ECOLOGY OF MOOSE WINTER RANGE IN WELLS GRAY PARK, BRITISH COLUMBIA

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[Note from Ralph Ritcey sent to Trevor Goward on 10 June 2017: The four study areas are located as follows: A - circular square mile of basically lodgepole pine centred on the flats SW of Philip Creek bridge. B - circle centered near the old Forest Service lookout atop Green Mtn. C - the flat east of Murtle River opposite Pyramid Mtn. D – south-facing slopes northeast of French Meadow at the base of Kilpil Mountain].

Introduction

This paper reports on some aspects of the ecology of a winter range used by a migratory moose population. Wintering concentrations of moose on this range are often as dense as any to be found in Western Canada. Edwards (1952) estimated a population of 2,000 animals to be present on 660 square miles of winter range. An early study (Edwards and Ritcey, 1956) was concerned with migration and dealt mainly with the departure of the herd from the winter range. Here we are concerned with the population between the main fall and spring migrations. Examination of factors involved in selection of local wintering areas may contribute to the understanding of moose distribution on a wider geographic basis.

I wish to extend my thanks to R.Y. Edwards, B.C. Parks Branch, under whose direction the early part of the study was carried out. In addition, I gratefully acknowledge the help of the Wells Gray Park staff and of students summer assistants who contributed to several aspects of the study. The late Fay Hartman made a valuable contribution to the study of range use for three years. The capable assistance of Herb Green, Wells Gray Park, on many winter field projects is also worthy of especial recognition. D.J. Spalding and Donald Thom gave helpful criticism of the manuscript.

The present study was carried out by the Parks Branch, British Columbia Department of Recreation and Conservation from 1952 to 1962 and during the past two years (1963 – 1965) by the Fish and Game Branch of the same department.

Methods

Four study areas of one square mile each were established in locations representing areas used by moose in the lower, mid, and upper levels of their winter distribution. Some salient features of the study are outlined in Table I. Snow depths were recorded along with observations of animal tracks on the areas at irregular intervals throughout each

winter. Fecal pellet group counts were carried out over a period of several years to determine relative moose use of the study areas.

Data on moose and predator distribution over the winter range was obtained by ground reconnaissance and by four aerial surveys.

In addition to the snow ata collected on the four study areas, a climatological station was maintained at Hemp Creek in the center of the moose winter range.

Table I: Descriptive Characteristics of the Four Study Areas.

Study Area	Elevation	Topography	Date when last burned over	Willow cover %	Moose use index*
A	2,200' to 2,500'	Rolling, bounded on west by a sheer rock face.	1926	13%	24.0
B	2,800' to 3,600'	Top of a rounded mountain, falls steeply away to southeast.	1926	22%	57.1
C	2,900' to 3,000'	Flat – rolling.	1938	37%	71.3
D	3,000' to 3,400'	Gentle, south facing slopes.	1938	62%	76.4

*Moose Use Index = Pellet groups per winter in thousands.

Insert Figure: Fig. 1 Snow Depth 1953-1963

Results

The several major items influencing this wintering moose population are climatological factors, competition, predation, cover types, and successional changes.

1. **Climatological Factors**

Deep snows at high elevations are responsible for the initial movement of moose to their winter range, which is generally below 3,500 feet. A helicopter survey of the herd in January, 1965 found less than 5% of the moose above this elevation.

At lower elevations, snow is seldom deep enough to cause complete desertion of major wintering areas.

Snow depth curves for areas C, D and Hemp Creek are given in Figure 1. The snow curve for Hemp Creek represents an intermediate curve between areas A and B and is presented because of incomplete weather data available for these two areas.

There is a gradual build up of snow in all areas until early February. On area D the snow pack keeps building into March. This gradual build up of snow at higher elevations serves to move moose downward until spring migration begins.

The relationship of date, snow depth and abundance of moose on the study areas is presented in Table II.

