

BIGHORN SHEEP MANAGEMENT
IN ROCKY MOUNTAIN NATIONAL PARK

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ABSTRACT

The objectives of bighorn sheep management in Rocky Mountain National Park are to preserve the integrity of the ecosystem and maintain bighorn as a viable component controlled by natural forces; to reduce the effects of visitor use on the sheep population and to restore bighorn to the historic ranges within the park. Meeting these objectives has required a research program and continued monitoring of the populations. Direct management action to reduce stress has been control of visitor use on critical bighorn habitat on Specimen Mountain and in Horseshoe Park. In cooperation with the State of Colorado, sheep have been reintroduced on one major historical winter range within the park and another range in close proximity. Initial analysis indicates some success with the sheep populations responding with more normal movements and behavior.

INTRODUCTION

About 1970 it was recognized that stress was probably adversely affecting the bighorn sheep (Ovis canadensis) populations in Rocky Mountain National Park and that some action was needed to reduce the impact at several locations. As early as 1939, Packard (1946) had described bighorn sheep leaving the Sheep Lakes area because they were "annoyed by camera enthusiasts". He also discussed the physiological drive by the sheep to get to salt licks and the apparent importance of these licks to their welfare. The presence of Pasteurella also as early as 1935 was identified by Potts (1937). These events and the intervening 40 years of observation were analyzed in the light of stress relationships as discussed by George Post (1976). Stress may be a major entity in bighorn sheep pneumonia. Range usurpment and disturbance caused by human activities as experienced in Rocky Mountain National Park could place bighorn sheep in such a stress situation. These same conditions may also aggravate the effects of lungworm (Protostrongylus), which has been reported in the population.

With a 19% increase in visitation to the park from 1971 to 1981, the potential for harassment of wildlife has increased considerably. With more people on the highways an even greater increase is apparent in the back-country where harassment may be even more detrimental.

With research findings indicating areas of potential conflict with people, it was decided that just the overall protection offered by the National Park was insufficient to prevent potential stress situations. Therefore a management program was instituted to provide the protection deemed necessary to reduce the stresses on the sheep.

ENVIRONMENT

Rocky Mountain National Park, with an area of 108,032 hectares, lies along the Continental Divide in northcentral Colorado. Elevations range from 2,329 meters on the east side to 4,345 meters on Longs Peak. The mountains were formed by precambrian metamorphic schists and gneiss created by large masses of granite and pegmatite (Richmond 1974). The northwest portion of the park is overlain by deposits of volcanic ash flow, the origins of which were in the northern part of the Never Summer Mountains. Present physiography demonstrates the extent of alternation by pleistocene glaciation. The soils are relatively infertile and low in essential elements, being very sandy with poor development from decomposed granitic substrates.

The climate is typical of mountainous regions. At lower elevations, annual precipitation is 41 cm., with a mean annual temperature of 6°C. Precipitation increases with elevation to as much as 66 cm. on the alpine tundra, while mean temperatures decrease. Highest precipitation occurs in late March and April, with heavy wet snows. In winter, precipitation falls as snow, but severe winds in December and January may blow many areas free, especially in the alpine, depositing it in drifts in protected sites.

Vegetation of the park represents 3 climax regions (Marr 1961), all of which are utilized by the bighorn sheep. On the lower east slope, the upper montane climax region occurs from 2,300 to 2,740 m. elevation. Dominant vegetation types are the ponderosa pine (*Pinus ponderosa*)/shrub savannah, closed canopy Douglas fir (*Pseudotsuga menziesii*)/ponderosa pine forest, and a lodgepole pine (*Pinus contorta*) forest. Interspersed in the bottom areas and more mesic sites are grassland, meadow, willow (*Salix* spp.), and big sagebrush (*Artemisia tridentata*) types. Aspen (*Populus tremuloides*) is present in small stands. Above the montane, from 2,740 to 3,500 m., is the subalpine forest region. This is an Engelmann spruce/subalpine fir forest, interspersed with lodgepole pine and limber pine (*Pinus flexilis*) stands. In the openings are willow and herbaceous meadow types. Above the forest (3,500 m.) is the alpine tundra. Vegetation of the alpine is a complex mosaic of types related to numerous environmental factors as described by Willard (1979).

