



Ecology of bighorn sheep in the Sun River area of Montana during fall and spring  
by Michael Redvers Frisina

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of  
MASTER OF SCIENCE in Fish and Wildlife Management  
Montana State University  
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Abstract:

A study of bighorn sheep was conducted in the Sun River area of west central Montana during the fall and spring of 1972 and 1973 to obtain quantitative data on range use, feeding habits, physical condition, quality of nutrition, productivity, and movements. Vegetation resulting from past fires was classified into two vegetation types and three subtypes. Percent canopy coverages and frequencies of occurrence were determined for low growing plant taxa on these types and subtypes. Sex and age composition of the herd was determined from 4,923 ground and 676 aerial observations of bighorn sheep. Numbers per 100 ewes for rams, lambs, and yearlings were 25, 59, and 14 during fall and 36, 54, and 10 during spring, respectively. Range use was determined by recording the locations of 2,149 and 3,291 observations of bighorn sheep in the fall and spring, respectively. During fall 64 percent of the bighorn sheep observations were made on the rocky reef type and 34 percent were on the bunchgrass type. During spring 59 percent of the bighorn sheep observations were made on the bunchgrass type. During both fall and spring those subtypes related to past fires received greatest use by bighorns. Southerly exposures received greater use than other exposures during both spring and fall. A mean slope of 60 and 42 percent was used by bighorns during fall and spring, respectively. An inverse relationship between mean bighorn sheep group sizes and security level of habitat was found. Spring and fall food habits were determined from the contents of 34 rumen samples and 3,993 instances of plant use at feeding sites. Grasses and grass-like plants, forbs, and browse made up 92, 5, and 1 percent of the diet during fall and 94, 3, and 2 percent of the diet during spring, respectively. These data were combined with those of earlier studies to summarize the year-round food habits of bighorn sheep in the Sun River area. Crude fiber and protein content of rumen samples, crude fiber in fecal samples, and percent light transmittancy of rumen liquor samples from each of 10 adult ewes collected in spring were determined. A kidney fat index was determined for each of the animals. Kidney fat indices indicated all bighorn sheep, except one, were in good condition. The values for protein and crude fiber may represent at least minimum and maximum values, respectively, for bighorn sheep on adequate ranges. A negative correlation between percent light transmittancy for rumen liquor and nutritive quality was found.

Each pair of ovaries of 10 adult ewes collected during spring contained one corpus luteum which together with embryo counts indicated a frequency of fertilization of 100 percent. Relocations of 60 marked bighorn sheep indicated that during spring they confined their movements to the winter concentration areas previously described and during fall were found on both the winter concentration areas and almost all portions of the summer range.

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Date April 8, 1974

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MICHAEL REDVERS FRISINA

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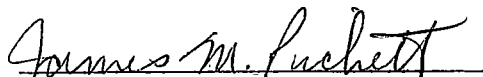
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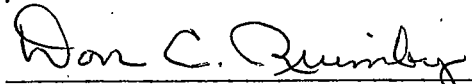
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in

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## ABSTRACT

A study of bighorn sheep was conducted in the Sun River area of west central Montana during the fall and spring of 1972 and 1973 to obtain quantitative data on range use, feeding habits, physical condition, quality of nutrition, productivity, and movements. Vegetation resulting from past fires was classified into two vegetation types and three subtypes. Percent canopy coverages and frequencies of occurrence were determined for low growing plant taxa on these types and subtypes. Sex and age composition of the herd was determined from 4,923 ground and 676 aerial observations of bighorn sheep. Numbers per 100 ewes for rams, lambs, and yearlings were 25, 59, and 14 during fall and 36, 54, and 10 during spring, respectively. Range use was determined by recording the locations of 2,149 and 3,291 observations of bighorn sheep in the fall and spring, respectively. During fall 64 percent of the bighorn sheep observations were made on the rocky reef type and 34 percent were on the bunchgrass type. During spring 59 percent of the bighorn sheep observations were made on the bunchgrass type. During both fall and spring those subtypes related to past fires received greatest use by bighorns. Southerly exposures received greater use than other exposures during both spring and fall. A mean slope of 60 and 42 percent was used by bighorns during fall and spring, respectively. An inverse relationship between mean bighorn sheep group sizes and security level of habitat was found. Spring and fall food habits were determined from the contents of 34 rumen samples and 3,993 instances of plant use at feeding sites. Grasses and grass-like plants, forbs, and browse made up 92, 5, and 1 percent of the diet during fall and 94, 3, and 2 percent of the diet during spring, respectively. These data were combined with those of earlier studies to summarize the year-round food habits of bighorn sheep in the Sun River area. Crude fiber and protein content of rumen samples, crude fiber in fecal samples, and percent light transmittancy of rumen liquor samples from each of 10 adult ewes collected in spring were determined. A kidney fat index was determined for each of the animals. Kidney fat indices indicated all bighorn sheep, except one, were in good condition. The values for protein and crude fiber may represent at least minimum and maximum values, respectively, for bighorn sheep on adequate ranges. A negative correlation between percent light transmittancy for rumen liquor and nutritive quality was found. Each pair of ovaries of 10 adult ewes collected during spring contained one corpus luteum which together with embryo counts indicated a frequency of fertilization of 100 percent. Relocations of 60 marked bighorn sheep indicated that during spring they confined their movements to the winter concentration areas previously described and during fall were found on both the winter concentration areas and almost all portions of the summer range.

