Research Work Order 32: Differences between coastal and inland sites within caribou summer habitat on the Arctic coastal plain

Michael D. Smith, Alaska Cooperative Wildlife Research Unit
Raymond D. Cameron, Alaska Department of Fish and Game
David R. Klein, Alaska Cooperative Wildlife Research Unit

INTRODUCTION

During July and early August, Central Arctic Herd (CAH) caribou (*Rangifer tarandus granti*) move primarily in response to the level of insect activity (mainly mosquitoes, *Aedes* spp.) (Smith and Cameron 1985). Under mosquito harassment, caribou aggregate and move towards the Arctic coast and may continue travelling along the coast into the prevailing northeasterly wind. Under extreme harassment, caribou wade into the Beaufort Sea to escape mosquitoes. Dau (1986) found that areas within 2 km of the coast had significantly lower mosquito levels than inland areas. With lower temperatures or higher wind velocities, mosquito activity declines and caribou disperse inland (Dau, 1986; Roby, 1978; White et al., 1975,).

When mosquito activity is low, access to inland areas may allow caribou to optimize foraging during the brief summer period of high plant productivity. Therefore, free access to both inland and coastal habitats may be critical for summer growth and fattening. A land cover map based on interpretation of LANDSAT satellite imagery of the summer range of the Central Arctic Herd (Walker and Acevedo, 1987) shows a greater occurrence of drier habitat inland than in coastal areas (Webber and Walker, 1975). These habitats consist of moist or dry tundra with tussock sedges and dense low shrublands. They are characterized by a higher relative proportion of willow and forb species, which are of high forage quality and should allow for better foraging than in coastal areas (Chapin et al., 1975, 1986; White et al., 1975). Data on the relative value of CAH summer habitats, from inland to coast, are necessary to assess the probable effects of impairment of movement of caribou through oilfield complexes (Smith and Cameron, WSU IIb). Accordingly, this research was designed to determine the spatial and temporal differences in quality and quantity of vegetation used by caribou during the summer insect season.

Objective: To determine whether an inland site provides significantly better foraging habitat for CAH caribou during the insect season than a coastal site.

Hypotheses to be tested:

- H_1: Quality of key forage species, in terms of digestibility and nutrient content, is higher at the inland site than at the coastal site.
- H_2: Quantity of key forage species, in terms of available forage biomass and percent cover is higher at the inland site than at the coastal site.

In this report, we present our results concerning plant cover.

METHODS

Study Site

The study sites were located approximately 50 km west of Prudhoe Bay, Alaska, in the Kuparuk Development Area (Fig. 1). This is a subsidiary field of the main Prudhoe Bay field. Bounded by the Beaufort Sea on the north and the Kuparuk River on the east, this is part of the

