %
Active Licenses:	203	162	150
Active License Success:	81%	75%	81 %
Recreation Days:	626	500	400
Days Per Animal:	3.8	4.1	3.3
Males per 100 Females	68	63	
Juveniles per 100 Females	56	64	

Population Objective (± 20%) :	800 (640 - 960)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	19%
Number of years population has been + or - objective in recent trend:	1
Model Date:	2/16/2023

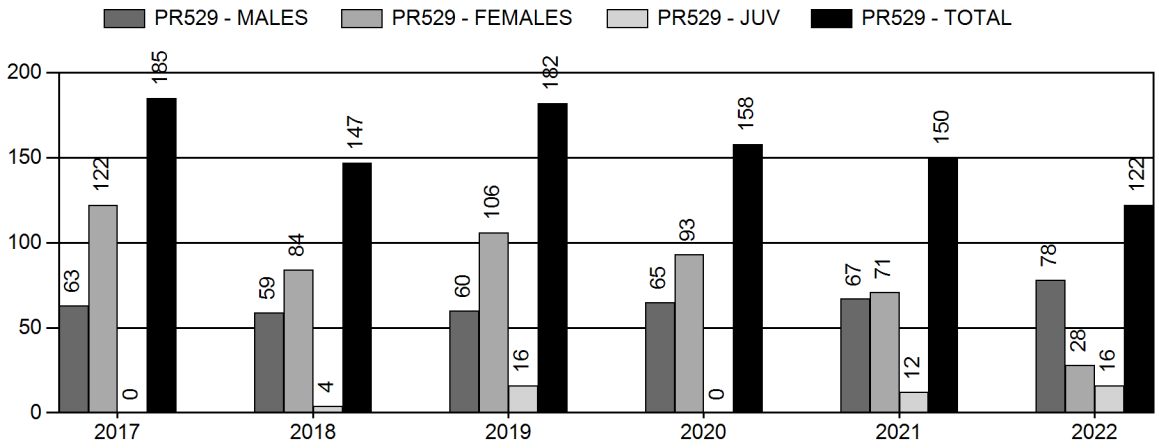
Proposed harvest rates (percent of pre-season estimate for each sex/age group):

	JCR Year	Proposed
Females ≥ 1 year old:	10%	5%
Males ≥ 1 year old:	18%	20%
Proposed change in post-season population:	2%	-3%

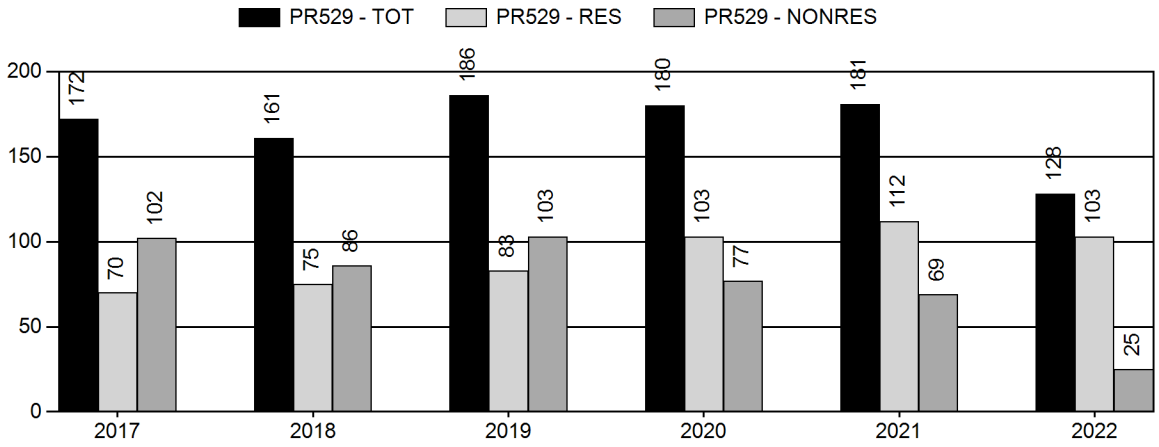
Population Size - Postseason



Harvest



Number of Hunters



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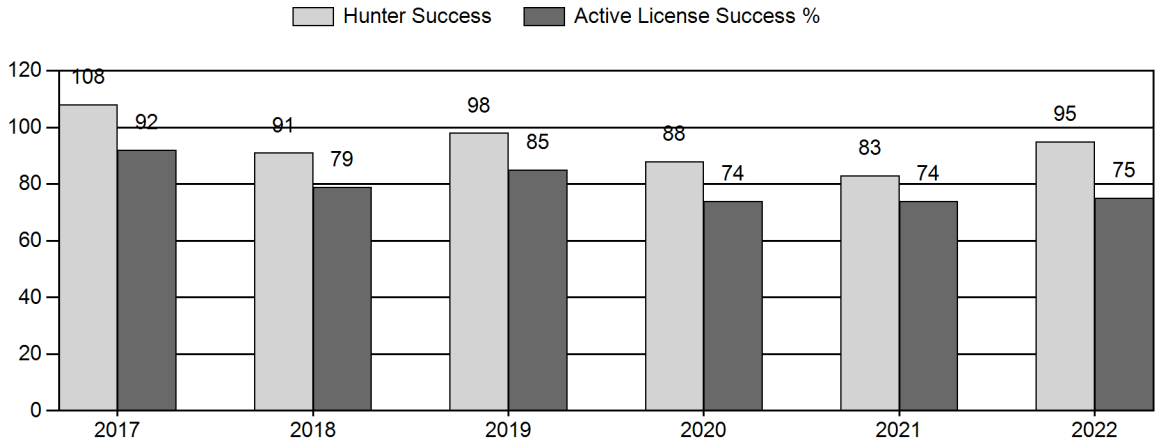
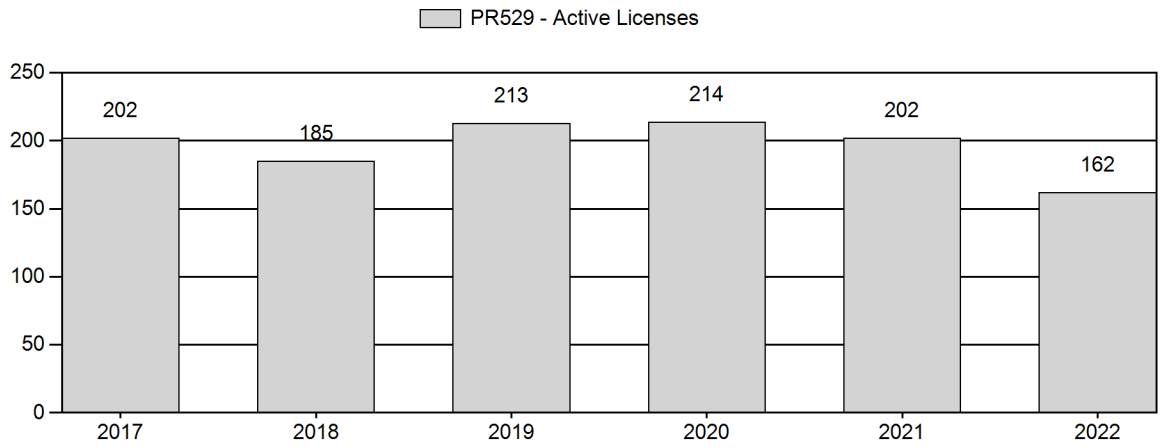
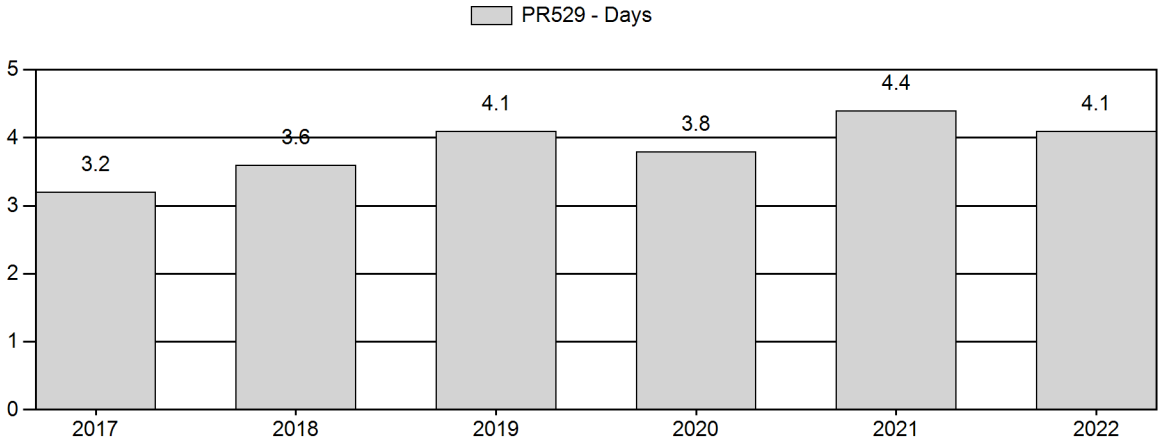


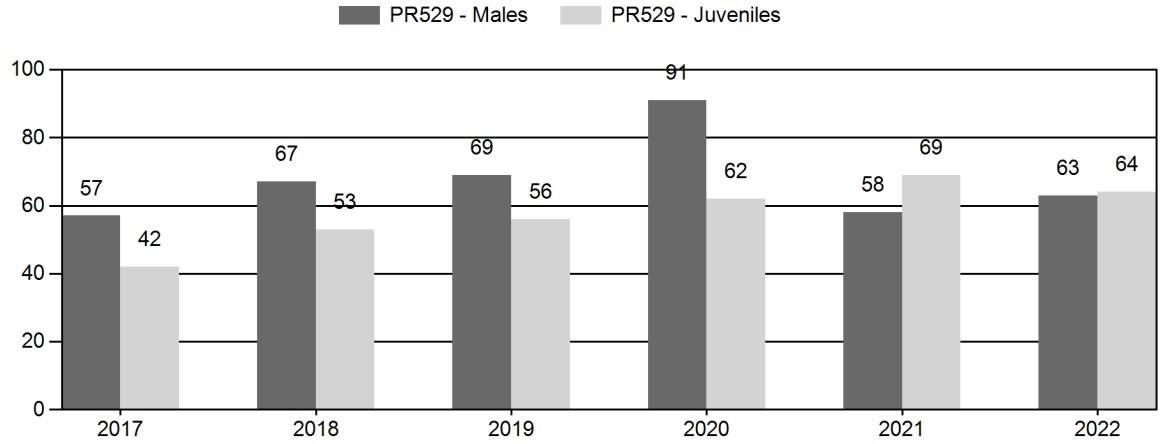
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2023 Hunting Seasons
Big Creek Pronghorn (PR529)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
51	1	Aug. 15	Sep. 15	Sep. 16	Nov. 14	100	Any antelope
	6	Aug. 15	Sep. 15	Sep. 16	Nov. 14	25	Doe or fawn

2022 Hunter Satisfaction: 88.9% Satisfied, 11.1% Neutral, 0% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The 2022 pre-season fawn to doe ratio (64/100) exceeded the ten-year average (56/100). The buck to doe ratio (63/100) was the same as the ten-year average and remained above recreational management objective limits. The yearling buck to doe ratio was 17/100, which indicated good over-winter fawn survival in 2021-22. The 2022 harvest metrics (hunter success, satisfaction, days to harvest) indicated slightly better pronghorn hunting compared to 2021, however each of the metrics indicated more challenging hunting conditions when compared to previous years.

Pronghorn can be difficult to access in this herd unit as they often congregate on private land during the hunting season. The 2022 type 6 hunter success (64.7%) remained below the ten-year average for the second consecutive year which was attributed to fewer does available to harvest on public land. Fawn survival was predicted to be lower in 2023 due to severe winter conditions and reported private land damage was minimal so type 6 licenses were reduced in 2023. The August 15-September 15 type 6 private land firearm season was removed because of minimal damage complaints.

If type 1 hunter success remains unchanged, the harvest rate of adult bucks is projected to be 20%, which was the same as the three-year average. Publically accessible buck pronghorn are limited and without improved hunter access in the herd unit this adult male harvest rate is acceptable. The 2023 license allocation is expected to maintain pronghorn numbers within the 800 (±20%) pronghorn objective range.

2.) Management Objective Review: The objective was last reviewed in 2019 and will be reviewed again in 2024.

3.) Weather/Habitat: Precipitation levels were below normal in 2022. Precipitation events in spring and early summer were minimal and covered small geographic areas. Late July and early August brought monsoonal moisture patterns and resulted in some green-up of herbaceous vegetation, which likely aided fawn rearing does in meeting nutritional demands. Through fall and early winter 2022, conditions remained mild, with no persistent snow accumulations. NOAA weather station data from Rawlins reported a 23% decline in average annual precipitation. According to U.S. Drought Monitor, this area was in a state of moderate to severe drought.

In September 2020, the Mullen Fire burned approximately 176,800 acres in the Snowy Range

Mountain. The southeastern portion of Hunt Area 51 falls within the Mullen Fire burn area. Over 10,300 acres were aerially treated with Rejuvra during the summer of 2021 to control cheatgrass infestations. In 2022, USFS, WGFD, and USGS completed a large-scale monitoring effort to evaluate herbicide efficacy one year post-treatment. Native, perennial grass recovery looks promising thus far. Plant species diversity was comparable pre- and post-treatment with the exception of a few native annual forbs. Cheatgrass was documented in areas where soil movement had occurred. Additionally, high densities of cheatgrass were documented within the no-spray buffer around the North Platte River. We will continue to monitor herbicide efficacy in 2023 and evaluate the need for retreatment. Due to high fire severity, some areas containing mixed mountain shrub stands experienced high levels of shrub mortality. We documented numerous antelope bitterbrush, serviceberry, and big sagebrush seedlings throughout the burn scar in 2022 which is a promising sign for shrub recovery. Several thousand mixed mountain shrub seedlings were planted west of the North Platte River in the fall of 2021 and 2022 by USFS, WGFD, and volunteers to aid in recovery. Past large-scale wildfires within the Sierra Madre Range (Snake fire – 2016, Beaver Creek fire – 2016, and Ryan fire – 2018) are recovering at varying rates. These fires have increased the age class diversity and reset succession within the fire perimeters. In 2022, approximately 5 miles of hazardous fence was converted to wildlife-friendly design in hunt area 51.

4.) Line Transect (LT) Survey: A LT survey was conducted to estimate pronghorn abundance at the end of biological year 2018. The end of biological year population estimate was 2,704 pronghorn (95% CI =1,946-3,757 pronghorn).

5.) Population Modeling: In 2021, WGFD managers also began using PopR integrated population models (IPM) to estimate population indices for pronghorn. The 2022 post-season population estimate for this herd unit from the PopR IPM was approximately 900 (CL=790-1,112) pronghorn.

2022 - JCR Evaluation Form

SPECIES: Mule Deer
PERIOD: 6/1/2022 - 5/31/2023

HERD: MD534 - GOSHEN RIM

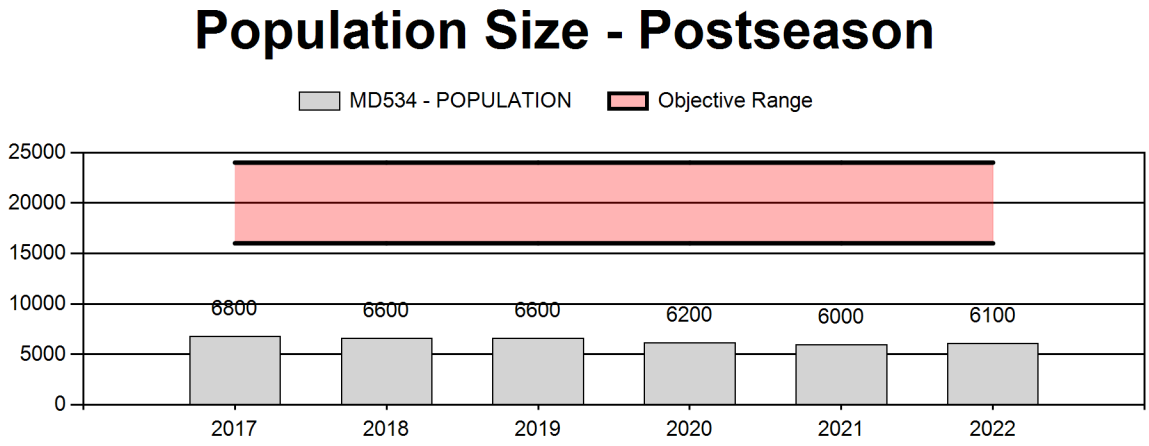
HUNT AREAS: 15
PREPARED BY: KEATON WEBER

	2017 - 2021 Average	2022	2023 Proposed
Population:	6,440	6,100	6,400
Harvest:	880	658	650
Hunters:	1,731	1,486	1,500
Hunter Success:	51%	44%	43%
Active Licenses:	1,805	1,579	1,500
Active License Success:	49%	42%	43%
Recreation Days:	7,252	6,315	6,300
Days Per Animal:	8.2	9.6	9.7
Males per 100 Females	30	30	
Juveniles per 100 Females	46	45	

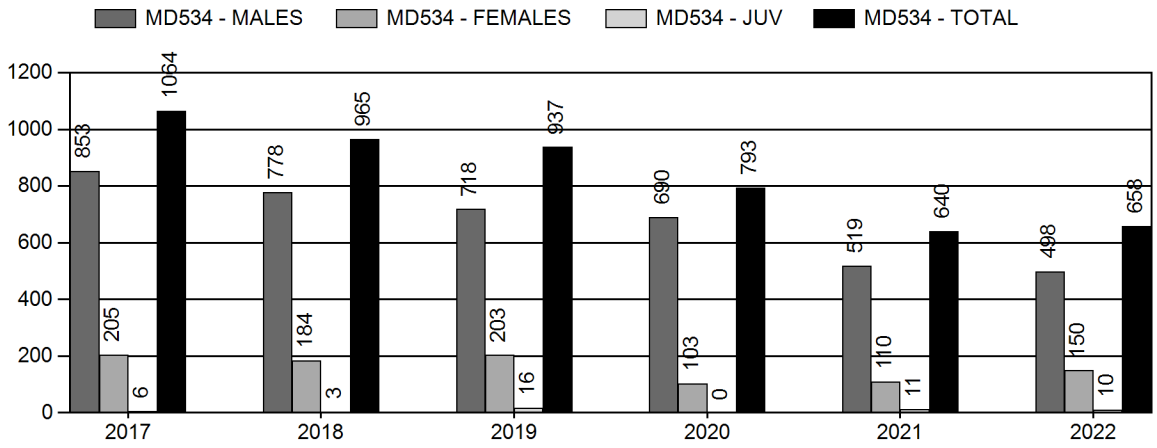
Population Objective (± 20%) :	20000 (16000 - 24000)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	-69.5%
Number of years population has been + or - objective in recent trend:	30
Model Date:	3/2/2023

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

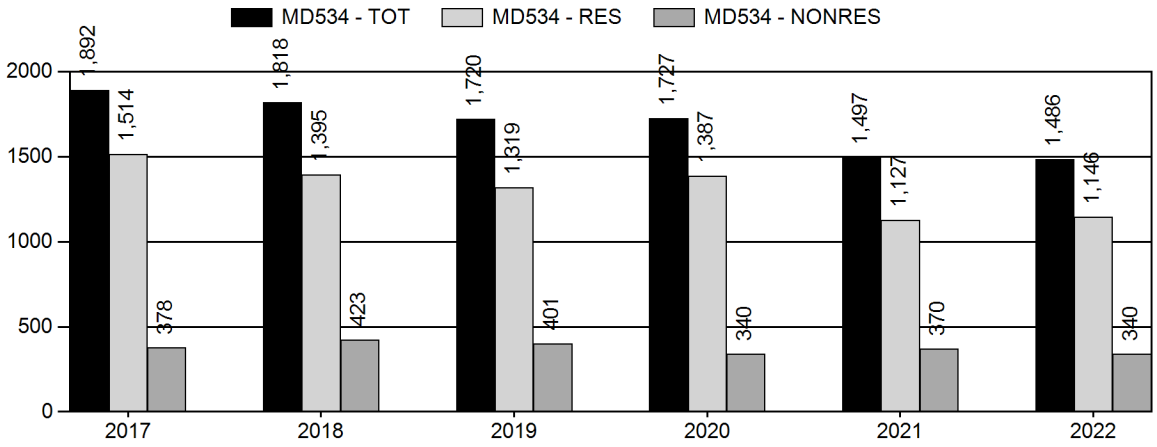
	JCR Year	Proposed
Females ≥ 1 year old:	3%	3%
Males ≥ 1 year old:	35%	35%
Proposed change in post-season population:	+1%	+6%



Harvest



Number of Hunters



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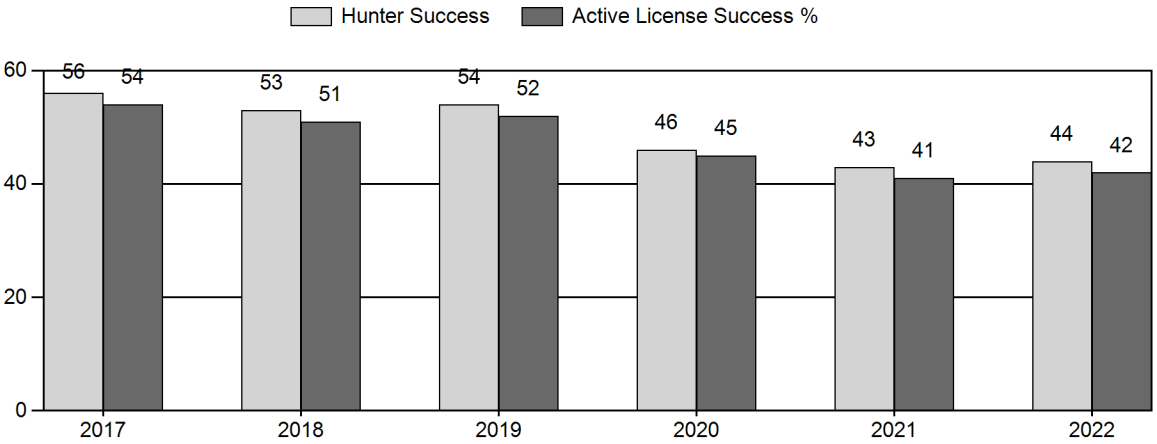
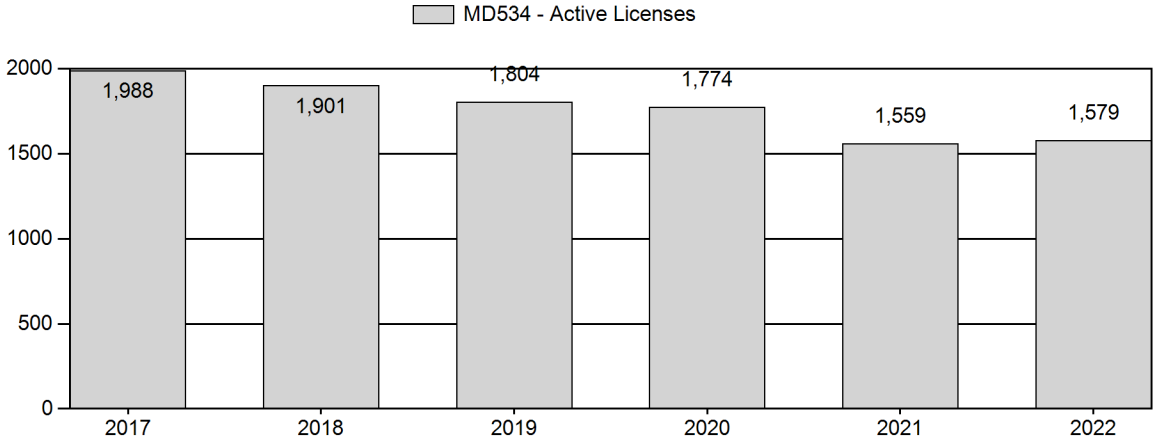
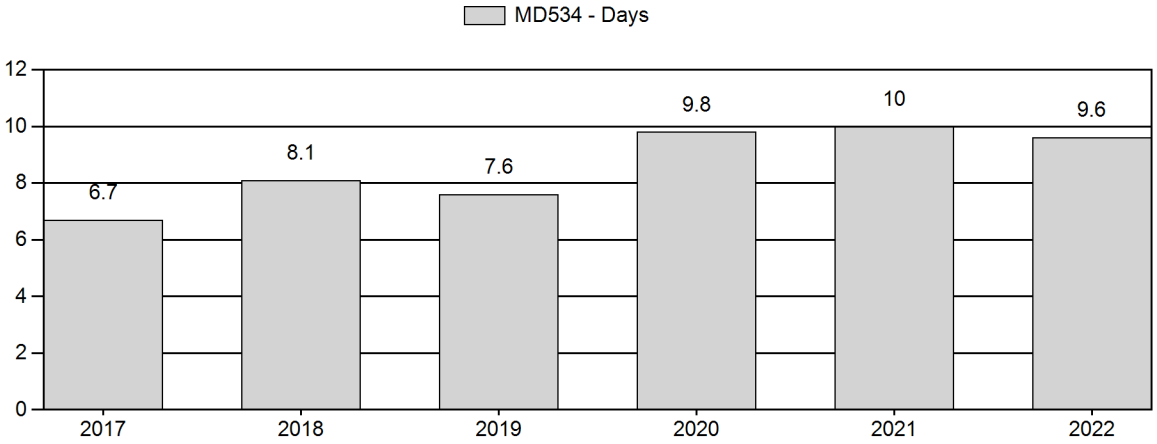


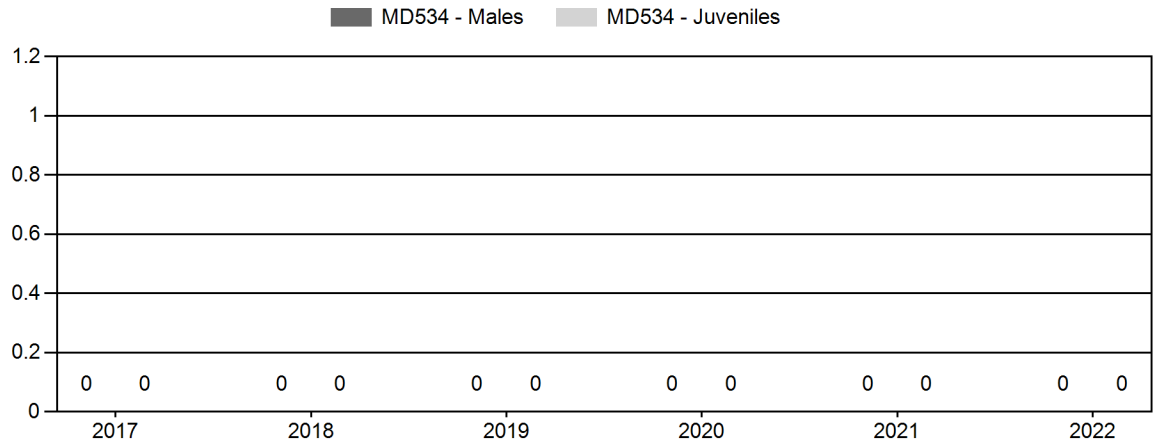
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2023 Hunting Seasons
Goshen Rim Mule Deer Herd Unit (MD534)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
15	Gen	Sept. 1	Sept. 30	Oct. 1	Oct. 14		Antlered mule deer or any white-tailed deer
15	6	Sept. 1	Sept. 30	Oct. 1	Dec. 31	250	Doe or fawn

2023 Region T nonresident quota: 400 licenses

2022 Hunter Satisfaction: 54% Satisfied, 22% Neutral, 23% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: Goshen Rim Mule Deer Herd Unit has been below the objective of 20,000 mule deer for well over the past 30 years so the season is structured to be as conservative as possible while still addressing minimal damage concerns throughout the herd unit. A reduction of 50 Type 6 licenses will reduce harvest pressure on the female portion of the population. Additionally, due to a decrease in damage claims throughout the hunt area, there is less of a need for Type 6 licenses to address those damage concerns. Buck ratios in 2022 were 30 bucks per 100 does, which was the same as the five year average and at the upper end of the recreational management range of 20-30 bucks per 100 does. Since buck ratios are within the guideline limits there does not appear to be a need to reduce public opportunity by decreasing hunting days or Region T licenses. CWD is and will continue to be an issue within this herd unit and will be up for priority surveillance again in 2025.

2.) Management Objective Review: In 2023, the Goshen Rim Mule Deer herd unit was up for objective review. Managers reviewed the past five year's population metrics, hunter satisfaction results, weather, and habitat data and determined the best course of action is to remain at recreational management with a population objective of 20,000 mule deer. This herd unit will be up for objective review again in 2028.

3.) Weather and Habitat: Annual precipitation was well below normal in the Goshen Rim herd unit in 2022. NOAA weather station data from Torrington and Cheyenne showed a 55% and 39% decrease from average for the year. Due to the juxtaposition of annual and perennial agricultural croplands intermixed with rangeland habitats, mule deer likely shift diets to crops when native rangeland forage production is compromised by declines in overall precipitation or poorly timed events. Mixed mountain shrub habitats found on the Goshen Rim remain in late seral stages due to a lack of managed disturbance on the landscape. Annual shrub production and shrub nutritive content are both compromised as plants mature. Cheatgrass remains a large threat in the understory of shrub communities and also in cropland environments. Conservation Reserve Program (CRP) enrolled lands continue their downward spiral and provide very little in the form of hiding, fawning, and thermal cover and exhibit equally poor forage production and nutritive quality for much of the year.

The NOAA U.S. Drought Monitor classified land in Goshen, Platte, and Laramie Counties in the severe to extreme drought categories in 2022.

Cheatgrass control was completed on private and BLM lands in northern portions of Hunt Area 15, totaling 1,070 acres. This area was burned by wildfire in 2006. Cheatgrass has become increasingly worse in burned areas over the last 15 years.

4.) Chronic Wasting Disease Management: Prevalence estimates and sample sizes are below (Table 1). Most recently, we have sustained a 35% prevalence through 2020-2022. This herd was up for priority surveillance in 2020-2021 and will be back up for priority surveillance in 2026. Managers are concerned with this high of prevalence in the herd unit and are in the process of gaining public input on CWD management options within the Department's CWD Management Plan.

Table 1. CWD prevalence for hunter-harvested mule deer in the Goshen Rim Mule Deer Herd, 2020 - 2022.

Year(s)	Percent CWD-Positive and (*n*) – *Hunter Harvest Only*		
	Adult Males (CI = 95%)	Yearling Males	Adult Females
2020	**31% (n=105)**	6.7% (n=15)	6.3% (n=16)
2021	**54%(n=28)**	0% (n=5)	0% (n=1)
2022	**31% (n=36)**	0% (n=1)	0% (n=6)
2020-2022	**35% (20-43%, n=169)**	5% (n=21)	4% (n=23)

5.) Population Modeling: In 2021, WGFD managers began using PopR integrated population models (IPM) to estimate population indices for mule deer and pronghorn. The bio-year 2022 postseason population estimate for this herd unit was 6,100 (CL = 5,200 – 6,900) mule deer.

2022 - JCR Evaluation Form

SPECIES: Mule Deer

PERIOD: 6/1/2022 - 5/31/2023

HERD: MD537 - LARAMIE MOUNTAINS

HUNT AREAS: 59-60, 64

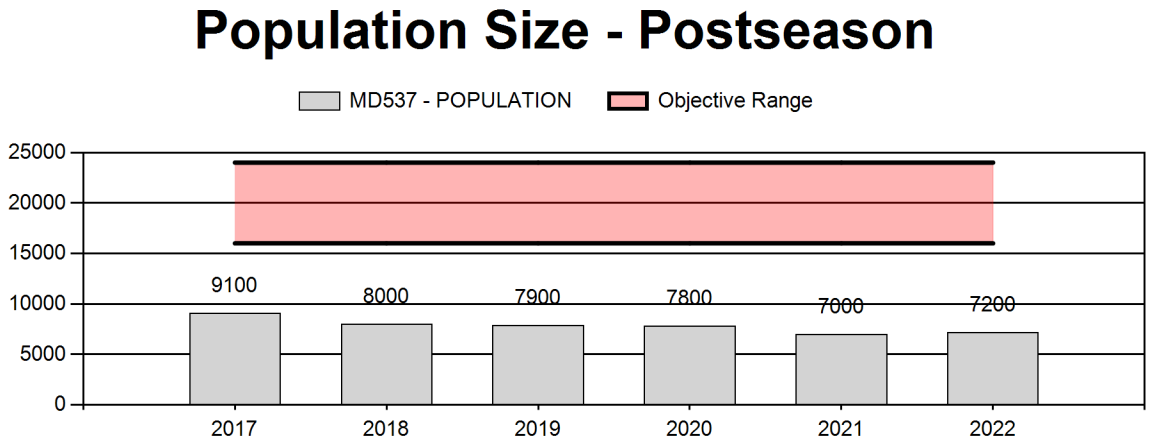
PREPARED BY: KEATON WEBER

	2017 - 2021 Average	2022	2023 Proposed
Population:	9,500	7,200	7,000
Harvest:	997	736	750
Hunters:	1,972	1,840	1,800
Hunter Success:	51%	40%	42%
Active Licenses:	2,018	1,895	1,750
Active License Success:	49%	39%	43%
Recreation Days:	8,891	9,709	9,500
Days Per Animal:	8.9	13.2	12.7
Males per 100 Females	43	0	
Juveniles per 100 Females	53	0	

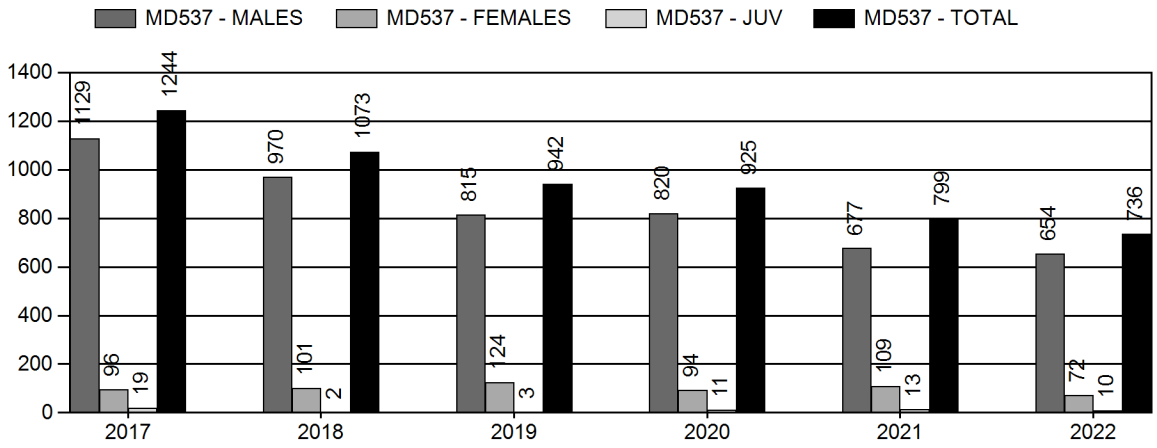
Population Objective (± 20%) :	20000 (16000 - 24000)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	-64%
Number of years population has been + or - objective in recent trend:	30
Model Date:	2/26/2023

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

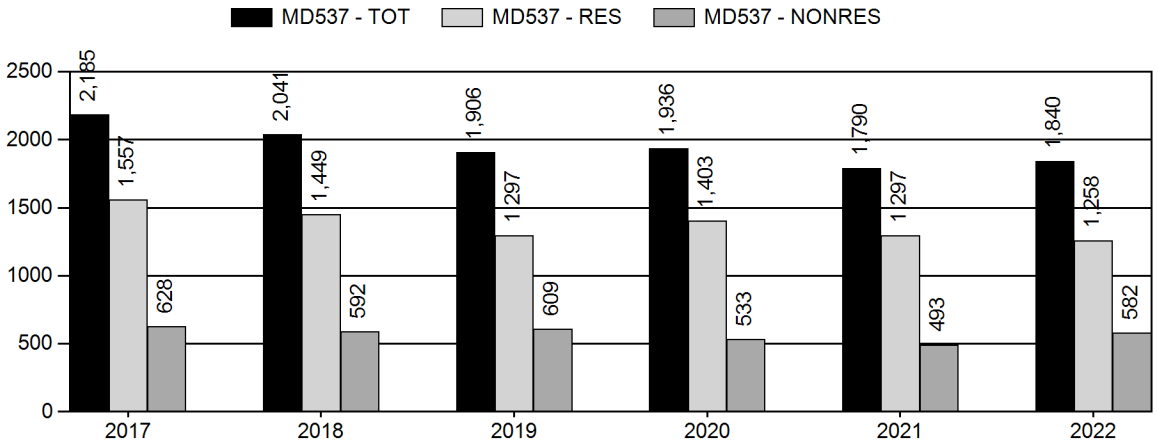
	JCR Year	Proposed
Females ≥ 1 year old:	2%	3%
Males ≥ 1 year old:	35%	33%
Proposed change in post-season population:	+3%	-3%



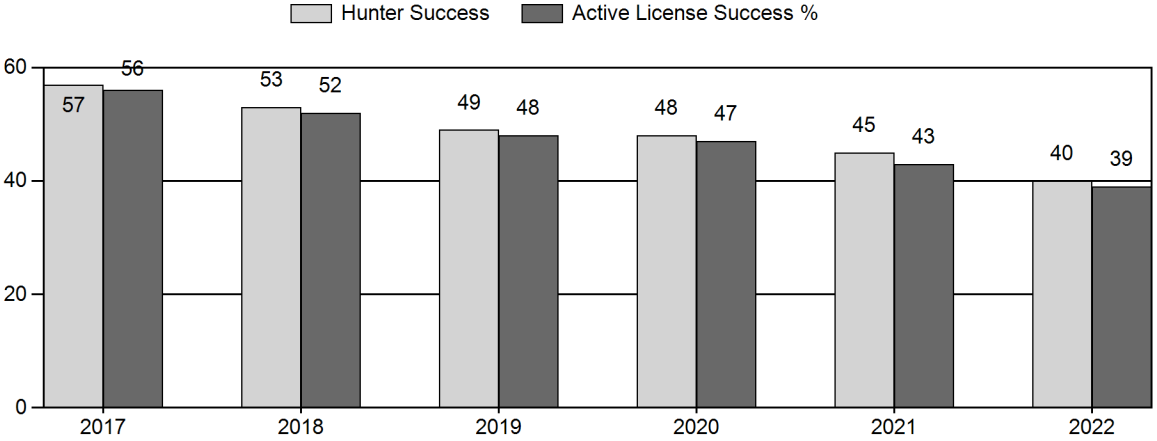
Harvest



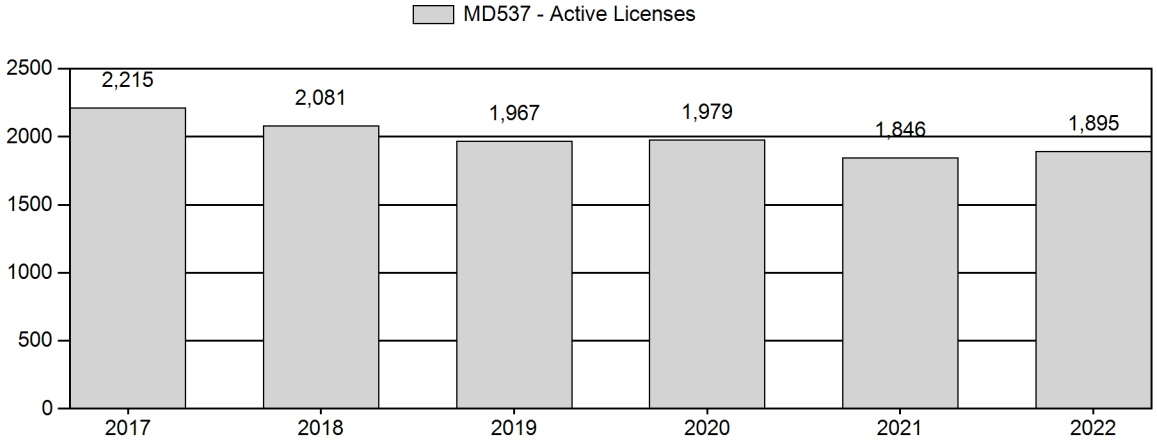
Number of Hunters



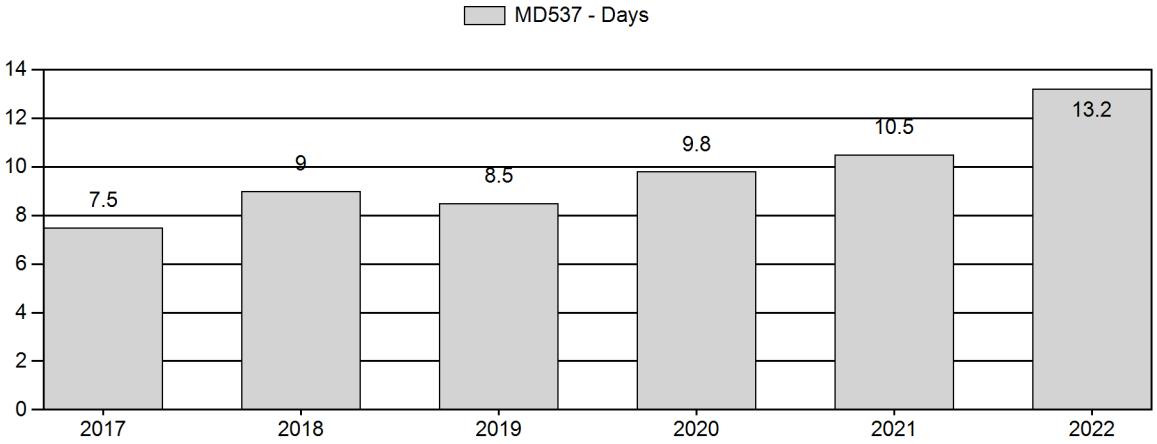
Harvest Success



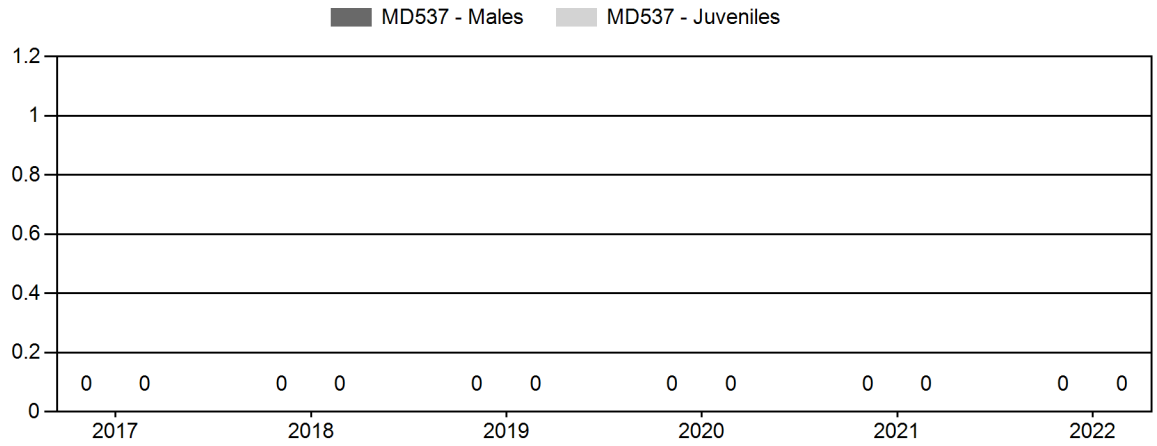
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2023 Hunting Seasons
Laramie Mountains Mule Deer Herd Unit (MD537)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
59	Gen	Sept. 1	Sept. 30	Oct. 15	Oct. 31		Antlered mule deer any white-tailed deer
59,64	6	Sept. 1	Sept. 30	Oct. 15	Oct. 31	100	Doe or fawn, valid on private land
59,64	6			Nov. 1	Dec. 31		Doe or fawn white-tailed deer, valid in the entire area
60	1	Sept 1	Sept 30	Oct. 15	Nov. 5	100	Any deer
60	2	Sept 1	Sept 30	Oct. 15	Nov. 5	200	Any deer off national forest
60	6	Sept 1	Sept 30	Oct. 15	Nov. 30	50	Doe or fawn
64	Gen	Sept. 1	Sept. 30				Antlered mule deer or any white-tailed deer valid in the entire area
64	Gen			Oct. 15	Oct. 31		Antlered mule deer or any white-tailed deer except the Wyoming Game and Fish Commission's Tom Thorne/Beth Williams Wildlife Habitat Management Area and the Laramie Peak Wildlife Habitat Management Area north of the Tunnel Road (Albany County Road 727) shall be closed
64	2	Sept. 1	Sept. 30	Oct. 15	Oct. 31	100	Antlered mule deer or any white-tailed deer

2023 Region J nonresident quota: 750 licenses

2022 Hunter Satisfaction: 53% Satisfied, 22% Neutral, 23% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The Laramie Mountains Mule Deer Herd Unit's population estimate of 7,200 is 64% below the objective of 20,000 mule deer and as a result the 2022 season is conservative in structure. A reduction in Type 6 licenses is warranted to relieve hunting pressure on female portion of the population. There will still be a small amount of Type 6 licenses to address isolated damage concerns on agriculture dominated lands. The general seasons will remain at 16 days to take advantage of high buck ratios (36 bucks per 100 does) that are above the upper end of the recreational management guidelines (20-30 buck per 100 does). A reduction of 150 licenses within the nonresident region quota will reduce overcrowding concerns on the limited amount of public lands within the herd unit. Harvest success has steadily decreased from 52% in 2018 to 39% in 2022 and is well below the five year average of 51%. Hunter effort has increased from 9 days per harvest in 2018 to 13 days per harvest in 2022. In 2022, managers did not classify this herd, but instead conducted a Sightability Survey flight that encompassed roughly 30 hours of flight time to provide a reliable density estimate, which resulted in an estimate of 11,700 deer. This herd's population continues to decline due to multiple years of poor fawn recruitment (5 year average = 52 fawns per 100 does), consecutive years of drought, and Chronic Wasting Disease. Based on harvest data and previous post-season composition surveys the majority of mule deer on the landscape are Class I ($\leq$19" antler width) and Class II (20-24" antler width) bucks. There are very few Class III males (> 25" in antler width) on the landscape, most likely due to high prevalence of CWD within this herd unit.

2.) Management Objective Review: The population objective for the Laramie Mountains Herd Unit was last reviewed in 2019 and will be reviewed again in 2024.

