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Moose habitat characteristics relative to logging in the Liard River Basin, Southeastern Yukon

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Abstract

Habitat characteristics and browse use by moose were assessed as part of a 2 year study in the Liard Basin, Yukon. Habitat availability was quantified using digital forest cover information. Browse production was assessed using random plot techniques for selected riparian shrub zones and cutblocks harvested between 1968 and 1984. Foraging intensity was assessed as browse twig removal relative to availability. Browse production did not differ among cutblock age classes ranging between 10 and 21 or more years post logging. Production also did not differ from older cutblock age classes in selected riparian shrub zones. However, browse removal in riparian shrub zones differ significantly relative to cutblocks. Distances to either thermal or visual cover were within ranges observed in other studies, suggesting factors in addition to those measured in this study were important to moose foraging in cutblocks and associated riparian systems. Small cutblocks, specified levels of residual conifer cover, and long deferrals were recommended to ensure current and future timber harvesting activity maintain the value of riparian habitats to moose.

Introduction

Timber harvest operations in the Yukon historically have been small harvesting for local markets. Although locally the demand has remained small markets in southern Canada and overseas have grown dramatically. Recent economic growth in pacific rim countries and log export restrictions in neighbouring jurisdictions have fuelled dramatic increases in the demand for round logs from the Yukon (D.I.A.N.D. 1993).

The Liard Basin encompasses the floodplain of the Liard, Rancheria and Meister Rivers in the southeast corner of the Yukon. Growing season characteristics are among the best in the Yukon. Rich alluvial floodplain soils support stands of 25 - 30 m white spruce (*Picea glauca*), mixed stands of spruce and balsam poplar (*Populus balsamifera*), and shrub communities of willow (*Salix* spp.) and alder (*Alnus* sp.). These riparian communities are among the most productive timber producing regions in the Yukon (Oswald and Senyk 1977). The surrounding upland and lowland forests are dominated by lodgepole pine (*Pinus contorta*) and mixed communities of pine and black spruce (*Picea mariana*). Timber harvesting has occurred in the Liard basin on various scales for more than 40 years.

The Liard Basin is also some of best moose (*Alces alces andersoni*) winter range in the Yukon (Lortie et al. 1978). It has supported almost 10% of Yukon's annual resident moose harvest over the last 12 years and is locally important to Liard First Nation hunters (unpubl. data).

This study was initiated to obtain information on moose and moose habitat within the Liard basin to facilitate the integration of wildlife and forest management objectives within this region.

Methods

Habitat availability within the Liard Basin was assessed using a digital forest cover database. A 750 km^2 study area was used for detailed assessments. Principal cover types were summarized into either pure species forests (≥70% of the primary species), mixed forest (<70%), or non-forested (<5% forest cover). Previously logged areas were classed into 4 age categories according to harvest date: pre 1969 (>21 years), 1969-1974 (16-21 years), 1975-1980 (10-15 years) and 1981-1985 (5-9 years).

Five blocks from each class were randomly selected for intensive sampling. Ten plots within each cut block were selected and a series of nested plots were used to sample conifer regeneration (10 x 10 m), shrub production and use (2 x 5 m) and herbaceous cover (1 m^2). Browse removal on deciduous shrubs was the dependent variable against which browse production, conifer production, distance to edge or residual, and horizontal sight distance were used to assess the relative value of the cutblock age classes to moose. Available browse was considered current annual growth (CAG) twigs and browsing intensity was used to assess relative use among cutblock age classes. Conifer regeneration was determined for pine, black spruce and white spruce in seedling (0 - 0.6 m) and sapling (0.61 - 3.0 m) height classes. The distance to thermal cover, as the cut edge, and residual conifer stands of 0.2 ha or greater in size (Hamilton et al. 1980) was measured from 1:10,000 scale airphotos. Visual obscurity was determined using a cover board of alternating black and white squares (Nudds 1977).

Differences among cutblock age classes were determined using one way analysis of variance (ANOVA) and the SNK multiple range test. Where assumptions of independence and equality of variance were not met observations were ranked and compared using the non-parametric Kruskal-Wallis test.

Results

No difference in browse production was noted in the three oldest age classes, 10-15 yrs: 228 kg/ha, 16-21 yrs: 200.9 kg/ha and >21 yrs:175 kg/ha. The 5-9 yr age class had significantly fewer browse twigs ($P<0.001$) and lower estimated browse production (84.2 kg/ha). However, browse use differed among cutblock age classes ($P=0.02$). The 2 intermediate age classes sustained higher browse use (16 kg/ha and 17 kg/ha) than was found in either the oldest (10 kg/ha) or youngest (1.9 kg/ha) classes.

Riparian shrub stands were sampled opportunistically as they were some of the best feeding habitat available to moose. No significant difference ($P>0.9$) was found in browse production when riparian sites were contrasted with cutblock age classes 10 years or older (Riparian: 201 kg/ha). However, browse use was significantly greater ($P=0.03$) in riparian shrub habitats relative to logging regeneration (46 kg/ha vs 10-17 kg/ha).