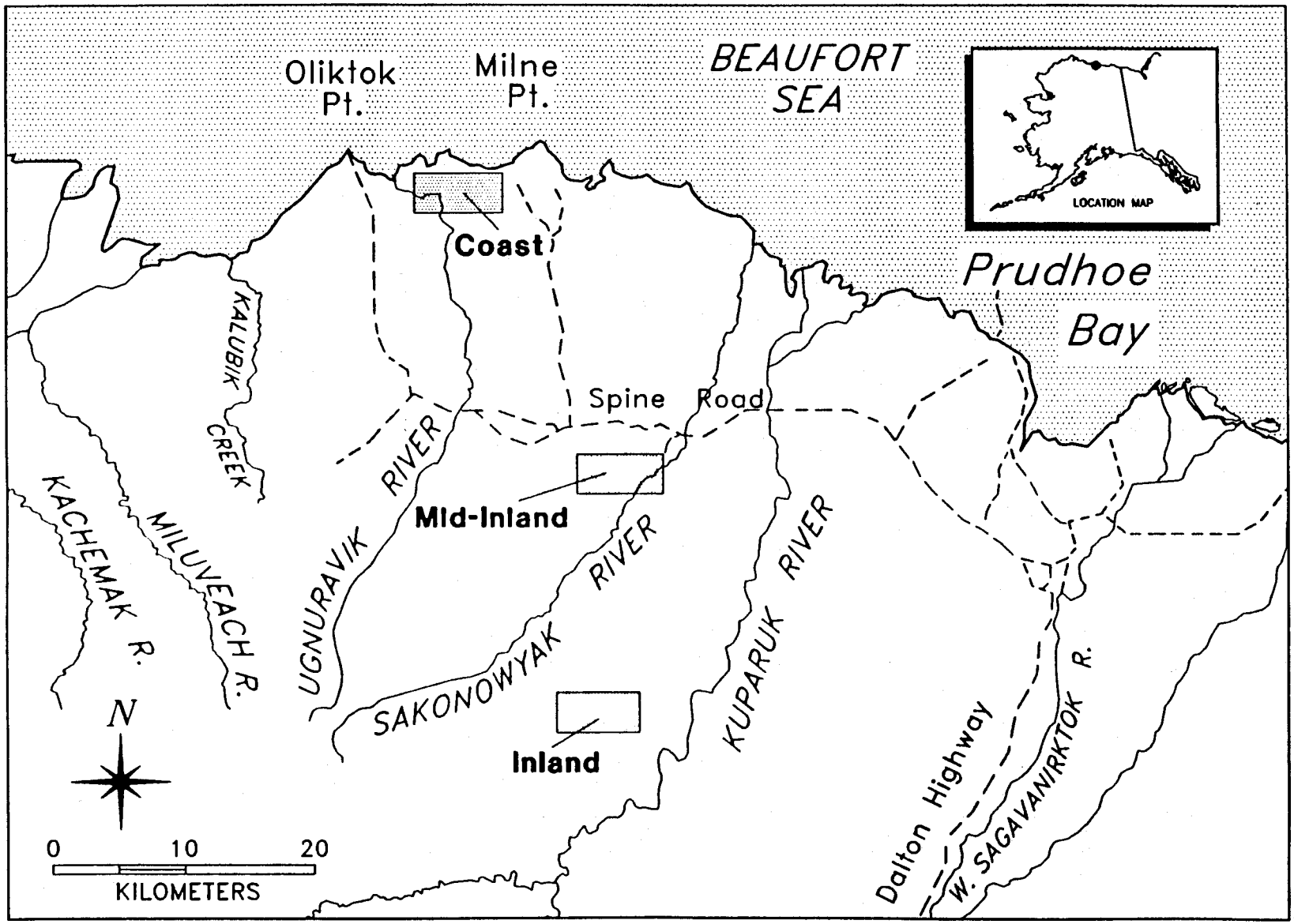

Figure 1. **Location of study sites in the Kuparuk Development Area, Alaska.**

Data Analysis

Preliminary analysis of the cover data has been completed. Species sampled on the transects were classified by forage type (Table 2), and a multiple analysis of covariance (MANCOVA) of differences in percent cover by site (Coast, Mid-Inland, Inland) was done while controlling for the effects (covariates) of year and sampling time (Johnson and Wichern, 1982). The data were square-root arcsine transformed to meet the univariate assumptions of homogeneity of variances as well as the Multivariate test for Homogeneity of Dispersion Matrices. The data were also checked for multicolinearity by examining the correlation matrix for the independent variables.

Table 2. Plant species list by forage type in the Kuparuk Development Area, Alaska.

WILLOWS:	**FORBS:**
Salix arctica	*Astragalus umbellatus*
S. lanata	*Hedasyum sp.*
S. planifolia	*Oxytropis sp.*
	Papaver macounil
SEDGES:	*Pedicularis sp.*
Carex aquatilis	*Polygonum viviparum*
C. atrofusca	*P. bistorta*
C. bigelowii	*Pyrolia grandiflora*
C. misandra	*Ranunculu nivalis*
C. rotundata	*Saussurea angustifolia*
C. saxatilis	*Saxifraga oppositifolia*
C. scirpoidea	*S. cernua*
C. vaginata	*S. hirculus*
Eriophorum angustifolium	*Senecio atropurpureus*
E. scheuchzeri	
E. vaginatum	**LICHENS:**
	Alectoria nigricans
SHRUBS:	*Cetraria cucullata*
Cassiope tetragona	*C. islandica*
Dryas integrifolia	*C. nivalis*
Ledum palustre	*Cladina rangiferina*
Silene acaulis	*Dactylina arctica*
Vaccinium vitis-ideae	*Hypogymnia subobscura*
	Masonhalea richarsonii
	Peltigera aphthosa
	Stereocaulon sp.
	Thamnolia Sp.

