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Altitudinal Movements and Summer Habitat Preferences of Woodland Caribou in the Kluane Ranges, Yukon Territory.

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ABSTRACT. The altitudinal movements, preferred topography and plant communities of 150 to 200 woodland caribou (*Rangifer tarandus caribou*) were recorded for two summers. Nine subalpine or alpine tundra communities constituting their major summer range were quantitatively described. Caribou calved in shrub communities between 1300 and 1450 m, moving upward as the summer progressed. Stags and associated juveniles preferred higher elevations than did other groupings. Caribou disproportionately chose north-facing slopes of less than 20°. They fed in birch-sedge meadow and sedge meadow communities nearly twice as much as expected from the areal extent of the communities, and also disproportionately chose other communities with high sedge components. The presence of sedges was the predominant vegetational characteristic chosen regardless of elevations, with only minor differences between caribou sex and age groupings.

RÉSUMÉ. Pendant deux étés, on a observé les migrations, déterminé les emplacements et la vegetation qu'appreciaient de préference un troupeau de 150 à 200 caribous, vivant en terrain boisé. On répertoriait neuf familles de toundra alpine à subalpine, constituant leur domaine d'été.

Les caribous velaient dans des familles d'arbrissaux entre 1300 et 1450 métres et migraient sur les hauteurs, au fur et à mesure que l'été avancait. Les males et leurs jeunes préferaient des hauteurs plus elevées que les autre groupes. Les caribous avaient une préference pour les talus orientés au Nord, avec une pente inferieure à 20°. Ils se nourrissaient dans des prairies de pousses de bouleaux et dans une vegetation de joncs de prairies, deux fois plus souvent que l'on s'y attendait d'après leurs extension dans la région; ils choisissaient aussi préferentiellement d'autres vegetations, riches en joncs. La presence des joncs était le facteur vegetatif primordial qu'ils choisissaient, quelque soit l'altitude; il n'y avait que quelques differences mineures suivant le sexe et l'age.

Traduit par Alain de Vendigies, Aquitaine Company of Canada Ltd.

INTRODUCTION

Wildlife biologists are increasingly required to assess impacts of proposed northern developments with a detailed understanding of what constitutes ideal habitat for ungulates. The subalpine and alpine tundra provides the summer range for caribou (*Rangifer tarandus caribou*) in mountainous regions of western Canada and Alaska. Such environments are variable, consisting of a mosaic of vegetation communities and topographic features. This paper describes the

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May to October altitudinal movements, preferred topography and plant communities, and the food habits of 150 to 200 woodland caribou on the Burwash Uplands and vicinity, southwest Yukon Territory.

