

HABITAT UTILIZATION, INTERSPECIFIC INTERACTIONS  
AND STATUS OF A RECOLONIZED POPULATION OF BIGHORN SHEEP  
AT A WILD HORSE RANGE

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Introduction

Data have been collected from 05-86 to 11-87 to aid in the development of a management program for Rocky Mountain bighorn sheep (Ovis canadensis canadensis) at Bighorn Canyon National Recreation Area (BICA). The purpose of this report is to summarize progress toward completing the following objectives:

Objectives

1. Determine the size, and age/sex composition of the sheep herd at BICA; determine the general health of the herd.
2. Analyze the seasonal food habits of sheep and wild horses; analyze the dietary overlap of these species; analyze the foraging behavior of sheep in habitats occupied exclusively by sheep and compare with the foraging behavior of sheep in habitats used in common with horses and/or humans.
3. Analyze seasonal habitat use throughout the annual cycle; analyze activity patterns during all daylight hours and relate to habitat use; identify and describe sensitive use areas for consideration in future sheep management programs.
4. Determine the total habitat potential of BICA.

Summarized Methodology

We chemically immobilized sheep for the purpose of radio telemetry and disease testing using a freeze-dried concentration of ketamine/xylazine hydrochloride. Muscle tissue was collected in later captures for genetic analysis. The experimental reversal agent, yohombine, was used to reduce recovery time from later captures (Hurley 1985). We administered prophylactic injections of Vit E/Selenium, penicillin, and a diuretic to minimize capture stress (Jessup et al. 1984).

Herd size and age/sex composition were determined from duplicate counts. All sheep observed were classified as follows: lambs, yearlings, adult ewes, and adult rams. Rams under 10-years of age were aged by horn-ring counts.

The following indices were used to evaluate general health of the herd: physical condition according to Riney (1960) and McCutchen (1985), vigor of lamb interactions (Geist 1971), length of suckling periods (Geist 1971), and intensity of ram interactions (Geist 1971). Sheep were physically examined at the time of capture. Blood was drawn and tested for parainfluenza 3, bovine virus diarrhea, blue tongue and soremouth. Nose and throat cultures were tested for general bacteriology and *Pasteurella hemolytica* type-t, respectively. Ear scrapings were collected and examined for psoroptic mites. Feces were collected at the time of capture to determine the occurrence of lungworm in the subject animal. Feces will be collected from January through April 1988 to determine the occurrence of lungworm in the population.

Replicate sets of fecal collections (2 pellets from each of 10 or more defecations) were obtained during all seasons for the analysis of ewe food habits. Fecal collections were obtained for the analysis of ram food habits during summer and spring. Separate analysis of ram food habits will not be made for fall or winter due to extensive association of sexes during these periods. Ewe food habits are considered representative of the ram diet during these periods. Replicate fecal collections were obtained for the analysis of horse food habits during all data collection periods. Dietary overlap of sheep and horses will be calculated after the completion of field work using Kulczynski's Formula (Oosting 1956).

The foraging behavior of ewes was analyzed during summer, fall, and spring to evaluate stress in different habitats. Different habitat categories were as follows: areas used exclusively by sheep (precipitous habitat), areas used in common by sheep and horses (non-precipitous habitat greater than 400-m, from the road), and areas used in common by sheep, horses and humans (roadside habitat). The foraging behavior of rams was analyzed when rams associated with wild horses and compared with foraging behavior of rams associated with conspecifics. The foraging behavior of ewes was analyzed during spring 1987 when ewes and yearlings were in close proximity to wild horses. In the analysis of foraging behavior according to Risenhoover and Bailey (1985), the time spent in alert behavior varies inversely with foraging efficiency (FE); time devoted to alert behavior was at the expense of forage intake. In addition, time spent in alert behavior provides an indication of the relative security of sheep in habitats with and without distributional overlap with horses and/or humans. Vegetation was similar in all habitat categories throughout the analysis to control for confounding effects of visibility on vigilance levels.

Habitat utilization was analyzed separately for ewes with lambs, ewes without lambs, groups of mixed sex/age composition, and for ram groups.

For each location of sheep the following data were recorded: group size, age/sex composition, activity, temperature, relative humidity, wind speed/direction, degrees slope, slope aspect, vegetation type, distance to escape terrain, distance to water, distance to road, and horse access (Y/N). Areas sensitive to human use were identified for consideration in future sheep management programs.

Diurnal activity patterns were analyzed and related to habitat utilization. Activity was recorded at half-hour intervals during all daylight hours. Due to their gregarious social structure the behavior of individual sheep is not independent (Chilleli and Krausman 1981). We recorded the activity in which the majority of adult group members were involved.

