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#### Abstract

The nature of the flora and the relationships between plant communities and the surficial materials on Lougheed Island were studied. Thirty-three vascular species were identified. Most communities are dominated by monocotyledons. Several *Luzula*-based communities occur on sandy materials; grass-based communities, primarily dominated by *Alopecurus alpinus* and *Puccinellia* species occur on fine grained materials. *Saxifraga oppositifolia*-based communities are restricted to materials with significant calcareous components. For each type of material, moisture content determines which type of community is present.

#### Introduction

Three weeks (mid July to early August 1979) were spent on Lougheed Island, in the northwestern Queen Elizabeth Islands (Fig. 47.1), studying the interrelationships between plant communities and the various surficial materials. This project was carried out in conjunction with mapping of surficial materials by D.A. Hodgson.

Travel about the island was on foot and by Honda 90 ATC. Seventy-five sites were reached from two camps.

Lougheed Island is a north-south elongated, low-lying island (70 km long, 20 km average width) developed on poorly consolidated Cretaceous sandstone, siltstone, and shale (Balkwill et al., 1977). The central part of the island has gently rolling topography (maximum elevation ca. 140 m). The coastal margins are generally gently sloping and of low relief.

The island shows evidence of Quaternary glaciation, including an esker in the southeastern part of the island, drumlinoid features on the west side, and the widespread presence of erratics, including limestone, igneous, and metamorphic granule to boulder sized materials.

The island was largely submerged during higher sea levels of the late Pleistocene and early Holocene, for marine deposits occur over much of the island and marine shells have been collected at elevations of more than 100 m.

#### Acknowledgments

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#### Previous Biological Studies

Little has been written on the vegetation or wildlife of Lougheed Island. Stephansson (1921) noted that the vegetation was abundant on the southern and western parts of the island and that this vegetation supported a sizeable caribou population. Macpherson (1961) recorded estimates made by R. Thorsteinsson in 1955 and 1959 of 300 caribou on Lougheed Island; Miller and Russell (1974) saw only 30 caribou. During the three weeks we travelled around the island, only four caribou were seen together with numerous well picked-over carcasses.

Glenister and Thorsteinsson (1963) reported that the vegetation was primarily grasses, lichens, and mosses; they observed no shrubs. Savile (1961) stopped briefly on the

northeastern part of the island and observed *Alopecurus alpinus* and *Saxifraga oppositifolia*. These were the first species recorded for the island and until the present study the only species information available.

#### General Remarks on Vegetation

The vascular flora of Lougheed Island is small, only 33 species in total, all present at both ends of the island (Appendix 1; taxonomic nomenclature follows Porsild, 1964). Grass-like species dominate the vascular plant component of most plant communities, namely the rushes *Luzula confusa* and *L. nivalis* and the grasses *Alopecurus alpinus* and *Puccinellia* species. Caryophyllaceae and Saxifragaceae are the most abundant and diverse dicotyledonous families. No shrubs, Cyperaceae, or aquatic species were found.

Despite the low number of vascular species, the percent cover of vegetation can be high (greater than 75 per cent cover, Fig. 47.1), where dark soil lichens (patina) and a few mosses are present. From the air this nearly continuous lower stratum gives the terrain a dark appearance. Areas without this lower cryptogamic stratum are generally poorly vegetated, usually less than 20 per cent cover. This "all or nothing" phenomenon of vegetation cover occurs on other high arctic islands as well. Vegetation cover between 20 and 75 per cent is too localized to be shown on Figure 47.1.

The reduced vascular flora and the absence of shrubs that are present on similar materials on southern Amund Ringnes, Cornwall and Graham islands (Hodgson and Edlund, 1975, 1978) and southern Sabine Peninsula (Barnett et al., 1975) indicate that this island belongs entirely in Zone 1, the most severe of the high arctic bioclimatic subdivisions described by Hodgson and Edlund (1978).

#### Surficial Materials and Plant Communities

Though the island is underlain by Cretaceous rocks, a substantial area is covered by Quaternary glacial, glacio-marine, fluvial, and eolian material. Soil development is minimal in this region so that the plants are rooted directly in unaltered or physically weathered material. The nature and composition of the materials, therefore, have a great influence on the vegetation.