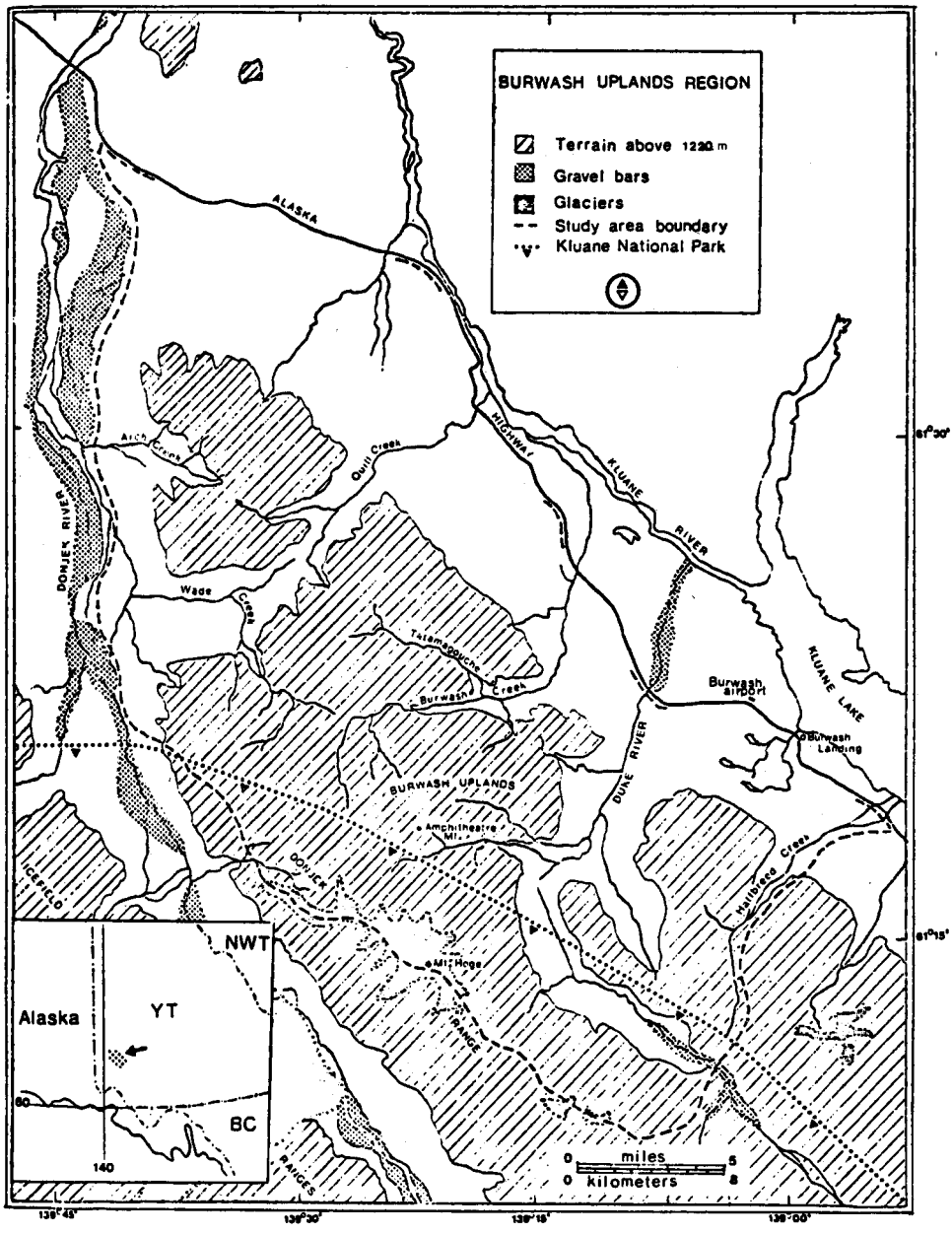


FIG. 1. Location of study area and Burwash Uplands, Yukon Territory.

STUDY AREA

The study area was located in the Kluane Ranges, on the northern flank of the St. Elias Mountains immediately west of Kluane Lake. It was approximately 1550 km^2 and included a central 163-km^2 portion between 1200 and 2000 m known as the Burwash Uplands. The Uplands and vicinity include a rolling plateau-like expanse of tundra about 100 km^2, six mountain peaks rising to a maximum of 2350 m, and lowland stream and river valleys covered by boreal forest generally below 1220 m. The study area was bounded on the east by Halfbreed Creek, on the north by the Alaska Highway, and on the west by the Donjek River. The southern boundary fell within Kluane National Park (Fig. 1).

Repeated glaciations have resulted in a widespread occurrence of glacial till, downcut by streams. Bedrock consists of an assemblage of sedimentary, volcanic and intrusive rocks ranging in age from Devonian to early Tertiary (Muller, 1967). In places, volcanic ash originating from an eruption 1220 years ago (Muller, 1967) forms beds 15-30 cm thick. A dry, cold-continental climate exists, with temperatures ranging from a mean monthly high in July of 11.9° C to a mean monthly low in January of -27.9° C measured at the Burwash airport at 807 m elevation on the east side of the study area (Webber, 1974). The region lies in the rain shadow of the St. Elias Mountains, receiving an annual precipitation of 29.0 cm, of which approximately half occurs during the summer.

The forested lowlands consist of a mosaic of post-fire successional stages from sub-climax poplars (*Populus balsamifera* and *P. tremuloides*) to climax white spruce (*Picea glauca*) constituting the "boreal forest subdivision Kluane" (Rowe, 1959). Erect willow (*Salix* spp.) and birch (*Betula glandulosa*) shrubs generally comprise the understory. Between 1220 and 1525 m, depending on local conditions of relief and drainage, the same erect shrubs become the predominant vegetation, underlain by heaths and prostrate shrubs. Above 1525 m erect shrubs disappear and are replaced by arctic-alpine tundra. Nine plant communities were recognized in the subalpine and alpine regions and will be described quantitatively (see Community Descriptions).

METHODS

Field data were collected between 26 May to 31 July 1973, and 16 May to 15 October 1974. Observations were made over the entire study area; however, the majority of observations (85%) occurred within the Burwash Uplands. Although caribou occurred elsewhere in and outside of the study area, the Burwash Uplands have traditionally been the major summer range for caribou in the Kluane Ranges (Hoefs, 1973; Oosenbrug, 1976).

Caribou were observed primarily from the ground from distance sufficient to prevent disturbance. Ground observations of caribou were described as to group size and composition, site characteristics (elevation, one or more of

slope, aspect, plant community) and behaviour (travelling, feeding, resting) and consisted of distinct, isolated sightings and sequential observations of groups and individuals; for the sequential observations, data about group composition, site characteristics and behaviour were recorded at intervals of not less than two hours. Sequential observations were made from strategic observation points with vistas containing a wide variety of relief, elevation and plant communities. A total of 965 behavioural observations was recorded, 62% of which included feeding. Where possible, plant species consumed were identified by examination of the feeding site after it had been vacated.

