BIGHORN SHEEP UNIT MANAGEMENT PLAN
BOX ELDER, NEWFOUNDLAND MOUNTAIN
August 2019

BOUNDARY DESCRIPTION

Box Elder County—Boundary begins at I-80 and the township line separating R15 and R16 West; north on this township line to the township line separating T7 and T8 North; east on this township line to the township line separating R12 and R13 West; south on this township line to the Central Pacific railroad grade; east along this grade to the west shoreline of the Great Salt Lake; south and east along this shoreline to the east side of Stansbury Island and the Stansbury Island East Fork Road; south along this road to Stansbury Island Road; south along this road to I-80 (Exit 84); west on I-80 to the line separating R15 and R16 West. EXCLUDES ALL MILITARY INSTALLATIONS.

LAND OWNERSHIP

Table 1. Land ownership and approximate area of modeled bighorn sheep habitat for the Box Elder, Newfoundland Mountain bighorn sheep management unit.

Ownership	MODELED BIGHORN HABITAT	
	Area (acres)	%
Bureau of Land Management	67,388	63.5%
Department of Defense	17,693	16.7%
Private	11,402	10.7%
Utah State Institutional Trust Lands	9,620	9.1%
State Sovereign Land	3	<0.1%
Utah Division of Wildlife Resources	1	<0.1%
Totals	**106,107**	**100%**

UNIT MANAGEMENT GOALS

The Newfoundland Mountains subunit is located in south-central Box Elder County and northern Tooele county in north western Utah (Figure 1). This mountain range is approximately 80 air miles west and north of Salt Lake City. The range is an "island" in the middle of the salt flats to the west of Great Salt Lake. The majority of this area is playa or salt flat. The narrow, rugged, rocky range rises from the Great Salt Lake Desert at an elevation of 4,200 feet up to an elevation of 7,060 feet at Desert Peak. This plan will guide future management decisions consistent with the Utah Statewide Bighorn Sheep Management Plan. 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 cattle 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 historically occupied the Newfoundland Mountains unit. However, they were extirpated from this area for unknown reasons. It is likely that disease and unregulated harvest may have played a role in the loss of bighorns from this area. Following the retirement of domestic sheep allotments on the Newfoundland Mountain Range, transplants of bighorn sheep to this portion of the unit began with 31 animals from Antelope Island, UT and Hart Mt, NV in 2001. Two additional transplants have occurred since that time totaling 34 additional bighorns.

Currently, the population is estimated to be approximately 313 bighorn sheep, all located on the Newfoundland Mountain Range. U.S. Military Lands are located on the southern tip of the subunit. Bighorn sheep are likely to continue using available habitat that includes some U.S. Military lands. As with management of other big game species within the exterior boundary, bighorn sheep management will be in accordance with the Cooperative Agreement between the U.S. Air Force through Hill Air Force Base and the State of Utah.

ISSUES AND CONCERNS

Potential Habitat: We modeled potential bighorn sheep habitat on the Newfoundland Mountains 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 mountain range in suitable rugged locations (Figure 1).

Livestock Competition: Currently there is little to no grazing by domestic cattle or sheep on the Newfoundland Mountains Range where bighorns are found, and so competition with livestock is not a concern. Other portions of the unit not occupied by bighorns are grazed by domestic cattle and sheep. 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 Newfoundland Mountains 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. If cougars are found on the Newfoundland mountain ranges they should be pursued aggressively as bighorn sheep would probably be their primary target. Currently there are few, if any, cougars in the areas occupied by bighorns within this unit.

POPULATION MANAGEMENT

Population Management Objectives:

1) Achieve and maintain a population objective of 300 - 350 total Rocky Mountain bighorn sheep.

Population Management Strategies:

Transplant Plan: There is potential to use the Newfoundland Mountains as a nursery herd. We have transplanted sheep from the Newfoundland Mountains to other areas of the state in the past. Given the difficulty in accessing the Newfoundland range, and the sensitive nature of acquiring air clearance in Department of Defense air space, it has proven to be difficult to capture and transplant sheep from this unit. It should still be considered, but it may prove to be more efficient to manage this unit with ewe hunts.

