

# Wyoming's Bighorn Sheep - Management Needs/Projects



December, 2020

(version 12072020)

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## ***Introduction***

Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*) are an iconic species of the Rocky Mountain West and are most commonly associated with vast, high elevation landscapes dominated by mountain peaks that are seemingly high enough to touch the blue sky. Bighorn sheep in Wyoming are found throughout the state in habitats ranging from low-elevation, isolated mountain ranges in the east to the spine of the Rockies in the west. At one time, Wyoming boasted the largest bighorn sheep population in the world on Whiskey Mountain near Dubois, WY.

Wyoming is home to 15 populations of bighorn sheep, which includes approximately 200 sheep that inhabit the area along the Yellowstone River in the northern portion of Yellowstone National Park. These sheep are managed by the U.S. Park Service and Montana, Fish, Wildlife and Parks and are not addressed in this document. Another herd of less than 25 individuals exists entirely within the Wind River Canyon of the Wind River Reservation. Two other “remnant” herds exist (Shell Canyon and Temple Peak), for which hunting seasons are not held, and numbers are periodically monitored. The remaining eleven bighorn sheep populations are managed as “herd units” using a “management by objective” system (Figure 1). Objectives can be based on postseason “population size”, “trend”, and “limited opportunity.” The current status of each herd unit relative to their objective is provided in Appendix A.

In the seven herds where managers are able to estimate postseason population size or conduct trend counts, currently it is estimated there are about 5,200 bighorn sheep. This is about 20% below the population size target or objective of 6,440 bighorn sheep for these areas.

The remaining four herd units encompass smaller numbers of bighorn sheep making a population estimate or a trend count not possible or unfeasible. As a result, they are managed to provide an appropriate level of hunting/harvest opportunity and their management is based on average hunter success and age of harvested rams. All four of those herd units are within the criteria for hunter success and/or age of harvested rams.

Though formal estimates or counts are not available in the “Limited Opportunity” herds, managers estimate there are about 600 sheep collectively in these four herd units. So combined with the herds where estimates or trend counts are conducted and estimates from the remnant herds, there are currently about 5,900 bighorn sheep throughout the state.

Wyoming Game & Fish Department (WGFD) places a high priority on conservation and management of this iconic species. However, costs to manage bighorn sheep (\$2.4 million) far outweigh revenues derived from hunting license sales (\$169,841) and total program revenue (\$1.5 million). It is apparent other funding sources are critical to implement management priorities and projects to enhance conditions for bighorn sheep in Wyoming.

Certainly, it is the goal of the WGFD to manage bighorn sheep to a population level commensurate with established objectives. First, in several herds we must arrest the population decline by focusing on those issues most affecting bighorn sheep.

Following is a summary of those issues and a detailing of the management priorities for each herd unit and statewide. The intent of this document is to provide a planning tool to direct needed

resources, including money and personnel, to address the issues and opportunities to better understand bighorn sheep ecology in ever changing environments to ensure bighorn sheep thrive in Wyoming.

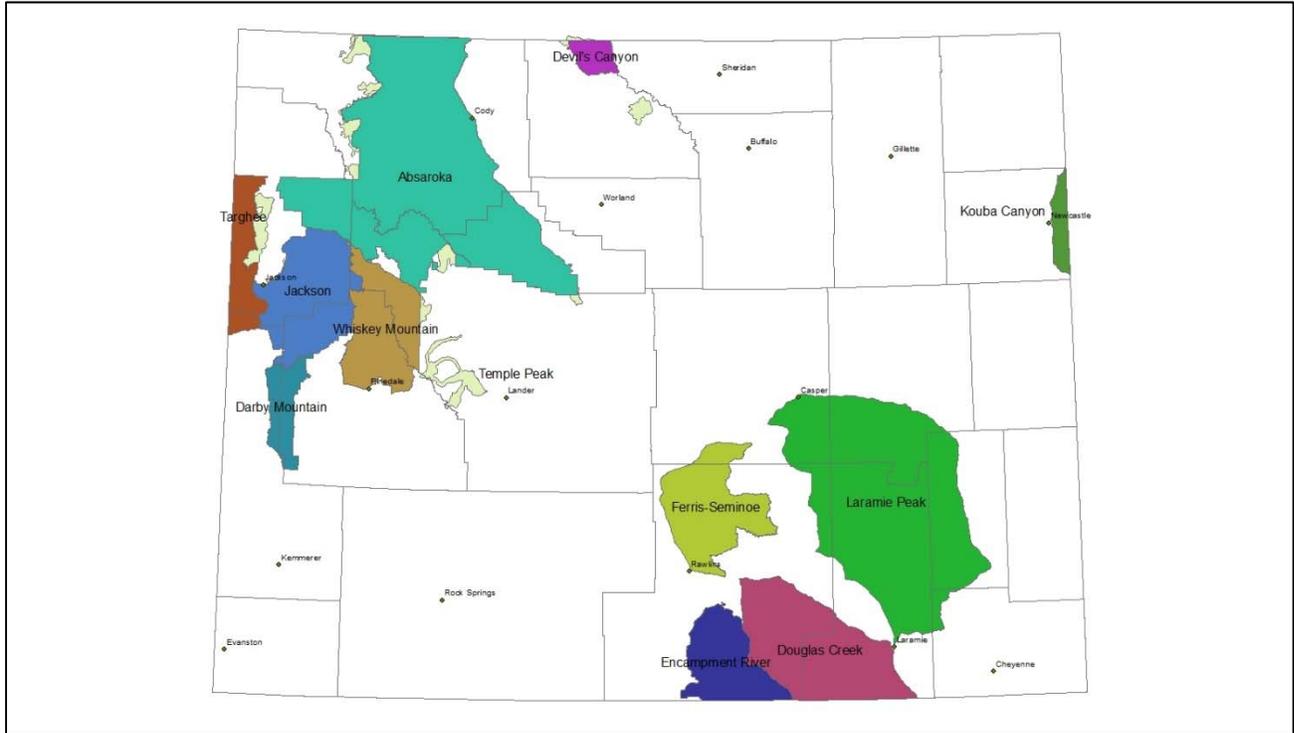


Figure 1. Bighorn Sheep herd units and occupied habitat outside of established herd units in Wyoming.