Ungulates sharing the park ranges with the bighorn sheep were the elk (*Cervus elaphus nelsoni*) and the mule deer (*Odocoileus hemionus*). The elk, the dominant ungulate in the park, with a population of about 3,000, utilize all vegetation types in the summer. Although mostly moving to the upper montane in winter, some remain on the alpine tundra. About 200-300 deer, a portion of a much larger summering population, remain in the park to winter.

HISTORY OF THE SHEEP POPULATION

Early settlers in the Estes Park area found bighorn sheep abundant, with an estimated population of 4,000. This population, however, declined rapidly as a result of market hunting, usurpation of winter range by human activities, and scabies, according to Packard (1946). Only when the scabies epidemic subsided in about 1907 did the population appear to recover. Packard (1946) estimated over 1,000 bighorn in the park when it was established in 1915.

By the early 1920's, however, the population had entered another decline. This decline was probably related to competition on the range with domestic livestock, but disease may also have been an important factor (Goodson 1978). Packard believed mineral deficiencies to be most important and mentioned lungworm and pneumonia a possible contributing factor.

In 1935, Potts estimated the population at 192, which was lower than previously noted. He documented the presence of pneumonia as a factor in several mortality cases (Potts 1937). Packard's study in 1935 and 1940 indicated more sheep, probably the result of a better and more intensive count.

The sheep population appears to have hit a low point in about 1958, when Contor (1958) attempted to duplicate Packard's work. His total of 211 sheep documented the loss of populations from MacGregor Mountain, Castle Mountain and the Needles. There were probably still a few sheep in the Cow Creek area at that time. By 1967, Capp (1967) indicated an increase, or at least more sheep present in the Mummy Range than Contor's study. Goodson (1978) estimated the population at 81 in the Mummy Range and 124 in the Never Summer Mountains.

The native bighorn generally utilize the northern half of the park, with two main population centers (Goodson 1978), Figure 1. On the west, the primary range is the Never Summer Mountains, including the Specimen Mountain area and the Continental Divide down to Bighorn Flats. The northern herd is primarily in the Mummy Range north of Trail Ridge Road. Goodson (1978) believed little interchange occurred between the two groups, with the possible exception of mature rams. Both populations utilize the alpine tundra year-round, only periodically using the lower ranges. These movements are made to gain access to natural mineral licks. The primary licks are located in the "Crater" on Specimen Mountain and in Sheep Lakes area of Horseshoe Park.