RESULTS

Vegetative Cover - Forage Type

Individual analysis of variance (ANOVA) statistical procedures were conducted to test for differences in percent cover of each forage type among the three sites. Percent cover of all forage types, except lichen was different ($P \leq 0.04$) among sites (Table 3). To determine the direction and magnitude of these differences, a Tukey HSD (Honest Significant Difference) multiple comparison test was used (Fig. 2) when the ANOVA was significant.

Table 3. Results of ANOVA of percent cover by caribou forage type among study sites.

VARIABLE	HYPOTH. MS	ERROR MS	F	P-VALUE
FORB	0.010	0.001	13.94	<0.001
LICHEN	0.001	0.001	0.57	0.57
MOSS	0.080	0.007	11.51	<0.001
SEDGE	0.004	0.001	3.29	0.04
SHRUB	0.022	0.002	13.55	<0.001
WILLOW	0.022	0.001	25.81	<0.001

Vegetative Cover - Individual Species

Although overall percent cover of sedges was highest at the inland site (Fig. 2), not all species within this forage type follow the same trend (Fig. 3). *Eriophorum vaginatum* and *Carex bigelowii* were more prevalent inland, while *C. aquatilis* was more common at the coast. The occurrence of *E. angustifolium* was similar in all sites.

Overall percent cover of willows was highest at the coast site and this result was due to the dominance of one species, *Salix planifolia*. *S. arctica* was most abundant at the mid-inland site, and *S. lanata* was most prevalent at the inland site (Fig. 4).

DISCUSSION

The results suggest increasing plant cover with distance from the coast for forbs, shrubs (other than willow), sedges, and mosses. Forbs were most abundant at the inland site. Mean shrub cover was highest in the mid-inland site, but not statistically different than the inland site, and lowest at the coast site. In contrast, cover of willows was highest at the coast site.

Sedges were generally associated with drier habitats, *Carex bigelowii* and *Eripohorum vaginatum*, species thought to be important due to their early availability during snow melt (Kuropat and Bryant, 1980), were most prevalent at the inland site. In contrast, *C. aquatilis*, a sedge common in wetter habitats, was most common at the coast site and *C. aquatilis* communities have been shown to be used less than predicted from their availability (White *et. al.*, 1975).

