

HABITAT SELECTION AND FOOD HABITS OF MOOSE  
IN NORTHEASTERN ALBERTA

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**Abstract:** Habitat selection and food habits of moose (*Alces alces andersoni*) in northeastern Alberta were studied during fall 1976 and winter 1977. Radiotelemetry was employed to relocate thirteen moose 211 times, yielding 260 observations of habitat use. Most relocation sites were examined, allowing identification and analysis of specific use categories, including feeding, bedding, and non-feeding-bedding. The data were also analyzed according to "presence only" in a given habitat, regardless of the category of use. During the fall, the aspen habitat type and aspen mixed with either white spruce or jack pine were heavily used for most categories of use and in terms of "presence only". The aspen-white spruce and aspen-jack pine were variously preferred. During the winter, aspen and aspen-white spruce were heavily used and were preferred ( $P < 0.05$ ) in terms of "presence only" and for all categories of use except non-feeding-bedding in aspen. Seventy-seven feeding sites were examined, and 9,055 instances of browse use recorded. During both fall and winter, saskatoon was clearly the most heavily used browse and appeared to be the only preferred species. Preference for habitat types appeared to depend on the amount of saskatoon available.

Much of northeastern Alberta contains deposits of bituminous sand, which are being strip mined for oil extraction. The mining will destroy thousands of hectares of moose habitat. In order to mitigate this loss, the Alberta Oil Sands Environmental Research Program directed a portion of its effort toward determining the habitat requirements of

moose in the impact area, with the ultimate objective of applying the results to rehabilitation of mined land.

Prior to initiation of the research, information about moose habitat in the area was scarce. Only the studies of Allison (1972) and Penner (1976) were applicable, and neither of these provided the detail that was required for the rehabilitation program.

This paper reports some results of the moose research conducted during fall 1976 and winter 1976-77. The objective was to quantify habitat selection and food habits in the mining impact area.

DESCRIPTION OF STUDY AREA

The study area was located 60 km north of Fort McMurray, Alberta. It encompassed approximately 220 km<sup>2</sup>, and was bounded by the Athabasca River on the west, by the Muskeg River on the east and south, and by the 25th baseline on the north.

Human disturbance was limited to construction of seismograph lines during the winter for oil exploration and to occasional hunting by native people.

Density of moose in the study area was low. A helicopter census by Jacobsen (1976) estimated one animal per 4.5 km<sup>2</sup>.

Rowe (1972) placed the area into the Mixedwood Section of the Boreal Forest Region of Canada. Individual habitat types were partially identified and described by Stringer (1976). His report served as a basis for final definition of 11 habitat types according to the dominant species present in each.

The following six types occurred on poorly drained sites: sedge (*Carex* spp.), willow (*Salix* spp.), black spruce (*Picea mariana*), tamarack (*Larix laricina*), black spruce-tamarack, and aspen (*Populus tremuloides*)-black spruce.

Well drained areas contained the following five types: aspen, jack pine (*Pinus banksiana*), aspen-white spruce (*Picea glauca*), aspen-jack pine, and upland shrub.

All the habitat types are self-descriptive except upland shrub. This type occurred on recently disturbed sites, exclusive of seismograph lines, where the forest overstory had been removed. Tree reproduction had a diameter at breast height of less than 3.8 cm, and common shrubs included prickly rose (*Rosa acicularis*), wild rose (*Rosa woodsii*), and saskatoon (*Amelanchier alnifolia*).

#### METHODS

Most data were collected by examining sites where moose were relocated by radiotelemetry. Relocations were determined by triangulation of radio signals from known geographical points. The relocations were repeated hourly on individual animals during daylight for not more than three consecutive days.

Results were grouped into two time periods; fall (1 September - 30 November) and winter (1 December - 4 March).

#### Habitat Selection

Selection of habitat types was quantified by determining percent use of each type and by statistically relating use with availability (Neu et al. 1974) to ascertain one of the following: 1) preference (use proportionately greater than availability), 2) use in proportion to availability, or 3) avoidance (use proportionately less than availability.)

Observations of use were obtained by recording the habitats used within a circular sampling plot of approximately 30 m radius, whose center was defined by the radio relocation of a moose.