3.) Weather and Habitat: Annual precipitation in the hunt area was below normal for 2022 based on weather data analyzed from Cheyenne and Laramie weather stations. NOAA weather station data from Laramie and Cheyenne showed a 37% and 39% decrease from average for the year. Southern portions of the herd unit were impacted by continued summer drought more than northern portions. NOAA's U.S. Drought Monitor classified most of this herd unit in the severe drought category in 2022. Some monsoonal rains were seen in late July 2022, causing some severe erosion in the Sybille Canyon area. Generally, shrub communities throughout the Laramie Range remain mostly in late seral successional stages, with decreased shrub productivity and nutritive content compared to more early seral shrub communities associated with recent disturbances (e.g. prescribed fire).

The Sugarloaf wildfire near Garrett burned 839 acres in early August. This wildfire did not exhibit the high fire severity levels seen in other recent wildfires, so hopefully we see positive vegetation responses to this event.

Cheatgrass control via herbicide application is on-going in the northern half of the Laramie Mountains herd unit. A 5,688 acre treatment was completed in Area 64 on the Thorne/Williams WHMA and surrounding BLM, private, and OSLI lands. This treatment was largely focused on

areas not previously burned by wildfire, but are at high risk. History has shown that summer wildfires in this area result in very high mortality of important winter range shrub stands, so this treatment was designed as a preemptive measure to reduce wildfire risk. A 900 acre treatment was also completed in Palmer Canyon on private lands burned by the 2018 Brittania wildfire.

Cheatgrass spraying will be occurring in the Pole Mountain and Curt Gowdy State Park area in 2023. Dalmation toadflax and cheatgrass are both present in mixed mountain shrub habitats. The use of Rejuvra herbicide may aid in control of both species.

Competition with elk for basic habitat requirements is likely a contributing factor for poor mule deer performance within the herd unit. Within deer hunt areas 59 and 60 we continue to see exponential elk herd growth, putting strains on habitats historically and previously occupied mostly by mule deer. Dietary overlap in Spring, Summer, Fall ranges between elk, mule deer, and cattle can result in increased competition for resources.

4.) Chronic Wasting Disease Management: This was a Tier 1 surveillance herd in 2022 in which managers needed to collect 200 CWD samples. By implementing mandatory CWD sampling, managers collected 390 CWD samples in 2022. By implementing mandatory CWD sampling, managers were able to improve confidence intervals in CWD prevalence. In 2021, the 3-year average CWD prevalence was 21% with confidence intervals at 12.5%-26.6%, a confidence range of 14%. With the increased sample size in 2022, the 3-year average CWD prevalence was 18% with confidence intervals at 12%-22%, a range of 10% (Table 1). Mandatory sampling also helped increase sample sizes from areas with low coverage. For example, Hunt Area 60 has limited licenses available, so managers have struggled obtaining sufficient sample sizes. The average annual sample size from 1997-2021 in hunt area 60 was 13 samples, in 2022, 67 samples were collected, which is a 81% increase in sample size. Mandatory sampling also enabled managers to collect female samples, which in the past was difficult to accomplish. The average annual sample size from 1998-2021 in the herd unit was 5 female samples, in 2022, 60 female samples were collected.

A Local CWD Working Group was created in 2022 comprised of 11 people from the local area to formulate CWD management recommendations for this herd to the Department that are within the Department's CWD Management Plan. This working group is scheduled to have these recommendations for Laramie Mountains mule deer herd unit completed by fall of 2023. Managers will then take these recommendations into consideration.

Table 1. CWD prevalence for hunter-harvested mule deer in the Laramie Mountains Mule Deer Herd, 2020 - 2022.

Year(s)	Percent CWD-Positive and (*n*) – *Hunter Harvest Only*		
	Adult Males (CI = 95%)	Yearling Males	Adult Females
2020	**15% (n=72)**	17% (6)	11% (9)
2021	**19% (n=83)**	0% (6)	12% (4)
2022	**19% (n=390)**	5% (64)	3% (60)
2020-2022	**18% (12%-22%, n=545)**	8% (49)	6% (73)

5.) Population Modeling: In 2021, WGFD managers began using PopR integrated population models (IPM) to estimate population indices for mule deer and pronghorn. The bio-year 2022 postseason population estimate for this herd unit from the PopR IPM was approximately 7,200 (CL = 5,700-9,200) mule deer.

2022 - JCR Evaluation Form

SPECIES: Mule Deer
PERIOD: 6/1/2022 - 5/31/2023

HERD: MD539 - SHEEP MOUNTAIN

HUNT AREAS: 61, 74-77
PREPARED BY: LEE KNOX

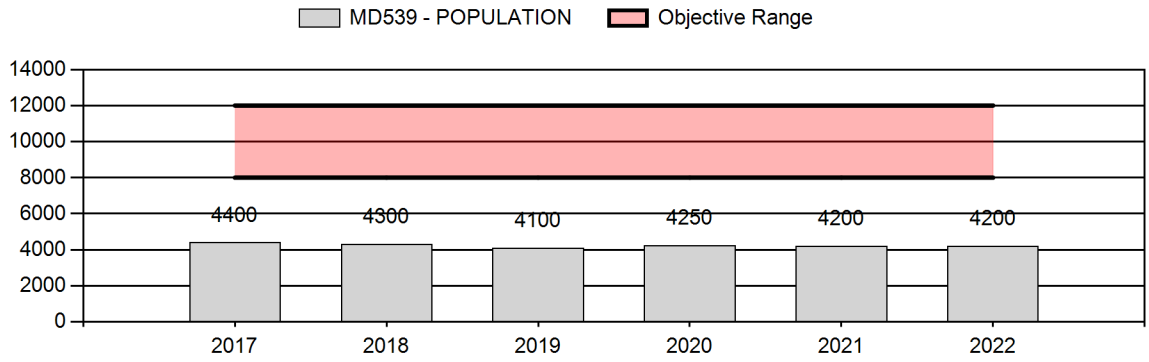
	2017 - 2021 Average	2022	2023 Proposed
Population:	4,250	4,200	4,000
Harvest:	388	408	450
Hunters:	1,455	1,653	1,600
Hunter Success:	27%	25%	28%
Active Licenses:	1,455	1,653	1,600
Active License Success:	27%	25%	28%
Recreation Days:	7,967	10,141	10,000
Days Per Animal:	20.5	24.9	22.2
Males per 100 Females	36	27	
Juveniles per 100 Females	59	58	

Population Objective (± 20%) :	10000 (8000 - 12000)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	-58%
Number of years population has been + or - objective in recent trend:	20
Model Date:	2/25/2023

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

	JCR Year	Proposed
Females ≥ 1 year old:	1%	1%
Males ≥ 1 year old:	35%	35%
Proposed change in post-season population:	-1%	-3%

Population Size - Postseason



2023 Hunting Seasons
Sheep Mountain Mule Deer (MD539)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
61	Gen	Sep. 1	Sep. 30	Oct. 1	Oct. 14		Antlered mule deer or any white-tailed deer
74	Gen	Sep. 1	Sep. 30	Oct. 1	Oct. 14		Antlered mule deer or any white-tailed deer
75	Gen	Sep. 1	Sep. 30	Oct. 1	Oct. 14		Antlered mule deer or any white-tailed deer
76	Gen	Sep. 1	Sep. 30	Oct. 1	Oct. 14		Antlered mule deer or any white-tailed deer
77	Gen	Sep. 1	Sep. 30	Oct. 1	Oct. 14		Antlered mule deer or any white-tailed deer

2023Region D nonresident quota: 300 licenses

2022 Hunter Satisfaction: 44% Satisfied, 29% Neutral, 27% Dissatisfied

2022 Management Summary

1.) Hunting Season Evaluation: The management strategy is recreational management which prescribes for a buck ratio of 20 to 29:100 does. The Sheep Mountain Mule Deer Herd Unit remains below the population objective of 10,000. The 2022 post season population estimates was 3,500 mule deer, which is 58% below the objective. This is not a reflection of a significant loss of the population, but rather driven by the 2020 sightability estimate of 3,300. An estimate of 3,500 mule deer is likely a more accurate population estimate than previously estimated and the objective should be revisited. The 2022 season was the second year hunters were able to take advantage of the 14 day season due to the Mullen fire in 2020 closing hunt areas 77 and 76 during the season. Harvest was 408 deer, still above the five year average of 387 deer harvested. Maintaining a 14 day season has brought the buck ratio down to within recreational management guidelines at 27:100 does. The five year average buck ratio was 35:100 does, exceeding recreational management.

2.) Management Objective: The management objective for the Sheep Mountain Mule Deer Herd is a post season population estimate of 10,000 mule deer. The management objective was last reviewed in 2020, maintaining a recreational management strategy of 20 to 29 bucks:100 does. When the objective is reviewed again in 2025 managers will explore a more realistic objective.

3.) CWD Management: CWD surveillance was shifted in the 2019 season to focus on specific herds instead of the blanket statewide approach. Deer herds statewide will be on a five year rotation with the goal of increase surveillance to maintain adequate sample with a goal of 200 samples in

3 years. Sheep Mountain Mule Deer was a Tier 2 focal herd and was a priority for CWD sampling from 2019 to 2021. Prevalence estimates and sample sizes are presented below in Table 1.

Table 1. CWD prevalence for hunter-harvested mule deer in the Sheep Mountain Mule Deer Herd, 2019-2021.

Year(s)	Percent CWD-Positive and (*n*) – *Hunter Harvest Only*		
	Adult Males (CI = 95%)	Yearling Males	Adult Females
2019	**14.8% (n=61)**	0%	0%
2020	**10.3% (n=29)**	0%	0%
2021	**16.3% (n=80)**	0%	0%
2019-2021	**14.7% (8.4-20.9%, n=170)**	0% (34)	0% (15)

4.) Sightabilty: A Sightabilty was flown in the Sheep Mountain Herd Unit in March of 2021. Total hours flown were 29, with 1,882 mule deer observed, for an abundance estimate of 3,334 SE 520 LCL 2,304 – UCL 4,345.

5.) Research: To fill in geographical gaps in data from the 2017-2019 movement and habitat use study, 15 does were collared north of Interstate 80 in November of 2020. We collared 15 additional does south of hwy 130 in January of 2021. These collars will collect locations every two hours for two years, falling off in winter of 2023/2024. Survival rate of collared does was 68% in 2022. We had nine mortalities, six of which were in hunt area 74.

6.) Habitat and Weather: Precipitation received in water year 2022 was 14% below the long term average. Within the 5 year review period of 2018 – 2022, annual precipitation exceeded the 30 year average in only 1 of the 5 years. The greatest deficiency in growing season precipitation was observed in 2022, followed by year 2021 and 2018.

In addition to a 14% deficit in 2022 overall annual precipitation below the 30 year average, moisture events in the critical growth months for herbaceous and woody vegetation was 41% below normal. Significant deficiencies occurred in May – July period in Spring, Summer, Fall ranges for mule deer, where percent departures from normal precipitation falling during this period were 24%. Precipitation falling in this time period is essential for growth at high elevations in the herd unit. The importance of lush, succulent and nutritious forage availability in summer fawn rearing habitats cannot be overstated. Lack of spring and early summer precipitation led to earlier senescence of herbaceous and woody plant forages across all seasonal ranges. Earlier than normal senescence of grasses and forbs occurred, especially on transition and winter range habitats. The foothills and plains located adjacent to the Snowy Range experienced very dry conditions, with a short window of green-up in the spring. Throughout the herd unit, some late summer monsoonal weather patterns developed, bringing much needed rain to higher and lower elevations. While too late in the year to provide anything in the way of forage production, green-up lasting a few weeks was witnessed in August. Significant erosion events occurred in the southern half of the Snowy Range, on Sheep Mountain and several drainages west of the Fox Creek Road in a couple of isolated downpours.

For additional habitat and weather information please see Appendix pending.

7.) Population Modeling: The bio-year 2022 from the PopR IPM was approximately 4,200 (CL = 3,800– 4,700) mule deer. Classification and harvest data was used from years 2000-2023. The effort variable that best matched harvest was number of licenses. Model convergence was likely. The Department replaced the WGFD spreadsheet model with the PopR IPM in bio-year 2021.

Appendix A

Habitat

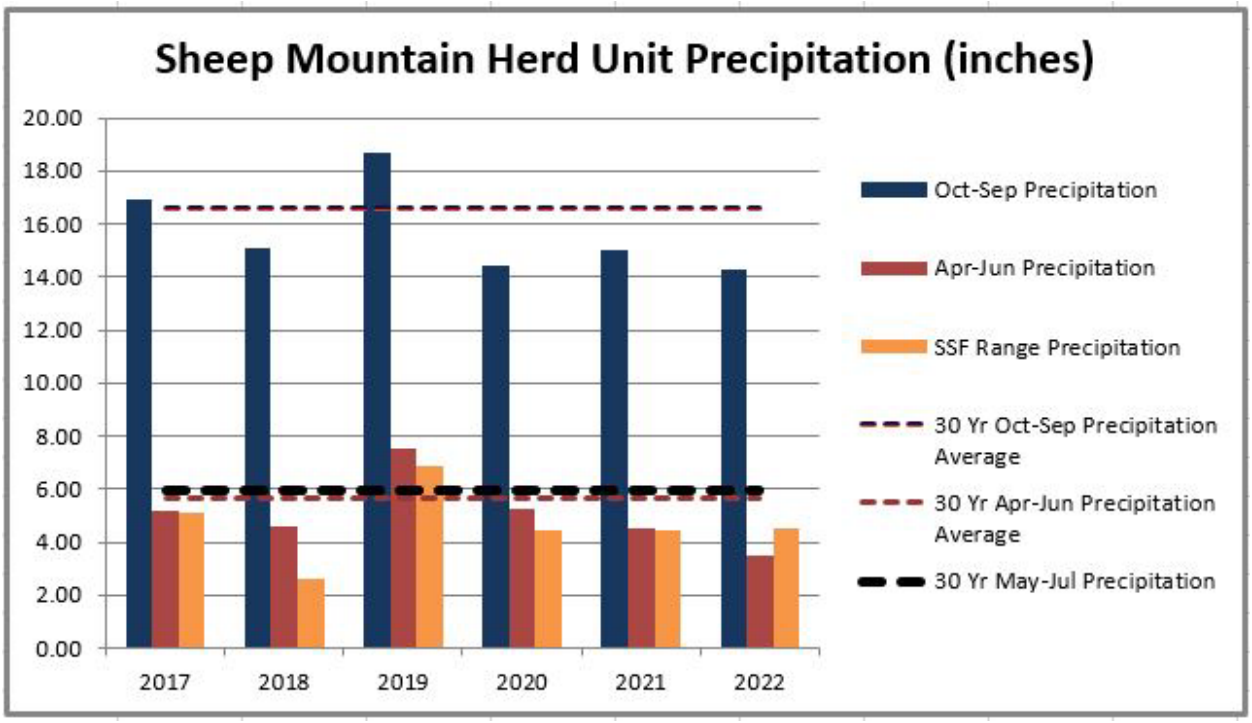


Figure 1. Parameter-Evaluation Relationships on Independent Slopes Model (PRISM) was utilized to estimate precipitation by calculating climate regressions for each Digital Evaluation Model grid cell (4 km resolution) for the Sheep Mountain mule deer herd unit.

Precipitation received in water year 2022 was 14% below the long term average. Within the 5 year review period of 2018 – 2022, annual precipitation exceeded the 30 year average in only 1 of the 5 years. The greatest deficiency in growing season precipitation was observed in 2022, followed by year 2021 and 2018.

In addition to a 14% deficit in 2022 overall annual precipitation below the 30 year average, moisture events in the critical growth months for herbaceous and woody vegetation was 41% below normal. Significant deficiencies occurred in May – July period in Spring, Summer, Fall ranges for mule deer, where percent departures from normal precipitation falling during this period were 24%. Precipitation falling in this time period is essential for growth at high elevations in the herd unit. The importance of lush, succulent and nutritious forage availability in summer fawn rearing habitats cannot be overstated. Lack of spring and early summer precipitation led to earlier senescence of herbaceous and woody plant forages across all seasonal ranges. Earlier than normal senescence of grasses and forbs occurred, especially on transition and winter range habitats. The foothills and plains located adjacent to the Snowy Range experienced very dry conditions, with a short window of green-up in the Spring. Throughout the herd unit, some late summer monsoonal weather patterns developed, bringing much needed rain to higher and lower elevations. While too late in the year to provide anything in the way of forage production, green-up lasting a few weeks was witnessed in August. Significant erosion events occurred in the southern half of the Snowy

Range, on Sheep Mountain and several drainages west of the Fox Creek Road in a couple of isolated downpours.

In 2022, 6,288 acres of Mullen wildfire burned areas on the eastern flanks of the Snowies within the Sheep Mountain herd unit were treated with Rejuvra for cheatgrass control. Field reconnaissance and vegetation monitoring efforts completed in 2022 rates showed significant recovery of mixed mountain shrub stands and aspens. Some of these areas showed little to no resprouting in 2021, causing concern for managers, but 2022 resulted in noticeable recovery of native vegetation. Timing of the wildfire, as well as lower than average precipitation heavily influenced resprouting in the first year following the wildfire.

Other areas recently burned by the Badger Creek (2018) and Squirrel Creek wildfires (2012) are still recovering. The USFS plans to aerially treat foothill slopes above Woods Landing in Summer 2023 for cheatgrass. This will be the second herbicide application on these slopes since 2018. Aspen regeneration has been very good within the Squirrel Creek and Badger Creek wildfire areas, so we anticipate similar results following recent wildfire activity. Areas burned twice by the Squirrel Creek and Mullen wildfires have experienced significant setback of aspen regeneration.

Prescribed burns in mixed mountain shrub stands are slated for Spring 2023 on the Wick WHMA, totaling approximately 1,200 acres. These treatments are located on crucial winter ranges for mule deer. After two years of delays, we are hopeful this burn will be completed this year.

USFS LaVA projects have been largely focused on northern half of the Snowy Range for future treatments in the near term. The Wick WHMA and associated USFS lands will be targeted for aspen enhancements through removal of encroaching conifers through mastication and hand cutting in the Foote Creek drainage in 2023. Future prescribed fires will be conducted as a follow-up treatment to further encourage aspen regeneration. USFS, BLM, and private lands in the Fallen Pines area, north of Centennial, has been identified as an area for future timber harvest that may lead to improved habitat conditions for deer and elk.

Sixteen (16) Rapid Habitat Assessments (RHA's) were completed in the Sheep Mountain mule deer herd unit in summer 2022, analyzing 621 acres total. Significant RHA effort was completed in the aspen and riparian habitats. Some of the most significant findings included:

Aspens burned in the 2018 wildfire are regenerating successfully. Herbivory is noticeable by wildlife and livestock, but not considered to be excessive. Some aspen stands will be above the browse line of large wild ungulates in the next two to three years and can be considered as a newly established age class. Aspen stands burned in the 2020 Mullen wildfire are regenerating successfully. Significant resprouting of mixed mountain shrubs was witnessed in 2022 after a poor year in 2021. Of particular interest is that mule deer, elk, and moose were all found in higher elevations despite deep snow levels in November and December. The quality of forage offered is likely worth the animal energy expenditures it takes to access these habitats.

Livestock grazing deferment in areas burned by the Mullen wildfire has likely aided in riparian woody and herbaceous plant reestablishment and the USFS should be commended for adhering to post-burn deferment requirements.

2022 - JCR Evaluation Form

SPECIES: Mule Deer
PERIOD: 6/1/2022 - 5/31/2023

HERD: MD540 - SHIRLEY MOUNTAIN

HUNT AREAS: 70
PREPARED BY: TEAL CUFAUDE

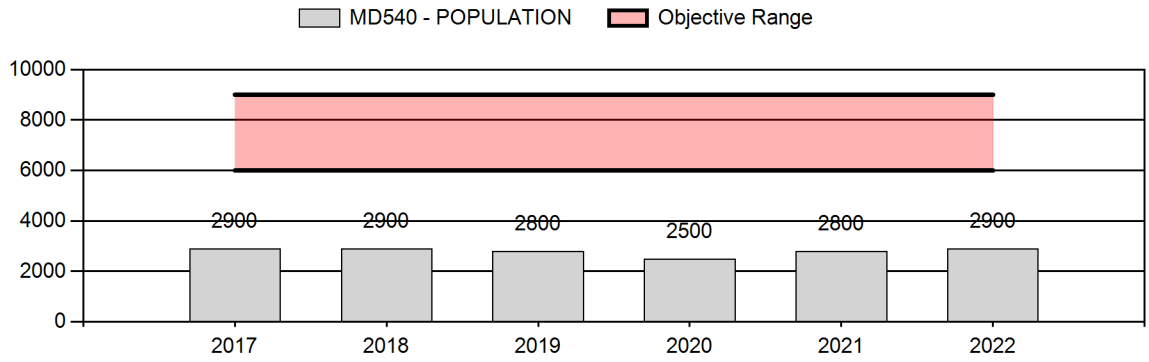
	2017 - 2021 Average	2022	2023 Proposed
Population:	2,780	2,900	2,900
Harvest:	236	219	215
Hunters:	569	521	525
Hunter Success:	41%	42%	41%
Active Licenses:	572	521	530
Active License Success:	41%	42%	41 %
Recreation Days:	2,326	2,022	2,000
Days Per Animal:	9.9	9.2	9.3
Males per 100 Females	37	26	
Juveniles per 100 Females	57	64	

Population Objective (± 20%) :	7500 (6000 - 9000)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	-61.3%
Number of years population has been + or - objective in recent trend:	6
Model Date:	02/27/2023

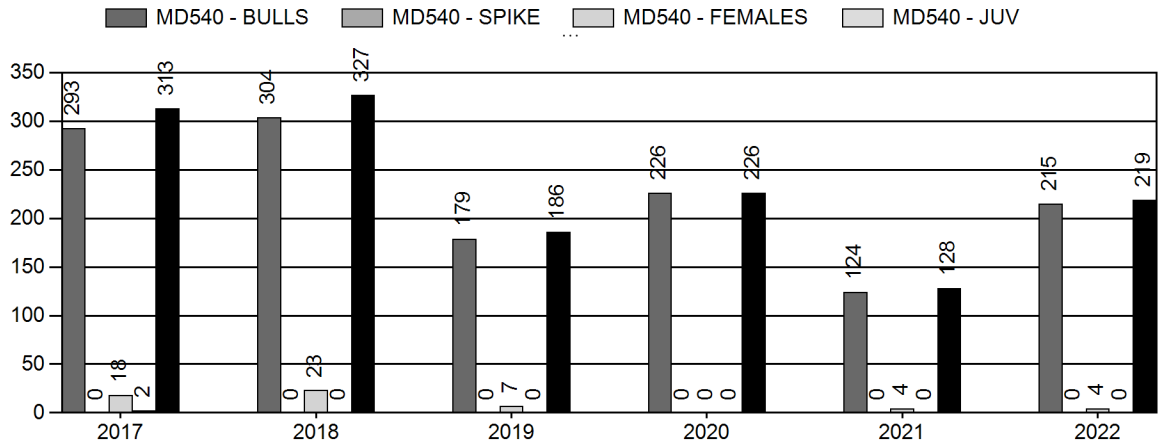
Proposed harvest rates (percent of pre-season estimate for each sex/age group):

	JCR Year	Proposed
Females ≥ 1 year old:	1%	1%
Males ≥ 1 year old:	24%	24%
Proposed change in post-season population:	2%	-1%

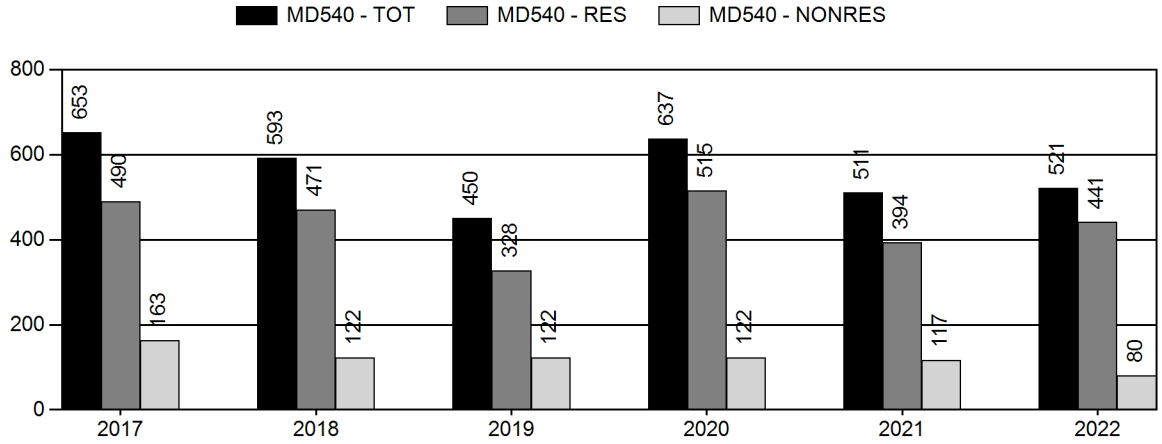
Population Size - Postseason



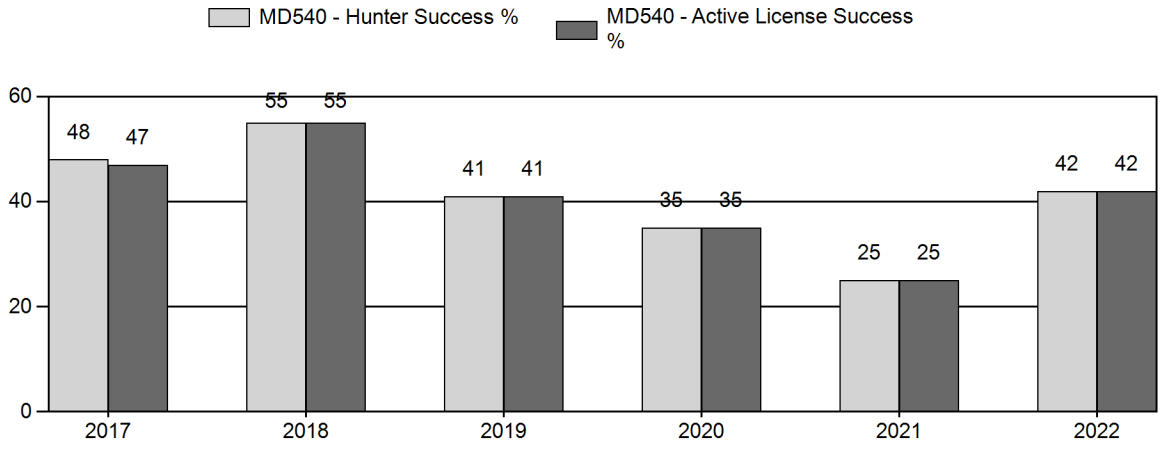
Harvest



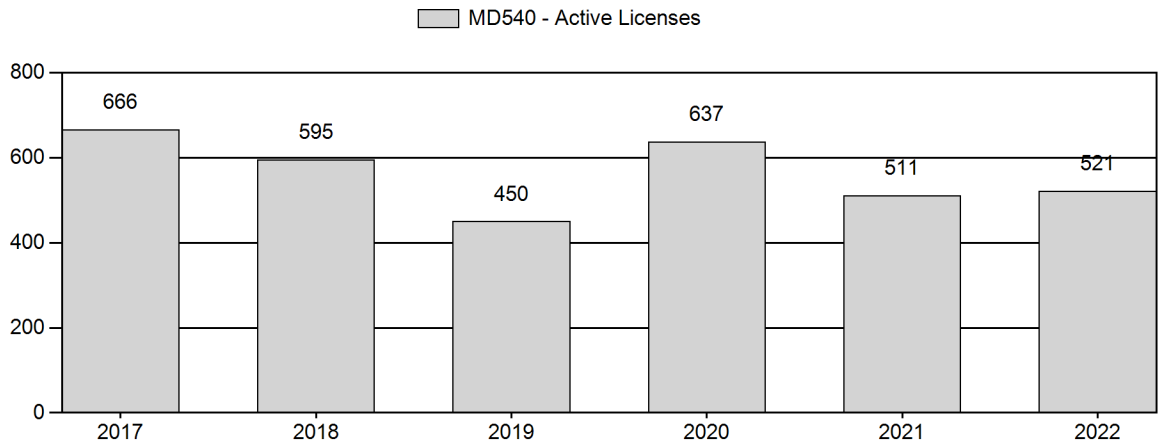
Number of Hunters



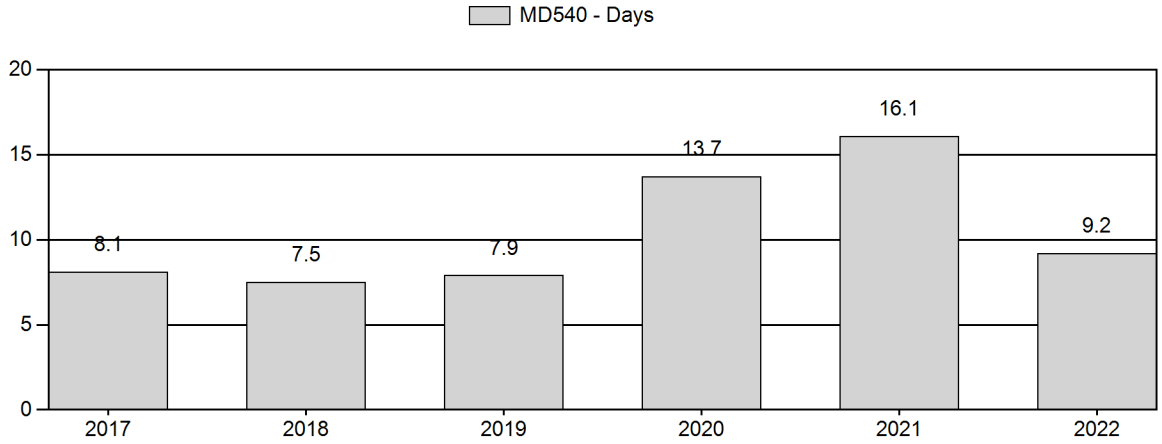
Harvest Success



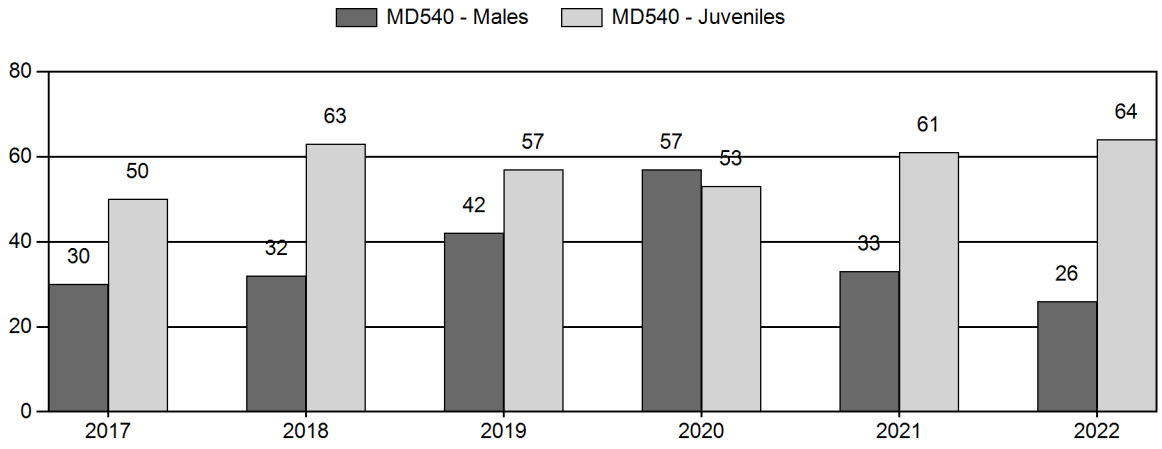
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2023 Hunting Seasons
Shirley Mountain Mule Deer (MD540)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
70	Gen	Sep. 1	Sep. 30	Oct. 15	Oct. 21		Antlered mule deer or any white-tailed deer

2023 Region D nonresident quota: 300 licenses

2022 Hunter Satisfaction: 49% Satisfied, 24% Neutral, 27% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The 2022 harvest survey report indicated 521 hunters harvested 219 buck mule deer for an overall success of 42%. The 2022 post-season fawn to doe ratio of 61/100 was above the five-year average, however the classification sample size was less than adequate. Adult bucks were assigned to antler classes during post-season classification surveys. The total adult buck classification sample (n=48) resulted in the following: 68% Class I (<20"wide) bucks, 26% Class II (20-25"wide) bucks, and 6% Class III (>26" wide) bucks (Appendix A).

A seven-day general season for antlered mule deer or any white-tailed deer was prescribed in 2023 and the Region D nonresident quota was maintained at 300 licenses. The 2023 season structure should maximize hunter opportunity. If the projected harvest of 220 mule deer bucks and normal fawn production is attained in 2023 the predicted post-season population of 2,900 (2,400-3,400) mule deer will continue to be below the objective range of 7,500 (±20%) mule deer.

2.) Management Objective Review: The management objective was evaluated in 2020 and will be reviewed again in 2025.

3.) Weather/Habitat: Precipitation levels were below normal in biological year 2022. Early spring precipitation occurred during April and May, but quickly diminished in early June. Precipitation events throughout the remainder of the summer were sporadic and covered very small geographic areas. NOAA weather stations in Laramie and Rawlins recorded departures from average annual precipitation of 37% and 23% respectively. NOAA's U.S. Drought Monitor labeled the majority of this herd unit as experiencing abnormally dry to moderate drought conditions in 2022. Shrub conditions continue to be very poor, with this landscape being dominated by late seral shrub plant communities and continued overutilization by big game.

4.) Chronic Wasting Disease (CWD) Management: CWD was first detected in the Shirley Mountain mule deer herd in 2006. To date, no meaningful CWD prevalence data has been collected within this herd unit and no CWD management actions have occurred. Given its close proximity to mule deer herds with high CWD prevalence, we would like to get a better estimate of prevalence in this herd. This is a Tier 2 surveillance herd and is scheduled to be intensely sampled starting in 2023, with the goal of sampling 200 hunter-harvested mule deer over the next three years.

5.) Population Modeling: In 2021, Wyoming Game and Fish Department (WGFD) managers began using PopR integrated population models (IPM) to estimate population indices for mule deer. The 2022 post-season population estimate for this herd unit from the PopR IPM was approximately

2,900 (2,500-3,300) mule deer. The PopR IPM estimate and long-term post-season abundance trend seems plausible, however we may be unable to develop more accurate population estimates for this herd unit without conducting an independent abundance survey.

2017 - 2022 Postseason Classification Summary

for Mule Deer Herd MD540 - SHIRLEY MOUNTAIN

		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	Yling	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2017	6,300	13	23	18	3	0	57	17%	191	56%	96	28%	344	870	7	23	30	± 6	50	± 8	39
2018	6,345	27	20	15	1	0	63	16%	198	51%	125	32%	386	1,011	14	18	32	± 6	63	± 9	48
2019	6,500	19	29	16	1	0	65	21%	155	50%	89	29%	309	965	12	30	42	± 8	57	± 10	40
2020	6,500	9	26	14	2	0	51	27%	90	48%	48	25%	189	1,024	10	47	57	± 13	53	± 12	34
2021	6,180	8	21	8	2	0	39	17%	117	52%	71	31%	227	894	7	26	33	± 8	61	± 11	46
2022	2,900	26	13	8	1	0	48	14%	182	52%	117	34%	347	0	14	12	26	± 5	64	± 9	51

2022 - JCR Evaluation Form

SPECIES: Mule Deer
PERIOD: 6/1/2022 - 5/31/2023

HERD: MD541 - PLATTE VALLEY

HUNT AREAS: 78-81
PREPARED BY: TEAL CUFAUDE

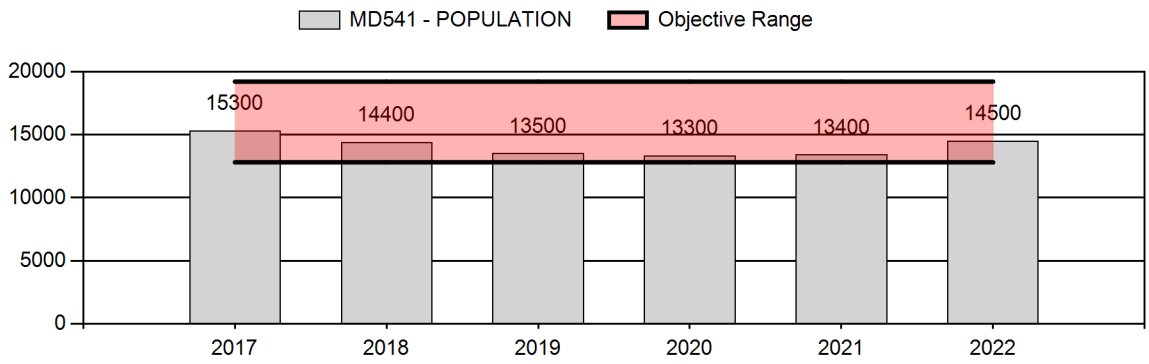
	2017 - 2021 Average	2022	2023 Proposed
Population:	13,980	14,500	15,500
Harvest:	564	561	550
Hunters:	1,019	1,048	1,050
Hunter Success:	55%	54%	52%
Active Licenses:	1,019	1,048	1,045
Active License Success:	55%	54%	53 %
Recreation Days:	6,120	6,430	6,400
Days Per Animal:	10.9	11.5	11.6
Males per 100 Females	41	34	
Juveniles per 100 Females	62	76	

Population Objective (± 20%) :	16000 (12800 - 19200)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	-9.4%
Number of years population has been + or - objective in recent trend:	9
Model Date:	02/28/2023

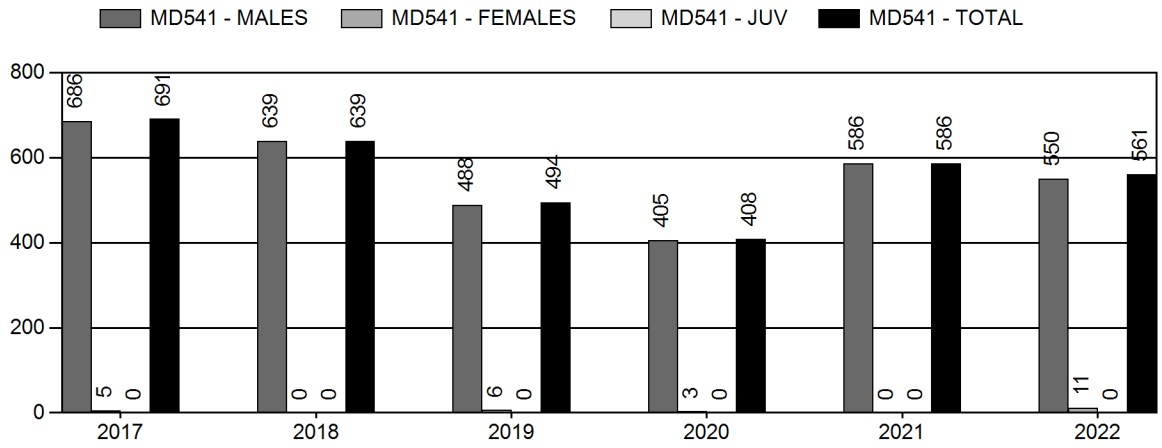
Proposed harvest rates (percent of pre-season estimate for each sex/age group):

	JCR Year	Proposed
Females ≥ 1 year old:	0%	0%
Males ≥ 1 year old:	16%	16%
Proposed change in post-season population:	8%	7%

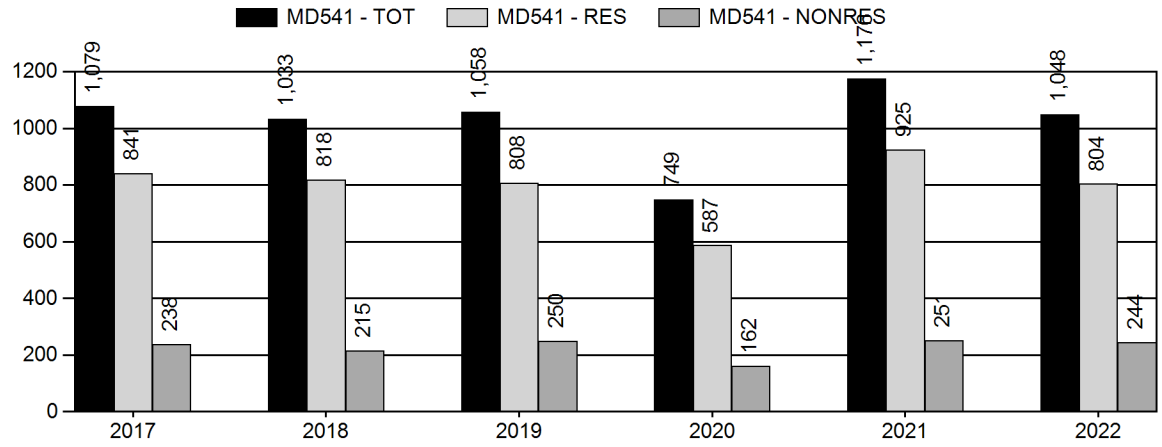
Population Size - Postseason



Harvest



Number of Hunters



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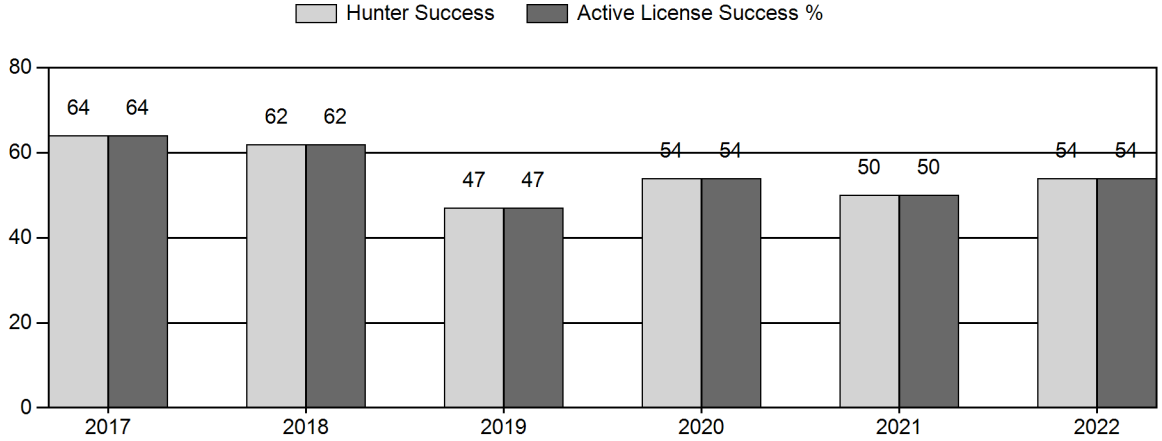
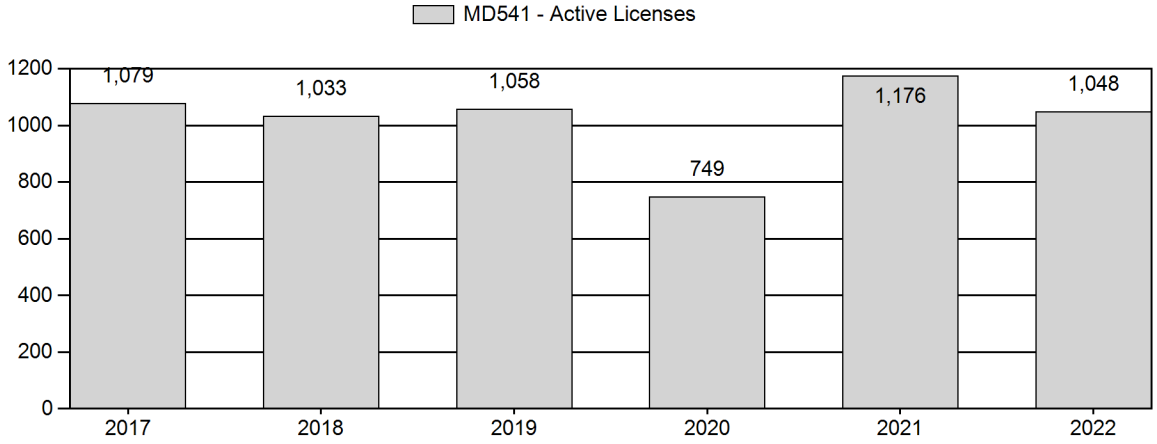
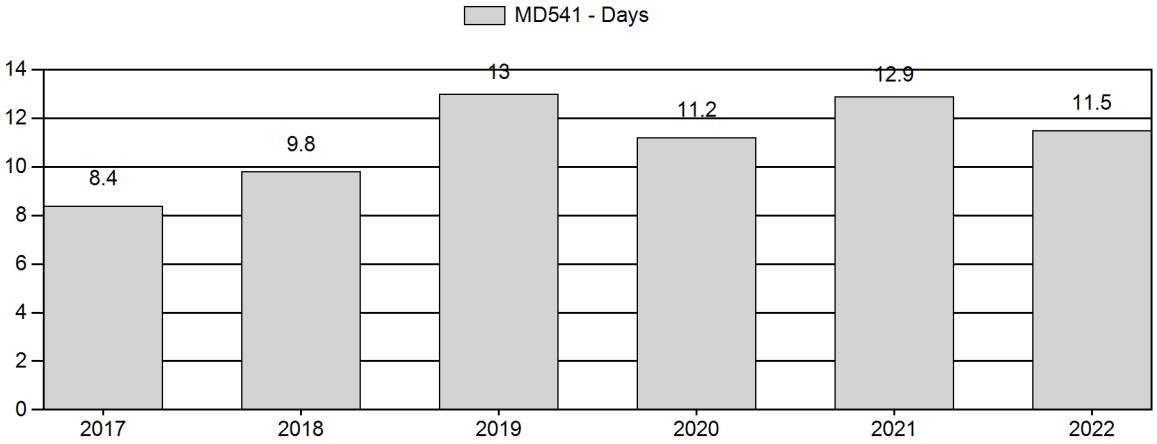


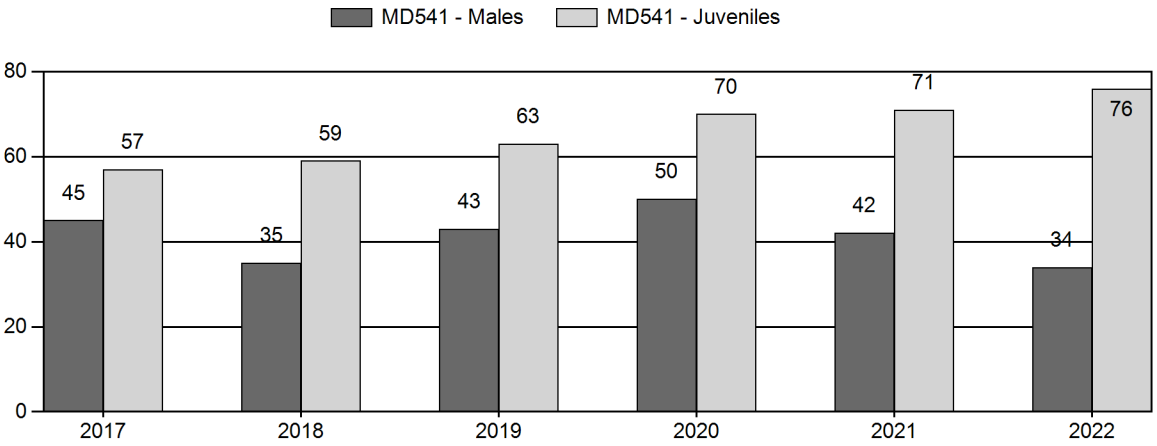
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2023 Hunting Seasons
Platte Valley Mule Deer (MD541)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
78	1	Sep. 1	Sep. 30	Oct. 1	Oct. 14	315	Antlered mule deer or any white-tailed deer
79	1	Sep. 1	Sep. 30	Oct. 1	Oct. 14	315	Antlered mule deer or any white-tailed deer
80	1	Sep. 1	Sep. 30	Oct. 1	Oct. 14	225	Antlered mule deer or any white-tailed deer
81	1	Sep. 1	Sep. 30	Oct. 1	Oct. 14	225	Antlered mule deer or any white-tailed deer

2022 Hunter Satisfaction: 57% Satisfied, 20% Neutral, 23% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: According to the 2022 harvest survey report a total of 1,048 hunters harvested 550 buck mule deer in 2022. Hunter success (54%) and satisfaction increased while days to harvest (11.5) decreased compared to 2021, indicating hunters had a less difficult time finding harvestable deer. Even with improved hunt metrics in 2022, hunter comments, satisfaction, and effort indicated that mule deer hunting in the Platte Valley herd unit was more challenging than it was 2013-18.