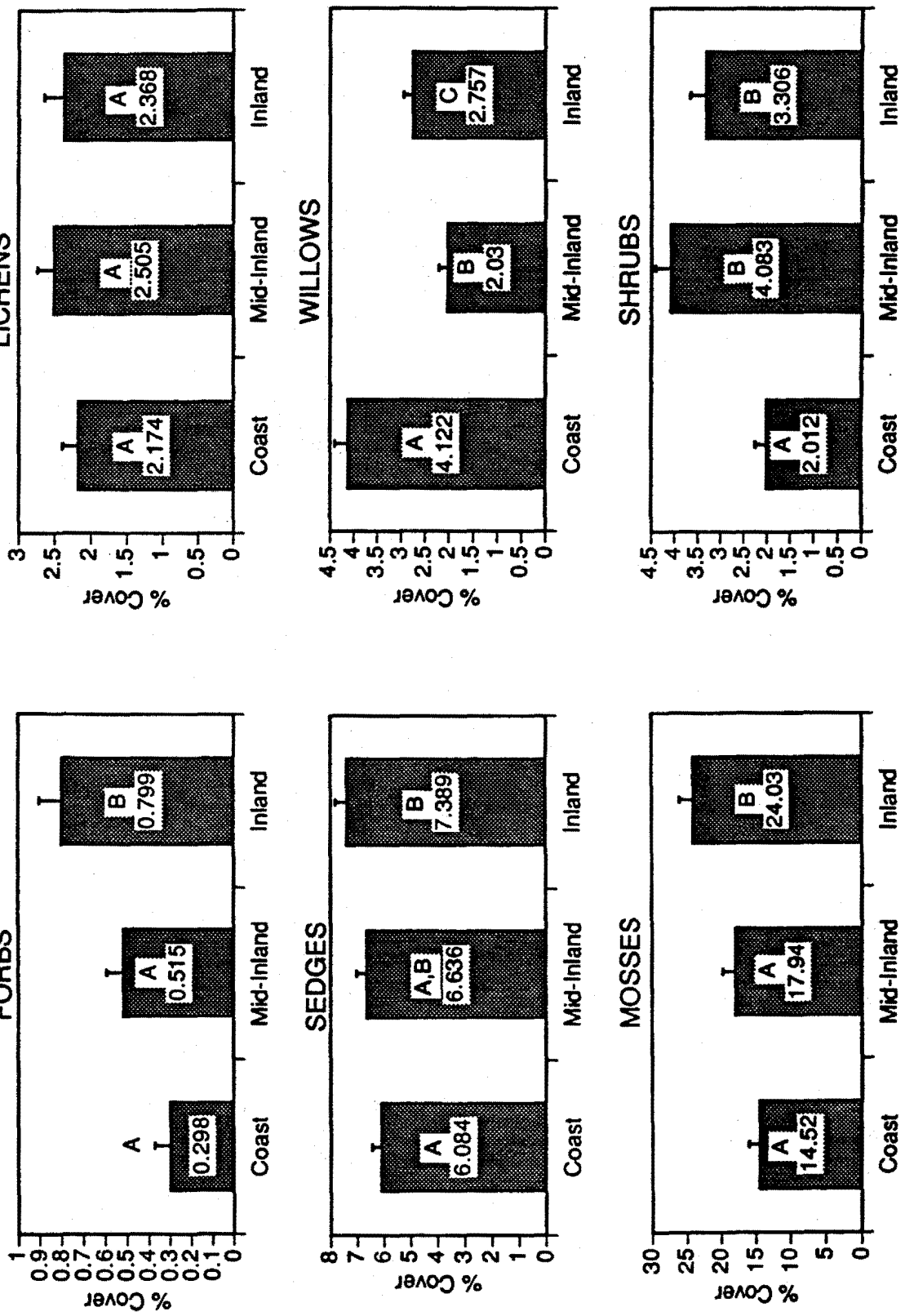

Figure 2. Mean percent cover for each forage class by sample site in the Kuparuk Development Area, Alaska. Values listed on bars denote mean percent cover. Means with the same letter are not significantly different (ANOVA) at $P > 0.05$.