Specific categories of habitat use were recorded depending upon evidence found when the sampling plots were visited. These categories were feeding, bedding, and non-feeding-bedding. The latter category was the only one which was mutually exclusive within any one habitat, and was simply the absence of either feeding or bedding.

Use of habitats was also recorded as "presence only" in a given type, regardless of the category of use. That is, the presence of a moose in a habitat type within the sampling plot was noted regardless of whether that habitat was used for feeding, bedding, or non-feeding-bedding. Recording the data in this manner was necessary for two reasons. First, most other studies have reported habitat use and selection on a "presence only" basis. Unless my data were treated in a like manner, meaningful comparisons would be impossible. Second, some relocations were not examined for categorization of use. In order to use these observations, an uncategorized stratification of the data was required.

The data were summarized as a percent of relocations within each habitat type for each category of use and for "presence only".

Availability of habitats was measured by conducting a systematic survey of the study area (Nowlin 1977). This involved determination of the habitat type at 231 sampling points spaced approximately 0.211 km apart along 48.5 km of transect lines.

#### Food Habits

Food habits were quantified by examining use and availability of browse. No statistical analysis was employed.

Use of browse was determined by examining feeding sites within the sampling plots (Cole 1956). Instances of use were recorded for individual plants. An instance of use was a browsed twig, or twigs from which leaves had been stripped. A maximum of approximately 200 instances were counted at each site.

If feeding was found in more than one habitat type within any one plot, then separate feeding sites were examined in each type.

Use of each species was summarized as a percent of the total diet, and was calculated using the average aggregate percent method (Martin et al. 1946).

Willows were identified according to Raup (1959), and other plants according to Moss (1959).

Availability of browse was determined by measuring the density of stems using the corrected-point-distance method (Laycock and Batcheler 1975). Measurements were taken within the sampling plots during the winter period. Only species eaten by the moose were considered.

Results for individual species were summarized as a percent of total stem density of browse.

## RESULTS

### Habitat Selection

Only habitat types that accounted for at least 4.3 percent of the observations in at least one category of habitat use or in terms of "presence only" were analyzed for use-availability relationships.

#### Fall Habitat Selection

Four cow and two bull moose were relocated 95 times during the fall (Table 1). At these relocations, 120 observations of habitat use were recorded in terms of "presence only".

The aspen, aspen-white spruce, aspen-jack pine, jack pine, tamarack and black spruce-tamarack habitats were all used in varying degrees (Fig. 1). The aspen and aspen-jack pine were heavily used for all categories of habitat use and in terms of "presence only". The aspen-white spruce type also got heavy use for feeding and bedding, but was lightly used for non-feeding-bedding and "presence only". The other habitats were lightly used in all respects.

The use-availability analysis was not completed for the feeding category of use because sample sizes were insufficient. In the other categories, aspen-white spruce and aspen-jack pine were preferred for bedding ( $P < 0.05$ ) and non-feeding-bedding ( $P < 0.10$ ), respectively. In

terms of "presence only", aspen-jack pine was preferred ( $P < 0.05$ ), and black spruce and black spruce-tamarack were both avoided ( $P < 0.05$ ). All other tests showed that habitat use was in proportion to availability.

Table 1. Sex, Age, and Number of Relocations of Telemetered Moose.

Moose		Age	Number of Relocations	
No.	Sex <sup>a</sup>		Fall	Winter
17	M	- <sup>b</sup>	0	12
40	M	-	0	12
47	F	-	0	7
75	M	5.5	11	0
79	F	3.5	0	1
81	F	9.5	0	27
83	M	5.5	0	22
85	F	8.5	12	5
87	F	6.5	26	10
88	F	3.5	0	15
89	M	10.5	14	0
90	F	6.5	11	0
96	F	8.5	21	5
Total			95	116

<sup>a</sup>Sex and age data provided by T. M. Hauge, University of Wisconsin.

<sup>b</sup>Not presently available.

Winter Habitat Selection

Seven cow and two bull moose were relocated 116 times during the winter, with 140 observations of habitat use recorded in terms of "presence only".