Caribou were classified visually as adult stags, adult does, juveniles (12-18 months), fawns, or unidentified. Stags were distinguished by larger body and antler size and where visible, presence of a penis, while juveniles could be identified by small body and antler size, light colour and curiosity traits (Skoog, 1956).

Aerial surveys, flown primarily to determine geographic and elevational distribution of caribou, supplemented ground observations. Nine flights were spaced 2-4 weeks apart, seven of which were flown in a Helio Courier STOL aircraft, and two in a Bell 206 Jet Ranger helicopter, flying at altitudes of 150-250 m above the ground. Flight paths generally followed topographical contours and were chosen to maximize coverage of terrain above tree-line. All observations were plotted on 1:50,000 topographical maps and elevations determined to the nearest 300 m.

Nine plant communities between 1200 and 2000 m were identified in the study area by means of aerial and ground examination. Communities were mapped and sampled in the central and most used 163 km^2 portion of the study area (Burwash Uplands). Each community was named after the visually dominant species present, mapped on 1:50,000 topographical maps, and total areas covered by each community determined by planimetry. To assess community selection by caribou, coverage values were extrapolated to include the entire study area, on the assumption that community distribution on the Uplands was similar to other portions of the study area.

Communities were sampled from early July to mid-August using a quadrat method similar to that described by Hanson (1953) and Hettinger *et al.* (1973). For each community representative sampling sites were located visually. A total of 45 sites was sampled, ranging from one per community where the community was limited in extent and variability, to 13 for more widespread and variable communities.

Quantitative data were collected from 30 quadrats at each sampling site. Using a random-numbers table, quadrats were located along five 15-m transects perpendicular to one side (15 m baseline) of the sampling site. Six quadrats, also chosen randomly, were placed along each transect. Quadrat size was determined by the predominant height of the vegetation of each quadrat: 1 m^2 for vegetation >50 cm tall, and 0.5 m^2 for herbaceous and low-shrub vegetation. Species composition for each quadrat was determined by visually estimating the percentage cover for each plant species. The average percentages cover and frequency for each species were calculated for

each sampling site and for each of the vegetation communities. Relative importance of plant species are prominence values (%Cover x %Frequency ½) (Douglas, 1974).

Assumptions about the preferred use of terrain and plant communities were based on comparisons of observed and expected values for slope, aspect, and communities as derived from their areal coverage of the study area. Chi-square analysis was used to assess the distributions of these values.

COMMUNITY DESCRIPTIONS

The nine communities identified included those predominantly between 1220 m and 1500 m: birch-willow shrub, occupying 23% of the Burwash Uplands, birch-sedge meadow (18%), sedge marsh (7%), spruce-willow forest (7%), and riparian willow shrub (4%). Communities predominantly above 1500 m included: *Dryas*-sedge meadow (13%), *Dryas* upland (11%), sedge meadow (8%) and bellheather slope (1%). Unvegetated terrain covered 8% of the area.

Tables 1 and 2 describe the species composition of the major communities in terms of prominence values, below and above 1500 m respectively. Some species listed are of particular significance to caribou food habits and so will be described further: sedge, lichens, willows and grasses. *Carex aquatilis* was by far the most prominent species in the sedge marsh community where the terrain was flat and poorly drained (Table 1). *Carex bigelowii* was by far the most prominent species in the sedge meadow community, where the terrain was slightly better drained.

Carex bigelowii was also the most prominent sedge in the *Dryas*-sedge meadow (well-drained upland sites), the birch-sedge meadow (intermediately drained lowland sites), and the spruce willow forest communities. In the former community it was co-dominant with *Dryas octapetala,* and in the latter two communities it formed an understory below *Betula glandulosa* or *Salix* spp. *Kobresia myosuriodes* formed a visual component in the *Dryas*-sedge meadow and *Dryas* upland communities, particularly on arid south-facing slopes.

Terrestrial lichens were uncommon in all communities (Tables 1 and 2), the highest prominence value being in the spruce-willow forest community (but with a value only 8% of the most prominent species, white spruce). Some lichens were also found in the bellheather slope and *Dryas* upland communities, but in both they were a very minor component.

Below 1500 m the riparian willow shrub community consisted primarily of *Salix pulchra* and *Salix lanata.* In the spruce-willow forest and birch-willow shrub communities, *Salix glauca* was most prominent. In partially wet sites with sedge meadow or birch-sedge communities, *Salix reticulata* was most prominent. Above 1500 m *Salix arctica* (a prostrate small plant) was prominent in the well drained *Dryas* upland and bellheather slope communities.