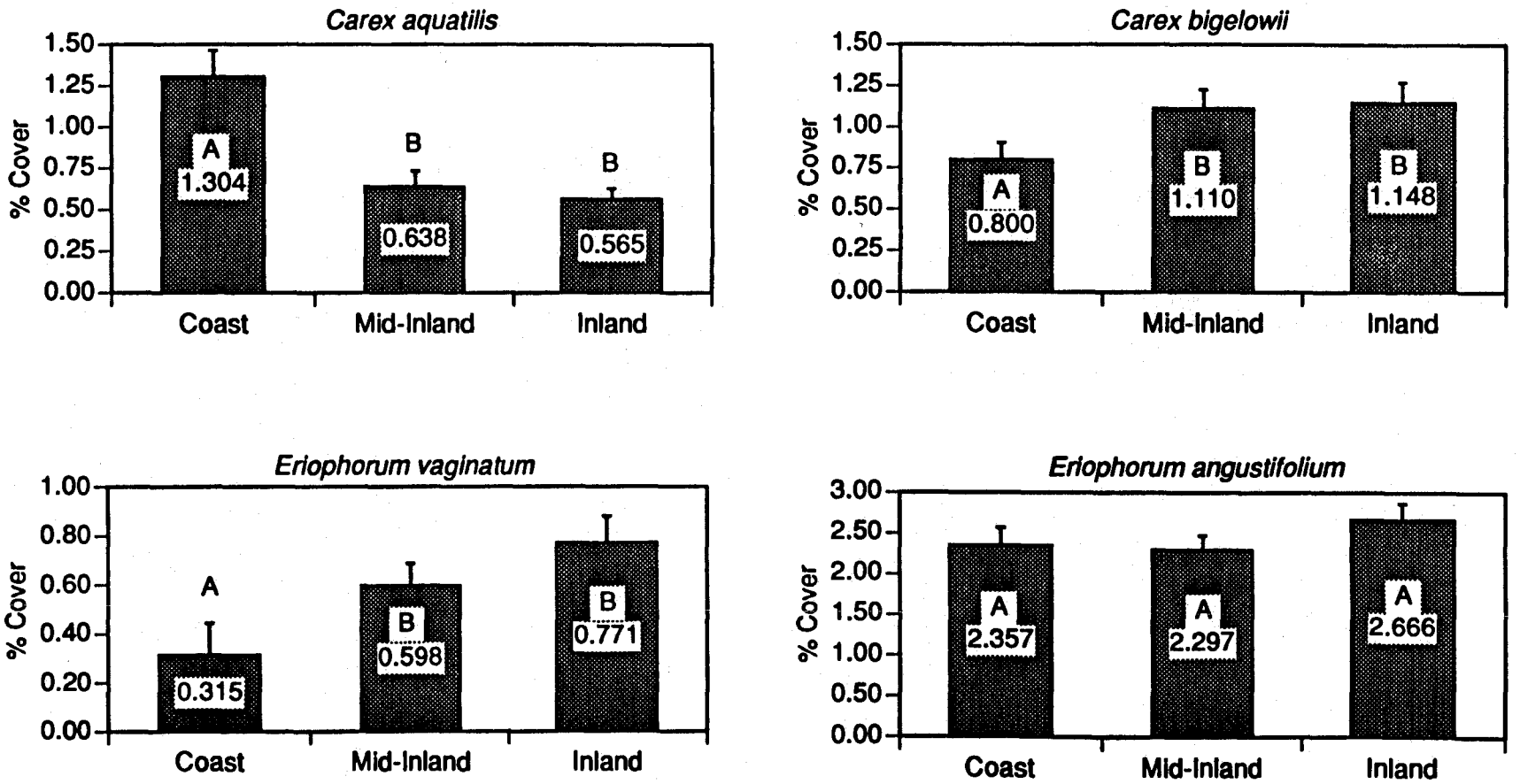

Figure 3. **Mean percent cover of individual sedge species by sample site in the Kuparuk Development Area, Alaska. Values listed on bars denote mean percent cover. Means with the same letter are not significantly different (ANOVA) $P > 0.05$.**

