BIGHORN SHEEP UNIT MANAGEMENT PLAN
BOOK CLIFFS, SOUTH (RATTLESNAKE) WMU #10
August 2019

BOUNDARY DESCRIPTION

Emery, Grand and Uintah counties--Boundary begins at the Utah-Colorado state line and the summit and drainage divide of the Book Cliffs; west along this summit and drainage divide to Diamond Ridge; southwest along Diamond Ridge and the Book Cliffs summit (north-south drainage divide) to the Uintah and Ouray Indian Reservation boundary (Hells Hole/head of Sego Canyon); west along this boundary to the Green River; south along this river to Swasey's Boat Ramp and the Hastings Road; south on this road to SR-19; south and east on SR-19 to Exit 164 on 1-70 near the town of Green River; east along I-70 to the Utah-Colorado state line; north along this state line to the summit and drainage divide of the Book Cliffs. EXCLUDES ALL NATIVE AMERICAN TRUST LAND WITHIN THE BOUNDARY. USGS 1:100,000 Maps: Huntington, Moab, Westwater. Boundary questions? Call the Price office, 435-613-3700.

LAND OWNERSHIP

Table 1. Land ownership and approximate area of modeled bighorn sheep habitat for the Book Cliffs, South bighorn sheep management unit.

Ownership	MODELED BIGHORN HABITAT	
	Area (acres)	%
Bureau of Land Management	319,419	85.4%
Utah State Institutional Trust Lands	43,675	11.7%
Private	10,528	2.8%
Utah Division of Wildlife Resources	544	0.1%
Tribal	26	<0.1%
State Sovereign Land	3	<0.1%
Totals	**374,195**	**100%**

UNIT MANAGEMENT GOALS

The Book Cliffs Rattlesnake Unit is located in east-central Utah in Grand County. It includes the lower elevations of the East Tavaputs Plateau just north of Interstate 70. It consists of relatively dry habitat more indicative of desert bighorn habitat in the state of Utah. The vast majority of the bighorn sheep reside within 2 miles of the Green River along the steep canyons draining in from the east (Figure 1). Occupied habitat also extends eastward approximately 20 miles near the town of Thompson. Most bighorns are found at elevations of 4,000 feet on the desert floor to 7,000

feet in the upper reaches of the canyons. Ram groups have been known to occasionally occupy elevations approaching 8500 feet during the summer months. The vast majority of the habitat is characterized by open grassy slopes with cheatgrass and native grasses with dispersed stands of greasewood, shadscale, and saltbush. Pinyon-Juniper stands begin to predominate at upper elevations and along north facing slopes with sagebrush being the primary browse species. Specific goals are to:

1) Manage for a healthy population of Rocky Mountain bighorn sheep capable of providing a broad range of recreational opportunities, including hunting and viewing.
2) Balance bighorn sheep impacts with other uses such as authorized grazing and local economies.
3) Maintain a population that is sustainable within the available habitat in the unit boundary.

HISTORY AND CURRENT STATUS

Bighorn sheep were established in the area in the early 1970's when the Ute Indian Tribe transplanted Rocky Mountain bighorns from Alberta and Wyoming on to the Uintah and Ouray Reservation north of the Rattlesnake Unit. This population established and bighorn sheep began dispersing on to BLM lands to the south. A hunt-able population on public lands was available by the mid 1980's. This population has slowly expanded over the past 30 years. The maximum number of counted bighorns was 235 in 2007 suggesting a population of 400 bighorn. The current population estimate is 230 bighorn sheep.

There is historic and current domestic sheep grazing on and near this unit. Domestic sheep and bighorn sheep likely comingled as the population established on this unit. There were two crucial conversions in the early 1990's that removed domestic sheep from the Rattlesnake and Floy allotments. These were both inside core bighorn use areas. In recent years, as the bighorn sheep population has expanded eastward there have been documented comingling with domestic sheep on winter allotments east of the town of Thompson. This could have significant population level impacts on this herd.