### ***The Issues***

Today, many bighorn sheep populations are struggling and are declining in Wyoming and throughout their range in the West. Managers are not certain of all the causative agents driving these declines, but many agree decreasing habitat quantity and quality and increasingly prevalent disease outbreaks are perhaps primary factors. It is obvious disease is the most important factor in the short-term, causing acute and dramatically sharp population declines. However, it may be that habitats, as they influence bighorn sheep body condition and immune response, may be an underpinning reason population recovery languishes for decades after a disease outbreak.

Habitats important to bighorn sheep range from high elevation summer ranges to low elevation habitat used during winter. Plant community resilience, species diversity, and nutritional value critical to maintain bighorn sheep body condition and healthy immune systems seems to be changing due to a variety of factors such as succession, climate change and invasive plant species. In addition, a better understanding of the role of micronutrients such as selenium, copper, and other

important elements is needed. Many speculate changes in availability of these important elements affect the immune system's ability to combat infection and disease.

At the same time, new pathogens have been introduced into bighorn sheep populations. Bacteria of the family Pasteurellaceae (*Pasteurella multocida*, *Mannheimia haemolytica* and *Bibersteinia trehalosi*), and *Mycoplasma ovipneumoniae* are most frequently associated with respiratory disease (pneumonia) in bighorn sheep. It has been well documented and understood that domestic sheep and goats have been a causative vector of pathogen transmission to bighorn sheep. While scientists and managers do not understand many of the complexities associated with disease in bighorn sheep, it is agreed the single most effective management tool to minimize disease transmission and outbreaks is to maintain the separation between wild sheep and domestic sheep and goats.

Where mountain goats occur in Wyoming, their distribution often overlaps with habitats important to bighorn sheep. Certainly, while it is appropriate and desirable to maintain mountain goat populations in Wyoming, it is important to recognize they compete with bighorn sheep for important resources and they also harbor many of the pathogens known to cause disease in bighorn sheep.

Understanding bighorn sheep population dynamics is an important component of effective management. Bighorn sheep are a relatively difficult species to census or to estimate population size. Their distribution across vast landscapes, often at high elevations and low densities, combined with limitations in personnel and money hinder needed data collection to best arrive at an accurate and usable population estimates. It is necessary to better understand population dynamics - that is, changes in population size and what causes those changes (i.e., survival, lamb production, disease, etc.). To that end, managers are "thinking outside the box" and starting to develop and evaluate alternative population estimation techniques (e.g. camera traps, fecal genetics, and drones).

Trapping and transplanting bighorn sheep has long been used as a technique to "put and keep sheep on the mountain." Transplants continue to this day and have recently been successful in restoring the Ferris/Seminole herd unit in south, central Wyoming. Future opportunities where habitats may be suitable for bighorn sheep can be evaluated, but with specific attention to the potential for disease transmission and other concerns. As pathogens and disease become perhaps more prevalent or virulent, managers are going to have to scrutinize the efficacy of transplants with increasing concern. Certainly, any considerations for future transplants will follow the Wyoming Plan and be fully vetted through the Statewide Bighorn Sheep-Domestic Sheep Interaction Working Group.

Finally, managers and scientists are focusing a great deal of research on all facets of bighorn sheep ecology and management. Specifically, ongoing research to better understand pathogens and disease, genetics, immune response, lamb production, survival, adult body condition, and habitat is currently being conducted and will be the focus of research into the foreseeable future.

### ***Priority Management Considerations - Statewide***

At the statewide level, the WGFD’s Bighorn Sheep Working Group identified management considerations grouped into four categories. Categories used are those that were identified by the Wyoming Governor’s Big Game License Coalition’s Bighorn Sheep Committee. These statewide categories are the same as those identified by herd unit managers, but the order of priority is different (Table 1).

<b>Management/Population monitoring</b>	46.67%
<b>Habitat</b>	20.00%
<b>Research</b>	20.00%
<b>Disease</b>	13.33%

*Table 1. Identified statewide management priorities – Bighorn sheep working group*

In general, statewide items identified were: 1) Better population size estimates, particularly in smaller populations; 2) Understanding the factors affecting lamb survival; 3) Understanding diet composition including micro-nutrients; 4) Research to understand disease ecology and the role of genetic strain-typing of harmful pathogens; and 5) Continued engagement, cooperation and coordination with all entities involved with bighorn sheep management in Wyoming including the U.S. Forest Service, Bureau of Land Management, private landowners, Wild Sheep Foundation (both National and the Wyoming Chapter), National Bighorn Sheep Interpretative Center, and other stakeholders.

### ***Priority Management Needs/Projects – Herd Units***

To better manage and understand bighorn sheep within each of the herd units, WGFD managers identified management needs or projects for each herd. Based on the identified needs or projects, WGFD prioritizes the following for increased focus and funding:

1. Cheatgrass control and management;
2. Developing techniques to better estimate population size;
3. Identification of suitable, unoccupied habitats statewide;
4. Continued research to better understand and manage the effects of disease.

Management priorities across all herd units were categorized, sub-categorized, and ranked based on the frequency of each category identified. Habitat, Management/Population Monitoring and Diseases were the three most frequent priorities identified (Table 2).