Table II: Relationship of Date, Snow Depth, and Moose Abundance on Study Areas

Study Area	Time of Arrival of migrant moose	Snow depth	Time of peak moose abundance	Snow depth	Time of decline of moose numbers	Snow depth
A	Late November	0-6”	January to February	12-20”	March spring migration	6-12”
B	Early November	0-6”	January	16-30”	March	20-30”
C	Early November	0-6”	January to February	24-36”	Late February	30-40”
D	October	0-6”	December to January	24-40”	Early February	36-50”

The influence of snow depth on moose movement is complex due to the variable of snow density and structure. To generalize, settled or compact snow deeper than 26 inches begins to impede movement as the legs above the hocks are involved. Serious impairment of movement begins at snow depths greater than 36 inches in nearly all conditions, although moose have been observed to move in very soft snow 47 inches deep with little difficulty.

Snow crusting is usually a serious hindrance to movement in deep snow. Crusting can be of advantage if it allows moose to travel on top of the snow, and this often occurs in March. Injury due to crust cuts were not observed except in cases where some abnormality or wound was involved.

Although the minimum temperature recorded during the study was minus 49 degrees Fahrenheit (-45 Celsius), the effect of severe cold on moose distribution appeared minor. There is a tendency for moose to remain in open burns if the air remains calm throughout the cold weather. On a few occasions, winds occurred in connection with sub zero temperatures and forced moose to the shelter of broken topography.

2. Competition

The ranges of caribou, moose and mule deer overlap in fall and early winter. However, with deepening snows, there is a separation of species by altitude, topography and vegetation. Moose seldom remain in mature conifer stands preferred by caribou as witner range nor do caribou use moose populated burns.

On the other hand, moose and deer ranges do overlap throughout the winter. Usually, however, there are no deer on the most heavily used moose ranges in late winter. For example, no deer wintered in area D during the entire study period, and only in 1963 did deer remain in area C all winter. A few moose are frequently found on the best deer ranges but it is only in winters of heavy snow that they appeared in numbers. Because of this invasion of the deer range by moose in critical years, competition probably affects deer more than moose.

Moose and deer were trailed in snow to determine the most important items in their winter diets. Two foods, willow and false box, made up more than 75% of 34,000 browsed tips examined on moose feeding trails. These two foods were also the first in importance in the mule deer diet from data obtained on 130 deer feeding trails. A comparison of the rankings of browse species eaten by moose and deer is given in Table III, and the similarity of the two diets is apparent. Thus, where moose and deer occur together on winter range there is considerable competition for food.

Table III. Comparison of Moose and Deer Winter Diets From Study of Feeding Sign

Species	Order of importance for:	
	Moose	**Deer**
Willow (*Salix spp.)*	1	2
False Box (*Pachystima myrsinites*)	2	1
Paper Birch (*Betula papyrifera*)	3	6
Hazel (*Corylus californica*)	4	-
Red Osier Dogwood (*Cornus stolonifera)*	5	5

Varying Hares are present on the moose winter range in moderate abundance. The most productive range supports few hares however, and it is only on marginal range that competition may be of importance. Moose and hare browse preferences were compared by offering twigs of several species in 'cafeterias' to moose and hares. The 'cafeterias' were placed at ground level for hares and at about 4 ½ feet for moose. Browsed and unbrowsed twigs were counted for each species and ranked in order of preference for moose and hare (Table IV).

Table IV. Comparison of Moose and Varying Hare Preferences For 8 Browse Species

Species	Preference ranking for:	
	Moose	**Hare**
False Box (*Pachystima myrsinites*)	1	8
Willow- dry site species (*Salix spp.*)	2	4
Paper Birch (*Betula papyrifera*)	3	1
Aspen (*Populus tremuloides*)	4	3
Red Osier Dogwood (*Cornus stolonifera*)	5	5
Hazel (*Croylus californica*)	6	6
Willow- wet site species (*Salix spp.*)	7	7

Douglas Fir (*Pseudotsuga menziesii*)	8	2

The browse preferences of moose and Varying Hares are not closely linked. The most striking difference exists in the case of False Box which is almost ignored by hares but is most highly preferred by moose. Tree species are generally preferred over shrub species by Varying Hares but the converse is true for moose.

Hares, by retarding forest succession through selective browsing, benefit moose. This has a greater longer term impact on the population than the immediate effect of competition for available browse.

3. Predation

A Timber Wolf population of 12 to 17 animals was associated with the moose herd during the study period. The number of moose killed by wolves is unknown but is considerably below the average annual hunter harvest of 193 head. The moose population remained relatively static between 1952 and 1962 with the possibility of a slight downward trend since then. The trend is associated with advancing plant succession on the winter range and does not appear to be directly related to predation or to hunting.