Monitoring: Monitoring of bighorn sheep will be conducted every 2-3 years by aerial survey to determine lamb recruitment, population status, ram-to-ewe ratios, range distribution, and ages and quantity of rams. This population will likely require 8 - 10 hours to conduct a complete trend count and survey adjacent areas to evaluate wild sheep

dispersal. Coordination with the Department of Defense will need to take place prior to all aerial surveys. Additional ground classification may be conducted as conditions permit. GPS collars with mortality signals are being used to document cause-specific mortality and identify annual survival estimates. If bighorn sheep are found wandering into areas where there is high risk of contact with domestic sheep or goats, the DWR may remove these animals in accordance with the Utah Bighorn Sheep Statewide Management Plan.

Trend Count Classification Data

Year	Pop Est	Total Count	Total Ewes	Total Lambs	Total Rams	Rams > 6 yrs old	Lambs/100 Ewes	Rams/100 Ewes
2009	230	173	81	34	58	20	42	72
2012	283	193	78	42	73	43	54	94
2014	232	139	61	29	49	24	48	80
2016	263	158	62	43	53	8	69	85
2018	313	188	71	22	94	9	32	132

Predator Management: Predator management will be coordinated with USDA Wildlife Services. If predation becomes a limiting factor on bighorns, predator control work will be administered within the guidelines of the DWR Predator Management Policy.

DISEASE MANAGEMENT

Disease Management Objectives:

1) Maintain a healthy population of Rocky Mountain bighorn sheep on the Newfoundland Mountain unit.
2) Maintain spatial separation from domestic sheep and goats as well as wild bighorns that are believed to be infected.

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.

Spatial Separation: Active domestic sheep allotments with domestic sheep will be evaluated for potential overlap with bighorn habitat. The DWR will delineate areas where there is high risk for domestic sheep and goats to come in contact with wild sheep or where wild sheep may stray and come in contact with domestics. These areas will be considered areas of concern. Lethal or non-lethal removal of bighorns may be warranted in these areas to prevent comingling. The need to test wandering sheep from this unit will

be evaluated on a case by case basis. The BLM and DWR will explore the possibility of using fencing to prevent comingling with trailing domestic sheep.

HABITAT MANAGEMENT

Habitat Management Objectives:

1) Maintain or improve sufficient bighorn sheep habitat to achieve population objective.
2) Improve habitat and water availability where possible. Suitable surface water is a limiting factor on the Newfoundland range and significant effort will be required to maintain sufficient water for a healthy bighorn herd.

Habitat Management Strategies:

Monitoring: The DWR will assist land management agencies in monitoring bighorn habitat to detect changes in habitat quantity and quality.

Habitat Improvement: Vegetative treatment projects to improve bighorn habitat lost to natural succession or human impacts will be sought out and initiated. The DWR will cooperate with the BLM to utilize seeding, controlled burns, and/or mechanical treatments for conifer removal in order to increase and improve bighorn habitat across the unit. Habitat restoration projects will be planned and executed through the Utah Watershed Restoration Initiative program, allowing for public input to ensure that projects that are beneficial to both bighorn sheep and sympatric cattle are given priority.

Water Improvement: The DWR will work with the BLM and private stakeholders to locate and cooperatively modify or improve existing water sources or install new water developments across bighorn habitat.

RECREATION MANAGEMENT

Recreation Management Objectives:

1) Provide hunting opportunities on the Newfoundland Mountains range 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.

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.

PUBLIC INVOLVEMENT

Public Involvement Objective:

1) Provide opportunities for local stakeholders and cooperating agencies to be involved in the management process and to jointly resolve potential issues involving bighorn sheep.

Public Involvement Strategies:

Plan Revision: If the unit boundary or population objective are to be revised in the future, affected cooperating agencies, local stakeholders, and grazing permittees will be invited to take part in the decision-making process.

