

Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*)

INDICATOR SPECIES HABITAT

Rocky Mountain bighorn sheep inhabit the cliffs and crags or other extremely rocky areas in tundra and alpine areas from the summit peaks to around 200 meters below the tree line of the Sangre de Cristo Mountains. The species is an indicator for the presence of alpine, subalpine tundra and mountain meadow grassland (USDA 1986a, p.97). Rocky Mountain bighorn sheep may have been extirpated from New Mexico, where it was native to the northern most area of the state. Populations have been reintroduced using more stock from the central and northern Rockies, and viable herds exist in several areas of the state, including the east-side of the Carson National Forest (NMDGF 2006b).

Bighorn prefer precipitous terrain adjacent to suitable feeding sites of high mountain meadows with grasses, forbs and browse species. Bighorn habitat is found in areas where canopy cover is less than 25 to 30 percent and slopes are greater than 60 percent for escape terrain adjacent to grazing areas. Forage, water, and escape terrain are the most important components of bighorn sheep habitat (Van Dyke et al. 1983, NMDGF 2005A).

Generally, bighorn sheep have two distinct, separate summer and winter ranges. Most of the year is spent on the winter range, where the elevation is typically below 10,826 feet (3,300 m). The aspect is usually south or southwest. Rams often venture onto the more open slopes, although rugged terrain is always nearby. During severe weather, if snow becomes unusually deep or crusty, bighorn sheep move to slightly higher elevations where wind and sunshine have cleared the more exposed slopes and ridges (NMDGF 2005A).

The spring range is generally characterized by the same parameters as the winter range; however, bighorn sheep will begin to respond to local green-ups along streambanks and valleys. Bighorn sheep heavily use areas around saltlicks in the spring. Preferred lambing range is in the most precipitous, inaccessible cliffs near forage, and generally has a dry, southern exposure.

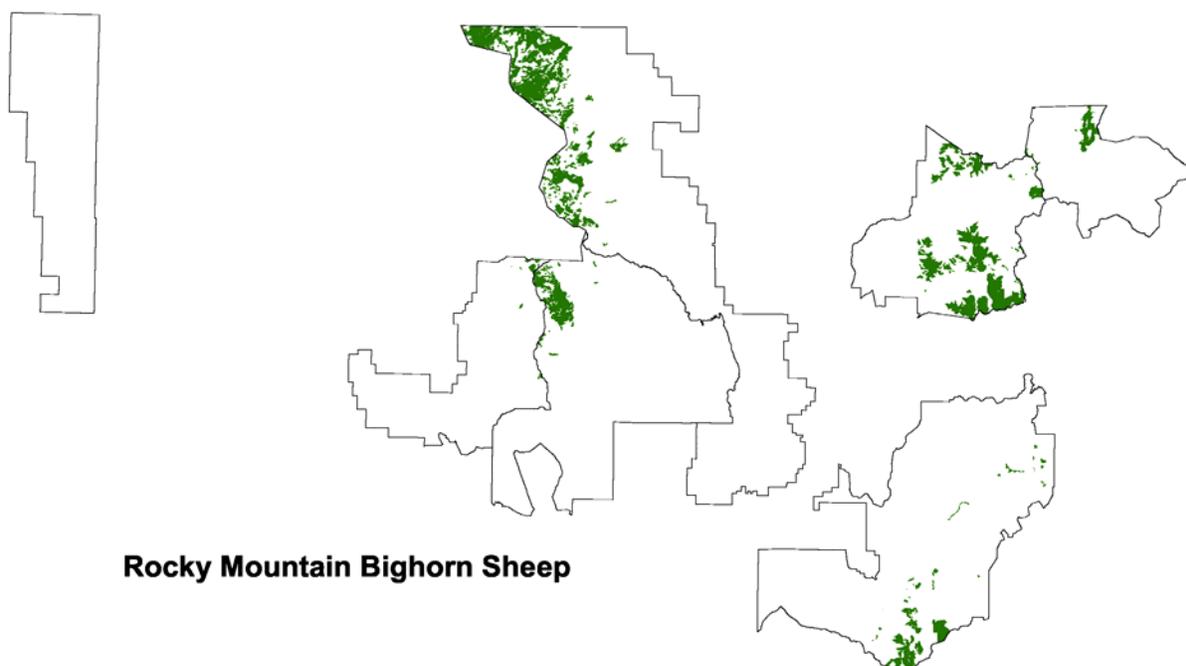
In the summer, bighorn sheep are mostly found grazing on high elevation grassland meadows and plateaus above timber. In early summer, south and southwestern exposures are most frequently utilized. By late summer the more northerly exposures are preferred. Snow accumulation seems to be the principal factor triggering bighorn sheep to move from summer to winter ranges (Van Dyke et al. 1983).