The 2022 post-season fawn to doe ratio of 76/100 exceeded the five-year average, which indicated good productivity. The post-season buck to doe ratio of 34/100 remained above the recreational management strategy parameters of 20-29/100. Adult (>1.5 years of age) bucks were assigned to antler classes during post-season classification surveys. The total adult buck classification sample (n=90) resulted in the following: 56% Class I (<20”wide) bucks, 36% Class II (20-25”wide) bucks, and 8% Class III (>26” wide) bucks (Appendix A).

The 14-day limited quota seasons for antlered mule deer or any white-tailed deer were retained for 2023. If the projected harvest of 570 bucks and normal fawn production are attained in 2023 the predicted post-season population of 15,500 (CL=12,400-18,400) mule deer will be within the objective of 16,000 (±20%) mule deer. The 2022 post-season buck and fawn ratios indicated maintaining quotas was appropriate, however concerns of reduced overwinter survival in adult and juvenile deer and public comment in support of reduced quotas prompted a 10% reduction in license quotas across the herd unit. We continue to monitor the quality of hunt metrics within the Platte Valley Mule Deer Plan, however consideration will also be given to disease prevalence and reduced carrying capacities of deer habitats in the herd unit, especially those areas that have been recently impacted by wildfires. Hunt areas in this herd unit are limited quota, but we continue to structure hunting seasons in a way that maximizes recreational opportunity.

2.) Management Objective Review: The objective was last reviewed in 2019 and will be reviewed again in 2024.

3.) Platte Valley Mule Deer Initiative Secondary Management Objectives: In 2012, Wyoming Game and Fish Department (WGFD) collaboratively developed the Platte Valley Mule Deer Plan and began to implement strategies identified to improve the quality of the hunting experience in this herd unit. These strategies included: 1.) change hunting season structure from traditional general seasons to limited quota seasons; 2.) achieve a buck harvest success rate of 40%; 3.) set a goal of at least 20% of field-checked harvested bucks meeting an antler spread of 24" or more; and 4.) 60% of the harvest survey respondents replying they were "satisfied" or "very satisfied" with their hunting experience. During the development of these harvest parameters it was recognized that each could be affected by annual events unrelated to management decisions, such as weather during hunting seasons. To lessen the effect of these variables, these management objectives were based on a three-year running average. In 2022, the buck harvest success rate was 50%, and the three-year average was 52%. In 2022, 17% of field-checked bucks (including yearlings) were ≥24". Yearling bucks made up 10% (n = 10) of the field-checked bucks. The 2020-22 average percentage of field-checked bucks ≥24" was 17%. Fifty-seven percent of harvest survey respondents were satisfied or very satisfied with their 2022 hunting experience, and the three-year average satisfaction was 59%.

4.) Weather/Habitat: We used Parameter-Elevation Relationships on Independent Slopes Model (PRISM) to estimate annual, growing season, and high elevation (spring/summer/fall; SSF) precipitation (PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created 4 Feb 2004). Using PRISM, we calculated climate-elevation regressions for each Digital Elevation Model grid cell (4 km resolution) for the Platte Valley mule deer herd unit. Within the 6-year review period of 2017-2022, annual precipitation exceeded the 30-year average in 2 of the 6 years (Figure 1). The largest deficit in annual and growing season precipitation occurred in 2018, followed by 2021. Across the entire herd unit, precipitation from October 2021 through September 2022 (water year) was below the 30-year average.

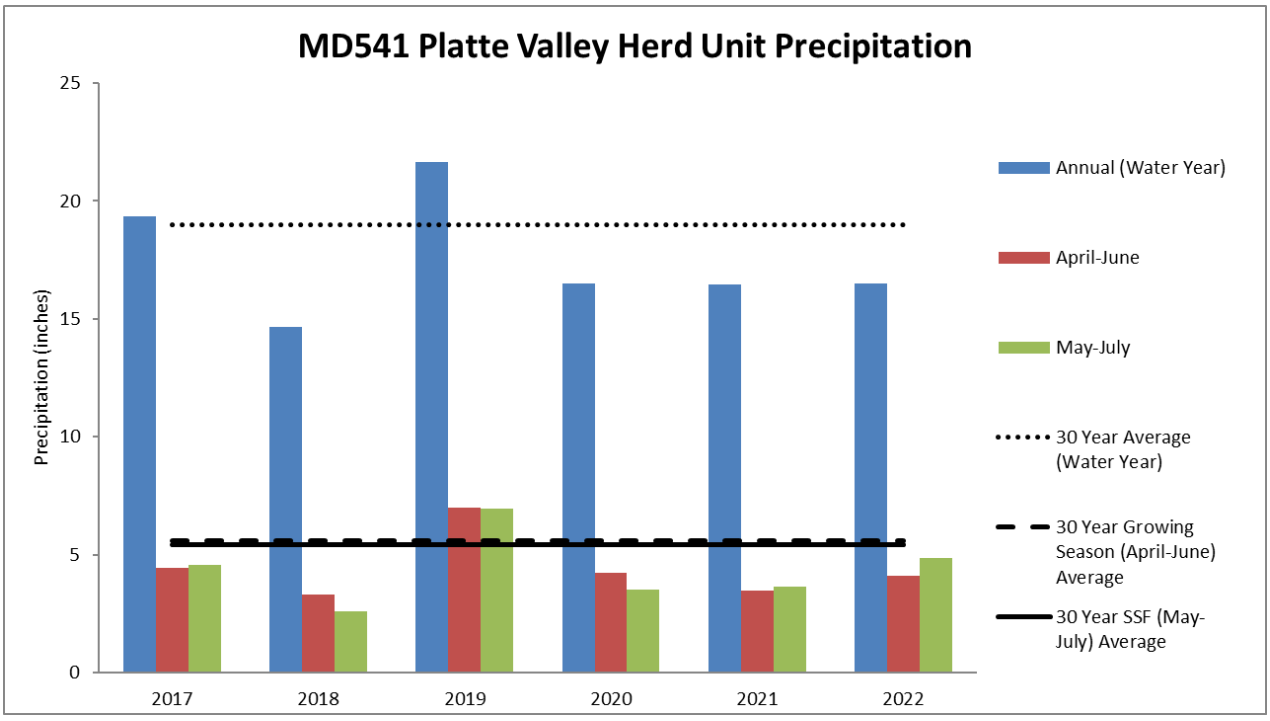


Figure 1. Parameter-Elevation Relationships on Independent Slopes Model (PRISM) estimate of annual, growing season, and spring/summer/fall (SSF) precipitation from 2017-2022 for the Platte Valley mule deer herd unit in Carbon County, Wyoming.

In addition to a 13% deficit in annual precipitation in 2022, moisture events in the critical growing months for herbaceous and woody vegetation were also below normal. The most significant deficits occurred during the growing season (April – June). In 5 of the last 6 years, moisture during this period was below normal. High elevation SSF (May – July) precipitation was higher than growing season precipitation, however, it was still below the 30-year average. Precipitation falling during these months is essential for plant growth at high elevations in this herd unit. Lack of summer precipitation in 2022 led to earlier senescence of herbaceous forages across all seasonal ranges. Late July and early August monsoonal moisture patterns provided some late summer green-up of forage which likely aided fawn rearing does in meeting nutritional demands.

The majority of precipitation in the Platte Valley herd unit occurs outside of the primary growing season, generally in the form of snow. The 2021-22 winter remained mild, with no persistent snow accumulations through fall and early winter at lower elevations. SNOTEL sites at higher elevation on the west side of the Snowy Range and the east side of the Sierra Madres reported below-average to slightly above average snowpack during the winter of 2021-22. As of February 2022, SNOTEL sites at higher elevations on the west side of the Snowy Range reported snow water equivalent (SWE) values ranging from 78-91% of average, while sites on the east side of the Sierra Madres reported SWE values ranging from 92-104% of average. Due to a lack of snow in the lower elevations, relatively mild temperatures, and early snowmelt, the 2021-22 winter conditions may have been favorable for big game.

The Mullen Fire (2020) burned approximately 176,800 acres in the Snowy Range. This includes acreages within the Platte Valley and Sheep Mountain mule deer herds (Hunt Areas 78 and 76). High fire severity in places is a continued cause for concern for cheatgrass invasion in Savage Run and Platte River wilderness areas, as well as other areas adjacent to North Platte River. Over 10,334 acres on the western slope of the Snowy Range were aerially treated with the herbicide Rejuvra in 2021. A large-scale monitoring effort was completed by USFS, WGFD, and USGS in 2022 to evaluate herbicide efficacy one year post-treatment. Recovery of native, perennial grasses looks promising thus far. Plant species diversity was comparable pre- and post-treatment with the exception of a few native annual forbs. Cheatgrass was documented in areas where soil movement had occurred. Additionally, high densities of cheatgrass were documented within the no-spray buffer around the North Platte River. We will continue to monitor herbicide efficacy in 2023 and evaluate the need for retreatment.

Antelope bitterbrush, serviceberry, and big sagebrush seedlings were observed throughout the burn scar, which is a promising sign for shrub recovery. Several thousand mixed mountain shrub seedlings were planted west of the North Platte River in the fall of 2021 and 2022 by USFS, WGFD, and volunteers to aid in recovery. Past large-scale wildfires within the Sierra Madre Range (Snake fire – 2016, Beaver Creek fire – 2016, and Ryan fire – 2018) are recovering at varying rates and continue to provide good early successional habitat for mule deer.

Appendix B describes significant events and habitat monitoring efforts in the herd unit during biological year 2022.

5.) Chronic Wasting Disease (CWD) Management: CWD was first observed in the Platte Valley herd unit in 2002. This is a Tier 1 surveillance herd and is scheduled to be intensely sampled, with the goal of sampling 200 hunter-harvested mule deer, in 2023. The three-year (2020-22) CWD prevalence in the herd unit was 6.7% (95% CI= 2.9-12.4). We are concerned with this prevalence and started gathering public input in 2023 to determine feasible management strategies through the guidelines of the WGFD CWD Management Plan.

6.) Research: In 2018, The Platte Valley Mule Deer Migration Corridor was designated. The Platte Valley Mule Deer Migration Corridor represents high use seasonal migration corridors documented through GPS collar technology and delineated using a Brownian Bridge Movement Model. In February 2020, 45 additional mule deer does were fitted with GPS collars in an effort to better understand mule movement in this herd. Data analysis for this project began in 2023.

7.) Population Modeling: In 2021, WGFD managers began using PopR integrated population models (IPM) to estimate population indices for mule deer. The change in models accounts for what appears to be a substantial change in the post-season population estimate from 2021 to 2022. The 2022 post-season population estimate for this herd unit from the PopR IPM was approximately 14,500 (CL = 12,700-16,500) mule deer. The trend in abundance also appeared biologically plausible. We anticipate winter conditions in 2022-23 could reduce overwinter survival of juveniles and adults, therefore the post-season population estimate and trend in abundance after 2022 is less probable.

2017 - 2022 Postseason Classification Summary

for Mule Deer Herd MD541 - PLATTE VALLEY

		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	Yling	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2017	13,100	64	125	114	29	0	332	22%	738	50%	419	28%	1,489	1,165	9	36	45	± 4	57	± 4	39
2018	10,866	147	200	188	33	0	568	18%	1,638	52%	971	31%	3,177	1,123	9	26	35	± 2	59	± 3	44
2019	11,940	229	308	246	40	0	823	21%	1,918	49%	1,209	31%	3,950	1,092	12	31	43	± 2	63	± 2	44
2020	12,950	57	104	67	15	0	243	23%	487	46%	340	32%	1,070	1,168	12	38	50	± 5	70	± 6	47
2021	12,400	43	85	50	7	0	185	20%	441	47%	315	33%	941	1,150	10	32	42	± 5	71	± 6	50
2022	14,500	32	50	32	8	0	122	16%	361	48%	275	36%	758	1,414	9	25	34	± 4	76	± 8	57

Significant Events

The Platte Valley Habitat Partnership continued to implement habitat projects across the Platte Valley herd unit. These projects included 9.2 miles of fence conversions to wildlife-friendly design, permanent removal of 3,400 feet of unnecessary, hazardous fence, 789 acres of juniper/conifer removal, and 213 acres of shrub mowing. These projects were funded by BLM, Saratoga-Encampment-Rawlins Conservation District (SERCD), WWNRT, US Fish and Wildlife Service Partners for Fish and Wildlife, private landowners, and WGFD.

The Landscape Vegetation Analysis (LaVA) Project was developed in response to changed forest vegetation conditions caused by the bark beetle epidemic and other forest health issues. In 2022, the WGFD, SERCD, Mule Deer Foundation, and USFS completed the first wildlife habitat improvement project under LaVA. The 213-acre shrub mowing project was completed by WGFD Habitat and Access Biologists. The project occurred partially within sage-grouse core area and the Platte Valley mule deer migration corridor. WGFD continues to work with the USFS and other federal, state, and local cooperators to plan and implement projects within the LaVA boundary.

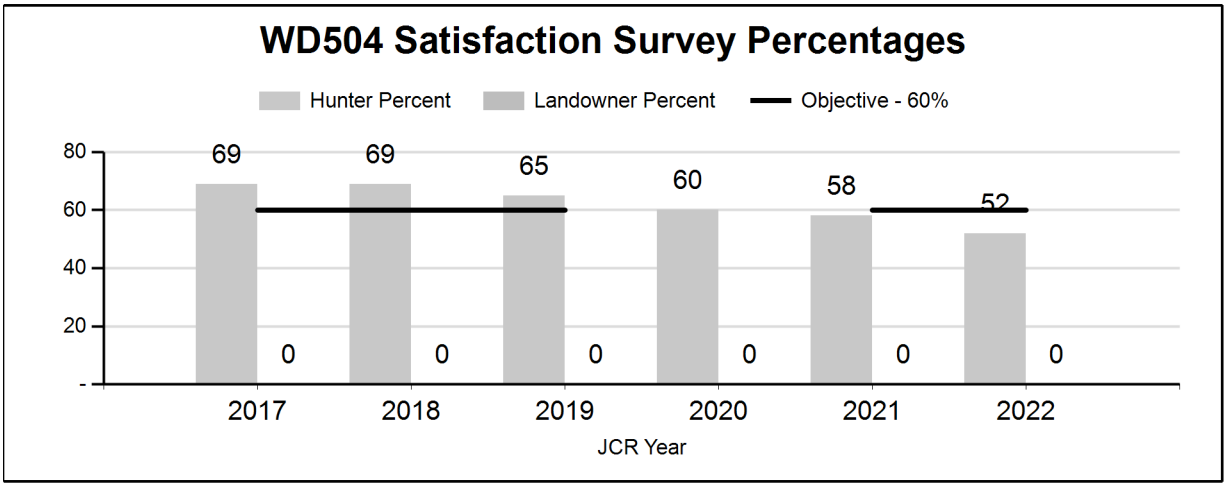
Habitat Monitoring

In 2015, Department personnel initiated the Rapid Habitat Assessment (RHA) 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 result of this effort is to provide a standardized habitat component for discussions about how mule deer objectives should or should not be adjusted based on the general concept of carrying capacity. In 2022, WGFD personnel surveyed twelve RHAs in the Platte Valley herd unit, totaling 549 acres. Fewer RHAs were done this year as personnel were focused on cheatgrass monitoring in the Mullen Fire during the optimal RHA timeframe. For the Platte Valley mule deer herd unit, WGFD personnel completed five aspen assessments (127.7 acres), five rangeland (353.7 acres), and two riparian assessments (67.8 acres). These data will provide population managers and the public with documentation of the current state of mule deer habitat conditions in the Platte Valley.

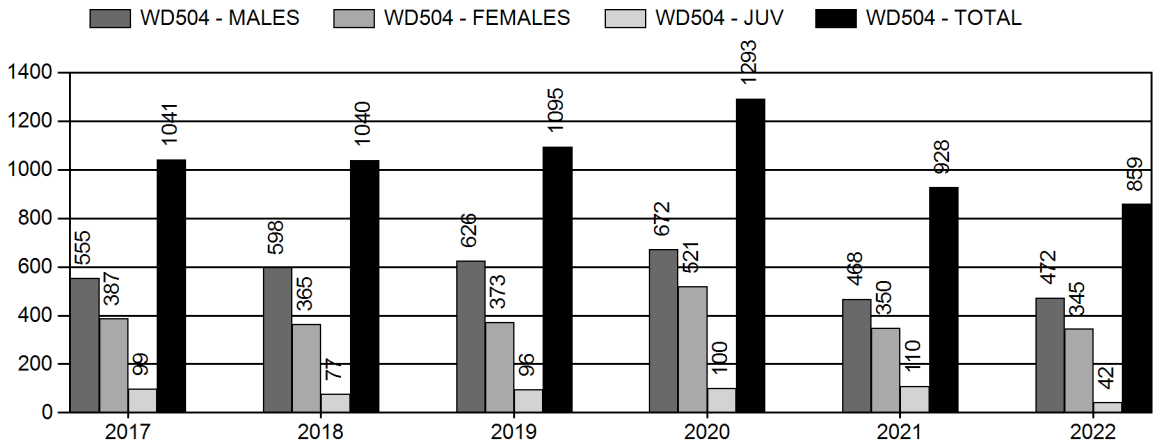
2022 - JCR Evaluation Form

SPECIES: White tailed Deer
PERIOD: 6/1/2022 - 5/31/2023
HERD: WD504 - SOUTHEAST WYOMING
HUNT AREAS: 15, 59-64, 70, 73-81, 83, 161
PREPARED BY: KEATON WEBER

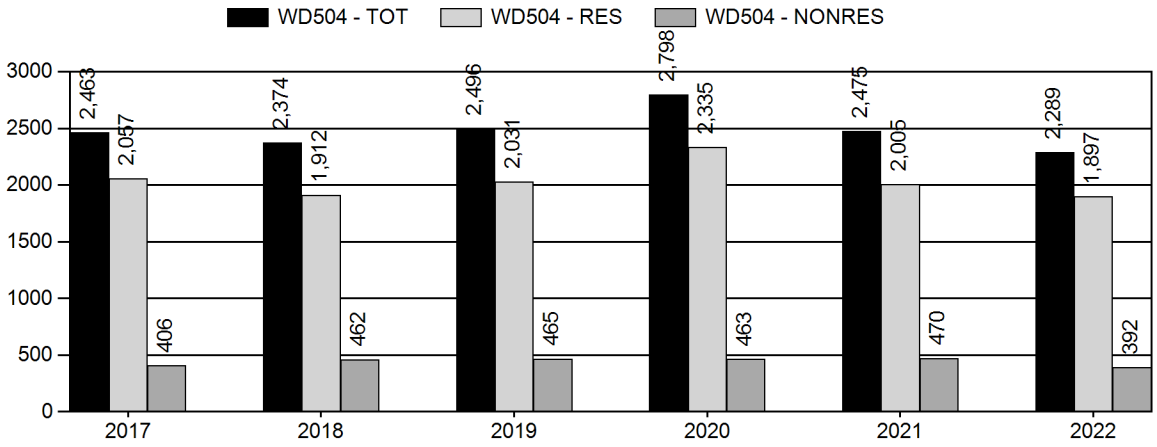
	2017 - 2021 Average	2022	2023 Proposed
Hunter Satisfaction Percent	64%	52%	60%
Landowner Satisfaction Percent	0%	0%	0%
Harvest:	1,079	859	900
Hunters:	2,521	2,289	2,500
Hunter Success:	43%	38%	36%
Active Licenses:	2,863	2,643	2,800
Active License Success:	38%	33%	32%
Recreation Days:	12,353	11,434	12,900
Days Per Animal:	11.4	13.3	14.3
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



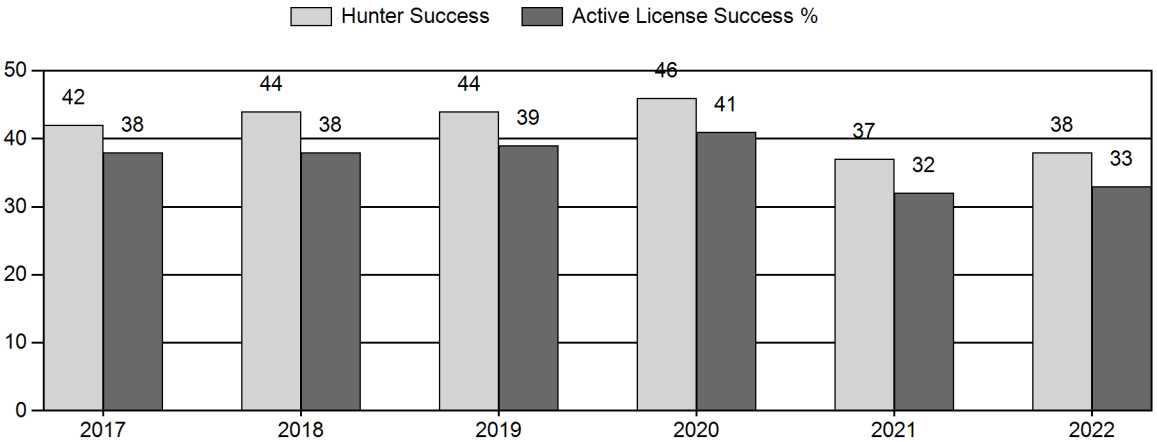
Harvest



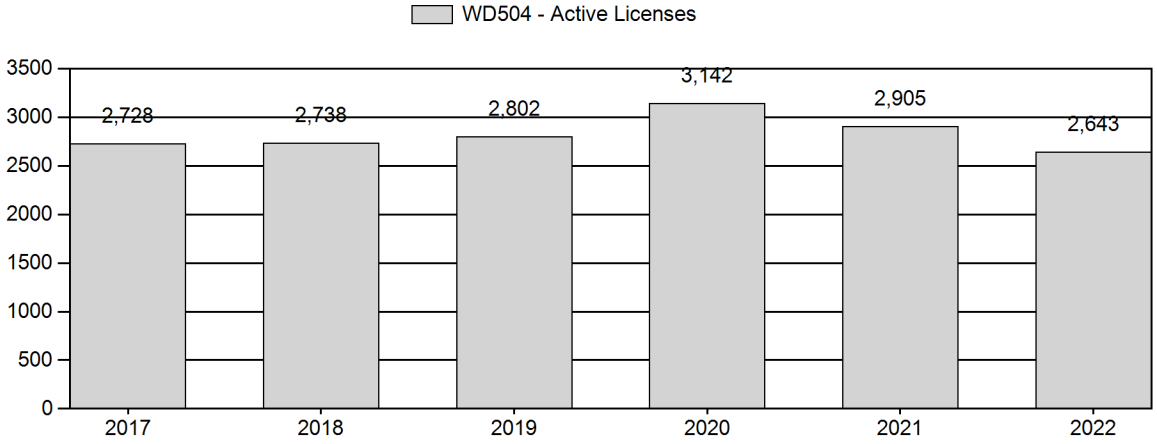
Number of Hunters



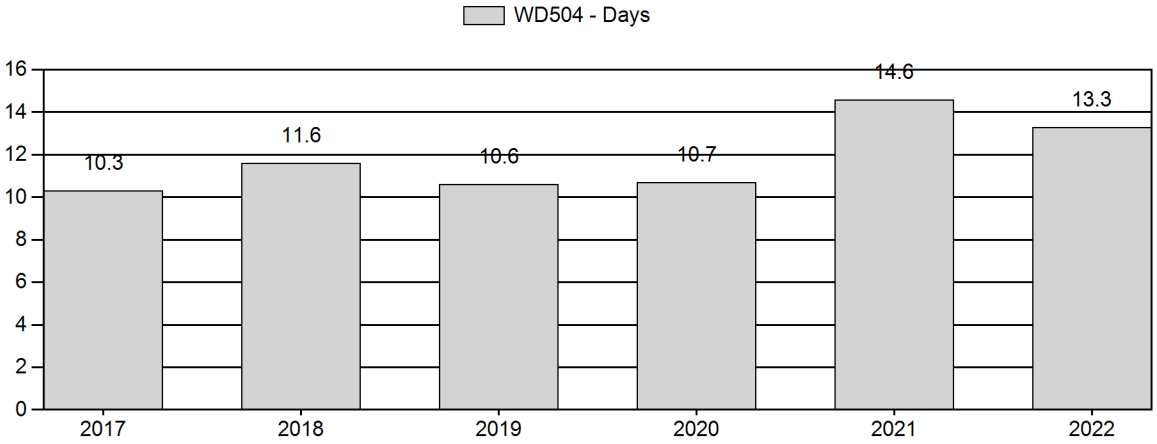
Harvest Success



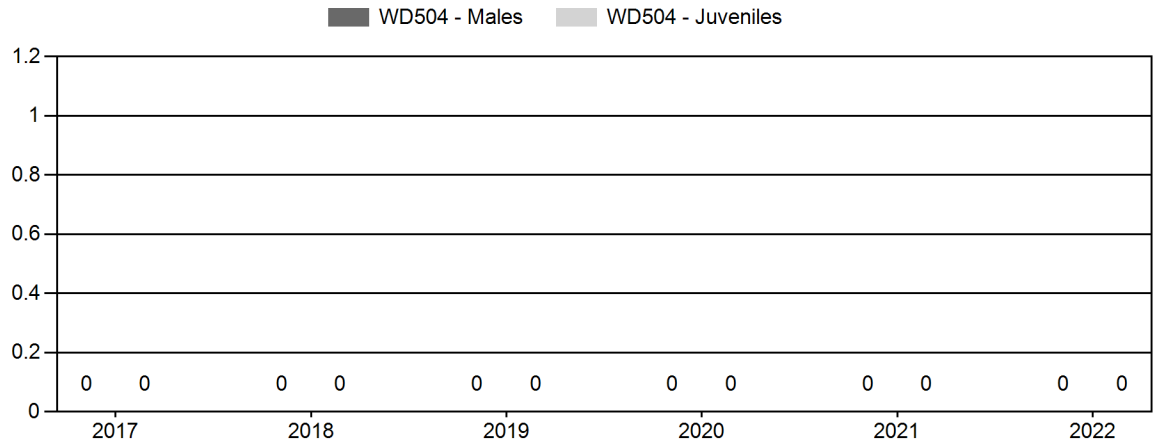
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2023 Hunting Seasons
Southeast Wyoming White-tailed Deer Herd Unit (WD504)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
15	3	Sept. 1	Sept. 30	Oct. 1	Nov. 30	500	Any white-tailed deer
15	3			Dec. 1	Dec. 31		Doe or fawn white-tailed deer
15	8	Sept. 1	Sept. 30	Oct. 1	Dec. 31	450	Doe or fawn white-tailed deer
59, 64	3	Sept 1	Sept 30	Oct. 1	Nov. 30	250	Any white-tailed deer
59, 64	3			Dec. 1	Dec. 31		Doe or fawn white-tailed deer
59, 64	8	Sept 1	Sept 30	Nov. 1	Dec. 31	350	Doe or fawn white-tailed deer
60	3	Sept 1	Sept 30	Oct 1	Dec. 31	100	Any White-tailed deer
60	8	Sept 1	Sept 30	Oct 1	Dec. 31	100	Doe or Fawn white-tailed deer
70,74	3	Sept. 1	Sept. 30	Oct. 1	Dec. 31	50	Any white-tailed deer
70,74	8	Sept. 1	Sept. 30	Oct. 1	Dec. 31	75	Doe or fawn white-tailed deer
75,76,77	3	Sept. 1	Sept. 30	Oct. 1	Dec. 31	75	Any white-tailed deer
75,76,77	8	Sept. 1	Sept. 30	Oct. 1	Dec. 31	100	Doe or fawn white-tailed deer
78,79,80,81	3	Sept. 1	Sept. 30	Oct. 1	Dec. 31	50	Any white-tailed deer
78,79,80,81	8			Sept. 1	Dec. 31	100	Doe or fawn white-tailed deer

2022 Hunter Satisfaction: 52% Satisfied, 24% Neutral, 24% Dissatisfied

2023 Management Summary

1). Hunting Season Evaluation: The season is designed to take advantage of high densities of white-tailed deer throughout southeast Wyoming as access allows. There were small localized outbreaks of Epizootic Hemorrhagic Disease (EHD) in the summer of 2021 within hunt areas 15, 59 and 64, but there were no known EHD outbreaks in 2022 anywhere within the herd unit. Portions of hunt areas 15, 59, and 64 that experienced isolated EHD outbreaks may see lower deer densities in the coming years. The majority of white-tailed deer are located on private land so the Department

is limited in management of this herd unit. Managers in hunt areas 78, 79, 80, and 81 continue to see white-tailed deer expand in range and increase in numbers in the herd unit. Access for white-tailed deer hunters remains good and managers anticipate more access will be provided as landowners would like to see numbers decrease.

2.) Management Objective Review: The Southeast WY White-tailed Deer Herd Unit's objective was last reviewed in 2019 and will be up for review again in 2024.

3.) Weather and Habitat: Annual precipitation across southeast Wyoming in areas occupied by white-tailed deer was less than normal. Based on NOAA weather station data from Cheyenne, Torrington, Laramie, and Douglas, precipitation was 26% - 55% below average for the year. Precipitation decreased most significantly in the southeastern portions of the herd unit. Much of Laramie and Goshen Counties were classified as experiencing extreme drought in 2022 by NOAA's Drought Monitor. White-tailed deer are typically associated with riparian habitats and irrigated cropland areas. Declines in annual precipitation may have some impact on fawning and fawn rearing habitats, through decreases in forage production and associated cover heights in riparian areas. Because of their strong dependence on agricultural crops, noticeable declines in white-tail deer populations are not as likely in a given year unless EHD events take place.

4.) Chronic Wasting Disease: CWD samples are collected on white-tailed deer opportunistically. Results from the Southeast Wyoming White-tailed Deer Herd Unit are located below (Table 1.). The majority of deer tested and that are positive come from Hunt Areas: 15, 59, 60 and 64.

Table 1. CWD prevalence for hunter-harvested white-tailed deer in the Southeast Wyoming White-tailed Deer Herd, 2020-2022.

Year(s)	Percent CWD-Positive and (*n*) – *Hunter Harvest Only*		
	Adult Males	Yearling Males	Adult Females
2020-2022	**16%, n=129**	0% (5)	19% (72)

2022 - JCR Evaluation Form

SPECIES: Elk
PERIOD: 6/1/2022 - 5/31/2023

HERD: EL531 - IRON MOUNTAIN

HUNT AREAS: 6
PREPARED BY: LEE KNOX

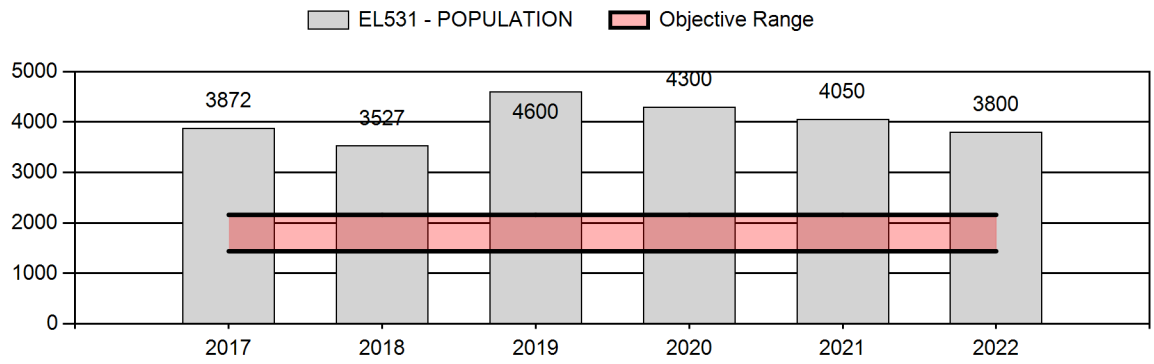
	2017 - 2021 Average	2022	2023 Proposed
Population:	4,070	3,800	4,200
Harvest:	593	577	600
Hunters:	1,343	1,203	1,300
Hunter Success:	44%	48%	46 %
Active Licenses:	1,384	1,232	1,200
Active License Success:	43%	47%	50 %
Recreation Days:	8,598	7,831	8,000
Days Per Animal:	14.5	13.6	13.3
Males per 100 Females	28	0	
Juveniles per 100 Females	48	0	

Population Objective (± 20%) :	1800 (1440 - 2160)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	111%
Number of years population has been + or - objective in recent trend:	20
Model Date:	3/24/2023

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

	JCR Year	Proposed
Females ≥ 1 year old:	14%	15%
Males ≥ 1 year old:	26%	27%
Proposed change in post-season population:	8%	10%

Population Size - Postseason



2023 Hunting Seasons
Iron Mountain Elk (EL531)

Hunt Area	Type	Archery Dates Opens	Archery Dates Closes	Season Dates Opens	Season Dates Closes	Quota	Limitations
6	Gen	Sep. 1	Sep. 30	Oct. 1	Oct. 31		Any elk valid off national forest
6	Gen			Nov. 1	Dec. 31		Antlerless elk valid off national forest
6	1	Sep. 1	Sep. 30	Oct. 1	Oct. 31	75	Any elk
6	1			Nov. 1	Jan. 31		Antlerless elk
6	4	Sep. 1	Sep. 30	Oct. 1	Jan. 31	50	Antlerless elk
6	6	Sep. 1	Sep. 30	Aug. 15	Jan. 31	1100	Cow or calf valid off national forest

2022 Hunter Satisfaction: 59% Satisfied, 27% Neutral, 14% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The Iron Mountain Elk Herd remains well above the population objective of 1,800 elk. The season structure is designed to maximize cow elk harvest and hunter opportunity. With the changes made in 2022, hunter success increased on both the type 1 and type 4 licenses from 28% and 16% respectively in 2021 to 40% and 35% respectively in 2022. The 2023 season structure will remain status quo.

2.) Management Objective review:

The management objective for Iron Mountain is a post season population objective of 1800 elk. This objective was set in 1997 and last reviewed in 2022.

3.) CWD management: The 3-year (2010-2022) CWD prevalence in the Iron Mountain Elk Herd is 12% (n= 298) LC 7.6% UC 16.3%.

4.) Habitat and Weather: Precipitation was below normal for the biological year. Areas in the northernmost portions of the herd unit did receive closer to normal precipitation in the more mountainous areas. NOAA weather station data from Laramie documented a 37% decrease, and Cheyenne a 39% decrease in precipitation from average annual precipitation. According to NOAA's U.S. Drought Monitor, the area encompassing this herd unit fell into the severe drought category in 2022.

The WGFD entered into an agreement to manage 3,110 acres of the Pilot Hill area as a WHMA in 2020. Suitable elk habitat is found mid-slope in mixed mountain shrub communities and at higher elevations in aspen / mixed conifer habitats on the WHMA. The USFS and Wyoming State Forestry Division have been working cooperatively to complete conifer and aspen mastication and

prescribed fire treatments on USFS, OSLI, and intermixed private lands on Pole Mountain. Aspen regeneration in treatment areas has been mixed. Some browsing of young aspen regeneration has been high, likely by a combination of wild ungulates and livestock. Western Spruce Budworm infestations are having some effect on conifers in upper elevations at Pole Mountain. Aggressive timber harvest practices are likely the only means to reduce potential impacts to coniferous forest communities. Wyoming State Forestry has completed some harvest of infected trees in the Pole Mountain area.

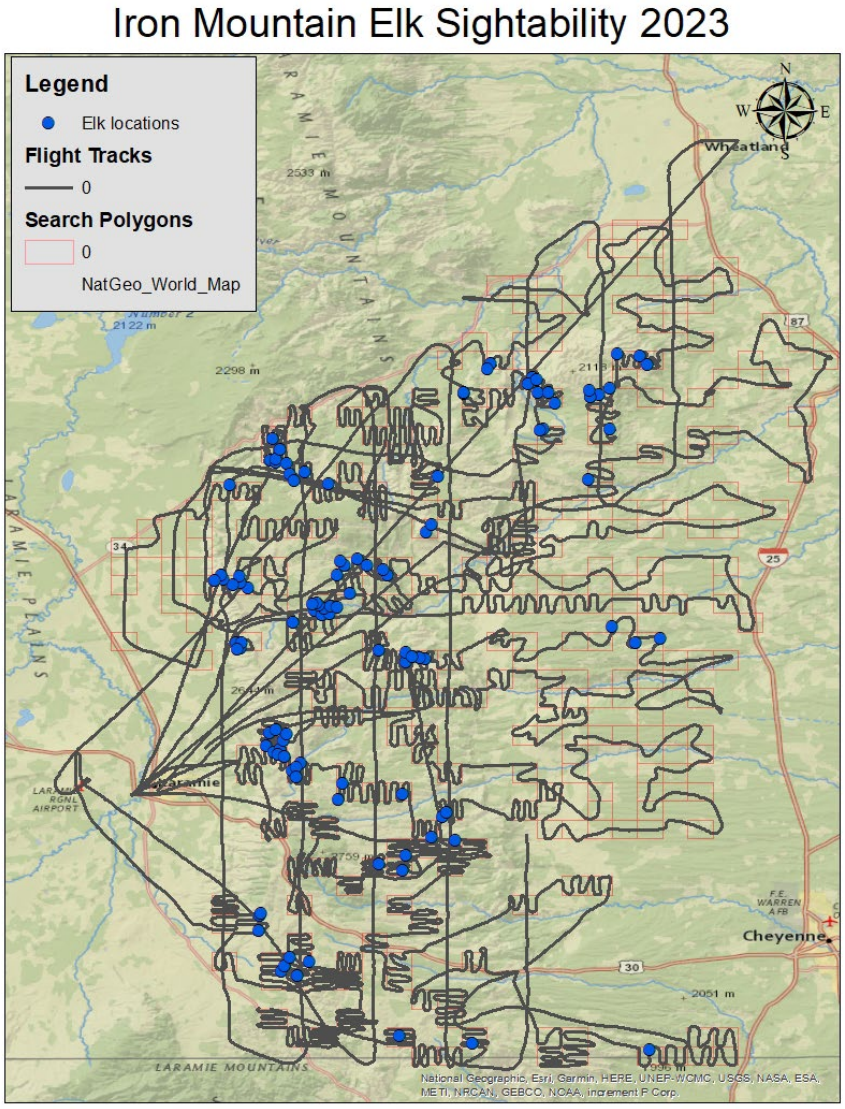
In the southernmost portions of Area 6 south of Interstate 80, and in the northern half of the herd unit, overall habitat conditions continue to be negatively impacted by increasing elk numbers, lack of managed disturbances in shrub dominated rangelands, and increases in cheatgrass composition in preferred habitats. Elk use of irrigated hay meadows continues to create private land damage situations throughout the entire herd unit. In periods of drought, private landowners see higher competition for forage resources between cattle and elk. With increased competition we expect to see decreased landowner tolerance for elk.

Appendix A

Sightability

Iron Mountain Sightability 2023 Results

The Laramie region conducted an elk sightability in the Iron Mountain Herd Unit May 4th through May 8th 2023. A pre fixed wing flight on transects was conducted on April 23rd to determine if elk had distributed from winter range, and broken into smaller groups. We selected 963 of 977 possible subunits as occupied habitat. Of the 963 sub units, we randomly selected 300 subunits to fly. We observed 1,403 elk and flew 37 hours to complete the survey. The sightability model used was Elk Sightability Model for the Bell 47G by Mark A. Hurley. The estimate was 4,894 LCI 2987 UCI 6,801 p 0.920.



