Bighorn Sheep

Ovis canadensis

REGULATORY STATUS

USFWS: No special status
USFS R2: Sensitive
USFS R4: Sensitive
Wyoming BLM: No special status
State of Wyoming: Big Game Animal (see regulations)

CONSERVATION RANKS

USFWS: No special status
WGFD: NSS4 (Bc), Tier II
WYNDD: G4, S2S3
Wyoming Contribution: HIGH
IUCN: Least Concern

STATUS AND RANK COMMENTS

Bighorn Sheep (*Ovis canadensis*) is classified as a big game animal in Wyoming by W.S. § 23-1-101 [1]. Harvest is regulated by Chapter 9 of the Wyoming Game and Fish Commission Regulations [2].

NATURAL HISTORY

Taxonomy:

Two species of wild sheep occur in North America; Dall's Sheep (also called "thin horn sheep"; *O. dalli*) and Bighorn Sheep (*O. canadensis*) [3]. Initial classification of Bighorn Sheep recognized 7 subspecies; Rocky Mountain Bighorn (*O. c. canadensis*), California Bighorn (*O. c. californiana*) and 4 subspecies of Desert Bighorn; Nelson's (*O. c. nelsoni*), Mexican (*O. c. mexicana*), Peninsular (*O. c. cremnobates*), and Weem's (*O. c. weemsi*) [4]. Also recognized was Audubon's Bighorn (*O. c. auduboni*), which may have occupied portions of eastern Wyoming before its extinction shortly after the turn of the 20th century. Recent classifications, however, only recognize 3 subspecies; Rocky Mountain Bighorn (*O. c. canadensis*), Sierra Nevada Bighorn (*O. c. sierrae*), and Desert Bighorn Sheep (*O. c. nelsoni*) [5]. Two populations (both distant from Wyoming) are listed as Endangered under the Endangered Species Act; Sierra Nevada Bighorn and Peninsular Desert Bighorn, a distinct population segment of *O. c. nelsoni* [6, 7]. In an effort to restore populations, nearly 1,500 separate translocations of Bighorn Sheep have been conducted throughout the United States and Canada [8]. In Wyoming, almost all of the 74 translocations conducted to-date have involved sheep from the Whiskey Basin, Wyoming herd to other locations in Wyoming, although 6 translocations of *O. c. canadensis* from Oregon, Montana, and Idaho have been released in Wyoming as well.

Description:

Bighorn Sheep is named for the large, circular horns possessed by adult males (rams). Females (ewes) also possess horns, but they are much smaller compared to those of males. Color patterns

include a brown body with a white muzzle, underbelly, and rump patch with white lining down the back of the hind legs. Adult rams weigh 175–300 lbs (80–136 kg), while adult ewes weigh 125–200 lbs (57–91 kg) [9]. Ewes and small rams superficially resemble female Mule Deer (*Odocoileus hemionus*) and Elk (*Cervus canadensis*), and may be briefly confused with those species at a distance, but Bighorn Sheep is largely distinctive in appearance.

Distribution & Range:
Bighorn Sheep occurs in portions of the Cascade and Sierra Nevada mountain ranges, and throughout the Rocky Mountains from the Peace River in British Columbia south into northern Mexico [3]. In Wyoming, the subspecies *O. c. canadensis* occurs in four core herds in the Absaroka, Teton, Gros Ventre, and Wind River mountain ranges. Ten smaller herds which have been augmented or re-established via transplants occur in the Wyoming, Snowy, Sierra Madre, and Laramie mountain ranges, as well as the Seminoe and Ferris Mountains, southern end of the Wind River Mountains, west slope of the Bighorn Mountains, the Black Hills, and Wind River Canyon. Dispersing individuals – especially young rams – are sometimes documented far from mountain population centers. In 2014 the estimated statewide winter population (including those residing in Yellowstone National Park) of Bighorn Sheep was 6,450. The large core herds in the northwest corner of the state account for over 85% of Wyoming's statewide total, and represent some of the largest meta-populations of Bighorn Sheep throughout its range. Still, the fragmented pattern of habitat and population segments in Wyoming is an important management consideration.

Habitat:
Bighorn Sheep evolved in semi-open, high visibility habitats near rocky escape terrain that allow efficient foraging, enhanced detection of predators, and opportunities to evade them [10]. In northwest Wyoming, alpine tundra and areas of associated rocky escape terrain are used during summer. In winter, lower elevation, grassy benches and southerly slopes are used, with some herds or populations segments wintering on wind-swept ridges at high elevations. Bighorn Sheep in the rest of the state are typically non-migratory and use open grassy areas close to rocky canyons, cliffs, buttes, and similar escape terrain as year round habitat.