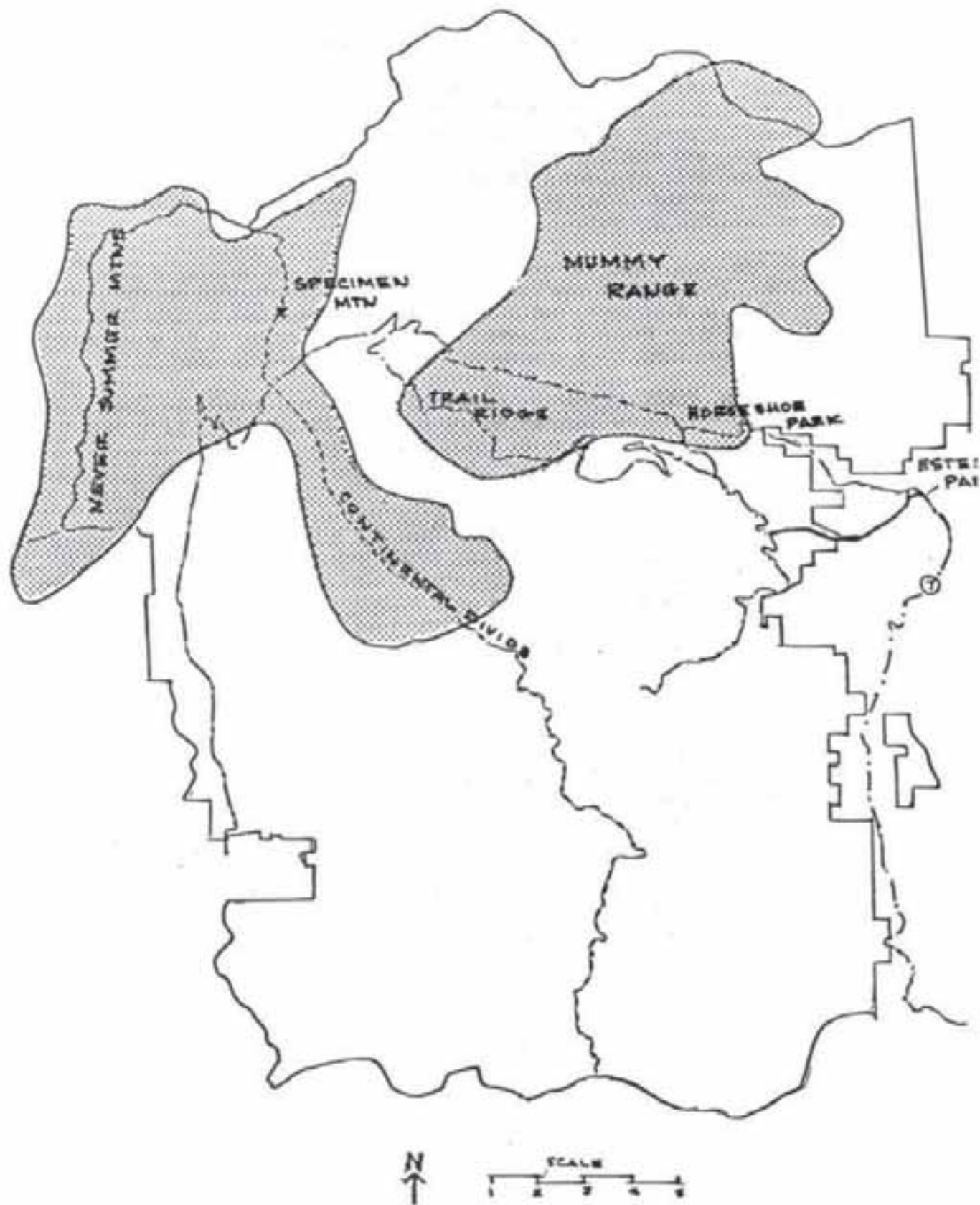


Figure 1. Primary distribution of native sheep population in Rocky Mountain National Park.

MANAGEMENT OBJECTIVES

The objectives of bighorn sheep management in Rocky Mountain National Park are:

1. To preserve the integrity of the Park ecosystem and maintain the bighorn as a viable component controlled by natural factors.
2. To reduce conflict between human beings and bighorn sheep.
3. To restore sheep to historic ranges and movement patterns within the park.

THE PROBLEM

Early investigators had identified problem areas that may affect bighorn sheep survival. First priority for the research effort when it was renewed in 1965 was therefore range competition, which had been identified by Packard (1946) and Contor (1958) as a problem area.

In 1965, John Capp (1967) initiated research on competition with elk and mule deer in the Mummy Range. He was followed by Fred Harrington (1978) on the Specimen Mountain area. Capp found that little competition existed on the Mummy Range in the summer of 1967; however, both Goodson (1978) and Bauman (1978) believed the potential for competition was very great. Forage competition was believed by all investigators to be less in the Never Summer and Specimen Mountain areas than in the Mummy Range. Harrington (1978), however, described the ecological segregation by the three species of ungulates on Specimen Mountain. He showed that these ungulates have evolved into niches which are separate and tend to reduce competition. Although the forage competition question has not been entirely resolved, it is not believed to be as severe as noted earlier. The only management action currently is the control of elk and deer populations through public hunting outside the park.