2022 - JCR Evaluation Form

SPECIES: Elk | PERIOD: 6/1/2022 - 5/31/2023

HERD: EL533 - SNOWY RANGE

HUNT AREAS: 8-12, 110, 125 | PREPARED BY: TEAL CUFAUDE

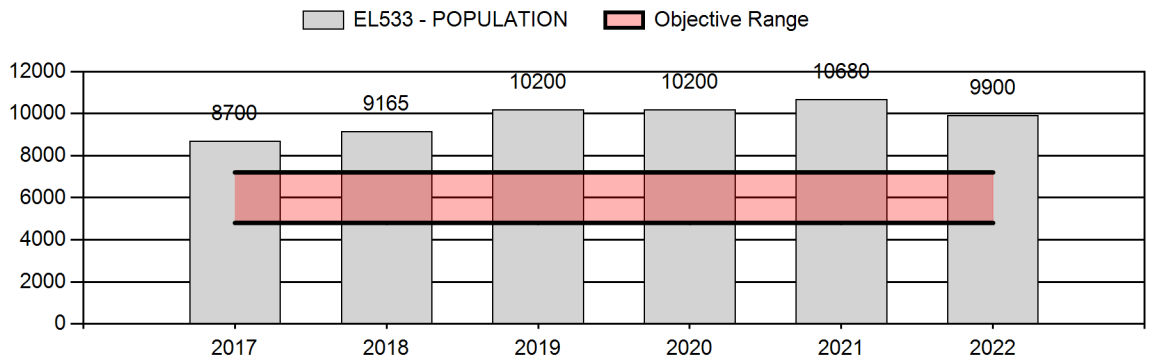
	2017 - 2021 Average	2022	2023 Proposed
Population:	9,789	9,900	9,300
Harvest:	1,979	2,342	2,143
Hunters:	5,492	5,978	6,000
Hunter Success:	36%	39%	36 %
Active Licenses:	5,873	6,470	6,500
Active License Success:	34%	36%	33 %
Recreation Days:	43,874	50,587	50,000
Days Per Animal:	22.2	21.6	23.3
Males per 100 Females	27	32	
Juveniles per 100 Females	39	41	

Population Objective (± 20%) :	6000 (4800 - 7200)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	65%
Number of years population has been + or - objective in recent trend:	8
Model Date:	02/23/2023

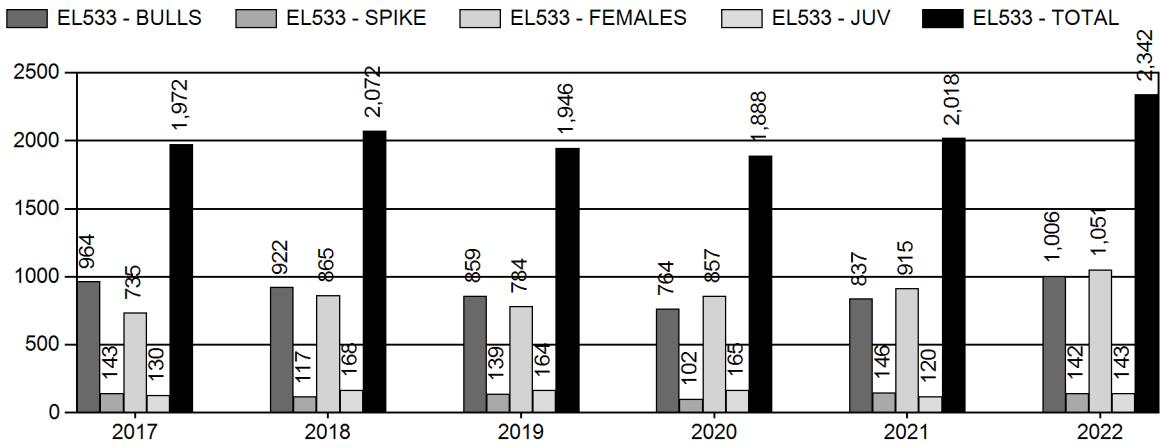
Proposed harvest rates (percent of pre-season estimate for each sex/age group):

	JCR Year	Proposed
Females ≥ 1 year old:	16.3%	16.4%
Males ≥ 1 year old:	44.3%	43.8%
Proposed change in post-season population:	-7%	-6%

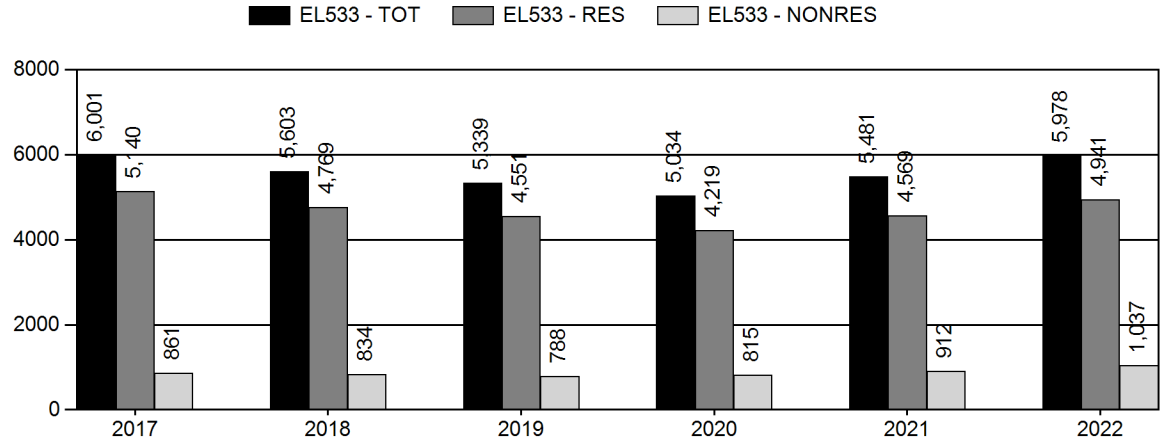
Population Size - Postseason



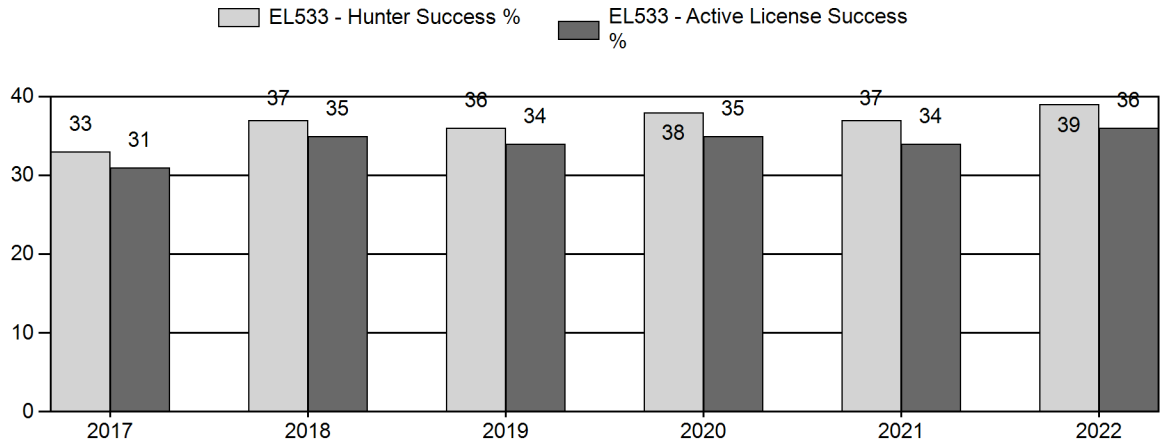
Harvest



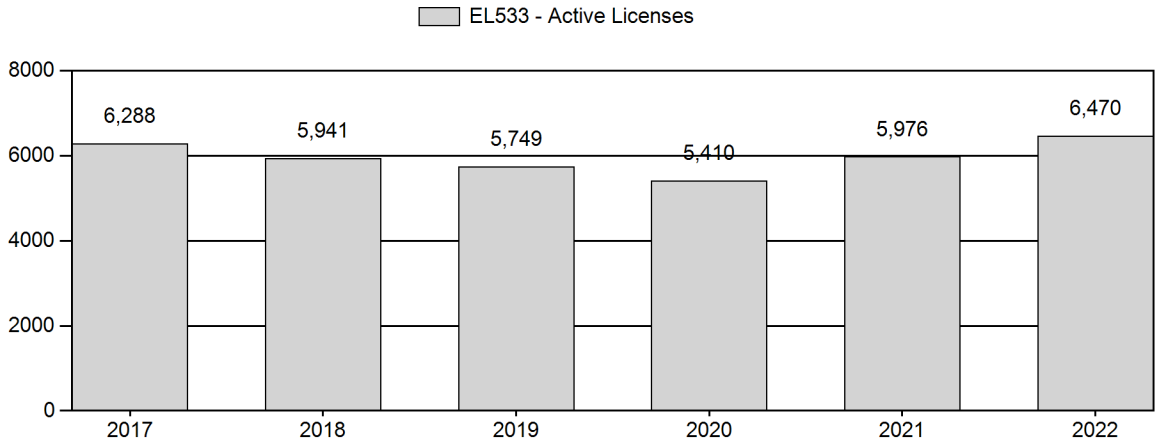
Number of Hunters



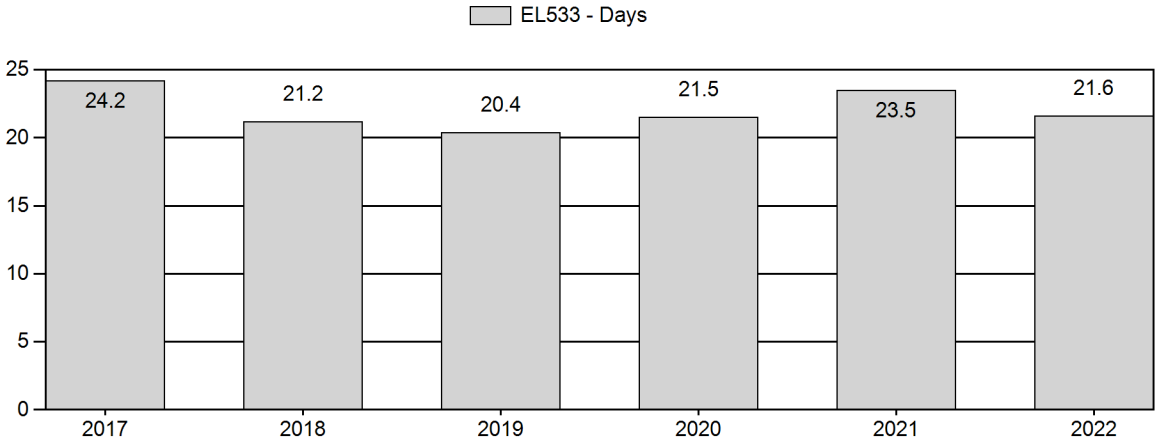
Harvest Success



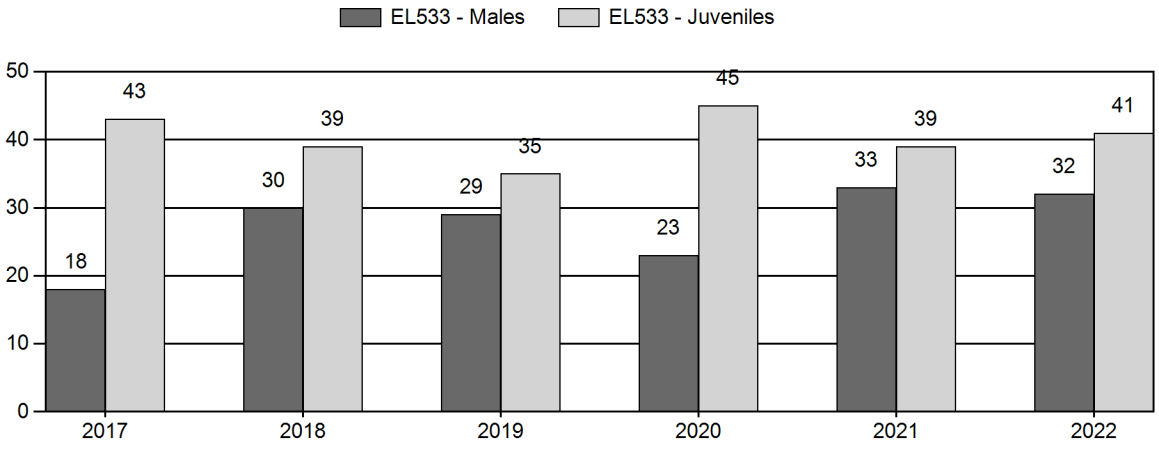
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2023 Hunting Seasons
Snowy Range Elk Herd Unit (EL533)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
8	1	Sep. 1	Sep. 30	Oct. 1	Jan. 31	150	Any elk
8	6			Aug. 15	Jan. 31	200	Cow or calf
8	7			Aug. 15	Jan. 31	200	Cow or calf valid on private land
9	Gen	Sep. 1	Sep. 30	Oct. 15	Oct. 31		Any elk
9	6	Sep. 1	Sep. 30	Oct. 1	Dec. 31	250	Cow or calf
9, 10	7			Aug. 15	Jan. 31	350	Cow or calf valid off national forest
10	Gen	Sep.1	Sep. 30	Oct. 15	Oct. 31		Any elk
10	6	Sep.1	Sep. 30	Oct. 1	Dec. 31	300	Cow or calf
11	1	Sep. 15	Sep. 30	Oct. 1	Nov. 30	200	Any elk
11	1			Dec. 1	Jan. 31		Any elk valid off national forest
11	4	Sep. 15	Sep. 30	Oct. 1	Jan. 31	100	Antlerless elk
11	6			Aug. 15	Sep. 30	450	Cow or calf valid off national forest; Wick Wildlife Habitat Management Area
11	6			Oct. 1	Jan. 31		Cow or calf
11	9			Sep. 1	Sep. 30	75	Any elk, archery only
12	Gen	Sep. 1	Sep. 30	Oct. 15	Oct. 31		Any elk
12	6	Sep. 1	Sep. 30	Oct. 1	Dec. 31	300	Cow or calf
12, 13, 15, 110	7			Aug. 15	Jan. 31	350	Cow or calf valid on private land
110	Gen	Sep. 1	Sep. 30	Oct. 15	Oct. 31		Any elk
110	6	Sep. 1	Sep. 30	Oct. 1	Dec. 31	300	Cow or calf
125	1	Sep. 1	Sep. 30	Oct. 1	Dec. 31	200	Any elk
125	1			Jan. 1	Jan. 31		Antlerless elk
125	6	Sep. 1	Sep. 30	Oct. 1	Jan. 31	200	Cow or calf

2022 Hunter Satisfaction: 66.4% Satisfied, 19.3% Neutral, 14.3% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The harvest survey report indicated 5,978 hunters harvested 2,342 elk in 2022. Hunter success (39.2%) increased compared to 2021 and days to harvest (21.6) was comparable to the last five years. Appendix A displays the post-season classification summary from 2017-2022. The 2022 post-season bull to cow ratio (32/100) and calf to cow ratio (41/100) exceeded the five–year averages. The 2022 post-season population estimate of 9,900 elk remained above the objective of 6,000 (±20%) elk.

The 2023 hunting seasons in the Snowy Range herd unit provided recreational elk hunting opportunities while reducing the overall elk population towards the objective. Hunt areas 9, 10, 12, and 110 remained general license hunting seasons and hunt areas 8, 11, and 125 remained limited quota hunting seasons in 2023. Hunt area 12 and 110 type 6 license quotas were increased to reduce elk numbers towards objective and newly enrolled Access Yes properties provided more access for antlerless elk hunters in hunt areas 12 and 110. Type 7 license quotas were also increased in hunt areas 8,12,13,15,110 to address increasing elk damage concerns on private lands.

In 2023, the hunt area 11 type 4 season was lengthened to January 31 to increase hunter opportunity. Hunt area 11 type 4 licenses were reduced to address hunter crowding concerns on the national forest in September, however these licenses were shifted to the type 6 license quota because these hunters typically have higher hunter success. The hunt area 11 type 6 early season (August 15-September 30) limitation was modified to encourage hunters to harvest cow/calf elk on private lands.

In 2023, the hunt area 12 type 6 license limitation allowed hunting on national forest and Pennock Mountain Wildlife Habitat Management Area (WHMA) from October 1–December 31. Pennock Mountain WHMA will be closed to motorized vehicles on November 15. Similarly, the national forest has areas and routes closed to motorized vehicles after November 14. The hunt area 110 type 6 license limitation was also liberalized to allow cow/calf hunting in the entire hunt area from October 1–December 31. The Wick WHMA closure language was removed from the hunt area 11 type 1 and type 6 (October 1- January 31) license limitations. The Wick WHMA has motorized vehicle closures that address concerns with crucial wildlife range disturbance, so it was unnecessary that it was also included in the license limitations. These limitation changes allowed hunters who wanted to pursue elk by foot/horseback the opportunity to access more areas later in the year and should improve hunter success.

There was a reduction in 125 type 1 and type 6 licenses in 2023. Hunt area 125 is a difficult to access hunt area and hunter success typically improves if private land access is granted. Hunt area 125 landowners and ranch managers have experienced an increase in hunters seeking access to private lands and hunting on private land without permission was a frequent issue during the 2021 and 2022 hunting seasons. Changes to agricultural practices and the timing of elk movement have reduced the amount of private land elk damage, therefore reducing the amount of elk hunting access that has been provided on private lands. We continue to evaluate alternative hunting season structures that could address changes in elk movement, while avoiding continual changes to license quotas in hunt area 125.

2.) Management Objective Review: We are maintaining this herd at the current objective and management strategy based on internal discussions and conversations with our constituents. We evaluated and considered population status and habitat data included in this document and a change is not warranted at this time. We will review this herd objective again in 2028; however, if the situation arises that a change is needed, we will review and submit a proposal as needed.

3.) Weather/Habitat: Annual precipitation in the Snowy Range elk herd unit was below normal in 2022 in the majority of the herd unit. Low precipitation levels received in the key growing season months at high and low elevations, resulted in decreased forage production for grasses, forbs, and shrubs across all seasonal ranges. Lack of precipitation, particularly on winter ranges, led to earlier senescence of grasses and forbs, likely leading to dietary shifts to riparian areas and irrigated lands earlier in the year than normal for wild ungulates.

In the eastern portions of the herd unit (hunt areas 8-11), the NOAA weather station in Laramie received 37% less total precipitation for the year compared to long term averages. Lower mountain foothills and plains portions of these hunt areas saw very little annual production in spring 2022. Late summer monsoonal moisture patterns created some late season green-up, but did little in the

way of production. Severe erosion in portions of wildfire burn scars was witnessed in Hunt Area 9 on Sheep Mountain and drainages west of Fox Creek Road, associated with these late season isolated thunderstorms.

In fall 2020, the Mullen Fire burned approximately 176,800 acres in the Snowy Range, affecting elk habitats in Hunt Area 9 and 110, with the bulk of acres burned on national forest lands, including two wilderness areas in Area 110. In 2021, over 10,300 acres were sprayed with the herbicide Rejuvra to control cheatgrass within the North Platte River drainage, including in two wilderness areas. Initial results look promising, with excellent control and native, perennial vegetation re-establishment. An additional 6,288 acres were treated within hunt area 9 in 2022. An intensive vegetation monitoring effort is underway to monitor herbicide efficacy in areas treated the last two years with herbicide.

Disturbances to habitats in the northern half of the Snowy Range, south of I-80, continue to be very limited. Prescribed burns in mixed mountain shrub stands are slated for spring 2023 on the Wick WHMA, totaling approximately 1,200 acres. While these treatments are specifically being completed for mule deer benefit, we fully anticipate elk will also utilize these shrubs and the associated herbaceous understory.

The Wick WHMA and associated national forest lands in the Foote Creek and Wagonhound Creek drainages will be targeted for aspen enhancements through removal of encroaching conifers through mastication and hand cutting techniques in 2023. We are in the early planning stages with Forest Service to plan timber cutting projects east of the Fallen Pines Road in hunt area 10, north of Centennial. This work may result in improved forage availability on national forest lands, thereby reducing forage competition on neighboring private lands.

Sixteen (16) Rapid Habitat Assessments (RHA) were completed in the herd unit, analyzing 628 acres total. While RHAs are designed to look more specifically at mule deer habitat requirements, some significant findings that also impact elk and their habitats can be inferred. Significant effort was spent assessing aspen habitats. Herbivory is noticeable by wildlife and livestock, particularly in undisturbed late seral stands. Herbivory was not considered to be excessive in most areas inventoried.

It was noted by population biologists in December 2022 that elk were wintering at higher than normal elevations within the Mullen wildfire scar. Forage quality and availability is likely a driving factor in elk staying in the burn scar for longer periods of time. Continued concern post-Mullen wildfire, is the loss of security cover. Due to the high density of roads within the Medicine Bow National Forest, elk may find it increasingly more difficult to find places of refuge away from roads. Fire severity throughout the burn area varied greatly, and large pockets of timber remain intact, so we remain optimistic that some security cover still exists in places.

4.) Chronic Wasting Disease (CWD) Management: This is a Tier 2 surveillance herd, and was last prioritized for CWD sampling in 2019. The three-year (2020-22) CWD prevalence was 1.3% (95% CI= 0.3%-3.2%).

2017 - 2022 Postseason Classification Summary

for Elk Herd EL533 - SNOWY RANGE

		MALES				FEMALES		JUVENILES				Males to 100 Females				Young to		
Year	Post Pop	Ylg	Adult	Total	%	Total	%	Total	%	Tot Cls	Cls Obj	Ylng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2017	8,700	182	146	328	11%	1,778	62%	768	27%	2,874	707	10	8	18	± 1	43	± 2	36
2018	9,165	187	278	465	18%	1,574	59%	608	23%	2,647	585	12	18	30	± 2	39	± 2	30
2019	10,200	434	326	760	18%	2,618	61%	919	21%	4,297	547	17	12	29	± 1	35	± 1	27
2020	10,200	41	46	87	13%	384	60%	174	27%	645	573	11	12	23	± 3	45	± 5	37
2021	10,680	155	234	390	19%	1,170	58%	462	23%	2,022	556	13	20	33	± 2	39	± 3	30
2022	9,900	90	184	274	19%	855	58%	350	24%	1,479	475	11	22	32	± 3	41	± 3	31

2022 - JCR Evaluation Form

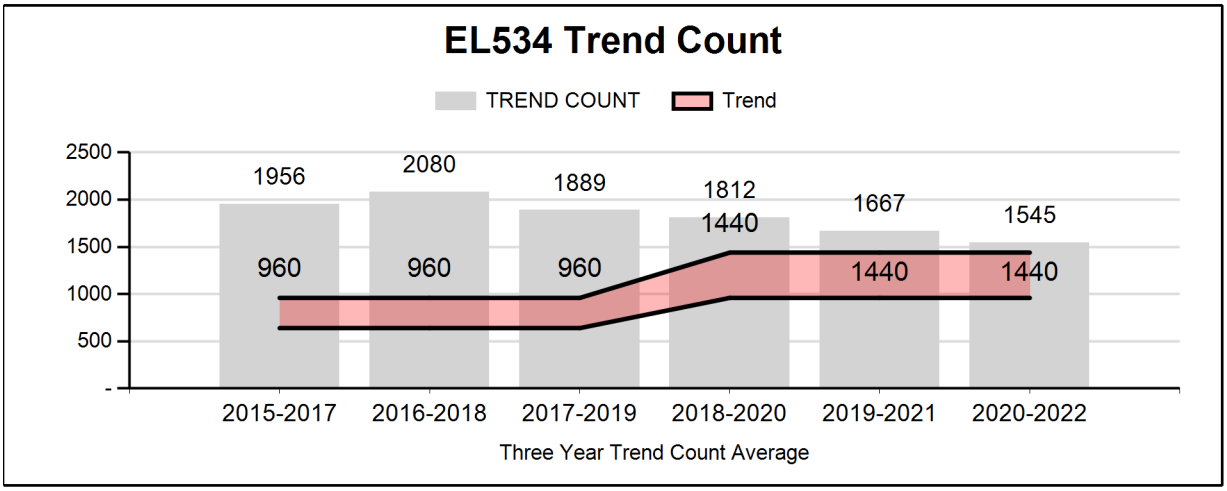
SPECIES: Elk
PERIOD: 6/1/2022 - 5/31/2023
HERD: EL534 - SHIRLEY MOUNTAIN
HUNT AREAS: 16
PREPARED BY: TEAL CUFAUDE

	2017 - 2021 Average	2022	2023 Proposed
Trend Count:	1,788	1,362	1,300
Harvest:	424	471	515
Hunters:	723	846	875
Hunter Success:	59%	56%	59 %
Active Licenses:	749	857	850
Active License Success	57%	55%	61 %
Recreation Days:	5,670	5,914	6,000
Days Per Animal:	13.4	12.6	11.7
Males per 100 Females:	32	50	
Juveniles per 100 Females	38	43	

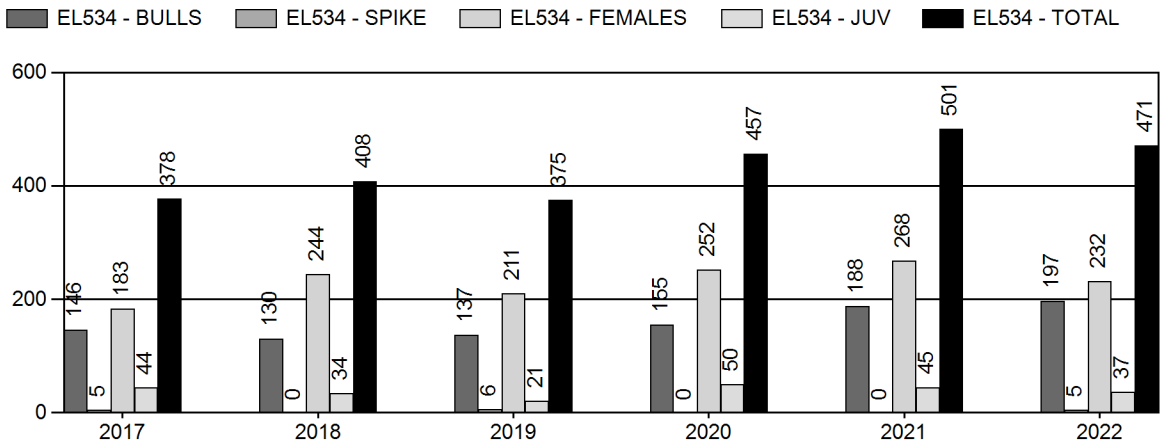
Trend Based Objective (± 20%)	1,200 (960 - 1440)
Management Strategy:	Special
Percent population is above (+) or (-) objective:	14%
Number of years population has been + or - objective in recent trend:	2

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

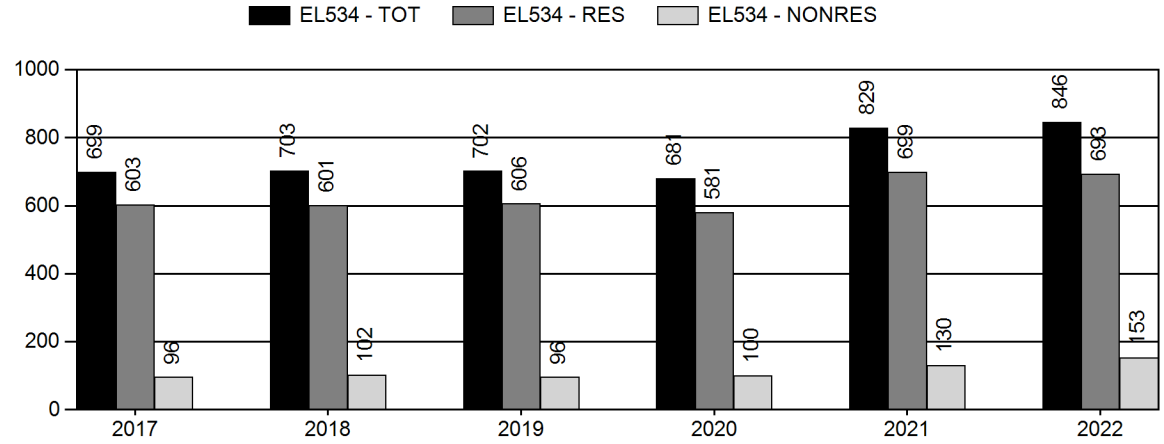
	JCR Year	Proposed
Females ≥ 1 year old:	N/A%	N/A%
Males ≥ 1 year old:	N/A%	N/A%
Juveniles (< 1 year old):	N/A%	N/A%



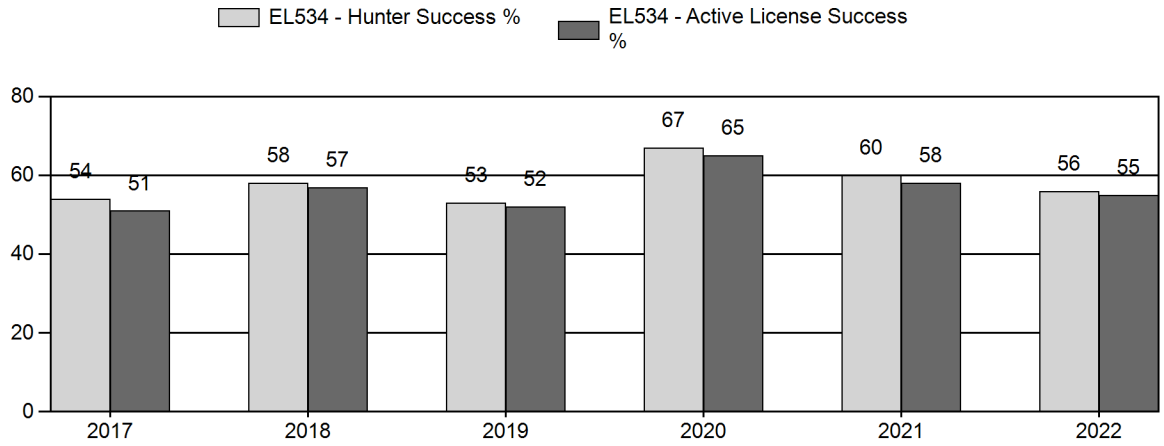
Harvest



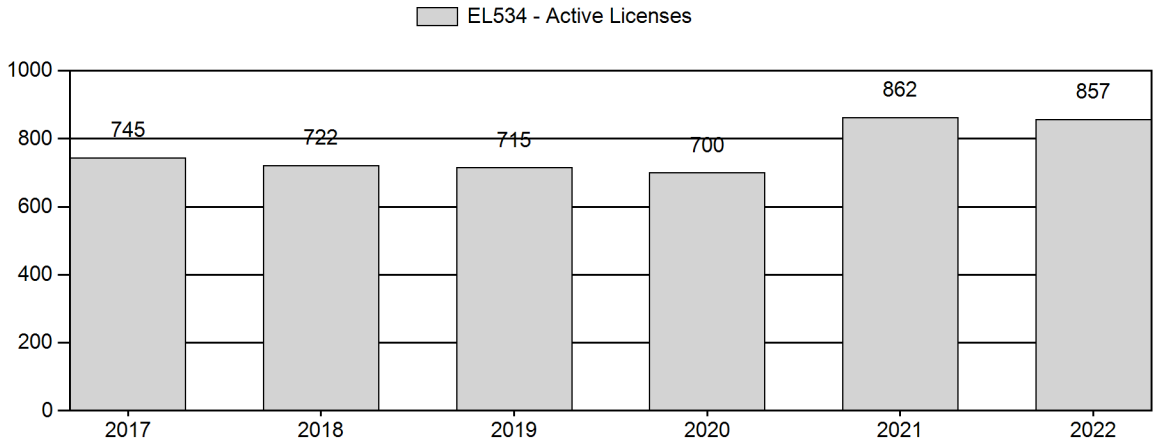
Number of Hunters



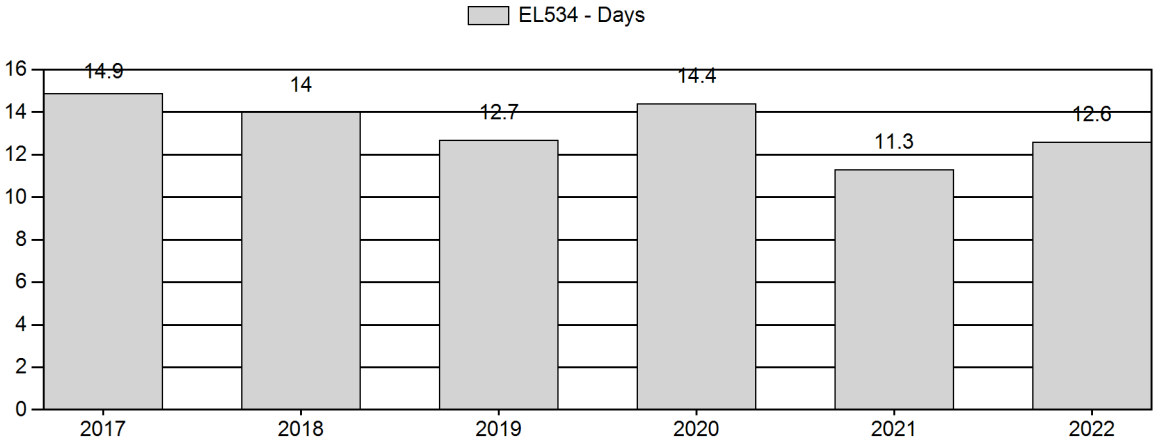
Harvest Success



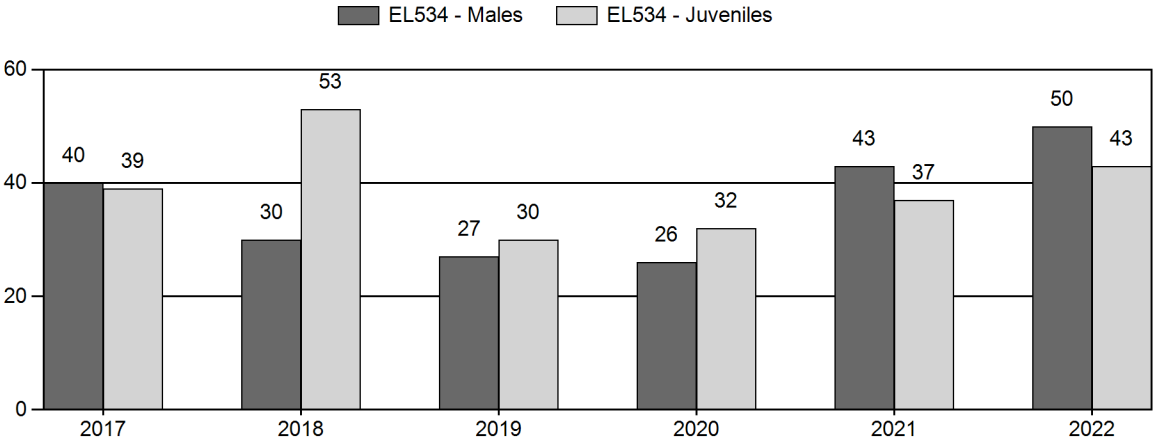
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2023 Hunting Seasons
Shirley Mountain Elk Herd Unit (EL534)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
16	1	Sep. 1	Sep. 30	Oct. 1	Oct. 31	250	Any elk
16	1			Dec. 1	Jan. 31		Antlerless elk
16	2	Sep. 1	Sep. 30	Nov. 1	Nov. 30	100	Any elk
16	2			Dec. 1	Jan. 31		Antlerless elk
16	4			Sep. 1	Sep. 30	300	Antlerless elk valid on private land; also valid on or within one-half (½) mile of irrigated land, and on the Hanna Draw Hunter Management Area (HMA permission slip required)
16	4	Sep. 1	Sep. 30	Oct. 1	Jan. 31		Antlerless elk valid in the entire area
16	6			Aug. 15	Sep. 30	300	Cow or calf valid on private land; also valid on or within one-half (½) mile of irrigated land, and on the Hanna Draw Hunter Management Area (HMA permission slip required)
16	6	Sep. 1	Sep. 30	Oct. 1	Nov. 30		Cow or calf valid in the entire area
16	7			Dec.1	Jan. 31	200	Cow or calf

2022 Hunter Satisfaction: 78.4% Satisfied, 15.3% Neutral, 6.3% Dissatisfied

2023 Management Summary

1.) Hunting Season Evaluation: The harvest survey report indicated 846 hunters harvested 471 elk in 2022, with an overall success of 55.7%. The percentage of branch-antlered bulls (97.5%) in the antlered elk harvest and bull to cow ratio (50/100) observed during the trend survey met the special management parameters. The mid-winter trend count to estimate the wintering population of elk in the herd unit was conducted in January 2023 and 1,463 elk were counted. The three-year (2020-22) trend count average was 1,545 elk which exceeded the objective of 1,200 (±20%) elk.

The 2022 hunting seasons were prescribed with the objective of maintaining bull ratios within the special management parameters and reducing elk numbers. Type 1 and type 2 license success has exceeded 60% over the last three years. Both the type 1 and type 2 license quotas were increased in 2023. Type 1 and type 2 licenses in hunt area 16 are highly coveted licenses and license holders expect a high quality hunt experience. A large portion of this herd unit is unavailable to type 1 and type 2 hunters due to the checkerboard land ownership pattern and limited private land access so managers preferred to take a conservative approach to increases in the type 1 and type 2 license quotas.

The type 6 and type 4 "within one-half (½) mile of irrigated land" limitation was retained to address elk damage. The type 7 license valid from December- January was retained to increase cow elk harvest, while minimizing hunter crowding concerns during the popular type 1 and type 2 hunting seasons. Given the location of winter ranges elk occupy in December, hunters will likely need private land access in order to be successful on this license.

2.) Management Objective Review: The management objective was reviewed in 2020 and changed from a mid-winter trend count of 800 elk to a mid-winter trend count of 1,200 (±20%) elk. The objective will be reviewed again in 2025.

3.) Weather/Habitat: Precipitation levels were below normal in biological year 2022. Early spring precipitation occurred during April and May, but quickly diminished in early June. Precipitation events throughout the remainder of the summer were sporadic and covered very small geographic areas. NOAA weather stations in Laramie and Rawlins recorded departures from average annual precipitation of 37% and 23% respectively. NOAA's U.S. Drought Monitor labeled the majority of this herd unit as experiencing abnormally dry to moderate drought conditions in 2022. Shrub conditions continue to be very poor, with this landscape being dominated by late seral shrub plant communities and continued overutilization by big game.

4.) Chronic Wasting Disease (CWD) Management: CWD was first detected in this herd unit in 2006. To date, no meaningful CWD prevalence data has been collected within this herd unit and no CWD management actions have occurred. This is not a targeted surveillance herd because of the challenges associated with collecting a statistically valid sample of hunter-harvested elk.

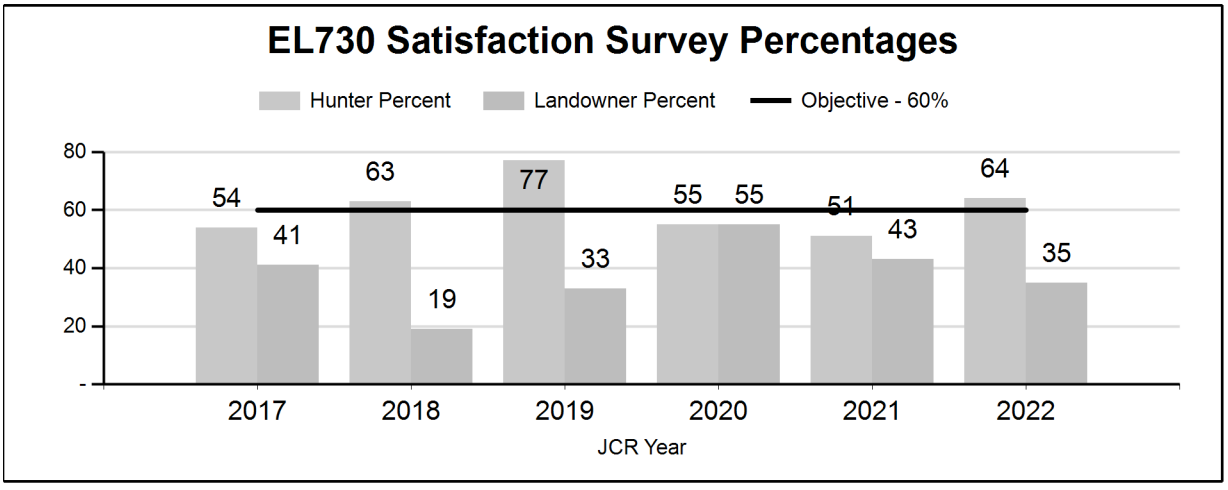
2022 - JCR Evaluation Form

SPECIES: Elk
HERD: EL730 - RAWHIDE
HUNT AREAS: 3

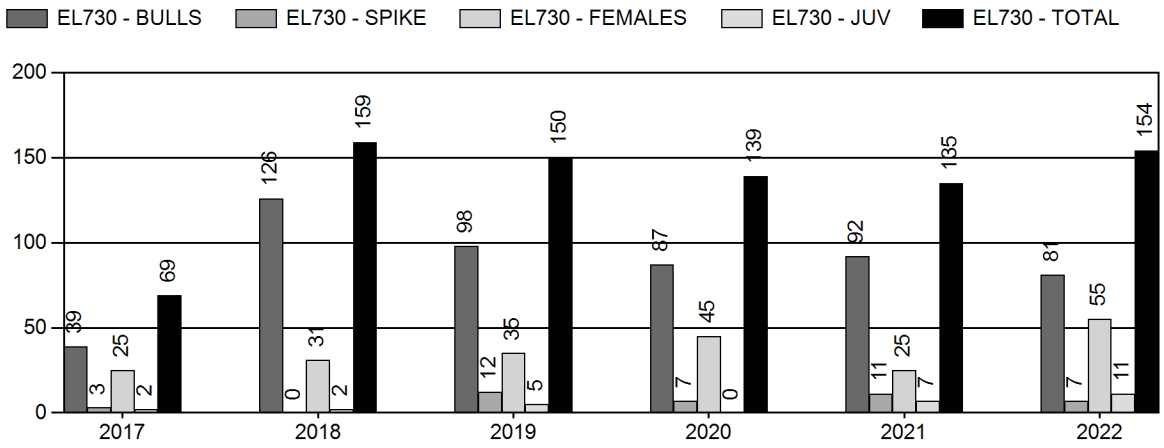
PERIOD: 6/1/2022 - 5/31/2023
PREPARED BY: KEATON WEBER

	2017 - 2021 Average	2022	2023 Proposed
Hunter Satisfaction Percent	60%	64%	65%
Landowner Satisfaction Percent	38%	35%	40%
Harvest:	130	154	140
Hunters:	358	323	350
Hunter Success:	36%	48%	40 %
Active Licenses:	374	348	350
Active License Success:	35%	44%	40 %
Recreation Days:	2,476	2,244	2,200
Days Per Animal:	19.0	14.6	15.7
Males per 100 Females:	0	0	
Juveniles per 100 Females	0	0	

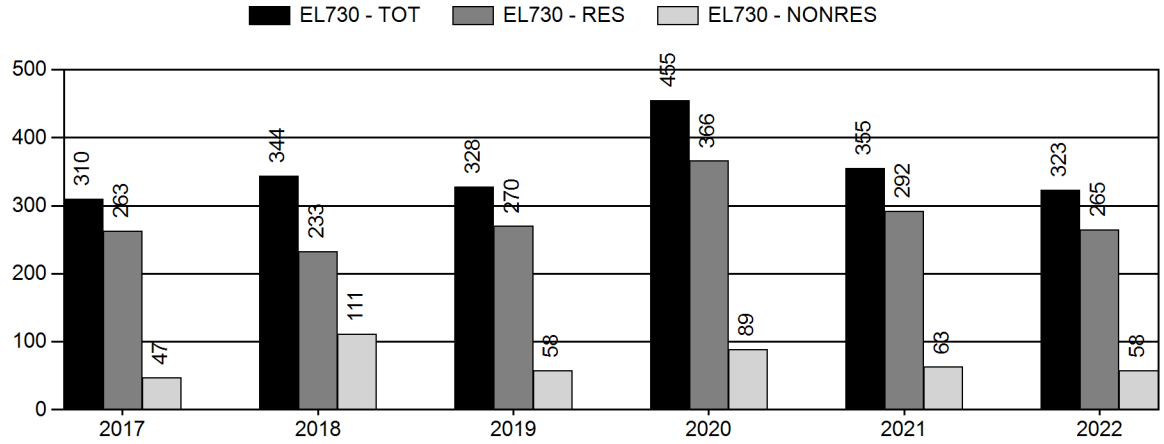
Satisfaction Based Objective	60%
Management Strategy:	Special
Percent population is above (+) or (-) objective:	-10%
Number of years population has been + or - objective in recent trend:	0



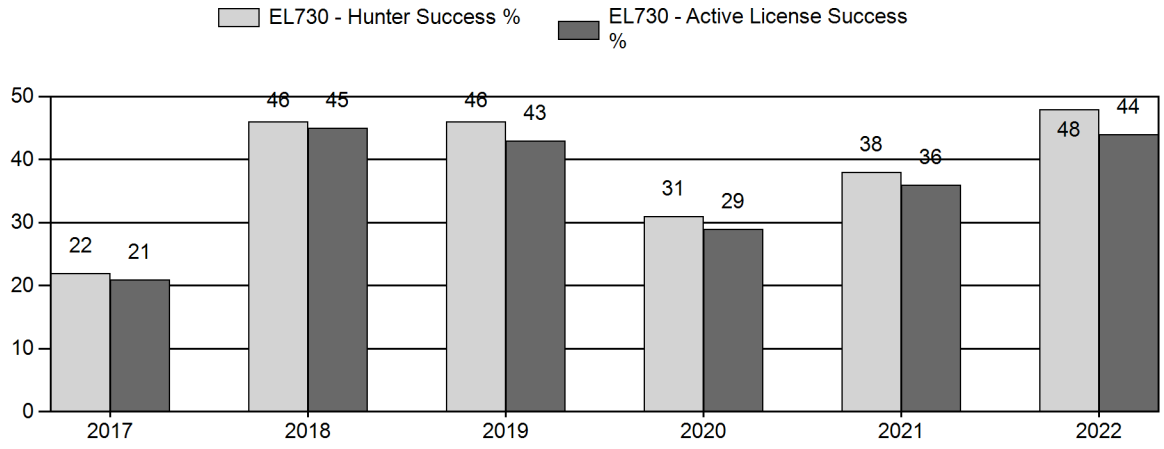
Harvest



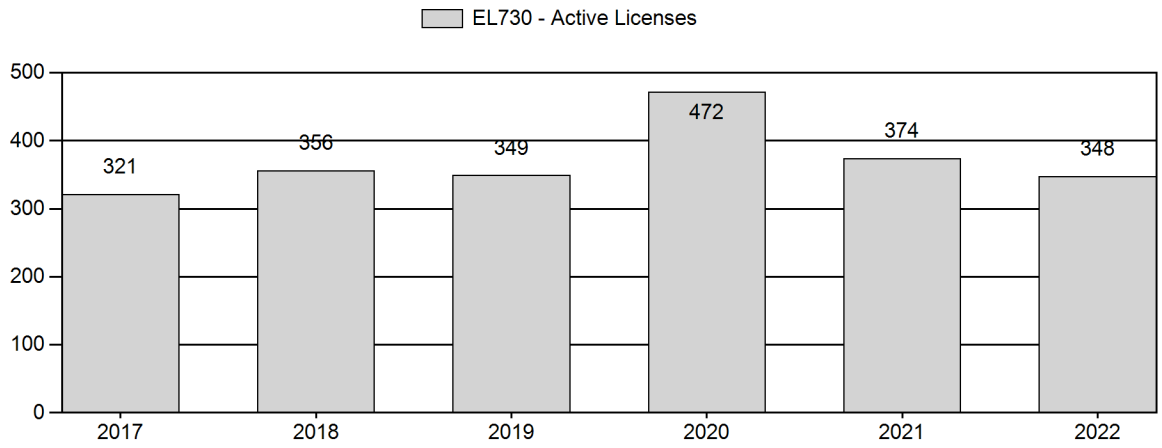
Number of Hunters



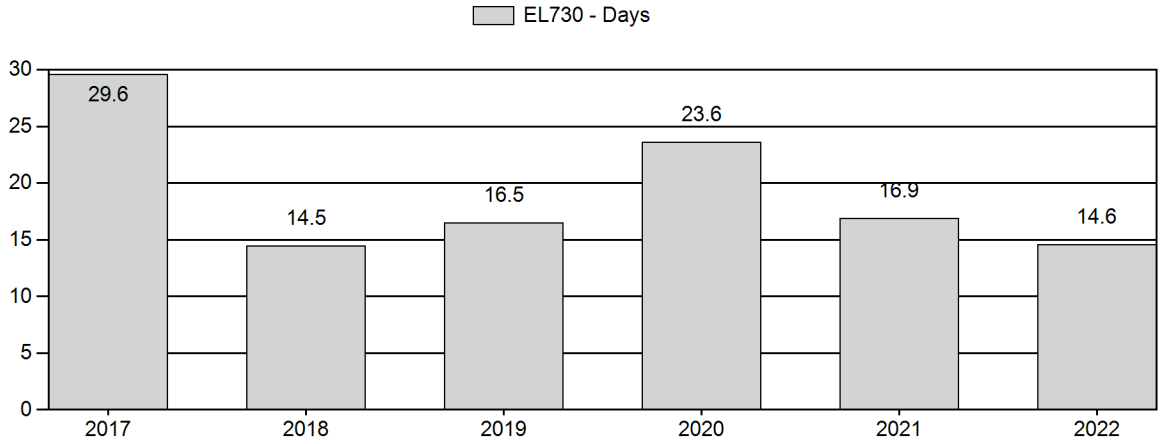
Harvest Success



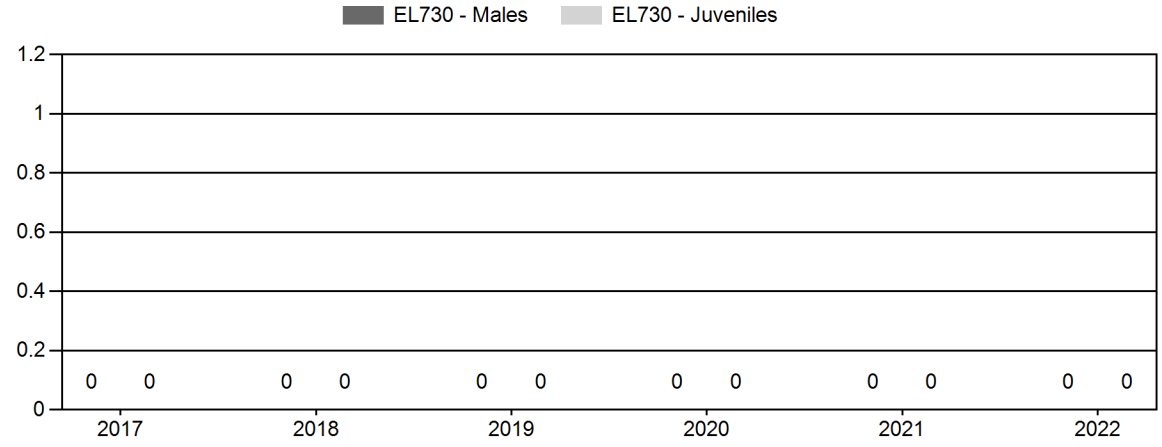
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2023 Hunting Seasons
Rawhide Elk Herd Unit (EL730)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
3	Gen	Sept. 1	Sept. 14	Sept. 15	Oct. 14		Any elk
3	Gen			Oct. 15	Jan. 31		Any elk valid south of U.S. Hwy 26
3	6	Sept. 1	Sept. 30	Aug. 15	Nov. 30	200	Cow or calf
3	6			Dec. 1	Jan. 31		Cow or calf valid south of U.S. Hwy 26

2022 Hunter Satisfaction: 64% Satisfied, 27% Neutral, 9% Dissatisfied
2022 Landowner Satisfaction: 22% Above Desired Levels, 35% At Desired Levels, 43% Below Desired Levels

2023 Management Summary
1.) Hunting Season Evaluation: The 2022 season is designed to maximize harvest on a landscape that is dominated by private land to try and keep a growing elk herd at check. However, there are landowner concerns with not enough elk north of U.S. Highway 26 so that will remain a conservative season to try and improve satisfaction levels for that segment of landowners.

