

# BIGHORN SHEEP MANAGEMENT PLAN

## DATA ANALYSIS UNIT RBS-4

### Mount Evans Herd

#### GAME MANAGEMENT UNITS

S3, S4, and S41

Prepared for:

Colorado Parks and Wildlife

By:

Lance M. Carpenter

Wildlife Biologist

Northeast Region



## DAU-RBS 4 (Mount Evans and Peru Creek)

### EXECUTIVE SUMMARY

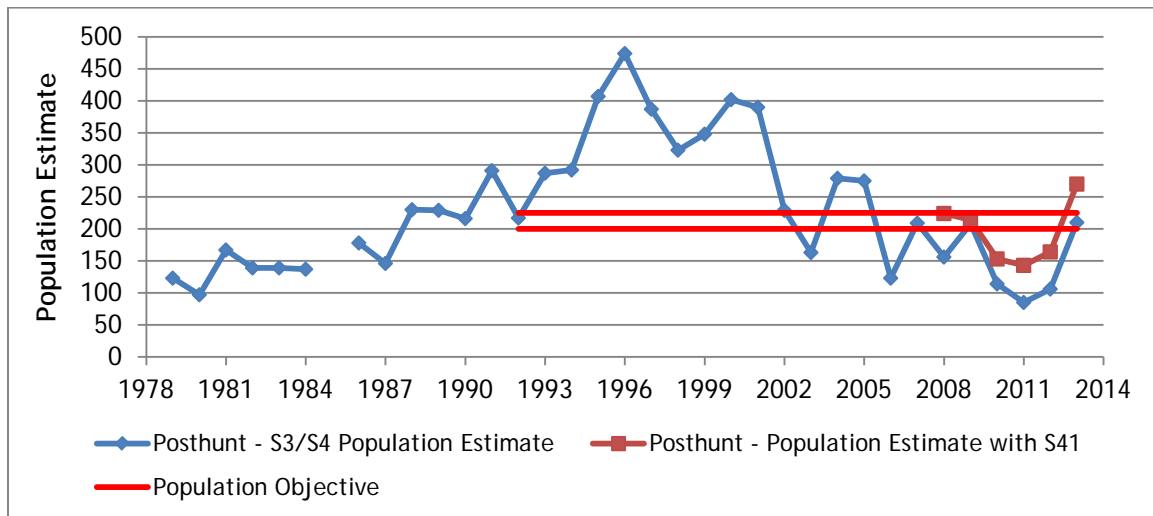
**GMUs:** S3, S4 and S41

**Tier Status:** 1 (large, native population that has been supplemented with  $\leq 50$  animals)

**Land Ownership:** 66% USFS, 26% Private, 4% City/Counties, 2% CPW, 2% Other Entities

**Posthunt Population:** **Previous Objective** 200-225; **2013 Estimate** 270;  
**Current Objective** 200-300

**3-Year Average Age of Harvested Rams:** **Previous Objective** not applicable;  
**2013 Estimate** 7 years; **Current Objective** 6-8 years



**Figure 1.** DAU RBS-4 bighorn sheep posthunt population estimates from 1978 to 2013 and objective range from 1992-2013. Estimates based on annual summer surveys assuming a 0.70 sighting probability.

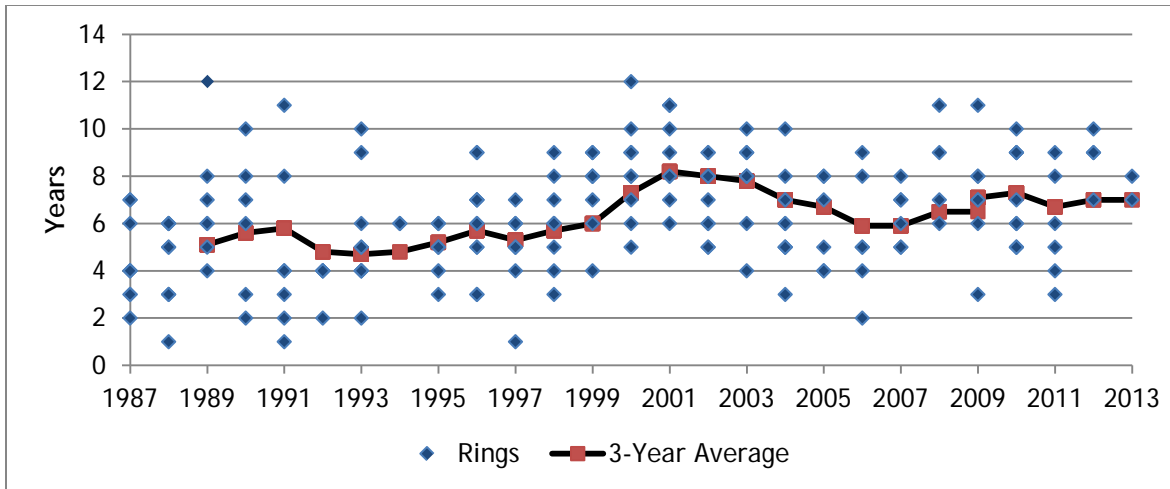


Figure 2. DAU RBS-4 age and 3-year average age of harvested rams from 1987 to 2013.

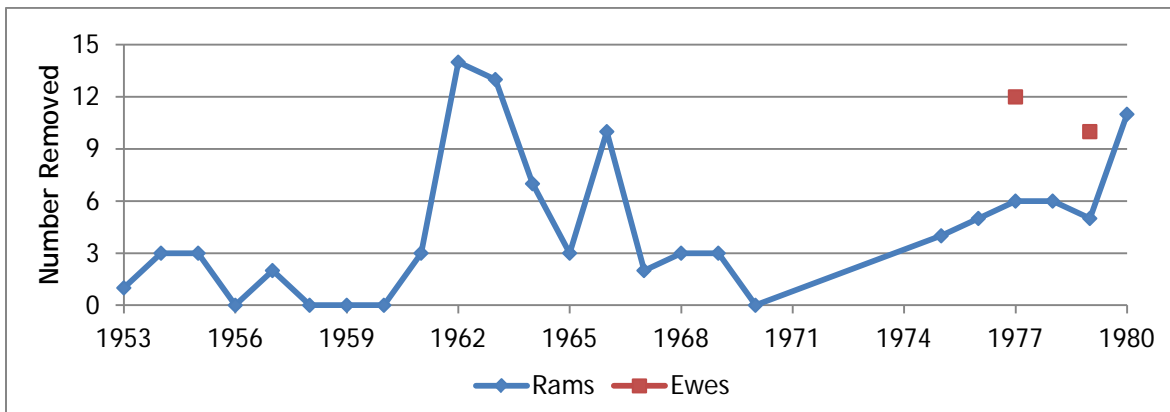


Figure 3. DAU RBS-4 number of rams and ewes removed via harvest and translocations from 1953 to 1980.

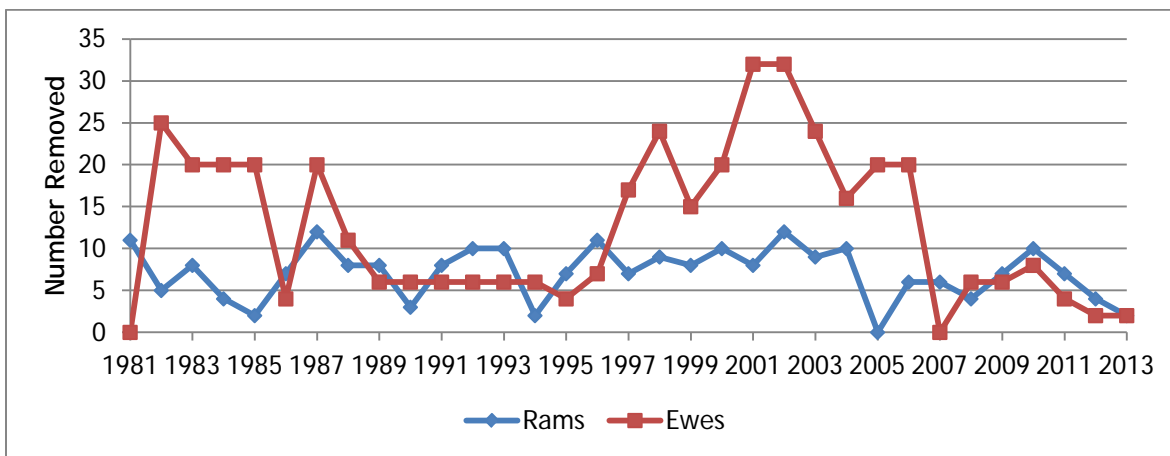


Figure 4. DAU RBS-4 number of rams and ewes removed via harvest and translocations from 1981 to 2013.

## Background Information

The Mount Evans bighorn sheep herd (Rocky Mountain Bighorn Sheep Data Analysis Unit - DAU RBS-4) is highly valued for the opportunities it provides for hunting, wildlife viewing, and photography.

DAU RBS-4 consists of Game Management Units (GMU) S3, S4 and S41. RBS-4 encompasses 645 mi<sup>2</sup> (1100 km<sup>2</sup>) in Clear Creek, Park, and Summit Counties. Municipalities include Frisco, Silverthorne, Georgetown, Idaho Springs, Evergreen, Conifer and Bailey. Most of the western half of the DAU is comprised of U.S. Forest Service (USFS) land, while much of the eastern half (east of US Highway 103) is owned privately or by cities and counties.

The Mount Evans bighorn sheep herd is indigenous. Population surveys and estimates have fluctuated from less than 20 in 1962 to over 400 in 1996. The 2013 posthunt population estimate was 270 and the 3-year average age of harvested rams was 7 years old.

Potential threats to this herd include disease epidemics, habitat fragmentation and degradation from human development, recreation, and forest encroachment into bighorn habitat.

## Management Objectives

### Population Objective Alternatives

#### Alternative 1: 200-225 bighorn sheep

Under alternative 1, the herd would be managed at the current objective of 200-225 bighorn sheep. This would necessitate a 15-20% decrease from the current population estimate.

#### Alternative 2: 200-300 bighorn sheep

This alternative increases the upper range of the current objective by 75 bighorn sheep to account for the 2009 addition of GMU S41 to RBS-4. Alternative 2 includes the 2013 population estimate.

#### Alternative 3: 300-400 bighorn sheep

This alternative represents a 10-20% increase over the 2013 population estimate.

### Three-Year Average Age of Harvested Rams Alternatives

#### Alternative 1: 4-6 years old

Alternative 1 would be a decrease from the current average age of harvested rams. This alternative would allow a higher level of harvest, but would likely result in higher hunter densities and smaller size of rams.

#### Alternative 2: 6-8 years old

Alternative 2 maintains the current average age at harvest for rams.

Alternative 3: >8 years old

This alternative is an increase from the current average age of harvested rams. This increase would necessitate a decrease in the number of hunting licenses and rams harvested. Alternative 3 would likely result in increased size of rams harvested and lower hunter densities. Since 1987, 197 rams have been harvested and only 36 rams were older than 8 years.

## Preferred Alternatives

### Population Objective

Alternative 2: 200-300 bighorn sheep

This alternative represents no change to the current lower end of the objective range and extends the upper range by 75 bighorn sheep to account for the 2009 addition of GMU S41 to RBS-4. Alternative 2 encompasses the 2013 population estimate of 270 animals. This alternative provides a wider range population objective which will allow managers more flexibility to adjust for environmental conditions (e.g., drought and severe winters). This population level is expected to be low enough to reduce the probability of catastrophic disease epidemics, allow for healthy individual animals and improved recruitment rates. Additionally, this alternative is expected to optimize long-term herd health, as well as hunting, viewing and photography opportunities.

### Three-Year Average Age of Harvested Rams

Alternative 2: 6-8 years old

Colorado Parks and Wildlife's (CPW) preferred alternative is to manage for an average age of harvested rams of 6-8 years old based on a rolling three-year average age. Current management would continue under alternative 2 allowing for a high quality hunt in terms of number of hunters in the field, mature rams available for harvest, viewing, and photography.

*This DAU plan was approved by the Colorado Parks and Wildlife Commission on March 19, 2016.*

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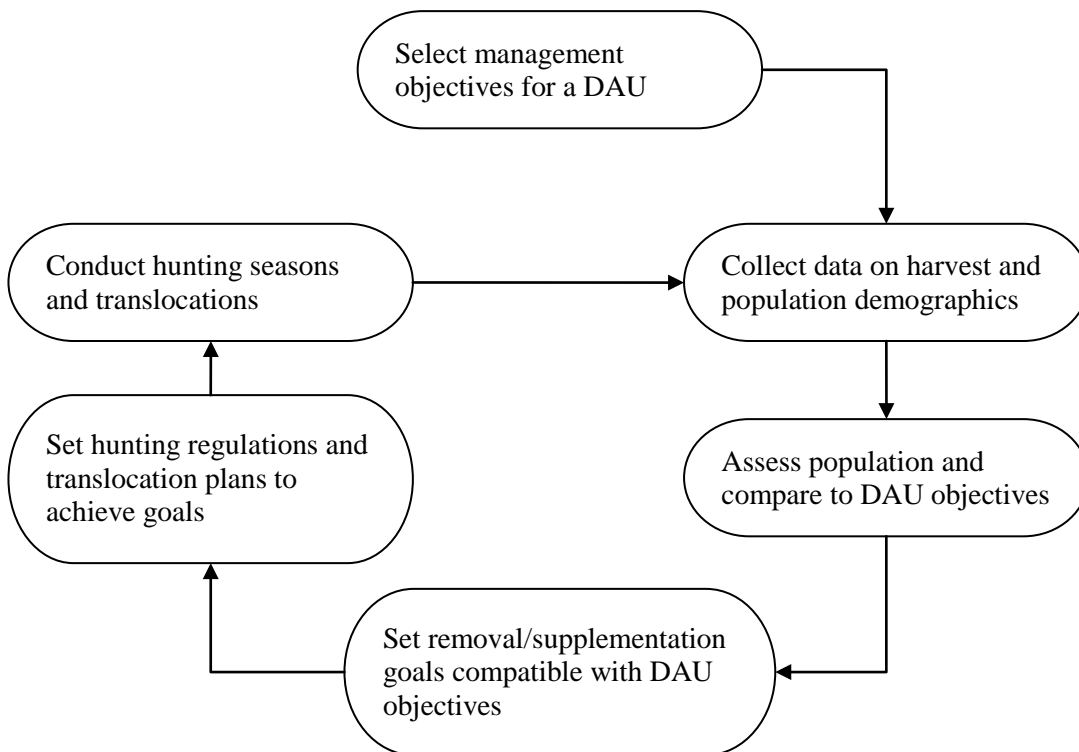
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## INTRODUCTION AND PURPOSE

Colorado Parks and Wildlife (CPW) manages bighorn sheep for the use, benefit, and enjoyment of the people of the state in accordance with CPW's Strategic Plan, the Colorado Bighorn Sheep Management Plan (Colorado Division of Wildlife 2009) and mandates from the Colorado Wildlife Commission and the Colorado Legislature. Colorado's wildlife resources require careful and increasingly intensive management to accommodate the many and varied public demands and growing human impacts. CPW uses a "Management by Objective" approach to manage the state's big game populations (Figure 5).



**Figure 5.** Management by Objective process used by Colorado Parks and Wildlife to manage big game populations by Data Analysis Unit.

In this approach, big game populations are managed to achieve population objectives established for a Data Analysis Unit (DAU). A DAU is the geographic area that includes the year-round range of a big game herd. A DAU includes the area where the majority of the animals in a herd are born, live and die. DAU boundaries are delineated to minimize interchange of animals between adjacent DAUs. A DAU may be divided into several Game Management Unit (GMUs) in order to distribute hunters and harvest within a DAU.

Management decisions within a DAU are based on a DAU plan. The primary purpose of a DAU plan is to establish population and other herd objectives for the DAU. The DAU plan also describes the strategies and techniques that will be used to reach these objectives. During the DAU planning process, public input is solicited and collected through questionnaires, public meetings, and comments to CPW staff and the Colorado Parks and Wildlife Commission. The intentions of CPW are integrated with the concerns and ideas of various stakeholders including the United States Forest Service (USFS), the Bureau of Land Management (BLM), city and county governments, hunters, guides and outfitters, private landowners, local chambers of commerce, and the general public. In preparing a DAU plan, agency personnel attempt to balance the biological capabilities of the herd and its habitat with the public's demand for wildlife recreational opportunities. DAU plans are approved by the Colorado Parks and Wildlife Commission and are reviewed and updated every 10 years.