<b>Habitat</b>	<b>31.82%</b>
Enhancement	50.00%
Invasive Species	50.00%
<b>Management/Population monitoring</b>	<b>31.82%</b>
Population Estimation	57.14%
Monitoring (disease status, survival, habitat use)	28.57%
Survey Flight Time	14.29%
<b>Disease</b>	<b>11.36%</b>
<b>Movement/Migration</b>	<b>9.09%</b>
<b>Separation of Wild and Domestic Sheep/Goats</b>	<b>6.82%</b>
<b>Trapping/transplanting</b>	<b>4.55%</b>
<b>Education/Outreach</b>	<b>2.27%</b>
<b>Research</b>	<b>2.27%</b>

*Table 2. Identified management priorities across all herd units.*

The following provides information concerning herd status in relation to desired management objectives and the top two priority management needs/projects for each herd (other needs/projects identified for each herd are included in Appendix 1). These needs/projects are provided to focus needed funding necessary to accomplish them. Estimated costs/budgets are provided and most certainly will change. Refined costs/budgets will be developed for each need/project as they are developed and proposed.

It is important to emphasize the implementation of many of these proposed management needs/projects may be subject to limitations or restrictions that are out of WGFD's control. For example, any habitat work on land managed by the USFS or BLM will be subject to environmental analysis and approval through their processes.

## Absaroka

SPECIES: Bighorn Sheep

PERIOD: 6/1/2019 - 5/31/2020

HERD: BS200 - ABSAROKA

HUNT AREAS: 1-5, 22, 999

PREPARED BY: TONY MONG

	<u>2014 - 2018 Average</u>	<u>2019</u>	<u>2020 Proposed</u>
Population:	3,853	3,600	3,600
Harvest:	124	99	105
Hunters:	155	128	128
Hunter Success:	80%	77%	82 %
Active Licenses:	155	128	128
Active License Success:	80%	77%	82 %
Recreation Days:	1,331	1,160	1,100
Days Per Animal:	10.7	11.7	10.5
Males per 100 Females	37	33	
Juveniles per 100 Females	27	32	

Population Objective (± 20%) : 4000 (3200 - 4800)

Management Strategy: Special

Percent population is above (+) or below (-) objective: -10%

Number of years population has been + or - objective in recent trend: 0

Model Date: 02/21/2020

### Priority Management Need/Projects for additional funding:

1. Disease - Conduct disease monitoring on the Owl Creek portion of the herd, collar a portion of these sheep (n=20) to help understand the potential for pathogen transmission, and assist in disease risk management.
  - **Projected Project Cost = \$48,500**
    - \$1,000/collar x 20 = \$20,000
    - \$550/capture x 30 (including 10 recaptures) = \$16,500
    - Annual Data Upload Fees = \$200/collar/year (3 years) = \$12,000
2. Survey Flight Time - The Cody, Lander, and Jackson regions seek funding for additional flight time to collect a baseline population estimate, better and more representative classification data, and collect change in ratio data to document lamb production and survival.
  - **Projected Project Cost (winter flight) = \$67,968**
    - \$944/hour flight time x 72 hours = \$67,968

## Darby Mountain

SPECIES: Bighorn Sheep	PERIOD: 6/1/2019 - 5/31/2020
HERD: BS121 - DARBY MOUNTAIN	
HUNT AREAS: 24	PREPARED BY: GARY FRALICK

	<u>2014 - 2018 Average</u>	<u>2019</u>	<u>2020 Proposed</u>
Trend Count:	52	43	50
Harvest:	1	1	1
Hunters:	1	1	1
Hunter Success:	100%	100%	100%
Active Licenses:	1	1	1
Active License Success	100%	100%	100%
Recreation Days:	2	1	3
Days Per Animal:	2	1	3
Males per 100 Females:	220	71	
Juveniles per 100 Females	70	8	
Trend Based Objective (± 20%)			65 (52 - 78)
Management Strategy:			Special
Percent population is above (+) or (-) objective:			-33.8%
Number of years population has been + or - objective in recent trend:			2

Priority Management Need/Projects for additional funding:

1. Monitoring – Monitor bighorn sheep throughout the herd unit and specifically in Box Canyon and along the crest of Wyoming Range (areas not sampled/monitored consistently).
  - **Projected Project Cost = \$43,400**
    - \$1,000/collar x 5 = \$5,000
    - \$Helicopter ferry time, availability, fuel truck, per diem = \$17,400
    - Helicopter capture cost @\$1,800/hour x 10 hours = \$18,000
    - Annual Data Upload Fees = \$200/collar/year (3 years) = \$3,000
  
2. Population Estimation - Need improved population estimation techniques. WGFD desires to continue assessing population estimation methods such as fecal DNA, camera traps, mark/recapture, and etc. (See Appendix 2).