2.) Management Objective Review: The Rawhide Elk Herd Unit's landowner and sportsmen satisfaction objective was last reviewed in 2022 and will be up for objective review in 2027.

3.) Ongoing Research: The WGFD partnered with the Wyoming Military Department (Camp Guernsey) and captured 42 female elk from 2018-2022. All 42 cow elk from the Rawhide Herd were fitted with GPS collars. Animals were captured on Camp Guernsey and lands adjacent to Camp Guernsey. Collars were programmed to collect a GPS location every two (2) hours and to drop off after three (3) years. As elk died, collars were collected and redeployed the following January. Western EcoSystems Technology, Inc (WEST) was contracted to evaluate and summarize all of the collar data and results. This projected was finalized in 2022 and the final report was completed in June of 2022.

The goal of this project was to identify 1) key winter, summer, and parturition ranges, 2) potential movement barriers, 3) important habitat components that elk select or avoid, and 4) assess whether elk are effected by military training activities or hunter activity.

Spatial location data indicated that this herd of elk are very nomadic and do not select for seasonal winter range or summer range habitats. However, data suggests most elk within this herd do have distinct parturition areas. This herd was thought to have potential movement barriers from Interstate 25 and the North Platte River. Collar data confirmed that Interstate 25 does limit natural elk movements westward across the interstate; however, it was common for elk to cross the interstate occasionally. It was also found that the North Platte River did not inhibit elk movements whatsoever. Results clearly indicated that elk were being displaced from

various military training (aerial activities, range fire, personnel on site etc.) disturbance events and the elk selected for more rugged terrain during these disturbance events. There was no detection of elk being displaced due to hunter activity; however, this was likely due to the lack of fine scale hunter activity data. Managers will ultimately use these results to help minimize disturbances to the elk, locate high use habitats, and assist in making informative recommendations for potential energy and mining developments in the area. The final report for this research can be found in Appendix A.

4.) Weather and Habitat: Annual precipitation was below normal in the Rawhide herd unit in 2022. NOAA weather stations in Cheyenne, Torrington, and Douglas showed decreases of 36%, 55%, and 26% from average. Native rangeland habitats largely remain in late seral stages due to a lack of natural or managed disturbances on this landscape. Due to the close proximity of perennial and annual agricultural crops to security cover provided by steep canyons and timber stands, elk are likely to shift their diets and utilize these forage resources in this intensive agricultural environment, when native rangeland forage resources are lacking in productivity or quality. Cheatgrass remains a large threat in native rangeland plant communities, and also in cropland environments. In 2022, 1,070 acres of native rangelands were treated with Rejuvra and Plateau herbicides in foothill mountain habitats north of Hartville. These acres were burned in the 2006 Tracer wildfire and over time we have witnessed cheatgrass become well established in disturbed areas.

Spatial Data Analysis of the Rawhide Elk Herd Using Camp Guernsey

Prepared for:

Wyoming Military Department

Prepared by:

Kurt Smith and Andrew Telander

Western EcoSystems Technology, Inc.
1610 Reynolds Street
Laramie, Wyoming, 82072

May 2022

Privileged and Confidential – Not for Distribution

PROJECT HIGHLIGHTS

The Wyoming Military Department contracted Western EcoSystems Technology, Inc. to evaluate location data collected from 2018–2022, from 42 female elk in the Rawhide Herd that use the Camp Guernsey Joint Training Center, Guernsey, Wyoming.
Findings included:

1) Winter, summer, and parturition ranges:
    a. Only five of 37 elk (14%) had distinct summer and winter ranges.
    b. The Rawhide Herd may be characterized as a resident herd with overlapping summer and winter ranges.
    c. We found evidence for distinct parturition areas for most elk, with mean dates of parturition beginning around 2 June each year.
2) Potential movement barriers:
    a. We did not visually detect barriers to elk movement.
        i. Elk frequently crossed the North Platte River.
        ii. Elk crossed Interstate 25 at multiple locations, but crossings were not isolated to particular locations.
3) Habitats that elk selected for or avoided:
    a. The North Training area had relatively high probability of selection during both summer and winter.
    b. The South Training Area received little use by elk over the study period so this area was not a focal point of our assessment.
4) Elk distribution patterns during military training or hunter activities:
    a. All training activities appeared to displace elk during both summer and winter (Figure i).
    b. Across all summer training activities, elk were displaced on average 0.14 km during a training activity and 0.54 km after the activity.
    c. During winter, elk were displaced on average 0.22 km during a training activity and 0.70 km after the activity.
    d. Elk tended to move to more topographically rugged areas during training activities in both seasons.
    e. We failed to detect a response by elk to hunter activity. Additional data would be necessary to uncover any potential responses.

Findings from this study may be useful for those tasked with managing the Rawhide Herd and their habitat.

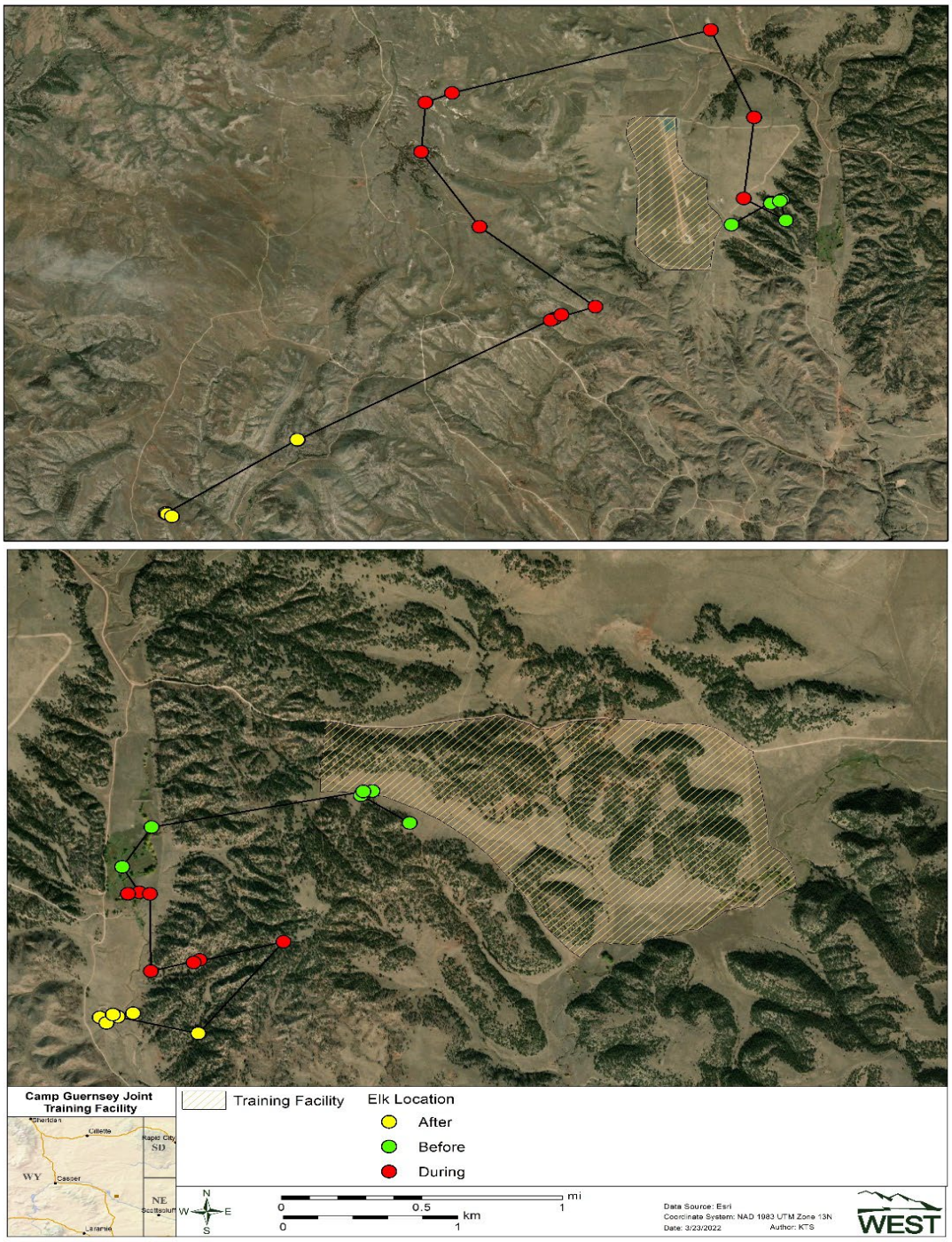


Figure i. Two examples of female elk before (green circles), during (red circles), and after (yellow circles) a military training activity (personnel on site) at the Camp Guernsey Joint Training Facility, Platte County, Wyoming. Elk were displaced on average 0.14 kilometer (km) during a training activity and 0.54 km after the activity in summer. Elk were displaced on average 0.22 km during a training activity and 0.70 km after the activity in the winter.

EXECUTIVE SUMMARY

The Wyoming Military Department contracted Western EcoSystems Technology, Inc. (WEST) to evaluate female elk in the Rawhide Herd that used areas within and adjacent to the Camp Guernsey Joint Training Center, Platte County, Wyoming. WEST worked with the Wyoming Military Department and the Wyoming Game and Fish Department (WGFD) to identify 1) key winter, summer, and parturition ranges, 2) potential movement barriers to the Rawhide Herd, 3) important habitat components elk select or avoid, and 4) assess whether elk shift their distribution patterns during military training or hunter activity. We used location data from 42 female elk collected during 2018–2020 to assess these objectives.

We used two novel approaches that generated spatio-temporal clustering of elk locations to identify seasonal ranges and parturition areas. We determined that only five of 37 individuals (14%) had distinct summer and winter ranges, suggesting that the Rawhide Herd may generally be characterized as a resident herd with overlapping summer and winter ranges. We found evidence for distinct parturition areas for most elk, with mean dates of parturition beginning on 3 June in 2018, 4 June in 2019, and 31 May in 2020. Elk spent an average of 22 days in potential parturition areas.

To identify potential movement barriers, we coupled visual inspection of elk locations with an algorithm that used speed and turning angle between successive elk locations to differentiate between locations identified as resting, foraging, or travelling. Locations identified as travelling were used to visually assess areas of high use when elk were travelling. We did not visually detect barriers to elk movement, and elk appeared to cross the North Platte River without restriction, with multiple crossings occurring repeatedly in two general areas. Elk also crossed Interstate 25 at multiple locations, but crossings were not isolated to specific locations.

We estimated Resource Selection Functions based on elk locations to predict summer and winter habitat selection for the Rawhide Herd. Locations were assigned to summer or winter based on WGFD seasonal definitions (summer: 1 May–14 November; winter: 15 November-30 April). We employed a use-availability design, where locations used by elk were contrasted with a random sample of available locations within the study area, defined by the extent of elk locations. During summer, elk selected areas that had a greater proportion of agriculture, a greater proportion of forest, a lower proportion of herbaceous cover, and areas closer to recent (occurring since 2005) fires, but farther from older fires. Elk also selected areas with greater topographic ruggedness that were farther from anthropogenic development and intermediate (~four km) distances from county

roads. During winter, elk selected areas with a greater proportion of agriculture, and a lower proportion of herbaceous and shrub cover that were near recent fires. Elk also selected areas with greater topographic ruggedness that were farther from anthropogenic development and intermediate distances from county roads and highways. The South Training Area of the Camp Guernsey Joint Training Center received little use by elk over the study period. However, the North Training area was predicted to have relatively high probability of selection during both summer and winter.

To assess whether elk were displaced by military training or hunter activity, we used integrated step-selection functions (ISSF). ISSFs account for changes in resource selection as well as movement between locations. Military training activity models included an assessment of all training activities combined, aerial activities (i.e., any activity involving helicopter or plane training), aerial fire (i.e., any aerial gunnery), personnel on site (i.e., human activity without gun fire), range fire (i.e., activity involving gun fire), large range fire (i.e., mortar, grenade or other fire larger than standard gun fire), and vehicle activity. We developed two separate models to evaluate hunter activity by including predictors that described the total number of hunters at the facility and the total harvest each day. During summer and winter, all training activities appeared to displace elk. Across all activity types during summer, elk were displaced on average 0.14 km during a training activity and 0.54 km after the activity. During winter, elk were displaced on average 0.22 km during a training activity and 0.70 km after the activity. During both seasons, displacement varied by training activity type. Elk also tended to move to more topographically rugged areas during training activities in both seasons. We failed to detect a response by elk to hunter activity, but this could have been due to a lack of fine scale hunter activity data.

REPORT REFERENCE

K. Smith and Telander, A., 2022. Spatial Data Analysis of the Rawhide Elk Herd Using Camp Guernsey. Prepared by Western EcoSystems Technology, Inc., Laramie, Wyoming. May 2022.

TABLE OF CONTENTS

PROJECT HIGHLIGHTS i
EXECUTIVE SUMMARY .....
INTRODUCTION 1
Primary Objectives 1
METHODS 1
GPS Data Cleaning 1
Seasonal Ranges 2
Parturition Areas 3
Movement Barriers and Corridors 3
Seasonal Resource Selection 3
Displacement by Military Training Activities 5
Hunter Analysis 6
RESULTS 7
Seasonal Ranges 7
Parturition Areas 10
Movement Corridor Barriers 10
Seasonal Resource Selection Analyses 15
Summer 15
Winter 18
Displacement by Military Training Activities 21
Displacement by Hunting Activities 25
DISCUSSION 26
REFERENCES 27

LIST OF TABLES

Table 1. Mean step length (meter [m]) and turning angles (standard error in parenthesis) between successive 2 hour relocations for each behavioral state identified by the segmentation clustering algorithm used to identify potential movement corridors by elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming. ..10
Table 2. Parameter estimates, standard errors (SE), and 95% confidence intervals (CI) for predictor variables describing female elk resource selection during summer near the Platte County, Wyoming. 15

Table 3. Parameter estimates, standard errors (SE), and 95% confidence intervals (CI) for predictor variables describing female elk resource selection during winter near the Camp Guernsey Joint Training Facility, Platte County, Wyoming.....18

Table 4. Mean displacement distance during and after training actives and the total number of activities used to assess displacement of elk near the Camp Guernsey Joint Training Facility, Platte County, Wyoming.....21

LIST OF FIGURES

Figure 1. All locations obtained from GPS collared female elk near the Camp Guernsey Joint Training Center, Platte County, Wyoming, between January 2018 and February 2021. 2

Figure 2. Summer ranges of GPS collared female elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming. 8

Figure 3. Winter ranges of GPS collared female elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming. 9

Figure 4. Potential parturition areas of GPS collared female elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming.....11

Figure 5. Movement paths of female elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming between January 2018 and February 2021. Individual paths were overlaid to identify areas where one or multiple paths occurred in the same areas (warmer colors indicate a greater number of overlapping paths when compared to cooler colors). 12

Figure 6. Movement paths of female elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming. The focus of the map is an area where elk appear to frequently cross the North Platte River. Individual paths were overlaid to identify areas where one or multiple paths occurred in the same areas (warmer colors indicate a greater number of overlapping paths when compared to cooler colors) ...13

Figure 7. Movement paths of female elk near Interstate 25, Platte County, WY. Individual paths were overlaid to identify areas where one or multiple paths occurred in the same areas (warmer colors indicate a greater number of overlapping paths when compared to cooler colors). 14

Figure 8. Relative probability of selection as a function of predictor variable in the most parsimonious summer (1 May–14 November) resource selection model for elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming. Relative probability of selection was standardized for each predictor variable by dividing predicted values by their maximum.....16

Figure 9. Predicted relative probability of selection by elk during summer (1 May–14 November) using the Camp Guernsey Joint Training Center, Platte County, Wyoming. 17

Figure 10. Relative probability of selection as a function of predictor variable in the most parsimonious winter (15 November–30 April) resource selection model for elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming. Relative probability of selection was standardized for each predictor variable by dividing predicted values by their maximum. 19

Figure 11. Predicted relative probability of selection by elk during winter (15 November–30 April) using the Camp Guernsey Joint Training Center, Platte County, Wyoming. ...20

Figure 12. Relative probability of elk summer resource selection as a function of distance to aerial activity, aerial gunnery, large range fire, range fire, personnel on site, and vehicle activity before, during, and after the activity at the Camp Guernsey Joint Training Center, Platte County, Wyoming. 22

Figure 13. Relative probability of elk resource selection as a function of distance to training activity (A), mean (± range) distance to training activity (B), mean (± range) natural log of step length (C), and mean (± range) roughness (D), before, during, and after all summer training activities at the Camp Guernsey Joint Training Center, Platte County, Wyoming. 23

Figure 14. Relative probability of elk winter resource selection as a function of distance to aerial activity, aerial gunnery, large range fire, range fire, personnel on site, and vehicle activity before, during, and after the activity at the Camp Guernsey Joint Training Center, Platte County, Wyoming. 24

Figure 15. Relative probability of elk resource selection as a function of distance to training activity (A), mean (± range) distance to training activity (B), mean (± range) natural log of step length (C), and mean (± range) roughness (D), before, during, and after all summer training activities at the Camp Guernsey Joint Training Center, Platte County, Wyoming. 25

INTRODUCTION

The Wyoming Military Department contracted Western EcoSystems Technology, Inc. (WEST) to evaluate habitat selection patterns of female elk in the Rawhide Herd using resource selection functions (RSFs). The overall goal for this spatial analysis was to determine whether, and to what extent, elk are displaced by military training or hunter presence on and adjacent to the Camp Guernsey Joint Training Center, Platte County, Wyoming. In addition, seasonal ranges (i.e., parturition, winter, and summer), migratory corridors, and potential movement barriers (e.g., North Platte River, Interstate 25) were assessed from location data.

Objectives

WEST worked with the Wyoming Military Department (WYMD) and the Wyoming Game and Fish Department (WGFD) to address the following research questions:

1. Where are the key winter, summer, and parturition ranges located for the Rawhide Herd and do they vary from year to year?
2. Are there any clear movement barriers to the Rawhide Herd?
3. What habitat variables are elk selecting for or avoiding (e.g., irrigated crops, rural residential development, burned woodland, and livestock grazing) and where are the best habitats located?
4. Do elk shift their distribution patterns during military training or hunter presence, and if so, what are the habitat characteristics of their security habitats and how long do they remain there?

METHODS

Forty-two female elk were captured using helicopter net gunning (Native Range Capture Services, Elko, Nevada) in late January and early February 2018 (n = 29), late January 2019 (n = 6), and mid-February 2020 (n = 7). All elk were captured on or adjacent to Camp Guernsey Joint Training Center, Platte County, Wyoming. Each captured animal was fitted with a Lotek GlobalStar Track M GPS neck collar. Collars were programmed to fix locations every two hours and were equipped with a release mechanism causing collars to release after a specified period of time. We censored locations recorded within the first week of capture to avoid capture influence on movement behavior (Northrup et al. 2014).

GPS Data Cleaning

We cleaned and filtered collar data by removing locations collected when collars were not on elk, accurately attributed location data to the correct animal (for collars that were affixed to more than one elk), and filtered data by removing any duplicates or erroneous location fixes. To remove erroneous locations, we calculated distance and time between successive locations to estimate speed, and removed any locations that were unreasonable based on visual inspection and maximum sustained speeds exceeding 3.5 meters/second (11.5 feet/second). Cleaned data were uploaded to movebank.org (Figure 1).

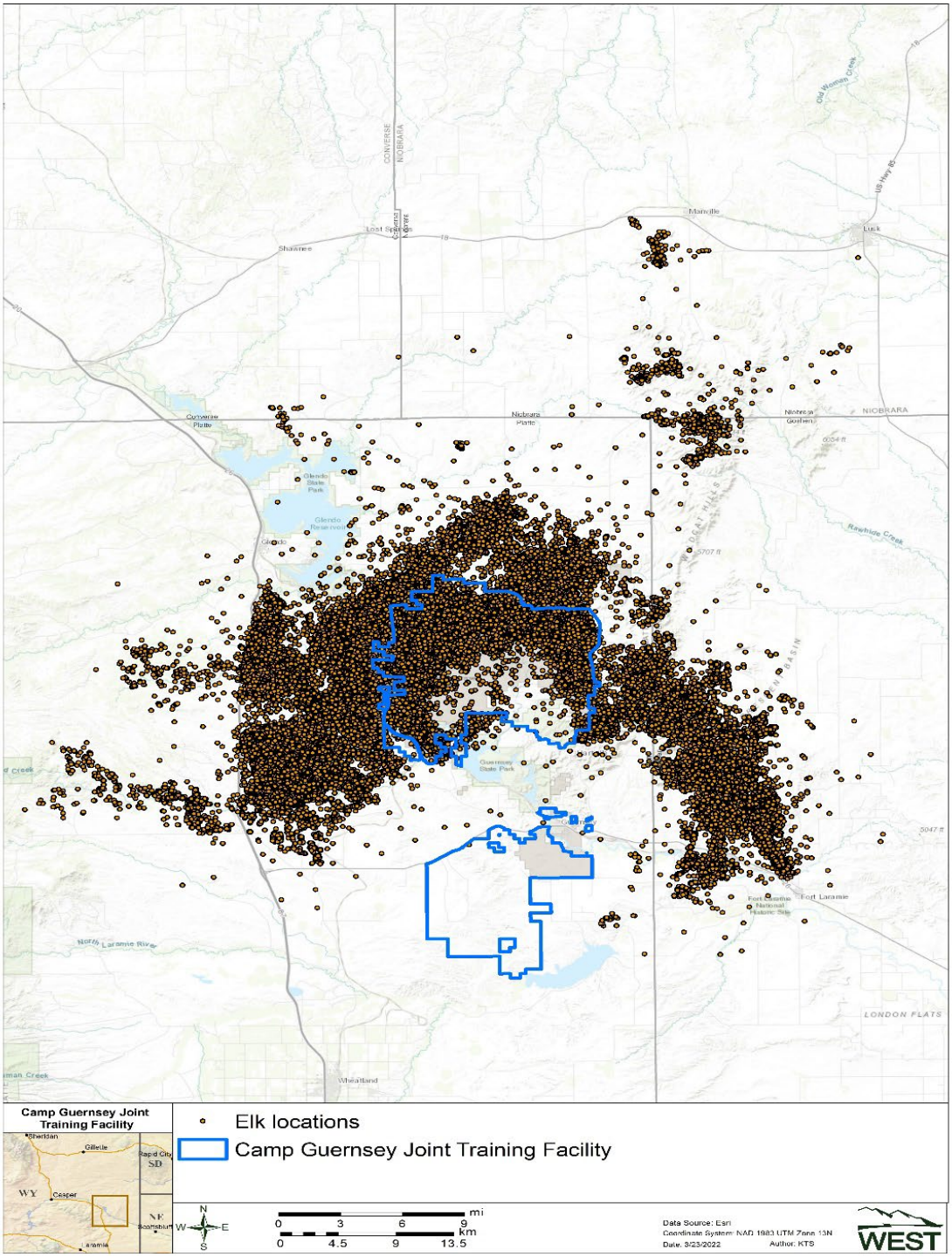


Figure 1. All locations obtained from GPS collared female elk near the Camp Guernsey Joint Training Center, Platte County, Wyoming, between January 2018 and February 2021.

Seasonal Ranges

To identify seasonal ranges, parturition areas, and potential movement corridors, we used two complimentary approaches: net-squared displacement (NSD; Bunnefeld et al. 2011) and a

segmentation algorithm with the *segclust2d* R package (Patin et al. 2019). NSD calculates the squared distance between subsequent GPS locations and is used to evaluate annual movement patterns and seasonal ranges (Papworth et al. 2012). The segmentation algorithm approach followed a modified version of Lavielle's method (Lavielle 1999) to detect change points in a time series of GPS locations (x- and y-coordinates) for each individual (Ducros et al. 2020, Patin et al. 2020). We set the minimum number of locations to 150 (~12 days) for a segment of elk GPS locations to be considered in a seasonal range. Once seasonal range dates were identified, we generated 95% fixed kernels around elk locations to identify individual seasonal ranges (default bivariate kernel smoothing parameter; Worton 1989). For individuals with non-distinct seasonal ranges, we used dates for summer (1 May–14 November) and winter (15 November–30 April) defined by WGFD (WGFD 2015) to assign seasonal ranges. We only identified seasonal ranges for an individual if there were at least 1,000 locations during the season of interest (approximately 83 days of data).

Parturition Areas

We used the *segclust2d* R package with a segmentation clustering algorithm to identify potential parturition areas. For each elk, we subset locations to the parturition period (15 May–30 June; WGFD 2015) and used x- and y-coordinates between successive relocations to differentiate space use by each elk. This method identified distinct areas of use during the parturition period, allowing us to identify distinct clusters of locations that could signify a potential parturition area. The minimum number of locations for each segment was set to 10 (~20 hour period).

Movement Barriers and Corridors

We used a simple mapping approach to investigate potential barriers to movement. We focused specifically on Interstate 25, the North Platte River, as well as generic linear features such as railways and roads. We coupled our visual investigation with the same segmentation clustering method, as described above, to identify travel versus foraging and resting, or stationary behavior by elk. This method also allowed us to identify potential movement corridors. We used speed and relative turning angle between successive locations to differentiate behavioral states. We considered three behavioral states, or clusters, in our models that we defined as resting, foraging, and travelling. Locations identified as travelling were segmented into unique events for each individual, connected by subsequent GPS time stamps, and then buffered by 200 m to visually assess areas of high use when elk were travelling.

Seasonal Resource Selection

We explored a suite of environmental predictor variables to explain both summer and winter resource selection by elk. Land cover covariates were derived from the National Land Cover Database (NLCD 2019) and the LANDFIRE Existing Vegetation Type raster dataset (LANDFIRE 2016). We estimated the proportion of forest (land cover class: deciduous, evergreen, and mixed forest), shrub (land cover class: shrub/scrub), and herbaceous (land cover class: herbaceous) land cover types, and calculated Euclidean distance to water using NLCD data. We used LANDFIRE to estimate the proportion of and distance to agriculture (EVT Name: Western Cool Temperate Row Crop – Close Grown Crop, Western Cool Temperate Row Crop, Western Cool

Temperate Close Grown Crop, Western Cool Temperate Fallow/Idle Cropland, and Western Cool Temperate Pasture and Hayland).

We used the Monitoring Trends in Burn Severity (MTBS 2019) dataset to calculate distance to wildfires. We separated wildfires into old (occurring before 2005) and recent (occurring after 2005) fires based on date of incident. Five wildfires in the region have occurred since 2005 (Incident Name = Guernsey State Park, Fish Creek #2, Sawmill Canyon, Table Mountain, and Old Chicago) and two occurred before 1997 (Incident Name = Haystack, Spring Creek). Covariates describing topography were derived from a digital elevation model (DEM: US Geological Survey [USGS] 2011). We calculated slope, roughness, terrain ruggedness index (TRI), and topographic position index (TPI). Roughness was calculated as the difference between maximum and minimum elevation of the raster cell and eight surrounding cells (Wilson et al. 2007). TRI was calculated as the mean of the absolute difference between the elevation at the raster cell and each of the eight surrounding cells (Wilson et al. 2007). TPI compared the difference in elevation at each cell to the mean elevation of the eight surrounding cells (Guisan et al. 1999). We used Wyoming Department of Transportation (WYDOT) GIS data (WYDOT 2016) to calculate distance to county roads and highways. We assessed the amount of anthropogenic disturbance and distance to anthropogenic disturbance, including rural residential development, using an urban impervious surfaces dataset (USGS 2019). We assessed all non-distance based predictors within five circular regions: 0.5-km radii (0.8 km^2), 1.0-km radii (3.1 km^2), 1.5-km radii (7.1 km^2), 2.0-km radii (12.6 km^2), and 2.5-km radii (19.6 km^2).

We estimated RSFs (Manly et al. 2002) based on the locations of GPS-collared elk to create data-driven predictions of summer and winter habitat selection for elk in the region. Locations were assigned to summer or winter based on WGFD seasonal definitions (winter: 15 November–30 April; Summer: 1 May–14 November; WGFD 2015). We employed a use-availability framework for each RSF analysis (Johnson et al. 2006, McDonald 2013), where used elk locations were contrasted with a random sample of 10 times the number of used points to serve as available locations. Available points were randomly drawn from the study area, which was demarcated by generating a 95% fixed kernel around all elk locations (default bivariate kernel smoothing parameter; Worton 1989). To estimate each RSF, we used binomial generalized mixed models with the lme4 R package (Bates et al. 2015). We used an individual elk intercept term nested within year to account for individual variation and possible variation in individuals across years (Gillies et al. 2006). We centered and scaled variables to ensure model convergence prior to modelling (Becker et al. 1988). The RSF took the following form:

$$w(x) = exp(\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n)$$

where w(x) was proportional to the probability of elk resource selection and β_1 represented the coefficient describing selection strength for covariate x_1, and n represented the number of covariates in the model.

We used a variable sub-setting approach (Arnold 2010) to develop nested candidate models and determined the most parsimonious set of covariates to describe selection by elk during each season. We started by exploring all variable combinations within land cover, topography, and anthropogenic variable groups separately. We did not allow variables in the same model when they were highly correlated ($|r| > 0.7$) and set the maximum number of variables in any model at three. We retained variables in the most predictive models from each subset, and assessed all combinations of remaining variables. We again ensured that correlated variables were not included in the same model. Candidate models were fit with the *MuMIn* R package (Barton 2020). We used Akaike's Information Criterion (AIC) to assess support for all models (Burnham and Anderson 2002) and considered models within two AIC of the best model to be competitive. If AIC scores were nearly equivalent (i.e., within two AIC), we evaluated support of individual covariates by evaluating whether coefficients had 95% confidence intervals that did not overlap zero (Burnham and Anderson 2002, Arnold 2010).

We used 5-fold cross validation to evaluate the most-supported summer and winter RSF models by randomly partitioning data by individual elk-years. We estimated predictions based on four of the five groups (training data) and compared them to the withheld group, and repeated this until the five withheld groups were evaluated (Johnson et al. 2006). By using this cross-validation method, we avoided holding back any of the data for validation and were able to use the entire dataset for modelling. We binned predictions into five equal-area (quartile) intervals (Wiens et al. 2008). Validations were performed by running simple linear regression models on the number of observed locations from the test group compared to expected locations generated from each RSF bin (Johnson et al. 2006). We considered models to be good predictors when linear regression models had high coefficients of determination ($r^2 > 0.9$) and 95% confidence intervals of slope estimates excluded zero and included one (Howlin et al. 2004). We mapped the most predictive RSF model across the study area by using coefficients from the top model and distributed predictions into five equal area binds corresponding to increasing relative probability of selection.

Displacement by Military Training Activities

To evaluate if elk were displaced by military training activities, we use an integrated step-selection function (ISSF; Avgar et al. 2016, Ladle et al. 2018). ISSFs differ from traditional step-selection function (SSF) models in that ISSFs account for changes in resource selection as well as movement between locations by including step length as a model covariate. To estimate the ISSF, elk locations were paired with 10 available locations, or endpoints, generated from the distribution of step length and turning angles from the population of marked elk (Fortin et al. 2005, Thurfjell et al. 2014). We applied conditional logistic regression to compare characteristics of used to available locations, with each stratum consisting of a used point and 10 paired available points. We assigned each individual to a cluster to calculate robust standard errors and 95% confidence intervals by accounting for potential correlation in individual responses (Craiu et al. 2008) using the *survival* R package (Therneau 2015).

We evaluated potential displacement of elk by military training by constructing nested candidate models for summer and winter seasons (described above). For each season, the base model included the same covariates that were in the most predictive seasonal RSF models, and were

used for comparison with more complex models used to identify potential displacement behaviors (displacement model). In addition to covariates in the base model, the displacement model contained distance to training activity, period (before, during, and after; described below), step length, and distance to training activity by period and distance to training activity by step length interaction terms. A significant interaction indicated that either distance to training activity or step length varied with period.

Each training activity that occurred at the Camp Guernsey Joint Training Facility contained a spatial location, a training activity type, and a start and stop time of the activity. We filtered each individual elk location that corresponded to a training activity based on the location time stamp. We then assigned the training activity type and distance to the activity. We paired available locations during the duration of the activity. If multiple activities occurred simultaneously, we assigned the elk and paired available locations to the nearest activity. For elk locations associated with an activity, the period term was set to equal 'during', which indicate that the location corresponded to when the activity was occurring. For each elk location(s) assigned to a training activity, we identified the six locations immediately preceding the training activity and the six locations occurring after the training activity (an approximate 12 hour period before and after the event). These locations were assigned as 'before' and 'after' the event, respectively. Training type and distance to the same training activity as assigned to locations during the event, was calculated for these locations and their paired available locations. For each group of elk locations assigned to a training activity (UID), we calculated the mean distance to the training activity for locations before the activity and subset data such that the mean location before any activity was within 2.5 km of the activity location. This was to ensure that elk were exposed to the training activity and available to respond to it. We repeated this in a *post hoc* analysis by sub setting UIDs with locations occurring before the event that were greater than 10 km from the activity as model validation. For each seasonal model, we ran seven separate models that compared different training activities. Models included an assessment of: all training activities combined, aerial activities (i.e., any activity involving helicopter or plane training), aerial fire (i.e., any aerial gunnery), human activity without gun fire (i.e., personnel on site), range fire (i.e., activity involving live gun fire), large range fire (i.e., mortar, grenade or other live fire larger than standard gun fire), and vehicle activity. We used AIC to assess model support between displacement and base models.

Hunter Analysis

We used ISSFs to assess whether elk were displaced by hunter activity, similar to the models used to assess military training activities. Location data were subset between 1 August and 1 March, to encompass a range of hunter activity levels before, during, and after the elk hunting season (1 September to 31 January). We developed two separate models, each with interaction terms that included either distance to the center of the training area by number of a hunters or distance to the center of the training area x total harvest interactions. A significant interaction would indicate that either distance to the training area varied by the number of hunters or the total harvest.

RESULTS

We used data collected from 37 of 42 elk (88%) in subsequent analyses (average locations per elk = 7,524 locations; range: 1,460–13,007 locations). Five individuals were equipped with transmitters that did not deploy properly or failed to transmit, resulting in the collection of only one data point every two days. The mean duration a transmitter was affixed to an elk was 634 days (range: 122–1,095 days). During the study, 16 (38%) mortalities were documented. Of the 16 mortalities, seven elk were harvested by hunters (44%), three were identified as lion kills (19%; one of the three died from a possible infection from a failed lion attack), and six mortalities were due to unknown causes (37%). The mean number of days between capture and date of morality was 573 days (range: 126–1,002 days).

Seasonal Ranges

Based on visual inspection of net-squared displacement plots and the segmentation algorithm applied to each individual, we determined that only five of 37 individuals (14%) had distinct summer and winter ranges. The mean date of arrival on summer range for these individuals was 19 May, and the mean date of departure was 6 September, which were outside of the dates commonly used to identify the summer season (WGFD 2015). For these reasons, we used seasonal dates identified by WGFD (WGFD 2015) to demarcate seasonal ranges. We identified 65 summer ranges (Figure 2). Fourteen elk had location data during one summer, nine elk had location data during two summers, and 11 elk had location data during three summers. Mean summer range size was 270.5 km^2 (median: 262.5 km^2, range: 52.9–1,089.8 km^2). We identified 68 winter ranges (Figure 3). Fourteen elk had location data during one winter, 12 elk had location data during two winters, and 10 elk had location data during three winters. Mean winter range size was 299.6 km^2 (median: 266.7 km^2, range: 69.6–672.5 km^2).

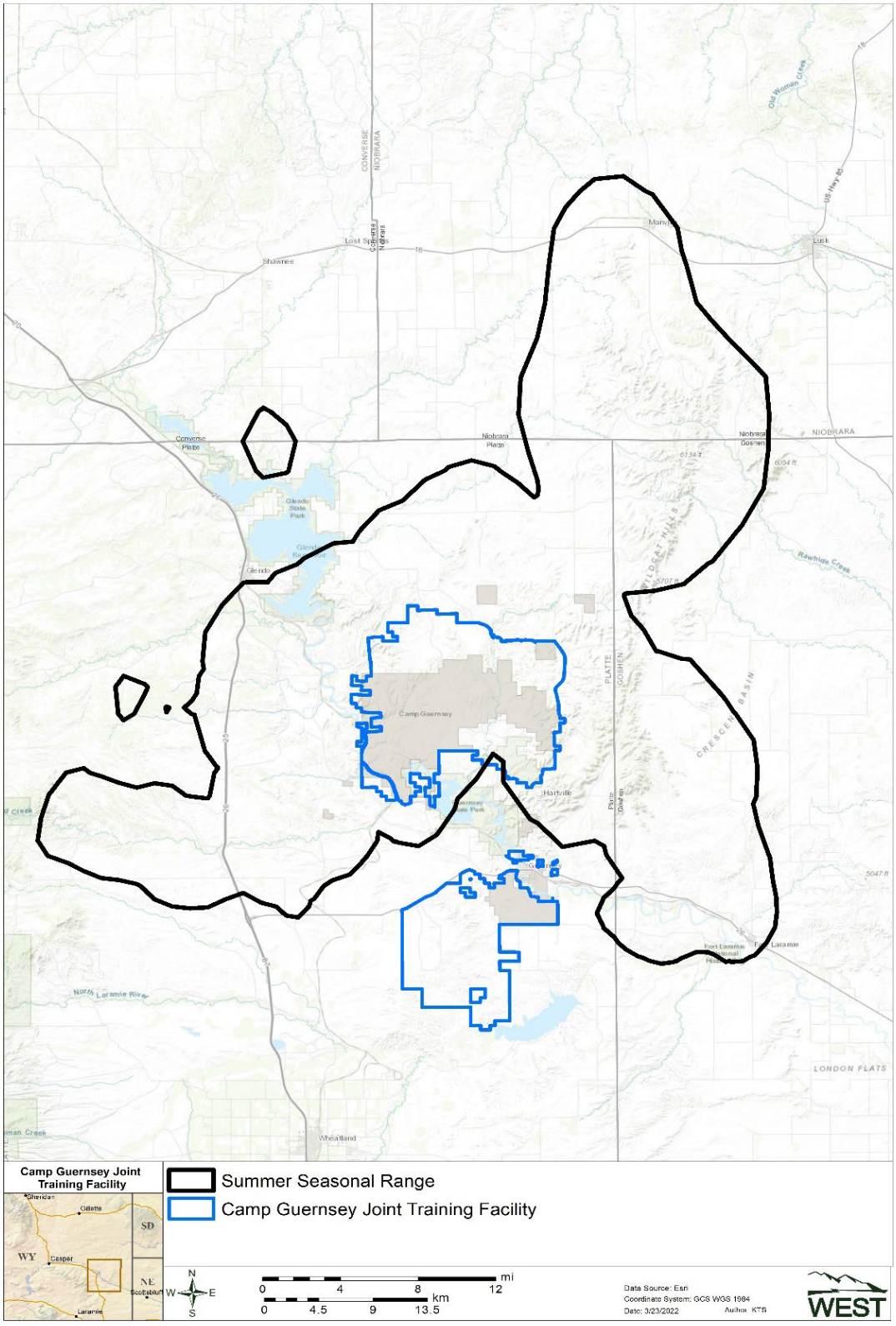


Figure 2. Summer ranges of GPS collared female elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming.

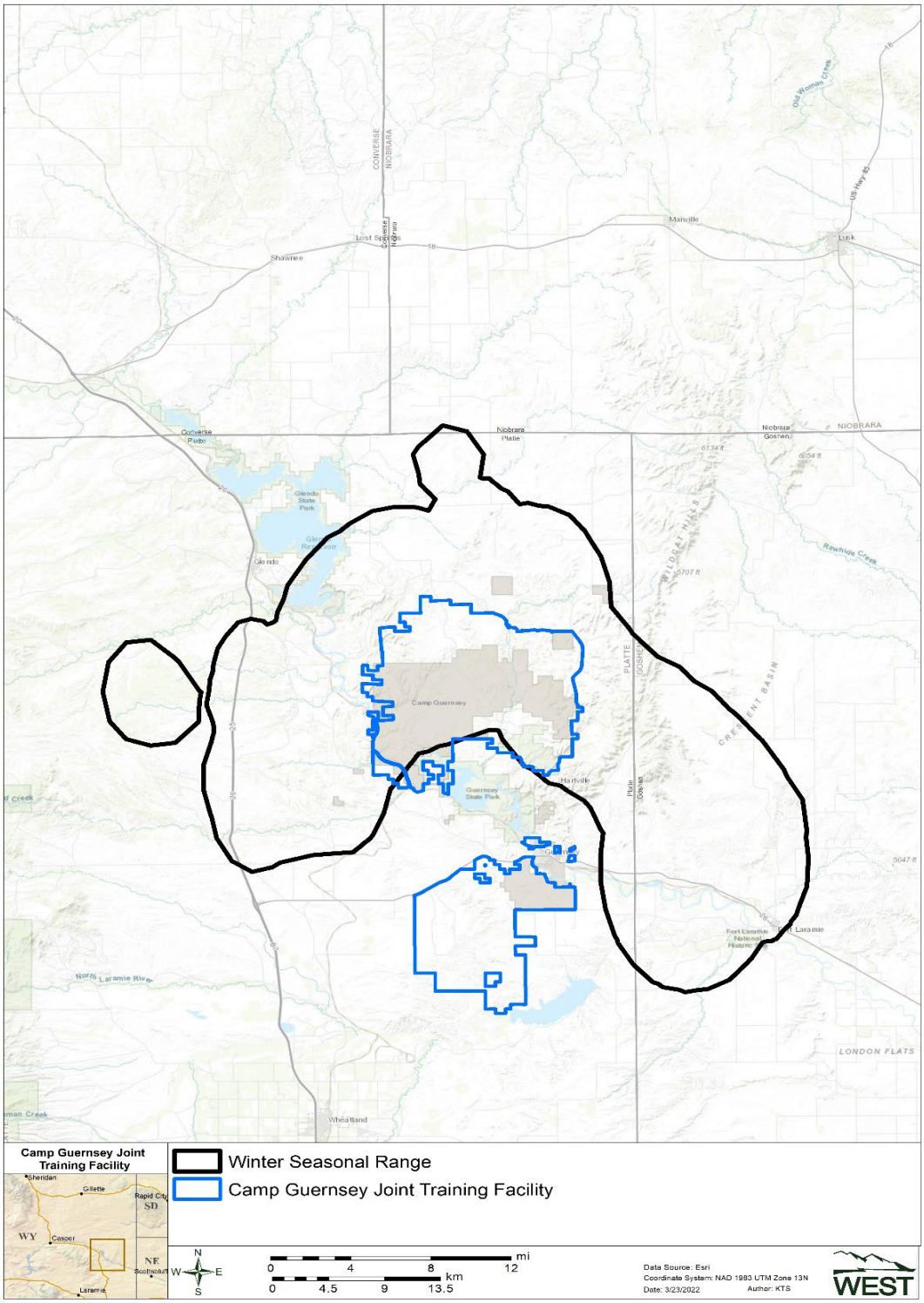


Figure 3. Winter ranges of GPS collared female elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming.

Parturition Areas

We evaluated potential parturition areas from 72 elk-years with location data during the WGFD defined parturition period (15 elk with one year of location data, nine elk with two years of location data, and 13 elk with three years of location data). We found evidence for 54 distinct parturition areas from 31 elk (Figure 4). The mean estimated date of parturition began on 3 June in 2018, 4 June in 2019, and 31 May in 2020. Elk spent an average of 22 days in potential parturition areas.

Movement Corridor Barriers

We did not visually detect barriers to elk movement; however our approach appeared to accurately differentiate elk locations into resting, foraging, and travelling behaviors (Table 1) and to identify potential movement corridors (Figure 5). Elk appeared to cross the North Platte River without restriction, with multiple crossing occurring in two general areas (Figure 6). Elk also crossed Interstate 25 at multiple locations, but there was little evidence to identify a particular location where crossing occurred multiple times (Figure 7).

Table 1. Mean step length (meter [m]) and turning angles (standard error in parenthesis) between successive 2 hour relocations for each behavioral state identified by the segmentation clustering algorithm used to identify potential movement corridors by elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming.

Behavior	Step length (m)	Turning angle
Resting	263.8 (1.3)	178.5 (0.4)
Foraging	479.3 (1.9)	179.3 (0.3)
Travelling	1015.8 (8.2)	178.1 (0.6)

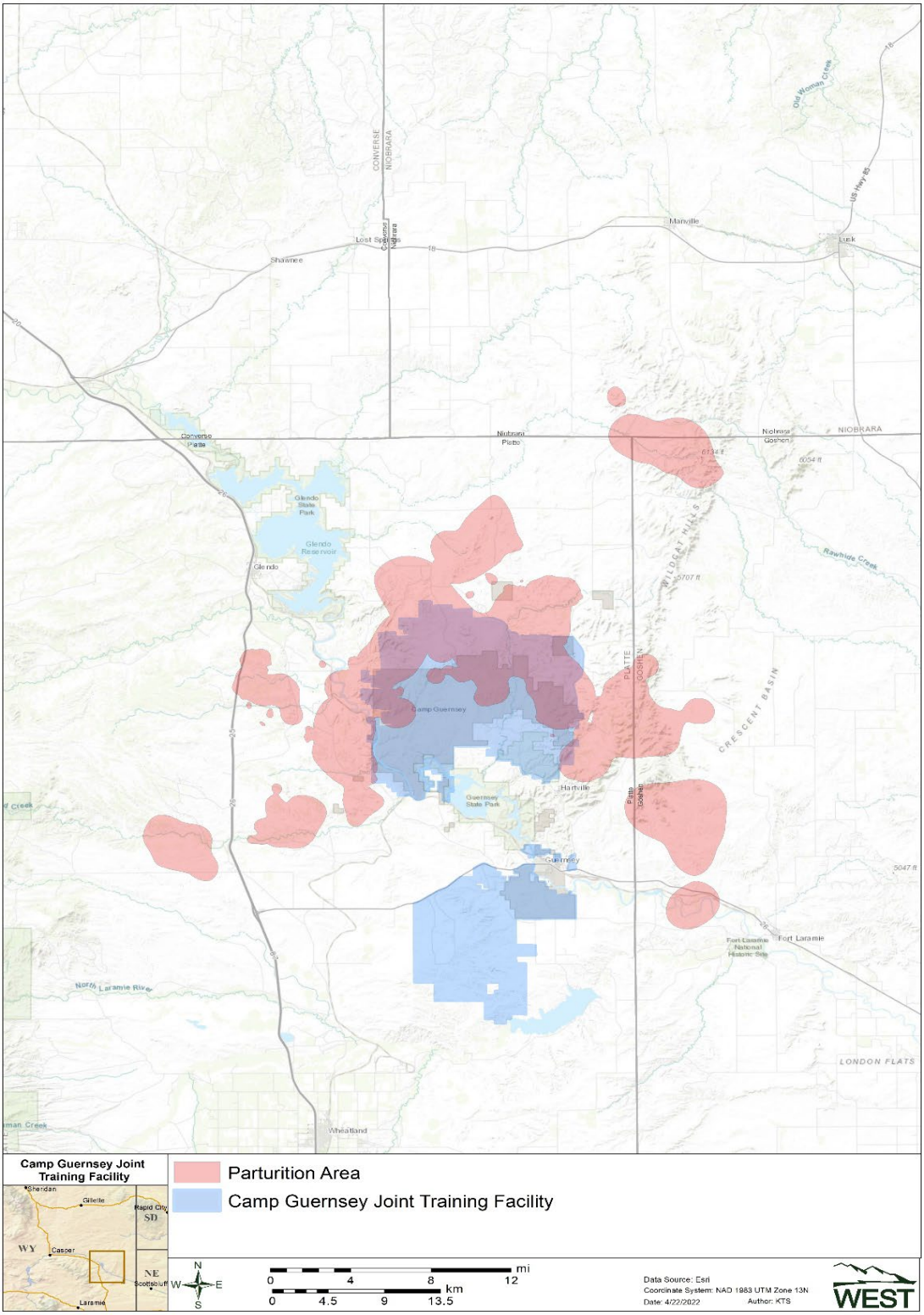


Figure 4. Potential parturition areas of GPS collared female elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming.