Poor drainage, due to permafrost underlying much of the area, limited the extent and distribution of grasses. *Festuca altaica* occurred primarily as an

TABLE 1. Composition of plant communities occurring primarily below 1,500 m on the Burwash Uplands, Yukon Territory. Data are for prominence value indices.[1]

SPECIES	COMMUNITIES				
	Spruce-willow forest (1)[2]	Birch-willow shrub (4)	Birch-sedge meadow (13)	Sedge marsh (8)	Riparian willow shrub (3)
Tall shrubs and trees					
Betula glandulosa Michx.	0.05	254.7	243.3	8.7	2.5
Picea glauca (Moench) Voss	352.0				
Salix pulchra Cham.		63.9	7.8	8.4	98.0
Salix glauca L.	10.6	91.9	0.1		0.1
Salix lanata L.	1.5				57.4
Salix spp.			10.5	3.4	
Low shrubs and herbs					
Carex aquatilis Wahlenb.				720.0	73.4
Carex bigelowii Torr.	203.1	90.1	178.4		22.7
Vaccinium uliginosum L.	105.0	13.6	20.7		7.1
Salix reticulata L.	4.5	26.9	65.6	16.5	7.8
Lupinus arcticus S. Watts	33.5	2.0	1.3		70.4
Arctostaphylos rubra (Rehd & Wilson) Fern	54.1	0.39			2.2
Cassiope tetragona (L.) D.Don	50.3				1.4
Carex spp.		13.0	35.0		
Festuca altaica Trin.	0.13	17.0	6.7		3.6
Dryas spp.			16.4	10.5	
Petasites frigidus (L.) Franch.		1.2	2.5		19.8
Ledum palustre L.	16.3				0.84
Dryas integrifolia M. Vahl	3.7	2.3	1.3	6.8	
Pedicularis capitata Adams	0.82	0.57	0.21		0.10
Eriophorum vaginatum L.			8.7	4.3	
Pedicularis spp.		0.10	2.5	8.8	
Polygonum bistorta L.	3.0	2.1	4.8		0.08
Rhododendron lapponicum (L.) Wahlenb.	0.16		0.09	7.3	
Vaccinium spp.			0.06	5.4	
Polygonum spp.			4.2	0.67	
Potentilla fruticosa L.		1.8	1.3	1.5	0.02
Pyrola spp.		0.07	3.3	T	
Saussurea angustifolia (Willd.) DC	1.8	0.63	0.15		
Empetrum nigrum L.	0.16				2.0
Rubus chamaemorus L.	0.11				1.6
Valeriana capitata Pall.		0.26	0.02	T	1.2
Poa alpina L.	0.02	0.07			1.2
Dryas octapetala L.		1.2	T[3]		0.03
Trisetum spicatum (L.) Richter					1.13
Mosses	96.7	191.8	203.9	5.5	137.8
Cladonia spp.	28.3	2.9	2.1		1.5
Cetraria spp.		1.1	0.09		0.06
Water	0.81			69.0	18.1
Ground					31.2

[1]Only those species with prominence values of 1.0 or more are listed. For complete list, see Oosenbrug, 1976.

[2]Number of sites.

[3]Prominence value less than 0.01.

TABLE 2. Composition of plant communities occurring primarily above 1,500 m on the Burwash Uplands, Yukon Territory. Data are for prominence value indices.[1]

SPECIES	COMMUNITIES			
	Sedge meadow (8)[2]	*Dryas*-sedge meadow (3)	*Dryas*-upland (1)	Bellheather slope (4)
Shrubs and herbs				
Dryas octapetala L.	2.0	225.8	324.5	102.1
Carex bigelowii Torr.	319.3	211.0	67.8	17.1
Salix arctica Pall.		30.1	180.6	52.8
Cassiope tetragona (L.) D.Don				253.7
Salix reticulata L.	100.9	81.3	51.1	19.6
Lupinus arcticus S.Watts	2.0		19.1	23.4
Kobresia myosuriodes (Vill.) Fiori & Paol.	1.4	24.0	18.0	T[3]
Carex spp.	27.7			14.3
Dryas spp.	14.7			11.0
Vaccinium uliginosum L.	4.4			20.8
Polygonum bistorta L.	6.2	16.3	.36	2.6
Polygonum spp.	11.4			6.0
Pyrola asarifolia Michx.	1.7			14.4
Eriophorum vaginatum L.	10.9			
Festuca altaica Trin.	5.8	1.8		0.47
Vaccinium spp.	1.3			5.0
Pedicularis capitata Adams	0.04	1.4	0.29	3.4
Betula glandulosa Michx.	3.4			
Polygonum viviparum L.	0.91	0.61	1.6	0.02
Pedicularis Kanei Durand	0.01		3.1	
Arctostaphylos rubra (Rehd & Wilson) Fern	3.0			253.7
Petasites frigidus (L.) Franch.	0.98			1.7
Saussurea angustifolia (Willd.) DC	T	1.1	0.22	1.2
Poa alpina L.	0.02	1.3	1.1	0.12
Dryas integrifolia M. Vahl	2.1	0.01		
Oxytropis scammaniana Hult.	T	0.79	1.4	0.07
Anemone parviflora Michx.	0.42	0.66	1.2	0.02
Salix pulchra Chamb.	1.8			
Pedicularis Oederi M. Vahl	1.8		0.02	
Pedicularis spp.	1.7			0.07
Arctogrostis arundinaceae Schreb.			1.5	
Astragalus umbellatus Bunge	0.16	0.06	0.93	0.42
Thalictrum alpinum L.	.13	0.94	0.22	
Papaver spp.		1.1		0.02
Mosses	243.8	279.6	112.7	275.3
Cladonia spp.	0.09	5.5	10.0	13.9
Cetraria spp.	0.01			
Ground	0.01		7.0	0.16
Water	0.97			