Phenology:
Bighorn Sheep is a year round resident of Wyoming. Sheep in the core herds of northwest Wyoming exhibit a variety of migratory strategies, from regular seasonal movements between high elevation summer ranges and lower winter ranges to year round occupation of high elevation ranges, and from simple altitudinal shifts to long distance (> 50 mi or 80 km) circuitous migrations. Sheep in other parts of Wyoming are primarily non-migratory, although some shorter seasonal movements may occur. Breeding occurs in late November and early December. Breeding is polygamous, with rams traveling between ewe-lamb groups seeking estrous ewes. Rams do not defend territories, nor tend harems, but establish dominance hierarchies through horn displays and/or physical horn to horn clashes [10]. Lambs are born in late May and early June. Non-migratory populations tend to lamb earlier, often as early as April. Ewes usually give birth to a single lamb - twinning is uncommon. In the wild rams rarely live beyond 10–12 years, while ewes may live 15 years or more.

Diet:
Bighorn Sheep is primarily a grazer, preferring perennial bunchgrasses in all seasons, although use of shrubs can be significant, particularly for non-migratory sheep occupying lower elevations year round [11].

CONSERVATION CONCERNS

Abundance:
Continental: WIDESPREAD BUT DISJUNCT
Wyoming: UNCOMMON
In 2014, the Wyoming Game and Fish Department (WGFD) estimated there were 6,450 Bighorn Sheep in Wyoming, which includes approximately 200 in Yellowstone National Park and 100 in Grand Teton National Park. Wyoming has approximately 20% of the total number of *O. c. canadensis* in the contiguous United States and 15% of the total range-wide estimate of sheep (including Canada).

Population Trends:
Historic: INCREASE
Recent: STABLE
Prior to European settlement Bighorn Sheep lived in suitable habitats throughout Wyoming, including the low and rocky Ferris, Granite, Rattlesnake, and Shirley Mountains, and on bluffs along the Sweetwater and North Platte Rivers. While historic numbers were almost certainly greater than current populations, there are no precise estimates of previous abundance. In 1960 there were estimated to be 2,000 Bighorn Sheep in Wyoming, restricted entirely to the northwest corner of the state [12]. By 1990, this estimate had risen to over 7,000 and it has ranged between 6,000 and 7,000 since that time, with populations established in central, eastern, and southern Wyoming. Range wide population trends appear to be downward, but not significantly.

Intrinsic Vulnerability:
MODERATE VULNERABILITY
Bighorn Sheep is moderately vulnerable to extrinsic stressors. The species occurs as disjunct populations in relatively restricted habitats, and is particularly susceptible to respiratory pathogens (primarily bacterial pneumonia) [13] which are present in most populations in Wyoming. Coyote (*Canis latrans*) and Golden Eagle (*Aquila chrysaetos*) are effective predators of lambs, while Mountain Lion (*Puma concolor*) and, to a lesser extent, Gray Wolf (*Canis lupus*) prey on adult Bighorn Sheep [14]. Typically, predation is not significant enough to hamper population performance.

Extrinsic Stressors:
MODERATELY STRESSED
In addition to pathogens already possessed by Bighorn Sheep, transmission of respiratory pathogens from domestic sheep and goats can result in disease outbreaks and population declines [13, 15]. The invasion of noxious weeds has and continues to adversely affect Bighorn Sheep habitats [16], primarily by reducing availability and production of favored perennial bunchgrasses. Recreational activities (e.g., backcountry skiing, snowmachine use) can prevent sheep from using some habitats [17, 18]. Expansion of non-native Mountain Goat (*Oreamnos americanus*) has the potential to adversely affect sheep in core herds, particularly through competition for forage and space on high elevation winter ranges [19, 20]. Conifer encroachment and vegetative succession in the absence of periodic fire (either naturally ignited or prescribed) have diminished habitat quality by reducing sight-lines in formerly open areas. Conversely, widespread conifer mortality from Mountain Pine Beetle (*Dendroctonus ponderosae*) infestation may open and improve new Bighorn Sheep habitat. The cumulative impact of climate change is uncertain, as the loss of conifers from persistent insect infestations could increase sight-lines and forage production, but warming could also negatively influence forage quantity and quality on existing ranges. The

effect of warming on the distribution and abundance of important noxious weeds such as Cheatgrass (*Bromus tectorum*) may be especially important for Bighorn Sheep.