Bighorn sheep obtain water from dew, streams, lakes, springs, ponds, catchment tanks, troughs, guzzlers, and developed seeps or springs (Van Dyke et al. 1983). Alkaline water is not suitable. Bighorn sheep spend most of their time within 1 mile (1.6 km) of water but have been located as far as 2 miles (3.2 km) from water. Water sources more than 0.3 mile (0.5 km) from escape terrain or surrounded by tall dense vegetation are avoided by bighorn.

Escape terrain is an important habitat requirement for bighorn sheep. Cliffs, rock rims, rock outcroppings, and bluffs with sparse cover of trees or shrubs typify escape habitat, which provides both thermal and hiding cover. While bighorn are not always found in precipitous mountain areas, ewes and lambs rely on these places for escape cover, especially during the lambing period (Van Dyke et al. 1983, NMDGF 2005A). Visibility is another important habitat component. It allows for predator detection, visual communication, and efficient foraging (NMDGF 2005A). Bighorn sheep tend to forage in open areas with low vegetation such as grasslands, shrublands, or mixes of these. They avoid foraging on mild slopes with shrub or

canopy cover in excess of 25 percent and shrubs 2 feet (60 cm) or higher. On steep slopes they have been noted to travel through or bed in dense brush (Van Dyke et al. 1983).

Bighorn sheep primarily graze grasses and forbs, but eat other vegetation depending on availability. They prefer green forage and move up- or down-slope or to different aspects for more palatable forage. Forage areas that provide a variety of aspects are preferable because they offer green forage for longer periods (Van Dyke et al. 1983). Bighorn sheep eat sedges and a variety of grasses including bluegrasses (*Poa* spp.), wheatgrasses, bromes, and fescues. Browse species include sagebrush, willow (*Salix* spp.), rabbitbrush, curleaf mountain-mahogany (*Cercocarpus ledifolius*), winterfat (*Kraschnennikovia lanata*), bitterbrush, and green ephedra (*Ephedra* spp.). Forbs include phlox (*Phlox* spp.), cinquefoil (*Potentilla* spp.), twinflower (*Linnaea borealis*), and clover (*Trifolium* spp.) (NMDGF 2006b). On the Carson National Forest, Rocky Mountain bighorn sheep are regularly observed along the highest (11,000-13,000 feet) ridges in the Pecos and Wheeler Peak wilderness areas (USDA 1987). Although Map 1 displays potential habitat on the west-side of the forest, however Rocky Mountain bighorn sheep are currently limited to the east-side of the Carson National Forest.



Map 1. Rocky Mountain Bighorn Potential Habitat Distribution on the Carson National Forest (USDA 1987)

Management Activities or Natural Events That May Affect Habitat

Negative: Recreation use, domestic sheep grazing, road use, fences, poor range conditions, excessive fire suppression, wild fire, severe winters, diseases specific to sheep, illegal harvest and predation (Dunn 1993).

Positive: Fire use (prescribed natural fire), possibly wildfire, and good grazing practices.

Plans, Regulations and Guidelines Supporting, Maintaining or Improving Habitat

- *Carson National Forest Land and Resource Management Plan, Management Area 9 (High Elevation Grassland)*. “Provide quality habitat for Rocky Mountain bighorn sheep” (USDA 1986c).
- *Long Range Plan for the Management of Rock Mountain Bighorn Sheep in New Mexico* (1996)
- *Wilderness Act* (1964) - Potential habitat for the bighorn is almost entirely located within the Pecos, Wheeler Peak and Latir Peak wilderness areas and the Columbine-Hondo Wilderness Study Area, and to some extent security of bighorn habitat falls within the protections provided by the Wilderness Act.