## INTRODUCTION

One of the largest herds of Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis* Shaw) ranges in the Sun River area of west central Montana. The early history of this herd was described by Couey (1950). The estimated population has increased from 260 in 1943 (Couey, 1950) to 805 in 1972. Annual bighorn sheep hunting seasons, under a permit system, were initiated in 1953 following a long closure which dated to 1912 (Watts *et al.*, 1971).

Winter food habits of animals of this herd were reported by Couey (1950) and Schallenberger (1966). Summer food habits were investigated by Erickson (1972). The latter author also studied movements of marked animals in winter and summer which resulted in the delineation of different herd segments for the Sun River, Ford Creek, and Deep Creek drainages. The study reported here was conducted during the summer and fall of 1972 and spring of 1973. I concentrated on range use, food habits, and movements during fall and spring to complement the data for the seasons previously reported. Special attention was given to use by bighorn sheep of habitats resulting from large wildfires which occurred between 1910 and 1945. Ewes were collected during spring for information concerning productivity, body condition, and food habits.

## METHODS

Ninety-eight bighorn sheep have been live-trapped, marked for individual identification and released during winter and spring in the study area since 1967 by Montana Fish and Game Department personnel. Ewes were marked with three inch wide neckbands. Rams were tagged in each ear with orange cattle tags embossed with black numerals. With the use of ocular aides these neckbands and ear tags can be observed for distances of approximately one mile and a few yards, respectively (Erickson, 1972).

Two aerial flights in the fall and three in the spring were conducted to locate groups of bighorns. A packtrain was used to establish base camps in areas where bighorns had been observed from the air. Daily searches for bighorn sheep were made in these localities. A 60X variable spotting scope, a 7 x 35 binocular and a 10 x 40 binocular were used as observational aides in locating bighorn sheep. Information recorded at each bighorn sheep observation site included an estimate of temperature and wind velocity, time of day, the vegetation type, exposure, distance to escape cover, elevation as determined by U.S.G.S. quadrangle maps, and percent slope as determined by abney level and estimation. The animals were classified as to sex, age, activity, and whether marked or unmarked. Rams were placed in one of five categories depending on the degree of horn curl: 1/4 or less, 1/4-1/2, 1/2-3/4, 3/4, or 3/4+.

Plants from the study area were collected and identified according to Booth (1950) and Booth and Wright (1959) to aid in food habits evaluations and classification of the vegetation. A plant collection was compiled for reference and verified by referring to a Montana Fish and Game Department reference collection. Areas considered representative of vegetation types were selected for study. Quantitative data on coverage and frequency of occurrence for herbaceous plants less than one and shrubs less than .5 meter in height, respectively, were gathered by examination of 20 randomly-spaced 2 x 5 or 4 x 10 decimeter plots located along a line transect. Tree heights and dbh were recorded by estimation and tape measure, respectively. The study area was divided according to vegetation types and subtypes to correlate use by bighorns of various plant communities during different seasons.

Information concerning bighorn sheep spring and fall feeding habits were obtained by examination of feeding sites (Cole, 1956). An estimation of one bite was considered to represent one instance of use for a plant species. At most feeding sites at least 100 instances of use were obtained. Rumen samples collected during the autumns of 1972 and 1973 by hunters and spring of 1973 by the author were examined. Analyses of data for both feeding site examinations and rumen analyses followed the aggregate percentage method of Martin *et al.* (1946).

During the spring of 1973 ten adult ewes were collected with the aid of a rifle for information concerning productivity, body condition, forage quality of rumen samples, and other biological data. Each bighorn sheep was measured for physical characteristics according to Russo (1965), and weighed with a spring scale. Kidneys, rumens, rumen liquor samples, lungs, fecal samples, ovaries and fetuses were placed in individual plastic bags which were frozen and saved for laboratory analysis. Heart, visceral, and sternal fat were recorded as "present" or "not present". Crown rump and head length measurements as described by Cheatum and Morton (1946) and other physical measurements as described by Russo (1965) were made on fetuses.

Personnel of the Montana State University Analytical Chemistry Laboratory analyzed rumen samples for crude fiber and nitrogen, fecal samples for crude fiber, and rumen liquor for light transmittance in a manner similar to that described by Klein (1962).

