

Snow Characteristics along Caribou Trails and within Feeding Areas during Spring Migration

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(Received 18 November 1986; accepted in revised form 21 January 1988)

ABSTRACT. Snow depth and hardness were measured at caribou feeding sites and along migration trails during spring migration of the Porcupine Caribou Herd from NE Alaska to Yukon. Snow was deeper along migration trails than within adjacent feeding areas, while no distinction was evident with respect to snow hardness between feeding and trailing areas. Average snow depths and hardness indexes were at or below values identified by previous authors as critical upper limits to caribou activity.

Key words: caribou, migration, winter, spring, snow, foraging, behaviour, Porcupine Caribou Herd

RÉSUMÉ. La profondeur et la dureté de la neige ont été mesurées sur les lieux de broutage et à côté des chemins de migration printanière de la herde Porcupine. La neige était plus profonde près des chemins de migration par rapport aux lieux de broutage tandis les différences observées entre ces deux milieux quant à la dureté de la neige, n'offraient pas une tendance cohérente. Les profondeurs et indices de dureté moyens étaient aux mêmes niveaux ou inférieurs à ceux identifiés par d'autres auteurs comme limites critiques supérieures pour l'activité du caribou.

Mots clés: caribou, migration, hiver, printemps, neige, broutement, comportement, la herde Porcupine

INTRODUCTION

Snow depth and hardness have been shown to influence the winter behaviour of caribou and reindeer (*Rangifer tarandus*) such that animals remain relatively sedentary and avoid areas where snow impedes access to food (Henshaw, 1968; LaPerriere and Lent, 1977; Skogland, 1978). Several authors have speculated on the influence of snow on caribou behaviour during spring migration when caribou travel long distances over snow-covered terrain (Nasimovich, 1955; Pruitt, 1959; Kelsall, 1968), but parameters describing snow cover have never been measured during this period. This study presents the first description of snow characteristics adjacent to caribou trails and feeding sites during spring migration from Alaska to Yukon.

METHODS

This study was part of a larger study of the activity patterns of migrating caribou in which caribou were observed from a series of field camps along spring migration routes in 1982 and 1983. The study area and location of study sites have been described by Duquette and Klein (1987). Briefly, the cow sector of the Porcupine Caribou Herd, which had wintered in NE Alaska, was observed as it travelled north and east into the Yukon Territory to calving grounds on the arctic coastal plain. Snow data were collected until extensive spring melting occurred in late May. Data for this study were collected at the following observation sites listed by Duquette and Klein (1987): site 1-82: 1-6 May; site 2-82: 12-16 May; site 3-82: 25-26 May; site 1-83: 8-21 April; site 2-83: 3-7 May. Snow measurements were taken within 2-3 h after caribou vacated an area from which they had been previously observed for several hours. Snow hardness was measured using a ramsonde penetrometer (Skogland, 1978). The conical tip of the apparatus penetrates the snow cover in response to a weight dropped from a specified distance. The result is a measure of resistance to compaction of the entire snow pack, expressed in kg force. Depths were recorded from a metre stick pushed vertically through the snow to the ground surface. Measurements were made in undisturbed snow adjacent to feeding craters at 10 m intervals along a transect bisecting a

feeding area and every 10 m along transects running parallel to migration trails (trails used by more than approximately 100 caribou). At each site, 3-4 transects were established along 1-2 km of trail. The Student's *t* distribution was used to test for relationships between the average snow depth and hardness at feeding and trailing areas at each study site.

RESULTS AND DISCUSSION

Snow depth within feeding areas was significantly less than along migration trails linking the feeding areas at all sites sampled (Fig. 1). This occurred in the extreme at site 3-82, where caribou were observed feeding in extensive snow-free patches. Obviously snow parameters could not be measured at this site. Snow was deepest along migration trails at site 2-82, where the average snow depth of 0.5 m was at the lower limit of the 0.5-0.6 m range reported by Pruitt (1959) and Henshaw (1968) as the critical upper limits to caribou activity. A preference for feeding in areas with a shallow snow cover is consistent with other late winter studies of caribou and reindeer (Bergerud, 1972; Gaare and Skogland, 1975; Henshaw, 1968; Moore, 1982).

