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Interrelationship of Forage and Moose in Game Management Unit 13

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RESEARCH PROGRESS REPORT

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SUMMARY

Willow treatments within exclosures in Tyone Creek and Oshetna River drainages were clipped at 30, 60,and 90% to simulate light, medium, and heavy rates of utilization by moose. Effects of sustained utilization at these rates will be determined. Percent winter utilization of feltleaf willows (*Salix alaxensis*) outside exclosures was 25.3% and 26.6%, respectively, for Oshetna River and Tyone Creek floodplains. Tall riparian willows have received light utilization for the last 3 consecutive years because moose have had relatively unlimited access to extensive upland stands of diamondleaf willow (*Salix pulcra*) during the same period. These observations, combined with the fact that moose in the study area have continued to have low reproductive rates, indicate that some nutritional factor(s) other than winter browse availability is limiting moose productivity.. Twig counts and shrub density estimates should be made for purposes of estimating browse and nutrient availability during winters when moose distribution is restricted by snow. Clipping treatments in exclosures should be maintained for the next 2 years to determine effects on shrub productivity, browse availability, and browse nutrient quality. Summer diets and consumption rates should be estimated by a combination of bite counts, feeding minutes and feeding site examinations. Summer and fall diet quality should be examined for effects on growth and reproduction of moose. Summer and winter foods should be collected and analyzed for crude protein, tannin, and digestible energy to determine possible nutrient limitations to moose in Unit 13.

Key words: *Alces alces*, browse utilization, diamondleaf willow, feltleaf willow.

CONTENTS

BACKGROUND

The Alaska State Board of Game has selected human consumptive use as the priority for wildlife management in Game Management Unit 13 (GMU 13). In accordance with this priority, the Alaska Department of Fish and Game (ADF&G) must determine what biological potential may exist for increasing the productivity and/or harvest of game species, including moose. Management biologists question if moose in Unit 13 are limited by forage resources, predation, or a combination of both.

Availability of nutrients to moose is one aspect of ecological carrying capacity that must be determined before these questions can be answered. Nutrient availability is affected by forage productivity and by factors that affect availability to the animal, including snow depth and previous utilization history. Assessment of these factors will be useful in development or modification of strategies to manage harvest and habitat for the welfare of moose in Unit 13.

According to Bishop and Rausch (1974), range condition has operated as a limiting factor to the moose population in Unit 13 in the past. Ballard et al. (1991) believed the degree of this limitation was unclear but recognized the significance of severe winters and their influence on forage availability as probable causes of declines in Unit 13 moose productivity. They also recognized the significance of habitat decline resulting from fire suppression and subsequent vegetation succession.

Prior browse utilization can affect the quantity and quality of food available to moose (Moen et al. 1990, Wolff and Zasada 1979, Molvar et al. 1993, Danell et. al. 1994, McKendrick et al. 1980),

Prior browse utilization can affect the quantity and quality of food available to moose (Moen et al. 1990, Wolff and Zasada 1979, Molvar et al. 1993, Danell et. al. 1994, McKendrick et al. 1980), causing increased mortality and decreases in moose reproduction (Franzmann and Schwartz 1985, Boer 1992). Forage–moose relationships are complicated by factors of snow accumulation in winter (Bishop and Rausch 1974, Schwab and Pitt 1991, Coady 1974, Telfer 1970 and 1978) and amount of solar radiation in summer (Bo and Hjeljord 1991). Ecological carrying capacity for moose is also affected by frequency and intensity of fire (Spencer and Hakala 1964, Wolff and Zasada 1979).

Milke (1969) ranked feltleaf and diamondleaf willows not only as highly preferred but as the 2 willow species being most "important" to moose in Interior Alaska. Important willows are palatable and preferentially browsed and are in such abundance or stature to produce abundant useable browse. In the study area, feltleaf willow is primarily a riparian species and typically grows 2 to 3 m tall, providing abundant browse above the level of snow accumulation. By contrast, diamondleaf willow primarily occupies hillsides and typically grows to heights of only 1 m or less. Both species are dominant in their respective habitats in the study area.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

To identify relationships of moose browse availability and quality to utilization histories, I will test the following null hypotheses:

H1. Productivity of principal winter browse species in Unit 13A is not limited by previous levels of utilization by moose (tested at 4 levels of utilization).

H2. Crude protein, tannin, and digestible energy of current annual growth are not affected by browsing history of the shrub.

H3. Winter nutrient consumption rates are not limited by utilization in prior years.

PROCEDURES

Seasonal Diets

I am determining early, mid, and late winter diets of moose by backtracking them and counting freshly browsed twigs at feeding sites. This will allow determination of forage species, plant parts, foraging rates, and diet mixing (Hobbs and Spowart 1984). Quantities of browse produced and percent utilization are being determined from twig counts in spring (Shafer 1965).