LITERATURE CITED

Bleich, V. C., R. T. Bowyer, and J. D. Wehausen. 1997. Sexual segregation in mountain sheep: resources or predation? Wildlife Monographs 3-50.

Cassirer, E. F., and A. R. E. Sinclair. 2007. Dynamics of pneumonia in a bighorn sheep metapopulation. Journal of Wildlife Management 71:1080-1088.

Dalton, L.B., and J.J. Spillett. 1971. The bighorn sheep in Utah: past and present. 1st North American Wild Sheep Conference 1:32-53.

Ernest, H. B., E. S. Rubin, and W. M. Boyce. 2002. Fecal DNA analysis and risk assessment of mountain lion predation of bighorn sheep. Journal of Wildlife Management 66:75-85.

George, J. L., D. J. Martin, P. M. Lukacs, and M. W. Miller. 2008. Epidemic pasteurellosis in a bighorn sheep population coinciding with the appearance of a domestic sheep. Journal of Wildlife Diseases 44:388-403.

Hayes, C. L., E. S. Rubin, M. C. Jorgensen, R. A. Botta, and W. M. Boyce. 2000. Mountain lion predation of bighorn sheep in the peninsular ranges, California. Journal of Wildlife Management 64:954-959.

Kamler, J. F., R. M. Lee, J. C. deVos, W. B. Ballard, and H. A. Whitlaw. 2002. Survival and cougar predation of translocated bighorn sheep in Arizona. Journal of Wildlife Management 66:1267-1272.

Manlove, K. R., E. F. Cassirer, P. C. Cross, R. K. Plowright, and P. J. Hudson. 2014. Costs and benefits of group living with disease: a case study of pneumonia in bighorn lambs (*Ovis canadensis*). In Proceedings of the Royal Society of London B 281(1797):2014-2331.

Manlove, K. R., E. F. Cassirer, P. C. Cross, R. K. Plowright, and P. J. Hudson. 2016. Disease introduction is associated with a phase transition in bighorn sheep demographics. Ecology 97:2593-2602.

Monello, R. J., D. L. Murray, and E. F. Cassirer. 2001. Ecological correlates of pneumonia epizootics in bighorn sheep populations. Canadian Journal of Zoology 79:1423-1432.

O'brien, J. M., C. S. O'brien, C. MCcarthy, and T. E. Carpenter. 2014. Incorporating foray behavior into models estimating contact risk between bighorn sheep and areas occupied by domestic sheep. Wildlife Society Bulletin 38:321-331.

Rominger, E. M., H. A. Whitlaw, D. L. Weybright, W. C. Dunn, and W. B. Ballard. 2004. The influence on mountain lion predation on bighorn sheep translocations. Journal of Wildlife Management 68:993-999.

Ryder, T. J., E. S. Williams, K. W. Mills, K. H. Bowles, and E. T. Thorne. 1992. Effect of pneumonia on population size and lamb recruitment in Whiskey Mountain bighorn sheep. In Proceedings of the Eighth Biennial Symposium of the Northern Wild Sheep and Goat Council 136-146.

Sappington, J. M., K. M. Longshore, and D. B. Thompson. 2007. Quantifying landscape ruggedness for animal habitat analysis: a case study using bighorn sheep in the Mojave Desert. Journal of Wildlife Management 71:1419-1426.

Schaefer, R. J., S. G. Torres, and V. C. Bleich. 2000. Survivorship and cause-specific mortality in sympatric populations of mountain sheep and mule deer. California Fish and Game 86:127-135.

Singer, F. J., E. S. Williams, M. W. Miller, and L. C. Zeigenfuss. 2000. Population growth, fecundity, and survivorship in recovering populations of bighorn sheep. Restoration Ecology 8:75-84.

Spraker, T. R., C. P. Hibler, G. G. Schoonveld, and W. S. Adney. 1984. Pathologic changes and microorganisms found in bighorn sheep during a stress-related die-off. Journal of Wildlife Diseases 20:319-327.

Valdez, R. and P. R. Krausman. 1999. Mountain sheep of North America. University of Arizona Press.

