



RANGE MANAGEMENT

Appraisal of a Moose Range in Southwestern Montana¹

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The Gravelly-Snowcrest Mountains complex in southwestern Montana has provided approximately 18 percent of the annual moose harvest in the State since 1957. Management of moose in this area involves evaluation of range condition as well as harvest and population data. This paper reports studies of four browse species important to moose, as observed from 1959 to 1962, and discusses factors influencing utilization of these species on the summer and winter ranges. These studies were conducted in conjunction with studies of reproduction and distribution of moose, reported by Peek (1962).

Unpublished Montana Fish and Game Department reports^{2, 3} indicated increases in moose populations in this area during the 1940's and early 1950's. Heavy utilization of willow (*Salix* spp.) by moose was noted in 1952. Knowlton (1960) counted 53 moose from the ground

along 13 miles of the Ruby River in March 1959.

Food habits and distribution of moose (Knowlton, 1960) provided data necessary to initiate browse surveys. Willow, silverberry (*Eleagnus commutata*), and aspen (*Populus tremuloides*) were found to be important species used by moose in this area. Use of bog birch (*Betula glandulosa*) was not noted, but Cowan, et al (1950) and Harry (1957) indicated that this species was highly palatable to moose.

Moose apparently drift off the winter concentration area at about 6,500 feet elevation along the Ruby River in early spring and spend the summer between 7,500 and 8,500 feet. Few remain at the lower elevations. Movement to elevations at or above the upper limits of the summer range occurs usually in October. Moose remain at these high elevations through early winter, but start to appear again on the winter concentration area as the winter progresses.

Study Area

The study area was located at the headwaters of the Ruby River, which separates the Gravelly Mountains from the Snowcrest Range in Beaverhead and Madison Counties. The area, typical of southwestern Montana mountain ranges, was essentially a combination of coniferous forest, aspen timber, sagebrush and grassland types. No attempt was made to analyze the vegetation quantitatively, but eight vegetative types were tentatively recognized. Scientific and common plant names followed Booth (1950) and Booth and Wright (1959).

Areas over approximately 8800 feet elevation were primarily alpine grassland with bluebunch fescue (*Festuca idahoensis*) and stonecrops (*Sedum* spp.) being common species. This type was rarely used by moose.

Below 8800 feet, a sagebrush-grassland community was present which could be separated into three vegetative types. First, a sagebrush type occupied most of the area. Big sagebrush (*Artemisia tridentata*) and three-tip sagebrush (*Artemisia tripartita*) characterized the general appearance, with bluebunch fescue, mountain brome (*Bromus marginatus*), wheatgrasses (*Agropyron spicatum*, *A. smithii*, *A. subsecundum*) and numerous forbs being abundant understory species. Snowberry (*Symphoricarpos albus*) was abundant in limited localities. The second type, a fescue-wheatgrass community, had similar characteris-

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²Hodder, R. L. 1948 1947-1948 Big Game Winter Survey. (Madison-Ruby Unit) Unpub. Job Compl. Rep't. Montana Fish & Game. 7 pp.

³South, P. 1953. Aerial moose census and trends in the Red Rock Lakes Area. Unpub. Job Compl. Rep't. Montana Fish & Game. 2 pp.

tics, except sagebrush was scattered or absent. Wright and Wright (1948) and Evanko and Peterson (1955) present evidence that this type represents the grassland climax in this area and that areas heavily populated with sagebrush represent a grazing disclimax. The third, a forb type, was present between 7500 and 8800 feet in limited localities, with sticky geranium (*Geranium viscosissimum*) being the most conspicuous plant. Lupine (*Lupinus* spp.), cinquefoils (*Potentilla* spp.) and various composites were also common. Grasses and sagebrush were minor associates in this type.