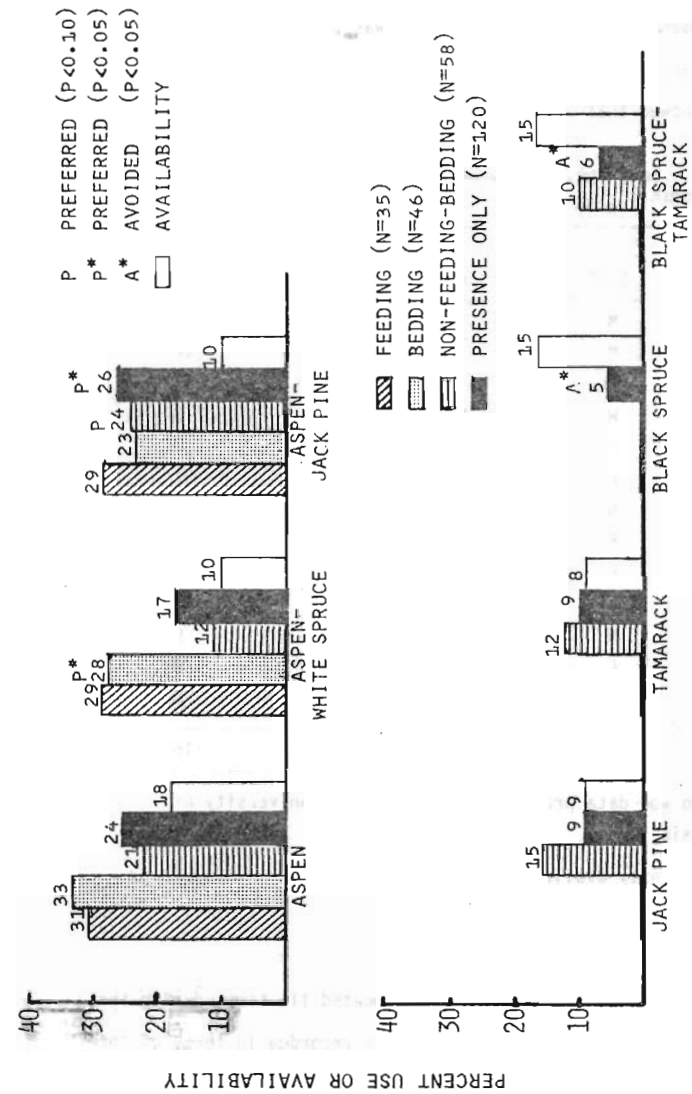


Fig. 1. Selection of habitat types during fall as indicated by percent use and by one of the following relationships between use and availability: 1) preference, 2) use in proportion to availability, or 3) avoidance. Preferred and avoided habitats are designated by "P" and "A", respectively. Habitats used in proportion to availability are not designated.