### Summary of Results to Date

Rocky Mountain bighorn sheep (Ovis canadensis canadensis) were located 328 times between 3 June 1986 and 30 November 1987. Three adult ewes and 1 ram were chemically immobilized, fitted with radio collars, and tested for diseases. The experimental antagonist, yohombine, was used to reverse the last immobilization and reduced recovery time by more than 50% in contrast to the average for previous captures. Blood was drawn and is being tested for parainfluenza 3\*, blue-tongue, soremouth, and brucellosis. Nose and throat cultures tested negatively for general bacteriology and pasteurella hemolytica type-t, respectively. Feces were collected at the time of capture and tested for lungworm; results were negative or low and insignificant. Additional fecal collections will be made from January through March 1988 and tested for lungworm by the Montana Department of Fish, Wildlife and Parks.

Fall 1986 age/sex classifications included 33.8% lambs, 11.8% yearling females, 18.3% rams, and 0.5% unclassified females. During fall 1986 we estimated the population to contain 38 to 42 animals. The overall classification of yearling females increased to 23% after pregnant ewes went into seclusion in May 1987. Twelve lambs were born in 1986, and 9 were recruited to the yearling age class. Fourteen lambs were born in 1987, but 3 were missing and presumed dead by 5-days of age. Recruitment from immigration was documented when an ear-tagged ewe moved onto the study area; all transplants in the area occurred 12 to 14 years ago. The immigrated ewe gave birth to the last lamb born in the population this year.

Food habits of sheep and horses were quantitatively analyzed by the Range Science Laboratory at New Mexico State University. During summer 1986, browse comprised an average of 50.6% of the ewe diets, and 56.1% of the ram diet. Key browse species were Cercocarpus ledifolius, Yucca glauca, Atriplex confertifolia, and Eurotia lanata. During fall 1986, utilization of browse increased to an average 65.6% of the diet for groups of mixed age/sex composition. Key browse species utilized during the fall were Yucca glauca, and Cercocarpus ledifolius. During winter

1986-87, utilization of browse increased to 76.2% of the diet for groups of mixed age/sex composition; key species utilized were similar to those shown above. During spring 1987, utilization of browse decreased to an average of 69.8% of the ewe diets, and 68.2% of the ram diet. Utilization of warm-season grasses increased during the spring green-up. Key browse species utilized during the spring were similar to those shown above with the addition of Juniperus osteosperma.

During summer 1986 and 1987, the foraging efficiency of ewes was highest in habitat used exclusively by sheep, and lowest in habitat used in common with horses and/or humans. Ewes devoted large amounts of time to alert behavior while foraging at the roadside. In the summers of 1986 and 1987 ewes devoted 33.9-min and 31.4-min, respectively, to alert behavior during 75-min of foraging at the roadside. Ewes used habitat exclusively occupied by sheep infrequently during fall 1986; foraging efficiency was highest in habitat used in common with horses. During spring 1987 the foraging efficiency of ewes was highest in habitat used in common with horses. During spring 1987 the foraging efficiency of ewes was highest in habitat used in common with horses, and lowest in habitat used in common with horses and/or humans. Resource competition between ewes accounted for decreased foraging efficiency in habitat used exclusively by sheep during spring 1987.

The foraging behavior of rams was analyzed in association with wild horses and compared with foraging behavior in association with conspecifics during fall 1986 and spring 1987; foraging efficiency of rams was 100% when in association with wild horses during all periods. Foraging behavior of rams with conspecifics was predominated by aggressive-social interactions. The foraging behavior of ewes was analyzed when ewes were in close proximity to wild horses during spring 1987; foraging efficiency of ewes was 100% during the period.

Between June 1986 and November 1987, sheep were located 315 times in research conducted to analyze seasonal habitat utilization. Conclusive statements regarding habitat preference or avoidance will be based on an analysis of the utilization-availability data (Neu et al. 1974). The analysis will be conducted after the completion of field work.

Seasonal activity patterns were analyzed and related to habitat use. Diurnal activity patterns were typified by extended feeding periods and short resting or rumination times. Extended feeding periods and short-retention times are associated with ruminants which rely mainly on the foliage of trees, shrubs, or forbs. Food habits data show that sheep rely increasingly on browse from spring through the remainder of the year. Therefore, the foraging strategy of sheep at BICA is that of an adaptable-concentrate feeder (Green 1987).

We analyzed the vegetation and topography of preferred feeding sites. Abundant suitable habitat was located through extensive field surveys. BICA and adjacent lands will potentially support large numbers of bighorn in a widely distributed, low-density population.

Areas sensitive to human use were identified for consideration in future sheep management programs. Sensitive-use areas included the lambing/maternity grounds, the highly visible ewe' summer range, and the area near Layout Creek in which rams are routinely observed in association with wild horses.

Specific management recommendations are made in the final report to eliminate potentially limiting factors and encourage expanded population distribution. Recommendations include enhancing genetic diversity by supplemental introduction, and constructing water developments in precipitous habitat to encourage expanded distributions while minimizing competition with deer or horses.

The final report for this contract will be submitted in July 1988 and includes maps of known sheep habitat, lambing and sensitive-use areas.

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