Two conifer types were recognized. Timber above 8000 feet was mostly dominated by Engelmann spruce (*Picea engelmanni*) and subalpine fir (*Abies lasiocarpa*), with varying amounts of whitebark pine (*Pinus albicaulis*) and limber pine (*Pinus flexilis*) on drier slopes. A douglas fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta*) type was prevalent below 8000 feet. Understories commonly contained pinegrass (*Calamagrostis rubescens*), low red huckleberry (*Vaccinium scoparium*), gooseberry (*Ribes* spp.) sticky geranium, bluebunch fescue, wheatgrasses and elk sedge (*Carex geyeri*).

Aspen stands, below 8800 feet, contain meadow rue (*Thalictrum occidentale*), sticky geranium, mountain brome, pinegrass, and cow parsnip (*Heracleum lanatum*) in the understory.

Willow stands above 7500 feet were limited to stream borders and occasional swampy areas. Sedges and shrubby cinquefoil (*Potentilla fruticosa*) were common understory plants. Bog birch occasionally occurred with willow on the Snowcrest Mountains.

Below 6500 feet, a willow-water birch (*Betula occidentalis*) type was found. It was more extensive than the willow type. Sil-

verberry, Rocky Mountain juniper (*Juniperus scopulorum*), dogwood (*Cornus stolonifera*) and various sedges and rushes (*Juncus* spp.) were present. This type contained the moose winter concentration area.

Methods

The Key Browse Survey Method (Cole, 1959) was used to study condition and utilization of willow, silverberry and bog birch. Twenty-five plants of one species were considered a sample unit. Metal fence posts were used to mark the beginning of each unit. Aluminum tags were used to identify individual plants, except those in willow units above 7500 feet, which were left unmarked. The method used a closest plant sampling technique, with a zone for selecting the next plant being a 180 degree arc ahead of the last plant sampled. Plants were judged to be either lightly, moderately, or severely hedged on a basis of appearance of the second past year's growth, or the growth immediately below that of the current year. Utilization of current year's growth was judged to be either 0, 5, 25, 50, 70, 90, or 100 percent of all leaders used on each plant. If a portion of a leader was taken, the whole leader was classed as having been used. Average utilization was then obtained for each sample unit. Plants were classed as decadent if more than 25 percent of the crown area was dead.

Densities of aspen stands were determined by the point-centered-quarter method described by Cottam and Curtis (1956). A 250-foot line was stretched through an aspen grove, and sampling points were established every ten feet along the line. The distance to the closest tree under eight feet tall and to the closest tree over eight feet tall in each quarter from the sampling point was measured, and the data con-

verted to number of trees per acre following Phillips (1959). Trees under eight feet tall, the maximum height generally browsed by moose were designated resprouts. Condition of the preceding year's growth of resprouts was judged in the same manner as other species. Resprouts under three feet tall, generally three years old or less, were tallied apart from those over three feet tall, to give an indication of the age of resprouts within each stand. Mature trees were examined for evidence of utilization of bark. One hundred mature trees were examined for evidence of utilization of bark. One hundred mature trees and one hundred resprouts were considered a sample unit for aspen.

Since the study area was also used by elk, deer, cattle and sheep, sample units were established in stands observed to be used commonly by moose and infrequently by other species, to eliminate as much as possible the influence of other than moose browsing. Except for the aspen data, all information was obtained when moose were using the complementary range, i.e., data for the lower range were obtained when moose were using the higher range.

Condition of Browse Species

Table 1 presents average condition and utilization from nine willow and three bog birch sample units located above 7500 feet. Condition and decadence information was obtained for bog birch in 1960, but utilization was omitted. Current year's growth for 1960 and 1961 was limited to a few short leaders on most plants. Catkins were found on only a few plants. The apparent reduced vigor, poor form, and high percentage of decadent plants indicated severe browsing pressure. Utilization for 1961 averaged 49 percent for the three sample units. Bog birch appeared to have received more se-

Table 1. Condition and utilization of willow and bog birch above 7500 feet.