HABITAT CONDITION AND TREND ON THE CARSON NATIONAL FOREST

In New Mexico, suitable range is relatively limited. It is believed bighorn sheep once occupied alpine ranges in most of New Mexico, implying the Pecos, Latir Peak, Wheeler Peak and Gold Hill areas of the Carson National Forest are historic ranges. Despite what is depicted in Map 1 (high elevation grasslands), the west-side of the Carson lacks the high elevation, rugged habitat of cliffs, crags, and rocky areas required to support a viable population of bighorn sheep.

The Forest Plan EIS identifies 20,430 acres of occupied bighorn sheep habitat on the Carson National Forest (USDA 1986a, p. 97). Based on Terrestrial Ecosystem Survey data, Map 1 displays only the alpine tundra portion (~ 10,100 acres) of bighorn habitat (USDA 1987). The Forest Plan EIS includes other adjacent alpine habitats; therefore the acres in Map 1 cannot be used in a habitat trend analysis. The core portions of bighorn habitat on the east-side can be found using Map 1. The removal of domestic sheep from the Latir Peak range is one management activity that has significantly increased habitat quality over the period of the Forest Plan. It is not certain if the acres originally identified in the Forest Plan EIS included this area.

For all existing bighorn sheep herds on the forest, reproduction is high and mortality of young is not significant. The Pecos, Wheeler Peak, and Latir herds quickly reached and remain at carrying capacity for their range. The Columbine/Hondo Wilderness Study Area herd also grew from animals released in Wheeler Peak Wilderness (NMDGF 2003b). If this trend stays consistent, the actual occupied range may gradually increase although there are natural limits. As herd size goes over the carrying capacity of the habitat, it becomes more vulnerable to large-scale die-offs and lower birth weight.

Since bighorn are highly susceptible to the diseases carried by domestic sheep, the viability of the species is dependent on whether or not domestic sheep are present within their occupied habitat. In the Pecos and Wheeler Peak areas and recently in the Latir Peak region, domestic livestock have been converted from sheep to cattle in order to prevent any *Pasturella* bacteria infection of bighorn sheep. The cows on the allotment at the north end of the Pecos Wilderness rarely if ever access bighorn sheep habitat. This type of interaction occurs only periodically during the winter months when the livestock are off the allotment and conditions are severe enough to push bighorn down onto private land, below their normal or preferred habitat.

Suitable feeding sites of high mountain meadows with grasses, forbs and browse species provide for optimal populations density. A variety of impacts can adversely affect bighorn including recreation use, roads, fences, poor range conditions, fire suppression, diseases, illegal harvest and predation (Dunn 1993). A lack of natural salt deposits required for their diet commonly found bighorn sheep “begging for food” from wilderness recreation users. The NM

Department of Game and Fish considered this type of human interaction with bighorn sheep as unhealthy to the species. Cooperative salting in remote locations by the NMDGF and Forest Service and the Sikes Act Program seems to have resolved much of this problem.

Prescribed fire or natural fire use can be useful tools in managing bighorn sheep habitat (Peek et al. 1985). Prescribed burning has been widely used to increase the quantity and nutritional quality of bighorn sheep forage throughout North America (Easterly et al. 1991). Since both positive and negative effects can occur from burning bighorn sheep range, a well-thought-out plan must be developed before fire is considered for use on their range. Plans must take into account (Peek 1985):

- Condition of plants.
- Plant response to burning.
- Adjacent conifers (the possibility of creating more open range exists if conifer stands or tall shrub fields occur next to currently used ranges).
- Limiting factors. Factors that may limit bighorn sheep populations should be identified, and an evaluation made as to how burning will effect these limiting factors.
- Lungworm infections. Lungworm can possibly be altered by reducing bighorn sheep concentrations; however, if burns are small and concentrate bighorn sheep, results could be negative. If burning disperses populations, the effects could be positive.
- Competition from other ungulates attracted to burned areas.