The DAU plan serves as the basis for the annual herd management cycle. In this cycle, herd size and other metrics (i.e. average age of harvested rams) are assessed and compared to the objectives defined in the DAU plan. Removal goals are then set. Based on these goals, specific removal strategies are made for the coming year to either maintain the population or move it toward the objectives (e.g., license numbers and allocation are set, translocation plans are made). Hunting seasons and translocations are then conducted and evaluated. The annual management cycle then begins again (Figure 5).

## DESCRIPTION OF DAU

### Location

Bighorn sheep DAU RBS-4 consists of GMUs S3, S4, and S41. The DAU encompasses 645 mi<sup>2</sup> (1,673 km<sup>2</sup>) in Clear Creek, Park, and Summit Counties. The DAU is bounded by I-70 on the north, US Highway 9 on the west and southwest, US Highway 285 on the south, and US Highway 74 on the east. Municipalities within the DAU include Frisco, Silverthorne, Georgetown, Idaho Springs, Evergreen, Conifer, and Bailey (Figure 6).

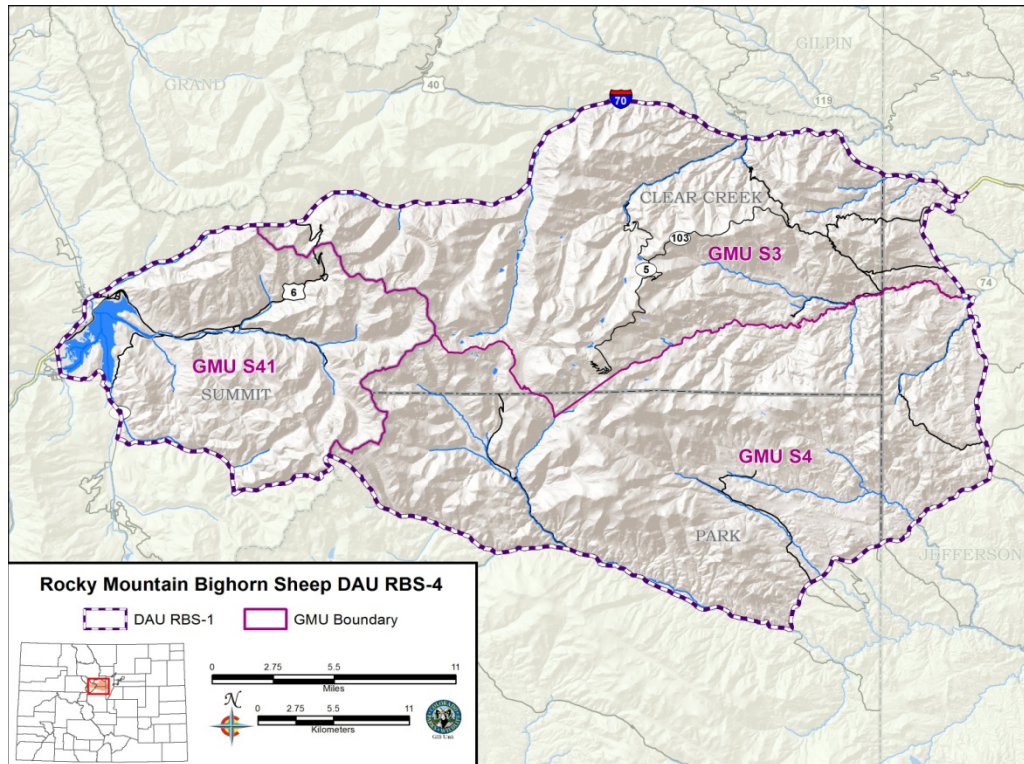


Figure 6. Geographic location of DAU RBS-4 encompassing GMUs S3, S4, and S41.

## Physiography

### Climate

The climate varies greatly from east to west across DAU RBS-4, depending on elevation. The eastern portion has comparatively warm summer temperatures and mild winters. The western portion is much colder with snow covering timbered areas and north-facing slopes from November through May. The eastern portion of DAU RBS-4 has relatively mild winters and is influenced by Chinook winds. These warm, down sloping winds melt snow quickly. Snow seldom stays for more than a few days on south-facing slopes below 9,000 feet and the alpine ridges.

Within DAU RBS-4 there are four, 14,000 foot peaks (Mount Evans, Mount Bierstadt, Gray's Peak, and Torrey's Peak) which can affect weather conditions. In the alpine of DAU RBS-4, the weather can be extreme. On the summit of Mount Evans the mean temperature is 18° F (-8°C), but temperatures as low as -40°F (-40°C) have been recorded (Ives and Fahey 1971).

### Vegetation

Vegetation in RBS-4 is diverse depending on elevation and climate. Elevation ranges from 7,600 to over 14,000 feet. Mountain riparian communities are found along streams, wetlands and irrigation ditches from 7,600 to 11,000 feet. Willows (*Salix sp.*), chokecherries (*Padus virginiana*), alders (*Alnus incana*) and narrowleaf cottonwoods

(*Populus angustifolia*) are common species. Ponderosa pine (*Pinus ponderosa*) dominated communities are found up to 8,500 feet with Douglas fir (*Pseudotsuga menziesii*) covering many north-facing slopes in the foothills. There are some agricultural fields, mainly hay and pasture that are found in areas up to 9,000 feet. DAU RBS-4 contains subalpine forests from 8,500 feet up to timberline at approximately 11,500 feet. Within the subalpine forest zone, lodgepole pine (*P. contorta*) intermixed with aspen (*Populus tremuloides*) is the dominant cover up to 10,500 feet. Spruce/fir subalpine forest interspersed with meadows is dominant up to timberline. Stands of limber pine (*P. flexilis*) and bristlecone pine (*P. aristata*) also occur at higher elevations. Alpine tundra, alpine willows, and rock dominate above timberline.

## Land management

DAU RBS-4 encompasses 645 mi<sup>2</sup>. The largest GMU within the RBS-4 is S4 (284 mi<sup>2</sup>), followed by S3 (231 mi<sup>2</sup>), and S41 (131 mi<sup>2</sup>). The primary landownership/management types in DAU RBS-4 are USFS (66%) and private lands (26%). The remaining 8% is divided among cities and counties (4%), CPW (2%), non-government organizations (NGO) (1%), State Land Board (SLB) (0.5%), and BLM (0.5%) (Figure 7).

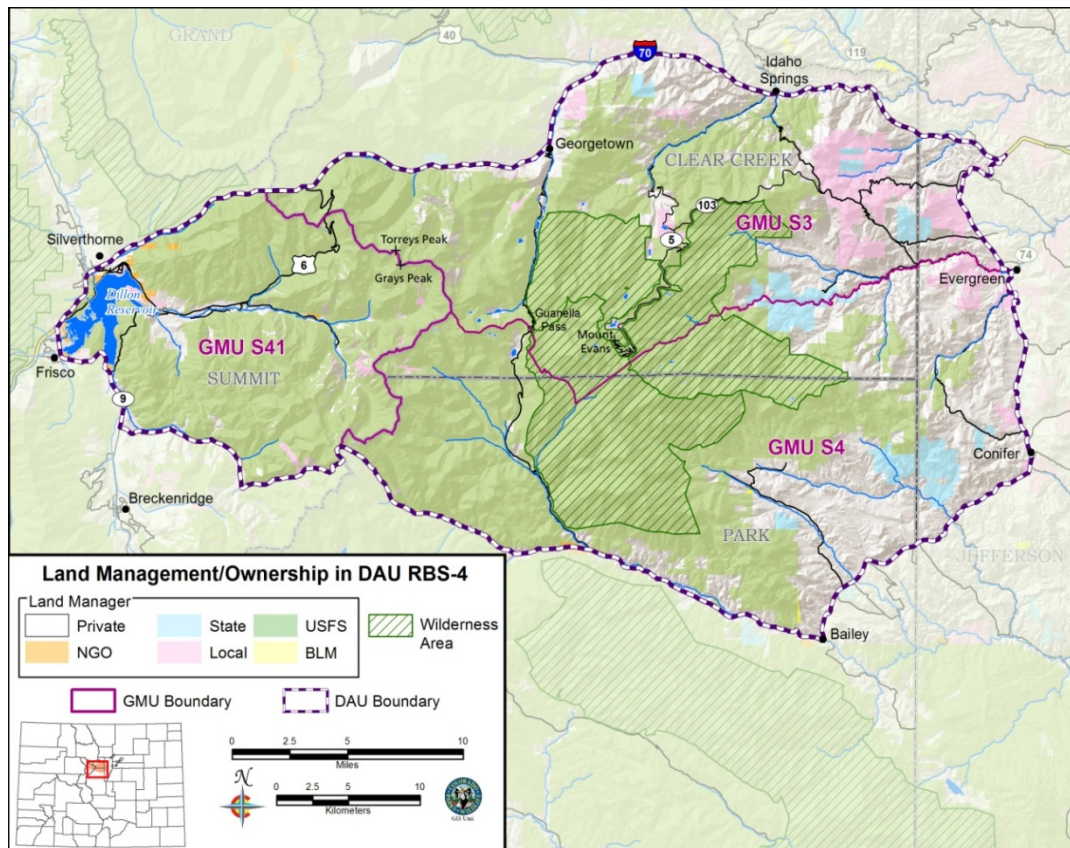


Figure 7. Land management within DAU RBS-4.

S4 is located in Clear Creek and Park Counties. S4 is bounded on the north boundary of the Pike National Forest, USFS Trail 603, a line from the junction of USFS Trails 603 and 602 to the head of Tumbling Creek, Tumbling Creek, Beartrack Creek, and Bear Creek; on the east by CR 73; on east and south by US Highway 285; on the south by the North Fork of the South Platte River and on the west by the Continental Divide. The majority of the area is managed by the USFS (Pike National Forest) which makes up 62% of S4. Private entities own/manage most of the remaining area in S4 (32%) followed by CPW (3%), local counties and municipalities (2%), and SLB (1%).

S3 is located in Clear Creek, Park and Jefferson Counties. S3 is bounded on the north by I-70; on the south by Bear Creek, Beartrack Creek, Tumbling Creek; a line from the head of Tumbling Creek to the junction of USFS Trails 603 and 602, and Pike-Arapaho National Forest boundary; and on the west by the Continental Divide. The majority of the area is managed by the USFS (Arapaho National Forest) which makes up 61% of S3. Private entities own/manage most of the remaining area in S3 (28%) followed by local counties and municipalities (8%), CPW (2%), and SLB (1%).

S41 (Peru Creek) is solely located in Summit County. S41 is bounded on the north by I-70; on the east by the Continental Divide; on the south by the Swan River Road (CR 6) and USFS 6; and on the west by CO Highway 9 and US Highway 6. The majority of the area is managed by the USFS (White River National Forest) which is 85% of S41 followed by private entities (10%). The remaining area is managed by NGOs (4%) and Summit County and municipalities (1%).

Of the 645 mi<sup>2</sup> of RBS-4, only 27% (173 mi<sup>2</sup>) is overall range for bighorn sheep. Among the GMUs, S4 has the most over all bighorn sheep range (33%) followed by S3 (27%) and S41 (15%) (Figure 8).

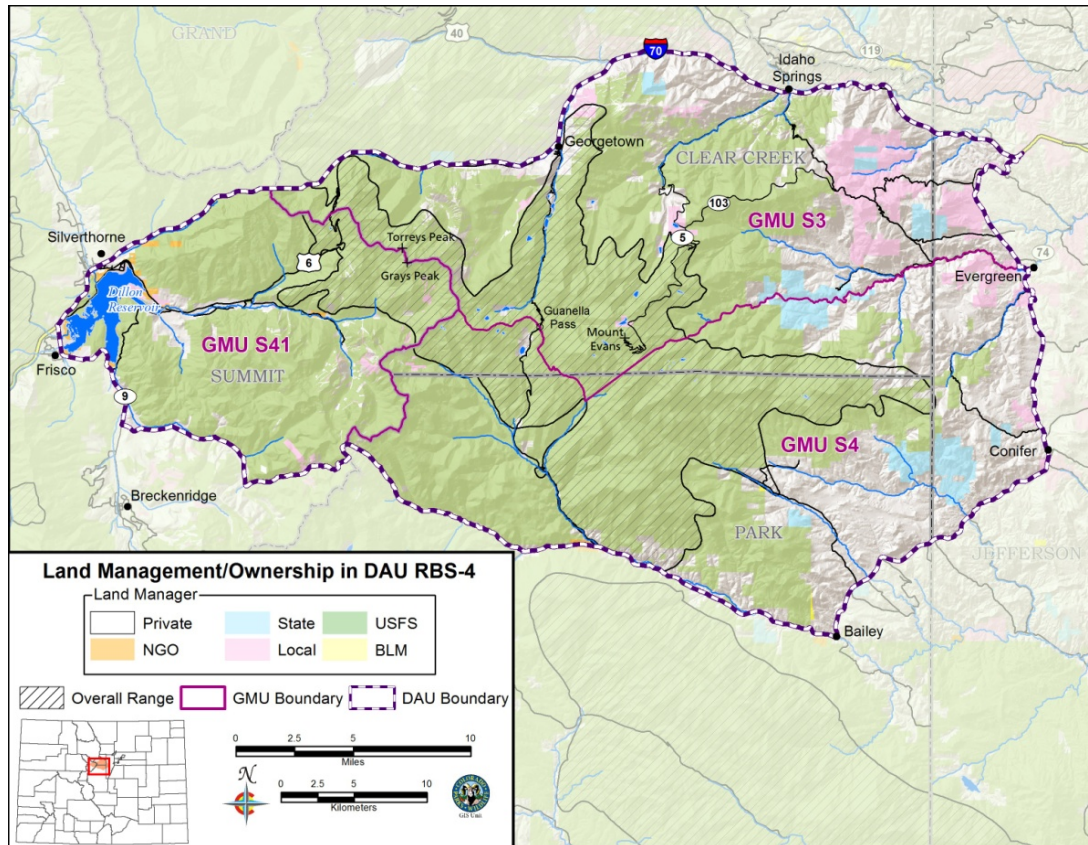


Figure 8. Land management and overall bighorn sheep range within DAU RBS-4.

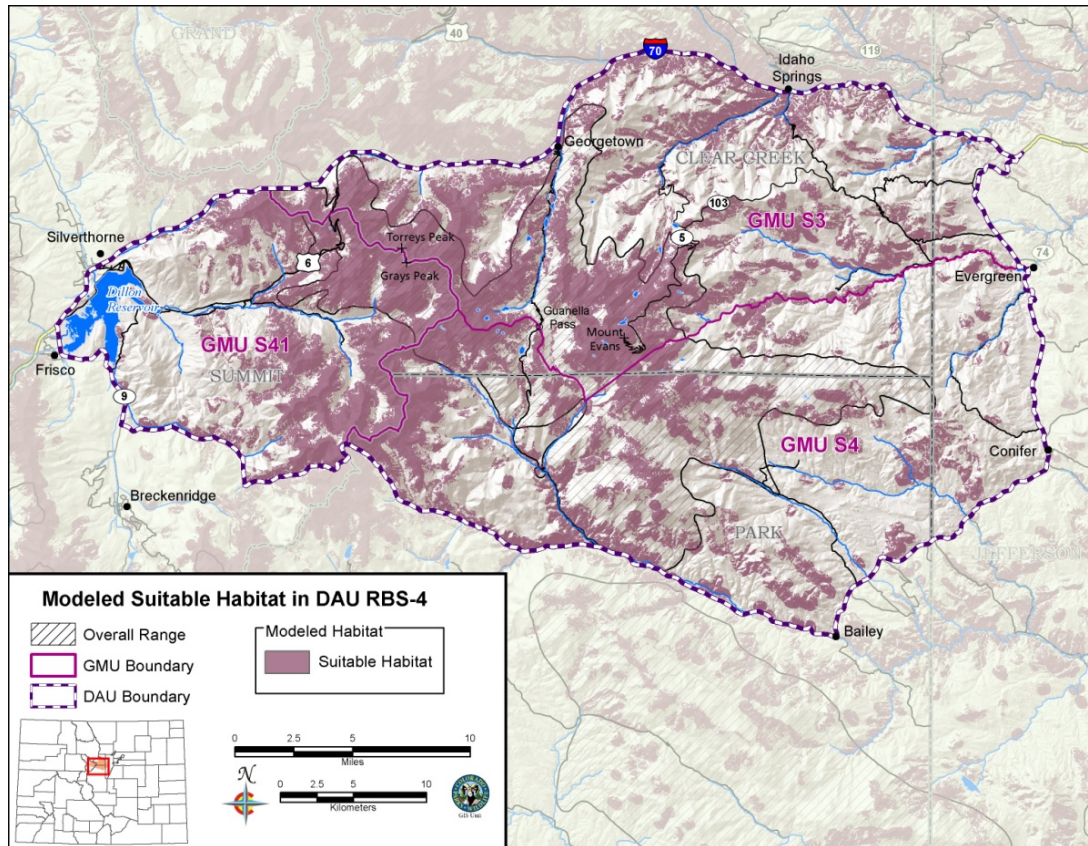
## Habitat Resources

The amount of available bighorn sheep habitat in DAU RBS-4 was estimated through a spatial analysis as outlined in the Bighorn Sheep Capture and Transplant Guidelines (George et al. 2008). This analysis identified the areas topographically suitable as bighorn sheep habitat and then removed areas that were known to be unsuitable due to vegetative characteristics.