## Devil's Canyon

SPECIES: Bighorn Sheep	PERIOD: 6/1/2019 - 5/31/2020
HERD: BS212 - DEVIL'S CANYON	
HUNT AREAS: 12	PREPARED BY: SAM STEPHENS

	<u>2014 - 2018 Average</u>	<u>2019</u>	<u>2020 Proposed</u>
Trend Count:	192	142	170
Harvest:	5	6	7
Hunters:	5	6	7
Hunter Success:	100%	100%	100%
Active Licenses:	5	6	7
Active License Success	100%	100%	100%
Recreation Days:	28	69	50
Days Per Animal:	5.6	11.5	7.1
Males per 100 Females:	48	66	
Juveniles per 100 Females	44	46	
Trend Based Objective (± 20%)			175 (140 - 210)
Management Strategy:			Special
Percent population is above (+) or (-) objective:			-18.9%
Number of years population has been + or - objective in recent trend:			2

Priority Management Need/Projects for additional funding:

1. Disease - Better understand bighorn sheep movements within this herd to assess disease risk in the future.
  - **Projected Project Cost = \$48,500**
    - \$1,000/collar x 20 = \$20,000
    - \$550/capture x 30 (including 10 recaptures) = \$16,500
    - Annual Data Upload Fees = \$200/collar/year (3 years) = \$12,000
2. Trapping/Transplanting – Maintain funding to trap and transplant, if necessary, bighorn sheep to maintain herd at objective.
  - **Projected Project Cost = \$43,000**
    - \$1,000/collar x 20 = \$20,000
    - \$550/capture x 20 = \$11,000
    - Annual Data Upload Fees = \$200/collar/year (3 years) = \$12,000

## Douglas Creek

SPECIES: Bighorn Sheep	PERIOD: 6/1/2019 - 5/31/2020		
HERD: BS516 - DOUGLAS CREEK			
HUNT AREAS: 18	PREPARED BY: LEE KNOX		
	<b><u>2014 - 2018 Average</u></b>	<b><u>2019</u></b>	<b><u>2020 Proposed</u></b>
Population:		N/A	N/A
Harvest:	0	0	2
Hunters:	0	0	2
Hunter Success:	0%	0%	100 %
Active Licenses:	0	0	2
Active License Success:	0%	0%	100 %
Recreation Days:	1	0	14
Days Per Animal:	0	0	7
Males per 100 Females	37	0	
Juveniles per 100 Females	45	0	
Population Objective (± 20%) :			75 (60 - 90)
Management Strategy:			Special
Percent population is above (+) or below (-) objective:			N/A%
Number of years population has been + or - objective in recent trend:			0
Model Date:			2/23/2020

Priority Management Need/Projects for additional funding:

1. Habitat Enhancement– Cheatgrass treatment post Mullen fire 2020.
  - **Projected Project Cost = \$525,000**
    - \$35/acre (Plateau) x 15,000 acres
2. Research – Better understand bighorn sheep movements, habitat use, and potential for population expansion post Mullen fire 2020.
  - **Projected Project Cost = \$29,100**
    - \$1,000/collar x 12 = \$12,000
    - \$550/capture x 18 (including 6 recaptures) = \$9,900
    - Annual Data Upload Fees = \$200/collar/year (3 years) = \$7,200

## Encampment River

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SPECIES: Bighorn Sheep	PERIOD: 6/1/2019 - 5/31/2020
HERD: BS519 - ENCAMPMENT RIVER	
HUNT AREAS: 21	PREPARED BY: TEAL CUFAUDE

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	<u>2014 - 2018 Average</u>	<u>2019</u>	<u>2020 Proposed</u>
Population:		N/A	N/A
Harvest:	1	0	0
Hunters:	1	0	0
Hunter Success:	100%	0%	0 %
Active Licenses:	1	0	0
Active License Success:	100%	0%	0 %
Recreation Days:	7	0	0
Days Per Animal:	7	0	0

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Limited Opportunity Objective:

- 5-year average of > 75% hunter success
  - 5-year average harvest age of 6-8 years
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Priority Management Need/Projects for additional funding:

1. Invasive Species - Continued monitoring and treatment of cheatgrass across the Platte Valley is needed to maintain and/or enhance important habitats.
  - **Projected Project Cost = \$484,750**
    - \$35/acre (Plateau) x 13,850 acres = \$484,750
  
2. Population Estimation - Need improved population estimation techniques. WGFD desires to continue assessing population estimation methods such as fecal DNA, camera traps, mark/recapture, and etc. (See Appendix 2).

## Ferris/Seminole

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SPECIES: Bighorn Sheep	PERIOD: 6/1/2019 - 5/31/2020
HERD: BS615 - FERRIS-SEMINOIE	
HUNT AREAS: 17, 26	PREPARED BY: GREG HIATT

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	<u>2014 - 2018 Average</u>	<u>2019</u>	<u>2020 Proposed</u>
Population:	153	245	265
Harvest:	2	5	5
Hunters:	2	5	5
Hunter Success:	100%	100%	100 %
Active Licenses:	2	5	5
Active License Success:	100%	100%	100 %
Recreation Days:	21	22	45
Days Per Animal:	10.5	4.4	9
Males per 100 Females	56	0	
Juveniles per 100 Females	48	0	

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Population Objective (± 20%) :	300 (240 - 360)
Management Strategy:	Special
Percent population is above (+) or below (-) objective:	-18.3%
Number of years population has been + or - objective in recent trend:	10
Model Date:	None

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### Priority Management Need/Projects for additional funding:

1. Monitoring - Re-deploy 10 radio collars on Bennett sheep to continue monitoring potential movements outside the herd unit (Pedro Mtns.).
  - **Projected Project Cost = \$24,250**
    - \$1,000/collar x 10 = \$10,000
    - \$550/capture x 15 (including 5 recaptures) = \$8,250
    - Annual Data Upload Fees = \$200/collar/year (3 years) = \$6,000
  
2. Enhancement/Invasives - Conduct planned cheatgrass management Seminole/Bennett Mountains every 3-5 years and treat an estimated 1000-1500 acres. It is estimated that about 1,200 acres will need to be treated in the 2020 Bradley Fire next fall, 2021. Initial estimated project costs are:
  - **Projected Project Cost = \$94,500**
    - \$35/acre (Plateau) x 2700 acres = \$94,500

