GEOLOGICAL SURVEY OF CANADA
PAPER 89-26

VEGETATION OF CORNWALLIS AND ADJACENT ISLANDS, NORTHWEST TERRITORIES: RELATIONSHIPS BETWEEN VEGETATION AND SURFICIAL MATERIALS

S.A. Edlund

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Available in Canada through

authorized bookstore agents and other bookstores

or by mail from

Canadian Government Publishing Centre
Supply and Services Canada
Ottawa, Canada K1A 0S9

and from

Geological Survey of Canada offices:

601 Booth Street
Ottawa, Canada K1A 0E8

3303-33rd Street N.W.,
Calgary, Alberta T2L 2A7

A deposit copy of this publication is also available for reference in public libraries across Canada

Cat. No. M44-89/26E
ISBN 0-660-13990-1

Price subject to change without notice

Cover description

Arctic poppy (*Paparer radicatum*) growing in weathered bedrock, near Resolute

Critical Reader

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Original manuscript received: 1988-06-30
Final version approved for publication: 1989-10-30

CONTENTS

Appendices

Tables

Illustrations

VEGETATION OF CORNWALLIS AND ADJACENT ISLANDS NORTHWEST TERRITORIES: RELATIONSHIPS BETWEEN VEGETATION AND SURFICIAL MATERIALS

Abstract

Vegetation occurs on only 20% of Cornwallis and adjacent islands. This general lack of vegetation is due to 1) the high alkalinity of and lack of plant nutrients in the carbonates and evaporites from which the predominant soils are derived and 2) possible active cryoturbation. Where vegetation does occur, it is restricted to weakly to moderately alkaline materials, either on impure materials or carbonates that have supplementary materials added, such as on marine deposits and marine reworked materials and till. The vegetation reflects the alkaline nature of the substrate, for calciphilous species such as Saxifraga oppositifolia and Dryas integrifolia *are major vascular plant components of most plant communities. The densest vegetation is concentrated in lowland areas, valley bottoms, and on lower slopes where there is adequate or abundant moisture throughout most of the growing season and where some surface leaching and organic incorporation into soils occur. Nineteen plant communities are grouped by their composition, dominant growth form, and apparent growing season lengths into three bioclimatic zones within the High Arctic region. This is a high number for such a sparsely vegetated area and reflects the variety of microhabitats. Zone 3 has more than 60 vascular plant species and is dominated by prostrate shrubs and sedges. Zone 2 has 35 to 60 vascular plant species and is dominated by herbs such as* Saxifraga oppositifolia, Luzula nivalis, *and* Alopecurus alpinus, *while sedges and prostrate shrubs have a minor role. Zone 1 has less than 35 vascular plant species and is dominated by herbs; sedges and dwarf shrubs are absent. This zonation also occurs locally in telescoped form downslope from late lying snowbeds, where the duration of the growth period is directly proportional to the length of time the unfrozen ground is exposed from beneath the gradually retreating snowbank.*

Résumé

Seulement 20 p. cent de la surface de l'île Cornwallis et des îles adjacentes est recouverte de végétation. Cette absence générale de végétation résulte 1) de la pauvreté en éléments nutritifs pour les végétaux et de la forte alcalinité des carbonates et des évaporites dont les principaux sols sont dérivés et 2) de l'existence possible de mouvements actifs de cryoturbation. La végétation ne croît que sur des matériaux faiblement à modérément alcalins, c'est-à-dire, sur des matériaux ou des carbonates impurs auxquels d'autres matériaux ont été ajoutés, comme des sédiments marins remaniés et du till. Elle reflète la nature alcaline du substrat : en effet, des espèces calciphiles comme Saxifraga oppositifolia *et* Dryas integrifolia *sont les principales plantes vasculaires de la plupart des associations végétales. La végétation la plus dense se trouve surtout sur les basses-terres, les fonds de vallées et la partie inférieure des versants, là où l'humidité est suffisante ou abondante pendant la majeure partie de la saison de croissance et où le sol est enrichi par le lessivage d'éléments nutritifs en surface et par l'incorporation de matière organique. Dix-neuf associations végétales ont été réparties en trois zones bioclimatiques de la partie septentrionale de l'Arctique, selon leur composition, la principale forme de croissance et la durée apparente de la saison de croissance. Ce nombre est élevé pour une région si peu recouverte de végétation et témoigne de la grande variété de microhabitats. La zone 3 compte plus de 60 espèces de plantes vasculaires et est dominée par des arbustes rampants et des laîches. On retrouve de 35 à 60 espèces végétales dans la zone 2, surtoutl des plantes herbacées comme* Saxifraga oppositifolia, Luzula nivalis *et* Alopecurus alpinus; *les laîches et les arbustes rampants y sont peu abondants. La zone 1 comprend moins de 35 espèces de plantes vasculaires, principalement des plantes herbacées; on n'y trouve pas de laîches ni d'arbustes rampants. Cette répartition en zones se manifeste aussi localement sous forme télescopée, en contrebas d'accumulations persistantes de neige; à ces endroits, la durée de la période de croissance est directement proportionnelle au temps pendant lequel le sol non gelé est exposé suivant le retrait de la couverture de neige.*

INTRODUCTION

Fieldwork

While the initial impression of Cornwallis Island area is one of extreme desolation and barrenness, about 20% of the island does support vegetation. Little has been reported on the nature of vascular plant species and plant communities of this area except for the Resolute Bay area (Schofield and Cody, 1955; Arkay, 1972). In August 1975, I was part of an interdisciplinary team involved in a reconnaissance terrain inventory of the Cornwallis Island area (Barnett et al., 1975, 1976, 1977; Fig. 1). My research involved an inventory of plant species, their segregation into plant communities, and the study of the interrelationships between the plant communities and the surficial materials in which they are rooted. I also conducted further plant community inventories in the Resolute Bay area in mid August 1979 and 1980. This report summarizes the vegetation and its relationships to the surficial materials, describes and maps the distribution of plant communities, and discusses environmental factors which control their distribution.