Diet Quality

Principal foods (>5% of diet) and composite diets will be analyzed for tannin, digestible energy, and digestible protein (Robbins 1983). Late winter collections of browse will be used in nutritional analyses.

Winter Browse Availability

Availability of winter browse species in principal vegetation types (riparian tall willow, hillside diamondleaf willow, and black spruce–willow communities) used by moose in Unit 13 in winter is being determined by twig counts and shrub density estimates. Availability is being determined by height strata for stems less than 4 cm diameter at 1.5 m above ground (dbh), but only up to 2.5 m height for stems greater than 4 cm dbh.

Effects of browsing and clipping on feltleaf willow availability will be evaluated in terms of shrub survival, total current annual growth (CAG), distribution/availability of CAG, and browse quality. Feltleaf willow will be evaluated in this manner because it is the principal source of browse in severe winters when deep snow covers diamondleaf willow in upland sites. As such, these plants are most likely to be overbrowsed and most indicative of "carrying capacity." Significance of leaf dimensions, leaf weight, and numbers of flowering stalks and seeds (Cook 1977) will also be investigated to determine their value as indicators of willow vigor.

Interpretation of browsing effects requires knowledge of browsing histories of individual shrubs (Shepherd 1971). Within the principal study area, browsing histories will be approximated through interpretation of shrub structures (numbers and chronological positions of previous browsing points) and supported by interpretation of historical moose trend-count data. Browsing effects will also be determined through clipping treatments because histories of clipped plants are more certain. We constructed 4 exclosures (600 m^2) within riparian willow stands to protect clipping treatments from browsing interference by moose and caribou.

Inside each exclosure, 4 treatment levels of utilization (none, light, moderate, and heavy) are being imposed. "Heavy" clipping treatments are intended to simulate 90% utilization, or approximately 15% more than what Wolff and Zasada (1979) suggested represents the carrying capacity of feltleaf willow. "Light" and "moderate" levels of clipping approximate 30 and 60% utilization, respectively. Actual utilization as currently occurs outside the proposed exclosures will be treated as inference covariates in analysis of shrub responses. Shrub response will be analyzed following a repeated measures, randomized block design, blocking on site (exclosure) in each vegetation type.

RESULTS AND DISCUSSION

SEASONAL DIETS

Percent of feltleaf willow twigs browsed in winter 1997–1998 remained low for a third consecutive year (Table 1), prompting me to reconsider my initial assumption that potential food limitations occur primarily in winter. During the past 3 years, no 2-year-old cows and less than 50 % of 3-year-old cows have reproduced, and only 25% of all cows have produced twins (Ward Testa, pers commun), indicating nutritional limitation. However, in the past 3 winters, snow has not prevented moose from browsing extensive hillside stands of diamondleaf willow or limited them to riparian feltleaf willow stands as in severe winters such as 1994–1995.

Preferential use of hillsides by moose during the past 3 mild winters indicates preference for diamondleaf willow over feltleaf willow. Palatability and availability of feltleaf willow evidently is

not significant enough to attract and concentrate moose in narrow riparian zones, unless availability of other browse is reduced by snow accumulation. Nevertheless, feltleaf willow provides the only source of browse during winters when snow accumulates more than 60 cm, bending down and covering most diamondleaf willows.

Reconnaissance of an important moose wintering and summering area in the Oshetna River Valley in June 1998 indicated significant utilization of diamondleaf willow by leaf stripping. The extent of this utilization was not suspected from observing the shrubs in winter. The level of stripping already evident in early summer suggested heavy utilization and limited availability of this principal food source could occur by late summer when moose typically prime their condition for winter. During summer caribou will further exacerbate these conditions as they leaf strip willows on their way through the area.

DIET QUALITY

Collected browse has not yet been analyzed for digestible energy or digestible protein.

BROWSING EFFECTS

Clipping treatments were imposed in all exclosures in late March 1998. Number and length of current annual twigs will be measured in winter 1999, and clipping will be repeated at that time. By summer 1999 the enclosed shrubs will have had 3 growing seasons to respond to sustained levels of simulated moose utilization. Beginning in July 1999, we will assess rates of flowering, sizes, and numbers of leaves per stem, rates of stem mortality, and basal sprouting for clipping treatments. Leaf and twig materials will also be collected at that time for nutritional analyses.

RECOMMENDATIONS

Twig counts and shrub density estimates should be made for purposes of estimating browse and nutrient availability during winters when moose distribution is restricted by snow. Clipping treatments in exclosures should be maintained for the next 2 years to determine effects on shrub productivity, browse availability, and browse nutrient quality.

Summer diets and consumption rates should be estimated by a combination of bite counts, feeding minutes and feeding site examinations. Summer foods, as will as winter foods, should be collected and analyzed for crude protein, tannin, and digestible energy to determine possible nutrient limitations to moose.

