

# Effect of Reindeer Trampling and Grazing on Lichens<sup>1</sup>

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## Highlight

A herd of approximately 500 reindeer was herded over a non-utilized portion of a large *Eriophorum-Carex*-dwarf shrub meadow near Nome, Alaska during both moist and dry conditions. After one summer of use on approximately 17 sections by the reindeer, 68% of the lichens were dislodged and 16% were shattered into segments less than ½ inch. On summer ranges where lichens comprise at least 30% of the available forage, at least 15% of the lichens should be considered as unavailable because of trampling by reindeer.

While evaluating different methods of vegetation analysis on reindeer ranges in Alaska, the opportunity arose to use a reindeer herd under controlled conditions to evaluate the extent of reindeer damage to lichens by trampling and grazing. Several range studies have indicated that reindeer and caribou cause considerable damage to lichens either by trampling or through their grazing habits (Palmer, 1926, 1934; Andreev, 1954; Skuncke, 1969; and Skoog, 1956). None of these studies have quantitatively measured this damage.

## Area, Vegetation and Reindeer

The herd used, known as the Model Herd, was established in March 1966 near Nome by the U.S. Bureau of Indian Affairs for demonstration purposes. The herd remained in the foothills of the Kigluaik Mountains on the Seward Peninsula until early June. They were then driven onto their summer range, a large *Eriophorum-Carex*-dwarf shrub meadow lying west of Nome, between the Penny and Snake Rivers, and between the coast of the Bering Sea and the Nome to Teller Road. This encompasses approximately 17 square miles. The area had not previously been occupied by reindeer for at least 26 years, although reindeer from near Teller have occasionally strayed within 7 miles of the *Eriophorum-Carex*-dwarf shrub meadow. Caribou have not been this far west on the Seward Peninsula since before the turn of the century.

The lichen flora, with the possible exception of *Cladonia alpestris*, had recovered from past use

and is composed primarily of *C. rangiferina*, *C. sylvatica*, *C. mitis*, *C. amaurocraea*, *C. gracilis*, *Cetraria cucullata*, and *C. islandica*. The living portions of these lichens are generally from 1.5 to 4 inches long and are in well developed clumps. Except for the numerous small ponds and streams, the vegetative cover is 100% with lichens comprising approximately 30% of the total vegetation. In the moist areas, sedges (primarily *Carex aquatilis*, *Eriophorum angustifolium*, *E. vaginatum*, and *E. scheuchzeri*) predominate. On the drier sites there is a combination of sedges, lichens, and small shrubs including bog blueberry (*Vaccinium uliginosum*), crowberry (*Empetrum nigrum*), dwarf alpine birch (*Betula nana*), and narrow-leaved Labrador tea (*Ledum palustre decumbens*). During the summer, the greatest damage to lichens by reindeer occurs on these drier sites.

Reindeer are selective foragers as they seldom stop and completely graze an area, rather they continually move, seeking out preferred succulent forage items. Large quantities of lichens are either dropped or rejected from the mouth and the reindeer make no apparent effort to retrieve these. These include all the major species of lichens both with and without decayed portions. The principal reindeer forage lichens are loosely attached or completely unattached to the substratum and are easily dislodged by reindeer grazing, as they tend to pull up rather than bite off their forage.

In summer reindeer prefer to graze during cool or moist or windy weather, as on warm, windless days they concentrate along the beach to cool off or avoid insects, doing very little grazing. On warm or dry, windy days the moisture content of lichens is reduced and they become dry and very brittle. Reindeer will not utilize the lichens in this condition, but they shatter into small fragments if stepped on.

## Procedure and Results

During a period of rainy and foggy days in July 1966, a herd of approximately 500 reindeer was herded in a loose front from 50 to 100 yards wide, across an area in the sedge meadow which had not previously been utilized. The reindeer were allowed to graze and move at their will except when they attempted to move onto grazed areas.

A square foot frame was randomly thrown out 300 times on the area that the herd had traversed. Within the frame the per cent of lichens that had been dislodged and the per cent that was shattered into segments ½ inch or smaller were estimated.

The reindeer dislodged 15% of the lichens while crossing over the area once. Only 2% were shattered into segments ½ inch or smaller and most

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FIG. 1. The vegetation on the pingo mound before a herd of reindeer trampled it severely.



FIG. 2. The reindeer herd bunched up tightly and began milling in a circle.

of these had probably been rejected or had dropped from their mouths.