## Jackson

SPECIES: Bighorn Sheep

PERIOD: 6/1/2019 - 5/31/2020

HERD: BS107 - JACKSON

HUNT AREAS: 7, 777

PREPARED BY: ALYSON COURTEMANCH

	<u>2014 - 2018 Average</u>	<u>2019</u>	<u>2020 Proposed</u>
Trend Count:	368	398	400
Harvest:	9	10	12
Hunters:	11	12	12
Hunter Success:	82%	83%	100%
Active Licenses:	11	12	12
Active License Success	82%	83%	100%
Recreation Days:	114	139	144
Days Per Animal:	12.7	13.9	12
Males per 100 Females:	42	32	
Juveniles per 100 Females	37	34	
Trend Based Objective ( $\pm$ 20%)			400 (320 - 480)
Management Strategy:			Special
Percent population is above (+) or (-) objective:			-0.5%
Number of years population has been + or - objective in recent trend:			0

### Priority Management Need/Projects for additional funding:

1. Research - Continue to fund the Jackson/Whiskey Mountain lamb survival study conducted through December 2021. .
  
2. Invasives - Cheatgrass treatments proposed next year in and around Jackson include bighorn sheep range and this effort will likely expand in the future. Approximately 15,000 acres of bighorn sheep crucial winter range that is at risk of cheatgrass infestation. Helicopter survey time is needed to map existing cheatgrass. Assuming 2% of the acres are currently infested and need helicopter treatment the estimated costs are:
  - **Projected Project Cost = \$39,600 (year 1)**
    - \$60/acre (Rejuvra) x 300 acres = \$14,100
    - Initial helicopter survey and mapping time ~10 hrs. x \$850/hr. = \$8,500
    - Helicopter treatment time ~20 hrs. x \$850/hr. = \$17,000

## Kouba Canyon

PERIOD: 6/1/2019 - 5/31/2020

HUNT AREAS: 20 (Kouba Canyon)

PREPARED BY: JOE SANDRINI

	<u>2014 - 2018 Average</u>	<u>2019</u>	<u>2020 Proposed</u>
Population:	154	150	150
Harvest:	2.2	3	3
Hunters:	2.2	3	3
Hunter Success:	100%	100%	100%
Active Licenses:	2.2	3	3
Active License Success:	100%	100%	100%
Recreation Days:	10	15	15
Days Per Animal:	4.6	5.0	5.0
Males per 100 Females	89	105	
Juveniles per 100 Females	50	19	
Population Objective (± 20%) :			150-200
Management Strategy:			Joint Management with South Dakota
Percent population is above (+) or below (-) objective:			South Dakota
Number of years population has been + or - objective in recent trend:			10
Model Date:			No Model

### Priority Management Need/Projects for additional funding:

1. Population Estimation - Need improved population estimation techniques. WGFD desires to continue assessing population estimation methods such as fecal DNA, camera traps, mark/recapture, and etc. (See Appendix 2).
2. Invasives - Manage cheatgrass and Japanese brome.
  - **Projected Project Cost = \$209,000**
    - \$35/acre (Plateau) x 2,200 = \$77,000
    - \$60/acre (Esplanade) x 2,200 acres = \$132,000

## Laramie Peak

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SPECIES: Bighorn Sheep	PERIOD: 6/1/2019 - 5/31/2020
HERD: BS517 - LARAMIE PEAK	
HUNT AREAS: 19	PREPARED BY: MARTIN HICKS

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	<u>2014 - 2018 Average</u>	<u>2019</u>	<u>2020 Proposed</u>
Population:		N/A	N/A
Harvest:	7	8	8
Hunters:	8	8	8
Hunter Success:	88%	100%	100 %
Active Licenses:	8	8	8
Active License Success:	88%	100%	100 %
Recreation Days:	81	68	65
Days Per Animal:	11.6	8.5	8.1

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Limited Opportunity Objective:

5-year average of > 75% hunter success

5-year average harvest age of 6-8 years

Secondary Objective:

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Management Strategy:	Special
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Priority Management Need/Projects for additional funding:

1. Enhancement/Invasives - The development of a habitat management plan for the herd unit would provide a basis for future habitat enhancements and Cheatgrass control, particularly in areas that have burned via wildfire is essential.
  - **Projected Project Cost = \$1,520,000**
    - \$35/acre (Plateau) x 16,000 = \$560,000
    - \$60/acre (Esplenade) x 16,000 = \$960,000
  
2. Disease – Surveillance to better understand the impact of the recent pneumonia outbreak in Sybille Canyon.
  - **Projected Project Cost = \$48,500**
    - \$1,000/collar x 20 = \$20,000
    - \$550/capture x 30 (including 10 recaptures) = \$16,500
    - Annual Data Upload Fees = \$200/collar/year (3 years) = \$12,000

## Targhee

SPECIES: Bighorn Sheep	PERIOD: 6/1/2019 - 5/31/2020
HERD: BS106 - TARGHEE	
HUNT AREAS: 6, 888	PREPARED BY: ALYSON COURTEMANCH

	<u>2014 - 2018 Average</u>	<u>2019</u>	<u>2020 Proposed</u>
Population:		N/A	N/A
Harvest:	1	1	1
Hunters:	1	1	1
Hunter Success:	100%	100%	100%
Active Licenses:	1	1	1
Active License Success:	100%	100%	100%
Recreation Days:	29	17	15
Days Per Animal:	29	17	15

Limited Opportunity Objective:

- 5-year average harvest age of 6-8 years
- 5-year average hunter success of  $\geq 50\%$

Secondary Objective:

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Management Strategy:	Special
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Priority Management Need/Projects for additional funding:

1. Enhancement - Winter and spring/fall range is limiting for this herd. There are several prescribed projects in the planning stages that could be implemented within the next 5 years, specifically Teton Canyon and Phillips Canyon.