Bighorn sheep escape terrain was defined as those areas with slopes  $\geq 60\%$  (i.e., approximately 27 degrees). All areas within 300 m of escape terrain were considered topographically suitable habitat. Areas within 500 m of escape terrain were also included, if escape terrain occurred on at least two sides. Finally, habitats that contained unsuitable vegetation (e.g., spruce fir) were removed to estimate the final amount of suitable bighorn habitat.

Using this definition, DAU RBS-4 has 233 mi<sup>2</sup> of suitable bighorn sheep habitat. Of the suitable bighorn sheep habitat, 55% (128 mi<sup>2</sup>) occurs in the overall range of the Mount Evans herd (Figure 9). Although this spatial analysis is useful for estimating potential suitable habitat for bighorn, the method likely overestimates actual suitable bighorn habitat as not all of the area identified as suitable is available for use by bighorn. Much of the area designated as suitable contains vegetative types that limit bighorn

use. Small patch sizes could not be mapped due to limitations in the spatial model or the resolution of the vegetation layers that were available.



**Figure 9.** Modeled suitable bighorn sheep habitat and occupied range in DAU RBS-4. Some of the modeled area may not be suitable habitat due to vegetative characteristics.

Winter range was defined as suitable habitat with a southerly aspect. DAU RBS-4 contains 172 mi<sup>2</sup> (74%) of suitable winter range, which is within the currently occupied range of the Mount Evans herd (Figure 10). Suitable winter range, when partitioned by GMU was estimated at 80 mi<sup>2</sup> (46%) in S4, 58 mi<sup>2</sup> (34%) in S3, and 34 mi<sup>2</sup> (20%) in S41.

Suitable lambing habitat was defined as patches  $\geq 2$  ha in size with  $>60\%$  slopes and with a southerly, easterly, or westerly aspect. Thus, DAU RBS-4 contains 60 mi<sup>2</sup> of suitable lambing habitat with S3 having 40% (24 mi<sup>2</sup>), S4 with 37% (22 mi<sup>2</sup>), and S41 having the least with 23% (14 mi<sup>2</sup>). Within the suitable lambing habitat there is approximately 8 mi<sup>2</sup> of known production areas, which is defined as part of the overall range of bighorn sheep occupied by pregnant females from May 1 to June 30 (Figure 11). These production areas have been identified by Wildlife Biologists and District Wildlife Managers over the years and are found in all three GMUs.



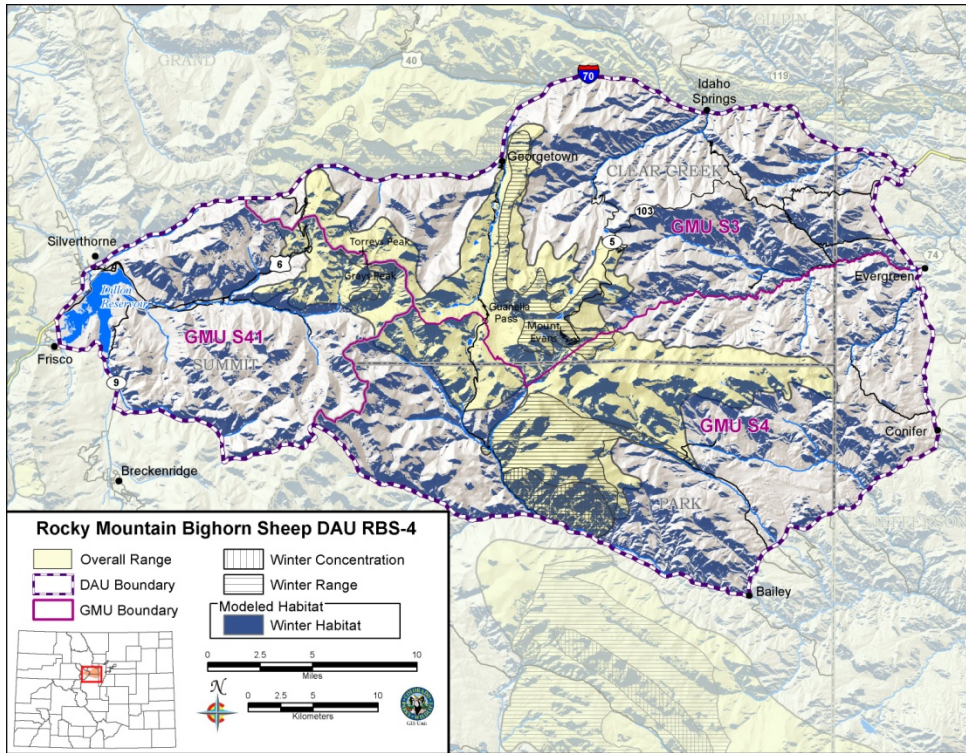


Figure 10. Modeled winter bighorn sheep habitat and occupied range in DAU RBS-4.

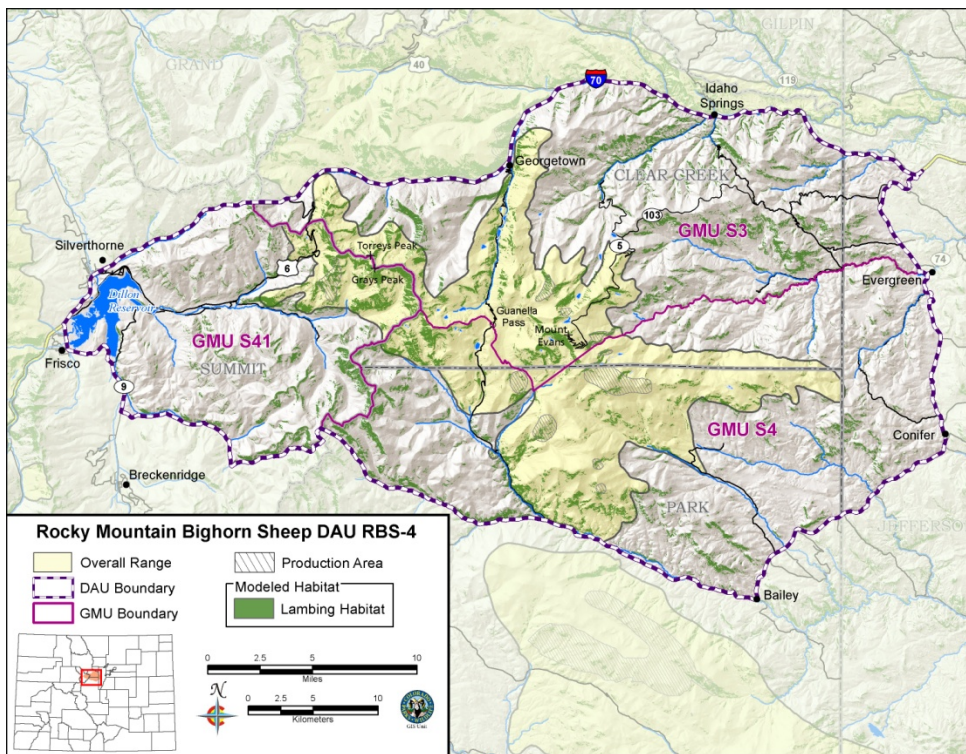


Figure 11. Modeled lambing habitat for bighorn sheep in relation to occupied range and production areas in DAU RBS-4.

## BIGHORN SHEEP POPULATION HISTORY

The Mount Evans bighorn sheep herd has been present since at least the 1920s and is considered native to the area. Jones and White (1950) reported that the Mount Evans herd had approximately 60 animals in the 1920s. Bighorn sheep were sporadically surveyed from the 1920s to 1977. Bear and Jones (1973) compiled records of 12 surveys from 1949-1969. The number of sheep counted ranged from 27 in 1949 to 154 in 1968, but the methods, area covered, and frequency of surveys varied. In addition, Streeter (1969) and several Wildlife Conservation Officers, indicated that the population had an increasing trend into the late 1960s. From 1970 to 1977, there are few records of bighorn sheep surveys on Mount Evans. In 1971, a total of 32 bighorn sheep were observed. In 1974, a helicopter survey yielded only 26 bighorn, however only 0.5 hours of flight time was used which would have limited the amount of terrain covered. Baumann (1979) reported that summer ground surveys were conducted in 1972 and 1977 resulting in a population estimate between 175-200 bighorn sheep (Figure 12).

Since 1978, population estimates and trends have been derived from an annual standardized coordinated ground surveys that provide minimum population numbers and demographic information such as age and sex ratios (Appendix A). See Inventory and Population Estimates section for details. The Mount Evans coordinated ground count is the longest running bighorn sheep inventory in the state.

From 1978 to 1987, the Mount Evans population appears to have been stable, although there is some variation in survey results that may be attributed to lower sighting probability in 1980 and 1985 (Figure 13). In the decade from the mid 1980s to the mid 1990s, the population showed an increasing trend and count totals reached a high of 342 sheep in 1996. The population began a steady decline from the late 1990s through 2011. This decline could be, in part, attributed to the increased ewe harvest (15-30/year), which started in 1997 (Figure 4). Ewe harvest was increased to bring the population down to the objective set in 1992 of 200-225 bighorn sheep. Other variables such as drought, declining lamb recruitment, and survey conditions may have also contributed to the apparent decline in bighorn sheep numbers observed since the late 1990s. Numbers increased in 2012 and 2013 (Figure 13).

Bighorn sheep observations were noted on standardized summer mountain goat helicopter surveys since 1992, in the area that was later designated as S41. More intensive monitoring of S41 began in 2008 including periodic ground surveys. When S41 was incorporated into the DAU, the total number of bighorn sheep increased slightly, but followed the same general pattern seen in S3 and S4 from 2009-2013 (Figure 13). From 2008 to 2011, there was a decline in number of bighorn sheep observed with a low of 105 in 2011. However, numbers increased in 2012 and 2013 (Figure 13).

In summary, within the Mount Evans DAU, annual summer surveys indicate the bighorn sheep population was increasing from 1980 to the mid 1990s, with the number counted peaking in 1996 at over 340 animals. Following the peak, annual surveys indicate a decreasing trend in the population until about 2010-2012 with the 2013 survey indicating the population may be at the beginning of an increase again.

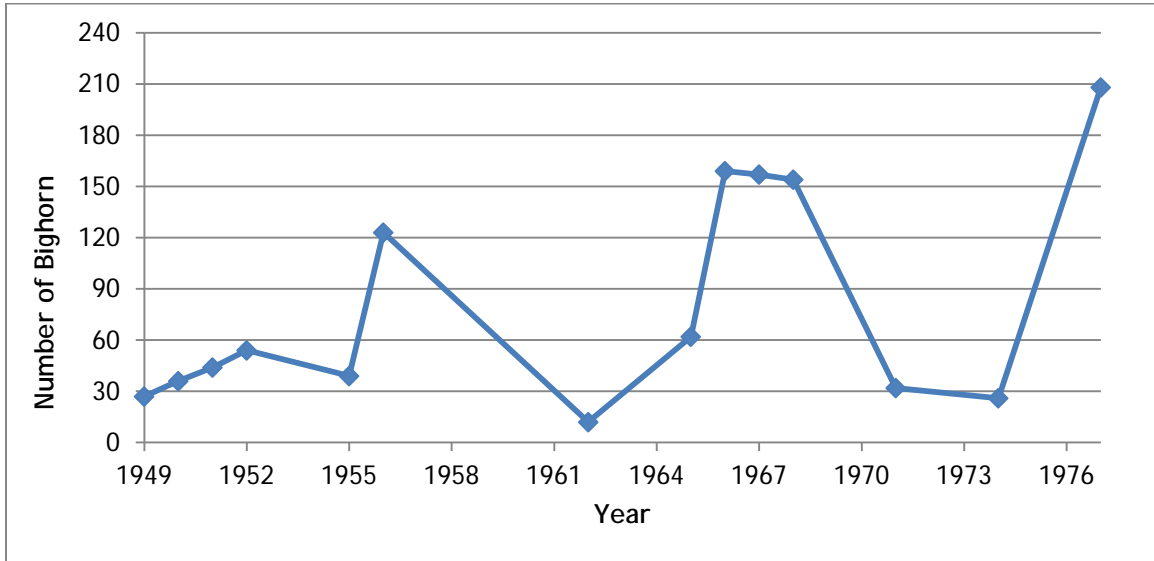


Figure 12. Minimum number of bighorn sheep observed in DAU RBS-4 from 1949 to 1977.

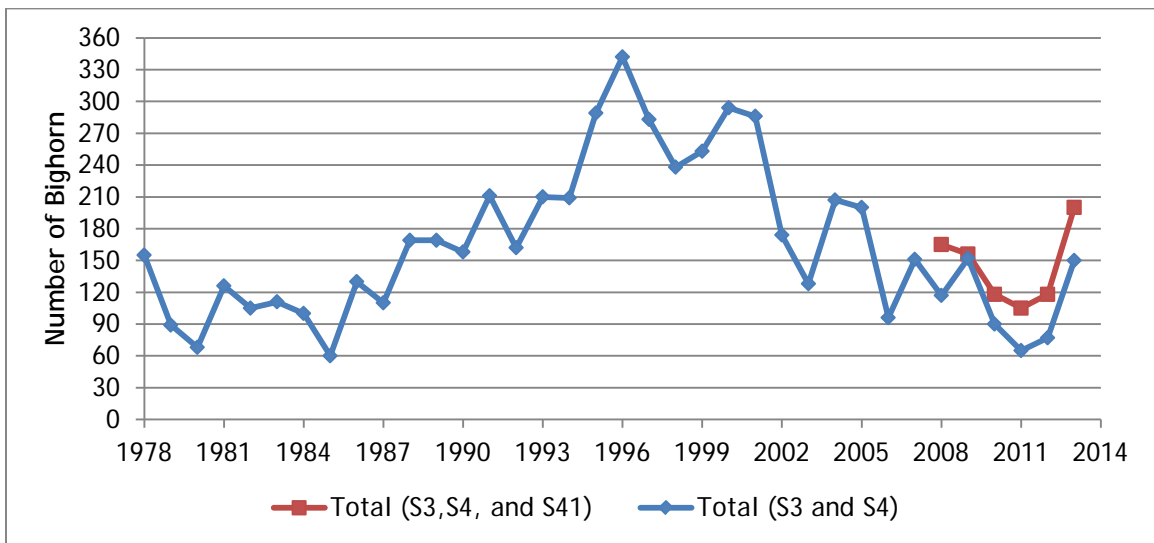


Figure 13. Minimum number of bighorn sheep observed in summer survey for GMUs S3 and S4 from 1978 to 2013 and for all GMUs in DAU RBS-4 from 2008-2013.

## Recruitment

Summer lamb:ewe ratios (lambs:100 ewes), which are an indicator of production, have varied significantly from year to year, ranging from a high of 106:100 in 1981 to a low of 13:100 in 2011 (Figure 14). However, the ratio in 1981 was likely an over estimate because this ratio is not biologically possible in a free ranging bighorn population. Lamb:ewe ratios were high in the late 1970s exceeding 60:100. Since 1982, ratios of less than 25:100 were observed several times and have been consistently low during the last three years in S3 and S4. However, when all GMUs are combined, the lamb:ewe ratio has been  $\geq 35:100$  since 2008 (Figure 14).