The 5-9 year age class supported only 4 deciduous browse species and only one, littletree willow (*Salix arbusculoides*), was consistently browsed. The older-aged cutblocks supported greater forage diversity with between 8 - 12 browse species used during winter. However, browsing was dominated by 2 species, littletree and Alaskan willow (*Salix longistylus*). These accounted for more than 50% of the browse removed although they composed only 30% of the available browse. The browse species that were preferred by moose in cutblocks were also preferred in riparian shrub habitats. However, Alaskan and littletree willow accounted for 81% of the biomass of all species browsed in riparian habitats. Browsing intensity on these 2 species increased from a mean of 10% in cutblocks, to between 20% and 30% of the available twigs in riparian shrub habitats.

Conifer regeneration in harvested cutblocks was assessed in 2 height classes: seedling (0 - 0.6 m) and sapling (0.61 - 3.0 m). Cut-blocks older than 21 years contained significantly more of both classes of regeneration ($P<0.001$) (Table 1).

The distance to cover as either edge or residual, was significantly shorter in the >21 year age class than in the 5-9 year and 16-21 year age classes ($P<0.001$) but did not differ from the 10-15 year old cutblocks. When the distance to cut edge rather than cover was assessed, the 10-15 year old cutblocks were significantly shorter ($P<0.001$)(Table 2). Distances were shorter because of smaller average block sizes in this class. Overall, the distances to either edge or residual in cutblocks ranged between 75 and 150 m. Visual obscurity was significantly correlated with cutblock age ($P<0.001$, $R^2=0.79$). The 2 intermediate-aged cutblocks were similar but differed from the oldest and youngest age classes (Table 3).

Total browse production followed by visual obscurity were the variables most highly correlated with winter browse use in cutblocks. Age and distance to cover contributed little to the overall fit of the browse use model. Although the model $R^2 = 0.19$ was significant ($P<0.001$), there was considerable variation in the relationship not explained by these data.

Discussion

Browse biomass has been considered critical to moose in winter because of reduced forage availability and quality and the increased energy cost of foraging (Poliquin et al. 1977). Browse quantity is often the only reasonably quantifiable factor available on which to assess the moose habitat quality (Joyal 1987) and the between species differences in winter forage quality are minor relative to differences in availability (Hjeljord et al. 1982). The biomass of browsable twigs in all but the 5-9 year class, of approximately 200 kg/ha, compare favourably with production levels on other high quality moose ranges (Milke 1969, Vallee 1980, Crete and Jordan 1982). The low biomass and browsing intensity in the 5-9 year class was also observed by Hamilton et al. (1980). Moose forage in areas where they can maintain high intakes given other factors being equal and therefore the older cutblocks evaluated in this study or riparian shrub zones would be most profitable to moose.

Browse species selection may be an important determinant of browse use in cutblocks. In this study the intermediate and older age classes received substantially lower levels of use than was found in riparian shrub habitats (10% vs 20-30% of available biomass). Browsing strongly favoured Alaskan and littletree willow in either habitat . Similar preference was noted in Alaska (Risenhoover 1989) and the Northwest Territories (Penner 1978). However, the relatively lower browsing intensity on these species within logged areas suggest other factors may influence the use of preferred browse species. Lower browsing intensity in cutblock regeneration may be a response to cutblock characteristics but also may occur because of traditional habitat use patterns of moose.

Currently, cutblock shape and size vary because of forest stand characteristics, river and stream channel erosion patterns, and recommendations and restrictions imposed by local forest and wildlife managers. Although differences in cover distance were found among cutblock age classes, these distances were within the often cited critical range of 80 m to 200 m (Hamilton and Drysdale 1975, Hamilton et al. 1980, Eastman and Ritcey 1987). The preference for browsing in sites that have thermal cover distances less than 150 m suggest 300 m to be the optimal maximum distance between cut edges. Although these values suggest moose in the Liard Basin would access

Table 1. Conifer regeneration (stems/ha) in 4 cutblock age classes for seedlings (0 - 0.6 m) and saplings (0.61 - 3.0 m) from blocks harvested in the Liard Basin, Yukon.

Cutblock age class (yr)	Growth stage			
	Seedling	SE	Sapling	SE
5-9	762 A	206	673 A	224
10-15	655 A	157	944 A	214
16-21	481 A	103	861 A	164
>21	1641 B	216	3492 B	381

note: mean differences are significant when letters within a column differ

Table 2. Minimum distance to residual timber and cut block edge in logged habitat of the Liard Basin.