Habitat conditions in the Pecos Wilderness Area are fair and stable, while the Wheeler Peak Wilderness Area, Latir Peak Wilderness Area, and Columbine-Hondo Wilderness Study Area are generally good and stable. There are a few locations where utilization is heavy, but these are isolated. The limiting factor for the bighorn is severe winter conditions when quality and quantity of forage can fluctuate significantly. Recent Forest Service management trends place more emphasis on thinning conifer encroachment and prescribed burning in transitory range, thus improving the quality of bighorn sheep habitat. **The habitat trend for Rocky Mountain bighorn sheep on the Carson National Forest is considered to be stable.**

POPULATION TREND

Rocky Mountain bighorn sheep are relatively widespread in western North America from central British Columbia and Alberta south to Colorado, although populations are smaller than in the past. In some areas, the species has been threatened by habitat changes resulting from fire suppression and human encroachment, as well as, by competition with feral and domestic livestock (NatureServe 2006).

Bighorn sheep are very susceptible to diseases. Incidence of lungworm infestation approaches 100 percent in some herds, although the level of individual infection varies depending upon sheep and domestic livestock densities, range conditions, climate, season, and age. A significant correlation exists between the intensity of the lungworm infestation and the amount of precipitation in the spring of the previous year.

The future of bighorn sheep depends on the preservation and improvement of critical native ranges. Bighorn sheep are poor competitors with other wild and domestic ungulates, and their range is diminishing. The effect of domestic livestock grazing on bighorn sheep is controversial and depends on the proximity and population size of competing species. Domestic livestock have been reported to have little deleterious effect if they do not graze on critical bighorn sheep

winter ranges. Nevertheless, extensive competition by livestock persists and is one of the reasons for the decline in density of bighorn sheep populations. Elk and mule deer can also be serious competitors with bighorn sheep on marginal habitat (Peek 1985).

The effects of human disturbance on bighorn sheep varies. Rocky Mountain bighorn sheep in New Mexico occur in areas with substantial human presence including hikers, skiers, dogs, off-road vehicles, trains, military and civilian aircraft and researchers and managers (NMDGF 2005A). Human activities responsible for declines in sheep use of an area include hiking and backpacking, snow skiing, fishing, motor biking, four-wheel-drive vehicle use, construction and use of roads, urban development, and recreational development. When bighorn sheep are pushed from prime to marginal habitat, mortality usually increases and productivity decreases. Some herds have adapted to human activity (Van Dyke et al. 1983).

Regional

The NatureServe database (www.natureserve.org/explorer) documents that throughout its range, the conservation status of Rocky Mountain bighorn sheep is ranked globally as "G4" and "T4" for populations, in other words, they are apparently secure (NatureServe 2006). Reasons given for the status ranking include the species being relatively widespread in western North America, although populations are smaller than in the past. In some areas bighorn are threatened by habitat changes resulting from fire suppression and human encroachment; also by competition with feral and domestic livestock.

New Mexico

Rocky Mountain bighorn were never prevalent in New Mexico, historically occurring in only four to six populations. In 2004, six populations comprised of about 845 animals were found in the state (NMDGF 2005A). Bighorn sheep are usually characterized by low reproduction rates, long life spans, and populations that remain stable at near carrying capacity (NMDGF 1996). Dunn (1993) has observed that populations with more than 100 animals normally have the best chance for long-term persistence. Most mortality occurs during winter when weather is severe and forage quality and availability are low. A long-range (1996 - 2002) plan for management of bighorn in New Mexico was published in 1996 (NMDGF 1996) and a new Draft long-range plan (2004-2014) is available at the New Mexico Department of Game and Fish website (NMDGF 2005A).

Carson National Forest

Native bighorn sheep populations were extirpated around the turn of the century, likely due to unregulated hunting and disease transmission from domestic sheep. Reintroduction of bighorn began in 1932, but was not successful. Again bighorn were reintroduced into the Pecos Wilderness in the 1960's. An extensive habitat distribution and food habits evaluation was conducted from 1976 to 1978. The continuous alpine habitat in the Pecos Wilderness is estimated at 27 square miles. The estimated carrying capacity based on winter range was thought to be 175 to 330 animals (NMDGF 2005A). Table 1 provides both actual and estimated population numbers for Rocky Mountain bighorn sheep in the Pecos Wilderness since 1989.