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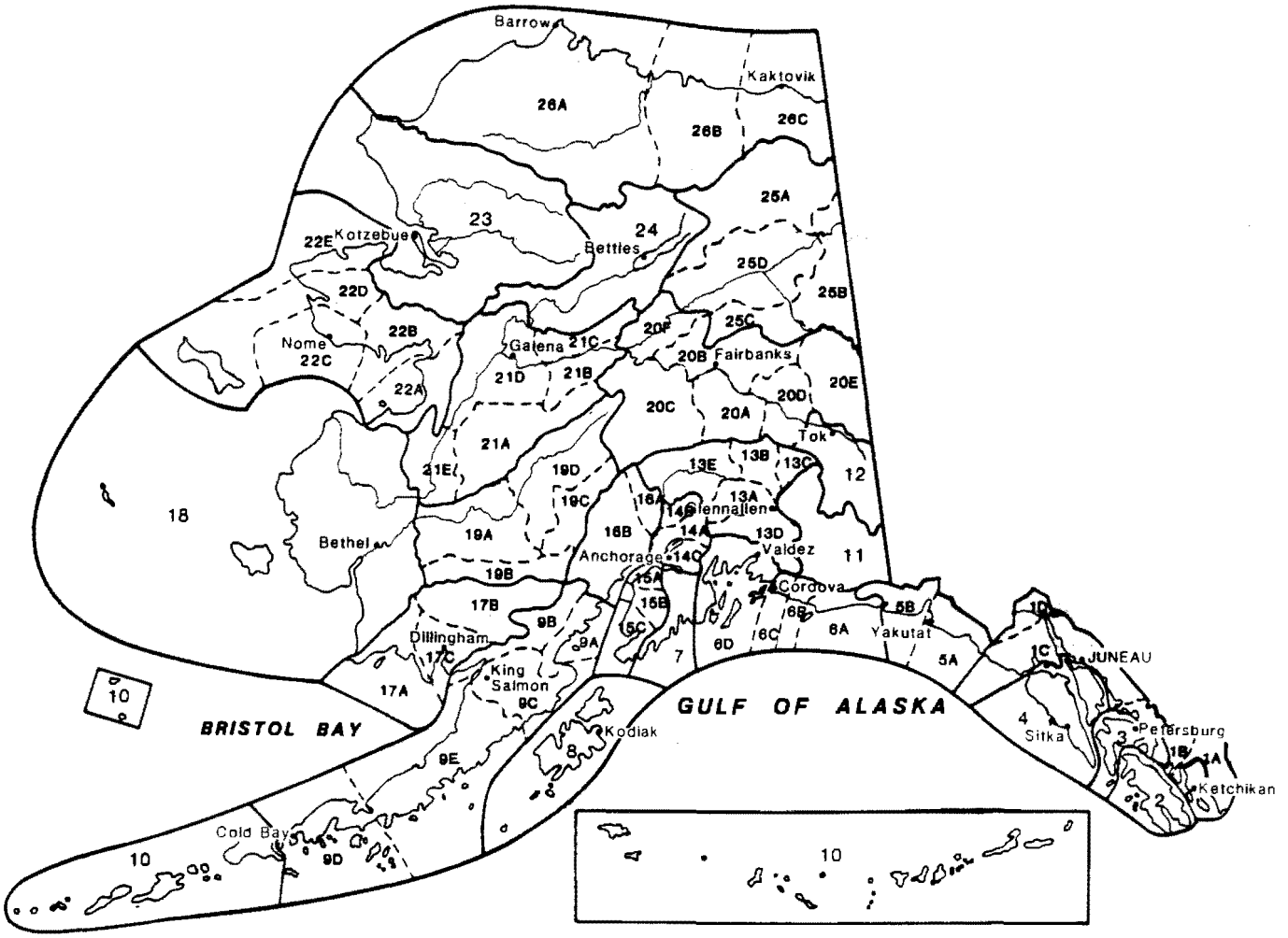
Table 1 Percent utilization of feltleaf willow by moose. Standard deviations are in parenthesis.

	Oshetna River				Tyone Creek			
Twig height (m)	1994	1995	1996	1997	1994	1995	1996	1997
0.5–1.5	n.d.	9.3 (11.1)	9.7 (10.0)	12.7 (9.2)	n.d.	4.3(4.5)	5.2(5.0)	7.2(7.6)
1.5–2.5	n.d.	10.5 (3.4)	11.2 (4.6)	12.2 (14.4)	n.d.	5.0(4.2)	6.6(6.5)	8.7(9.2)
Terminal	82.0 (22.2)	13.0 (11.6)	31.5 (13.8)	25.3 (9.6)	76.2 (16.2)	12.0(12.8)	28.7(10.2)	26.6(10.0)

Alaska's Game Management Units



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