[1]Only those species with prominence values of 1.0 or more are listed. For complete list, see Oosenbrug, 1976.

[2]Number of sites sampled.

[3]Prominence value less than 0.01.

understory species in the birch-willow shrub community. On north-facing slopes conditions were more hydric than on south-facing slopes, because the permafrost lies closer to the surface of the ground. Sedges predominated, with shrubs (primarily *Betula glandulosa* and *Salix* spp.), growing on elevated frost-heave features.

RESULTS

During the period of study, aerial and ground surveys indicated that the Burwash Uplands were the major summer range for caribou in the Kluane Ranges. Herds of up to 180 caribou, or 90% of the estimated total population (Oosenbrug, 1976) occupied portions of the Uplands at various times as post-calving and rutting aggregations. Does, juveniles, and fawns predominated observations throughout the study, comprising 56.9% of 204 observations between 16 May and 15 June, and 25.8% of 446 observations during the rest of the summer. Between 16 May and 15 June, stags comprised 6.3% of 204 observations, and 13.7% of 446 observations during the rest of the summer. Aggregations of caribou made up 1.0% and 28.5% of the observations during these periods. The remainder of observations, 35.8% and 32.0%, were of unidentified caribou.

Elevational and topographic preferences

Caribou were observed in subalpine habitats between 1200 and 1500 m from mid-May to mid-June, moving upward as the season progressed to occupy primarily 1500-1800-m elevations through mid-summer, and moving even higher above 1800 m from mid-August through the rutting period until observations ceased in mid-October (Fig. 2). The full range of elevations was available to caribou within no more than one hour's travel-time, so these elevational preferences represent continuous immediate choice, rather than being influenced by a time lag to reach any more desirable elevations.

During early May groups of five to twenty caribou, composed almost entirely of does and juveniles, moved out of the trees into the subalpine region in response to the appearance of new plant growth in snow-free areas. By mid-May, as parturition neared, the animals dispersed, and the groups became smaller. Eight observations of newborn fawns were all between 1300 and 1450 m elevation on flat terrain, or, in two cases, on 5° southeast and 15° north slopes. From mid to late June does, fawns, many juveniles and a few stags formed post-calving aggregations, sometimes consisting of more than 150 animals. Stags and juveniles associating with them more commonly occupied higher terrain after mid-June than did other caribou groups (does and juveniles associating with them, doe-fawn groups), since 59.0% of the of the 41 observations of stags and associated juveniles were above 1500 m compared with 39.8% of the total caribou observations (446).

During July and August small groups and individuals dispersed from the large aggregations as they progressively sought higher wind-blown terrain and remnant snow patches above 1500 m, in response to insect harassment and