Late fall/winter lamb:ewe ratios are a more reliable indicator of recruitment than summer ratios and inferences can be made on whether a population is stable, increasing or decreasing. Winter surveys on Mount Evans have not been done consistently because access is difficult in the winter. A winter ground survey was conducted in 2011 for S3 only and the observed lamb:ewe ratio was 60:100; however, the sample size was small ( $n=21$ ; 10 ewes, 6 lambs, 2 yearlings and 3 rams). In 2013 (March), a helicopter survey was conducted in S3 and S4 resulting in an observed lamb:ewe ratio of 38:100. In the future, fall surveys may be conducted in late October or early November to accommodate better access to the back country to adequately monitor recruitment trends for the Mount Evans herd.

Since winter surveys are difficult on much of the Mount Evans winter range due to access, summer yearling:ewe ratios may be an alternate indicator of recruitment. However, yearlings are similar in horn and body size to adult ewes which can lead to classification errors depending on the experience of the observers. The summer yearling:ewe ratios for DAU RBS-4 have been highly variable over time (Figure 15). Bauman (1979) suggested that a yearling:ewe ratio of 24:100 indicated the Mount Evans population was stable. However, because of the potential for classification errors, yearling:ewe ratios should be viewed with caution.

Ram:ewe ratios are an indicator of number, age, and horn size of the rams in the herd. Ram:ewe ratios obtained from the summer surveys are highly variable due to the spatial separation of rams and ewes on summer range and the data must be viewed with caution. Ram:ewe ratios tend to be more reliable during late fall (November-December) surveys, but there have been few late fall surveys in this DAU. During the 35 years of the summer surveys, ram:ewe ratios were as low as 9:100 in 1987 and as high as 130:100 in 1999 (Figure 16). Ram:ewe ratios for the DAU show a downward trend (Figure 16).

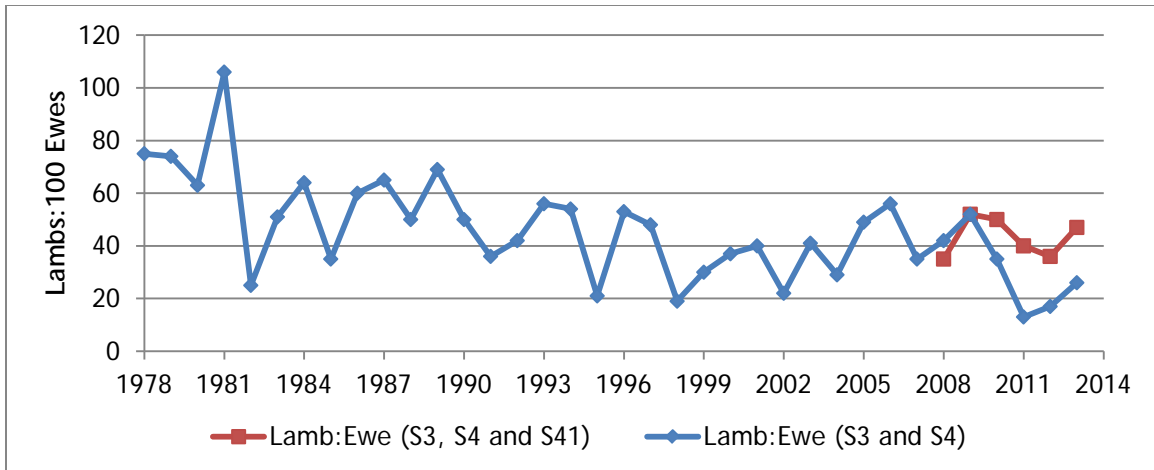


Figure 14. Summer lamb:ewe ratios for GMUs S3 and S4 from 1978-2013 and for all GMUs in DAU RBS-4 from 2008-2013.

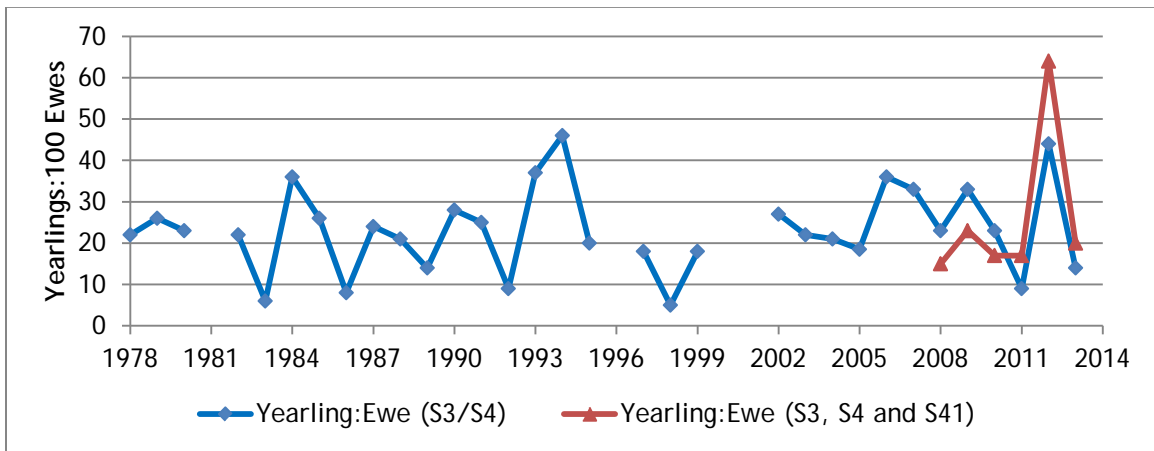


Figure 15. Summer yearling:ewe ratios for GMUs S3 and S4 from 1978-2013 and for all GMUs in DAU RBS-4 from 2008-2013.

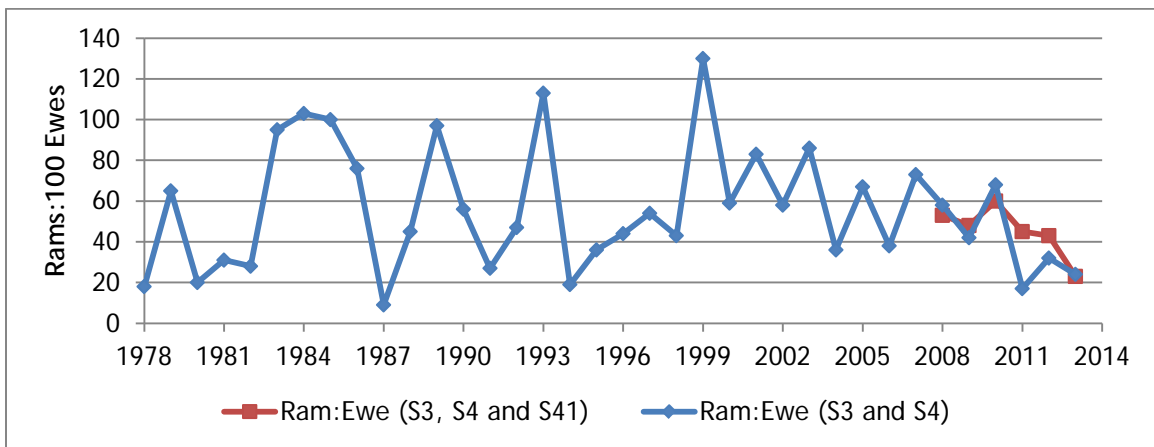


Figure 16. Summer ram:ewe ratios for GMUs S3 and S4 from 1978-2013 and for all GMUs in DAU RBS-4 from 2008-2013.

## Distribution

Jones and White (1950) reported that the Mount Evans herd had approximately 60 animals in the 1920s. Transplants occurred in 1945 and 1948 from the Tarryalls to expand overall bighorn sheep range. These bighorn sheep were released near Grant and expanded occupied bighorn range south to Grant along US Highway 285 and primarily east of the Guanella Pass Road. Jones and White (1950) and Streeter (1969) identified four subherds which included Chicago Creek, Scott Gomer, Mount Logan-Grant, and Deer Creek. During the winter months the Mount Logan-Grant subherd and Deer Creek subherd typically wintered below timber-line. The Chicago Creek subherd and, to a lesser extent, the Scott Gomer subherd could be found above timber-line year round. During the summer months most of the subherds could be found on the alpine (Figure 17). Bauman (1978) identified seven lambing areas which included Gray Wolf Mountain, Geneva Mountain, Kataka Mountain, Mt. Logan, and the Chicago Lakes, Camp Creek and Frozen Lake cirques. Currently, CPW knows of 10 lambing areas including those identified by Bauman (Figure 18).

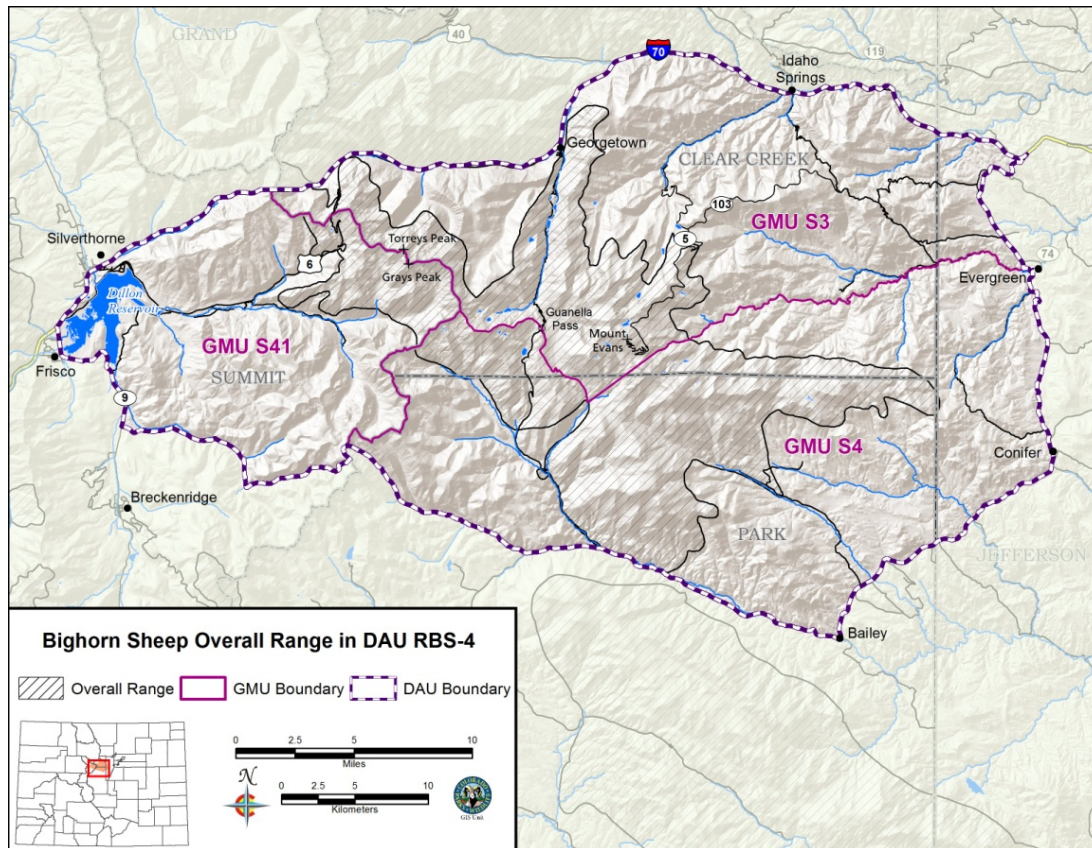


Figure 17. Distribution of bighorn sheep in DAU RBS-4.

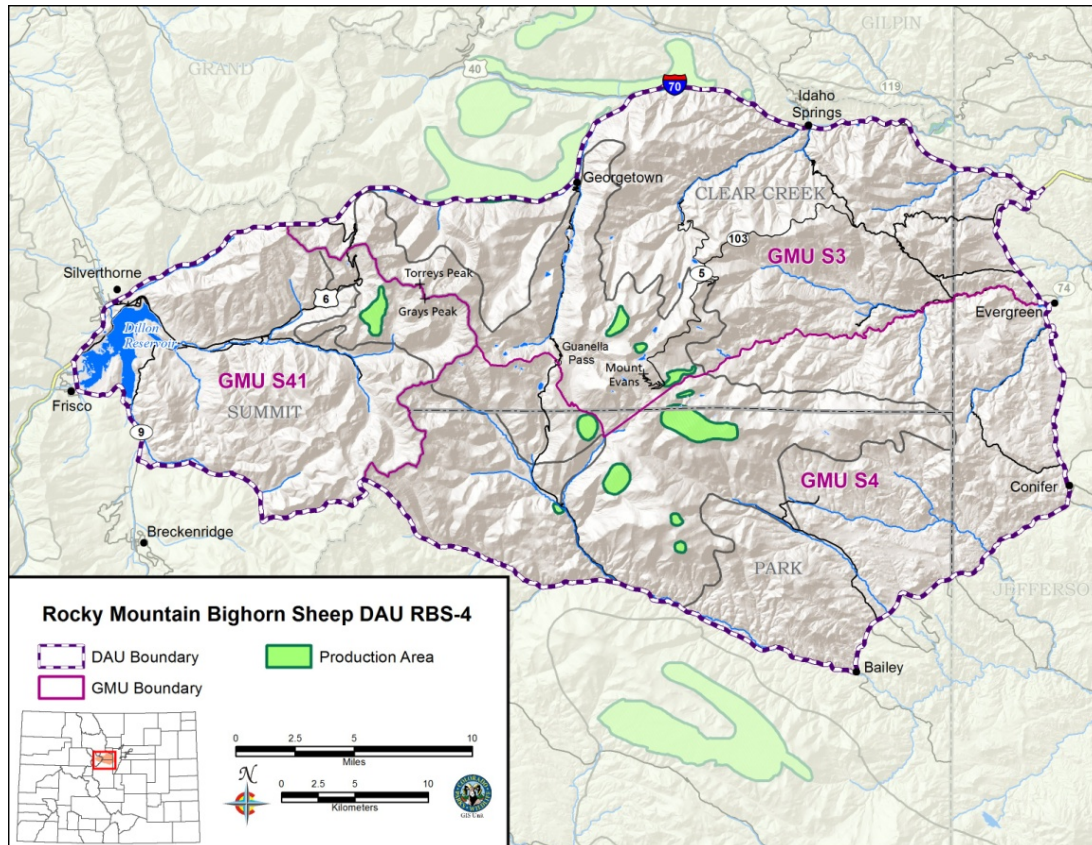


Figure 18. Known lambing areas in DAU RBS-4.

Since the mid 1990s, bighorn sheep have been consistently observed west of Guanella Pass Road on Square Top Mountain and Smelter Gulch; in the area that is now S41, further expanding their range west of the Continental Divide. Initial observations in Peru Creek and Chihuahua Gulch coincided with peak bighorn numbers in S3 and S4 in the 1990s, indicating there may have been dispersals from the core habitat around Mount Evans. In 2009, bighorn numbers in Peru Creek were considered adequate to support hunting, thus GMU S41 was created. Based on bighorn sheep movements between Peru Creek and S3 and S4 from radio telemetry studies (Huer 2015), S41 was incorporated into DAU RBS-4.