#### Bedrock

Weathered and unweathered rock is commonly exposed at higher elevations, and in stream cuts and in headwalls of nivation hollows at lower elevations. Vegetation is generally sparse, but there are definite patterns to the plant groups found on the various rock types.

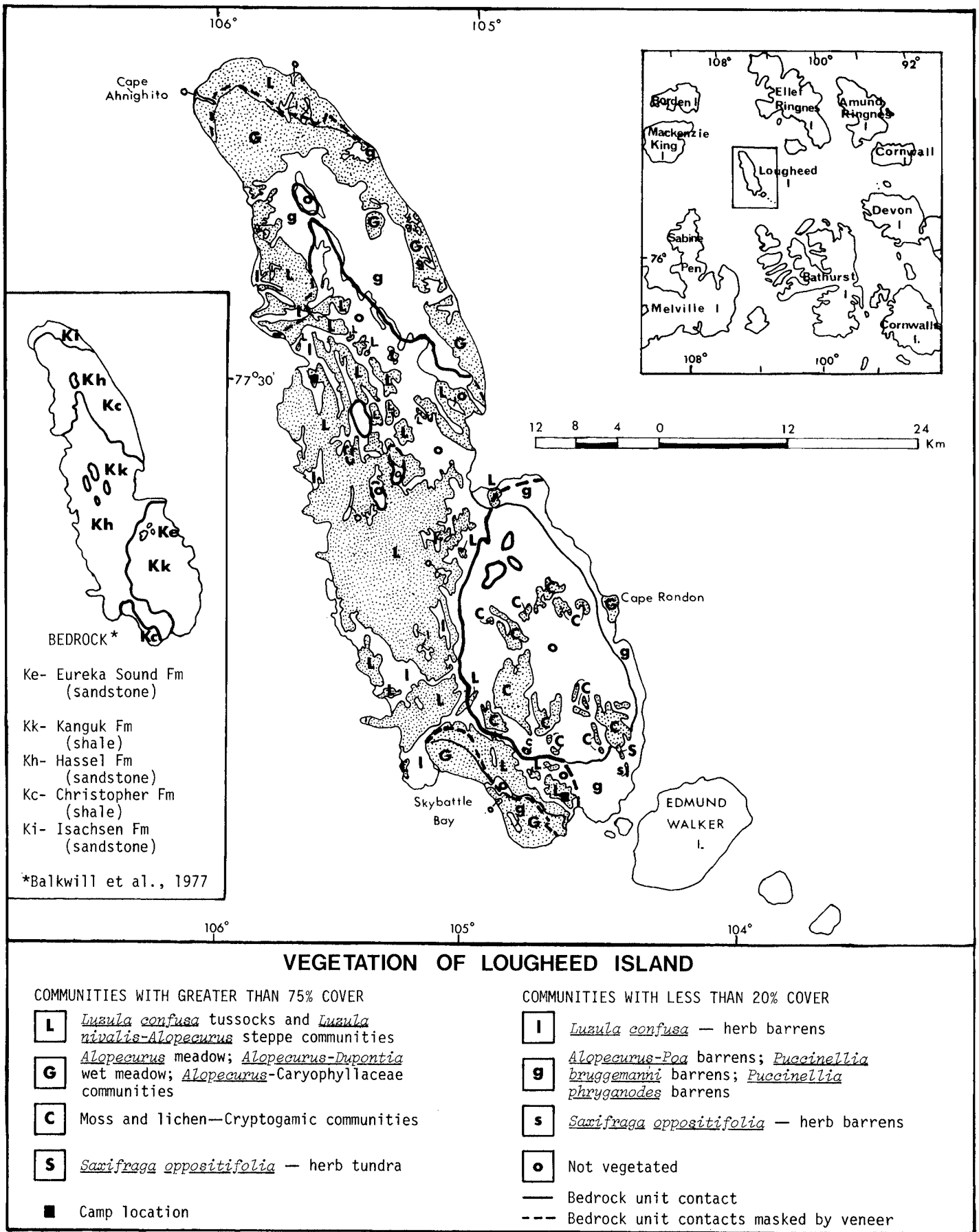


Figure 47.1. Vegetation of Loughheed Island.