## DESCRIPTION OF AREA

The study area is the same as that described by Erickson (1972) and the following is from his paper: "The 800 square-mile . . . area lies within the Sawtooth Mountain Range, approximately 65 miles west of Great Falls, Montana. Boundaries . . . were Moose Creek, Headquarters Creek, and Teton River on the north, the West Fork of the South Fork of Sun River, Wood Creek, Ford Creek, and Willow Creek on the south,  $112^{\circ}35''$  longitude on the east, and the Continental Divide on the west (Figure 1). The Sun River, which flows eastward along the boundary between Teton County to the north and Lewis and Clark County to the south, constitutes the major drainage in the area. Minor drainages include Deep Creek and Ford Creek to the north and south of the Sun River, respectively. A prominent feature of the area is Gibson Lake which extends 7 miles in length and was formed by a large dam completed in 1929 for irrigation."

Two-thirds of the study area is within the Bob Marshall Wilderness from which motorized vehicles have been excluded. That portion of the study area between the north and south forks of the Sun River lies within the boundaries of the Sun River Game Preserve, established in 1913 to protect the Sun River elk herd.

The topography of the study area is characterized by parallel reefs running north and south with abrupt cliffs on the east and precipitous slopes on the west. The reefs are connected by east-west

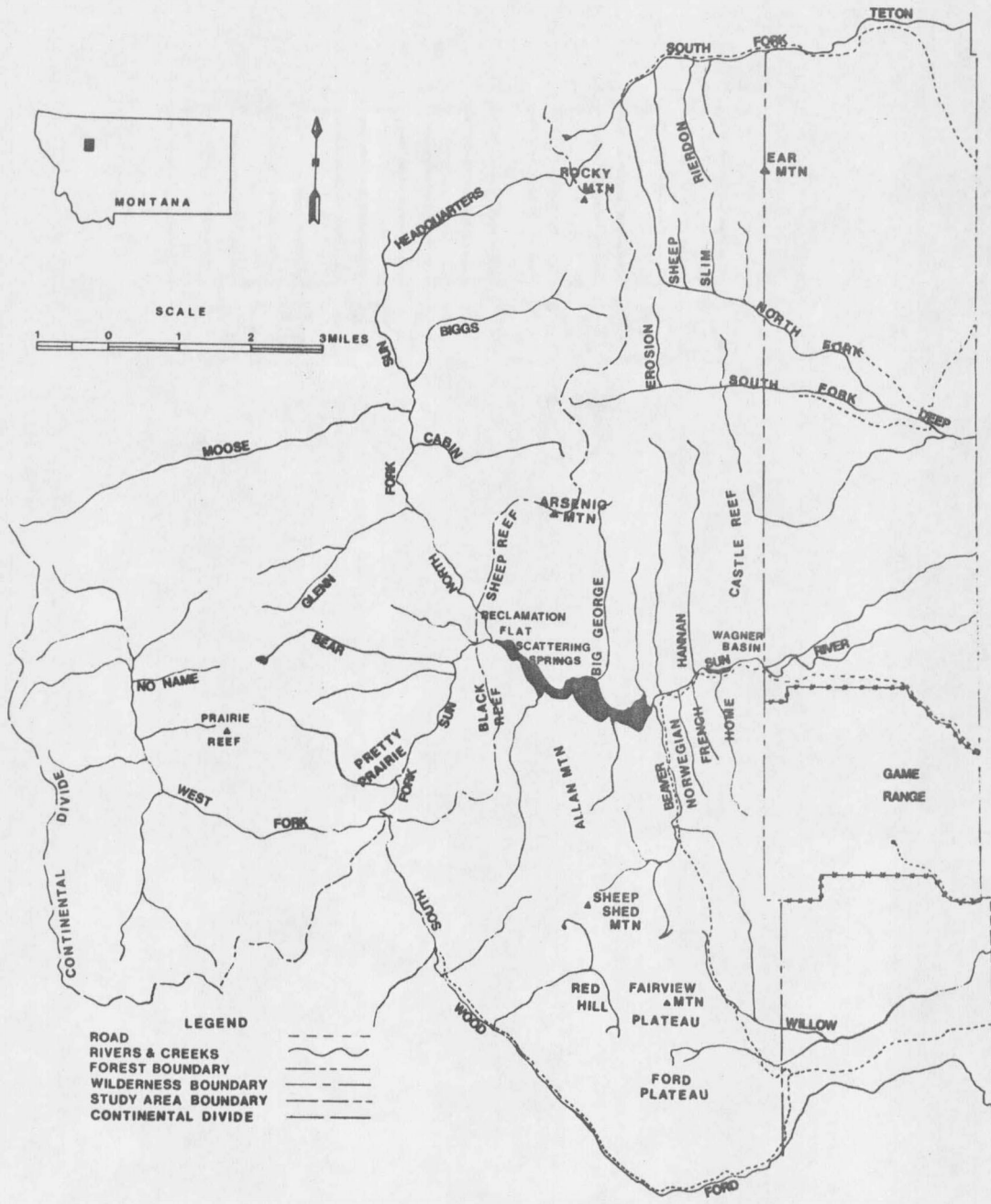


Figure 1. Map of study area showing major drainages (Erickson, 1972).













































































































