## Movements

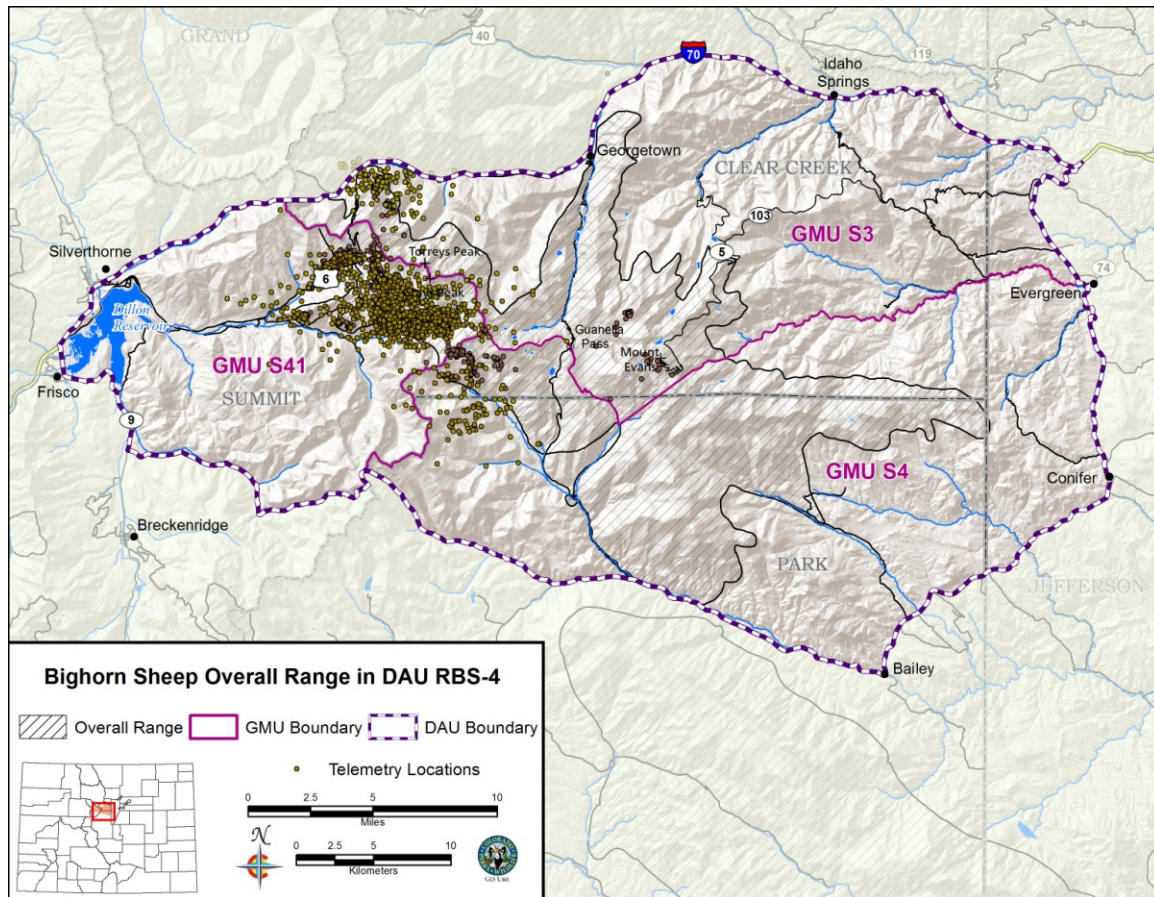
### Interaction of Subherds

Historically, four subherds could be found within the DAU, which included the Chicago Creek, Scott Gomer, Mt. Logan-Grant, and the Deer Creek subherds (Jones and White 1950). Streeter (1969) reported movements of bighorn sheep between the Mt. Logan-Grant and the Deer Creek subherds, but no interchange between those and the Chicago Creek or Scott Gomer subherds. Additionally, Streeter (1969) speculated that there was little interchange between Chicago Creek and the Scott Gomer subherds.

Bauman (1978) reported there were three subherds in the mid-1970s. Bauman (1978) marked over 30 bighorn sheep in two different locations (Goliath Peak and Grant). Based on his observations, the Mount Evans subherd (trapped on Goliath Peak) occupied cirques and mountain tops near the Scott Gomer and Chicago Creek drainages. The Three Mile/Deer Creek subherd occupied slopes of Geneva Creek and the Platte River Valleys. The third subherd, Frozen Lake, occupied Arrowhead Mountain-Geneva Mountain and the Mount Bierstadt-Epaulet Mountain areas. Bighorn sheep in the Frozen Lake subherd were not marked during this study and movements were based on direct observations. Bauman (1978) did not detect interchange between Three Mile/Deer Creek and the other two subherds. Bauman (1978) reported there were two major ram band concentration areas, one near Sugarloaf and the other at Rosedale Peak, but thought that these rams drifted throughout the entire study area.

In the late 1990s, bighorn sheep were observed west of the Continental Divide in the Peru Creek drainage, as well as in western S4 near Square Top Mountain and Shelf Lake. Since then, bighorn sheep have been consistently observed in Peru Creek. Huwer (2015) put three radio collars on bighorn sheep between 2005-2007 near the boundary of S41, S3, and S4 to determine if there was any movement north into the Georgetown herd (S32) or between S41 and S3/S4. These consisted of one ewe in Peru Creek (S41), one ram on Sniktau Mountain (western S3), and one ram in Smelter Gulch (western S4). While no movements between S41 and S32 were observed, collared bighorn were found moving between GMUs S41, S3, and S4. In 2012 two bighorn were radio collared in S41 and movements were similar to those observed by Huwer (2015) (K. Oldham, pers. comm.) (Figure 19).





**Figure 19.** Telemetry locations of radio-collared bighorn sheep in GMUs S3, S4, and S41 within DAU RBS-4.

### Interaction with other DAUs

There are two bighorn sheep herds in adjacent DAUs that are in close proximity to Mount Evans (DAU RBS-4), the Kenosha Mountains (S27) and Georgetown (S32-DAU RBS-3). To the south, the Kenosha herd is separated from RBS-4 by the North Fork of the South Platte River and US Highway 285; to the north the Georgetown herd is separated from RBS-4 by Clear Creek and Interstate I-70, except over the Eisenhower Tunnel where there are no roads or creeks.

There appears to be little interaction between the Mount Evans herd and other bighorn sheep herds. The only documented movement was in the early 1990s when a ram that had been captured and ear-tagged near Georgetown was reportedly harvested in the Kenosha Mountains (George et al. 1996 and 2008). Additionally, Huwer (2015) did not detect any movements of radio collared ewes or rams from the Georgetown herd into the Mount Evans herd. Likewise, bighorn sheep captured and marked with visual collars and eartags northeast of Grant (S4) in the early 1990s were not observed outside S3 and S4 (CPW unpublished data).

The lack of movement between the Mount Evans herd and Georgetown or the Kenosha Mountain herds is further supported by the known distribution of Johne's disease. Johne's disease occurs in the Mount Evans bighorn sheep herd but has never been identified in the Georgetown or Kenosha herds. Additionally, a major die-off attributed to pneumonia occurred in the Tarryall and Kenosha Mountain herds in the late 1990s, but no impact was reported in the Mount Evans herd during that time which also indicates that there was little to no interchange with the Kenosha bighorn sheep herd (George et al. 2008).

## **Herd Management**

### **Inventory**

In 1978, CPW established survey routes for coordinated ground surveys in the Mount Evans herd in bighorn sheep habitat that was known to be occupied at the time (Appendix A). During these surveys, teams of observers simultaneously searched for bighorn sheep along specified routes. Over the years, a few routes have been slightly modified, added and dropped as bighorn range expanded west of Guanella Pass Road. Overlap occurs among routes allowing for improved sighting probability of bighorn sheep. These coordinated ground surveys have been consistently conducted the third week of July. Originally, the coordinated summer survey was a single day, but from 1992 until the mid 2000s, the survey was repeated on two consecutive days. More recently, the survey has returned to a single day for efficiency. The Mount Evans coordinated ground survey is the longest running bighorn sheep inventory in the state.

When the annual surveys started in 1978, there was limited evidence that a viable bighorn sheep subherd was present west of Guanella Pass in what is now S41 (Peru Creek). Bear and Jones (1973) reported that 16 bighorn sheep were counted on Gray's Peak (GMU S41) in 1950. However, there were no other records documenting bighorn sheep in that area again until observations in the mid 1990s during the annual Gray's and Torreys Peak mountain goat helicopter surveys. As a result, no survey routes were established west of Guanella Pass Road when the Mount Evans count was initiated in 1978. Consequently, bighorn sheep in the Peru Creek portion of the DAU were not included in the population estimates until 2008 when annual surveys for S41 began.

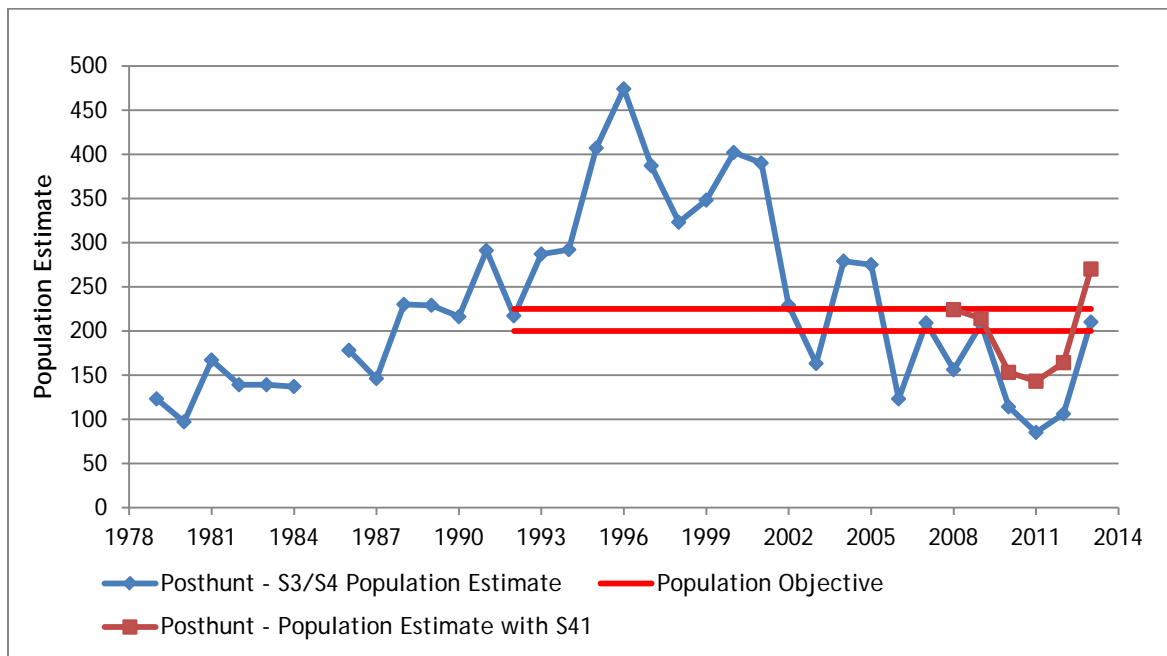
### **Population Estimation**

While the Mount Evans bighorn sheep summer survey is the longest running data set for the species in Colorado, data has not been used to model the population due to the limitations of summer age and sex ratios previously discussed. However, the consistent nature of the survey does allow for a coarse population estimate based on assumed sighting probability on surveys. Several studies have been conducted on sighting probability of bighorn sheep in various habitats (Huyer 2015, Stiver 2011, McClintock and White 2007, Bodie et al. 1995, Neal et al. 1993). Among these studies, sighting probability ranged between 0.30-0.70 and varied across years, seasons, and between sexes.

Bauman (1978) suggested that sighting probability on Mount Evans was 0.70, based on observations from collared bighorn sheep over a one year period. The most applicable mark-resight study was conducted on the Pikes Peak bighorn sheep herd (Stiver 2011). Pike Peak and Mount Evans are comparable since bighorn sheep use the alpine extensively during the summer in both areas. On Pikes Peak, sighting probability was between 0.48-0.58, which included rams, ewes, and young greater than three months. The three year average sighting probability was 0.538.

Mount Evans could have a higher sighting probability compared to Pike Peak because the number of routes on the coordinated grounds surveys are greater for Mount Evans (n=26) compared to Pikes Peak (n=10). Likewise, with the number of routes and overlap between routes, observers can see the same areas at different angles increasing the chances of detecting bighorn sheep. Therefore, for the purpose of estimating bighorn sheep numbers on Mount Evans a sighting probability of 0.70 was applied to summer survey results to generate posthunt population estimates. With no long term mark-resight/modeling on the Mount Evans herd, the sighting probability of 0.70 could result in conservative estimates.

The posthunt estimate, for only S3 and S4 have varied over time with a high of over 400 in 1996 to a low of 86 in 2011 (Figure 20). From 2011 to 2013, the population increased and was near the lower end of the posthunt population objective, which was set in 1992 (Figure 20). When S41 was added in 2008, the population estimate was at objective. From 2010 through 2012, the population fell below objective, but exceeded the objective again in 2013 (Figure 20).



**Figure 20.** Posthunt population estimate for GMUs S3 and S4 from 1978 to 2013 and for all GMUs in DAU RBS-4 from 2008 to 2013 assuming a 0.70 sighting probability on annual summer surveys. Population objective range from 1992-1013.

## Translocations

Two supplemental translocations into the Mount Evans herd have occurred. Sixteen bighorn sheep (3 rams, 8 ewes, and 5 lambs) from the Tarryall herd were released near Grant in 1945. Seven more bighorn sheep (7 ewes) from the Tarryall's were released near Grant in 1948 (Colorado Division of Wildlife 2009).

There have been four translocations of bighorn sheep out of the Mount Evans herd. Twenty bighorn sheep (3 rams, 12 ewes, and 5 lambs) were taken from Mount Evans in 1977 and released on Cross Mountain (Moffat County). Twenty-one more bighorn sheep (1 ram, 10 ewes, and 10 lambs) were removed from Grant (Geneva Creek) in 1979 and taken to Colorado State University (CSU) as part of other ongoing research on the species. In 1980 and 1995 a total of 24 bighorn sheep (1980=12 and 1995=12) were trapped at Grant (Geneva Creek) and taken to CSU (Colorado Division of Wildlife 2009).

## Hunting and Harvest History

Unregulated market hunting, along with habitat losses and introduced diseases, contributed to reductions in statewide bighorn numbers in the 1860s and 1870s. In response to declining bighorn populations, the Colorado legislature placed a moratorium on bighorn sheep hunting in 1885 (Colorado Division of Wildlife 2009). By 1953, many of the herds in the state had recovered and several areas were reopened to hunting, including Mount Evans.

Since its inception, hunting on Mount Evans has been referred to as rifle; however, other legal methods can also be used such as archery and muzzleloader equipment. From 1953-1957, hunters were required to harvest rams that were  $\frac{1}{2}$  curl or larger. In 1960, the curl size was reduced to a  $\frac{1}{3}$  curl but was changed back to  $\frac{1}{2}$  curl the following year, where it remained until 1966. From 1966 to 1969, the curl size was increased to  $\frac{3}{4}$  curl and in 1970, the minimum size was again increased to a full curl (Bear and Jones 1973). Currently, hunters are required to take a  $\frac{1}{2}$  curl or larger ram. Allocation of ewe licenses began in 1981 and continues today. Additionally, from 1981 to 1985 either sex licenses were offered (Appendix B).

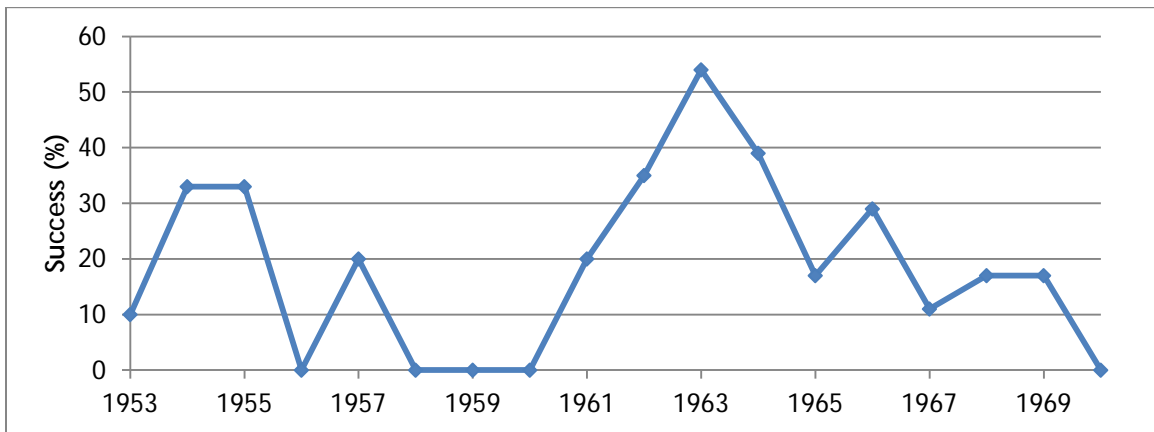
The number of days hunted and licenses have varied over time. From 1953 to 1994, there was one hunting season for this herd. In 1995 two more seasons were added in an effort to distribute increasing numbers of licenses across multiple seasons and avoid hunter crowding. The number of hunting days has increased from a low of 9 in 1954 to a high of 68 in 1995. Currently, hunting occurs from mid August to early October. The number of licenses has varied from a low of 5 in 1956 to a high of 60 in 1987 (Appendix B). In 1992, the population objective was set for S3 and S4 at 200-225 bighorn sheep. Due to the population exceeding the objective, license allocations increased from 25 in 1992 to 50 in the early 2000s to reduce the population to objective.

Prior to 1985, only residents of Colorado were eligible to draw bighorn sheep licenses. From 1985 to 1988, 20% of the licenses were made available to non-resident hunters.