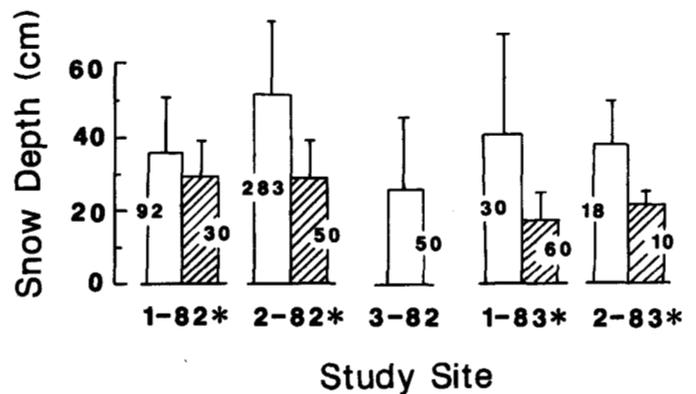


FIG. 1. Snow depth and hardness ($\bar{x} \pm SD$) of feeding areas (hatched columns) and migration trails (open columns) during spring migration. Caribou at site 3-82 were observed feeding in snow-free areas. Number of snow measurements is indicated inside columns.

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The force required to compact the snow column (snow hardness) ranged from 3 ± 2 to 10 ± 6 kg. Snow hardness between feeding and trailed areas was not consistently different in this study, whereas other studies (LaPerriere and Lent, 1977; Skogland, 1978) showed that snow was more resistant to compaction in non-feeding than feeding areas. Snow hardness probably did not influence caribou behaviour during this study because hardness values were considerably below the upper tolerance levels for feeding and trailing identified by the earlier studies (22 and 29 kg respectively).

Pruitt (1959) and Kelsall (1968) have suggested that during spring migration caribou might respond to snow conditions by directly selecting migration routes where shallow or hard snow, or frozen water courses, facilitate walking. The results of the present study suggest that given the apparent importance of feeding site selection, the route of travel may be simply a direct corridor between the feeding areas which are snow free or lightly covered. During this study, virtually all caribou travelled single file along snow trails that were previously used by as many as several thousand caribou, except when travelling over extensive areas of bare ground at the very end of migration. Presumably, this behaviour allows caribou to avoid the high energy costs of travelling in deeper snow (Fancy and White, 1987).

Adverse snow conditions may cause delays in migration because lead caribou appear reluctant to break trail in deep or soft snow. For example, the onset of migration occurred three weeks later in 1982 than in 1983, possibly because deeper snow in 1982 discouraged lead individuals from breaking snow trails. Given that adverse snow conditions may cause delays in migration, natural selection has probably favoured caribou that follow previously successful migration routes. Pulliainen (1974) suggests that traditional migratory routes are learned by young

caribou following older, experienced animals. Perhaps traditional migratory routes have predictably better snow conditions for travelling than alternate routes, and by following traditional routes caribou may be indirectly selecting travel corridors with more favourable snow conditions.

REFERENCES

- BERGERUD, A.T. 1972. Food habits of Newfoundland caribou. *Journal of Wildlife Management* 36:913-923.
- DUQUETTE, L.S., and KLEIN, D.R. 1987. Activity budgets and group size of caribou during spring migration. *Canadian Journal of Zoology* 65:164-168.
- FANCY, S.G., and WHITE, R.G. 1987. Energy expenditures for locomotion by barren-ground caribou. *Canadian Journal of Zoology* 65:122-128.
- GAARE, E., and SKOGLAND, T. 1975. Wild reindeer food habits and range use at Hardangervidda. In: Wielgolaski, F.E., ed. *Fennoscandian tundra ecosystems*. New York: Springer-Verlag. 206-215.
- HENSHAW, J. 1968. The activities of wintering caribou in northwestern Alaska in relation to weather and snow conditions. *International Journal of Biometeorology* 12(1):21-27.
- KELSALL, J.P. 1968. The migratory barren-ground caribou of Canada. Ottawa: Queen's Printer. 339 p.
- LAPERRIERE, A.J., and LENT, P.C. 1977. Caribou feeding sites in relation to snow characteristics in northeastern Alaska. *Arctic* 30(2):101-108.
- MOORE, J.T. 1982. Factors affecting grazing patterns of reindeer on summer tundra ranges. M.S. thesis, Department of Wildlife Management, University of Alaska, Fairbanks, Alaska. 144 p.
- NASIMOVICH, A.A. 1955. The role of the regime of snow cover in the life of ungulates in the USSR. Moskva: Akademiya Nauk SSR. 403 p.
- PRUITT, W.O. 1959. Snow as a factor in the winter ecology of the barren-ground caribou. *Arctic* 12:158-180.
- PULLIAINEN, E. 1974. Seasonal movements of moose in Europe. *Naturaliste Canadienne* 101:379-392.
- SKOGLAND, T. 1978. Characteristics of the snow cover and its relationship to wild mountain reindeer feeding strategies. *Arctic and Alpine Research* 10(3):569-580.