Table 1. Population Observations and Estimates of Bighorn Sheep in the Pecos Wilderness, NM 1989-2006 (Hass 1995, NMDGF 2003b, NMDGF 2006a)

Year	No. of Animals	Year	No. of Animals
1989	404	1998	300-400
1990	406	1999	300-400
1991	398	2000	~350
1992	396	2001	~350
1993	401	2002	~350
1994	381	2003	~350
1995	318	2004	~350
1996	349	2006	~350
1997	300-400		

In 1993, the NM Department of Game and Fish (NMDGF) determined that the Pecos population, which has consistently increased, would be a primary source of sheep for transplant to other areas thought to have suitable habitats. This population has fluctuated between 300 and 400 with high winter mortality in the lamb and yearling cohorts during severe winters. This strongly suggests a density dependent carrying capacity tightly linked to winter severity with a maximum carrying capacity of around 400 animals (Rominger 2001). Goldstein (personal communication) shows the population to be steady at around 350 from 2000 to 2005 (NMDGF 2005). The Forest Plan EIS considered the bighorn herd in the Pecos Wilderness to be unstable and a downward trend was expected (primarily due to lungworm-pneumonia disease) (USDA 1986a, p. 98). Conversely, populations have done very well on the forest and several relocations have been successful.

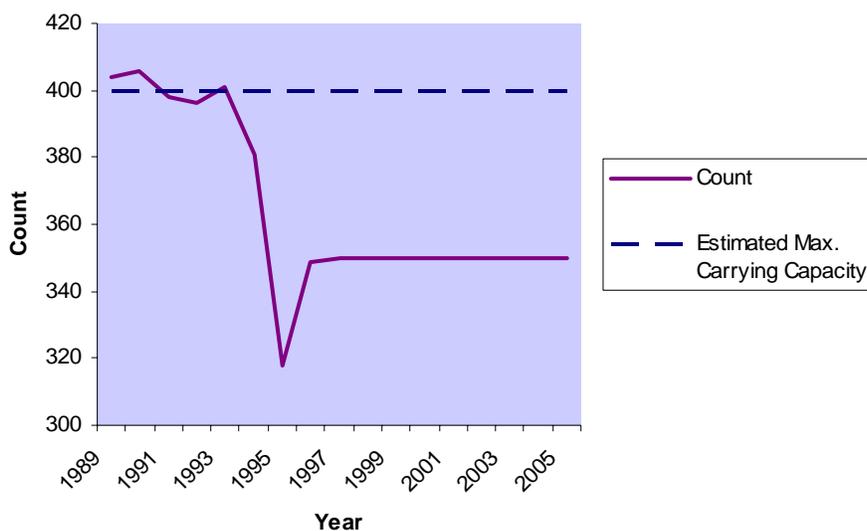


Figure 1. Bighorn Sheep Population Census for the Pecos Wilderness (1989-2005)¹⁶

¹⁶ The drop in numbers in 1983 is due to the initiation of a transplant program by the NMDGF to remove sheep from the Pecos Wilderness and place them in the Wheeler Peak Wilderness.

In 1993, 33 animals from the Pecos herd were transplanted to the Wheeler Peak Wilderness and adjacent Columbine-Hondo Wilderness Study Area (NMDGF 1993). The population has increased from an estimated 180 individuals, with a projected or potential population of up to 275. Recent estimates suggest that 275 is likely over the carrying capacity, and at a population density is 243 based on the highest density and 180 based on the lower density (NMDGF 2005A). The New Mexico Department of Game and Fish (NMDGF) has been capturing bighorn sheep from the Wheeler Peak area since 2003 to reduce population numbers and to bring the herds within carrying capacity. Population census has been conducted annually since 1993.