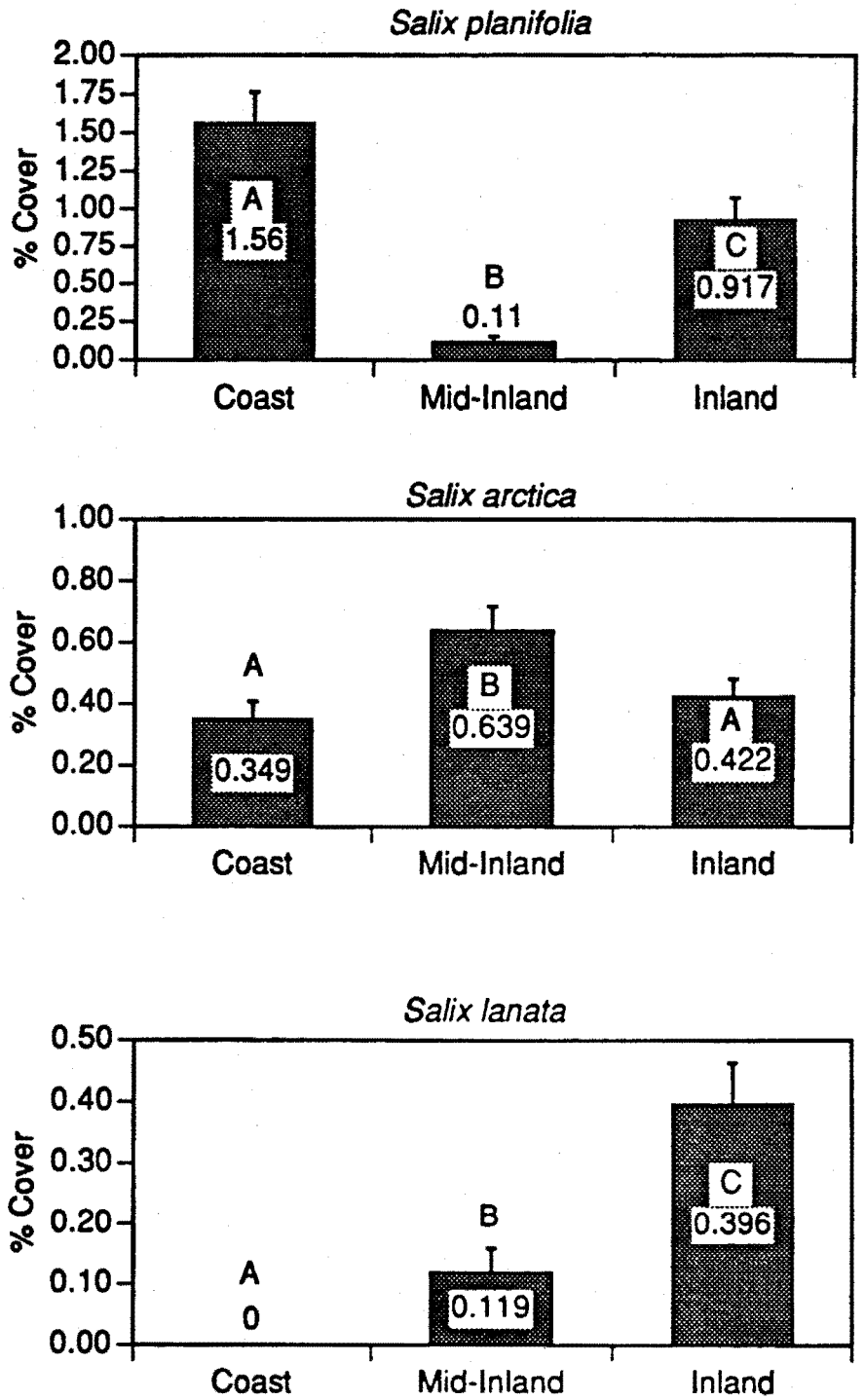

Figure 4. Mean percent cover of individual willow species by sample site in the Kuparuk Development Area, Alaska. Values listed on bars denote mean percent cover. Means with the same letter are not significantly different (ANOVA) $P > 0.05$.

The results for willows may reflect a problem inherent in cover sampling. Cover is a reliable index to biomass only when the growth form of the species is similar across sampling areas. At the coast site, willows were prostrate, usually less than 8 cm in height, whereas inland site willows have an upright shrub growth form reaching heights 10 times that of coastal willows. Individual stands of *S. planifolia*, on a unit area basis, are higher in biomass at inland sites, but their occurrence can be more infrequent. Additionally, the tendency for larger stands inland may provide for higher foraging efficiency due to increased bite size and frequency. Consequently, the higher ground cover of coastal site willows may not reflect higher plant biomass. Further analysis using biomass estimates of *S. planifolia* and S. *arctica* is needed.

MANAGEMENT IMPLICATIONS

If inland sites provide better foraging habitat for caribou, as our initial results suggest, access to these areas may be necessary for an optimal diet to support lactation, growth of young, and replenishment of body reserves. However, in view of the influence of insects on caribou in limiting foraging opportunity, causing harassment, and loss of blood, what may be even more vital is free movement between inland and coastal sites. The ability to forage in inland habitat when conditions permit and move to coastal relief habitat when insect activity rises may be necessary for optimal nutritional status and energetic balance of CAH caribou.