KEY ACTIVITIES IN WYOMING

Formed in 2000, the Wyoming Statewide Domestic Sheep-Bighorn Sheep Interaction Working Group (hereafter "Statewide Working Group") has worked collaboratively to prioritize acceptable risk and seek solutions to specific issues in Wyoming where commingling between Bighorn Sheep and domestic sheep and/or goats is possible [21]. The goal of the Statewide Working Group is to "maintain healthy bighorn sheep populations while sustaining an economically viable domestic sheep industry in Wyoming". The statewide plan developed by this working group was adopted into law by the 2015 Wyoming Legislature. The WGFD has embarked on substantial statewide disease surveillance to document the current disease status of all populations in the state. Since 2012 over 600 individual Bighorn Sheep have been captured and sampled (primarily in the core herds of northwest Wyoming), which has greatly increased understanding of Bighorn Sheep diseases. To assist in this effort, the WGFD upgraded facilities at the Thorne-Williams Wildlife Research Center to conduct additional disease related Bighorn Sheep research. Recent collaborations with Washington State University have been completed, current WGFD projects with captive Bighorn Sheep are underway, and future projects are planned. Other recent collaborations with the University of Wyoming and the Wyoming Cooperative Fish & Wildlife Research Unit include an assessment of Bighorn Sheep body condition as it relates to disease susceptibility, and a statewide genetic evaluation of Bighorn Sheep populations. A recently-initiated effort led by Montana State University, the WGFD, Montana Fish, Wildlife & Parks, Idaho Fish & Game, Yellowstone and Grand Teton National Parks, and the Shoshone, Bridger-Teton, Caribou-Targhee, Custer, and Gallatin National Forests will evaluate the impact of expanding Mountain Goats on Bighorn Sheep populations.

ECOLOGICAL INFORMATION NEEDS

Knowledge of Bighorn Sheep disease dynamics requires continued and additional investigation. This is particularly relevant with respect to translocating and/or "mixing" groups of sheep with different pathogens. Any additional increase and/or expansion of Bighorn Sheep in Wyoming will likely depend upon disease issues and the success of translocated herds into low-mid elevation mountain ranges outside of core herds in northwest Wyoming. A better understanding of the influence of expanding Mountain Goat populations on Bighorn Sheep is also needed. Projects are currently ongoing to address both of these issues. Information on the effect of changing climate on the quantity and quality of Bighorn Sheep habitat and the influence of exotic weed proliferation could help predict future impacts to Bighorn Sheep distribution and abundance.

MANAGEMENT IN WYOMING

This section authored solely by WGFD; Doug McWhirter. Bighorn Sheep is classified as a Species of Greatest Conservation Need in Wyoming. Monitoring of populations includes aerial and ground-based sex/age classification and/or trend surveys to document recruitment and population trends. Mandatory registration of hunter harvested sheep allows for detailed knowledge of hunter effort and success, average age of harvested rams, and provides opportunities to gather data on horn measurements and obtain biological and/or genetic samples. Voluntary hunter observation logs provide additional information on sheep location and

abundance observations. Translocations of Bighorn Sheep are conducted in order to augment existing populations and to establish new herds. Most of these opportunities exist in low-mid elevation mountain ranges outside of the core herds of northwest Wyoming. In order to enhance the likelihood of success, specific attention is paid to closely match habitat selection characteristics and lambing chronology of "source" herds (often out-of-state) with habitats that occur in "target" release sites. Such actions are done in coordination with the Statewide Working Group in order to avoid conflicts between domestic and wild sheep. Monitoring and managing wild sheep disease issues will continue to be a necessary component of wild sheep management in Wyoming. Statewide disease surveillance efforts, disease research (including captive and field studies), and collaborative efforts such as the Statewide Working Group are all important aspects of this work. The WGFD has an internal Bighorn Sheep Working Group, comprised of population and habitat managers and wildlife disease specialists from around the state created to identify, consider, and address wild sheep management priorities in Wyoming. The WGFD also partners with land management agencies to design and implement habitat improvement projects, including prescribed burns, noxious weed treatments, and water guzzler installation. In addition to WGFD funds, research and monitoring efforts are made possible by financial contributions of wild sheep conservation organizations such as the Wyoming Chapter of the Wild Sheep Foundation and the Wyoming Governor's Big Game License Coalition.

CONTRIBUTORS

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Figure 1: Adult male (left) and female (right) Bighorn Sheep in Teton County, Wyoming. (Photo courtesy of Elizabeth Boehm)