**Shale.** One of the most striking illustrations of the influence of bedrock composition on vegetation can be seen by comparing vegetation on shales of the Christopher and Kanguk formations.

Christopher Formation weathers into fine silts and clays and supports grass communities. Sparse *Alopecurus alpinus*, *Colpodium vahlianum*, and *Poa* species are the most common plants on well drained materials. On lower slopes and in valleys and depressions where drainage is poor, *Alopecurus* is the dominant grass (usually less than 5 per cent cover). A lower stratum of patina and mosses is commonly found. Caryophyllaceae, Saxifragaceae, and *Papaver radicum* are sporadic associates. This assemblage of plants is also found on the Christopher Formation on Sabine Peninsula, Melville Island (Barnett et al., 1975), and on the Ringnes Islands (Hodgson and Edlund, 1978).

Fine grained Kanguk Formation is unvegetated, regardless of the moisture regime; this was also observed on Kanguk Formation on Amund Ringnes Island. The shale is extremely acidic and probably inhibits plant growth; only where there is a marine or glaciomarine veneer over the bedrock do plants grow.

**Sandstone.** The Hassel Formation is predominantly a poorly consolidated sandstone which includes thin shale beds. Unconsolidated sand weathered from the Hassel Formation is present on hilltops and ridges in the central part of the island. The sand is generally well drained and prone to deflation. Some of the weathered surface is covered by a thin, red-weathering sandstone and siltstone lag deposit. Although the sands are commonly unvegetated, the lichen *Cornicularia divergens* attaches to the lag pebbles in a few places. Locally *Luzula confusa*, *Papaver radicum*, and other herbs occur sporadically. Only in sheltered locations where moisture is retained, such as snowmelt seepage slopes, are there places with continuous vegetation. Such areas are dominated by *Luzula*-patina communities described in greater detail below.

In a few places where fine grained material is present at the surface, sparse grasses and a variety of Caryophyllaceae occur, including *Alopecurus*, *Puccinellia* species, *Poa glauca*, *Stellaria longipes*, *Cerastium arcticum*, *C. regelii*, *Arenaria rossii*, *Saxifraga caespitosa*, and *Papaver radicum*.

Sandstones from the Isachsen and Eureka Sound formations were not visited. It is probable, however, that these outcrops are extremely poorly vegetated or unvegetated, as is the case on Sabine Peninsula and the Ringnes Islands. Communities present are probably *Luzula* based.

#### Quaternary Deposits

Much of the bedrock of Loughed Island is masked by a variety of unconsolidated Quaternary materials from several metres to less than a metre thick. Included are fine to coarse grained glacial deposits, silt and clay of glaciomarine and offshore marine sediments, beach sands, sand to fine grained deltaic deposits, and modern fluvial sediments. These materials are generally moderately or poorly drained. Saturated soils are common; however, ponding is rare and extremely localized.

**Sands.** Sandy Quaternary materials, including fluvial and some deltaic and nearshore deposits, are derived primarily from Hassel Formation sandstone. These deposits are among the most heavily vegetated materials on the island where depositional processes are not currently active. Communities are primarily *Luzula* based, with a nearly

continuous lower stratum of patina and *Polytrichum* moss. *Luzula confusa* is the dominant vascular plant of moderately to well drained sites; *Luzula* cover is typically drained 5 to 15 per cent. *Potentilla hyparctica*, *Luzula nivalis*, *Alopecurus alpinus*, *Papaver radicum*, *Draba* species, and *Stellaria longipes* are common associates. *Luzula confusa* tussocks can be extremely dense (25 to 50 per cent cover) in areas adjacent to current eolian activity.

On imperfectly drained sands, *Luzula nivalis* is the dominant vascular plant and *Alopecurus alpinus* is a common associate. The moss component of the nearly continuous lower stratum is thicker and includes *Polytrichum*, *Rhacomitrium lanuginosum*, and *Aulacomnium*.

Standing water is rare on Quaternary sand, but in the few areas where it is present, there are pure bryophytic communities and *Alopecurus - Dupontia fisheri* communities with a dense bryophytic lower stratum. Other vascular species are rare.