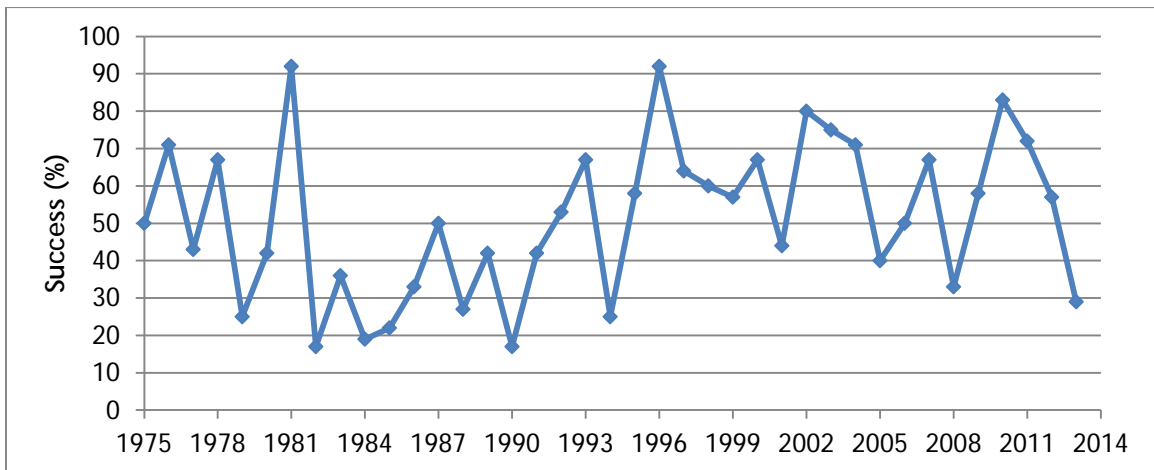
In 1989, the non-resident allocation was reduced to 10% of licenses statewide. Non-resident licenses have been issued for the Mount Evans bighorn sheep herd since 1985.

In 1992, a hunting closure was implemented within a ½ mile of CO Highway 5 from CO Highway 103 to the top of Mount Evans. This closure included the Summit Lake Cirque and Ptarmigan Flats. In 2013, the closure was modified so that hunting would be prohibited within ½ mile of the Mount Evans Highway (CO Highway 5) only while the road was open to vehicle traffic. When the Mount Evans Highway is officially closed to vehicles at the intersection of CO Highway 103, the hunting closure is lifted with the exception of hunting ptarmigan.

Hunters have harvested 0-40 bighorn sheep annually in DAU RBS-4 (Appendix B). From 1953 to 1970 ram harvest success rates ranged from 0 to 54% and from 1975-2013 success rates ranged from 22% to 92% (Figures 21 and 22 respectively). Ewe harvest started in 1981 and success rates have ranged from 0 to 83% (Figure 23).



**Figure 21.** Ram hunter success rates in DAU RBS-4 from 1953 to 1970, calculated as number of bighorn harvested divided by the number of licenses issued.



**Figure 22.** Ram hunter success rates in DAU RBS-4 from 1975 to 2013, calculated as number of bighorn harvested divided by the number of licenses issued.

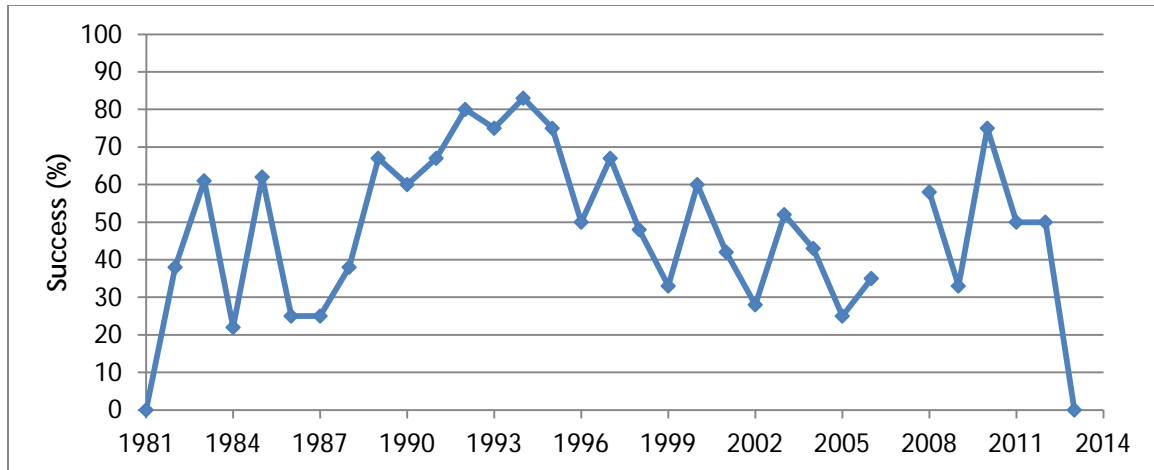


Figure 23. Ewe hunter success rates in DAU RBS-4 from 1975 to 2013, calculated as number of bighorn harvested divided by the number of licenses issued.

## MANAGEMENT ISSUES

### Habitat Quality

Habitat quantity does not appear to be limiting bighorn sheep numbers in DAU RBS-4. Most of the bighorn sheep reside within the Mount Evans Wilderness and west of Guanella Pass up to the Continental Divide. The DAU contains a sufficient amount of escape terrain, lambing and winter habitats to sustain the number of bighorn sheep that are proposed in this plan.

Productivity and recruitment are vital to ensure bighorn sheep populations remain viable. Productivity in DAU RBS-4 (based on summer lamb:ewe ratios) has varied over the years and the summer lamb:ewe ratios have remained relatively stable since 2008. Forage quality may have played a role in poor lamb production and recruitment in the past and may be a limiting factor in the future for this population.

Nutrition affects reproduction, susceptibility to disease, and the general health of both lambs and adults. Streeter (1969) briefly studied the nutritional values (crude protein, crude fat, crude fiber, ash, calcium, and phosphorus) of four plants species (*Agropyron trachycaulum* (slender wheatgrass), *Poa rupicola* (timber bluegrass), *Festuca ovina* (hard fescue), and *Kobresia bellardi* (kobresia)) used by bighorn sheep on Mount Evans. He concluded that crude protein, calcium, and calcium:phosphorus levels were lower than minimal requirements for domestic sheep. Carpenter (2005) found the trace nutrient selenium below the national standards for domestic sheep in areas adjacent to Mount Evans. The level of selenium in the Kenosha Mountains was 40 ppb and these low levels are known to cause reproductive disorders in domestic sheep. While these studies shed light on possible nutritional deficiencies, information is lacking on the nutritional needs of wild bighorn sheep.

## Human Development

Since the early 1900s, human development has had little impact within the DAU because 66% of RBS-4 is owned by the USFS and of that 18% is wilderness where most of this bighorn herd resides. However, if there is movement of this herd farther to the east outside of the wilderness boundary then commercial/residential development and habitat fragmentation could become a concern in S4 and S3. Based on the historical use patterns of this herd, habitat fragmentation from development does not pose a major threat to the overall herd.

## Human Recreation Impacts

Bear and Jones (1973) stated that human activities on Mount Evans were heavy and bighorn sheep were harassed in many ways: chased by dogs, photographers, trail bikes (motor cycles), and snowmobiles. Trail bikes and snowmobile use were common and posed a direct threat to bighorn sheep from harassment. Additionally, human activities along CO Highway 5 were reported to move sheep out of area to more southerly ranges.

In 1980, a large portion of Mount Evans became a wilderness area (74,401 acres) under the Colorado Wilderness Act. With the creation of the wilderness no motorized vehicle access was allowed except on CO Highway 5 which bisects S3 and S4. In addition, CO Highway 5 was closed to vehicles during the winter months which eliminated access for snowmobiles. Since 1980, trail bikes and snowmobiles have posed little threat to bighorn sheep in S3 and S4. In S41, trail bikes and snowmobile use has historically been limited because of the steep terrain used by bighorn sheep.

Because of its close proximity to Denver and the presence of four 14,000 foot peaks (Mount Evans, Mt. Bierstadt, Gray's and Torrey's Peaks) within DAU RBS-4, thousands of people each year come to this area to recreate. The USFS estimated that over 60,000 people attempted to climb the various peaks within DAU RBS-4 in 2012 (R. Badt, pers. comm.). In addition to the peaks, there are over 77 miles of trails within the wilderness. The USFS estimated in 2010 approximately 28,000 people accessed the wilderness, based on trail head registration (R. Bradt, Pers. Comm.). It is unclear what effect this level of human activity has on bighorn sheep, especially during lambing season.

Vehicle traffic has increased tremendously since the early 1970s. In 2013, approximately 52,000 cars drove up CO Highway 5 (USFS 2013). The two areas that most tourists visit are Summit Lake and the summit of Mount Evans. Due to the narrow road and low vehicle speed mortality from collisions has been minimal.

Bighorn sheep frequent Summit Lake and the summit of Mount Evans, and have become habituated to people. Often people feed the bighorn sheep and try to pet the animals. Additionally, bighorn sheep have been attracted to the outhouses and port-a-potties at both parking areas to access minerals in de-icers, etc. In order to reduce human animal conflicts, CPW has placed salt blocks east of the Summit Lake parking

area as an alternate mineral source. This has been somewhat successful; however, bighorn sheep can still be seen in the parking lots. An increased presence of the USFS personnel and signage in the areas also appears to be reducing the human/sheep interactions, although these interactions still occur.

## Vehicle Caused Mortality

Vehicle collisions can be a cause for concern in some bighorn sheep herds in Colorado. Several major highways and heavily used roads are found within and adjacent to the DAU including: Interstate I-70 to the north, US Highway 285 to the south, US Highway 6 (Loveland Pass) to the west, and Colorado Forest Highway 80 (Guanella Pass), which bisects RBS-4. However vehicle caused mortality has not been a significant mortality factor in DAU RBS-4.

In 1991, Guanella Pass road was designated as a National Forest Scenic Byway. In 2002, the Final Environmental Impact Statement was completed and in 2003 the Record of Decision was finalized for the improvement of Colorado Forest Highway 80. Currently, the north side of the pass has been completed and the south side will start construction in 2014/2015. The improvements to the Guanella Pass road will likely increase traffic and speeds, which may increase vehicle mortality. Thus far, no bighorn sheep have been killed on the north side.

Vehicle-caused mortality does occur on US Highway 285 near Grant and on US Highway 6 (Loveland Pass). Approximately 1-4 bighorn sheep per year have been killed (D. Swanson, pers. comm.) on US Highway 285 near Grant over the past 10 years. When the population peaked in the 1990s, vehicle-caused mortalities near Grant were higher (J. George, pers. comm.). However, there are some years in which there are no vehicle mortalities. On the west side of Loveland Pass, a bighorn sheep is killed every few years (S. Shwab, pers. comm.). Bighorn sheep mitigation signs have been placed near Grant and on the north side of Guanella pass to remind drivers that there could be bighorn sheep along the roads. If the bighorn sheep populations were to increase to levels observed in the mid 1990's (over  $\geq 450$  bighorn sheep), mortality from vehicle collisions are likely to increase in these areas.

## Disease and Parasites

Bighorn sheep are unique among Colorado's big game species with regard to the influence of diseases on population performance and species abundance. Managers generally agree that bacterial pneumonia is the main reason for population declines across much of the west in recent decades (WAFWA 2012).

There are a number of strains of pneumonia causing bacteria commonly carried by domestic livestock that are highly pathogenic to bighorns. The introduction of a pathogenic strain or another novel pathogen into bighorn populations can cause all-age die-offs and lead to low lamb recruitment. In some instances, low lamb recruitment can last for a decade or more. Once introduced, these pathogenic bacterial strains can persist in surviving animals. These infected animals may serve to spread the



pathogens to other animals and herds through natural movements and translocations. The susceptibility of bighorn sheep to pathogens originally introduced by domestic livestock is regarded as the primary factor limiting Rocky Mountain bighorn sheep populations in Colorado. Moreover, the continued presence of introduced pathogens likely plays an important role in preventing statewide bighorn numbers from rebounding to historical levels. One of the most important aspects of bighorn sheep management is to keep them separated from domestic livestock (WAFWA 2012). There are currently no active domestic sheep or cattle grazing allotments on USFS lands within DAU RBS-4. However, in 2013, one domestic sheep and goat were identified during the summer bighorn sheep and mountain goat survey. The domestic sheep was removed and the domestic goat was not relocated.

The Mount Evans herd has had some level of die-offs related to pneumonia. In 1952, fourteen bighorn sheep (6 rams, and 8 ewes) were found dead in the Geneva Creek area. One yearling ewe that was sent to CSU for necropsy died of hemorrhagic septicemia (Bear and Jones 1973). Streeter (1969) described finding the remains of 28 bighorn sheep and determined that 45% fell into the 0-1 year age class, along with one 15 year old ram and two 13 year old rams. However, the time of year or cause of death was not reported.

Another infectious disease found in the Mount Evans herd is Johne's disease, which is caused by the bacterium *Mycobacterium paratuberculosis*. Johne's disease was first identified in the Mount Evans area in 1972 in one bighorn sheep (Williams et al. 1979). Four bighorn sheep in 1977 and one mountain goat in 1978 had clinical signs of the disease. These cases were observed in Grant and Lincoln Lake (Williams et al. 1979).

Johne's disease is associated with domestic livestock (cattle and goats) and causes severe diarrhea and dehydration. Infected animals shed the organism in their feces and clinical signs of the disease are usually seen in adult animals. It is unknown how Johne's disease became established in the Mount Evans population, but it could have been spread by domestic livestock or possibly by mountain goats that were transplanted to Mount Evans in 1961.

In the early 1980s, there was an attempt to reduce the number of bighorn sheep in S3 and S4 by issuing either sex licenses out of concern for Johne's being transmitted to elk. In 2000, over 100 hunter samples were analyzed for Johne's from several GMUs (G4, G7, S3, S4, and S23) and there was one positive result for a bighorn sheep from S3 and one mountain goat from G4 (CPW unpublished data). Currently Johne's continues to persist in bighorn sheep and mountain goats at low prevalence within DAU RBS-4, but has minimal population impact. CPW continues to remove and necropsy bighorn sheep and mountain goats exhibiting clinical symptoms.

### **Interspecific Competition**

Elk occur year round within occupied bighorn sheep range in RBS-4, especially on the alpine. Competition likely occurs between elk and bighorn sheep, but has never been

studied. Mule deer are also present within the DAU and their numbers and range have expanded in recent years. The highest densities of mule deer occur on portions of low elevation bighorn sheep range. Competition between these species is believed to be minimal, although it has never been studied.

Mountain goats were introduced to Mount Evans in 1961. Bear and Jones (1973) estimated that the goat population was at least 100 animals, but they ranged below timberline. There is anecdotal evidence that there was little to no overlap with bighorn sheep until the mid 1970s after which mountain goats were commonly observed above timberline.

There is concern that mountain goats may compete with bighorn sheep. Bighorn sheep and mountain goats have similar habitat requirements, wide overlap in forages they consume, and can be direct competitors (Colorado Division of Wildlife 2009). Mountain goats have been observed displacing bighorn sheep with aggression (Carpenter and Ramey 2007). However, it is not uncommon to see mountain goats and bighorn sheep foraging near each other in S3 and S4. Hobbs et al. (1990) predicted declines in bighorn sheep numbers in areas with established mountain goat populations, based on model simulations. However, these models also suggest that aggressive population management of mountain goats may mitigate competition-disease interactions.

The mountain goat population within DAU RBS-4 (GMU G4 and G7) is currently managed through hunting to keep the goat population at a healthy sustainable level of 100-125 in G4 and 250-300 animals in G7 to allow both species to coexist sympatrically. The minimum goat population for G4 (the core of the Mount Evans bighorn sheep herd) from 1978 to 2013 ranged from 40 to 160 animals (Figure 24). Some of the variation is likely due to survey conditions and sighting probability. Current mountain goat management provides an opportunity for hunters and watchable wildlife that visitors of the Mount Evans area can enjoy.

## **Other Mortality**

The effect of predation on the Mount Evans population is mostly unknown. Mountain lions, coyotes, and bobcats reside within DAU RBS-4 and it is likely that each accounts for some bighorn mortality. Additionally, golden eagles are also known to prey on bighorn sheep lambs.

The extent and effects of illegal take of bighorns in DAU RBS-4 is largely unknown. There are known cases of illegal take, but the impacts on the population are probably minor.