Species	Year	Form Class ¹						Decadence ²	Leader Use ³
		1	2	3	4	5	6		
		(Percent)							
Willow	1959	1	72	14	—	10	3	51	44
Willow	1960	—	26	62	—	4	8	51	51
Willow	1961	—	39	46	—	7	8	92	39
Bog birch	1960	—	—	100	—	—	—	65	—
Bog birch	1961	—	1	99	—	—	—	97	49

¹1—all available, little or no hedging. 2—all available, moderately hedged.

3—all available, severely hedged. 4—partly available, little or no hedging.

5—partly available, moderately hedged. 6—partly available, severely hedged.

²25 percent or more of crown dead.

³Current year's growth.

were browsing pressure than willow.

Willow condition and number of decadent plants suggested that sample units above 7500 feet were also subject to heavy utilization. Utilization of current year's growth was 44 percent in 1959, 51 percent in 1960, and 39 percent in 1961. The sampling in 1960 was done in two feet of snow, which obscured many smaller plants observed in 1959 and 1961. A minor preference for two taller willow species over a shorter one has been reported for western Montana.⁴ Plants appeared to be in progressively poorer condition as elevations increased on the higher range, and the extent of willow areas decreased. Deterioration of sample units was indicated by the increasing decadence and trend towards severely hedged form.

Table 2 presents data from eight aspen stands. Density of mature trees was considerably greater than that recorded for resprouts. Competition for light and moisture with mature trees probably accounts more for the lesser density of resprouts than browsing. Thirty-nine percent

of all mature trees examined showed evidence of "barking." Moose were seen eating aspen bark during the summer months. Form data for resprouts and high percentage of resprouts under three feet tall (92 percent) indicated suppression of aspen reproduction by browsing.

Table 3 presents data from three willow and two silverberry sample units located along the Ruby River at about 6500 feet. Utilization for the four years ranged between 56 and 79 percent for willow and between 66 and 71 percent for silverberry. Utilization was highest for both species in 1962. Form data showed a predominance of severely hedged plants. The poor form, high percentage of decadence and high leader use suggested that browsing was contributing to the deterioration of this range. Spencer and Chate-lain (1953) and Harry (1957) considered 50 percent of current year's growth of willow to be maximum allowable utilization. Utilization for all four years was considerably above this figure. Average utilization of silverberry (68 percent) for the four years was only slightly higher than the average (65 percent) for willow. One silverberry plant, tagged in 1959 and classed as severely hedged, was dead in 1962.

Dogwood occurred in limited amounts on this concentration area. Virtually all current year's

growth had been removed from plants observed each of the four years. Knowlton (1960) reported this species to be highly palatable to moose.

Factors Influencing Utilization

The period of use of areas above 7500 feet by moose became important in considering relationships between the higher and lower ranges. Knowlton (1960) and the writer observed that most moose spent ten months of 1959 and 1960 and eight months of 1961 above 7500 feet. This long period of use of the higher ranges, plus the scarcity of willow and bog birch above 7500 feet probably contributed much to the critical condition of those species on the higher range.

Snow depths appeared to influence migration between the two ranges, which in turn influenced length of time spent on each range. Moose appeared to remain on the higher range until snow depths became such that availability of deciduous browse was severely limited. A cold wave with temperatures dropping to -30° F., which occurred in November, 1959, when snow depths did not exceed two feet, did not appear to initiate a downward movement. However, in late December, 1960, very little moose sign was observed above 7500 feet when snow depths, especially in willow bottoms, were three feet or more. Edwards and Ritcey (1956) state that snow appears to be a major controlling factor in moose migration in British Columbia.

Knowlton (1960) observed that moose used forbs more than browse during the summer of 1958. Feeding site examinations made during the drier summers of 1959 and 1960 indicated greatly increased use of browse, mainly willow. It seems possible that both winter snow conditions and amount of summer precipitation have an effect on length

⁴Smith, N. S. 1962. *The fall and winter ecology of the shiras moose (Alces alces shirasi) in the Rock Creek Drainage, Granite County, Montana*. Unpubl. M. S. Thesis. Montana State University, Missoula, Montana. 52 pp.