**Teton Canyon Projected Project Cost = \$161,200**

- Mechanical slashing and prep work: 208 acres x \$250/acre = \$52,000
- Prescribed fire: 840 acres of historical sheep habitat x \$130/acre = \$109,200

**North Phillips Canyon Projected Project Cost = \$180,000**

- Mechanical slashing and prep work: unknown # acres, estimate \$50,000
- Prescribed fire: 1,000 acres x \$130/acre = \$130,000

2. Population Estimation - Need improved population estimation techniques. WGFD desires to continue assessing population estimation methods such as fecal DNA, camera traps, mark/recapture, and etc. (See Appendix 2).

## Temple Peak

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- Temple Peak is not an active herd unit.
  - Bighorn sheep spend portions of the year on/off the Wind River Reservation
  - WGFD and Wind River Reservation personnel estimate between 75 – 100 bighorn sheep.
  - Population has been steady to slightly declining the past 10 years.
  - Bighorn sheep outside of the Wind River Reservation are not hunted.
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Priority Management Need/Projects for additional funding:

1. Survey Flight Time - Better document winter use areas and obtain a minimum census of those bighorn sheep in both WRR and SNF. We propose a mid-winter trend count flight of both jurisdictions utilizing GPS collar location data to locate groups of bighorn sheep that are occupying both alpine tundra and traditional winter range habitats.
  - **Projected Project Cost = \$10,500**
    - \$875/hour X 12 hours = \$10,500

## Whiskey Mountain

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SPECIES: Bighorn Sheep	PERIOD: 6/1/2019 - 5/31/2020
HERD: BS609 - WHISKEY MOUNTAIN	
HUNT AREAS: 8-10, 23	PREPARED BY: GREG ANDERSON

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	<u>2014 - 2018 Average</u>	<u>2019</u>	<u>2020 Proposed</u>
Population:	738	N/A	N/A
Harvest:	15	11	12
Hunters:	22	17	16
Hunter Success:	68%	65%	75 %
Active Licenses:	22	17	16
Active License Success:	68%	65%	75 %
Recreation Days:	248	83	100
Days Per Animal:	16.5	7.5	8.3
Males per 100 Females	53	51	
Juveniles per 100 Females	22	22	

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Population Objective (± 20%) :	1350 (1080 - 1620)
Management Strategy:	Special
Percent population is above (+) or below (-) objective:	N/A%
Number of years population has been + or - objective in recent trend:	10
Model Date:	None

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### Priority Management Need/Projects for additional funding:

Continue implementation of the action items identified in the “Whiskey Mountain Bighorn Sheep Plan” that was the result of the Whiskey Mountain Bighorn Sheep collaborative process with priority on:

1. Enhancement/Invasives - Prescribed burns on Torrey Rim will occur over multiple years beginning in 2021 and pre and/or post-treatment cheatgrass control actions will be necessary.
  - **Projected Project Cost = \$31,620**
    - \$60/acre (Esplenade) x 527 acres = \$31,620
2. Research - Continue to fund the Jackson/Whiskey Mtn. herds lamb survival study conducted through December 2021 and Whiskey Mtn (Pinedale/West Side Story) study through 2024 (See Appendix 3).
  - **Projected Project Cost Jackson/Whiskey Mtn. herds = \$414,140**
  - **Projected Project Cost Whiskey Mtns.’s West Side Story = \$413,423**

**Appendix 1. Additional management needs/projects.**

**Douglas Creek**

Herd Unit	Management Category	Sub-categories	Management Needs
Douglas Creek	Trapping/Transplanting		<p>If bighorn sheep movement and habitat use data in conjunction with habitat assessments indicate carrying capacity in this herd unit has increased as a result of the Mullen fire, there may be potential to supplement and expand this population by introducing other bighorn sheep.</p> <p><b>Projected Project Cost = \$43,000</b></p> <ul style="list-style-type: none"> <li>• \$1,000/collar x 20 = \$20,000</li> <li>• \$550/capture x 20 = \$11,000</li> <li>• Annual Data Upload Fees = \$200/collar/year (3 years) = \$12,000</li> </ul>

**Encampment River**

Herd Unit	Management Category	Sub-categories	Management Needs
Encampment River	Management/Population monitoring	Collaring	<p>Collar 10 additional ewes and have the funds to redeploy mort collars in 2021. Continuation of disease surveillance work and resource use projects.</p> <p>➤ <b>Projected Project Cost = \$24,250</b></p> <ul style="list-style-type: none"> <li>• \$1,000/collar x 10 = \$10,000</li> <li>• \$550/capture x 15 (including 5 recaptures) = \$8,250</li> <li>• Annual Data Upload Fees = \$200/collar/year (3 years) = \$6,000</li> </ul>

<b>Encampment River</b>	Habitat	Enhancement	Analyze fine-scale movement data from collars and delineate annual variation in seasonal movements, habitat selection and resource use. These analyses will likely take place in 2024/2025. Use the resource selection function analyses to help inform the goals and placement of future habitat enhancement projects. These analyses may also provide insights on habitat components that are important to the resilience and expansion of other small, isolated bighorn sheep herds across the state.
<b>Encampment River</b>	Management/Population monitoring	Survey Flight Time	Dedicated bighorn sheep flight time for BS519 and BS516. WGFD currently classifies bighorn sheep opportunistically during deer/ elk flights. Approximately 4 hours of dedicated flight time would improve classification data. With improved data, WGFD will assess whether more ram harvest opportunity exists in these two herd units. ➤ <b>Projected Project Cost = \$5,250</b> • \$875/hour X 6 hours (4 hours mission, 2 hours ferry) = \$5,250
<b>Encampment River</b>	Separation of Wild and Domestic Sheep/Goats		It will be important to review/refine bighorn sheep seasonal ranges using habitat use analyses in the Snowy Range and Sierra Madres to understand the risk of commingling with domestic sheep in the event allotments in the Snowy Range and Sierra Madres are once again used.