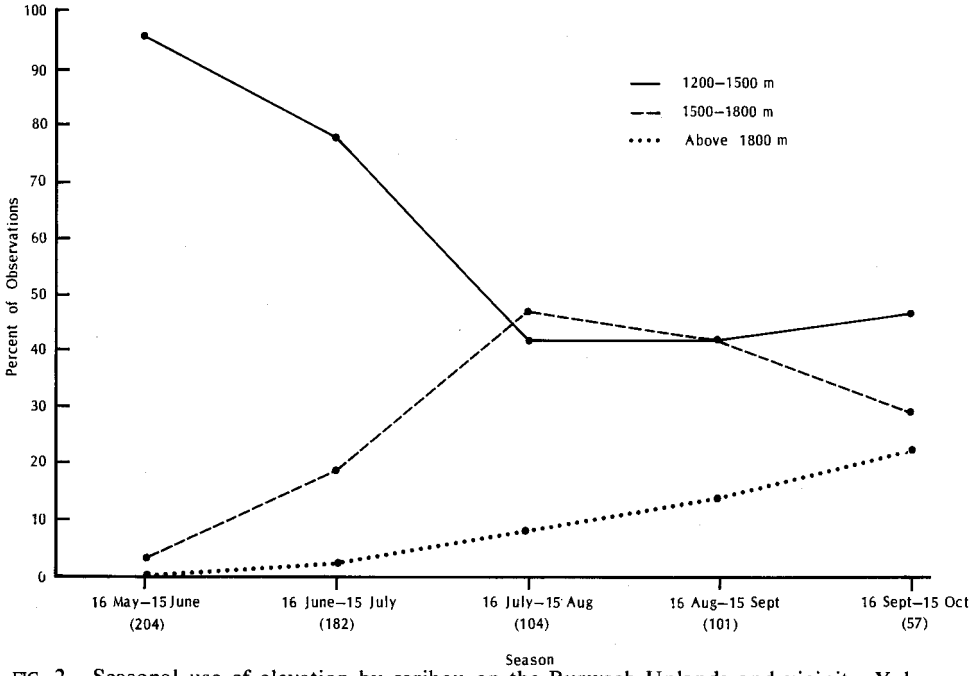


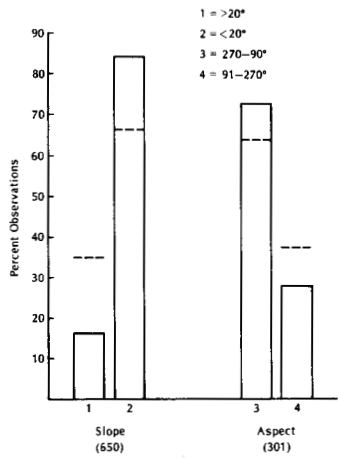
FIG. 2. Seasonal use of elevation by caribou on the Burwash Uplands and vicinity, Yukon Territory (number of observations is given in brackets).

heat, according to Pruitt (1960), Skoog (1968) and Kelsall (1968). By late July most unattached juveniles, does with fawns, and does with juveniles had joined herds at these higher elevations. By late August and early September many caribou were at or above 1800 m in pre-rutting groups of 20-80 animals, although the majority of individuals and small groups remained below this elevation. The rut occurred primarily above 1800 m during late September and early October, before rapid accumulation of snow forced caribou to lower elevations.

Over the entire summer caribou showed a preference for flat to rolling terrain with slopes less than 20° ($\chi^2 = 106.7$ $p<0.001$) and northern aspects ($\chi^2 = 12.8$ $p<0.001$) (Fig. 3). Ridges, plateaus and stream bottoms were commonly utilized land forms.

Plant community preferences

Over the entire summer, caribou demonstrated preferences for the sedge meadow community, on the basis of twice the expected level of use in relation to the areal extent of the community (Table 3, Fig. 4). From spring to fall, selection for the primarily subalpine birch-sedge meadow community declined, while selection for the primarily alpine sedge meadow and *Dryas*-sedge meadow increased (Fig. 5). Less pronounced preferences were shown for sedge marsh and riparian willow shrub communities (Fig. 4), both primarily subalpine communities; in total, 57.5% of their use (73 of 127 observations) occurred prior to 15 July.



$\underline{\text{Slope}}$ $\chi^2 = 106.7$; $\chi^2_{0.001} = 10.83$

$\underline{\text{Aspect}}$ $\chi^2 = 12.83$; $\chi^2_{0.001} = 10.83$

FIG. 3. Terrain preferences of caribou on the Burwash Uplands and vicinity, Yukon Territory (dashed lines represent expected values based on areal extent of slopes and aspects; number of observations is given in brackets).

Table 3. Number of expected and actual observations of caribou according to vegetation communities on the Burwash Uplands, Yukon Territory; summer 1973-74.

COMMUNITIES	Percent areal coverage of study area[1]	OBSERVATIONS			
		Occurrence[2]		Feeding[2]	
		Expected	Actual	Expected	Actual
Sedge meadow	8.3	80	178	50	112
Sedge marsh	7.3	70	77	44	45
Dryas-sedge meadow	12.8	124	111	76	68
Birch-sedge meadow	18.2	176	271	109	190
Birch-willow shrub	23.0	221	189	137	105
Spruce-willow forest	6.7	65	22	40	10
Riparian willow shrub	3.8	37	50	23	34
Dryas upland	10.8	104	46	65	25
Bellheather slope	0.9	9	17	5	9
Unvegetated terrain	8.2	79	4	49	0
Total	100.0	965	965	598	598

[1]Based on vegetation mapping of Burwash Uplands; km²

[2]χ^2 for occurrence = 320.6, $\chi^2 0.001 = 27.88$; χ^2 for feeding = 250.1, $\chi^2 0.001 = 27.88$