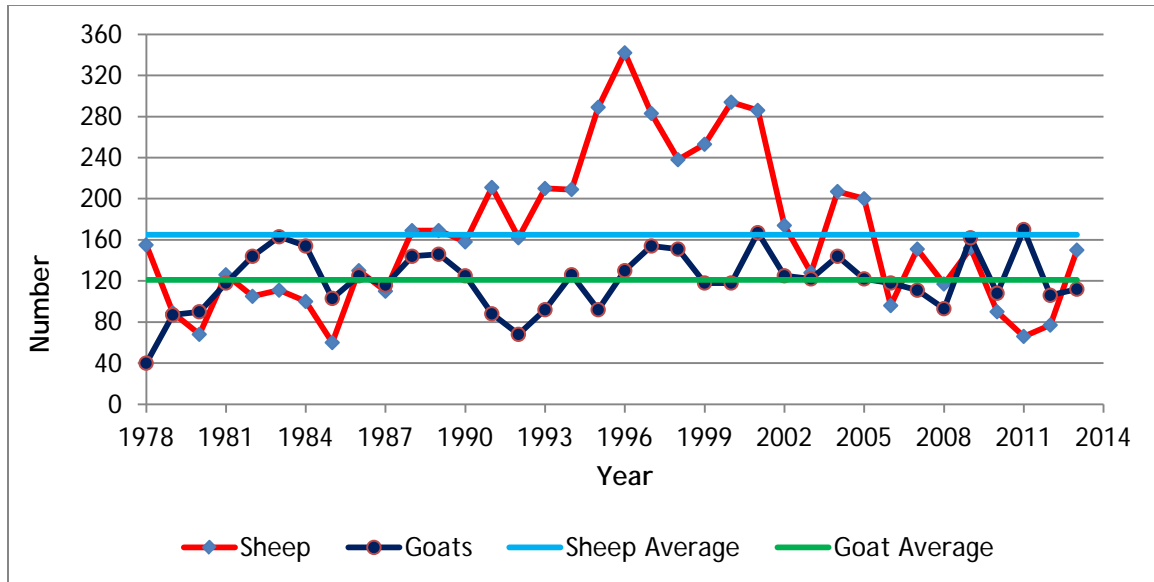


Figure 24. Summer bighorn sheep and mountain goat minimum counts 1978-2013 in G4 and portions of S3 and S4 east of Guanella Pass Road.

## Watchable Wildlife

The Mount Evans bighorn sheep herd has special value to the people of Colorado because it is one of the most easily viewed herds in the state. Throughout the summer, bighorn sheep can be seen feeding and resting along the rocky south facing slopes along CO Highway 5. Opportunities to watch and photograph bighorn sheep attract thousands of people from Colorado, as well as people from around the world.

## PUBLIC INPUT IN THE DAU PLANNING PROCESS

Prior to the draft DAU plan, public input was collected at one public meeting and surveys were completed by visitors at Summit Lake and the Summit of Mount Evans. Additionally, a public notice at the Peru Creek trail head with a link to an online survey was posted to gather input from non-consumptive users of this area to strengthen the DAU plan. To reach out to the hunting community, post cards were mailed to individuals who hunted in the DAU within the past three years, as well as, everyone who applied for a bighorn sheep license in 2013. A public meeting was held on January 16, 2014 in Frisco. The meeting was advertised in the local papers and on the CPW website.

There were 178 people who provided public comments regarding activities that may affect their interest in bighorn sheep management; of those, 64% were hunters and a majority (75.8%) of respondents considered themselves as people who watch wildlife (non-consumptive users), which probably includes many hunters. Of the 173 people who submitted public comments regarding alternatives to guide CPWs management of bighorn sheep in RBS-4, 47% supported maintaining the current ram hunting

opportunities and 27% were in favor of decreasing hunting. Of the 173 people who commented on whether or not they were in favor of increasing or decreasing bighorn numbers over the next ten years, 46% were in favor of a small increase; 37% were in favor of a large increase in the population to provide more hunting and viewing opportunities for bighorn sheep. In total, comments represented the diverse interest of people and the importance of bighorn sheep. Most of the public comments generally supported CPW preferred alternatives. The USFS communicated support for the CPW preferred alternatives.

## **MANAGEMENT RECOMMENDATIONS AND FUTURE NEEDS**

### **Herd Management**

DAU RBS-4 will be managed as a primary (Tier 1) core population. Primary core populations are defined as those that are large ( $\geq 100$  for  $\geq 90\%$  of the years since 1986), native populations comprised of one or more interconnected herds that have received few (i.e.  $\leq 50$  animals total) if any supplemental releases in the past. DAU RBS-4 meets all criteria for a primary (Tier 1) core population.

The management strategy for the bighorn sheep herd in RBS-4 is to maintain the population at a moderate level in order to reduce the probability of catastrophic disease outbreaks causing mortality. Currently, the CPW's primary management tool to control this herd's population size is hunting.

Lamb recruitment rates are an indication of herd health. Summer surveys have been the norm due to difficult winter access, thus lamb recruitment rates are uncertain. In the future, CPW will strive to collect lamb recruitment data from surveys conducted in October to mid November. This will allow better access to the back country and to expand our understanding of recruitment trends for the Mount Evans herd.

### **Domestic Livestock**

CPW will continue to work with the USFS, city and county governments to prevent the introduction of domestic sheep and goats in or near occupied bighorn sheep range. CPW will also remain vigilant in identifying and mitigating the impacts of domestic livestock on private property. When domestic livestock are found within occupied bighorn range, information will be provided to the landowner on the risks of domestic livestock to bighorn sheep and possible ways to reduce the potential negative impacts to bighorn sheep.

### **Habitat Improvements**

Noxious weeds are an issue that impacts numerous species of wildlife. Many invasive species provide little or no forage for wild and domestic animals. Once established, the weeds are nearly impossible to eradicate, requiring intensive amount of resources. The best way to combat this is through prevention, which can be done through

education of agency personnel, contractors, permittees, and the general public as well as, monitoring for the appearance of these weeds on the landscape. If noxious weeds are found steps should be taken to eradicate them before they spread.

Fire suppression over the last 100 years has led to tree and shrub encroachment into bighorn sheep range, causing habitat loss and fragmentation. CPW should work with land managers to use prescribed burns or forest thinning to improve forage quality and reduce visual barriers. These efforts should be concentrated on lower elevation winter range, which could limit this herd's population potential.

### **Reduction in Vehicle Caused Mortality**

Bighorn sheep signs have been placed near Grant and on the north side of Guanella Pass to alert drivers that there could be sheep along the roads. If the bighorn sheep population were to increase to levels observed in the mid 1990's (over 450 bighorn sheep), mortality from vehicle collisions may increase. If vehicle mortality increases then additional mitigation measures may need to be implemented other than the current signage.

### **Source Herd**

There have been four translocations of bighorn sheep out of Mount Evans. However, only one of those translocations were bighorn sheep released into the wild. If the herd increases above objectives, removal of sheep via transplants could be a tool to reduce the population. However, since Johne's disease persists at a low level, increasing the hunting opportunity to prevent disease transmission and reduce the population to within objective will continue to be the preferred tool. Due to the low level of Johne's disease, the Mount Evans herd may not be an ideal population source for translocations.

### **Research Needs**

Lamb recruitment is uncertain for this herd, but productivity has been declining since 1978. Studies should be initiated to identify possible management strategies that could be used to improve productivity and recruitment.

## **MANAGEMENT OBJECTIVES**

The Mount Evans bighorn sheep herd cannot be managed by the same management objectives as other ungulate big game herds. Sex ratio objectives are standard for many big game DAU plans. In DAU RBS-4 where summer surveys have been the norm due to difficult winter access, sex ratio variability is high due to the spatial separation of rams and ewes. Therefore, we recommend using age of harvested rams as an alternative population metric that complements the existing posthunt population estimate along with the proposed posthunt population objective.

## Posthunt Population Objectives

The posthunt population objective should be established at a level that allows for a healthy, self-sustaining herd while providing quality hunting and wildlife viewing opportunities. It is difficult to accurately estimate the population of this herd; however, we can base a population objective on the population performance of this herd at various population levels in the past.

Many studies on various species have shown that animal populations are most productive and individual animals are healthiest at approximately half the maximum number of animals that the habitat can sustain. At high population densities, the health of individual animals, body and horn size of animals, and recruitment of young animals into the population decrease due to competition among individuals for resources. Several studies on bighorn sheep have indicated that densely populated herds have a higher mortality rate from disease and a decrease in lamb recruitment (Sells et al. 2015; Portier et al. 1998; Jorgenson and Wishart 1993).

The carrying capacity for bighorn sheep in DAU RBS-4 is unknown. However, the Mount Evans herd reached its highest posthunt population estimate in the mid 1990s with over 450 bighorn sheep. At that time, CPW believed animal movements occurred which resulted in the colonization of S41. Considering the Mount Evans bighorn and mountain goat herds are the only wild ungulate populations where Johne's disease is known to persist, a conservative population objective is warranted.

### Alternative 1: 200-225 Bighorn Sheep

This alternative would require no change to the current population objective. This alternative would require a 17% decrease in the population, based on current estimates. The high end of the range (225) is less than half of the number of bighorn sheep that were in DAU RBS-4 in 1996.

### Alternative 2: 200-300 Bighorn Sheep

This alternative would increase the upper range of the current population objective by 75 bighorn sheep to account for the addition of S41 to the DAU and to give managers more flexibility to manage the animals within DAU RBS-4. The current population estimate is within this objective; therefore, no change in management action is needed. If the bighorn sheep population reached the upper end of the range (300) that is about 61% of the population estimate in 1996.

### Alternative 3: 300-400 Bighorn Sheep

This alternative would increase the lower and upper limit of the current posthunt population estimate by 75 and 125 respectively. If the bighorn sheep population reached the upper end of the range (400) it would reach 88% of the number of bighorn sheep estimated in 1996. Previously, when bighorn sheep numbers exceeded 400 animals, dispersal of rams and ewes was observed. In addition, higher densities in bighorn populations have been associated with respiratory disease.

### **Three-Year Average Age of Harvested Rams**

Average age of rams harvested is an alternative measurement of hunting quality. Overall, this measurement objective is easily monitored. In 2013, the 3-year rolling average age of rams harvested in RBS-4 was 7 years. Adopting a high ram age objective may decrease hunting opportunity, but increase the hunting quality. A lower objective will allow more opportunity with a potential decrease in the size and age rams.

#### **Alternative 1: 4-6 Year Three-Year Average Age of Harvest**

This objective would allow a higher level of harvest at the cost of a lower quality hunt in terms of hunter densities and size and age of rams harvested.

#### **Alternative 2: 6-8 Year Three-Year Average Age of Harvest**

Current management could continue under this scenario allowing for a high quality hunt with minimum hunters in the field and mature rams available.

#### **Alternative 3: Greater Than 8 Year Three-Year Average Age of Harvest**

This objective would result in lower harvest of rams and increase the size and age of the rams harvested. Since 1987, only 14 bighorn sheep rams have been harvested that were older than 9 years. This alternative could be difficult to achieve even with very low levels of hunter opportunity based on the life span of rams (10-12 years).

## **PREFERRED OBJECTIVES AND ALTERNATIVES**

CPW's preferred objectives for DAU RBS-4 are to manage for a post-season population of 200-300 bighorn sheep (Alternative 2) with a 3-year rolling average age of harvested rams of 6-8 years old (Alternative 2). This population objective represents no change to the current lower end of the range and increases the upper range by 75 sheep. This is a wider range than the current population objective to account for the addition of S41 and to provide more flexibility to respond to environmental conditions (i.e. drought, severe winters). The upper end of the objective range represents 61% of the estimated population in 1996. Alternative 2 (population objective), reduces the probability of catastrophic disease epidemics, allowing for healthy animals and improved recruitment rates. The number of hunters, size and age of harvested rams are expected to remain at current levels. Given the distribution and movement patterns of this herd, opportunities for viewing and photographing bighorn sheep are expected to remain high.

Managing for a 3-year rolling average age of harvested rams of 6-8 years old would continue to allow for a high quality hunt with minimum hunters in the field. No additional management action is needed to maintain this objective.

## LITERATURE CITED

- Baumann, T. G. 1979. Final report for the 1978 Mount Evans bighorn sheep and mountain goat study. Colorado Division of Wildlife, Fort Collins.
- Bear, G. D. and G. W. Jones. 1973. History and distribution of bighorn sheep in Colorado. Final Report, Project W-41-R-22. Colorado Division of Wildlife, Fort Collins.
- Bodie, W. L., E. O. Garton, E. R. Taylor, and M. McCoy. 1995. A sightability model for bighorn sheep in canyon habitats. *Journal of Wildlife Management* 59:832-840.
- Carpenter, L. M. 2005. The role of trace nutrients in the survival of bighorn sheep lambs: are current population declines caused by malnutrition? Thesis, University of Colorado, Denver.
- Carpenter, L. M. and R. R. Ramey. 2007. Selenium and other trace nutrients and bighorn sheep lamb survival in Colorado. Colorado Division of Wildlife, Denver.
- Colorado Division of Wildlife. 2009. Colorado bighorn sheep management plan:2009-2019. Special Report 81. Colorado Division of Wildlife, Fort Collins.
- Jones, G. W. and C. E. White Jr. 1950. Rocky mountain bighorn sheep surveys and investigations. Summary Report, Project 41-R. Colorado Game and Fish Department, Fort Collins.
- 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.
- George, J. L., L. Wolfe and M. Miller. 2008. Bighorn sheep capture and transplant guidelines. Colorado Division of Wildlife, Fort Collins.
- George, J. L., M. W. Miller, G. C. White, and J. Vayhinger. 1996. Comparison of mark-resight population size estimators for bighorn sheep in alpine and timbered habitats. Biennial Symposium North American Wild Sheep and Goat Council. 10:20-25.
- Hobbs, N. T., J. A. Bailey, D. F. Reed, and M. W. Miller. 1990. Biological criteria for introductions of large mammals: using simulation models to predict impacts of competition. *Transactions of the North American Wildlife and Natural Resources Council*. 55:620-632.
- Huwer, S.L. 2015. Population estimation, survival estimation and range delineation for the Georgetown bighorn sheep herd: Final Report. Colorado Parks and Wildlife. Fort Collins.
- Ives, J. D. and Fahey, B. D. 1971. Permafrost occurrence in the Front Range, Colorado Rocky Mountains. *Journal of Glaciology* 10:105-111.



Jorgenson, J. T. and W. D. Wishart. 1993. Harvesting bighorn ewes: consequences for population size and trophy ram production. *Journal of Wildlife Management* 57:429-435.

Loessberg, H. W. Jr. 1972. 1972 census of *Ovis Canadensis canadensis* and *Oreamos americanus* in the Mount Evans summer range. Colorado Division of Wildlife, Fort Collins.

Martin, L. M. and D. W. Stewart. 1977. 1977 summer census of the Mount Evans bighorn sheep and rocky mountain goat populations. Colorado Division of Wildlife, Fort Collins.

McClintock, B.T. and G.C. White. 2007. Bighorn sheep abundance following a suspected pneumonia epidemic in Rocky Mountain National Park. *Journal of Wildlife Management* 71:183-189.

Neal, A. K. G. C. White, B. Gill, D. F. Reed and J. H. Olterman. 1993. Evaluations of mark-resight model assumptions for estimating mountain sheep numbers. *Journal of Wildlife Management* 57:436-450.

Portier, C., M. Festa-Bianchet, J. M. Gaillard, J. T. Jorgenson and N. G. Yoccoz. 1998. Effects of density and weather on survival of bighorn sheep lambs (*Ovis canadensis*). *Journal of Zoology* 245: 271-278.

Sells, S. N., M. S. Mitchell, J. J. Nowak, P. M. Lukacs, N. J. Anderson, J. M. Ramsey, J. A. Gude, and P. R. Krausman. 2015. Modeling risks of pneumonia epizootics in bighorn sheep. *Journals of Wildlife Management* (*in press*).

Stiver, J. 2011. Bighorn sheep management plan: data analysis unit RBS-8, Pikes Peak/Dome Rock/Beaver Creek herds. Colorado Division of Wildlife, Colorado Springs.

Streeter, R. G. 1969. Demography of two rocky mountain bighorn sheep populations in Colorado. Dissertation, Colorado State University, Fort Collins.

Wild Sheep Working Group. 2012. Recommendations for domestic sheep and goat management in wild sheep habitat. Western Association of Fish and Wildlife Agencies.