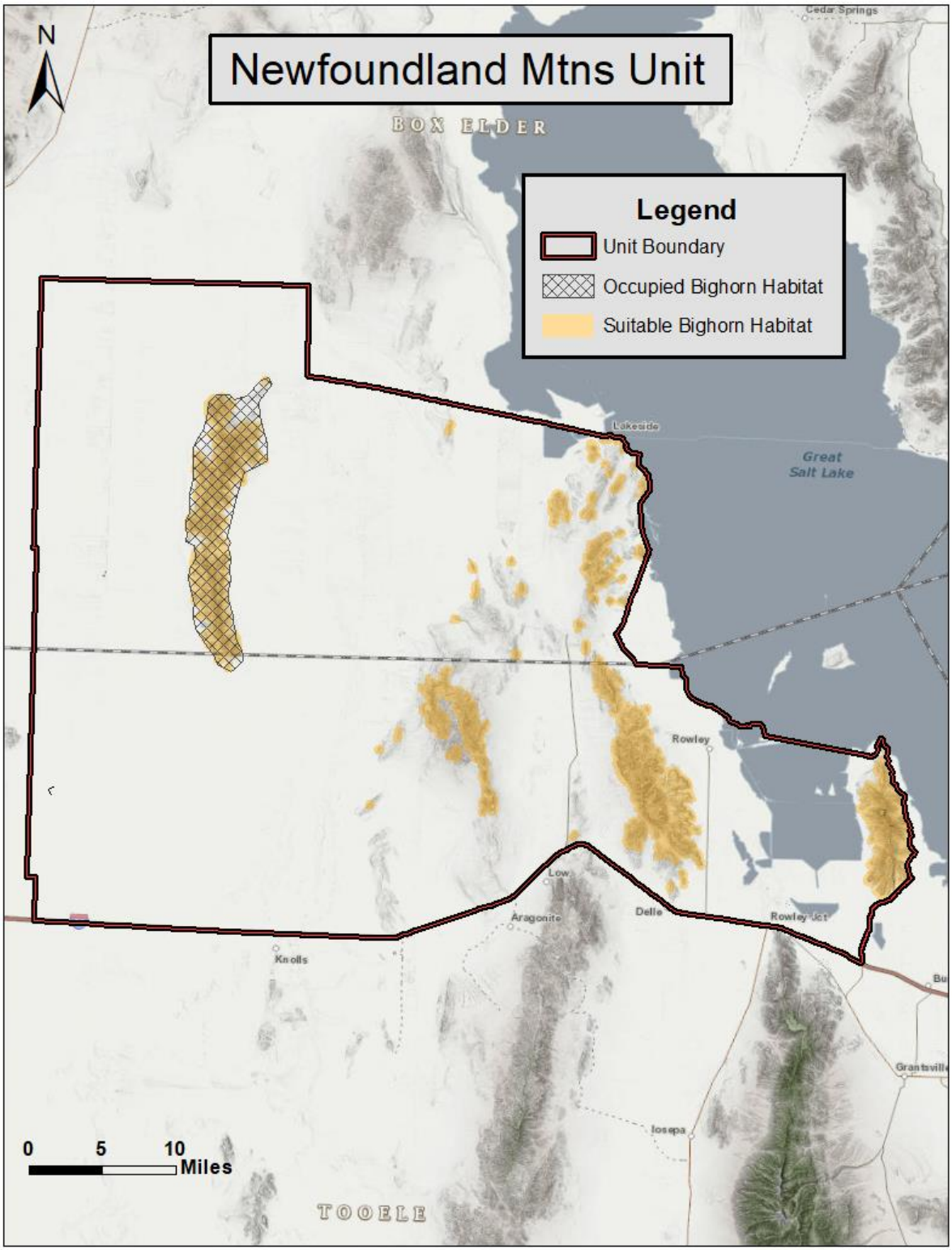

Figure 1. Box Elder, Newfoundland Mountain unit management boundary, modeled suitable bighorn sheep habitat, and currently occupied bighorn habitat. Box Elder and Tooele Counties, UT, USA.