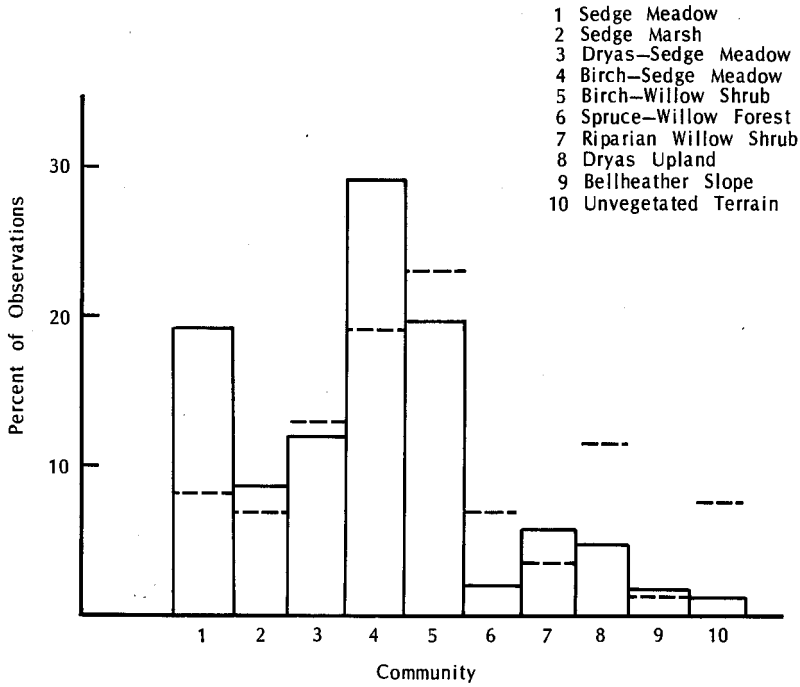


FIG. 4. Selection by caribou of plant communities on the Burwash Uplands and vicinity, Yukon Territory (dashed lines represent expected values based areal coverage of communities. eg:).

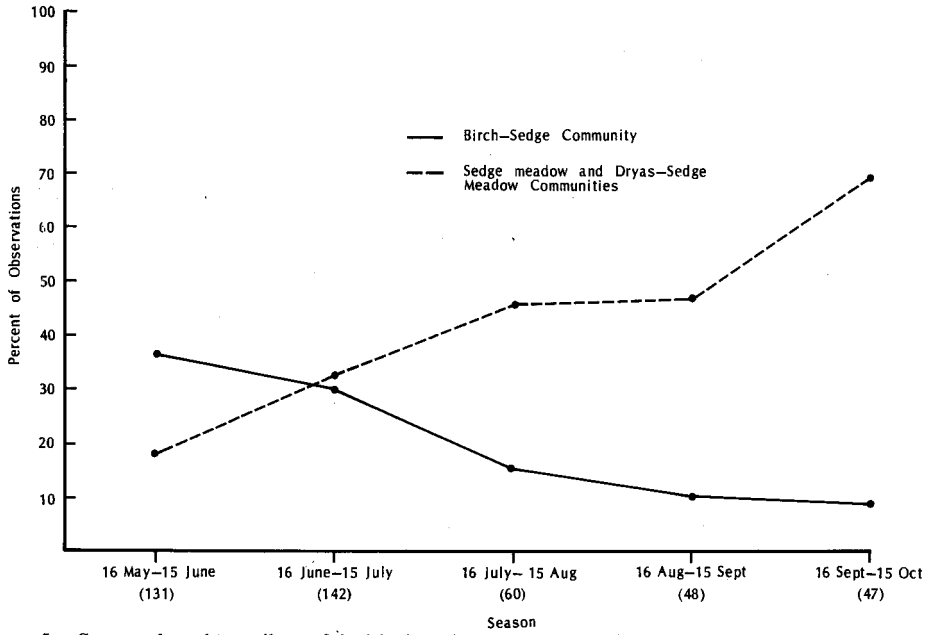


FIG. 5. Seasonal use by caribou of the birch-sedge meadow community compared with the sedge meadow and *Dryas*-sedge meadow communities on the Burwash Uplands and vicinity, Yukon Territory (number of observations is given in brackets).

Over the entire summer, *Dryas* upland and spruce-willow forest, and to a lesser extent birch-willow shrub communities, were clearly disfavoured (Fig. 4), although visibility was generally not as good in the latter two communities as in the more open alpine areas.

Stags and associated juveniles showed a preference earlier in the summer for the sedge meadow community (40.9% of 44 observations of them prior to 15 July) than did does with fawns (9.8% of 61 observations), or did post-calving aggregations (15.8% of 76 observations). The latter two groups were found mostly in birch-sedge meadow (2.3%) and birch-willow shrub (22.6%) prior to 15 July. Six of the eight calving sites were in birch-sedge meadow, and two in spruce-willow forest communities. Aggregations shifted to sedge meadow and *Dryas* -sedge meadow communities after mid-July, with 63.6% of 55 observations of them made in these two communities.