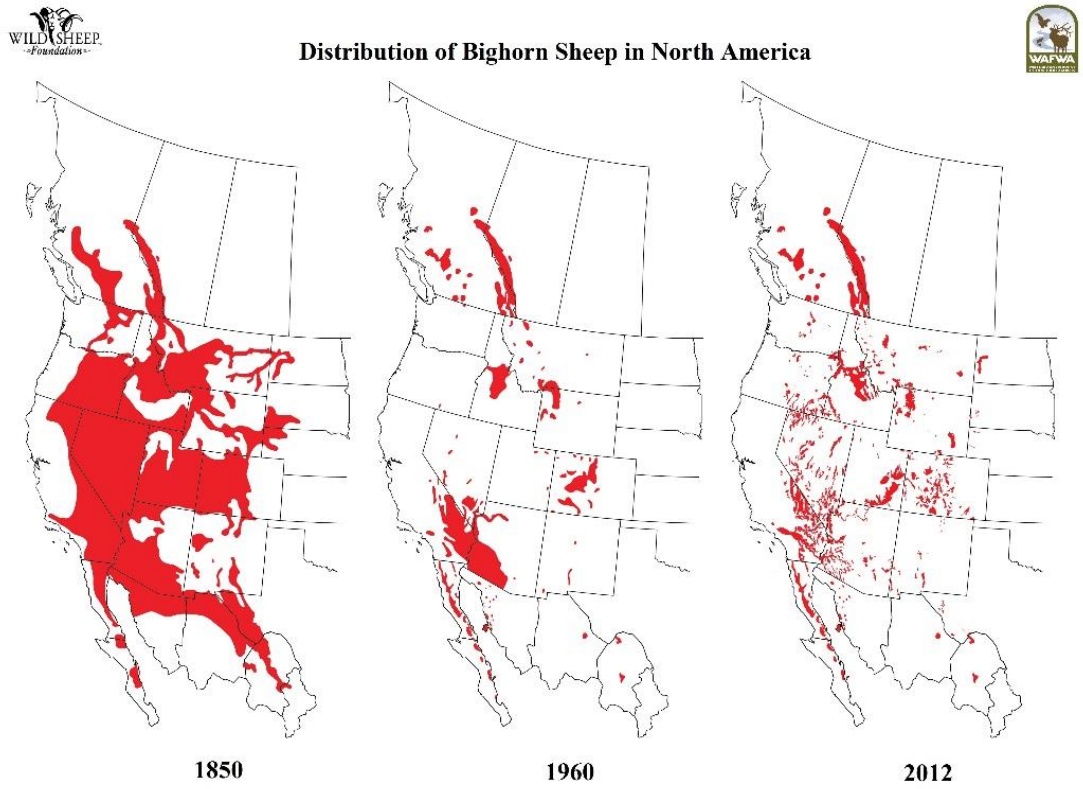

Figure 2: North American range of *Ovis canadensis* in 1850, 1960, and 2012. (Maps courtesy of the WAFWA Wild Sheep Working Group)

Figure 3: Rocky Mountain Bighorn Sheep on grassland winter range. (Photo courtesy of Mark Gocke)

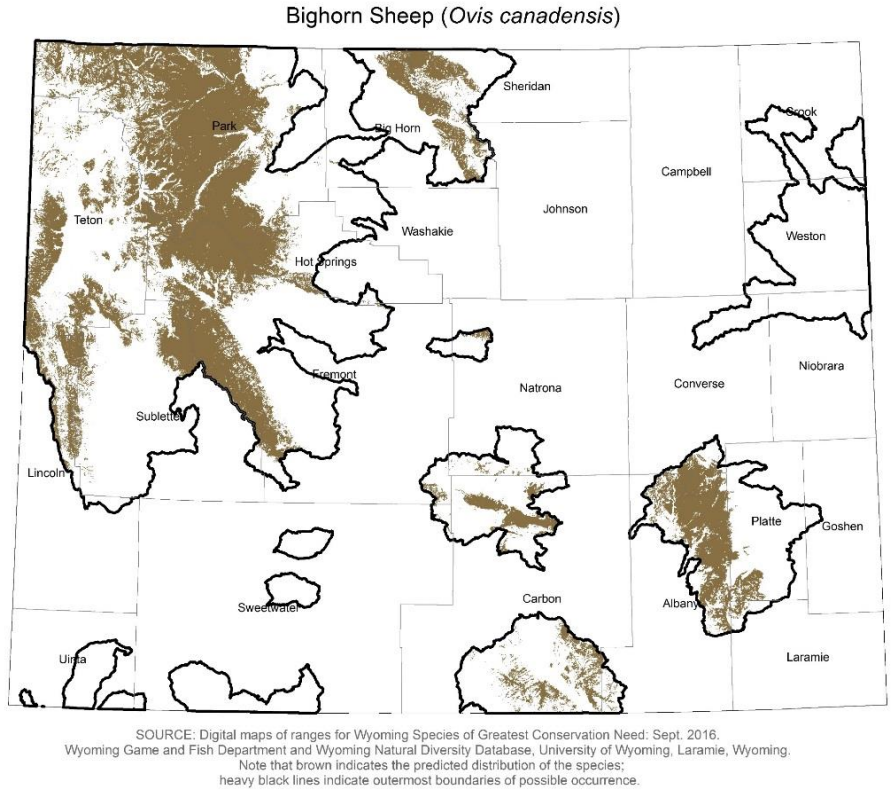

Figure 4: Range and predicted distribution of *Ovis canadensis* in Wyoming.