ISSUES AND CONCERNS

Potential Habitat: We modeled potential bighorn sheep habitat on the Book Cliffs, South unit using methodology outlined by O'Brien et al. (2014). Bighorn sheep select habitat based on the proximity of steep-sloped escape terrain, forage availability, ruggedness, and horizontal visibility (Bleich et al. 1997, Valdez and Krausman 1999, Sappington et al. 2007). Bighorn sheep habitat is located throughout the unit in suitable rugged locations (Figure 1).

Livestock Competition: Bighorn sheep annual use of forage classes, when compared to cattle, differ significantly (Dodd and Brady 1988). Likewise, bighorn sheep generally avoid areas where cattle are present (Bissonette and Steinkamp 1996), and also select areas with a much higher degree of slope (Ganskopp and Vavra 1987). For these reasons, competition between cattle and bighorns should not be a significant concern within this unit. Because of the risk of pathogen transmission between bighorns and domestic sheep, the areas where domestic sheep are present are not suitable for bighorn sheep.

Disease: Disease, especially bacterial pneumonia, has been responsible for numerous declines in bighorn populations throughout North America (Cassirer and Sinclair 2007). Pneumonia outbreaks typically affect all age/sex cohorts and are usually followed by several years of annual pneumonia outbreaks in lambs that dramatically reduce population growth (Spraker et al. 1984, Ryder et al. 1992, George et al. 2008). These events are attributed to the transfer of pathogens from domestic sheep (*Ovis aries*) or goats (*Capra aegagrus hircus*) to wild sheep through social contact (Singer et al. 2000, Monello et al. 2001, Cassirer and Sinclair 2007). Disease-induced mortality rates in bighorn sheep vary substantially by population due to multiple processes including contact rates, social substructuring, pathogen virulence, and individual susceptibility (Manlove et al. 2014, 2016). Therefore, spatial separation from domestic sheep and goats is the most important factor in maintaining overall herd health. It is not the intent of this plan or the DWR to force domestic sheep operators off public lands or out of business. Rather, the intent is to look for opportunities that will protect bighorn sheep populations while working with the domestic sheep industry and individual grazers.

Predation: Cougar predation may limit bighorn sheep in locations where predator populations are largely supported by sympatric prey populations (Hayes et al. 2000, Schaefer et al. 2000, Ernest et al. 2002), which, in this case, includes a limited amount of mule deer. It has been hypothesized that declines in sympatric ungulate populations can increase predation on bighorn sheep as cougars switch to bighorns as an alternate prey source (Kamler et al. 2002, Rominger et al. 2004). It is anticipated that cougars will be the main predator of bighorns in the Book Cliffs, South unit. If predation becomes a limiting factor, predator control work will be administered within the guidelines of the DWR Predator Management Policy. Predator management is coordinated with USDA Wildlife Services.

POPULATION MANAGEMENT

Population Management Objective:

1) Manage for up to 450 bighorn sheep throughout suitable habitat west of Thompson, Utah. Bighorn sheep populations should not be allowed to expand east of Thompson to maintain separation between wild and domestic sheep. A population of 450 would be well below the recommended 1.3-1.9 bighorns /sq km (Van Dyke 1983); however if disease issues becomes a concern local densities may be reduced.

Population Management Strategies:

1) Conduct transplants on or off the unit as needed to meet population objectives as allowed by disease conditions in source and receiving herds.
2) Utilize ewe hunts as needed to target bighorn sheep inhabiting areas with a high potential for comingling with domestic sheep.
3) Ewe hunts could also be used as a tool to regulate overall population levels and localized bighorn sheep density issues if disease issues prevent transplants.

4) Conduct adequate disease sampling of bighorn sheep on the unit as needed to develop current disease profiles**.**

Population Monitoring Plan:

Continue aerial surveys of the unit every two years to monitor total population and herd composition. Approximately 12 to 16 hours of flight time are typically needed. Monitor survival, habitat use, and potential disease issues through continued radio telemetry studies on the unit. Conduct ground classification as conditions permit to obtain annual production estimates. This information is highly valuable as an indicator of population health and condition.
All population data will be collected and submitted on standardized forms, including all GIS flight and collar data (waypoints, flight paths, etc.).