Williams, E. S., T. R. Spraker, and G. G. Schoonveld. 1979. Paratuberculosis (Jonhe's Disease) in bighorn sheep and a rocky mountain goat in Colorado. *Journal of Wildlife Diseases* 15:221-22.

United States Forest Service (USFS). 2013. Mount Evans Recreation Enhancement Project Summary. Clear Creek Ranger District, U.S. Forest Service, Idaho Springs, Colorado.

## APPENDIX A

Results of the DAU RBS-4 (GMU S41) surveys from 2008 to 2013. The totals for all surveys are shown for each year. The highest number of unduplicated bighorn seen on a single day is in the total column. From 2008 to 2010, helicopter surveys were utilized in conjunction with annual mountain goat surveys. In 2011 ground and helicopter surveys were conducted, and in 2013 ground counts were conducted.

Year	Ewes	Lamb	Yearling	Ram	Total	L:E	Y:E	R:E
2008	29	6	0	13	48	21	0	45
2009	0	0	0	4	4	0	0	0
2010	12	12	0	4	28	100	0	33
2011	22	9	0	10	41	41	0	45
2012	10	10	13	8	41	100	130	80
2013	14	17	8	3	42	121	57	21

Results of the DAU RBS-4 (GMUs S3 and S4 combined) summer coordinated ground surveys from 1978 to 2013. The totals for all surveys are shown for each year. The highest number of unduplicated bighorn seen on a single day is in the total column.

Year	Ewe	Lamb	Yearling	Ram	Unclassified	Total	L:E	Y:E	R:E
1978	65	49	14	12	15	155	75	22	18
1979	31	23	8	20	7	89	74	26	65
1980	30	19	7	6	6	68	63	23	20
1981	35	37	38	11	5	126	106	108	31
1982	60	15	13	17	0	105	25	22	28
1983	37	19	2	35	18	111	51	6	95
1984	33	21	12	27	*7	100	64	36	103
1985	23	8	6	23	0	60	35	26	100
1986	50	30	4	38	8	130	60	8	76
1987	55	36	13	3	3	110	65	24	9
1988	62	31	13	28	35	169	50	21	45
1989	36	25	5	35	68	169	69	14	97
1990	57	29	16	32	24	158	50	28	56
1991	109	39	27	29	7	211	36	25	27
1992	78	33	7	37	7	162	42	9	47
1993	46	26	17	52	68	210	56	37	113
1994	90	49	41	17	12	209	54	46	19
1995	156	33	32	56	12	289	21	20	36
1996						342	53		44
1997	103	49	19	56	56	283	48	18	54
1998	129	24	6	56	23	238	19	5	43
1999	78	24	14	104	33	253	30	18	130
2000						294	37		59
2001						286	40		83
2002						174	22	27	58
2003						128	41	22	86
2004						207	29	21	36
2005						200	49	19	67
2006	39	22	14	15	6	96	56	36	38
2007	55	19	18	40	19	151	35	33	73
2008	52	22	12	30	1	117	42	23	58
2009	69	36	16	29	2	152	52	33	42
2010	40	14	9	27	0	90	35	23	68
2011	47	6	4	8	0	65	13	9	17
2012	34	6	15	11	11	77	17	44	32
2013	88	23	12	21	6	150	26	14	24

## Appendix B

Licenses offered, harvest, success, and number of hunters in DAU RBS-4 (GMU S3 and S4 combined). Only one ram license has been issued in GMU S41 from 2009-2013.

Year	# of Licenses				# Harvested			# of Hunters				% Success			
	ram	ewe	E/S	total	ram	ewe	total	ram	ewe	E/S	total	ram	ewe	E/S	total
1953	10			10	1		1	10			10	10			10
1954	10			10	3		3	10			10	33			33
1955	10			10	3		3	10			10	33			33
1956	5			5	0		0	5			5	0			0
1957	10			10	2		2	10			10	20			20
1958	10			10	0		0	10			10	0			0
1959	6			6	0		0	6			6	0			0
1960	6			6	0		0	6			6	0			0
1961	15			15	3		3	15			15	20			20
1962	40			40	14		14	40			40	35			35
1963	24			24	13		13	24			24	54			54
1964	18			18	7		7	18			18	39			39
1965	18			18	3		3	18			18	17			17
1966	36			36	10		10	36			36	29			29
1967	18			18	2		2	18			18	11			11
1968	18			18	3		3	18			18	17			17
1969	18			18	3		3	18			18	17			17
1970	6			6	0		0	6			6	0			0
1975	10			10	4	0	4	8			8	50			50
1976	7			7	5	0	5	7			7	71			71
1977	7			7	3	0	3	7			7	43			43
1978	9			9	6	0	6	9			9	67			67
1979	16			16	4	0	4	16			16	25			25
1980	27			27	11	0	11	26			26	42			42
1981	12	0	15	27	11	2	13	12	0	14	26	92	0	36	50
1982	32	25	0	57	5	6	11	30	16	0	46	17	38	0	24
1983	22	20	15	57	8	11	19	22	18	15	55	36	61	20	35
1984	22	20	15	57	4	2	6	21	9	15	45	19	22	13	13
1985	22	20	15	57	2	5	7	9	8	13	30	22	62	38	23
1986	22	4	15	41	7	1	8	21	4	15	40	33	25	7	52
1987	25	20	15	60	12	5	17	23	20	15	58	50	25	20	29
1988	30	11	0	41	8	3	11	30	8	0	38	27	38		29
1989	20	6	0	26	8	4	12	19	6	0	25	42	67		48
1990	19	6	0	25	3	3	6	18	5	0	23	17	60		26
1991	19	6	0	25	8	2	10	19	3	0	22	42	67		45
1992	19	6	0	25	10	4	14	19	5	0	24	53	80		58
1993	15	6	0	21	10	3	13	15	4	0	19	67	75		68
1994	9	6	0	15	2	5	7	8	6	0	14	25	83		50
1995	12	4	0	16	7	3	10	12	4	0	16	58	75		63
1996	12	7	0	19	11	3	14	12	6	0	18	92	50		78
1997	11	17	0	28	7	10	17	11	15	0	26	64	67		65
1998	15	24	0	39	9	10	19	15	21	0	36	60	48		53
1999	14	15	0	29	8	5	13	14	15	0	29	57	33		45

Year	# of Licenses				# Harvested			# of Hunters				% Success			
	ram	ewe	E/S	total	ram	ewe	total	ram	ewe	E/S	total	ram	ewe	E/S	total
2000	15	20	0	35	10	9	19	15	15	0	30	67	60		63
2001	18	32	0	50	8	10	18	18	24	0	42	44	42		43
2002	18	32	0	50	12	7	19	15	25	0	40	80	28		48
2003	14	24	0	38	9	11	20	12	21	0	33	75	52		61
2004	15	16	0	31	10	6	16	14	14	0	28	71	43		57
2005	15	20	0	35	6	5	11	15	20	0	35	40	25		31
2006	12	20	0	32	6	7	13	12	20	0	32	50	35		41
2007	9	0	0	9	6	0	6	9	0	0	9	67	0		67
2008	12	6	0	18	4	7	11	12	6	0	18	33	60		61
2009	12	6	0	18	7	2	9	12	6	0	18	58	33		50
2010	12	8	0	20	10	6	16	12	8	0	20	83	75		80
2011	7	4	0	11	7	2	9	7	4	0	11	58	50		82
2012	7	2	0	9	4	1	5	7	2	0	9	57	50		55
2013	7	2	0	9	2	0	2	7	2	0	9	29	0		22

## Appendix C

Lance,

Thanks for the opportunity to comment on the Draft DAU RBS-4 for the Mt Evans bighorn sheep herd. I am responding on behalf of the Clear Creek Ranger District and have been talking with Mikele Painter who will also be sending input on behalf of the South Platte Ranger District. Mikele's input will cover several typos and clarification of USFS jurisdictional boundaries within the DAU so I won't cover them here. But please correct the spelling of Arapahoe National Forest to Arapaho.

Overall, the Clear Creek District supports the preferred alternative recommended for herd population objective (Alternative 2: 200-300 sheep) and average age of harvested rams (Alternative 2: 6-8 year 3-year average age of harvest). This is a Tier 1 population, but seems to have an unknown factor contributing to slow population decline. Both respiratory disease complexes and low-level endemic Johne's disease could be contributing factors that could outbreak at higher population size/densities.

Mt. Evans staff feel that the use of salt licks away from Highway 5 and associated parking areas helps reduce potential human-bighorn conflicts and the potential for direct contact along the Byway and would like to see this management continue (p. 25).

Bev Baker, South Zone Noxious Weed Program Manager, suggests the addition of a middle paragraph to the Habitat Improvement discussion on p. 31 that would add some noxious weed information. This is provided for your information, and please add whatever level of detail would be helpful for the habitat discussion in the DAU Plan.

“Known noxious weed occurrences in bighorn sheep range on the Arapaho National Forest in GMU S3 include oxeye daisy, scentless chamomile, Chinese (oriental) clematis, Canada thistle, musk thistle, yellow toadflax, and cheatgrass. Scentless chamomile and oxeye daisy are primarily associated with the I70 corridor. Chinese clematis is abundant around Georgetown, occurring adjacent to I70 and Guanella Pass road. These infestations have been treated in recent years and are declining. A large infestation of Chinese clematis, for which the full extent is unknown, is located north and west of I70, just outside of GMU S3 in GMU S32. Remaining noxious weeds are primarily associated with travel corridors including roads and trails, and other areas that have been disturbed through mining activity, residential development, construction, wildfire, and other human and natural disturbances. Several potentially invasive, nonnative species which are not listed as noxious weeds in Colorado appeared along the Guanella Pass road corridor after recent construction. These have been treated by Forest Service and County crews post-construction, and treatment is planned to continue. Orange hawkweed, a serious threat to high-elevation habitat and mandated for eradication in Colorado, occurs in the Mount Evans Wilderness in GMU S3, within one mile of bighorn sheep range. Treatment is ongoing and the 30-acre infestation has been decreasing in density since treatment began in 2006.”

If you have any questions, please feel free to contact me, and thanks again for the opportunity to comment. Nice work, Lance. Doreen Sumerlin, Wildlife Biologist, USFS

Hi Lance,

Thank you for the opportunity to comment on the Draft DAU RBS-4 for the Mt. Evans bighorn sheep herd. I am responding on behalf of the South Platte Ranger District (Pike National Forest), as Doreen Sumerlin (Arapaho National Forest) previously indicated in her 3/5/2015 email to you.

Overall, the South Platte Ranger District supports the Division's preferred alternative recommended for herd population objective (Alternative 2: 200-300 sheep) and average age of harvested rams (Alternative 2: 6-8 year 3-year average age of harvest). This is a Tier 1 population that has persisted with little to no supplementation from external herds, but there seems to be an unknown factor contributing to slow population decline. Both respiratory disease complexes and low-level endemic Johne's disease could be contributing factors that could outbreak at higher population size/densities.

Below is a list of my questions and comments according to page numbers in the draft plan. In particular, it would be helpful to see a little more discussion about possible habitat management opportunities. In relation to habitat management, I would also like to know if the Division has any concern about bighorn sheep and ever-increasing recreation pressure in RBS-4 (much of it focused on the 14'ers). Other than these questions, I just noted a few typos and some confusion about USFS descriptions.

- a) Page 2, "...Highway 74 on the east." The eastern boundary of the DAU looks like it also includes Highway 73 south of Evergreen.
- b) Page 4, typo: "S4...USFS **Trail** 603..."
- c) Page 4. The descriptions of National Forest Land in GMUs S3, S4, and S41 are incorrect. In DAU RBS-4, all of the NFS land in S3 is part of the Arapaho National Forest (mostly in Clear Creek County, but a tiny bit in Jefferson and Park counties). Then S4 includes the Pike National Forest and a bit of the Arapaho National Forest (and parts of Jefferson, Park, and Clear Creek counties). The boundary between the Pike NF and the Arapaho NF follows the watershed boundary from Guanella Pass to Black Mountain (just north of Staunton SP). All NFS land west of the Continental Divide in S41 is part of the White River National Forest.
- d) Page 18, "...Kenosha herd is separated from RBS-4 by the South Platte River..." The river by Highway 285 is the North Fork of the South Platte River.
- e) Page 25, "Human Development...66% of RBS-4 is owned by USFS, and of that 18% is wilderness..." The USFS **manages** the land, US citizens own the land.
- f) Page 25, Human Development question: Does CPW consider potential development west of the wilderness area to be a concern in the future? There are several private parcels in that part of the DAU.
- g) Page 25, "Human Recreation... The USFS estimated that over 60,000 people attempted to climb the various peaks within DAU RBS-4 in 2012 (R. Bradt, pers. comm.). In addition to the

peaks, there are over 77 miles of trails within the wilderness. The USFS estimated in 2010 approximately 28,000 thousand people accessed the wilderness, based on trail head registration (R. Bradt, Pers. Comm.). It is unclear what effect this level of human activity has on bighorn sheep, especially during lambing season.”

h) Page 25, Human Recreation question: Would any of the research on bighorn sheep stress response to humans (and dogs and other disruptions) and immune system effectiveness relate to the herd in RBS-4? Although the sheep may appear accustomed to humans at the parking lots and trailheads, perhaps the amount of dispersed recreation in the wilderness area has an effect on the stress sheep experience away from the roads.

i) Page 31, typos: “Habitat Improvements...education of agency personnel, contractors...”  
“Fire suppression over the last 100 years has led to tree and...”

j) Page 31, Habitat Improvement question: Does CPW have any further thoughts about where and how vegetation might be improved specifically for RBS-4? If the data exist, it could be informative if the plan pointed out locations where vegetation work or past fires have benefitted sheep in RBS-4.

Finally, our wilderness staff would like to add a reminder that the central mandate of the Wilderness Act is to protect and preserve the wilderness character of areas designated as wilderness, including the wildlife and vegetation within.

Should you have any questions about these remarks, please don't hesitate to contact me ([mpainter@fs.fed.us](mailto:mpainter@fs.fed.us), 303-275-5614). Thank you very much for the opportunity to participate – I will be looking forward to the final plan!

Cheers,

Mikele

**Mikele Painter**  
**Wildlife Biologist**

**Forest Service**

**Pike/San Isabel National Forests & Cimarron/Comanche National Grasslands**

**South Platte Ranger District**

p: [303-275-5614](tel:303-275-5614)  
f: [303-275-5642](tel:303-275-5642)  
[mpainter@fs.fed.us](mailto:mpainter@fs.fed.us)

19316 Goddard Ranch Ct.  
Morrison, CO 80465  
[www.fs.fed.us](http://www.fs.fed.us)





P.O. Box 8320 • Denver, CO • 80201-8320

April 8, 2015

Lance Carpenter  
Colorado Parks and Wildlife  
6060 Broadway  
Denver, CO 80216

Dear Mr. Carpenter:

The Rocky Mountain Bighorn Society (RMBS) welcomes the opportunity to comment on the draft management plan for Rocky Mountain bighorn sheep DAU RBS-4 prepared by Colorado Parks and Wildlife (CPW) biologists. Our organization represents approximately 850 members, with a mission to promote and enhance the well-being of Colorado's state animal, the Rocky Mountain bighorn sheep.

The RMBS prefers **Alternative 2: 200-300 Bighorn Sheep** under *Posthunt Population Objectives* in the draft management plan. We understand and agree with the concern the plan expresses about the potential of an expanding sheep population spreading Johne's disease to neighboring sheep herds.

The RMBS prefers **Alternative 2: 6-8 Year Three Year Average Age of Harvest** under *Three-Year Average Age of Harvested Rams* in the draft management plan. We prefer that hunters have the opportunity to harvest older age class rams given a reasonable hunting effort. However, we point out that some hunters only wish to fill their license, and may not choose to pass up a young ram to search for a more mature ram. We hope that CPW staff will rely more heavily on herd inventory data, if available, when considering future hunter opportunity. We also wish for CPW to experiment with increasing hunting opportunity when appropriate to test whether management plan objectives can be met under increased ram harvest.

Thank you for giving RMBS the opportunity to comment on this draft management plan. Please do not hesitate to contact me if you have any questions or concerns about our comments. Also, please apprise us of future opportunities to comment on this plan or other bighorn sheep management issues.

Sincerely,

A handwritten signature in black ink that reads "Terry E. Meyers". The signature is written in a cursive, flowing style.

Terry E. Meyers  
President  
Rocky Mountain Bighorn Society