Project Principal Investigator:

Thomas R. McCabe, Alaska Fish and Wildlife Research Center

Field Principal Investigators:

Michael D. Smith, Alaska Cooperative Wildlife Research Unit
Raymond D. Cameron, Alaska Department of Fish and Game
David R. Klein, Alaska Cooperative Wildlife Research Unit

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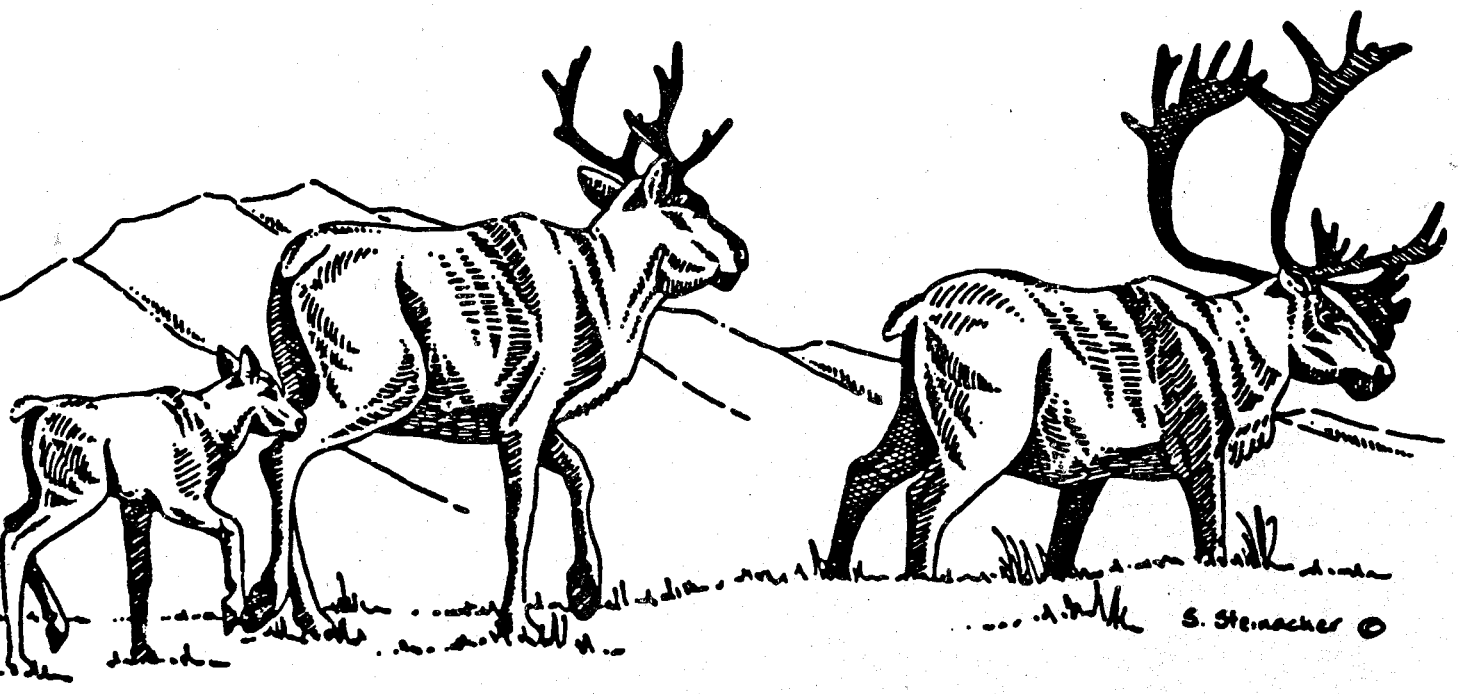
TERRESTRIAL RESEARCH

1002 AREA - ARCTIC NATIONAL WILDLIFE REFUGE



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