Trend Count and Classification Data

Year	Pop Est	Total Count	Total Ewes	Total Lambs	Total Rams	Rams > 6 yrs old	Lambs/100 Ewes	Rams/100 Ewes
1991	90	55	19	17	19	11	89	100
1993	185	110	48	27	35	16	56	73
1995	135	82	33	22	27	3	67	81
1997	200	118	55	26	37	4	47	67
1999	310	187	87	43	57	22	49	65
2001	180	108	52	23	33	11	44	63
2003	185	111	54	24	33	10	44	61
2005	330	200	89	51	60	16	57	67
2007	400	235	113	44	78	25	39	69
2009	300	174	84	25	65	20	30	77
2011	300	181	101	26	54	17	26	53
2013	250	153	83	27	43	16	32	52
2016	209	138	78	20	40	11	26	51

Population Monitoring Plan:

Due to the current prevalence of bighorns infected with pathogens that contribute to respiratory disease, this herd is not suitable as a source population for transplants.
Transplants to the unit may be necessary in future years to augment the existing herd or expand the population if spatial separation with domestic sheep can be ensured.

Predator Management:
The Book Cliffs Rattlesnake bighorn sheep unit is managed under a predator management plan. The unit is designated as a bighorn sheep protection area with a liberal cougar harvest quota and year-round cougar hunting season. Over the past 15 years, 15 total cougars have been harvested on the unit, 9 of which were by sport hunters and the remainder by Wildlife Services personnel.

Cougar harvest is difficult in bighorn sheep habitat as there are relatively few snow days for good tracking, extremely rough terrain, and low cougar densities.
If cougar predation on the unit is shown to have adverse impacts on bighorn sheep, cougar population control will be accomplished through established UDWR policy and procedures.

Research Needs:

1) Continued GPS collaring studies are needed to document survival, production, habitat use, and potential comingling with domestic sheep. This will also provide an avenue to collect blood and nasal swabs to maintain an accurate disease profile.
2) Document bighorn sheep use (or lack of use) of newly constructed guzzlers.

DISEASE MANAGEMENT

Disease Management Objective:

1) Maintain a healthy population of Rocky Mountain bighorn sheep on the Book Cliffs, South unit.
2) Strive for spatial separation from domestic sheep and goats.

Disease Management Strategies:

Disease Monitoring: The DWR may perform periodic live captures to assess herd health, as well as take advantage of opportunistic sampling of hunter harvested bighorns or bighorns that are found dead. In 2014, 20 sheep were sampled on this and the adjacent Nine Mile, Gray Canyon unit. Sixty percent of these sheep showed exposure to *Mycoplasma.* An additional 20 sheep in this area were sampled in 2015 (of which 6 were from the Rattlesnake unit), these sheep showed a 90% exposure rate to *Mycoplasma.* There was also evidence of exposure to Parainfluenza and EHD. These findings will influence future management.

Spatial Separation: Work with land management agencies and private landowners to implement agency guidelines for management of domestic sheep and goats in bighorn areas. The most likely bighorn dispersal areas will be eastward along the Book Cliffs to the Colorado border. There are 3 primary threats that challenge effective separation:
  1) Farm flocks on private lands in the Green River Valley – Much of the land immediately adjacent to bighorn sheep habitat near the town of Green River is privately owned and managed for livestock grazing or row crops. Currently none of the landowners closest to bighorn sheep have domestic sheep. Great effort is needed to keep good relationships with landowners.
  2) Cisco Allotment - This allotment is inside currently occupied bighorn sheep habitat. It includes the desert habitat east of the town of Thompson. Seventeen bighorn sheep were removed by DWR personnel in 2013 on this allotment as direct contact with domestic sheep was likely. While this allotment is 15 miles away from core high density bighorn sheep areas, radio collar studies have

documented that bighorns travel from these areas on to this domestic sheep allotment so there is a very high risk of disease transmission.

3) <u>Cisco Mesa Allotment</u> – This allotment is east of the Cisco Allotment and is 16 miles east of most occupied habitat and 33 miles from core use high density bighorn sheep habitat. However, radio telemetry studies have shown that at least one ram has traveled from core bighorn habitat to this allotment. Good bighorn sheep habitat is found on the northern portions of this allotment.