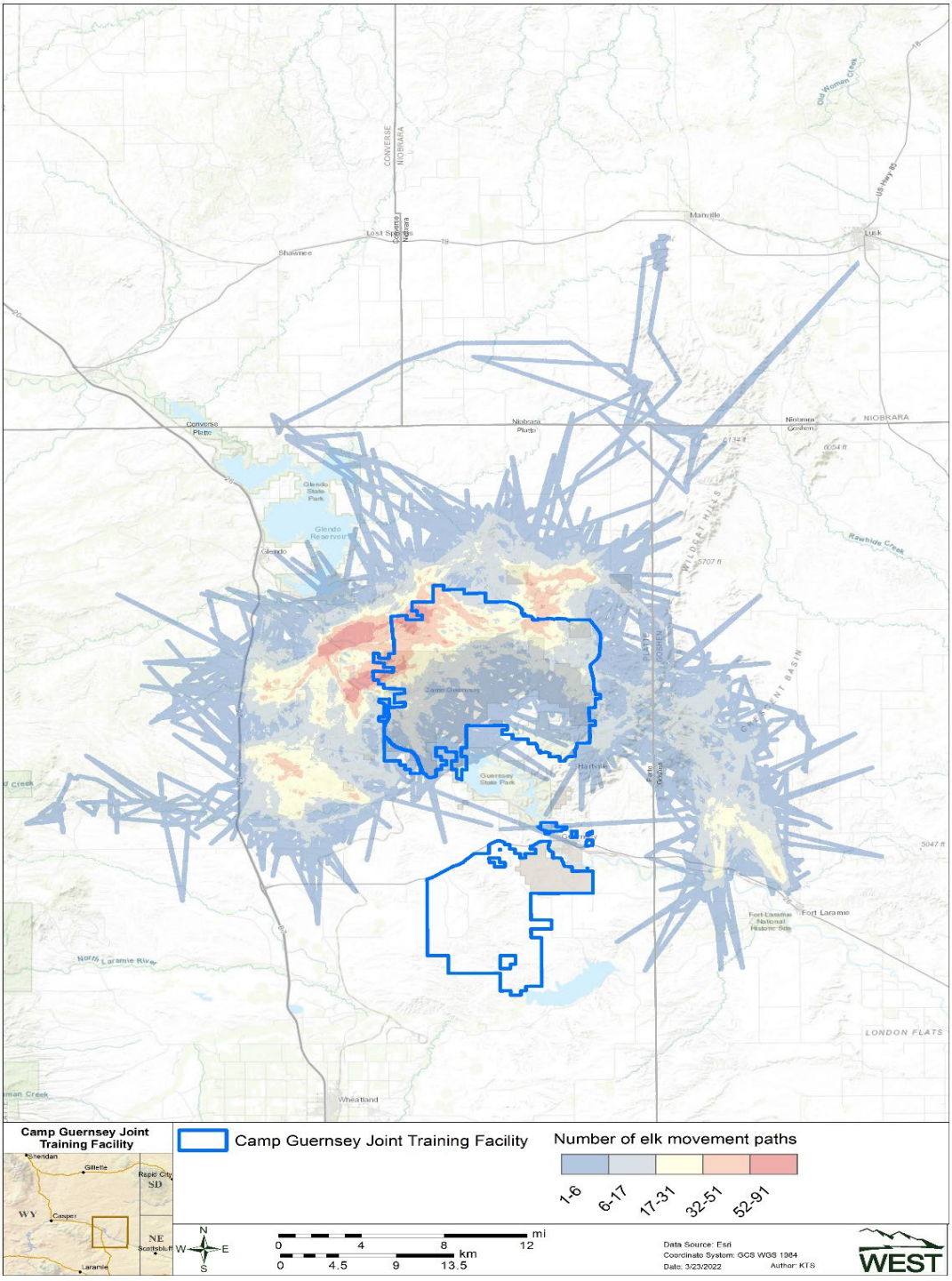


Figure 5. Movement paths of female elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming between January 2018 and February 2021. Individual paths were overlaid to identify areas where one or multiple paths occurred in the same areas (warmer colors indicate a greater number of overlapping paths when compared to cooler colors).

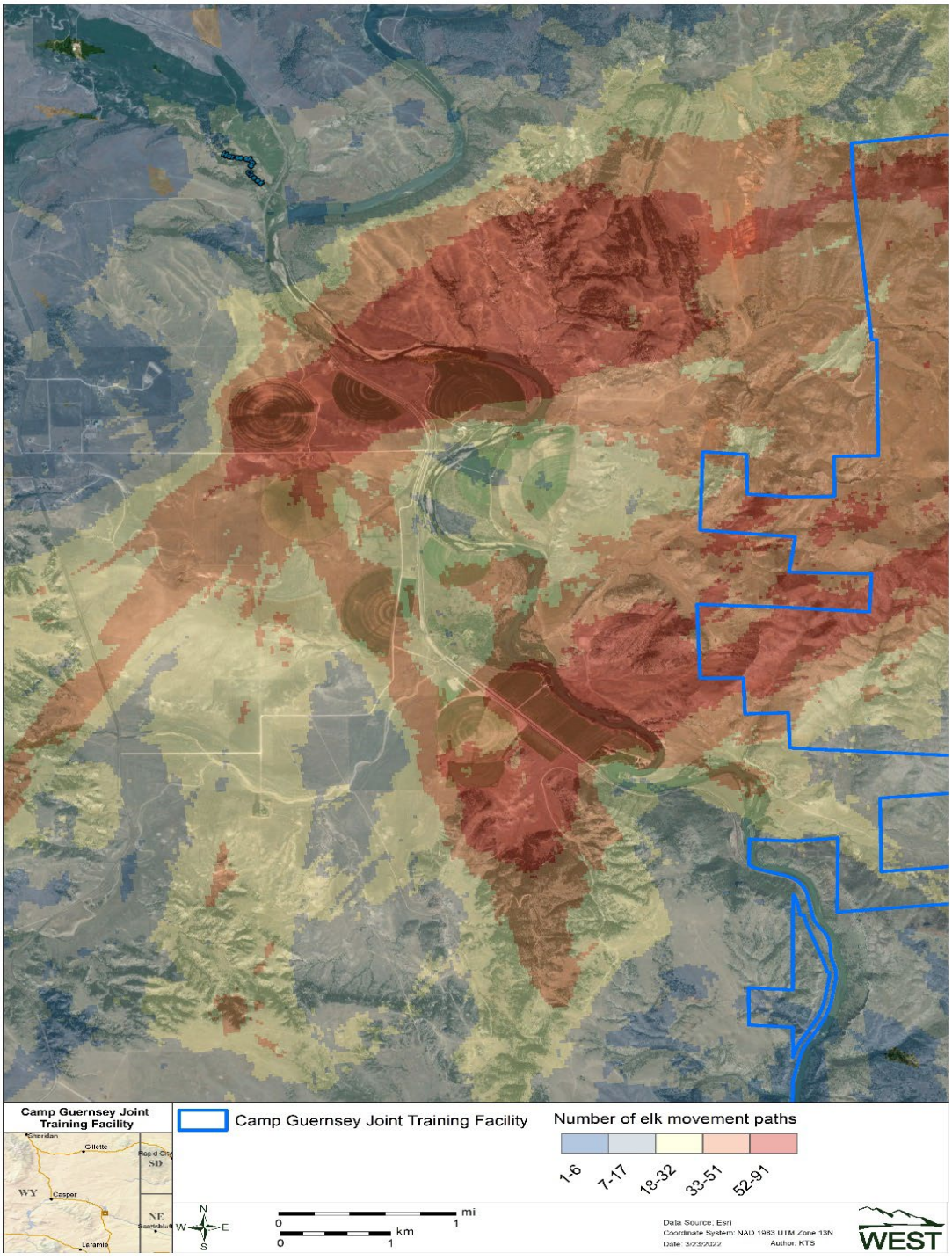


Figure 6. Movement paths of female elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming. The focus of the map is an area where elk appear to frequently cross the North Platte River. Individual paths were overlaid to identify areas where one or multiple paths occurred in the same areas (warmer colors indicate a greater number of overlapping paths when compared to cooler colors)

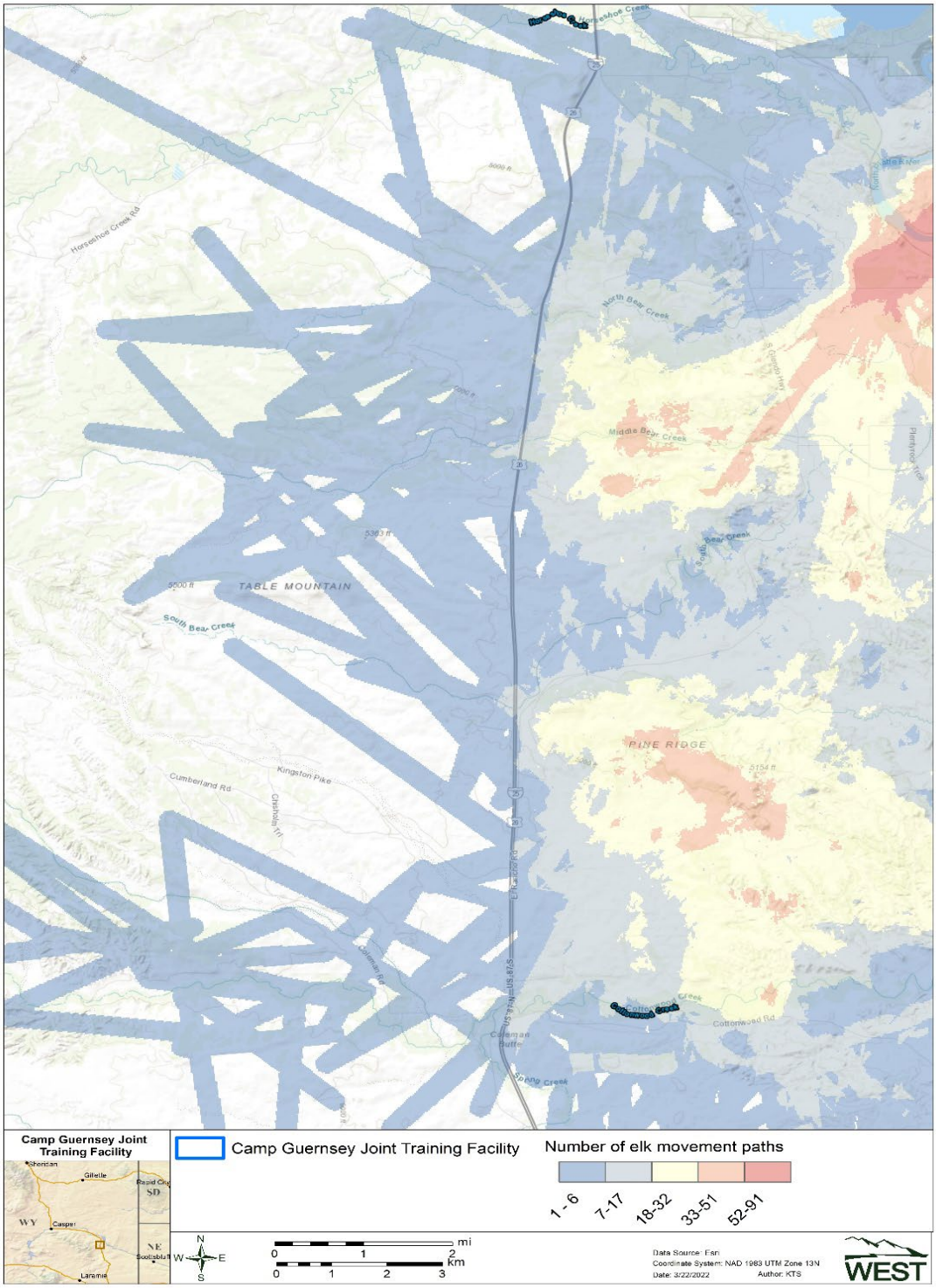


Figure 7. Movement paths of female elk near Interstate 25, Platte County, WY. Individual paths were overlaid to identify areas where one or multiple paths occurred in the same areas (warmer colors indicate a greater number of overlapping paths when compared to cooler colors).

Seasonal Resource Selection Analyses

Summer

The best model explaining elk resource selection during summer included 10 predictor variables (Table 2; Figure 8). No other models were within two AIC points of this model. During summer, elk selected areas with a greater proportion of agriculture within 0.5 km, a greater proportion of forest within 2.5 km, a lower proportion of herbaceous cover within 2.0 km, areas closer to recent fires, and areas farther from old fires. Elk also selected areas with greater terrain roughness at lower elevations and intermediate distances to county roads. Relative probability of selection was greatest at approximately 4.0 km from a county road. Elk avoided areas with a greater proportion of anthropogenic disturbance within 1.5 km and selected areas farther from anthropogenic disturbance.

The spatial prediction of the RSF was a strong positive predictor of elk resource selection during summer (Figure 9). When we partitioned validation testing and training groups by individual elk, we saw an average r^2 = 0.93 ± 0.001 (standard error [SE]) and confidence intervals of slope estimates which included one and excluded zero in all folds.

Table 2. Parameter estimates, standard errors (SE), and 95% confidence intervals (CI) for predictor variables describing female elk resource selection during summer near the Platte County, Wyoming.

			95% CI	
Parameter	**Estimate**	**SE**	**Lower**	**Upper**
Agriculture $_{0.5\ km}$ (%)	0.34	0.002	0.34	0.35
Forest $_{2.5\ km}$ (%)	0.24	0.003	0.24	0.25
Herb $_{2.0\ km}$ (%)	-0.33	0.004	-0.34	-0.33
Elevation (meter)	-0.09	0.004	-0.09	-0.08
Roughness	0.08	0.002	0.08	0.09
Distance to recent fire (km)	-0.51	0.004	-0.51	-0.49
Distance to old fire (km)	0.25	0.004	0.24	0.25
Distance to county road (km)	0.31	0.003	0.30	0.31
Distance to county road^2 (km)	-0.17	0.002	-0.17	-0.16
Anthropogenic $_{1.5\ km}$ (%)	-0.26	0.010	-0.28	-0.23
Distance to anthropogenic (km)	0.25	0.003	0.24	0.26

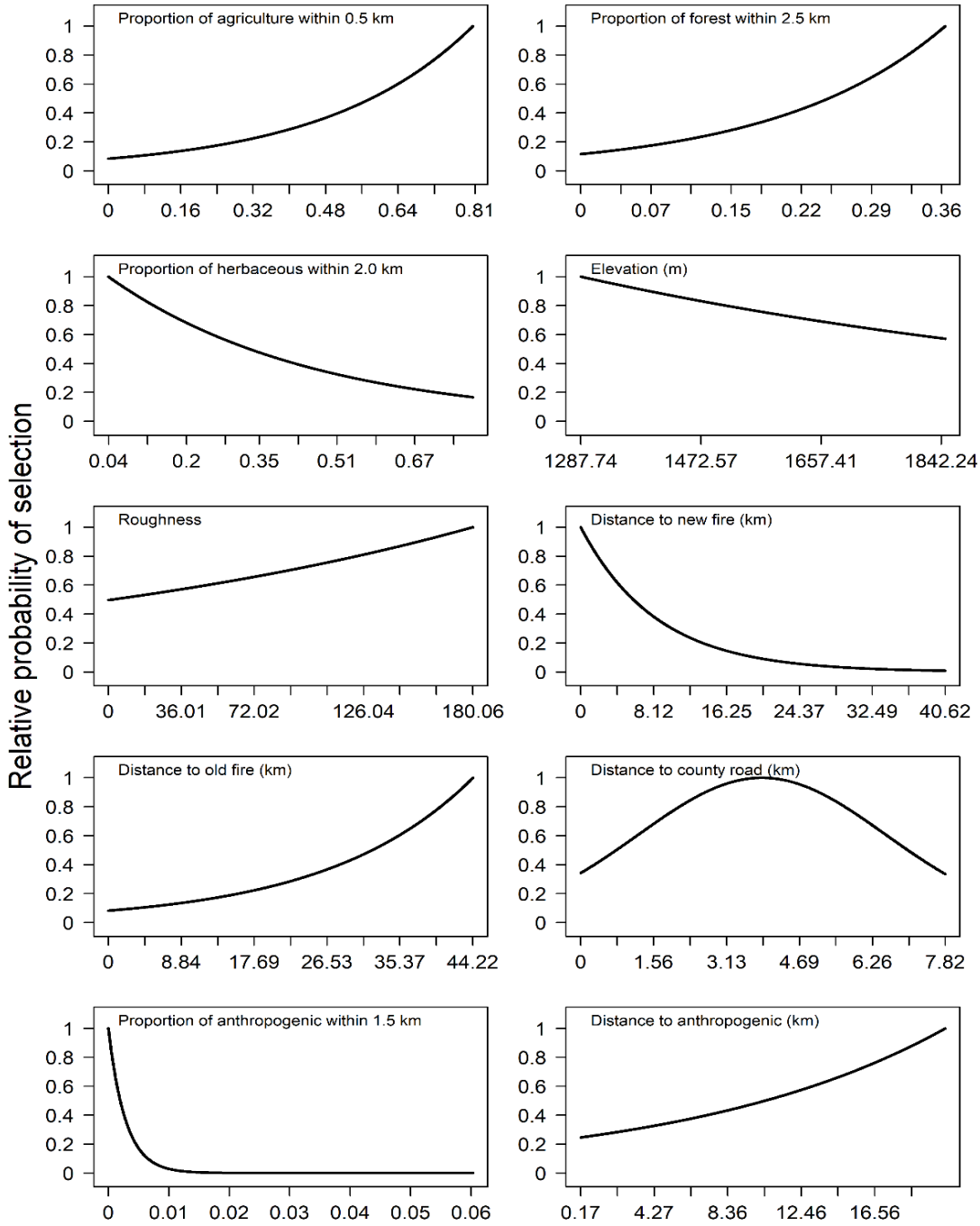


Figure 8. Relative probability of selection as a function of predictor variable in the most parsimonious summer (1 May–14 November) resource selection model for elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming. Relative probability of selection was standardized for each predictor variable by dividing predicted values by their maximum.

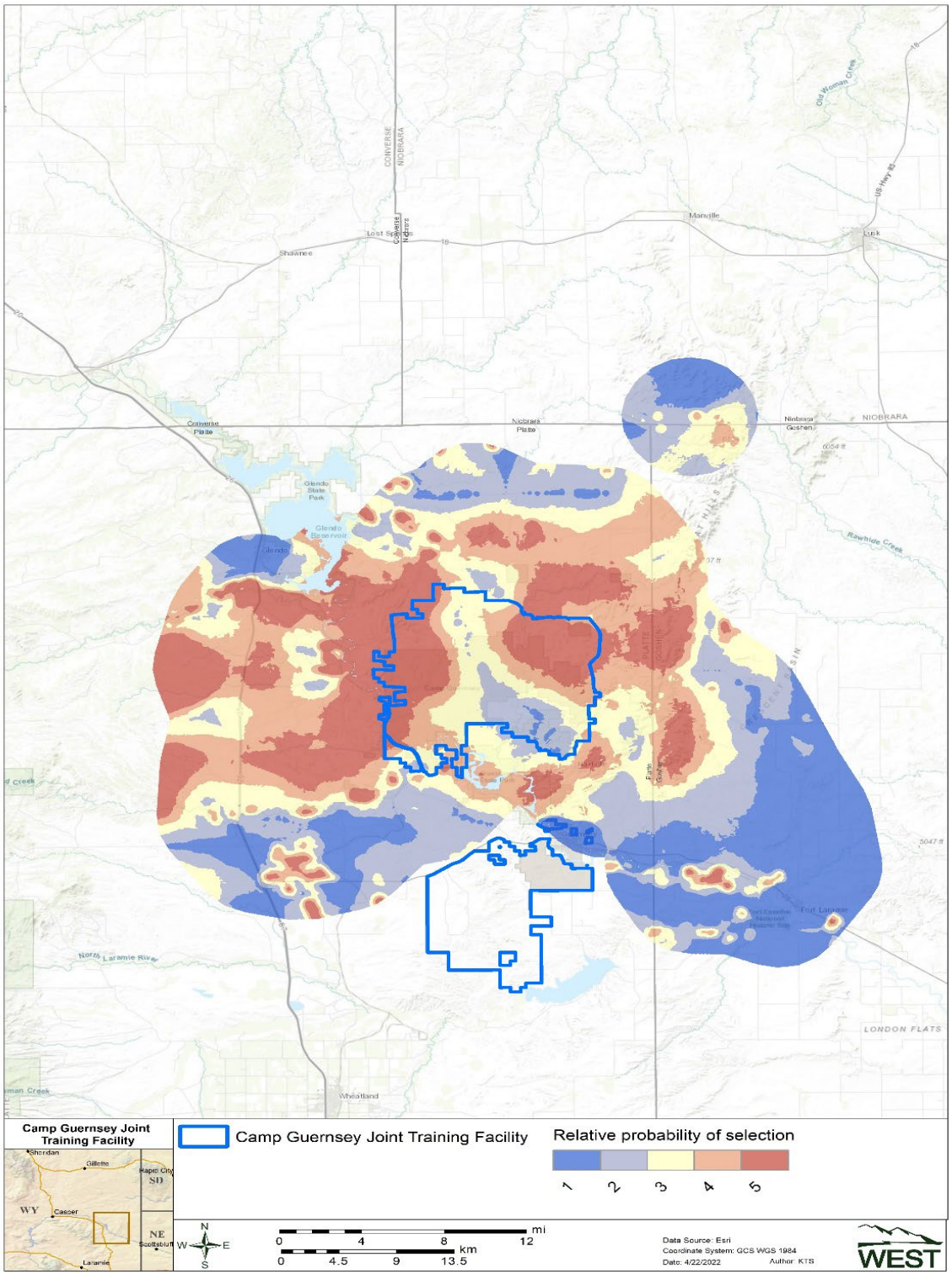


Figure 9. Predicted relative probability of selection by elk during summer (1 May–14 November) using the Camp Guernsey Joint Training Center, Platte County, Wyoming.

Winter

The best model explaining elk resource selection during winter included 10 predictor variables (Table 3; Figure 10). No other models were within two AIC points of this model. During winter, elk selected areas with a greater proportion of agriculture within 0.5 km, a lower proportion of herbaceous cover within 0.5 km, a lower proportion of shrub cover within 0.5 km, and areas closer to recent fires. Elk also selected areas with greater terrain roughness, higher elevations, and intermediate distances to county roads and highways. While elk selected areas with a greater proportion of anthropogenic disturbance within 2.5 km, the maximum proportion of anthropogenic disturbance within 2.5 km of an elk location was low (0.03). Elk selected areas farther from anthropogenic disturbance as indicated by a moderate relationship between anthropogenic disturbance and selection (Figure 10).

The spatial prediction of the RSF was a strong positive predictor of elk resource selection during winter (Figure 11). When we partitioned validation testing and training groups by individual elk, we saw average r^2 = 0.98 ± 0.001 (SE), and confidence intervals of slope estimates which included one and excluded zero in all folds.

Table 3. Parameter estimates, standard errors (SE), and 95% confidence intervals (CI) for predictor variables describing female elk resource selection during winter near the Camp Guernsey Joint Training Facility, Platte County, Wyoming.

			95% CI	
Parameter	**Estimate**	**SE**	**Lower**	**Upper**
$Agriculture_{0.5km}$ (%)	0.31	0.002	0.30	0.31
$Herb_{0.5km}$ (%)	-0.51	0.003	-0.51	-0.50
$Shrub_{0.5km}$ (%)	-0.30	0.003	-0.31	-0.30
Elevation (meter)	0.23	0.004	0.22	0.24
Roughness	0.02	0.003	0.01	0.02
Distance to recent fire (km)	-0.19	0.003	-0.19	-0.18
Distance to county road (km)	0.31	0.003	0.30	0.32
Distance to county road^2 (km)	-0.30	0.003	-0.31	-0.30
Distance to highway (km)	0.06	0.003	0.05	0.06
Distance to highway^2 (km)	-0.08	0.003	-0.09	-0.08
$Anthropogenic_{2.5km}$ (%)	0.26	0.005	0.25	0.27
Distance to anthropogenic (km)	0.008	0.003	0.002	0.01

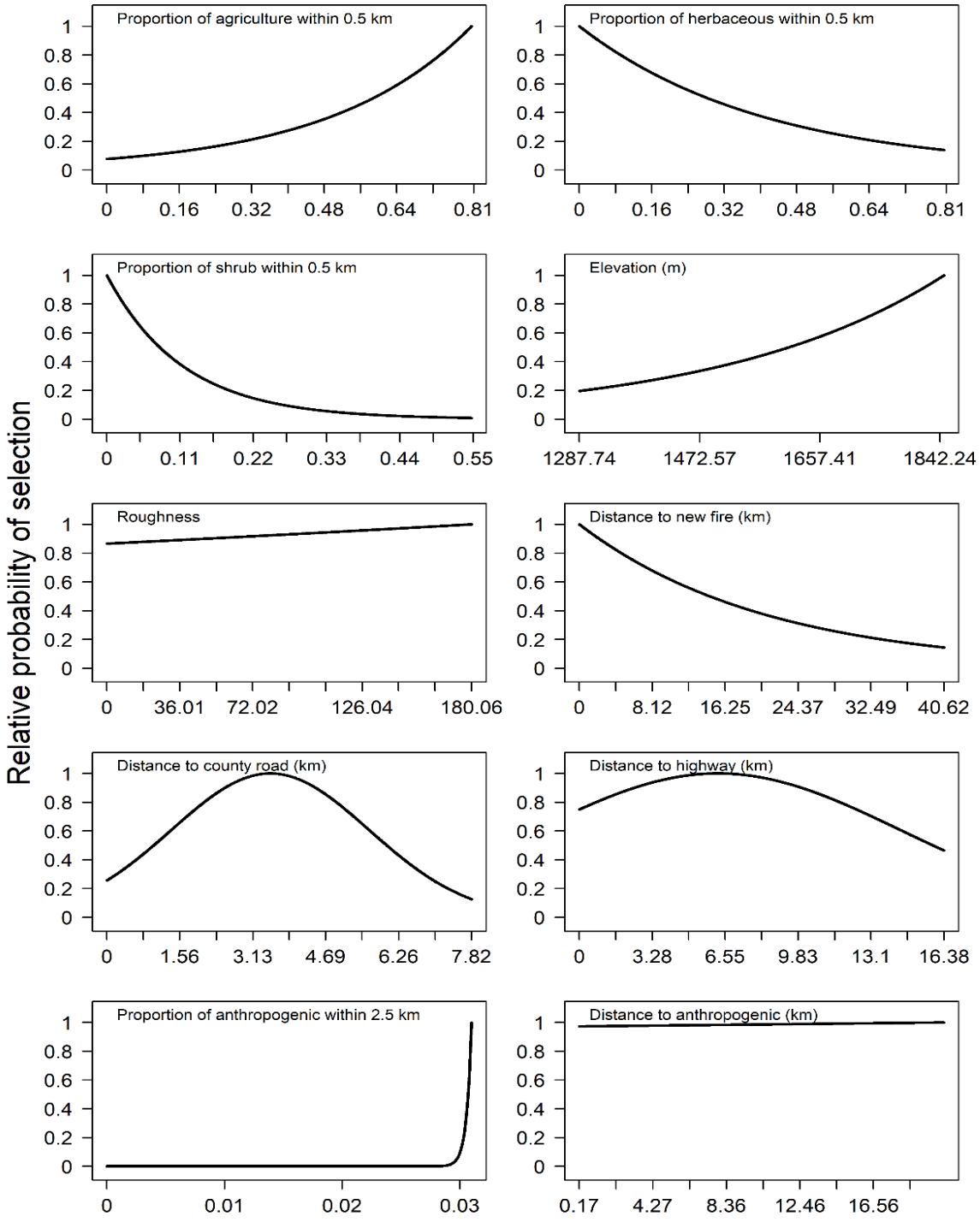


Figure 10. Relative probability of selection as a function of predictor variable in the most parsimonious winter (15 November–30 April) resource selection model for elk using the Camp Guernsey Joint Training Center, Platte County, Wyoming. Relative probability of selection was standardized for each predictor variable by dividing predicted values by their maximum.

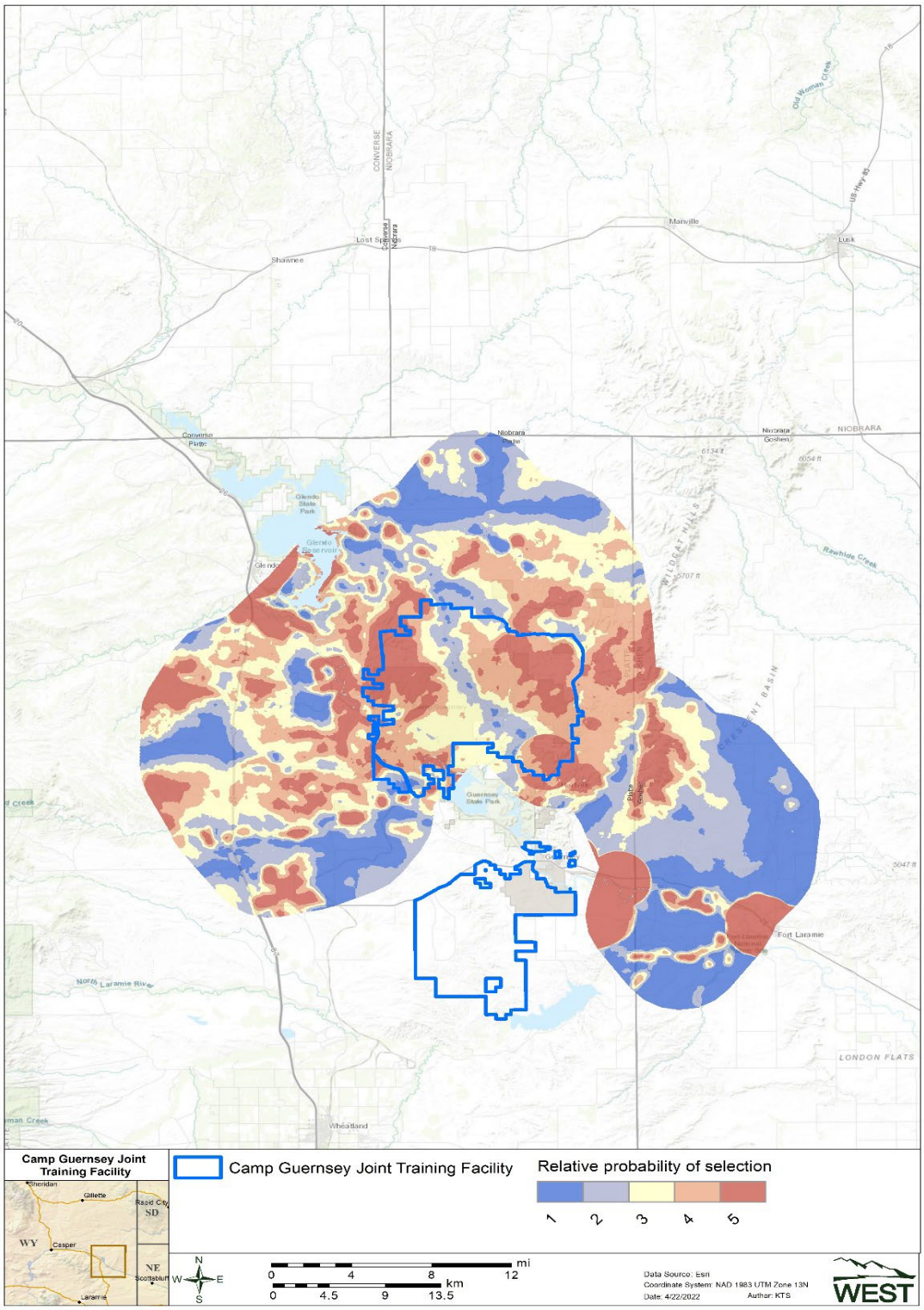


Figure 11. Predicted relative probability of selection by elk during winter (15 November–30 April) using the Camp Guernsey Joint Training Center, Platte County, Wyoming.

Displacement by Military Training Activities

The number of training activities and type of activity varied, but activities were more prevalent during the summer (Table 4). During summer, all models that included a distance to training activity by period interaction term were more informative than base models, suggesting that all activity types led to displacement of elk. Elk response varied by type of activity (Figure 12). However, elk generally selected areas farther from military training during and after the occurrence of the activity when compared to their location before the activity (Figure 13). Across all activity types, on average, elk moved 0.14 km and 0.54 km from the training activity during and after the activity, respectively (Table 4; Figure 13). Elk also tended to decrease their step lengths and selected more rugged areas during the activity.

Similar to summer models, all training activities during winter appear to displace elk (Figure 14). During winter, elk selected areas farther from training activities during and after their occurrence (Figure 15). Elk on average moved 0.22 km and 0.70 km away during and after the activity, but this varied by activity type (Table 4). Elk also tended to select more rugged areas during the training activity (Figure 15). Similar responses were not observed in models for individuals that were >10.0 km from a training activity during summer or winter.

Table 4. Mean displacement distance during and after training actives and the total number of activities used to assess displacement of elk near the Camp Guernsey Joint Training Facility, Platte County, Wyoming.

Parameter	Mean displacement–During (kilometer)	Mean displacement–After (kilometer)	Number of events
Summer			
Aerial	0.39	0.75	79
Aerial fire	0.06	0.64	71
Large range fire	0.21	0.58	51
Range fire	0.20	1.11	25
Personnel	0.11	0.51	1,583
Vehicle	0.34	0.46	22
All activities	0.14	0.54	1,831
Winter			
Aerial	0.61	1.53	50
Aerial fire	0.16	1.01	96
Large range fire	0.38	0.64	4
Range fire	1.51	2.95	17
Personnel	0.14	0.46	478
Vehicle	--	--	0
All activities	**0.22**	**0.70**	**645**

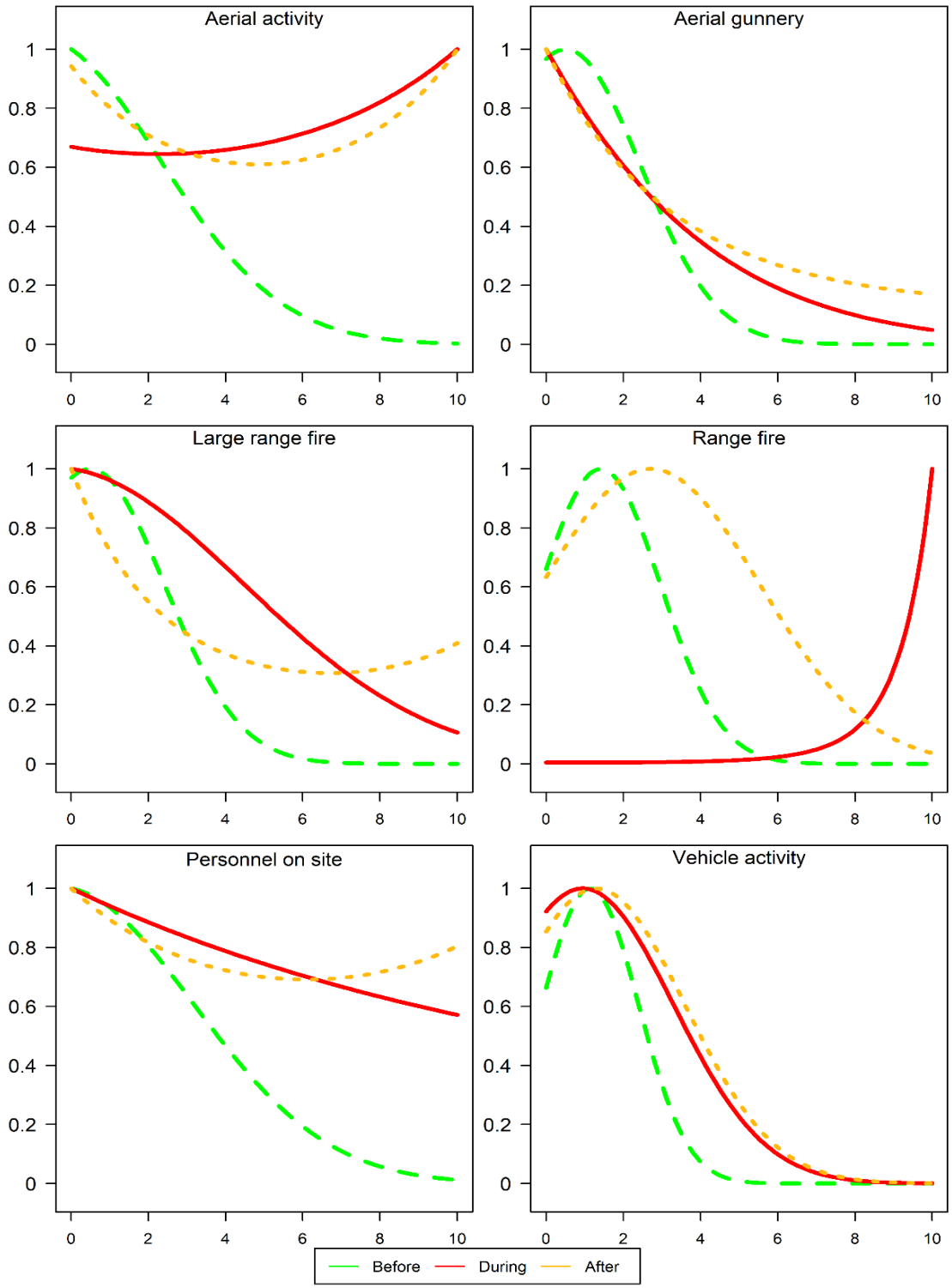


Figure 12. Relative probability of elk summer resource selection as a function of distance to aerial activity, aerial gunnery, large range fire, range fire, personnel on site, and vehicle activity before, during, and after the activity at the Camp Guernsey Joint Training Center, Platte County, Wyoming.

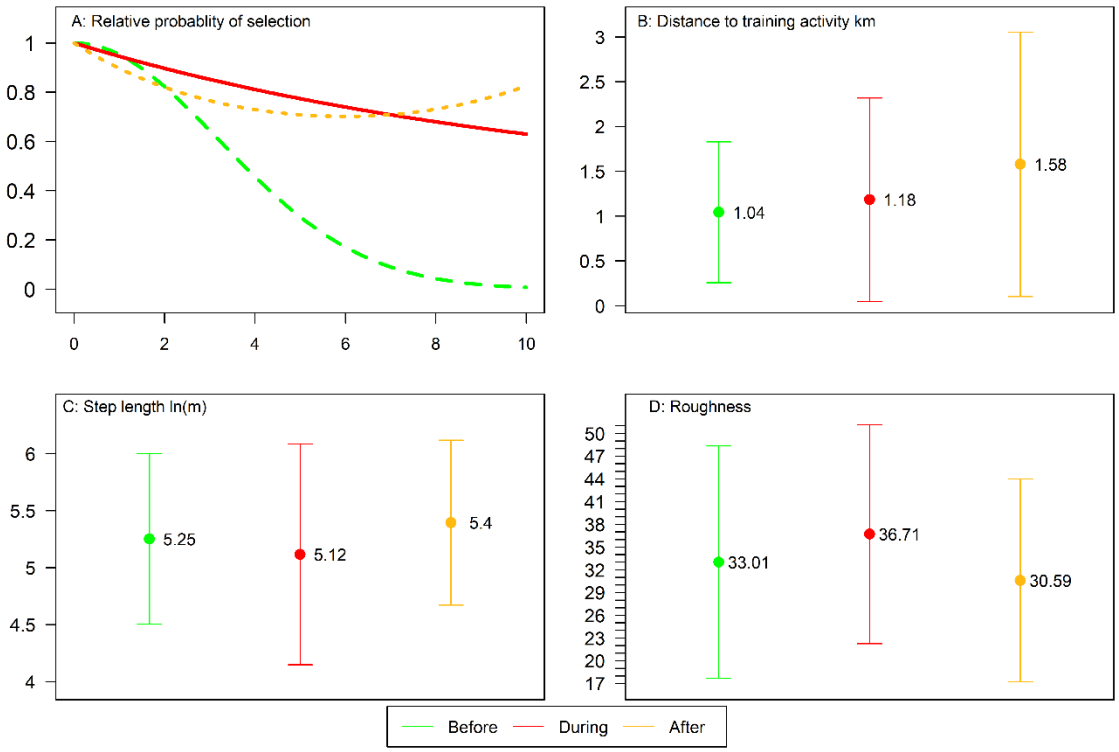


Figure 13. Relative probability of elk resource selection as a function of distance to training activity (A), mean (± range) distance to training activity (B), mean (± range) natural log of step length (C), and mean (± range) roughness (D), before, during, and after all summer training activities at the Camp Guernsey Joint Training Center, Platte County, Wyoming.

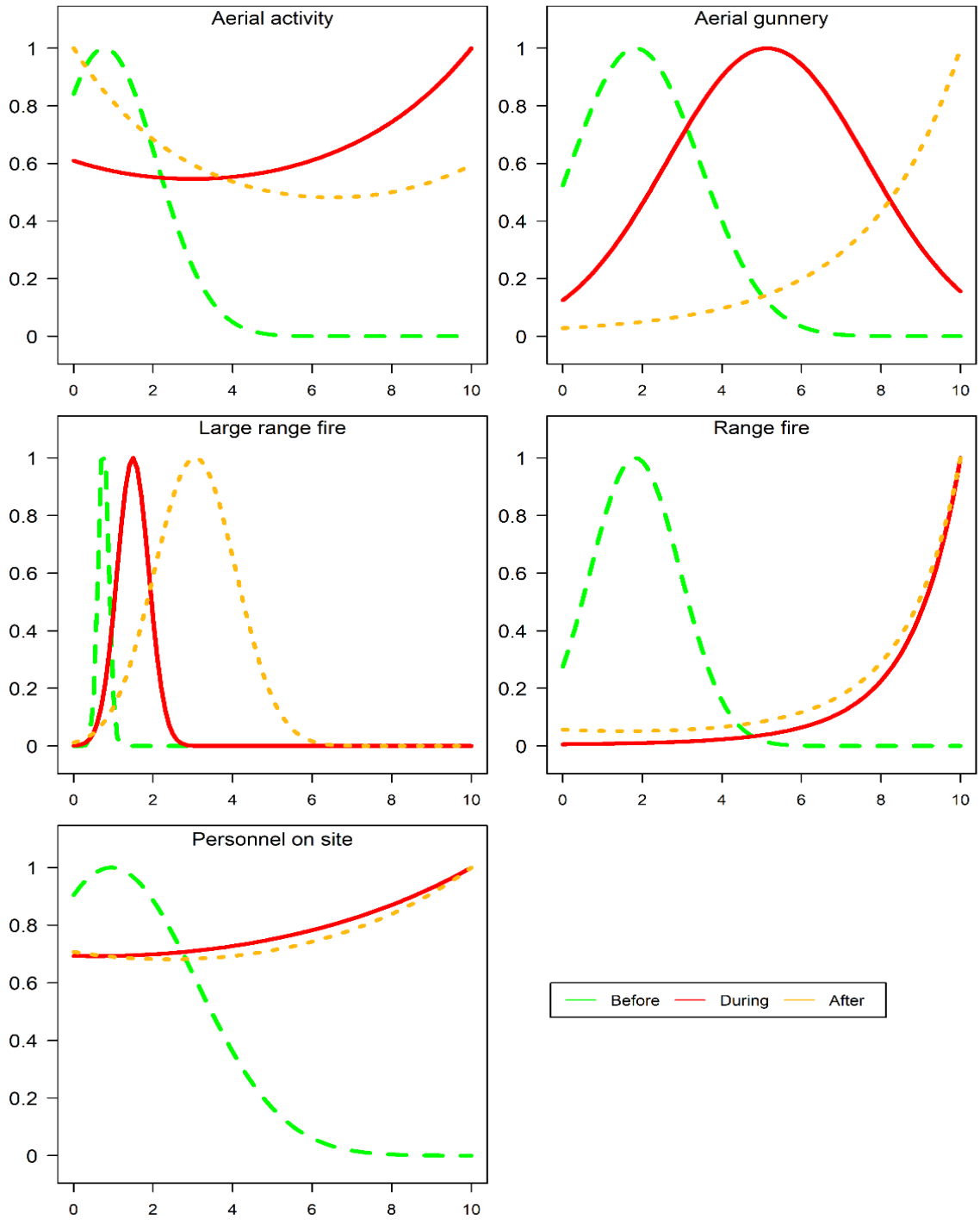


Figure 14. Relative probability of elk winter resource selection as a function of distance to aerial activity, aerial gunnery, large range fire, range fire, personnel on site, and vehicle activity before, during, and after the activity at the Camp Guernsey Joint Training Center, Platte County, Wyoming.