Age class (yrs)	Mean distance (m)[1]		SE		N	
	edge	residual	edge	residual	edge	residual
5-9	177.5 A	168.2 A	35.4	37.0	38	11
10-15	103.5 B	121.5 AB	8.9	16.2	59	37
16-21	156.3 A	131.7 A	17.4	14.1	72	53
>21	171.3 A	78.4 B	17.3	7.3	71	79

[1] Means within a column followed by different letters differ significantly (P<0.05)

Table 3. Visual obscurity measured as distance to 50% cover for logged habitat in the Liard Basin

Age class (yrs)	Mean distance[1] (m)	SE	N
5-9	87.7 A	5.8	36
10-15	31.9 B	3.0	19
16-21	29.2 B	2.0	52
>21	18.4 C	1.0	45

note: mean differences are significant when letters within a column differ significantly (P<0.05)

adjacent conifer edge or residual thermal cover from cutblocks within acceptable ranges, other physical and behavioral factors influence browse use in cutblocks. Thompson and Vukelich (1981) found that snow altered how cow/calf pairs used adjacent cover.

Cutblocks covering less than 100 ha have been considered optimal for moose whereas late winter habitats having larger cutblocks tended to be vacant (Peek et al. 1976, Parker and Morton 1978, Eastman and Ritcey 1987). This study found that acceptable sight distances within cutblocks ranged between 32 and 88 m. However, because an index of 50% cover was used to assess this parameter, screening distances of up to 100 m provide reasonable security to moose.

Conifer regeneration within cutblocks was relatively low with the exception of the oldest age class. Conifer regeneration sufficiently tall to create visual barriers of 2-4 m height would require 15 to 25 years under growing conditions in the Liard Basin (unpubl. data) and forest cover to the pole timber stage (10-15 m ht) are projected to require more than 40 years.

Under conditions in the Liard Basin and other areas where riparian white spruce stands are being harvested in the Yukon, the current policy and guidelines restricting block size to 15 ha is appropriate for local conditions. Future forest policy aimed at maintaining an interspersion of significant stands of mature forest cover, until regeneration of adjacent forest blocks attain the stage of dense canopy pole forest, would produce a mix of riparian habitats least likely to be deleterious to moose and other associated wildlife populations.

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References

Crete, M. 1988. Forestry practices in Quebec and Ontario in relation to moose population dynamics. For. Chron. 64:248-250.

Crete, M. and P.A. Jordan. 1982. Production and quality of forage available to moose in southwestern Quebec. Can. J. For. Res. 12:151-159.

D.I.A.N.D. 1993. Towards the development of a policy for export of whole-logs, wood chips, and fuel wood from the Yukon Territory: A public discussion paper. Forest Resources, Northern Affairs Program. 47pp.

Eastman, D.S. and R. Ritcey. 1987. Moose habitat relationships and management in British Columbia. Swed. Wildl. Res., Suppl. 1:101-117.

Hamilton, G.D. and P.D. Drysdale. 1975. Effects of cutover width on browse utilization by moose. Proc. North Am. Moose Conf. 11:5-26.

Hamilton, G.D., P.D. Drysdale, and D.L. Euler. 1980. Moose winter browsing patterns on clear-cutting in northern Ontario. Can. J. Zool. 58:1412-1416.

Hjeljord, O., F. Sundstol and H. Haagenrud. 1982. The nutritionial value of browse to moose. J. Wildl. Manage. 46:333-343.

Joyal, R. 1987. Moose habitat investigations in Quebec and management implications. Swed. Wildl. Res., Suppl. 1:139-152.

Lortie, G., M. Hoefs, T. Wagner, W. Klassen, and L. Mychasiw. 1978. Wildlife inventories on G.M.Z. 8 and G.M.Z. 10, Yukon Territory with an evaluation of present levels of sheep harvest (1976-1977). Unpubl. Rep.,Govt. of Yukon, Dept. Ren. Res.

Milke. G.C. 1969. Some moose-willow relationships in the Interior of Alaska. M.S. Thesis, Univ. Alaska, Fairbanks. 79p.

Nudds, T.D. 1977. Quantifying the vegetative structure of wildlife cover. Wildlife Society bulletin Vol. 5:113-117. 546

Oswald, E.T. and J.P. Senyk. 1977. Ecoregions of the Yukon Territory. Fisheries and Environment Canada, Victoria. 115 pp.

Parker, G.R. and Morton L.D. 1978. The estimation of winter forage and its use by moose on clearcuts in northcentral Newfoundland. Journal of range manage. 31:300-304.

Peek, J.M., D.L. Urich, and R.J. Mackie. 1976. Moose habitat selection and relationships to forest management in northeastern Minnesota. Wildl. Mono. 48, 65 pp.

Penner, D.F. 1978. Some relationships between moose and willow in the Fort Providence, NWT area. M.Sc. Thesis. University of Alberta, Edmonton, Alberta. 183 pp.

Poliquin, A., B. Scherrer and R. Joyal. 1977. Characteristics of winter browsing areas

of Moose inwestern Quebec as determined by multivariate analysis. Proc. N. Am. Moose Conf. and Workshop. 13:128-144.

Risenhoover, K.L. 1989. Composition and quality of moose winter diets in interior Alaska. J. Wildl. Manage. 53:568-577.

Thompson, I.D. and M.F Vukelich. 1981. Use of logged habitats in winter by moose cows with calves in northeastern Ontario. 59:2103-2114.