**Ferris/Seminole**

<b>Herd Unit</b>	<b>Management Category</b>	<b>Sub-categories</b>	<b>Management Needs</b>
<b>Ferris/Seminole</b>	Management/Population monitoring	Collaring	Continued collaring sheep in the Ferris and Seminoes to monitor survival, habitat use (including treated areas, guzzlers). ➤ <b>Projected Project Cost = \$48,500</b> • \$1,000/collar x 20 = \$20,000

			<ul style="list-style-type: none"> <li>• \$550/capture x 30 (including 10 recaptures) = \$16,500</li> <li>• Annual Data Upload Fees = \$200/collar/year (3 years) = \$12,000</li> </ul>
<b>Ferris/Seminole</b>	Trapping/Transplanting		<p>Make funds available to transplant sheep to the west end of Ferris Mountain. This could be done using transplants from within the herd or from other source populations (i.e., Devil's Canyon).</p> <p>➤ <b>Projected Project Cost = \$43,000</b></p> <ul style="list-style-type: none"> <li>• \$1,000/collar x 20 = \$20,000</li> <li>• \$550/capture x 20 = \$11,000</li> <li>• Annual Data Upload Fees = \$200/collar/year (3 years) = \$12,000</li> </ul>

### Jackson

<b>Herd Unit</b>	<b>Management Category</b>	<b>Sub-categories</b>	<b>Management Needs</b>
<b>Jackson</b>	Trapping/Transplanting		Explore the potential to have more sheep in the southern portion of the Jackson Herd. The Camp Creek and Ramshorn bands are small and appear to be stagnant. Could we remove the remaining Camp Creek sheep and translocate new sheep? Is this too risky with domestic sheep allotments farther south? Along the same lines, what about translocations within the herd to south of Jackson into sheep habitat from Leeks Canyon to Hoback to expand the herd's range?
<b>Jackson</b>	Management/Population monitoring	Population Estimation	Currently we fly a winter trend count on this herd. There is a need to explore alternative population estimation techniques, including camera trap grids. Since their winter

			range is relatively limited, this could be a good candidate to test using cameras in this way.
<b>Jackson</b>	Movement/Migration		<p>Use substantial amount of existing collar data to map seasonal movements. Also, collar a sample of rams in this herd to assess sub-herd connectivity (main Jackson Herd to Camp Creek to Ramshorn) is of interest.</p> <p>➤ <b>Projected Project Cost for ram collaring = \$35,215</b></p> <ul style="list-style-type: none"> <li>• Collars: \$1,000/collar x 15 = \$15,000</li> <li>• Captures: \$550/animal x 15 = \$8,250</li> <li>• Captures fringe: \$625 ferry + \$780/day for fuel truck and per diem x 3 days = \$2,965</li> <li>• Annual Data Upload Fees = \$200/collar/year (3 years) = \$9,000</li> </ul>

### Kouba Canyon

Herd Unit	Management Category	Sub-categories	Management Needs
<b>Kouba Canyon</b>	Movement/Migration		<p>Deploy collars to better understand emigration and how much time &amp; how many sheep are on each side of the state line. This would also enlighten managers who question why aren't there BHS "coming out of our ears" given how good lamb survival to 6 mo. seems to be.</p> <p>➤ <b>Projected Project Cost = \$48,500</b></p> <ul style="list-style-type: none"> <li>• \$1,000/collar x 20 = \$20,000</li> <li>• \$550/capture x 30 (including 10 recaptures) = \$16,500</li> <li>• Annual Data Upload Fees = \$200/collar/year (3 years) = \$12,000</li> </ul>

### Laramie Peak

Herd Unit	Management Category	Sub-categories	Management Needs
Laramie Peak	Movement/Migration		Use existing collar data gathered to identify seasonal movements corridors and more particularly in the way of habitat treatments.
Laramie Peak	Habitat	Enhancement	
Laramie Peak	Habitat	Enhancement	Based on the collar data from Iron Mountain out of Hunt Area 19 in three years wild sheep do not stray too far from the areas that were burned through prescription 10-12 years ago as well as areas that burned naturally (Reese Fire) 17 years ago within the Duck Creek subherd of Laramie Peak. Use this information to identify prescribed burn areas.

### Targhee

Herd Unit	Management Category	Sub-categories	Management Needs
Targhee	Education/Outreach		Continue to engage the public on this herd, specifically the impacts of recreation. We are finishing a public collaborative process in 2020 focused on backcountry skiing impacts on the sheep, but we will need continued education efforts and engagement going forward, including signs, outreach, films, designing apps for skiers to submit sheep observations, etc. Exact costs are unknown at this time. ➤ <b>Projected Project Cost = \$10,000/year</b>
Targhee	Separation of Wild and Domestic Sheep/Goats		Continue to have a mountain goat hunting season outside of the National Park. Continue to work with NPS on mountain goat removal in the park through skilled

			volunteer harvest and/or translocation (funding may be needed to help support these efforts).
<b>Targhee</b>	Disease		Continue to monitor respiratory pathogen presence/absence in the herd and sinus tumors. M. ovi has not been found in this herd, but sample size is small.
<b>Targhee</b>	Research		Update genetics study that was done about 10 years ago. Is there still genetic differentiation between the northern and southern sub-herds? Also evaluate paternity lines within the herd to determine how many rams are breeding (and how many rams could we remove through harvest without affecting reproduction/inbreeding).
<b>Targhee</b>	Management/Population monitoring	Collaring	<p>Develop a proposal to collar sheep in the future to monitor sheep survival, pregnancy, disease status, etc. Catching sheep has been incredibly difficult in recent years, but continued efforts are needed.</p> <p>➤ <b>Projected Project Cost = \$65,525</b></p> <ul style="list-style-type: none"> <li>• Collars: \$1,000/collar x 10 = \$10,000</li> <li>• Captures: \$1,500/hr x 3 hrs/sheep x 10 sheep = \$45,000</li> <li>• Captures fringe: \$625 ferry + \$780/day for fuel truck and per diem x 5 days = \$4,525</li> <li>• Annual Data Upload Fees = \$200/collar/year (3 years) = \$6,000</li> </ul>