Silty sand, particularly common as a fluvial deposit overlying the Kanguk Formation, appears barren; however, close examination commonly revealed small clumps of *Puccinellia bruggemanni* (1 to 10 per cent cover) partially masked by a layer of fine eolian sand. The only other vegetation rarely observed on this material was *Papaver radicum*.

On sand and silty sand near the modern shoreline, sparse, sporadic *Puccinellia phryganodes* halophytic communities occur. In zones where ice thrust is common this community may occur immediately inshore of the ice thrust features.

**Silt and Clay.** Silt and loamy clay, commonly including granule or larger sized clasts are widespread. These materials of marine, glaciomarine, and glacial origin are commonly covered by continuous vegetation. They are poorly drained for the most part, and where relief is slight, such as on broad ridge tops, the materials are frequently saturated. Only on moderate and steep slopes do materials appear to be moderately to well drained.

Where this veneer overlies Kanguk Formation shale, communities are essentially cryptogamic. Vascular plants are poorly represented (usually less than 5 per cent) by *Alopecurus alpinus* and *Puccinellia bruggemanni* and rarely *Luzula nivalis*. Scattered thermokarst ponds commonly are surrounded by dense bryophytic mats; *Alopecurus alpinus* and *Dupontia fisheri* can be found locally on raised moss hummocks at the pond edges, along with rarer *Saxifraga nivalis*, *S. tenuis*, and *S. cernua*. On moderate to steep slopes, the vegetation is much more varied; *Saxifraga oppositifolia*, the above Saxifrages, *Papaver radicum*, *Stellaria longipes*, and *Cerastium arcticum* appear in conjunction with *Alopecurus alpinus*.

Over Hassel Formation sandstone, poorly drained silt and clay veneers support *Luzula nivalis* communities, with *Alopecurus* usually co-dominant. *Juncus biglumis*, *Puccinellia bruggemanni*, *Saxifraga nivalis*, *S. tenuis*, *S. cernua* and *S. caespitosa* are common associates. On saturated materials *Puccinellia bruggemanni* and *Alopecurus alpinus* are commonly the only vascular plants. A moss-patina lower stratum is nearly continuous on such materials. On better drained slopes of fine grained material, the highest diversity of vascular plants on the island occurs. In addition to the expected *Luzula* species and *Alopecurus*, six saxifrages, *Potentilla hyparctica*, *Cochlearia officinalis*, *Cardamine bellidifolia*, *Draba* species, *Papaver radicum*, four Caryophyllaceae, and two *Ranunculus* species commonly occur.

*Alopecurus alpinus* is the dominant vascular plant where marine silt and clay overlie Christopher Formation shale,

Table 47.1  
Relationships between plant communities, moisture regime, and surficial materials

Dominant Plant Community	Surficial Material	Moisture Regime
<u>BEDROCK</u>		
1. <i>Alopecurus-Poa</i> barrens	Shale (Kc)	Dry
2. <i>Luzula confusa</i> barrens	Sandstone (Kh, Ke, Ki)	Dry
3. Unvegetated	Shale (Kk)	Dry to wet
<u>QUATERNARY DEPOSITS</u>		
4. <i>Luzula confusa</i> barrens	Sand	Dry
5. <i>Luzula nivalis</i> - <i>Alopecurus</i> steppe	Sand	Moderately to imperfectly drained
6. <i>Alopecurus-Poa</i> barrens	Silt and clay	Dry
7. <i>Alopecurus-Caryophyllaceae</i> tundra	Silt and clay	Moderately drained
8. <i>Alopecurus-Puccinellia</i> steppe	Silt and clay	Imperfectly drained to saturated
9. <i>Alopecurus-Dupontia</i> wet meadow	Sand, silt, and clay	Saturated; around ponds and seepage slopes
10. <i>Puccinellia phryganodes</i> barrens	Sand and silty sand	Imperfectly drained shoreline
11. <i>Saxifraga oppositifolia</i> barrens	Calcareous gravelly sand	Dry
12. <i>Saxifraga oppositifolia</i> moss tundra	Calcareous gravelly sand	Imperfectly drained

regardless of the moisture regime. Imperfectly and poorly drained materials are the most common and these support *Alopecurus* meadows with a nearly continuous moss-patina lower stratum. *Luzula nivalis* is a rare component of this community. *Puccinellia bruggemanni* appears on the saturated materials with *Alopecurus*. Moderately well drained materials have *Alopecurus-Caryophyllaceae* communities. *Cerastium regelii* and *Stellaria longipes* are common associates, along with scattered clumps of *Saxifraga oppositifolia*. The driest materials have a sparse *Alopecurus-Poa* barrens similar to that on Christopher Formation outcrop.