Wolf distribution in winter is influenced by snow conditions as well as prey abundance. Wolves are frequently unable to kill moose in the deep loose snows of December and early January. At that time they often leave the areas of moose concentrations and are associated with deer at lower elevations. When wolves remain on the moose range they are sustained by carrion and crippled animals from the fall moose hunt, which leaves a minimum of five tons of waste annually.

By late winter, wolves are usually able to travel freely and can kill moose without difficulty in the deep, settled snow. At this time few moose remain in high, open burns, and when they do they are usually found close to mature coniferous stands which are used as escape cover. Food supplies here are often limited. Wolves, then, by forcing moose to use food deficient winter range may serve indirectly to limit population.

4. Cover Types and Successional Changes

Hatter (1946) has outlined the dependence of moose on early stages of forest succession for winter range. In mountainous regions where large number of moose concentrate on small areas, it is imperative that the ranges have a high production of food. In Wells Gray Park, upland willow is the only palatable browse plant capable of producing heavy annually removable crops of twigs. Highest moose densities are found in burns where the predominant vegetation is upland willow. Table I shows the relationship of use to the percent willow cover in each area. There is good general agreement between willow abundance and the amount of use given the areas, however, use in area D is influenced by snow depth. Moose are forced to leave the area before browse supplies are depleted.

Studies of moose utilization of various cover types occurring in the study areas were carried out in 1956. Pellet group counts were made on 1/100th acre plots and the dominant vegetation on each plot was recorded. The results, summarized in Table V, showed that the willow type received the highest use.

Table V. Use of Cover Types by Moose on Four Study Areas Combined as Indicated by Pellet Group Counts.

Cover type	Groups per acre	Percent use
Willow	182	41%
Aspen	67	15%
Bush	67	15%
Mixed	56	13%
Alder	33	7%
Regeneration	25	6%
Meadow	13	3%

The effect of succession on moose food production has been summarized by Cowan et al (1950) who concluded that, "the declining carrying capacity noted in a forest approaching its climax stage results from decreases in both the quantity and quality of food produced."

The decline of willow browse production in the 1926 burn in the vicinity of study area B has been documented since 1953.

Measurements of 100 marked willows have show a drip in available browse production of more than 50% in a 12 year period. The number of moose using this part of the range has decreased a corresponding amount. A spring track count which measures the herd wintering in the 1926 burn has dropped from 913 in 1953 to 544 in 1962. The decline in available browse is brought about by lessened vigor in old plants which are competing with larger tree species, and because growth on many willows is now too high for moose browsing. Over-browsing was not a major factor in the decline of browse production.

In 1957, clipping and weighing indicated the weight of current annual growth available to moose was only 67 kilograms per acre in the 1926 burn at Hemp Creek. This is capable of supporting approximately 6 moose days of browsing per acre. Clear cutting an experimental area of 67 acres created an immediate response of willow sprouting. Browse production increased to 300 kilograms per acre in the first fall after cutting. This was mostly in the form of large suckers. In the fifth fall twig production was estimated at 225 kilograms per acre with most of the production being twigs under 20 inches.

Moose use of the area has shown a marked increase over a four year period. Pellet group counts indicated an increase in use from 160 moose days in 1961 to 876 moose days in 1964. A helicopter survey in February, 1964 found 16 moose in the area with 10 more in the immediate periphery.

Summary and Conclusions

Depth of settled snow is the chief factor in determining winter moose distribution in Wells Gray Park. The upper altitudinal limit of the range is 3,500 feet and few moose are found in settled snow more than 40 inches deep. The abundance of upland willow is the most important single factor in determining use of areas on the winter range. Willow production and moose use of the burnt over areas decline with advancing plant succession. It is shown that clear-cutting could reverse these trends.

Although their winter food habits show many similarities, competition between moose and mule deer is minimal as deer usually remain below the moose range.

Competition between Varying Hares and moose is not directly important but hares may influence plant succession to the benefit of moose.

The role of wolf predation is poorly understood but it does not appear to be a direct factor in the control of moose numbers.

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