***Appendix 2. Estimated cost to develop and test a population estimation technique for smaller bighorn sheep herds.***

To develop and test techniques (fecal DNA and camera traps) to estimate population sizes of smaller bighorn sheep herds the best approach is to make this a university lead graduate student project. These techniques while being tried and tested in the following herd units, would be applicable to others in the state. The following cost estimates include equipment, graduate student stipend, and salaries for two technicians for 2 years.

<b>Herd</b>	<b>Approximate Herd Size</b>	<b># Fecal Samples</b>	<b>Total Fecal Sample Cost (\$75/sample)</b>	<b># Cameras</b>	<b>Total Camera Costs (@\$150/camera)</b>	<b>Total Cost</b>
<b>Darby Mountain</b>	<b>75</b>	225	\$16,875	15	\$2,250	\$19,125
<b>Encampment River</b>	<b>50</b>	150	\$11,250	10	\$1,500	\$12,750
<b>Kouba Canyon</b>	<b>150</b>	450	\$33,750	30	\$4,500	\$38,250
<b>Targhee</b>	<b>125</b>	375	\$28,125	20	\$3,000	\$31,125
<b>Totals</b>	<b>400</b>	1200	\$90,000	75	\$11,250	<b>\$101,250</b>
<b>Graduate Student (2 yrs. @\$25,000/yr.)</b>						\$50,000
<b>Field Technicians (x2 for 2 yrs. @\$14,400/yr.)</b>						\$57,600
<b>Travel, Supplies, other misc.</b>						\$25,000
<b>Total Project Cost</b>						<b>\$233,850</b>
<i>Assumption 300 fecal samples and 20 cameras needed for every 100 sheep.</i>						

**Appendix 3. Estimated cost and current funding for the Jackson/Whiskey Mtn. herd lamb survival study and the Whiskey Mtn.'s West Side Story lamb survival study.**

**Jackson/Whiskey Mtn.**

Project Partner	Phase I	FY2019	FY2020	FY2021	FY2022	FY2023	
	Wyoming Wildlife/Livestock Disease Research Partnership	\$60,945	\$0	\$0	\$0	\$0	\$0
Wyoming Game and Fish Commission	\$0	\$350,000	\$0	\$0	\$0	\$0	
Wyoming Game and Fish Commission License	\$0	\$14,855	\$0	\$0	\$0	\$0	
Animal Damage Management Board	\$0	\$45,000	\$30,000	\$0	\$0	\$0	
Wyoming Wildlife and Natural Resource Trust	\$0	\$135,000	\$100,000	\$0	\$0	\$0	
Bureau of Land Management	\$0	\$50,000	\$41,500	\$0	\$0	\$0	
US Forest Service	\$0	\$0	\$0	\$0	\$0	\$0	
Wyoming Governor's Big Game License Coalition	\$130,800	\$55,000	\$135,000	\$50,000	\$0	\$0	
Teton Conservation District	\$0	\$0	\$0	\$10,000	\$0	\$0	
Bowhunter's of Wyoming	\$0	\$5,000	\$1,300	\$6,300	\$0	\$0	
Wyoming Wild Sheep Foundation	\$12,000	\$0	\$0	\$0	\$0	\$0	
National Wild Sheep Foundation	\$0	\$15,000	\$22,000	\$0	\$0	\$0	
<b>Total Needed</b>	\$203,745	\$492,939	\$385,997	\$359,570	\$227,008	\$14,580	
<b>Committed</b>	\$203,745	\$669,855	\$329,800	\$66,300	\$0	\$0	
<b>Balance</b>	\$0	-\$176,916	\$56,197	\$293,270	\$227,008	\$14,580	<b>\$414,140</b>

**West Side Story**

Project Partner	FY2020	FY2021	FY2022	FY2023	FY2024	
	Wyoming Wildlife/Livestock Disease Research Partnership	\$0	\$0	\$0	\$0	\$0
Wyoming Game and Fish Department	\$89,000	\$60,000	\$0	\$0	\$0	
Wyoming Game and Fish Commission	\$0	\$0	\$0	\$0	\$0	
Animal Damage Management Board	\$0	\$0	\$0	\$0	\$0	
Wyoming Wildlife and Natural Resource Trust	\$0	\$0	\$0	\$0	\$0	
Bureau of Land Management	\$0	\$0	\$0	\$0	\$0	
Wyoming Governor's Big Game License Coalition	\$75,000	\$0	\$0	\$0	\$0	
Wyoming Wild Sheep Foundation	\$40,000	\$0	\$0	\$0	\$0	
National Wild Sheep Foundation	\$0	\$0	\$0	\$0	\$0	
<b>Total Needed</b>	\$202,824	\$232,351	\$184,146	\$43,522	\$14,580	
<b>Committed</b>	\$204,000	\$60,000	\$0	\$0	\$0	
<b>Balance</b>	-\$1,176	\$172,351	\$184,146	\$43,522	\$14,580	<b>\$413,423</b>