Moose Habitat and Population in Mount McKinley National Park Alaska

MOOSE HABITAT AND POPULATIONS IN MOUNT McKINLEY NATIONAL PARK, ALASKA

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During winter of 1978-79, moose browsing intensities in Mt. McKinley National Park averaged 65%. Browsing intensities were greatest in small, dense, single-species stands and less in large, mixed-species stands. Moose population densities are below but approaching the carrying capacity of the range and are currently being limited by predation.

Key words: Alaska, browse, carrying capacity, habitat, moose, predation.

Mount McKinley National Park supports a substantial moose (Alces alces) population of about 1,000 animals (J. Dalle Molle, pers. comm.). This is a higher density in good moose habitat than recorded in other regions of interior Alaska (W. Gasaway, pers. comm.). During winter, moose congregate in tall shrub communities to feed on several species of willow (Salix spp.) and other woody vegetation. We measured browse availability and utilization by moose in McKinley Park as part of an extensive moose browsing study in interior Alaska (Wolff 1978, Wolff and Zasada 1979). It was hypothesized that moose population density in McKinley Park would be at or near carrying capacity of the range when hunting is totally restricted and fire absent. The last fire recorded in

the park occurred in 1924.

To assess this hypothesis, browsing intensities were recorded and the biomass of available browse and carrying capacities were estimated in the major wintering areas in the park. All data were collected in May and June of 1979.

STUDY AREAS AND METHODS

Browsing intensities were recorded in 14 stands at 7 sites. One transect was sampled near the park entrance by the railroad tracks (1.8 km from the Parks Highway turnoff), one at Headquarters (8.3 km), one at Hogan Creek (34.2 km), two at Sanctuary River (34.5 km), one at Sanctuary Campground (35.8 km), one at Teklanika Campground (45.6 km), one at Teklanika River (46.6 km), one at Teklanika Bridge (48.0 km), and two at Igloo Creek (51.0 km; 52.0 km). All willows sampled in these stands were felt-leaf willow (Salix alaxensis). This was a highly preferred willow and an abundant species in the park.

Numbers of browsed and unbrowsed twigs were recorded on 100 willow stems along a 500-m transect in each stand. Two stems closest to the observer (one right and one left) were sampled at 10-m intervals along a 500-m transect. All twigs were less than 4 mm in diameter and between 0.5 and 3.5 m above ground level.

In three stands along the Savage River (11.8 km; 19.8 km; 20.3 km), numbers of browsed and unbrowsed twigs were recorded in 20 2x5-m plots. All browse species were included in the sampling. The Shafer (1963) twig-count method was used to estimate availability and utilization of browse. Diameters at point of browsing were measured on 30 browsed twigs of each species. Thirty unbrowsed twigs of the same diameter were

clipped, dried, and weighed.

A road census was conducted in May and June of 1979 to count cows and calves. Additional data on natality, survival, and predation were supplied by the National Park Service and Haber (1977).

RESULTS

Browsing intensities on S. alaxensis at the 14 stands are shown in Table 1. The mean browsing intensity for all stands was 65.0% with a range of 35.1% at Teklanika Campground to 86.3% at headquarters 8.3 km from the park entrance. Browsing intensities corresponded to the distribution and abundance of forage. A mean browsing intensity of 75.8% (± S.E. 2.91) was recorded in single species stands and/or in stands which were dispersed in small dense patches of less than 5 hectares, such as on river islands, in clearings, or along streams. Browsing intensities were significantly lower (52.8% + S.E. 4.08, p .001, t-test) in mixed species stands greater than 5 ha in size or when forage shrubs were widely dispersed. There was no correlation between browsing intensities and number of twigs per stem.