Loss of range to livestock goes back to 1859, when Joel Estes first arrived in the valley. In the early days, livestock was numerous and grazed far into the park, often on the bighorn sheep range. Grazing by domestic sheep occurred on the alpine tundra in the Never Summers and Comanche Peak areas. This grazing was removed gradually after 1932. In Horseshoe Park and Moraine Park, grazing was eliminated by 1962 and in Cow Creek by 1974. Removal of the grazing provided forage for the ungulates, but where the ranges had been abandoned by the bighorn sheep, use was not resumed after the vegetation became available.

The mineral deficiency question which was first noted in the 1930's has never been resolved. Harrington documented the movement of sheep from the Never Summer Mountains across the Colorado River valley to Specimen Mountain for the mineral licks. He felt that these licks had particular

importance for the sheep in a social way. The need for the licks physiologically has not actually been documented. Keiss (1976), studying 23 licks in and out of Rocky Mountain National Park, said that the only consistent pattern was that the total dissolved solids was higher in the licks than in surrounding areas. Goodson (1978) analyzed these data from the Park licks and thought that the licks might be important for copper, iron, sodium, and manganese. It is well documented that the sheep have a tremendous drive to visit these licks.

Lungworm and the pneumonia complex have also been present in the Rocky Mountain National Park sheep population for a long time. Goodson (1978), however, reported the lungworm level low compared to other populations in Colorado, but was not sure if this was significant. She did believe that the herd composition on the west side in 1975 and 1976 indicated summer lamb mortality, typical of lungworm effects. Post (1976) believed that pneumonia and the acute effects of lungworm can be aggravated by "psychological stress".

Effects of visitors, although present in the 1930's have continued to increase with the increase in total visitation. Goodson (1978) noted that visitors bothered sheep most where they were not expected. The critical situations, however, appeared to be at the 2 major mineral licks.

In Horseshoe Park, the sheep would be turned back from crossing the highway or, once they were in the meadow using the licks, they would be disturbed sufficiently for them to vacate the area. Either of these apparently are quite stressful, although the sheep outwardly were calm.

On Specimen Mountain, the sheep used the mineral licks in the "Crater" and, generally, this is where the disturbance took place. Visitors would enter the "Crater" to view the sheep and get close pictures. Further investigation, however, revealed more disturbance when the sheep would leave the rocky outcrops of the "Crater" to feed on the east slope tundra. The trail to the top of Specimen runs along the ridge, separating these areas. Visitors in their rush to attain the summit would chase the sheep back into the rocks. Usually the sheep would only withstand this disturbance for a short time before leaving that portion of Specimen and the mineral licks.

These actions all were viewed as possible sources of stress as described by Post (1976). Post stated that "I am of the opinion that psychological stress is a major entity in bacterial and possibly viral or mycoplasmal pneumonia." This statement essentially links these factors together and may give us the key to bighorn management: the reduction of stress in the population.

MANAGEMENT ACTION AND RESULTS

CONTROL OF VISITOR USE

The plan was conceived and implemented incrementally based on available information. The first step in 1971 was to close the trail on Specimen Mountain to public use from May 1 to July 1. This was designed to reduce visitor effects during the lambing period, which was considered the most critical time for sheep. After a few years of observation with several research studies in progress, it was evident that this was not sufficient. Heaviest sheep use in the "Crater" extended well into July and included the nearby tundra areas (Harrington 1978). Therefore, in 1977 the total "Crater" was closed to public use. At the same time, an effort was made to get public opinion on a total closure of the trail to the top of the mountain. A sign explaining the plan and its justification was established at the "Crater" saddle. The public input was supportive of the move for the benefit of the sheep, so the trail was closed in 1978.

Although it is difficult to assess results of this action, the sheep do appear to be staying on the Specimen-Shipler area longer than in the past. They are certainly more observable on the alpine tundra feeding areas. Available data, however, are still not sufficient to document any improvement. Using reproductive success as an indicator of herd condition, no difference has been noted.