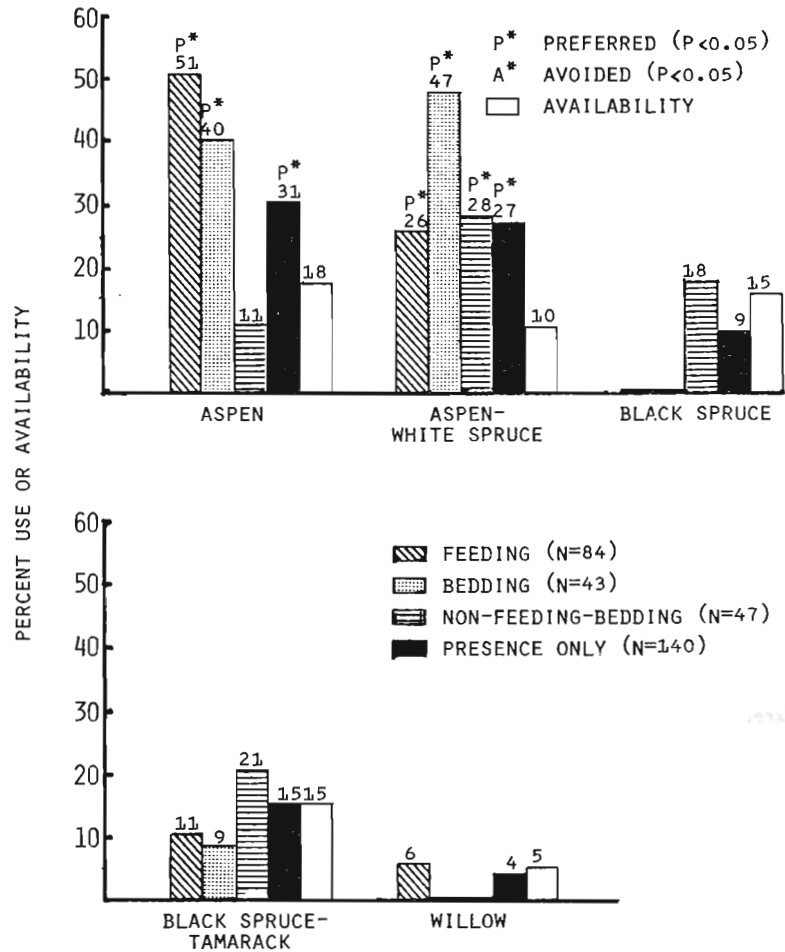


Fig. 2. Selection of habitat types during winter as indicated by percent use and one of the following relationships between use and availability: 1) preference, 2) use in proportion to availability, or 3) avoidance. Preferred and avoided habitats are designated by "P" and "A", respectively. Habitats used in proportion to availability are not designated.

The aspen, aspen-white spruce, black spruce, black spruce-tamarack, and willow habitats were all used sufficiently to be included in the analysis (Fig. 2). Aspen-white spruce was the only habitat heavily used for all categories of use and "presence only". Aspen was also heavily used for feeding, bedding, and "presence only"; but was only lightly used for non-feeding-bedding. The other habitats were lightly used in all respects, except for moderate use of black spruce-tamarack for non-feeding-bedding.

The use-availability analysis revealed that aspen-white spruce was the only habitat preferred ( $P < 0.05$ ) for all categories of use and "presence only". Aspen was preferred ( $P < 0.05$ ) for feeding, bedding, and "presence only". All the other tests showed that use was in proportion to availability.

Weather during most of the winter period was extremely mild. Mean temperatures at Ft. McMurray were 2.8°, 13.3°, and 4.2°C above normal for January, February, and March, respectively (Environment Canada, Atmospheric Environment Service, 1977). Mean snow depths on the study area never exceeded 25.2 cm in any habitat type (Nowlin 1977).

#### Food Habits

During the fall, 31 feeding sites were examined and 3,321 instances of use of browse were recorded (Table 2).

Saskatoon was the most heavily used species, accounting for 46 percent of the observations. Second in importance was beaked willow (*Salix bebbiana*) with 20 percent. All other species were used less than eight percent each.

Table 2. Use of Browse Species During Fall and Winter, And Availability of Browse During Winter.

Species	Percent of Available Browse <sup>b</sup>	Percent of Diet <sup>a</sup>	Fall	Winter
<i>Alnus crispa</i>	- <sup>c</sup>	Tr. <sup>c</sup>		2
<i>Amelanchier alnifolia</i>	9		46	57
<i>Betula papyrifera</i>	* <sup>d</sup>		6	Nu.
<i>Betula</i> spp. <sup>e</sup>	10		Nu. <sup>c</sup>	3
<i>Cornus stolonifera</i>	Tr.		Tr.	Nu.
<i>Corylus cornuta</i>	*		3	1
<i>Populus balsamifera</i>	Tr.		Nu.	1
<i>Populus tremuloides</i>	2		7	2
<i>Prunus pensylvanica</i>	*		7	Nu.
<i>Prunus virginiana</i>	*		Nu.	Tr.
<i>Rosa woodsii</i>	2		Tr.	Nu.
<i>Rubus</i> spp.	-		2	Tr.
<i>Salix bebbiana</i>	19		20	10
<i>Salix discolor</i>	*		3	1
<i>Salix planifolia</i>	30		3	15
<i>Salix maccalliana</i>	Tr.		Nu.	1
<i>Salix mackenzieana</i>	*		2	Nu.
<i>Salix myrtillofolia</i>	*		Nu.	3
<i>Salix serrissima</i>	Tr.		Tr.	Nu.
<i>Salix</i> spp.	-		Nu.	Tr.
<i>Shepherdia canadensis</i>	21		Nu.	1
<i>Viburnum edule</i>	3		Tr.	3
Number of feeding sites examined			31	46
Total instances of use			3,321	5,734

<sup>a</sup>Average aggregate percent (Martin et al. 1946).