Biomass of browse available, carrying capacities, and browse utilization at the three Savage River stands are shown in Table 2. The mean diameters at point of browsing were 3.6 mm (± S.E. 0.13) for S. alaxensis, 2.8 mm (± 0.09) for S. arbusculoides and 3.0 mm (± 0.10) for S. glauca. The mean weights per twig were .64 g (± .02), .55 g (± .02)s and .60 g (± .02) for the 3 species, respectively. Balsam poplar (Populus balsamifera) is a browse species in other regions of Alaska and was included in the sampling. Balsam poplar has a mean weight per twig of 1.32 g (+ .07)

for a 4 mm twig (Wolff and Zasada 1979). The amounts of browse available ranged from 39.2 kg/ha to 110.7 kg/ha. These values are within the range reported by Wolff and Zasada (1979) for 16 stands in interior Alaska. Salix alaxensis made up 90% of the browse available in all stands followed by by littletree willow (S. arbusculoides), grayleaf willow (S. glauca), and balsam poplar. Diamondleaf willow (S. planifolia) was also present in the study area but was not in our plots. Alder (Alnus crispa) was present in most study areas but was infrequently browsed. A preference was shown for S. alaxensis, followed by S. arbusculoides, S. glauca, and balsam poplar.

At a daily consumption rate of 5 kg dry weight per moose (Gasaway and Coady 1974), the biomass of browse available in the 3 stands would support between 5.9 and 16.7 moose per day per hectare (M.D./ha). Actual carrying capacity was adjusted to 75% of total browse available (Wolff and Zasada 1979). The actual utilization of S. alaxensis was about 86% of the adjusted carrying capacity and for all browse species was between 64% and 78% of the adjusted carrying capacity.

The numbers of calves and cows counted from June 3 through 8, 1979 were 13 calves and 21 cows for a calf:cow ratio of 62:100 (National Park Service aerial census). Haber (1977) recorded spring calf:cow ratios ranging from 58 to 126 calves per 100 cows from 1966 to 1974. Five of 6 cows which we saw on June 3-4 had twins. The incidence of twinning was between 38 and 55% from 1966 to 1974 (Haber 1977). Fall calf:cow ratios ranged from 12 to 38 calves per 100 cows from 1969 to 1973 (Haber 1977) and from 8.2 to 18.9 calves per 100 cows from 1974 to 1978 (Troyer, 1979).

DISCUSSION

In an earlier paper, Wolff and Zasada (1979) suggested that actual carrying capacity of a habitat is about 75% of total browse available. Twenty-five percent is either of poor quality, inaccessible, or otherwise too energetically costly to obtain. They recorded browsing intensities of greater than 75% in small homogeneous stands, but larger stands had browsing intensites less than 60%. The results of the present study support this trend of heavy utilization of small or single-species stands and lighter utilization of large mixed-species stands. In large mixed-species stands moose have a greater number of species and individual plants from which to select good quality forage (Oldemeyer et al. 1977) than they do in smaller and more dense single-species stands. In small patchily distributed stands it is probably energetically more efficient to consume large quantities of forage before moving to another patch.

The high incidences of twinning recorded in this study and in previous years result in a calf:cow ratio at the time of birth of about 130 calves per 100 cows. Although reproductive rates appeared high in 1979 and in previous years, recruitment rates have remained low. The calf:cow ratio of 62:100 recorded in June 1979 and the even lower ratios of 8.2 to 38.0 calves per 100 cows recorded in fall from 1969 to 1978 suggest high summer mortality - probably resulting from predation by wolves (Canis lupus) or to a lesser extent, Grizzly bears (Ursus arctos) (Haber 1977, Ballard and Taylor 1977, Gasaway, et. al. 1977, S. Buskirk, pers. comm.).

The relatively high browsing intensities recorded suggest that the population is below, but approaching the upper limits of the carrying capacity. Subjective observations made during this study suggest browsing

intensities in previous years were also high, but the high twinning and natality rates indicate the population was still below carrying capacity. We therefore conclude that the moose population in McKinley National Park is below, but near, the food carrying capacity. If this is the case, the moose population is currently being controlled by some other means, most likely predation. Even if predation were reduced, the population could increase by only 10 to 15% before reaching the current habitat carrying capacity.

Wolff and Zasada (1979) presented a model to show the relationship between browse production and forest succession. This model predicted peak productivity in willow stands in interior Alaska between 12 and 16 years of age. Willow browse production in McKinley Park probably follows a similar pattern. All stands sampled in this study were over 20 years old and current annual growth was less than that recorded in younger stands. Most of the tall willow shrub communities in upland sites in the Park are in a climax state with low current annual growth. The seral communities along the major river systems are self-perpetuating with yearly alluvial deposition providing a substrate for primary succession of willow communities. An increase in seral habitat resulting from fire in uplands or continued alluvial deposition along rivers would improve moose habitat in Mt. McKinley National Park.