In Horseshoe Park, a similar situation existed, but since it was beside a major highway it was considerably more aggravated. The first step was taken in 1974, when signs were erected to keep visitors on the road when sheep were present in the meadow. This helped until the sheep wanted to cross back over the road to their escape terrain on the north side. It appeared that an avenue across the road had to be maintained to allow easy access for the sheep. Therefore, two crossing zones were established in 1976. Each one is 100 m. long and signed to prohibit stopping, standing, or walking within the zone. In 1980 a visitor contact station was established and has been run during the busy season each day by a uniformed park interpreter.

The efforts in Horseshoe Park did not appear to have much effect on the sheep the first few years. In 1965 to 1966, before any visitor control was implemented, sheep utilized the licks an average of 15 days each year in the three months' of heavy visitor use (June, July and August). With the signs in place in the meadow and the crossing zones in place from 1976 to 1978, the average number of days increased annually to 23 during the same period. In 1980, however, with the park interpreter in uniform on-site, the number of visits increased to 43 and in 1981 to 46. Although observation of the area was more intense, it is doubtful that this would account for an 87 percent increase. Often the interpreter had to ask people to return to their vehicles or to not park in the crossing zones, in order to reduce disturbance.

TRANSPLANTS

Since the nutritional status of the sheep may also be a possible stress factor, an improvement in available forage was considered as another mitigating measure. The technique chosen to improve the nutritional status was to increase the winter range used by a transplant to previously abandoned historic low elevation areas. None of the native sheep presently migrate to low elevation winter ranges. The objectives of this transplant were to expand the sheep population to the low elevation winter ranges and to redevelop historic migration routes between the low elevation range and the alpine tundra range. The initial transplant was to come from another non-park population with migratory habits which would interbreed and intermix with the native sheep.

On March 17, 1977, 20 bighorn sheep were transplanted from the Tarryall Range west of Pike's Peak and released on Cow Creek. This area had maintained a bighorn population until about 1960, when they disappeared. The exact cause was not determined, but most thought it was related to livestock grazing and forest succession. Grazing by the McGraw Ranch had taken place there since about 1880. In 1964, that portion of the ranch within the park (393 acres) was purchased by the National Park Service. However, a grazing permit for 300 AUM was allowed for the following ten years. During this time, grazing by 30-40 head of horses severely impacted the area. In 1973, this grazing was eliminated.

Relocations of the marked sheep indicated distribution (Figure 2) from Mummy Mountain to Castle Mountain and from Chasm Falls to Eagle Rock. This range was about what was expected, since they are using both the alpine and subalpine ranges. Good reproduction is present, with a lamb: ewe ratio of 58:100. The highest count of 50 sheep was made on Fall River this fall.

This year a radio telemetry study has been initiated to better document the distribution of these sheep and their utilization of habitat types.

In keeping with this program, the Division of Wildlife made another transplant to the Button Rock Reservoir site in March 1980. This site is 7 miles east of the park boundary on the North St. Vrain River. The situation is very similar to the Cow Creek area, and it is hoped the sheep may repopulate the south end of Rock Mountain National Park.

DISCUSSION

Although the success of various management techniques is still far from being documented, it appears progress is being made. Since the National Park Service policy is to allow the ecosystem to function with the least interference by man, management action must be limited to minimizing or eliminating those impacts on the population caused by man's activities. The theory that an ecosystem which is essentially intact as it evolved, requires little or no management action, is the primary basis of the National Park Service policy. If this theory is true, then the closer that

we can restore the ecosystem to its original condition, the more normal it should function. In the case of bighorn sheep in Rocky Mountain National Park, an attempt has been made to reduce man-caused stress on the population and to restore the use of available historic low elevation winter range. Granted, this does not eliminate the effects of men or other decimating factors. The total low elevation winter range will never be restored, and we will continue to have large number of visitors. Hopefully the efforts that we do make, however, will be sufficient to maintain the animals as a viable part of the park ecosystem.