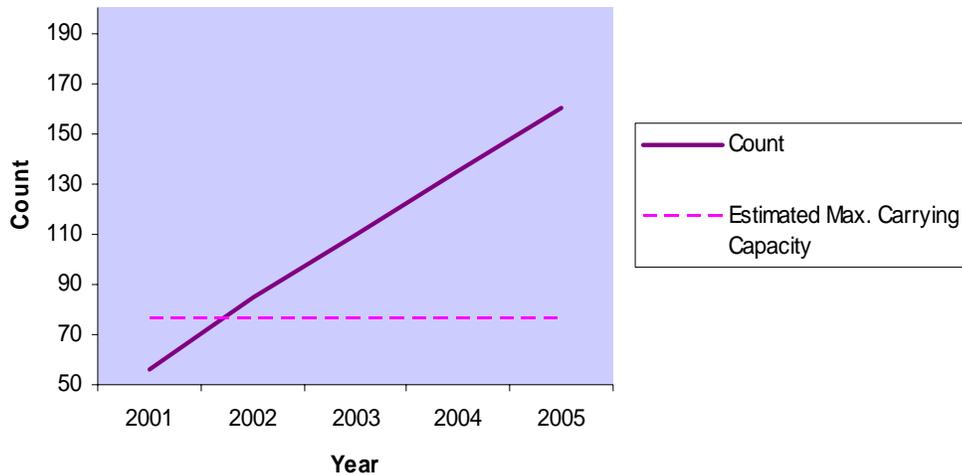


Figure 2. Wheeler Peak Transplant Bighorn Sheep Population Census 1993 to 2005 (NMDGF 2005)¹⁷

Expecting the Latir Peak Wilderness to be equally suitable as the Wheeler Peak area, the NM Department of Game and Fish relocated 56 bighorn sheep from the Pecos Wilderness to the Latir Wilderness in August 2001. Monitoring of the herd later in September 2001 indicated healthy individuals and an especially vigorous lamb crop. The Latir population carrying capacity is estimated to be 76 based on the highest density and just 56 based on the lower density (NMDGF 2005A). The herd size has increase with surveys in 2002 showing 85 sheep (NMDGF 2003b), 2003 documenting 110 (NMDGF 2005A), and in 2005 the herd had increased to 160 (NMDGF 2006a). In 2006, the New Mexico Department Game and Fish removed bighorn sheep from the Latir head to reduce the number of sheep in the area. The New Mexico Game Commission has permitted the sale of two public hunting tags and the option for auction/raffle hunter to hunt in this area.

¹⁷ The numbers for 2000 to 2002 also include sheep found on Gold Hill area (NMDGF 2003 and 2006).

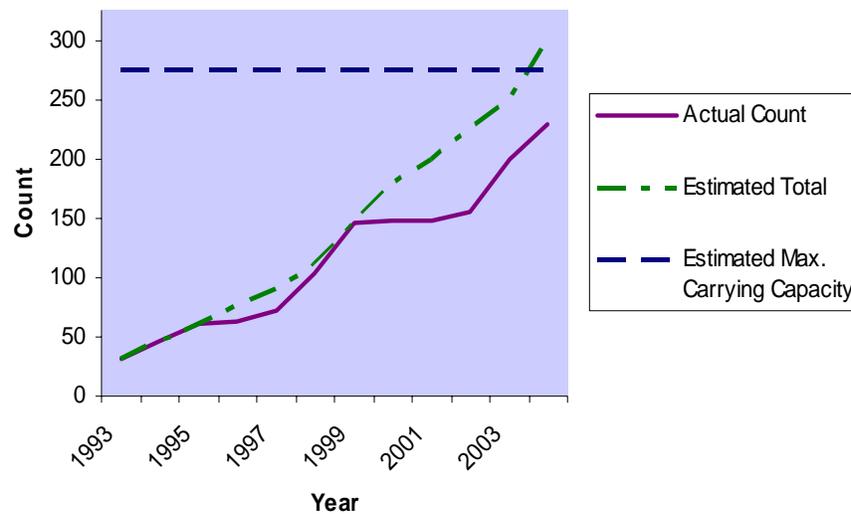


Figure 3. Latir Peak Transplant Bighorn Sheep Population Census 2001 to 2005 (NMDGF 2003b, 2004, 2005)

The expansion of transplanted populations in the Wheeler Peak and Latir Peak areas demonstrates the success of Rocky Mountain bighorn sheep and species viability in New Mexico. Even when the Pecos Wilderness and Wheeler populations are used as the source for transplantation, they have been able to effectively recover. **The populations of Rocky Mountain bighorn sheep on the Carson National Forest are in an upward trend.** This confirms what the Forest Plan predicts of bighorn sheep populations over the course of plan implementation – “...populations are expected to increase because of improved habitat condition” (USDA 1986c, p. 238).

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