<sup>b</sup>Availability measured as stems per hectare.

<sup>c</sup>Not measured (-); not used (Nu); Trace (Tr - less than 1%)

<sup>d</sup>Not encountered on browse plots.

<sup>e</sup>Includes *Betula glandulosa* and *B. pumila*.

Forty-six feeding sites were examined during the winter, with 5,734 instances of use recorded.

Saskatoon was again the most heavily used species, with 57 percent of the observations. It was followed by *Salix planifolia*, with 15 percent, and by beaked willow, with 10 percent. All other species were used less than three percent each.

When use was compared to availability, it appeared that saskatoon was preferred, beaked willow was used in proportion to its availability and *Salix planifolia* was used much less than available.

#### DISCUSSION

Aspen, aspen-white spruce, and aspen-jack pine were the most important habitat types during the fall. They were heavily used for most categories of use and in terms of "presence only". Aspen-white spruce was preferred for bedding, and aspen-jack pine was preferred for non-feeding-bedding and "presence only". Both these types probably would have been preferred for feeding also, had sample sizes been sufficient to complete the analysis.

Other habitat studies in northeastern Alberta and similar areas have reported variable results during the fall. In the same area as my work was completed, Hauge and Keith (1977) reported similar values for use of aspen, aspen-white spruce, and aspen-jack pine. However, their observations of use of the black spruce and black spruce-tamarack habitats were two to three times greater. In the Peace-Athabasca Delta, 110 km north of the study area, moose were primarily sighted in willow and willow-meadow habitats (Allison 1972). Coniferous habitat

types were most heavily used in northeastern Minnesota, with no preferences detected (Peek et al. 1976).

During the winter, the aspen and aspen-white spruce habitat types were clearly the most important. They were heavily used and were preferred in terms of "presence only" and for all categories of use except non-feeding-bedding in aspen.

As during the fall, other studies in Alberta have reported variable results. In my study area, Hauge and Keith (1977) reported the same pattern of use during February and March. However, during December they found less use of aspen and aspen-white spruce, and greater use of black spruce and willow. In the Peace-Athabasca Delta, willows and deciduous types were heavily used (Allison 1972). Deciduous habitats, primarily aspen and balsam poplar (*Populus balsamifera*), were also heavily used in central Alberta, with little or no use of coniferous or mixedwood types (Nowlin 1976, Penner 1971).

Several authors outside of Alberta have reported heavy use of dense habitats often dominated by conifers, and have related this use to deep snow and severe weather conditions (Coady 1974, Krefting 1974, Peek et al. 1976, Van Ballenberghe and Peek 1971). The same could be true of moose in northeastern Alberta in a more severe winter.

The most heavily used, and probably preferred, browse species during both fall and winter was saskatoon. Beaked willow and *Salix planifolia* were used less and were probably not preferred.

Other Alberta studies have reported similar patterns of forage use during winter, with some additions. In the Peace-Athabasca Delta, moose fed primarily on willow, red osier dogwood (*Cornus stolonifera*), paper birch (*Betula papyrifera*), and balsam poplar (Allison 1972).

Saskatoon was uncommon, but heavily used where it occurred. Saskatoon composed 30 percent of the diet in central Alberta, and was probably preferred (Nowlin 1976). Other less important species there were pussy willow (*Salix discolor*), beaked hazelnut (*Corylus cornuta*), and red osier dogwood. In southern Alberta, saskatoon composed 56 percent of the diet and was, again, probably preferred (Barrett 1972).

Food habits studies from outside Alberta have reported dissimilar results during winter. In northeastern Minnesota willows were the most important species yearlong, being most heavily used during September through December (Peek et al. 1976). Peek (1974), in his review of food habits of moose in Canada, reported that balsam fir (*Abies balsamea*), aspen, and paper birch were important.

It appeared that habitat use and selection during both fall and winter were related to the preference for saskatoon. The most important habitats were also the only habitats in which saskatoon was commonly found. Relationships between habitat use or selection, and forage availability have also been reported by Bassard et al. (1974), Kearney and Gilbert (1976), Peek et al. (1976) and Telfer (1967).

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