Outreach efforts should take place with private landowners, grazing permittees and BLM employees concerning domestic and wild sheep interactions. Active removal of bighorn sheep and domestics as outlined in UDWR GLN-33 is a priority in this unit

Risk Management and Response Plan:

Areas of greatest concern for dispersing bighorn sheep include all areas east of Thompson, UT along the Book Cliffs. Any bighorn sheep in these areas should be removed immediately. All wandering bighorn sheep and stray domestic sheep and goat issues will be handled following the UDWR GLN-33. The need to test wandering bighorn sheep from this unit will be evaluated on a case by case basis.

HABITAT MANAGEMENT

Habitat Management Objectives:

1) Maintain or improve sufficient bighorn sheep habitat to achieve population objectives.
2) Continue to identify crucial bighorn sheep habitats and work with land managers and private landowners to protect these areas.
3) Assist land management agencies in monitoring bighorn habitat to detect changes in habitat quantity or quality.
4) Work with land managers to minimize and mitigate loss of bighorn habitat due to human disturbance and development.

Current and Potential Bighorn Sheep Distribution:

Bighorn sheep densities are highest along the Green River Corridor from Nefertiti south to Tushar Canyon. Approximately 5 bighorn sheep/square mile were documented in this area when the population was at its peak. Lower densities of bighorn can be found east from Tushar Canyon to as far east as Nash Wash (Figure 1).

Potential Threats to Habitat:

1) Human disturbance can result in abandonment or degradation of bighorn habitat. Human use along the Green River is very high in the summer months. To date, no adverse effects to bighorn sheep have been documented by high river runner traffic during the summer months.
2) Some oil and gas leases have been approved on bighorn sheep habitat on the eastern portions of the unit near Crescent Junction. Most of the proposed and developed wells are in flat areas away from good bighorn habitat. There is, however, potential for impacts to bighorn sheep to arise as oil and gas development increases. The DWR will foster a

positive relationship and work cooperatively with the energy development industry and land management agencies to implement appropriate mitigation measures if impacts to bighorn sheep arise.

Vegetation Management Projects:

1) Initiate vegetative treatment projects to improve bighorn habitat lost to natural succession or human impacts.
2) Cooperate with the BLM to utilize controlled burns and/or mechanical treatments to remove conifer encroachment on open hillsides   to increase and improve bighorn habitat across the unit.
3) Promote "let it burn" policies with BLM on all wildfires in bighorn sheep habitat when human safety and human structures are not at risk.
4) Identify specific habitat restoration projects to immediately benefit bighorn sheep. No specific projects have been identified. Much of this habitat is found in Wilderness Study Areas and will be difficult to initiate active habitat management.

Water Management Projects:

1) Work with the BLM, and private landowners to locate and improve water sources across bighorn habitat.
2) Cooperatively modify or improve existing water developments and guzzlers for bighorns.
    1) Tushar Canyon to Crescent Canyon
3) Install new water developments or guzzlers in bighorn habitat where water may be scarce or lacking.
    1) Upper Horse Canyon
    2) Upper Tushar Canyon
    3) Floy Wash

RECREATION MANAGEMENT

Recreation Management Objectives:

1) Provide hunting opportunities on the Book Cliffs, South unit that are a quality experience.
2) Increase public awareness and expand viewing opportunities of bighorn sheep.

Recreation Management Strategies:

Hunting: Hunting and permit allocation recommendations will be made in accordance with the Utah Bighorn Sheep Statewide Management Plan. Ewe hunts may be utilized as a tool for maintaining population objective.

Harvest Statistics

Year	Permits	Mean Days Hunted	Harvest	Satisfaction
2004	5	7.3	100%	-
2005	5	6.6	100%	4.5
2006	5	5.4	100%	4.8
2007	5	2.2	100%	5.0
2008	8	6.1	100%	3.9
2009	7	3.9	100%	4.7
2010	7	8.7	86%	4.2
2011	8	4.4	100%	4.9
2012	7	5.0	100%	5.0
2013	7	5.9	100%	4.4
2014	5	6	100%	5.0
2015	5	5.8	80%	4.2
2016	5	6.2	100%	4.6
2017	5	5.4	100%	4.8
2018	5	7.2	100%	5.0

Non-Consumptive Uses: The DWR will look for opportunities to increase public awareness and expand viewing opportunities of bighorn sheep through viewing events and public outreach. This is a difficult task considering the remoteness of the habitat currently being used by the bighorn sheep herd. Significant viewing opportunities are available along the Hastings Road north of Green River.