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Table 1. Numbers of Twigs Per Stem and Browsing Intensities on Salix alaxensis at all stands. (N=100).**

Stand	Twigs/stem $\bar{x}$ (± S.E.)	Browsing intensities $\bar{x}$ (± S.E.)
Single species stands or small dense stands		
Headquarters 1.8 km	4.6 (0.23)	75.7 (3.22)
Headquarters 8.3 km	5.0 (0.25)	86.3 (2.19)
Hogan Creek	6.1 (0.35)e	83.7 (3.73)
Sanctuary River I	13.6 (2.22)	75.1 (3.22)e
Sanctuary River II	5.3 (0.33)	76.5 (3.15)
Sanctuary Campground	6.0 (0.32)	70.7 (3.12)
Igloo Creek I, 51 km	5.6 (0.26)	63.d (3.76)e
Mean		75.8 (2.91)*
Mixed species stands and/or dispersed stands		
Savage River I **	4.3 (0.17)	68.5 (2.61)
Savage River II **	11.4 (2.28)e	59.1 (2.56)e
Savage River III **	18.7 (2.70)e	50.6 (3.13)
Teklanika Campground	14.9 (2.42)	35.1 (3.88)e
Teklanika River 46.6 km	4.9 (0.25)	44.6 (4.03)
Teklanika Bridge	4.6 (0.26)	53.9 (4.21)
Igloo Creek, 52 km	5.3 (0.26)	57.9 (3.80)
Mean		52.8 (4.08)*

* ($p < .01$ t-test)e

** For Savage River I, N=228, Savage River II, N=224; Savage River III, N=158.

Table 2. Production of Woody Browse and Utilization by Moose at the Savage River Stands.

Stand	Species	Stems/ha $\bar{x}$ (± S.E.)	Twigs/stem $\bar{x}$ (+ S.E.)	Browse available[1] kg/ha	Browsing intensities % (± S.E.)	Adjusted carrying capacity[2] M.D./ha[40]	Utilization[3] M.D./ha[40]
Savage River I	S. alaxensis	11,600 (1,700)	4.3 (0.17)	31.9	68.5 (2.61)	4.80	4.4
	S. arbusculoides	2,700 (850)	4.9 (0.33)	7.3	31.7 (5.41)	1.10	0.50
	Total	14,300		39.2	56.8 (3.14)	5.90	4.90
Savage River II	S. alaxensis	11,700 (2,040)	11.4 (2.28)	85.4	59.1 (2.56)	12.8	10.1
	S. arbusculoides	2,800 (960)	4.0 (0.29)	6.2	55.0 (5.05)	0.9	0.7
	S. glauca	300 (250)	5.8 (1.31)	1.0	16.0 (6.79)	0.2	0
	Total	14,800		92.6	58.0 (2.45)	13.9	10.8
Savage River III	S. alaxensis	8,500 (1,500)	18.7 (2.70)	101.70	50.6 (3.13)	15.3	10.30
	S. arbusculoides	2,800 (960)	4.0 (0.29)	6.20	34.6 (7.86)	0.9	0.4
	S. glauca	300 (160)	5.7 (0.58)	1.00	23.0 (8.05)	0.2	0
	P. balsamifera	150 (80)	9.0 (1.52)	1.80	0	0.3	0
	Total	11,750		110.70	48.1 (2.94)	16.70	10.7

1 *S. alaxensis* .64 g/twig, *S. arbusculoides* .55 g/twig, *S. glauca* .60 g/twig, *P.* balsamifera 1.32 g/twig.

2 Adjusted carrying capacity: $\frac{75\% \text{ of browse available}}{5 \text{ kg/moose/day}}$ (Wolff and Zasada 1979).

3 Utilization: $\frac{\text{Browsing intensity x total}}{5 \text{ kg/moose/day}}$ browse available (Gasaway and Coady 1974)

4 M.D./ha: Moose days per hectare.