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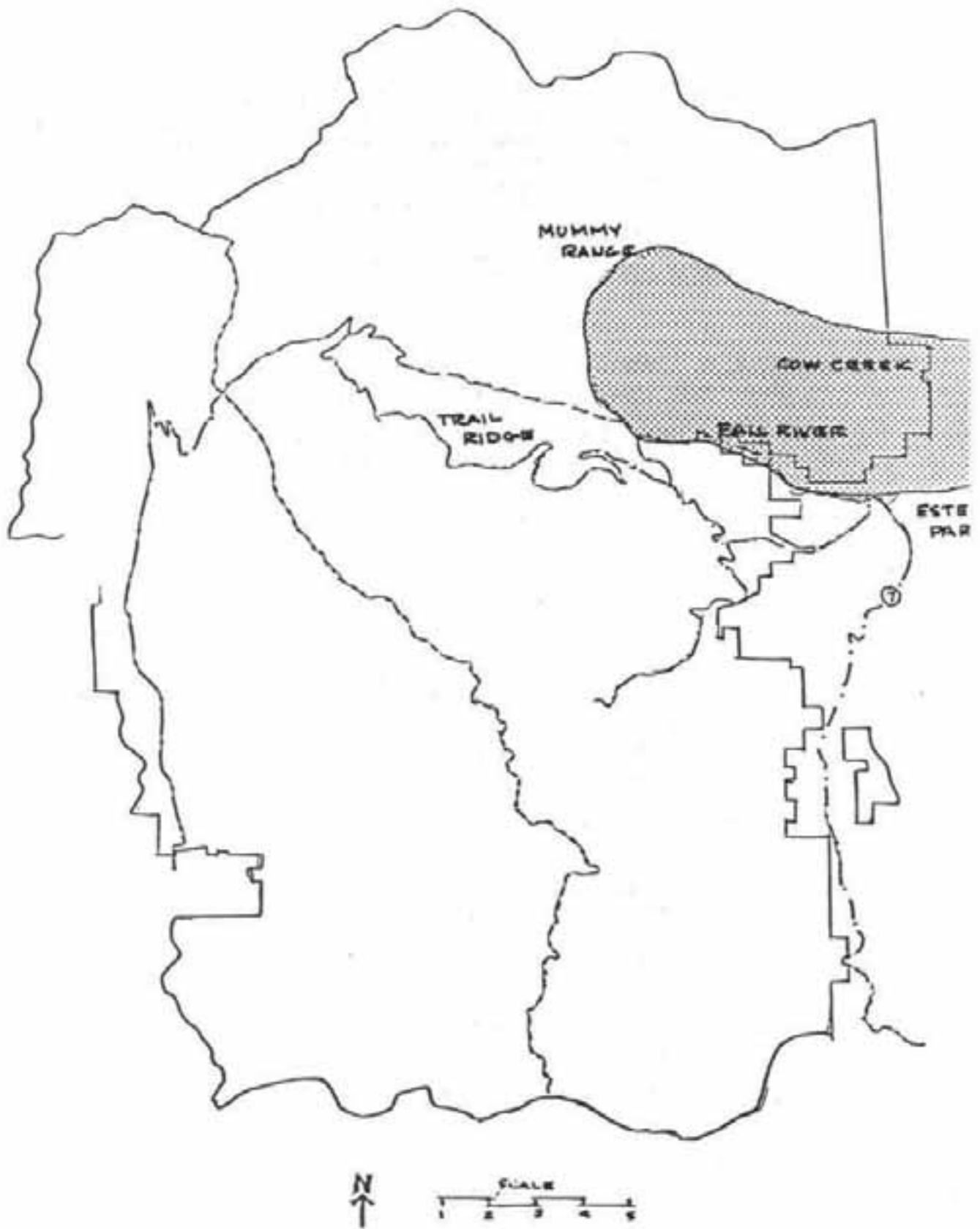


Figure 2. Primary distribution of bighorn sheep population introduced in 1977 in Rocky Mountain National Park.