Although observations of caribou feeding comprised 62.0% of the 965 observations of caribou occurrence in the various vegetation communities, the disproportionate use was found to be almost identical (Table 3, Fig. 4). Noticeable selection to feed occurred in the birch-sedge and sedge meadow communities. In 35 observations for which plant species fed upon could be identified, 15 were willow: *Salix pulchra* (4), *Salix glauca* (4), *Salix lanata* (3), *Salix alaxensis* (2), *Salix reticulata* (2); 11 were sedges: *Carex bigelowii* (6), *Eriophorum vaginatum* (4), *Carex aquatilis* (1); *Betula glandulosa* (3); and the remainder forbs (6).

DISCUSSION

An assessment of habitat selection requires knowledge on the structure of the population under study. For caribou populations this information is usually only available during the rutting period. The lack of males in the Uplands (13% of post-calving aggregations in mid-June) is somewhat reflected in the low proportion of stag observations prior to 15 June (6.3%), and may be due to their use of forest habitats below 1200 m or ranges outside the study area. Percent males doubled to 30% in pre-rutting aggregations during September. Proportions of doe observations decreased from 57% before 15 June to 26% during the rest of the summer. These changes are due more to absorption of the female segment of the population into aggregations, than to dispersal out of the study area.

Thus the habitat preferences described in this paper reflect those of the sex and age groups present in the study area, except for stags which were under-represented until the pre-rut period, because they were either in the lowland forests or on distinct tundra areas.

Our data indicate that sedges were the main component of the vegetation of the summer range which influenced habitat choice. The two most preferred communities were characterized by sedge components, one of which was dominated by sedge (sedge meadow community). That birch was not the attraction in the latter is clear because of the disproportionate lack of use in the birch-willow community where sedges were not prominent. Sedge marsh,

the other community that included sedge as major component, was also disproportionately used. The *Dryas*-sedge meadow community, the highest elevational community with a prominent sedge component, while not used quite at the level of expectance, was far more favoured than the *Dryas* upland community which lacked the sedge component. Thus both early and late in the summer, as caribou gradually moved to higher elevations with attendant changes in plant communities, they sought out the sedge-type communities.

The prefence by caribou for slopes less than 20° and northern aspects may have reflected the hydric site preferences of sedges. Freddy (1974) found similar preferences in slope and aspect by caribou in the Selkirk Mountains in northern Idaho.

Willows made up a major component of three communities: birch-willow shrub, spruce-willow forest, and riparian willow shrub. Although visibility in tall shrub and forest communities was generally not as good as in open subalpine and alpine communities, and it is possible that use of these communities was as a result underestimated, one of these, riparian willow shrub, was disproportionately used. Since caribou commonly used stream bottoms as travel routes and feeding sites, this may have been reflected in the high use of this community. Preference for the birch-sedge community was supported by the even greater proportion of feeding observations in this community. Similarly the proportionately lower number of feeding observations in the birch-willow shrub community attested to its lack of use.

While willows made up 42% of our identified food items, we could determine signs of browsing on woody stems more easily than we could grazing on herbaceous vegetation. Willows are undoubtedly important to caribou in summer, along with other shrubs (Bergerud, 1978a), but did not influence habitat choice as much as to determine selection at low elevations for the birch-willow community over the birch-sedge community, or influence caribou in late summer to remain at lower elevations where willows were more abundant.

Murie (1944) found that in May and early June, dwarf birch made up the bulk of caribou food in Mount McKinley Park, Alaska. Skoog (1968) found that "willows and dwarf birch dominate the diet during early summer and remain important well into the fall period in Alaska's Fortymile and Nelchina herds", although grasses and sedges were also heavily utilized. Both of these studies involved *Rangifer tarandus granti* rather than *R. t. caribou*, but living in alpine and tundra habitats very similar to the Burwash Uplands. During September, Lensink (1954) found that the leaves of woody plants predominated in rumen samples of Nelchina caribou. Our results on habitat selection of the Burwash Uplands caribou, where sedges were of greatest significance, differed somewhat from the three Alaskan herds. Skoog (1968) who reviewed the extensive literature, concluded, however, that "the wide variety of plants, animal, and mineral material known to be ingested by this species during the year seems extraordinary."

Our observed subalpine and low elevation calving sites were similar to those described by Skoog (1968), but Bergerud (1978b) also observed calving

at high elevations well above any green vegetation in some herds in northern British Columbia. We found fewer calving sites than expected (57% of does were parous; Oosenbrug, 1976) at all elevations, and speculate, similar to Bergerud (1978b) for a herd near Atlin, British Columbia, that some calving must have taken place in the forest.

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