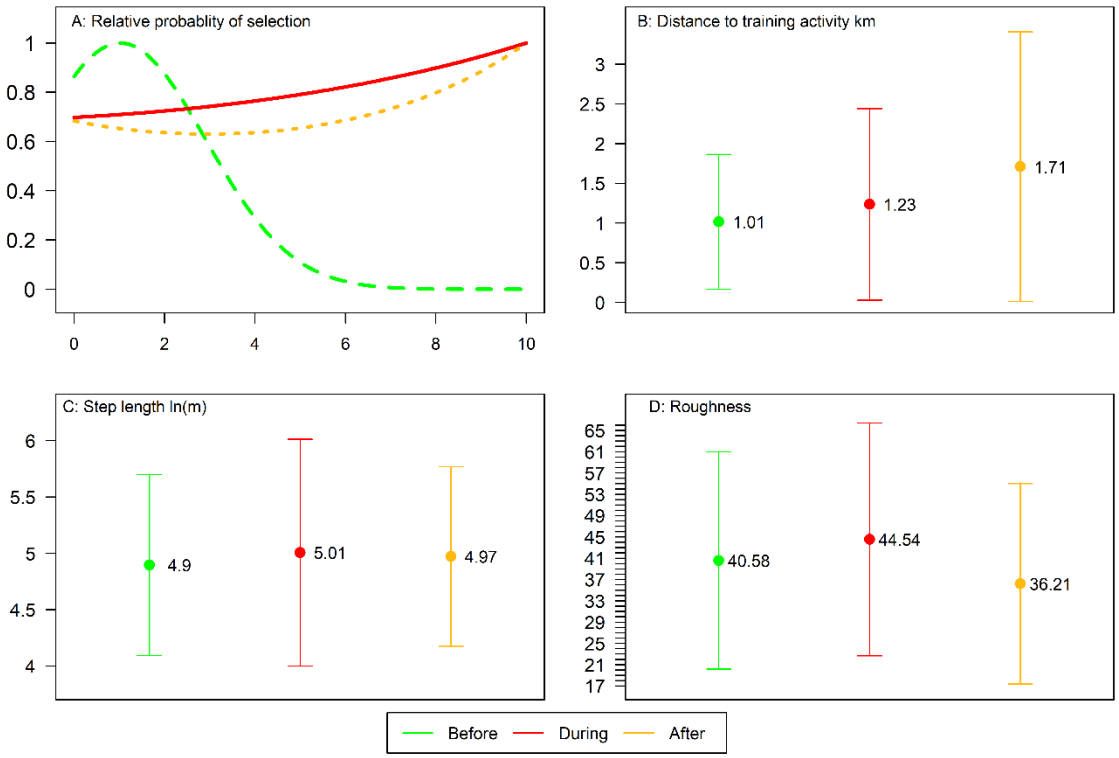


Figure 15. Relative probability of elk resource selection as a function of distance to training activity (A), mean (± range) distance to training activity (B), mean (± range) natural log of step length (C), and mean (± range) roughness (D), before, during, and after all summer training activities at the Camp Guernsey Joint Training Center, Platte County, Wyoming.

Displacement by Hunting Activities

We failed to detect a meaningful relationship between the distance of elk from the center of the training facility and the number of hunters on Camp Guernsey or the total harvest reported from Camp Guernsey each day.

DISCUSSION

The purpose of this study was to determine, and to what extent, habitat selection and movement of elk from the Rawhide Herd was impacted by a variety of external factors. Using location data from GPS collared female elk, we assessed location and timing of elk seasonal ranges, location and timing of elk parturition areas, movement barriers, seasonal resource selection, and elk displacement by military training and hunting activities. We were able to determine some seasonal ranges for individual elk, but temporal and spatial trends were lacking across the herd, suggesting that the Rawhide elk herd is likely a resident population that utilizes similar yearlong habitats. We were able to identify spatial and temporal bounds for parturition areas. These findings can be used by Camp Guernsey staff, particularly if they want to consider parturition areas when planning timing and location of training exercises. We did not find any obvious barriers to movement when considering major potential barriers (i.e., the North Platte River and Interstate 25) and more diffuse barriers (i.e., roadways and railways). We found many relationships using the RSF models to explain elk resource selection. A few trends were evident in both summer and winter models, including elk avoidance of anthropogenic features, selection for areas farther away from old fires, selection for areas close to recent fires, and selection for areas with higher agricultural density. Elk appeared to respond to military training activities by selecting habitats farther from the activity, though the degree of response varied depending on the type of training and seasonality. We did not find any meaningful relationships between hunter activity and elk movement or resource selection.

The elk location dataset available for this study was robust and enabled us to adequately address most of the research questions. The same was true for the military training exercise data. One limitation of the elk location data was the fix rate of the dataset when compared to the military training data. Some of the military training exercises were short in duration and it was difficult to detect responses by elk to these short duration exercises with the two hour fix rate. Another limitation was the hunting activity data. We did not have hunter location data to pair with elk location data, only the number of hunters in the facility on a given day. The coarseness of the data led to inconclusive model results.

There were a few unexpected results, particularly with the RSF models. Elk selected for higher elevation in winter. Elk also selected more strongly for rougher terrain in both summer and winter. These relationships were contrary to our expectations. We also saw a unimodal relationship between distance to roads (highway and county roads) and relative selection. We assume that this relationship is due to the inability of elk to move far away from roads due to road density and not due to selection for a certain proximity to roads.

There are opportunities for future research of the Rawhide Herd to better address the research questions of this project. Most of the research questions could be better addressed with shorter fix rate location data. This is particularly true for determining the impact of military training exercises on elk resource selection and movement. More fine scale temporal data would allow for better comparisons with the training data. Fine scale temporal data would also be useful to determine relationships between hunting pressure and elk responses. Additional hunter use data,

including hunter location (i.e., hunter GPS location) would also be helpful including hunter location data (i.e., hunter GPS location data), as well as specific coordinates of elk harvest and failed harvest attempts.

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2022 - JCR Evaluation Form

SPECIES: Bighorn Sheep
PERIOD: 6/1/2022 - 5/31/2023

HERD: BS516 - DOUGLAS CREEK

HUNT AREAS: 18
PREPARED BY: LEE KNOX

	2017 - 2021 Average	2022	2023 Proposed
Population:		N/A	N/A
Harvest:	1	1	3
Hunters:	1	1	3
Hunter Success:	100%	100%	100 %
Active Licenses:	1	2	100
Active License Success:	100%	100%	3 %
Recreation Days:	4	4	20
Days Per Animal:	4	4	6.6

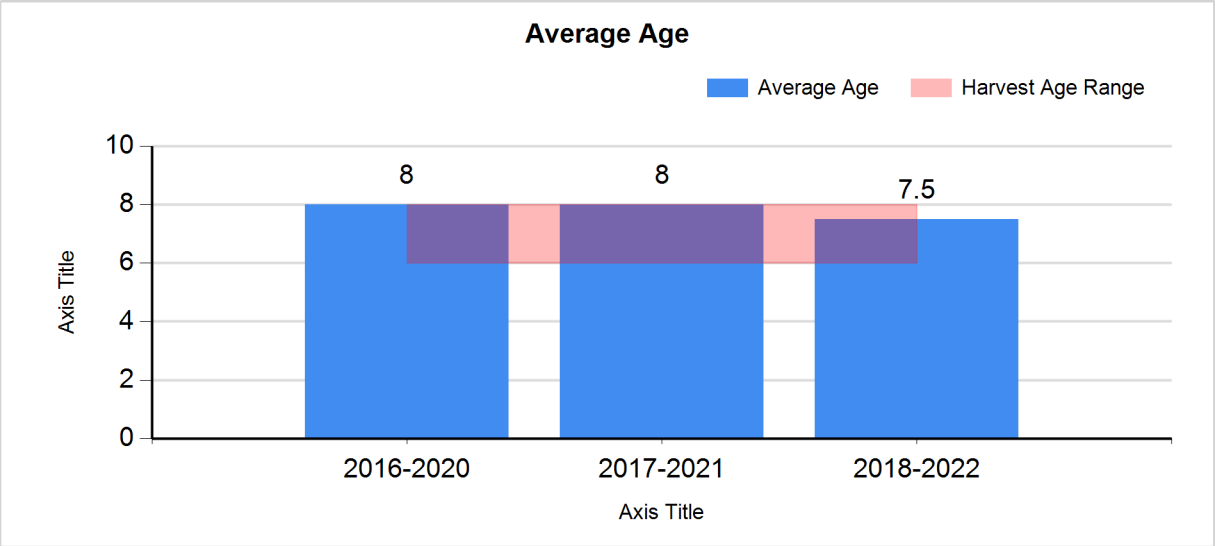
Limited Opportunity Objective:

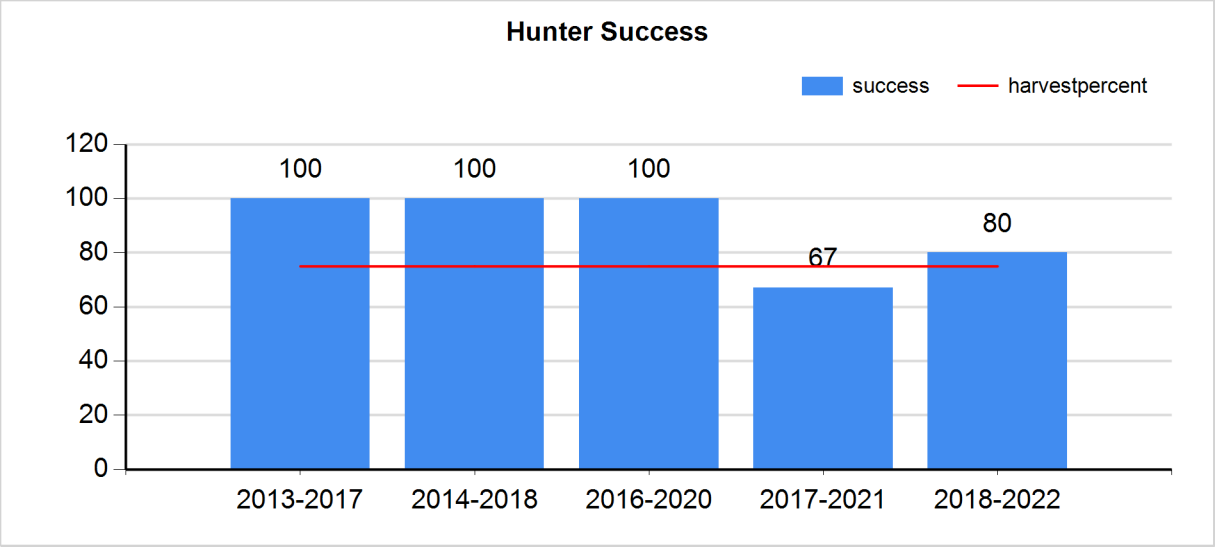
5-year average of > 75% hunter success

5-year average harvest age of 6-8 years

Secondary Objective:

Management Strategy: Special




Hunter Success
success
harvestpercent
120
100
80
60
40
20
0
100
100
100
67
80
2013-2017
2014-2018
2016-2020
2017-2021
2018-2022

2023 Hunting Seasons
Douglas Creek Bighorn Sheep Herd Unit (BS 516)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
18	1	Aug. 15	Aug. 31	Sep. 1	Nov.30	3	Any ram (3 residents)

Current Management Objective: Bighorn Sheep Limited Opportunity

1) 5-year running average of >75% hunter success
   - Currently Met: 2018-2022 Hunter Success- 100%
2) 5-year running average age of harvested rams between 6 and 8 years of age
   - Currently Met: 2018-2022 Harvest Mean Age- 8 years of age
3) Documented occurrence of adult rams in the population
   - Currently Met: > 12 adult rams observed in 2022

2023 Management Summary

1.) Hunting Season Evaluation The 2022 hunting season structure provided one resident hunter and one nonresident hunter the opportunity to harvest mature rams in hunt areas 18 or 21. One ram was harvested in hunt area 18 and the other in hunt area 21. The 2023 hunting season structure will provide three resident hunters the opportunity to harvest mature rams in hunt area 18. Based on frequent observations of mature rams in Douglas Creek (hunt area 18) and Encampment River (hunt area 21), managers elected to forgo the traditional season structure and provide more opportunity by allocating separate license quotas for each hunt area. We expect hunters will have a high likelihood of success and this herd will continue to meet the bighorn sheep limited opportunity management objectives.

2.) Management Objective Review: The management objective for the Douglas Creek Herd Unit is a limited opportunity. The herd management objective was reviewed in 2021 and will be reviewed again in 2026.

3.) Research: We collared 19 adult ewes, including 6 recaptures, from the Douglas Creek Herd Unit on February 12, 2022. The median age was 4.5, with the oldest being 9.5, and the youngest 3.5. Ambient temperatures during capture were between -5 and +32 degrees that day, however we still had 7 of the 19 ewes come in at over 105 degrees. All were cooled quickly with alcohol, and only one had to be released due to temps not declining. We discussed this with the crew and decreased chase times and herds were given more time between captures. We did have a few injuries including a bloody mouth, cut on leg, and a nasty torn scalp between horns, which were all treated. We did not have any post capture mortalities. To date we have had three mortalities, with the first mortality documented on July 5th. I was unable to get to the site in time to determine the cause of death. The second mortality was on September 7th. This ewe was found next to the Platte River near another older mortality of an unmarked yearling ewe. During the field necropsy

it was discovered that she had a severe case of pneumonia. M. ovi was not found during the first testing of Douglas Creek sheep in 2019, but unfortunately it was found in 12 of the 19 ewes sampled in 2022 (appendix A).

Additionally we are seeing an increased movement into areas of the burn that were not previously utilized which is encouraging, but they still have strong fidelity to an old burn scar between the Platte and Savage Wilderness areas. Lamb surveys have proven difficult during the summer, but the best count was around 50:100 lambs to ewes.

4.) Habitat Annual precipitation in Hunt Area 18 was below normal in 2022. Winter severity was light to moderate, likely resulting in little to no significant mortality events. While no NOAA weather stations are close to the vicinity of occupied bighorn sheep habitats in Hunt Area 18, weather stations in Laramie and Rawlins reported declines in annual precipitation by 37% and 23%, respectively.

In September 2020, the Mullen Fire burned approximately 176,800 acres in the Snowy Range, including two wilderness areas. The western third of the burn area encompasses occupied bighorn sheep habitat. The wildfire likely increased line of sight visibility and created more open travel corridors for bighorn sheep, aiding their movements to escape terrain and lambing habitats. High fire severity in places is a continued cause for concern for cheatgrass invasion in Savage Run and Platte River wilderness areas, as well as other areas adjacent to North Platte River. In 2021, 10,334 acres on the western slope of the Snowy Range were aerially treated with the herbicide Rejuvra. A large-scale monitoring effort was completed by USFS, WGFD, and USGS in 2022 to evaluate herbicide efficacy one year post-treatment. Native, perennial grass recovery looks promising thus far. Plant species diversity was comparable pre- and post-treatment with the exception of a few native annual forbs. Cheatgrass was documented in areas where soil movement had occurred. Additionally, high densities of cheatgrass were documented within the no-spray buffer around the North Platte River. We will continue to monitor herbicide efficacy in 2023 and evaluate the need for retreatment.

Antelope bitterbrush, serviceberry, and big sagebrush seedlings were observed throughout the burn scar, which is a promising sign for shrub recovery. Several thousand mixed mountain shrub seedlings were planted west of the North Platte River in the fall of 2021 and 2022 by USFS, WGFD, and volunteers to aid in recovery. Collars affixed to bighorn sheep in Hunt Area 18 will provide useful information on resource use and habitat selection pre- and post-fire.

Appendix A

Disease Sampling Report

Thursday, February 24, 2022

Douglas Creek 2022 BHS Herd Health Surveillance Report

Animal ID	Date Sampled	Location	Nasal culture/PCR final	Tonsil culture/PCR final
22-031	2/12/2022	A bar A Ranch	M. ovipneumoniae	LKT+ Mannheimia haemolytica/glucosida, LKT+ Mannheimia sp., P. multocida
22-032	2/12/2022	A bar A Ranch	M. ovipneumoniae	LKT+ Mannheimia haemolytica/glucosida, LKT+ Mannheimia sp., P. multocida
22-033	2/12/2022	A bar A Ranch	NSP	LKT+ Mannheimia sp., P. multocida
22-034	2/12/2022	A bar A Ranch	M. ovipneumoniae	LKT+ Mannheimia sp., P. multocida
22-035	2/12/2022	A bar A Ranch	M. ovipneumoniae	LKT+ Mannheimia sp.
22-036	2/12/2022	A bar A Ranch	NSP	LKT+ Mannheimia sp., P. multocida
22-037	2/12/2022	A bar A Ranch	NSP	hemolytic B. trehalosi (no leukotoxin)
22-038	2/12/2022	A bar A Ranch	NSP	LKT+ Mannheimia haemolytica/glucosida, LKT+ Mannheimia sp.
22-039	2/12/2022	A bar A Ranch	M. ovipneumoniae	LKT+ Mannheimia sp., P. multocida
22-040	2/12/2022	A bar A Ranch	M. ovipneumoniae	LKT+ Mannheimia sp., P. multocida
22-041	2/12/2022	State line	NSP	LKT+ Mannheimia sp.
22-042	2/12/2022	State line	NSP	LKT+ Mannheimia sp., P. multocida
22-044	2/12/2022	A bar A Ranch	NSP	NSP

NSP = No significant pathogens NA = No samples received

Animal ID	Date Sampled	Location	Nasal culture/PCR final	Tonsil culture/PCR final
22-045	2/12/2022	A bar A Ranch	M. ovipneumoniae	LKT+ Mannheimia sp., P. multocida
22-046	2/12/2022	A bar A Ranch	M. ovipneumoniae	LKT+ Mannheimia sp.
22-048	2/12/2022	A bar A Ranch	M. ovipneumoniae	LKT+ Mannheimia sp., P. multocida
22-049	2/12/2022	A bar A Ranch	M. ovipneumoniae	LKT+ Mannheimia sp.
22-105	2/12/2022	Douglas Creek	M. ovipneumoniae	
22-106	2/12/2022	Douglas Creek	M. ovipneumoniae	

NSP = No significant pathogens NA = No samples received

2022 - JCR Evaluation Form

SPECIES: Bighorn Sheep

PERIOD: 6/1/2022 - 5/31/2023

HERD: BS517 - LARAMIE PEAK

HUNT AREAS: 19

PREPARED BY: KEATON WEBER

	2017 - 2021 Average	2022	2023 Proposed
Population:		N/A	N/A
Harvest:	8	6	8
Hunters:	8	7	10
Hunter Success:	100%	86%	80%
Active Licenses:	8	7	10
Active License Success:	100%	86%	80%
Recreation Days:	83	97	140
Days Per Animal:	10.4	16.2	17.5

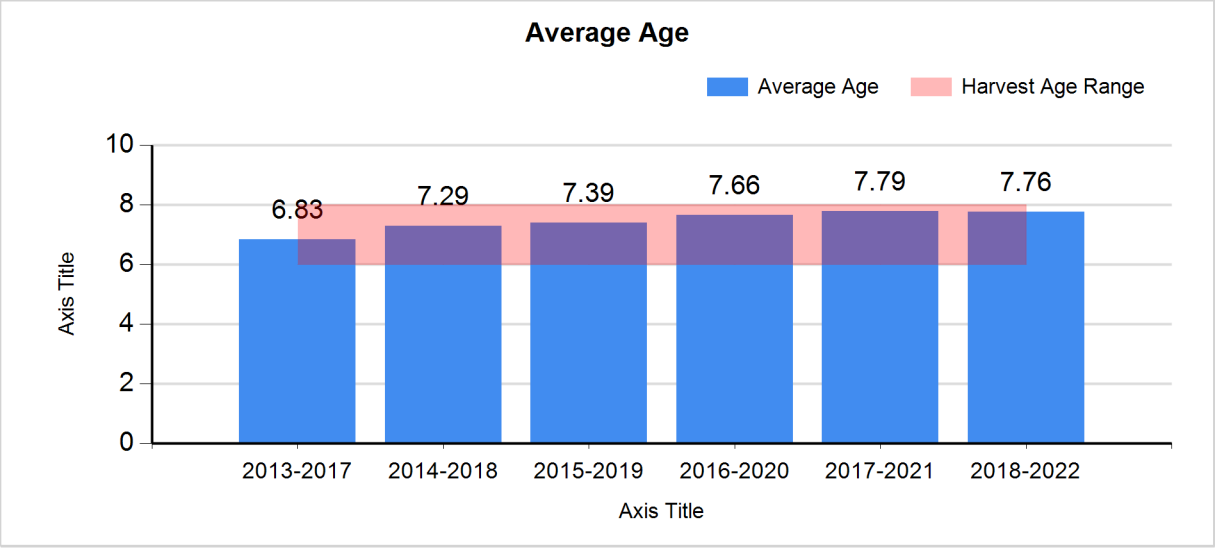
Limited Opportunity Objective:

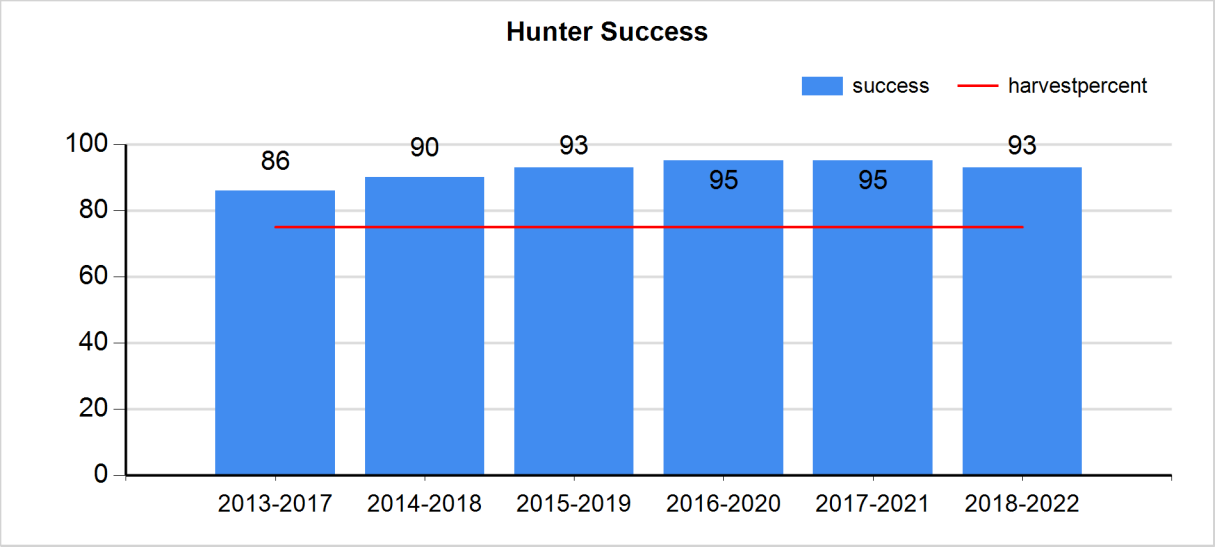
5-year average of > 75% hunter success

5-year average harvest age of 6-8 years

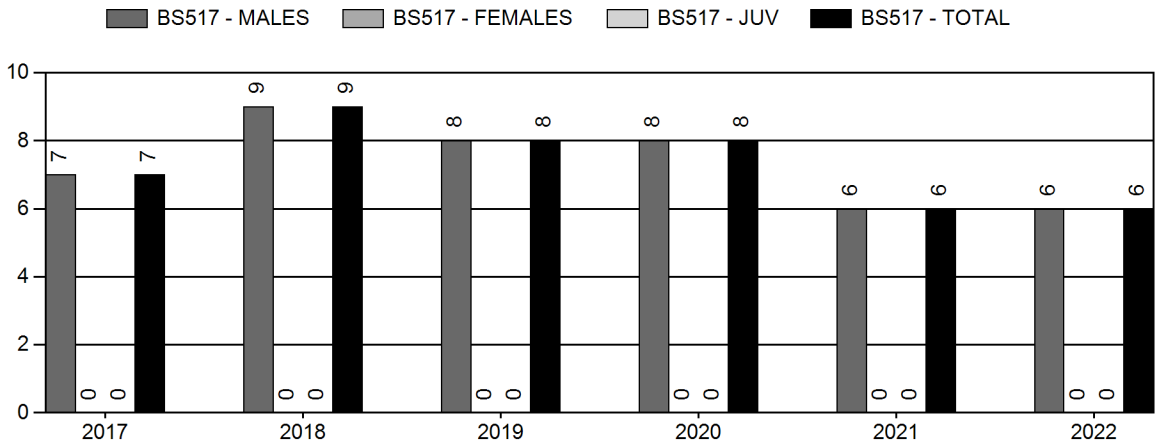
Secondary Objective:

Management Strategy: Special

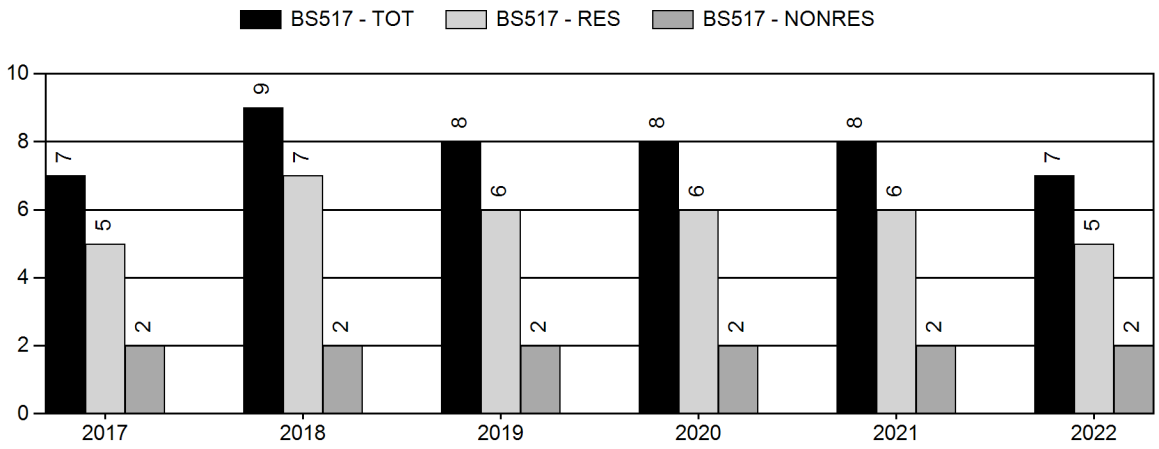



Hunter Success
success
harvestpercent
100
80
60
40
20
0
86
90
93
95
95
93
2013-2017
2014-2018
2015-2019
2016-2020
2017-2021
2018-2022

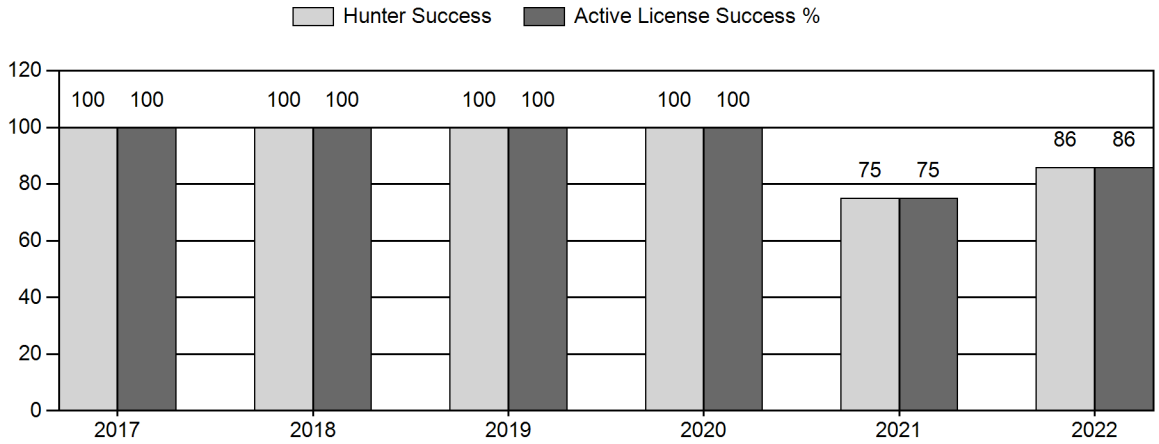
Harvest



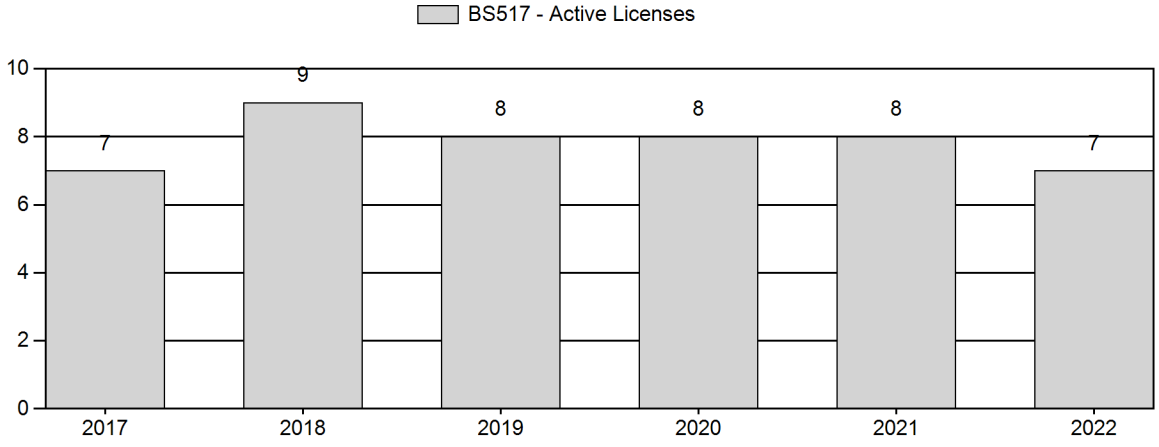
Number of Hunters



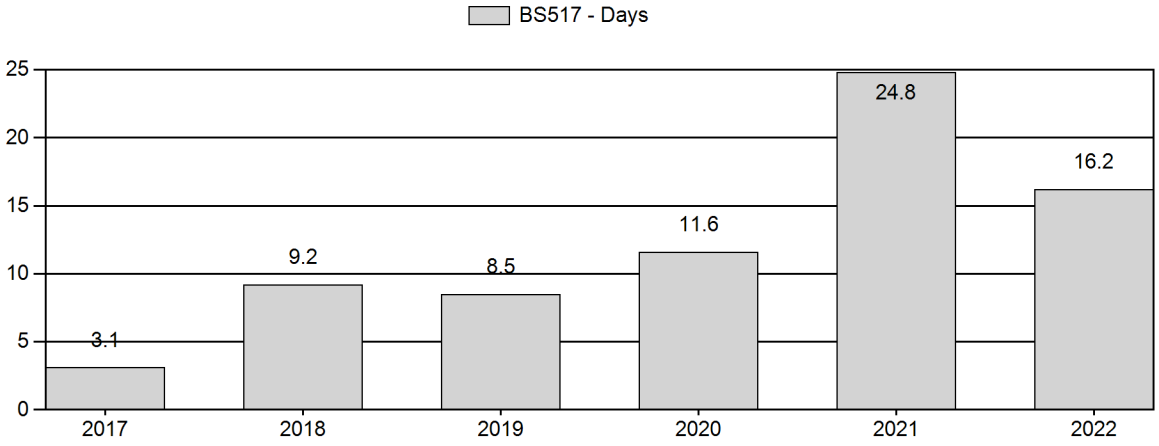
Harvest Success



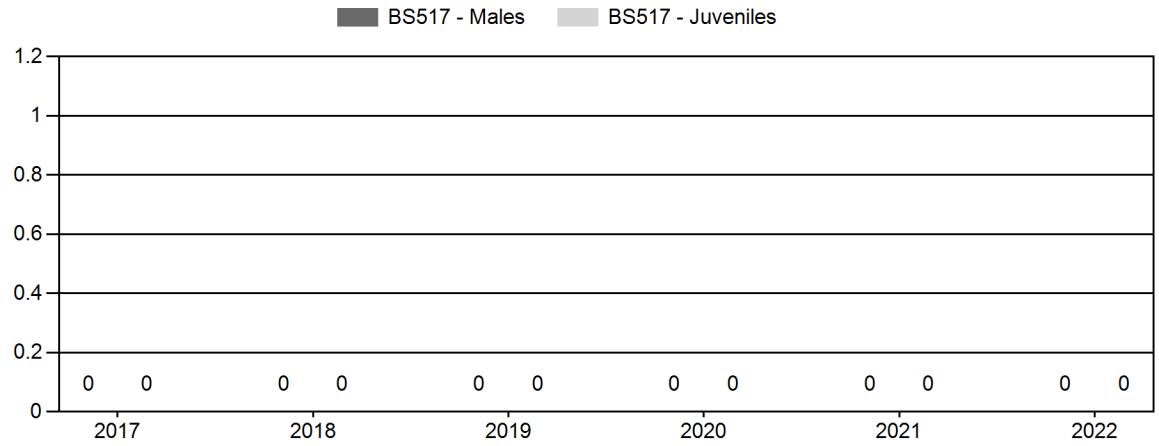
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2023 Hunting Seasons
Laramie Peak Bighorn Sheep Herd Unit (BS517)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
19	1	Aug. 15	Aug. 30	Sept. 1	Oct. 31	10	Any ram (9 residents, 1 nonresident)

Current Management Objective:

1) **5-year running average of >75% hunter success -** 90%
2) **5-year running average age of harvested rams between 6 and 8 years of age -** 8
3) **Documented occurrence of adult rams in the population -** 25

2022 Management Summary

1) Hunting Season Evaluation: New for 2023, 90% of bighorn sheep licenses in the state will be allocated to residents and 10% will be allocated to nonresidents. To meet the requirement of this 90/10 split in license allocation for residents and nonresidents, the quota has been increased to 10 licenses (9 resident, 1 nonresident). There are still a healthy number of older age rams within the population to maintain the management objective and absorb the increase by two licenses. Hunter success was 75% in 2022. Only 7 of the 8 licenses were active due to one hunter being at an older age where they could not hunt. Access to the wild sheep remains difficult due to large tracts of private land within occupied sheep habitat. Hunter success will be closely monitored in the coming years to see if the increase in licenses causes overcrowding on the limited public lands and consequently a decrease in hunter success.

2.) Management Objective Review: The herd objective was reviewed in 2019 and will be reviewed again in 2024.

3.) Ongoing Research: GPS collars have been deployed throughout this herd as part of the statewide bighorn sheep disease surveillance effort, to garner baseline information on the various respiratory pathogens within Wyoming's wild sheep populations. For the Laramie Peak herd unit (Hunt Area 19), the primarily goal is to better monitor respiratory disease outbreaks that could potentially cause large or small scale die-offs. Additionally, this collar data will assist in identifying seasonal movement patterns, crucial winter ranges, habitat selection, lambing areas, and cause specific mortality and survival estimates.

The following captures have taken place within the Laramie Peak Herd Unit:

- **2017:** 6 ewes in the Iron Mountain sub-herd
- **2019**: 16 ewes, only 15 collared, 5 from the Sybille Canyon sub-herd and 10 from the Duck Creek sub-herd
- **2021:** 7 ewes, 3 from Sybille Canyon sub-herd and 4 from the Duck Creek sub-herd
- **2022:** 10 ewes, 3 from Sybille Canyon sub-herd and 7 from the Duck Creek sub-herd
- **2023:** 10 new collars and 2 redeployments from mortalities

As of February 2023, there have been 10 mortalities within the Sybille Canyon and Duck Creek sub-herds. There were two mortalities throughout 2022. One mortality was in March of 2022 and it was determined that this ewe had succumbed to starvation due to a large sarcoma abscess

(cancer) in her jaw. The second mortality occurred in October of 2022, and it was determined that the ewe was predated by a mountain lion.

Within the herd unit, there have been wild and prescribed fires in which location data will be used to determine if sheep are utilizing habitat within these burn scars more or less frequently. More specifically, burned areas and unburned areas with high sheep use have been treated for cheat grass. Collar location data will help managers determine if sheep are selecting for these treated habitats more often post-treatment.

The primary concern with this herd unit is outbreaks of respiratory pathogens. In 2019, there was a small scale die-off due to a pneumonia outbreak within the Sybille Canyon sub-herd and these collars will aid in monitoring future disease outbreaks and mortalities. Mortality notifications from collars will assure managers if there are any major die-offs occurring. As of March 3, 2023, there are 25 collars online.

4) Weather and Habitat: Precipitation in this herd unit was below normal in 2022. Most of this herd unit experienced fairly normal precipitation patterns, as far as timing of moisture events, but were less in amount. No significant winter storms occurred in 2022, and overall winter severity was considered normal or below normal for most of the herd unit. While no NOAA weather stations are close to the vicinity of occupied bighorn habitats in Area 19, weather stations in Laramie, Cheyenne, and Douglas, all reported declines in annual precipitation, from 37%, 55%, and 26% from normal respectively.

Cheatgrass control efforts completed in the last 3 years in Sybille Canyon and other areas directly west of Wheatland, continue to show real promise in recovery of native vegetation. Additional cheatgrass spraying efforts using the herbicides Rejuvra and Plateau in occupied habitats occurred in Summer 2022 on the Thorne / Williams WHMA and adjacent private, state, and federal lands totaling 5,688 acres. Additional bighorn sheep habitats in Palmer Canyon were treated with a tank combination of Plateau and Rejuvra on private lands encompassing an additional 900 acres. Areas impacted by the Brittania wildfire have been taken over by cheatgrass in many places. This is cause for concern and future monitoring and surveillance is necessary. Future treatments will be planned where necessary and funding and time allows for proper project planning and implementation.

Fence conversion efforts are underway on the Thorne/Williams and Laramie Peak WHMA. Conversions from woven wire to barbed/smooth wire will result in improved movements of all wild ungulates, including bighorn sheep.

2022 - JCR Evaluation Form

SPECIES: Bighorn Sheep
PERIOD: 6/1/2022 - 5/31/2023

HERD: BS519 - ENCAMPMENT RIVER

HUNT AREAS: 21
PREPARED BY: TEAL CUFAUDE

	2017 - 2021 Average	2022	2023 Proposed
Population:		N/A	N/A
Harvest:	1	0	2
Hunters:	1	0	2
Hunter Success:	100%	0%	100%
Active Licenses:	1	0	2
Active License Success:	100%	0%	100 %
Recreation Days:	4	0	30
Days Per Animal:	4	0	15

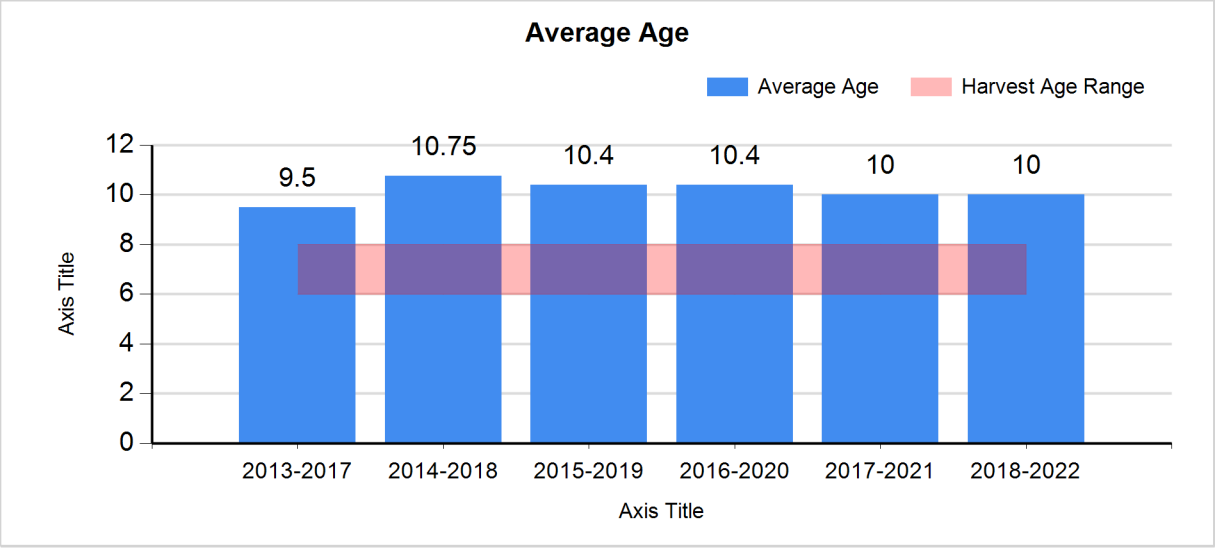
Limited Opportunity Objective:

5-year average of > 75% hunter success

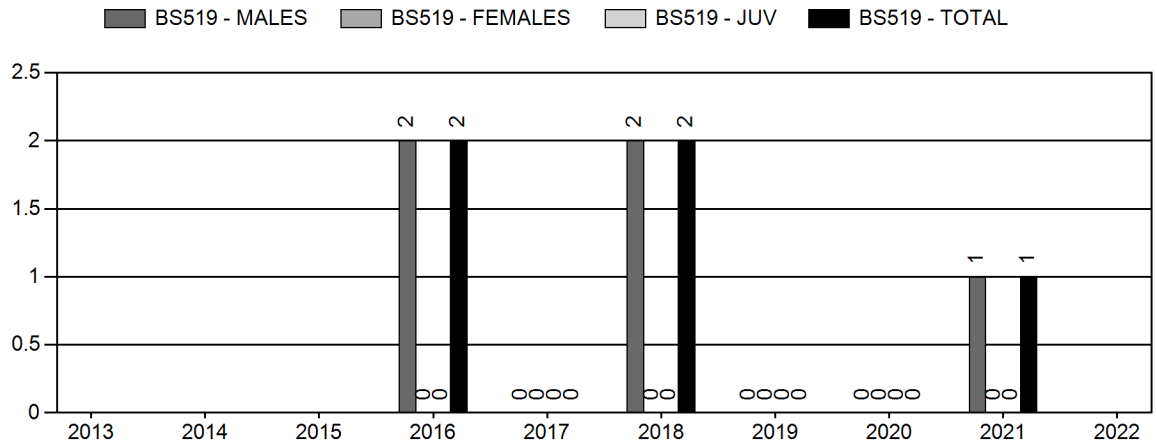
5-year average harvest age of 6-8 years

Secondary Objective:

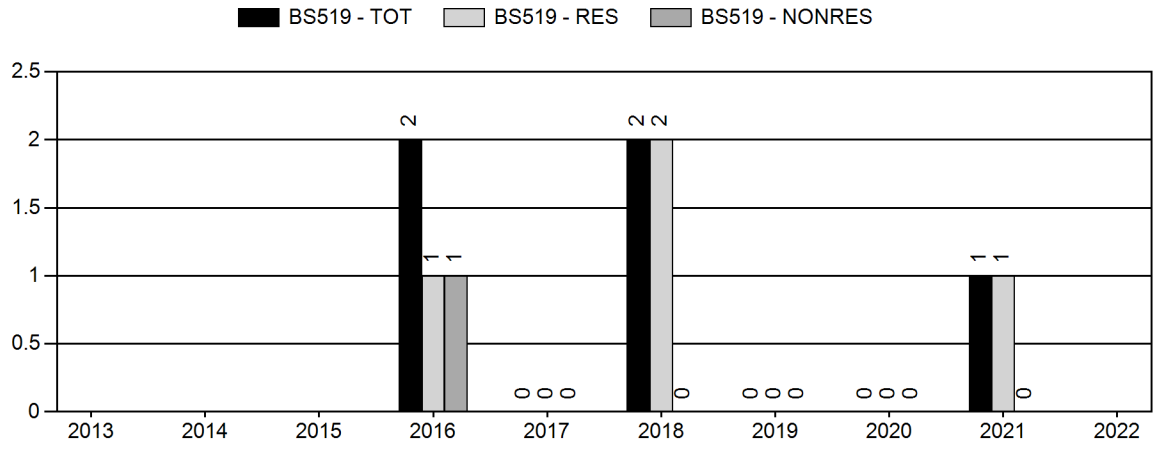
Management Strategy: Special



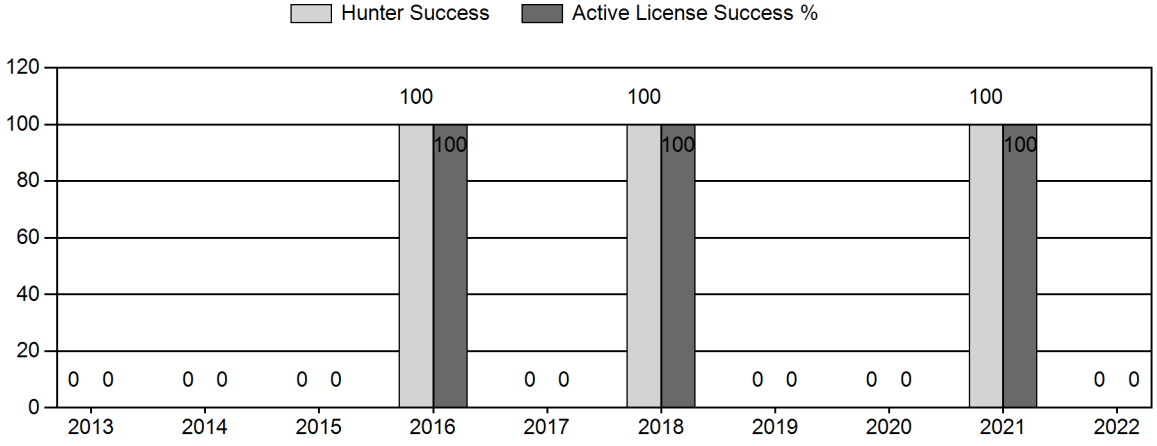
Harvest



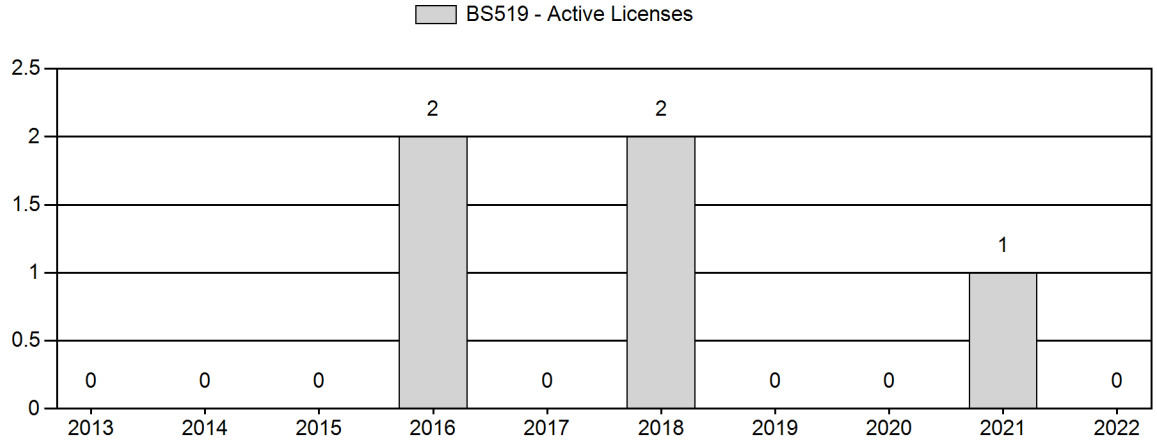
Number of Hunters



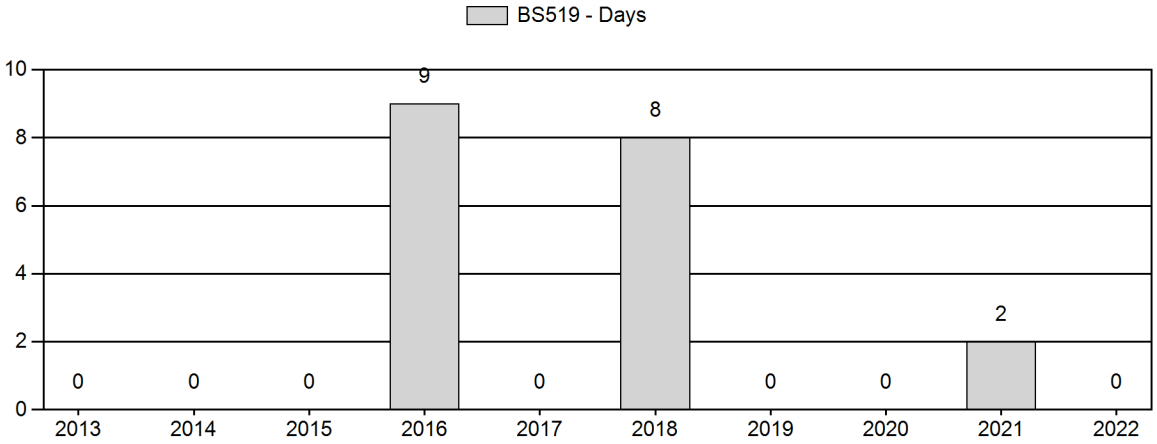
Harvest Success



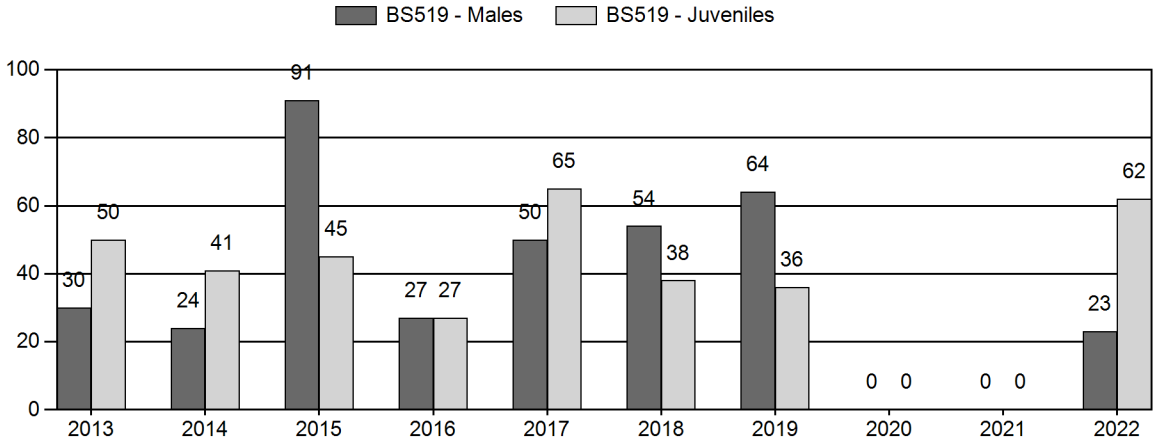
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2023 Hunting Seasons
Encampment River Bighorn Sheep (BS519)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
21	1	Aug. 15	Aug. 31	Sep. 1	Oct. 31	2	Any ram (1 resident, 1 nonresident)

Current Management Objective: Bighorn Sheep Limited Opportunity

1) 5-year running average of >75% hunter success
   - Currently Met: 2018-2022 Hunter Success- 100%
2) 5-year running average age of harvested rams between 6 and 8 years of age
   - Currently Met: 2018-2022 Harvest Mean Age- 10 years of age
3) Documented occurrence of adult rams in the population
   - Currently Met: >10 adult rams observed in 2022

2023 Management Summary

1.) Hunting Season Evaluation: The 2023 hunting season structure provided one resident hunter and one nonresident hunter the opportunity to harvest mature rams in hunt area 21. Based on frequent observations of mature rams in Douglas Creek (hunt area 18) and Encampment River (hunt area 21), we elected to forgo the traditional season structure and provide more opportunity by allocating separate license quotas for each hunt area. We expect hunters will have a high likelihood of success and this herd will continue to meet the bighorn sheep limited opportunity management objectives.