Gravel and Gravelly Sand. An esker-like ridge at the southeast extremity of the island is composed of gravelly sand armoured with granule to boulder sized materials of local and exotic lithologies; there is a substantial limestone component. Fine grained glaciomarine deposits overlap all but the ridge crest and are vegetated with *Luzula* and *Alopecurus* communities; however, on the ridge crest *Saxifraga oppositifolia* communities appear. The driest materials support *Saxifraga oppositifolia* - herb barrens with *Luzula confusa*, *Poa abbreviata*, *Alopecurus alpinus*, *Ranunculus sabinei*, *Potentilla hyparctica*, *Draba* species, and *Papaver radicum* as associates. On the moderately to imperfectly drained materials *Saxifraga oppositifolia* (5 to 25 per cent cover) is the dominant vascular plant component, and there is a dense moss-patina lower stratum.

These gravels are the only materials on the island that support purple saxifrage communities. This is probably due to the presence of calcareous erratics, for purple saxifrage communities are common on slightly to moderately calcareous materials on other high arctic islands.

Table 47.1 summarizes the interrelationships between plant community and surficial materials. For a given material, the moisture regime determines which community dominates.

*Luzula*-based communities are the most common plant communities on Loughheed Island. These are found primarily on sandy sediments derived from Hassel Formation sandstone and on veneers of Quaternary sediments over sandstone. *Luzula confusa* communities occur on the drier aspects, whereas *Luzula nivalis* - *Alopecurus* communities favour less well drained sites.

Grass-based communities are found on fine grained Christopher Formation shale and glaciomarine deposits. Sparse *Alopecurus-Poa* barrens occur on dry silt and clay. On moderately drained surfaces *Alopecurus-Caryophyllaceae* communities occur. *Alopecurus* meadows dominate the poorly drained materials.

*Alopecurus - Puccinellia bruggemanni* communities occur on both saturated sands and saturated fine grained materials. In the few places that ponding occurs, *Alopecurus-Dupontia* wet meadow communities, with a dense bryophytic lower stratum, occur near the water margin.

Kanguk Formation shale is devoid of vegetation, regardless of the moisture regime. In regions where material derived from this shale are mixed with sand, and eolian processes are active, sparse *Puccinellia bruggemanni* tussocks occur.

Purple saxifrage (*Saxifraga oppositifolia*) communities occur on the probable glacial deposits where there are significant calcareous erratics.

*Puccinellia phryganodes* halophytic communities occur sporadically on sand and sandy silt at the coast.

The plant communities and variety of vascular plant species on Lougheed Island are similar to adjacent islands, notably northern Amund Ringnes Island, northern Sabine Peninsula, and King Christian Island, where similar surficial materials occur. On Lougheed Island, however, there is a higher total per cent cover than on these other islands; this is probably due to the extent to which glaciomarine and marine veneers blanket the island.

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## APPENDIX 1

### Vascular species of Lougheed Island

*Alopecurus alpinus*, *Poa abbreviata*, *P. alpigena*, *P. hartzii*, *P. glauca*, *Colpodium vahlianum*, *Puccinellia angustata*, *P. phryganodes*, *P. bruggemanni*, *Dupontia fisheri*, *Juncus biglumis*, *Luzula confusa*, *L. nivalis*, *Oxyria digyna*, *Papaver radicum*, *Arenaria rossii*, *Cerastium arcticum*, *C. regelii*, *Stellaria longipes*, *Cochlearia officinalis*, *Cardamine bellidifolia*, *Draba bellii*, *D. oblongata*, *Ranunculus nivalis*, *R. sabinei*, *Saxifraga caespitosa* ssp. *uniflora*, *S. cernua*, *S. flagellaris*, *S. nivalis*, *S. oppositifolia*, *S. rivularis*, *S. tenuis*, *Potentilla hyparctica*.