During a period of warm, dry days in July, the reindeer were again herded in a similar manner. It had not rained for over 24 hours, there were few clouds, and a persistent wind had dried the lichens until they were brittle. The reindeer were bothered by insects and were constantly moving. They fed nervously, taking sporadic bites of forage as they travelled. Herding under these conditions is difficult as the reindeer are hard to control and can easily outdistance the herders. When the herd had passed over the area, the square foot frame was thrown 300 times and the condition of the lichens judged in the same manner as on the moist day.

Twenty-seven per cent of the lichens were dislodged or broken into parts  $\frac{1}{2}$  inch or larger. Eight per cent of the lichens were shattered into portions  $\frac{1}{2}$  inch or smaller by the herd passing over the area once. Almost all of the shattering of the dry lichens was caused by trampling as reindeer seldom graze dry lichens.

On the morning of July 6, 1966, approximately 1,000 reindeer of the Model Herd were running to avoid insects. They ran to the top of a low pingo mound which was covered by typical dry tundra of the *Eriophorum-Carex*-dwarf shrub meadow type with *Carex aquatilis* dominating on a thick moss layer (*Sphagnum* spp. and *Polypodium* spp., Fig. 1). The herd bunched up and began to mill in a tight, elliptical circle about 75 by 100 ft (Fig. 2). Animals on the outer edge of the circle were continually running and trying to work into the circle, while the animals in the center either stood still or moved about slowly. They milled for 12 minutes, then broke and ran into some shallow ponds.

In the process of this tight milling, the vegetation was thoroughly trampled. All that remained were fragments of sedges, lichens, and shrubs cov-

ered by shredded, displaced moss. The insulating effect of the vegetation was now lost and within two days melt water from the thawing subsoil seeped up through the moss and completely inundated the trampled area (Fig. 3). The area remained covered by water during the entire summer and a small flow continued to run off the site until freezeup. During 1967, water covered the site throughout the snow-free period and a few sedges started recovering along the periphery of the trampled area. In 1968 the site was inundated until mid-June. As the summer progressed, more individual sedge plants became established and those examined were either *Carex aquatilis* or *Eriophorum angustifolium* that had sprouted from rhizome fragments buried in the moss mat. By September 1968, the only recovery that had taken place was these sedges and some mosses. There was no evidence of shrubs or lichens recovering.

This is probably the first step leading to the severe destruction of vegetation and eventual erosion of the soil that Bos (1967) observed on the west end of Nunivak Island. He noted that



FIG. 3. The trampled area was completely inundated two days after the herd had milled on it.

on warm or windless days the reindeer herds tended to mill in tight circles near the cliffs. The vegetation was destroyed at such sites and on sedge meadows the vegetation was trampled into the peaty substratum. Rapid erosion was occurring at one of the sites he examined, which had probably been trampled repeatedly.

Fortunately the topography of the sedge meadow near Nome is fairly uniform and it is unlikely that the reindeer herd would mill on the same area consistently so the vegetation should be able to recover.

In mid-August 1966, the area on the *Eriophorum-Carex* dwarf shrub meadow where the herd grazed during favorable conditions was sampled. Five hundred throws were taken with the square foot frame to determine the extent of the damage caused by trampling during the summer. Sixty-eight per cent of the lichens were dislodged and 16% were shattered into segments less than 1/2 inch in length.

### Conclusions

The effect of dislodging the lichens is not fully understood since most forms derive nutrients directly from the atmosphere. Dislodged lichens are more susceptible to drying by the wind and are generally totally desiccated on warm, dry days, whereas those that are not disturbed will retain some moisture at their bases since they commonly grow in or on the moss layer which retains some moisture even under drying conditions. Andreev (1954) indicates that growth occurs only when lichens are moist.

It is possible that shattered segments will regenerate (Andreev, 1954; Fink, 1935; Skuncke, 1969; Faegri, 1937; and Llano, 1944). However, in the USSR, segments of podetia that were less than two internodes long required over two years to initiate growth (Andreev, 1954) and not all of the segments regenerated.

The average annual linear growth rate of the principal forage lichens, *Cladonia alpestris*, *C. rangiferina*, and *C. sylvatica*, on the Seward Peninsula is 5 mm (Pegau, 1969). Using this value plus the two years indicated by Andreev which is required for reestablishment, but during which no linear growth takes place, it would require at least 10 years before the segments would be large enough to be grazed again.

In any calculation of carrying capacity on ranges where lichens are an important component of the forage, the effect of trampling and selective grazing must be considered. On summer ranges where lichens comprise at least 30% of the available forage, at least 15% of the lichens should be considered as unavailable because of trampling.

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