2.) Management Objective: The herd management objective was reviewed in 2021 and will be reviewed again in 2026.

3.) Weather/Habitat: Precipitation was below normal in biological year 2022. Moderate to severe drought conditions persisted throughout the year. The nearest NOAA weather station, located in Rawlins, reported a 23% decline in annual precipitation. Winter conditions remained mild throughout fall and early winter, with no persistent snow accumulations. No major habitat disturbances were documented within the herd unit in 2022. The lack of natural disturbances has resulted in shrub communities trending towards late seral stages with older, decadent age classes and conifer encroachment, which may be limiting habitat availability. Cheatgrass continues to be an issue on the southeast facing slopes at lower elevations within this herd unit.

4.) Research: WGFD conducted several capture and collar events from 2018-2021 in this herd unit as part of a statewide disease assessment effort. Data gathered from 21 collared bighorn ewes will also be used for habitat selection analyses beginning in 2023.

5.) Disease: In late summer and early fall 2022, there were several observations of bighorn sheep in close proximity to bands of domestic sheep west of the Continental Divide, however we were not able to locate the reported bighorn sheep. There remains a high risk of commingling with domestic sheep herds in this area, so we will continue to monitor and respond to any reports of bighorn sheep west of the Continental Divide.

2022 - JCR Evaluation Form

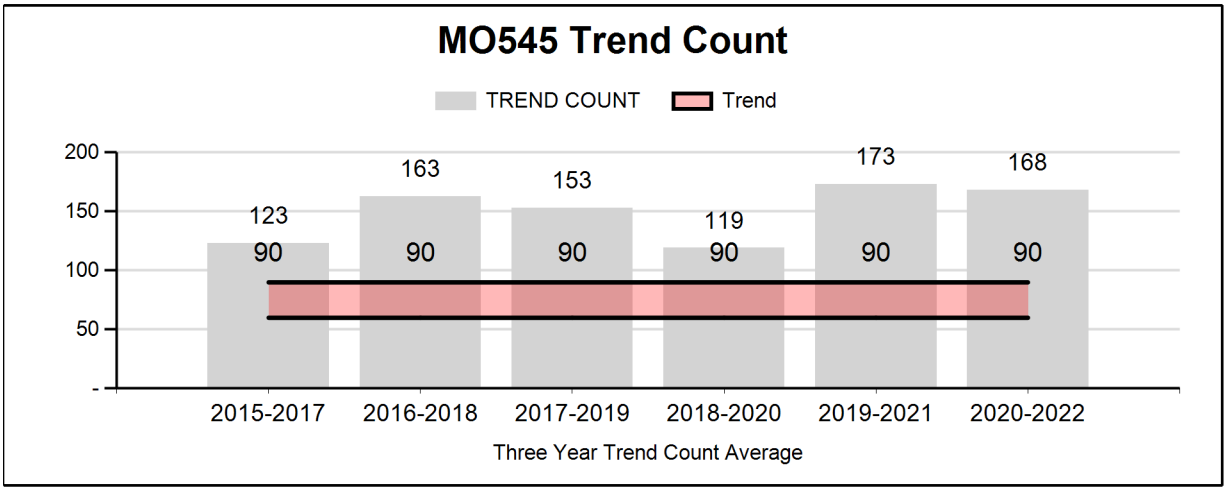
SPECIES: Moose
PERIOD: 6/1/2022 - 5/31/2023
HERD: MO545 - SNOWY RANGE
HUNT AREAS: 38, 41
PREPARED BY: TEAL CUFAUDE

	2017 - 2021 Average	2022	2023 Proposed
Trend Count:	162	154	0
Harvest:	39	51	52
Hunters:	42	53	54
Hunter Success:	93%	96%	96 %
Active Licenses:	42	53	54
Active License Success	93%	96%	96 %
Recreation Days:	350	334	350
Days Per Animal:	9.0	6.5	6.7
Males per 100 Females:	84	79	
Juveniles per 100 Females	45	29	

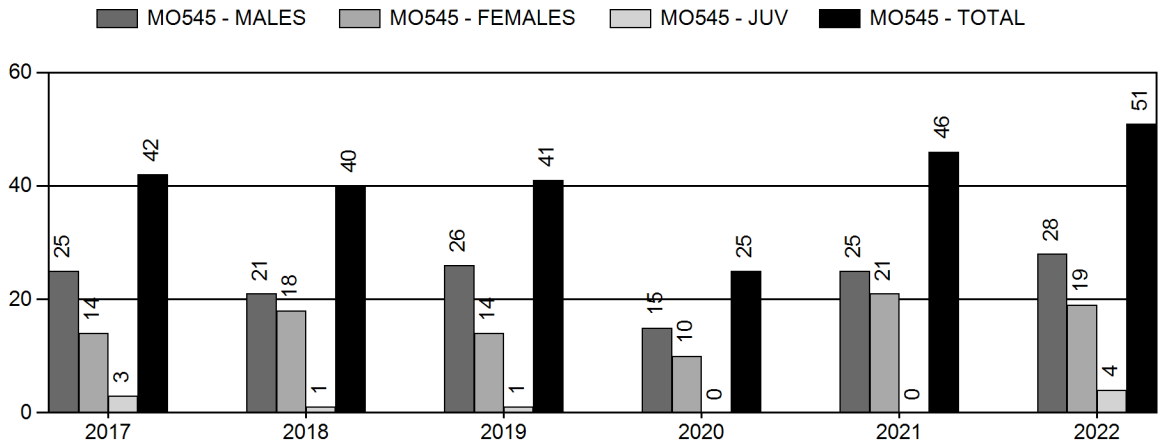
Trend Based Objective (± 20%)	75 (60 - 90)
Management Strategy:	Special
Percent population is above (+) or (-) objective:	105%
Number of years population has been + or - objective in recent trend:	8

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

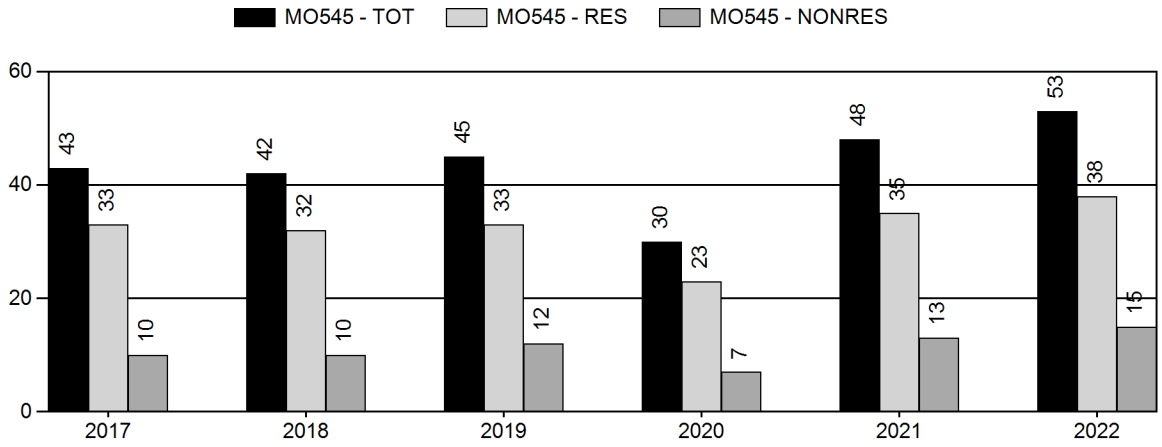
	JCR Year	Proposed
Females ≥ 1 year old:	N/A%	N/A%
Males ≥ 1 year old:	N/A%	N/A%
Juveniles (< 1 year old):	N/A%	N/A%



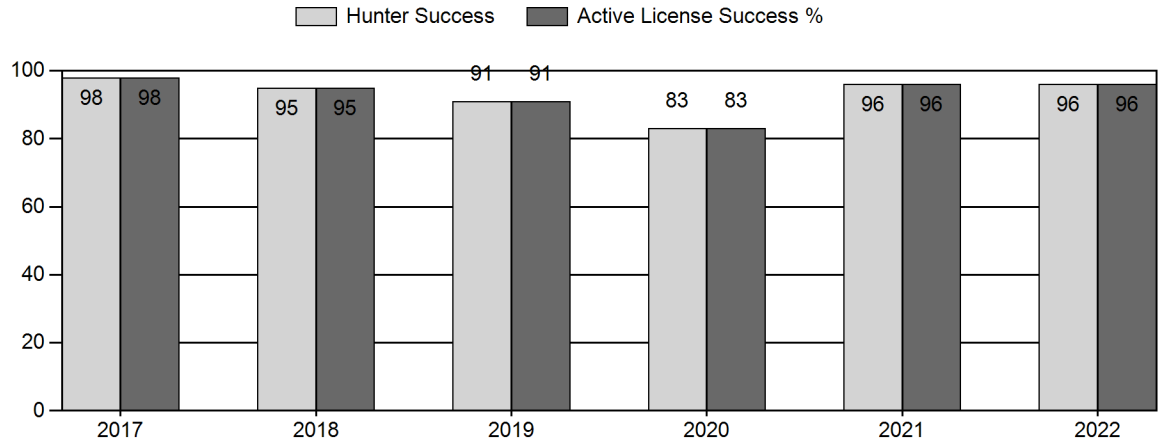
Harvest



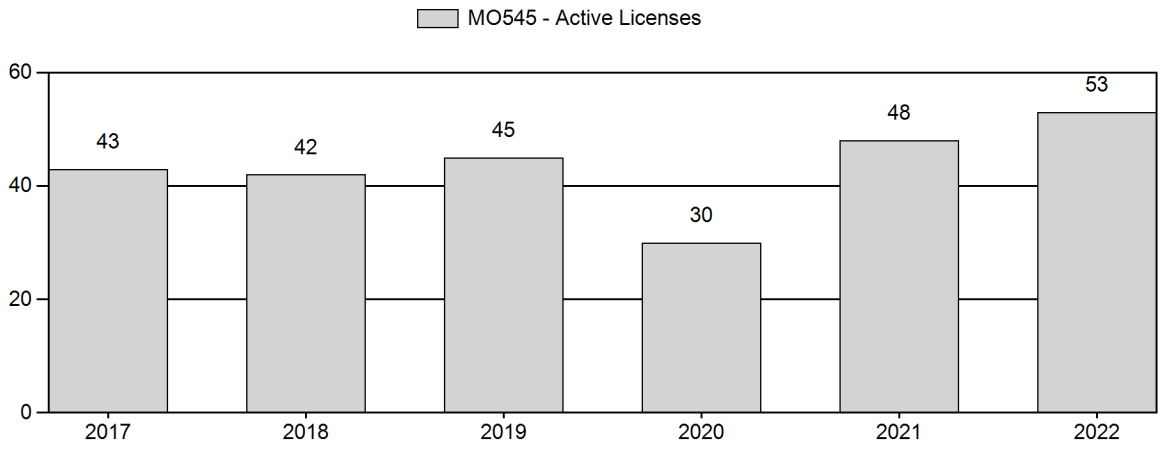
Number of Hunters



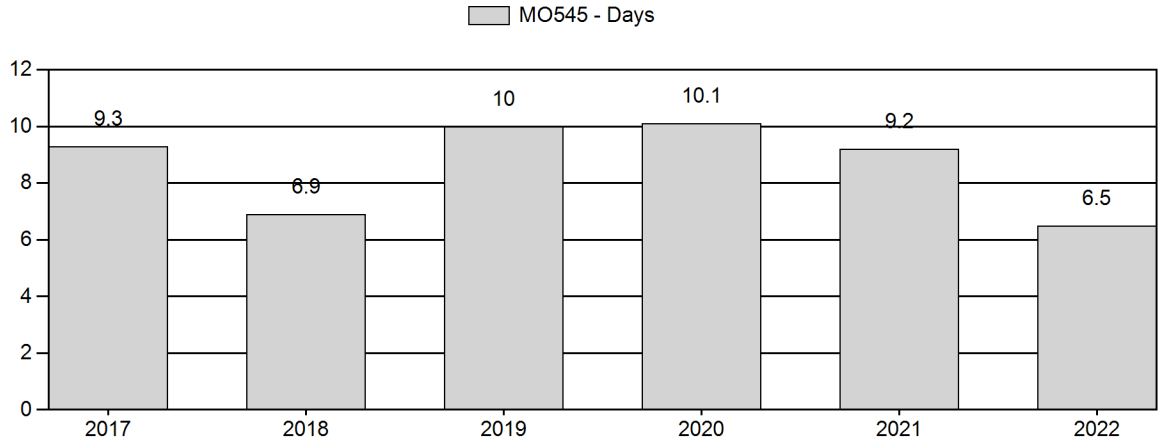
Harvest Success



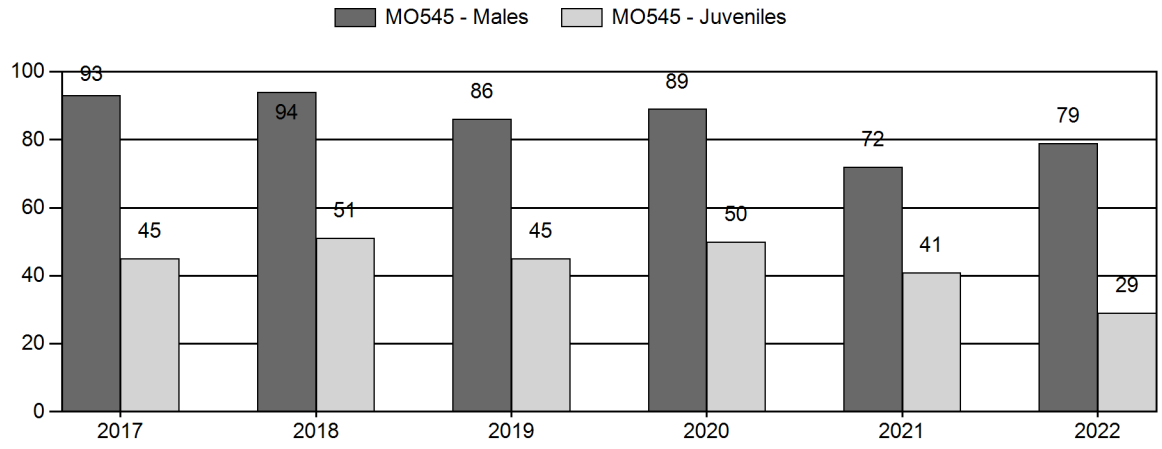
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2023 Hunting Seasons
Snowy Range Moose (MO545)

Hunt Area	Type	Archery Dates		Season Dates		Quota	Limitations
		Opens	Closes	Opens	Closes		
38, 41, 45	1	Sep. 1	Sep. 30	Oct. 1	Nov. 14	25	Any moose, except cow moose with calf at side
	4	Sep. 1	Sep. 30	Oct. 1	Nov. 14	25	Antlerless moose, except cow moose with calf at side

Secondary Management Objectives:

1) 3-year average of ≥ 4 years of age median for harvested bulls
    - Currently Met: 2020-2022 Median Age for Harvested Bulls- 5.3 years of age
2) 3-year average of ≥ 40% of bulls in harvest = ≥ 5 years of age
    - Currently Met: 2020-2022 Percentage of Bulls ≥ 5 years of age- 60%
3) Maintain sustainable communities of willow species preferred by moose
    - Reference Habitat Section

2023 Management Summary

1.) Hunting Season Evaluation: Since biological year 2016, mid-winter trend counts have been conducted to monitor moose in this herd unit. The three-year trend count average from 2019-21 was 173 moose, which exceeded the trend count objective. Although we have been able to detect more than 75 moose in the count blocks each year, the current mid-winter trend objective of 75 moose and trend survey design has done little to inform us on whether moose are increasing, stable, or declining. This prompted our interest in evaluating how we survey and monitor this herd.

In January 2023, we flew a 20-hour composition abundance survey in lieu of the trend survey. The goal of this new survey design was to collect composition (age and sex ratio) data, while also generating a low-precision abundance estimate. During this survey, we observed 154 moose (116 in survey subunits). The estimated number of moose based on this survey was 1,300 (CL= 430-2,200). We believe this estimate is higher than the number of moose in this herd, however we are optimistic that with some survey design changes an annual composition abundance survey could provide useful data for the newly developed Snowy Range moose integrated population model (IPM). The calf to cow ratio, observed in the composition abundance survey subunits, was 29/100. This was the lowest calf to cow ratio observed in the last five years, which may have been attributed to drought conditions across the herd unit or large-scale habitat changes such as the Mullen Creek Fire. The lower calf to cow ratio did not align with anecdotal field observations and hunter comments received regarding the difficulty of finding cow moose without calves. Age and sex ratios observed during the last six years is illustrated in Appendix A.

The Snowy Range moose herd unit has a reputation for producing trophy quality bulls. The 2022 bull harvest continued to be within Wyoming Game and Fish Department's parameters for "prime-age bulls" (Appendix B). The average antler spread of harvested antlered moose was 39 inches (n=25) in 2022. The post-season bull to cow ratio was 79/100.

From 2010-22, 620 total hunters have harvested 566 moose in this herd unit. During this time, 262 antlerless moose (236 cows and 26 juveniles) have been harvested. Only one antlerless moose has been harvested on a type 1 license since 2010.

During the 2022 hunting season, 53 active licensed hunters harvested a total of 51 (28 bulls, 19 cows, and 4 calves) moose in hunt area 38. These active licensed hunters included four Governor's tag hunters and one Supertag hunter. Hunter success was 96.2%. No activity was reported in hunt area 41 in the 2022 harvest survey report.

We believe the moose herd can sustain more licenses and additional hunter opportunities, however we would like to strategically allocate these licenses across the herd unit to ensure appropriate distribution of moose hunters. In 2023, hunt area boundaries were changed within the Snowy Range Moose herd unit. We modified the hunt area 38 boundary and added a new Pole Mountain hunt area (hunt area 45). The Sierra Madre hunt area (hunt area 41) boundary remained unchanged.

The moose herd continues to meet the secondary management parameters and exceed the three-year trend count objective so we are confident that the herd can sustain the proposed license quota. We continue to hear from landowners who are interested in allowing more moose hunting opportunity in the Elk Mountain area. In 2023, type 1 and type 4 license quotas were kept at 25 licenses each. This license allocation is expected to maintain the population at the current objective and age of harvested bulls within the secondary management objective ranges. These licenses were valid in hunt areas 38, 41 and 45.

In 2024, we plan to offer separate type 1 and potentially type 4 license quotas in Snowy Range (hunt area 38), Sierra Madre (hunt area 41), and Pole Mountain (hunt area 45) areas.

2.) Management Objective Review: The management objective review was deferred to 2024. We plan to evaluate transitioning from a mid-winter trend count objective to a population estimate objective. The population estimate would be derived from the new moose IPM. We also plan to conduct a sightability survey in this herd unit in January/February 2024. An additional sightability estimate could bolster the population estimates we get with the IPM. We plan to retain the secondary management objectives to ensure trophy quality moose are available in the herd unit.

3.) Habitat: Snowpack and total annual precipitation were below the 30-year average for the majority of this herd unit in the Snowy Range and Pole Mountain areas. PRISM data collected for the Sheep Mountain and Platte Valley mule deer herd units were analyzed, as moose habitats, particularly at higher elevations that overlap the mule deer herd units. Precipitation in April through July was below the 30-year average, negatively affecting the overall production of forage. Over 10% declines in precipitation were documented in the upper elevations for the period of May through July in western portions of the herd unit, and declines of 21% were seen in the eastern half of the herd unit for the same period. NOAA weather station data from Laramie showed a 37% decrease from average annual precipitation. Foothill and plains portions of the herd unit on the eastern flanks of the Snowy Range were extremely dry in the growing season months and forage production was negatively affected. Monsoonal moisture patterns were observed in late summer, with some thundershowers causing substantial erosion, particularly in areas burned by recent wildfires on the eastern portion of the herd unit. These late-season precipitation events likely had little effect on herbaceous production but did aid with some short-term green-up.

The Mullen CreekFire (2020) burned approximately 176,800 acres in the Snowy Range, comprising the southern half of moose hunt area 38. Over 10,300 acres on the western half of moose hunt area 38 were aerially treated with the herbicide Rejuvra in 2021. A large-scale monitoring effort was completed by USFS, WGFD, and USGS in 2022 to evaluate herbicide efficacy one year post-treatment. Recovery of native, perennial grasses looks promising thus far. Plant species diversity was comparable pre- and post-treatment with the exception of a few native annual forbs. Cheatgrass was documented in areas where soil movement had occurred. Additionally, high densities of cheatgrass were documented within the no-spray buffer around the North Platte River. We will continue to monitor herbicide efficacy in 2023 and evaluate the need for retreatment. Antelope bitterbrush, serviceberry, and big sagebrush seedlings were observed throughout the burn scar, which is a promising sign for shrub recovery. Several thousand mixed mountain shrub seedlings were planted west of the North Platte River in the fall of 2021 and 2022 by USFS, WGFD, and volunteers to aid in recovery.

In 2022, 6,288 acres were aerially treated with Rejuvra herbicide to control cheatgrass on the eastern side of the Snowy Range, focusing on the foothill areas between Albany and Woods Landing. Some of the areas treated have been burned twice by the Squirrel Creek (2012) and Mullen (2020) wildfires. In the eastern portion of moose hunt area 38, Pole Mountain, cheatgrass treatments are planned for USFS and State Parks lands. Mixed mountain shrub habitats will be the primary habitat type planned for treatments. Dalmatian toadflax and cheatgrass are both present in this area and treating them with the Rejuvra herbicide may aid in the control of both species. Approximately, 200 acres of mixed mountain shrub communities were mowed on USFS and private land in 2022 in the Troublesome Ridge area. Moose utilize these shrub species in the fall and winter months. Monitoring will occur in 2023 to quantify annual leader growth and browsing pressure. Outside of the Troublesome shrub mowing, disturbances and enhancements to moose favored habitats in the northern half of the Snowy Range continue to be limited. Aspen habitat enhancement through conifer cutting in foothill areas within the Foote Creek and Wagonhound Creek drainages is planned for 2023. Prescribed burning will be scheduled for two to three years post-mechanical cutting.

The Laramie biologist team established a long-term willow monitoring program in 2021 to monitor willow production and utilization within the Snowy Range and surrounding areas of available moose habitat. We evaluated willow community conditions using the Keigley Live-Dead Index (LD Index). The LD Index is a quantitative measure of browse intensity calculated by subtracting the height dead (H_D) from the height of the base of current year growth (H_{BCYG}).

$$LD = H_{BCYG} - H_D$$

Positive values indicate the willow is escaping browsing pressure, values near zero indicate the current level of browsing is preventing vertical plant growth, and negative values indicate the willow is being suppressed by browsing. We completed 16 Live-Dead Index surveys from August to early September, focusing our efforts on planeleaf (*Salix planifolia*), drummond (*S. drummondiana*), and booth willow (*S. boothii*). These willow species were selected based on a combination of moose preference and willow abundance within the Snowy Range. We also opportunistically completed the live-dead index for other willow species. The majority of surveys in 2022 were completed on planeleaf willow. Habitat biologists will complete the analysis in the coming months and put together a summary for the Snowy Range moose herd objective review.

Snowpack and total annual precipitation were below the 30-year average for this herd unit in the Sierra Madre Range. PRISM data collected for the Platte Valley and Baggs mule deer herd units was analyzed, as moose habitats, particularly at higher elevations that overlap the mule deer herd units. Precipitation amounts in April through June were below the 30-year averages, negatively affecting the overall production of forage. A 13% decline in precipitation was documented in the upper elevations for the period of May through July in the eastern portions of the hunt area 41 and a 6% decline was documented in the western half of hunt area 41 for the same period. NOAA weather station data from Rawlins reported a 23% decline in average annual precipitation. While annual precipitation was below the 30-year average on the western portion of the Sierra Madres, it was significantly higher than the amount of precipitation received in the last two years. Monsoonal moisture patterns were observed in late summer, in turn leading to slightly above-average precipitation in the May-July timeframe in the western Sierra Madres. These events likely had little effect on herbaceous production but did aid with some short-term green-up.

Past large-scale wildfires within the Sierra Madre Range (Snake fire – 2016, Beaver Creek fire – 2016, and Ryan fire – 2018) are recovering at varying rates. These fires have returned plant communities to earlier seral stages and increased the age-class diversity of mixed mountain shrubs and aspens. The resulting productivity and diversity should benefit moose, deer, and elk.

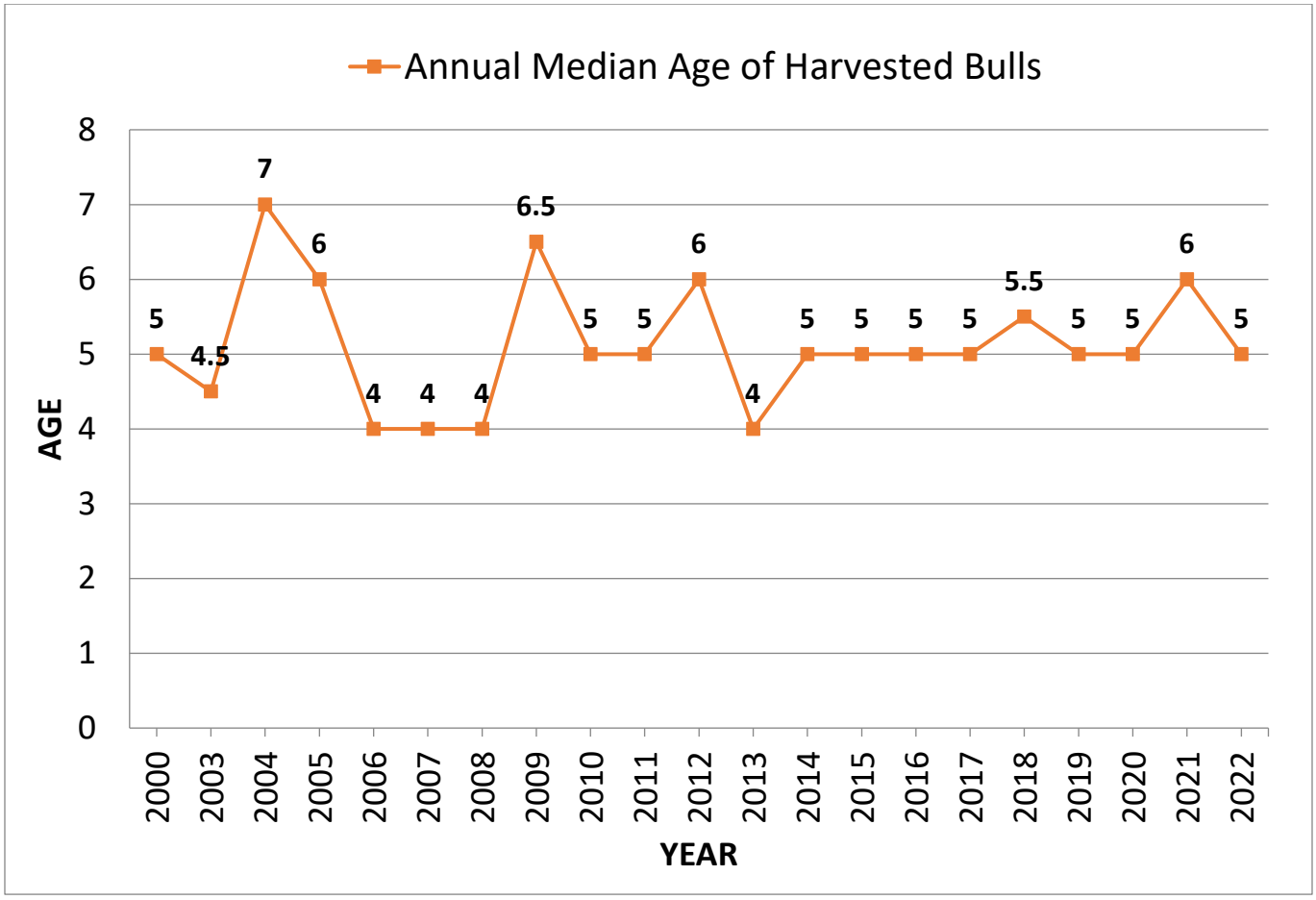
4.) Research: The Snowy Range moose population has been monitored through several studies over the past 15 years (2005-2006, 2015-2017, 2018-2020), allowing us the unique opportunity to compare moose habitat use, movement, and behavior pre- and post- wildfire. Phase 1 of the Snowy Range Moose Post-Wildfire Monitoring Project began in March 2022 and phase 2 began in February 2023; 28 female moose were captured via helicopter darting on winter habitats within and surrounding the Mullen Creek Fire perimeter. Moose were fitted with GPS-enabled collars set to collect hourly fixes (locations). The fix-rate is identical to the previous Snowy Range moose studies, which will allow us to compare movement strategies and resource use of moose prior to and following the fire. These collars will be deployed for a period of three years, during which we will gather information on the status of each moose and their response to recently burned habitats. In addition, we will be able to track animals' survival and rate of juvenile recruitment. This research addresses five primary objectives. These objectives include 1) quantifying movement and distribution of female moose; 2) evaluating the effects of the Mullen Creek fire on habitat selection; 3) assessing changes in habitat quality post-burn; 4) measuring cow moose survival; and 5) opportunistically assessing the health of captured moose.

5.) Disease: In 2022, nine hunter harvested moose, four targeted moose, and three road-killed moose were tested for Chronic Wasting Disease (CWD). No sampled moose from this herd unit tested positive for CWD. In 2022, carotid artery worms were not detected in any hunter harvested moose in the Snowy Range herd unit.

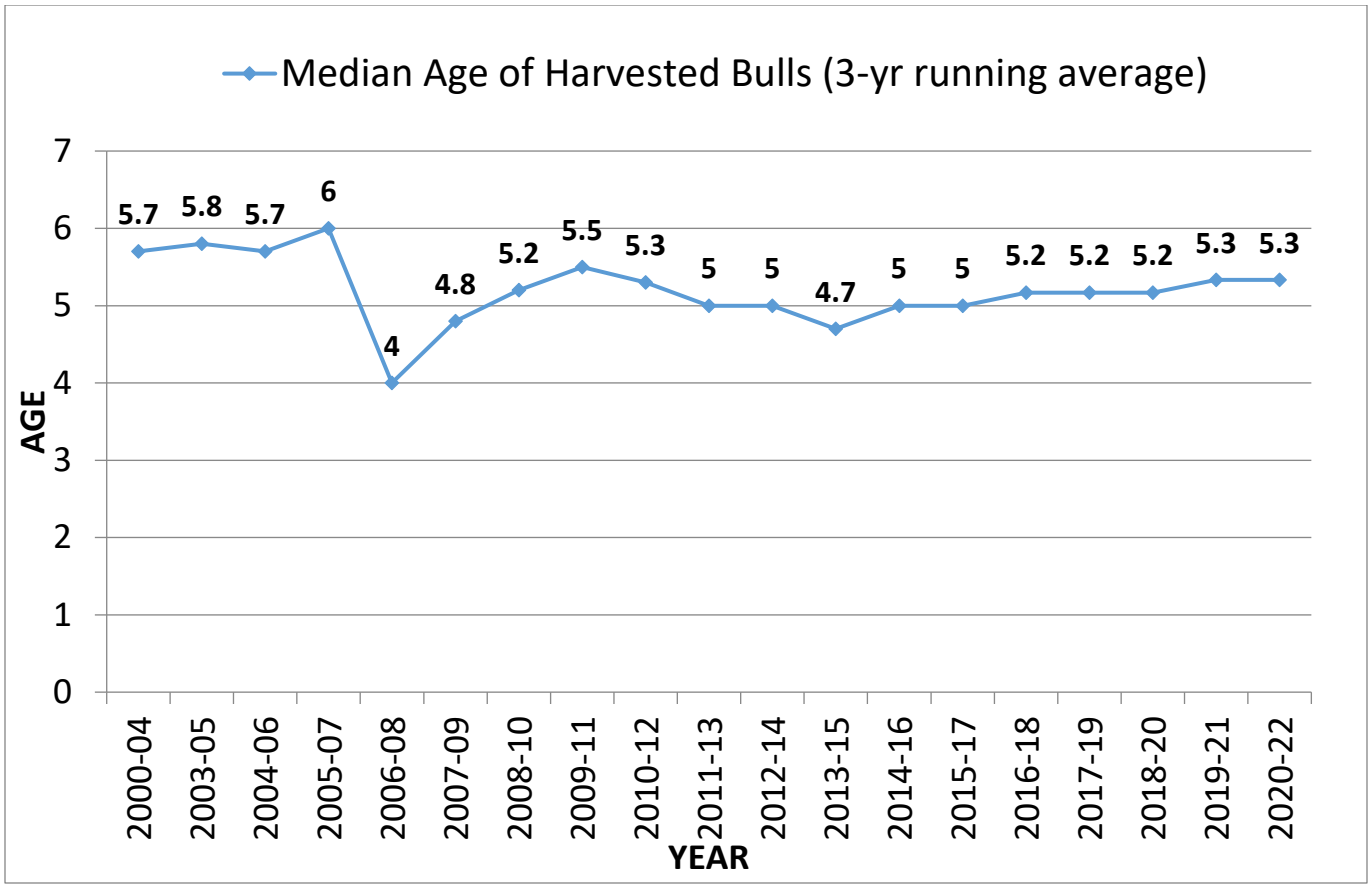
2017 - 2022 Postseason Classification Summary

for Moose Herd MO545 - SNOWY RANGE

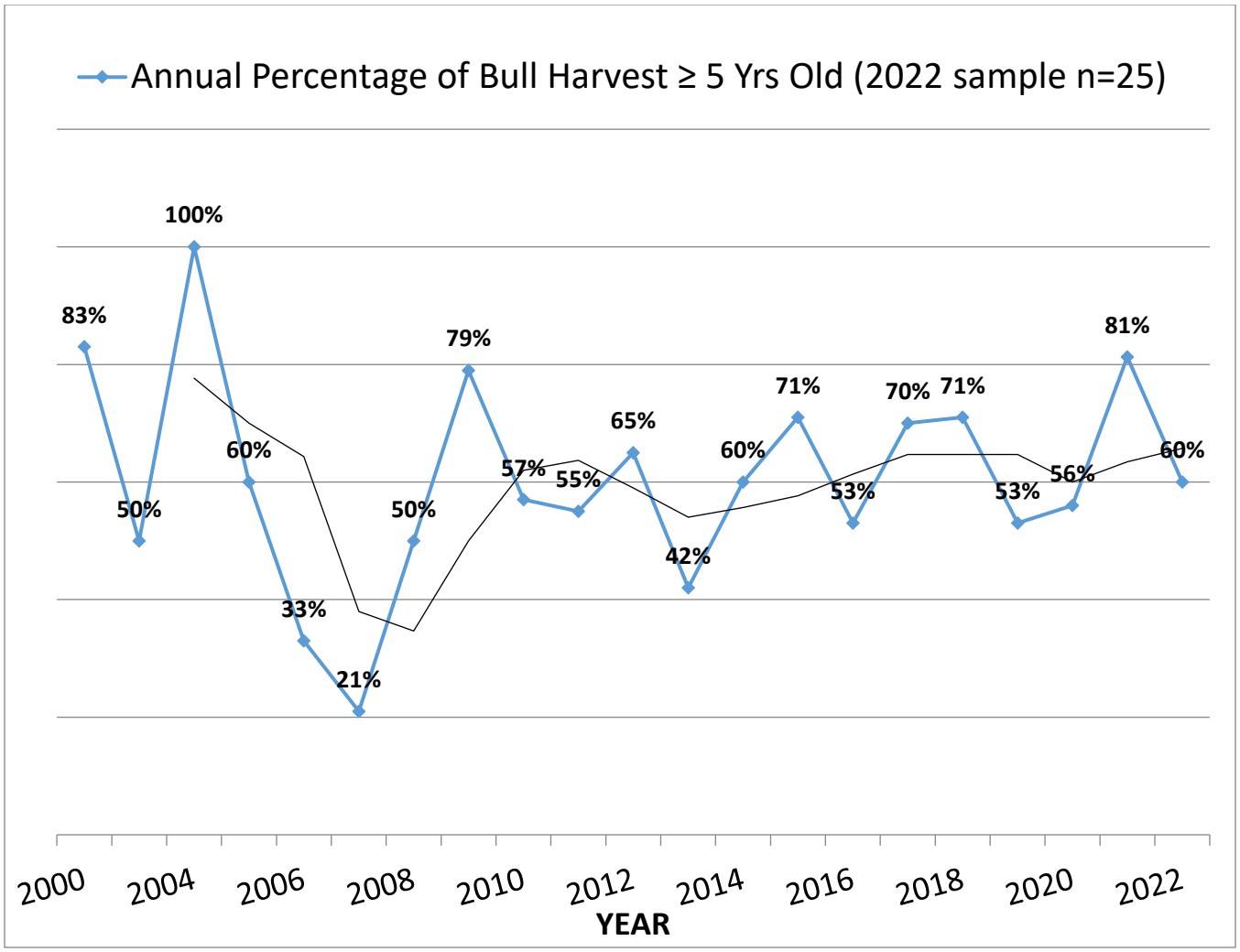
		MALES				FEMALES		JUVENILES				Males to 100 Females				Young to		
Year	Post Pop	Ylg	Adult	Total	%	Total	%	Total	%	Tot Cls	Cls Obj	Ylng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2017	0	17	49	66	39%	71	42%	32	19%	169	0	24	69	93	± 0	45	± 0	23
2018	0	13	33	46	38%	49	41%	25	21%	120	0	27	67	94	± 0	51	± 0	26
2019	0	8	55	63	37%	73	43%	33	20%	169	0	11	75	86	± 0	45	± 0	24
2020	0	7	8	25	37%	28	42%	14	21%	67	0	25	29	89	± 0	50	± 0	26
2021	0	10	72	96	34%	133	47%	54	19%	283	0	8	54	72	± 0	41	± 0	24
2022	0	5	38	44	38%	56	48%	16	14%	116	0	9	68	79	± 0	29	± 0	16



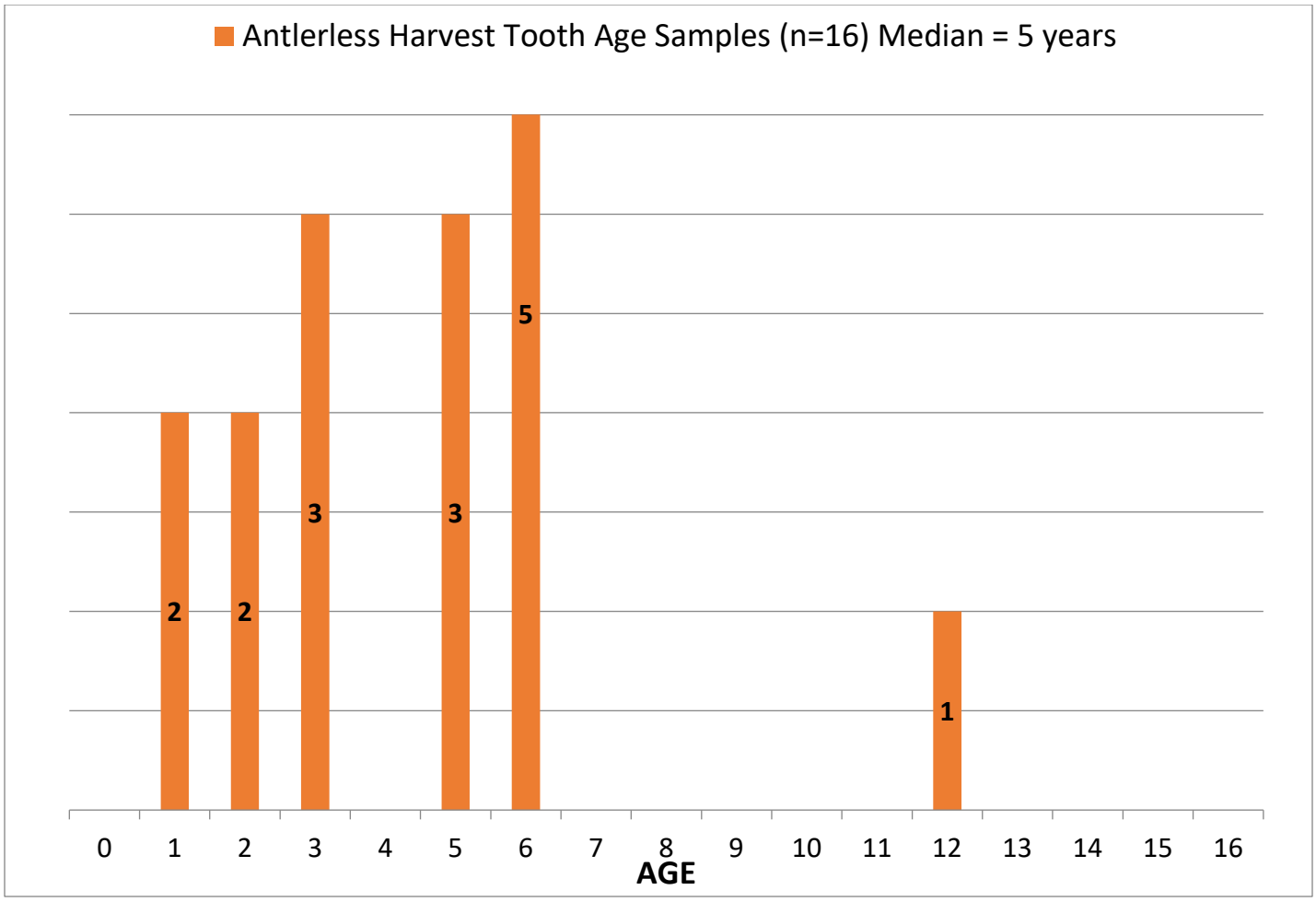
Median age of bulls harvested from the Snowy Range Moose herd unit, from lab aged teeth (n=25) in 2022.



Average (3-year running) median age of bulls harvested from the Snowy Range Moose herd unit, from lab aged teeth.



Annual percentages of the bull harvest ≥ 5-years in age from Snowy Range Moose herd unit, from lab aged teeth.



Age class distribution for antlerless moose harvested from Snowy Range Moose herd unit in 2022.