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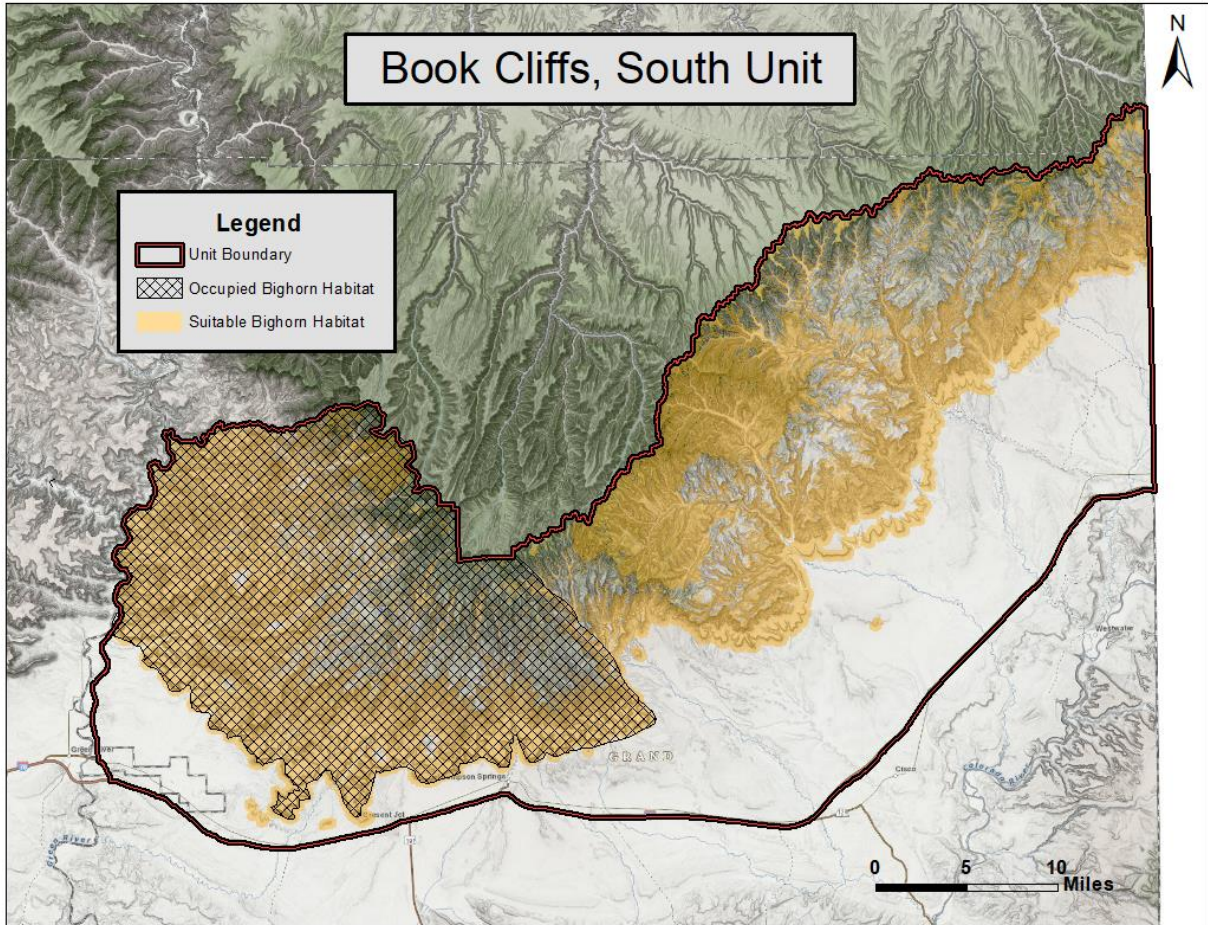
Figure 1. Book Cliffs, South unit management boundary, modeled suitable bighorn sheep habitat, and currently occupied bighorn habitat.