Table 2. Condition of eight quaking aspen stands above 7500 feet, in August, 1960.

Barked ¹	Mature trees Density ²	Density	Sprouts Form Class			Under 3 feet
			1	2	3	
(Percent)			(Percent)			
39	611	470	19	14	67	92

¹Evidence of bark use.²Number of individuals per acre.

and degree of utilization of browse by moose on both the higher and lower ranges.

Summer utilization of browse by moose consisted mainly of stripping leaves from leaders (McMillan, 1953). This type of use was not considered with the method used. Instances of dead leaders, probably resulting from leaf stripping, were seen. This type of use, if measured, would probably raise utilization on the high ranges. At present the utilization data probably represent use which occurs mostly after leaf-fall, generally in late September. The trend towards more decadent and severely hedged plants suggests that leaf stripping may increase utilization above that indicated.

Utilization by Other Animals

Although aspen stands sampled were used most frequently by moose, some use by other animals did occur. One aspen stand used frequently by cattle as well as moose contained no aspen plants under eight feet tall. This stand was not included in the summaries used here. Sheep were observed to feed heavily on aspen resprouts in some stands. The data presented indicate that mature aspen stands produced considerable amounts of forage, both in the form of resprouts and of bark. The value of aspen stands as cover for big game and livestock has been noted by many writers.

Willow sampled above 7500 feet appeared to receive negligible utilization by cattle, even when the understory grasses and sedges were extensively taken.

Checks of stands in areas used frequently by cattle and only rarely by moose revealed less than ten percent utilization, except on one unit checked in December 1961, where use was 33 percent. Periodic checks through the summer and fall of 1962 suggested most use of willow by cattle occurred in late September and October.

Two willow sample units were located in areas known to be frequented by elk as well as by moose. Their average utilization, 53 percent for the three years, was slightly above the average of 46 percent for all sample units above 7500 feet. Browse, including willow, was found to make up a small part of the summer diet of elk in this area.⁵

Moose share the winter concentration area with mule deer. Cattle use it in June each year. Some use of willow and silverberry by mule deer may occur although Lovaas (1958), and Wilkins (1958) did not record either species in the winter diet of mule deer in other areas of Montana. Checks of willow after cattle left the area and before

moose arrived revealed less than five percent utilization each year.

Discussion

The data, taken in their entirety, suggest that the four major browse species used by moose, on both the high and low ranges, were over-browsed, and in poor condition. Peek (1962) found an extremely low twinning rate in this moose population, which could very well be the result of a lowered nutritional plane. Pimlott (1961) suggested that factors of the environment as well as of population density may influence the reproductive status of moose.

Although other browsing animals occurred within the study area, moose apparently were the major species influencing the units which were sampled.

Summary

Studies of willow, silverberry, bog birch and aspen located on a moose range in southwestern Montana were reported. Willow and silverberry located on a moose winter concentration area were more heavily utilized than were willow and bog birch located at higher elevations; however, all appeared to have received heavy utilization. Al-

⁵Rouse, R. A. 1957. *Elk food habits, range use, and movements, Gravelly Mountains, Montana*. Unpubl. M.S. Thesis, Montana State College, Bozeman. 29 pp.

Table 3. Condition and utilization of willow and silverberry on the moose winter concentration area.

Species	Year	Form Class						Leader Decadence	Use
		1	2	3	4	5	6		
		(Percent)							
Willow	1959	—	86	14	—	—	—	73	56
Willow	1960	—	28	70	—	—	2	—	66
Willow	1961	—	—	98	—	2	—	84	59
Willow	1962	—	3	97	—	—	—	100	79
Silverberry	1959	—	80	20	—	—	—	—	70
Silverberry	1960	—	28	72	—	—	—	—	66
Silverberry	1961	—	—	100	—	—	—	28	67
Silverberry	1962	—	26	74	—	—	—	96 ¹	71

¹One dead plant in sample units.

though the area was also used by elk, mule deer, cattle and sheep, moose apparently were the major influence upon the browse species examined.

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