Over 200 sites were surveyed on traverses by a Bell 206B helicopter based at our field camp on Abbott River (Fig. 2) during August 1975, and by foot and Honda ATC tricycle from Resolute Bay in mid August 1979 and 1980. At each site individual species were inventoried and categorized as to their predominant moisture regimes. At most sites per cent cover of major plant species was estimated. At 37 sites more detailed per cent cover measurements were made by Linear Pin Frame method for densely vegetated areas and Line Intercept method for sparsely vegetated areas (Brown, 1954).

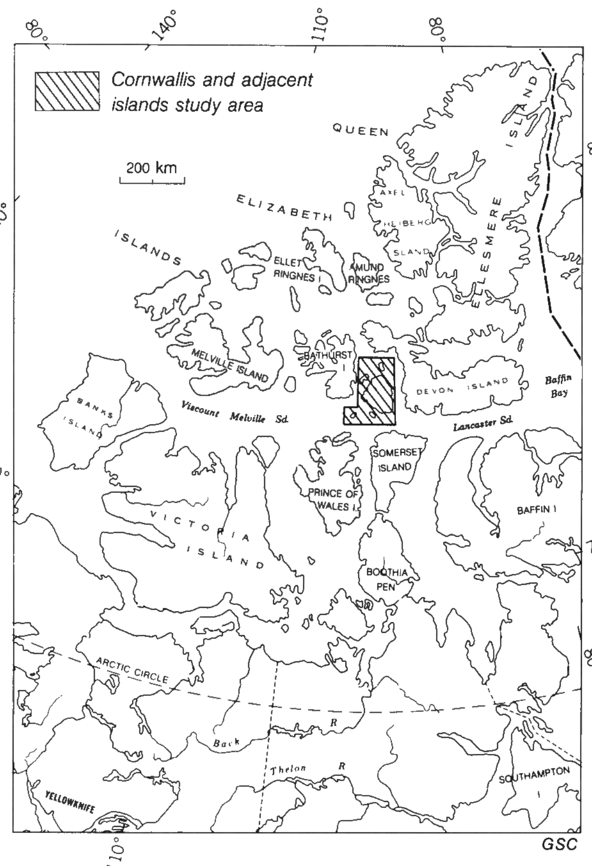


Figure 1. Location of the Cornwallis Island map area in the southern Queen Elizabeth Islands.

Patterns of plant communities and complexes of communities, as seen by changes in moisture patterns and thus by tonal variation, were mapped on 1:60 000 scale black and white aerial photographs. These were reduced to 1:250 000 scale for an initial vegetation map (Edlund, 1982b), and further reduced to the 1:500 000 scale map (Map 1767A) which accompanies this report.

Surficial materials sampling was carried out by D.M. Barnett and L.A. Dredge who excavated pits to the base of the active layer (10-70 cm thick) where possible. Grain size analysis, pH, carbonate content, and calcite-dolomite ratios were obtained from 183 samples by the sedimentology laboratory of Terrain Sciences Division (Edlund, in press a). Twenty samples from the Resolute Bay area (Fig. 2) were analyzed for pH, nitrogen, organic content and cation concentrations by Soil-Anal Co. Ltd.

Previous botanical work

The first botanical collections of Cornwallis Island and possibly Griffith Island were made in 1851-52 by P.G. Sutherland, a member of the Austin Expedition. Simmons (1913) reported 38 species from Cornwallis Island. Further collections were not made until the late 1940s to mid 1950s. Collins (1951, 1952, 1955), an archeologist, deposited a plant collection from the Resolute Bay area with the National Herbarium, and the plants are reported in Porsild (1955). Schofield and Cody (1955) studied the vegetation around Resolute Bay in 1949 and began the first species distribution studies for the area; they collected 47 species of vascular plants. Steere (1951) identified 95 bryophytic species, which were collected at the same time. Thorsteinsson (1955, 1958) reported the first correlations between surficial materials and plant communities.

As Resolute Bay became a staging area for High Arctic expeditions, numerous collections were made of that local area of Cornwallis Island. Porsild (1964) revised the list of vascular plants of Cornwallis Island from 47 to 72, some of which have not been currently confirmed (Appendix 1). In 1972, Arkay completed a thesis on vascular flora of the Char Lake (Resolute area) drainage basin. It was both a floristic study, and one showing terrain-vegetation relationships and growth habits.

Nomenclature

Vascular plant nomenclature conforms to Porsild and Cody (1980), and the species are shown in Appendices 1 and 2; the cryptogamic nomenclature follows Conard (1956) for bryophytes and Hale (1969) for lichens.

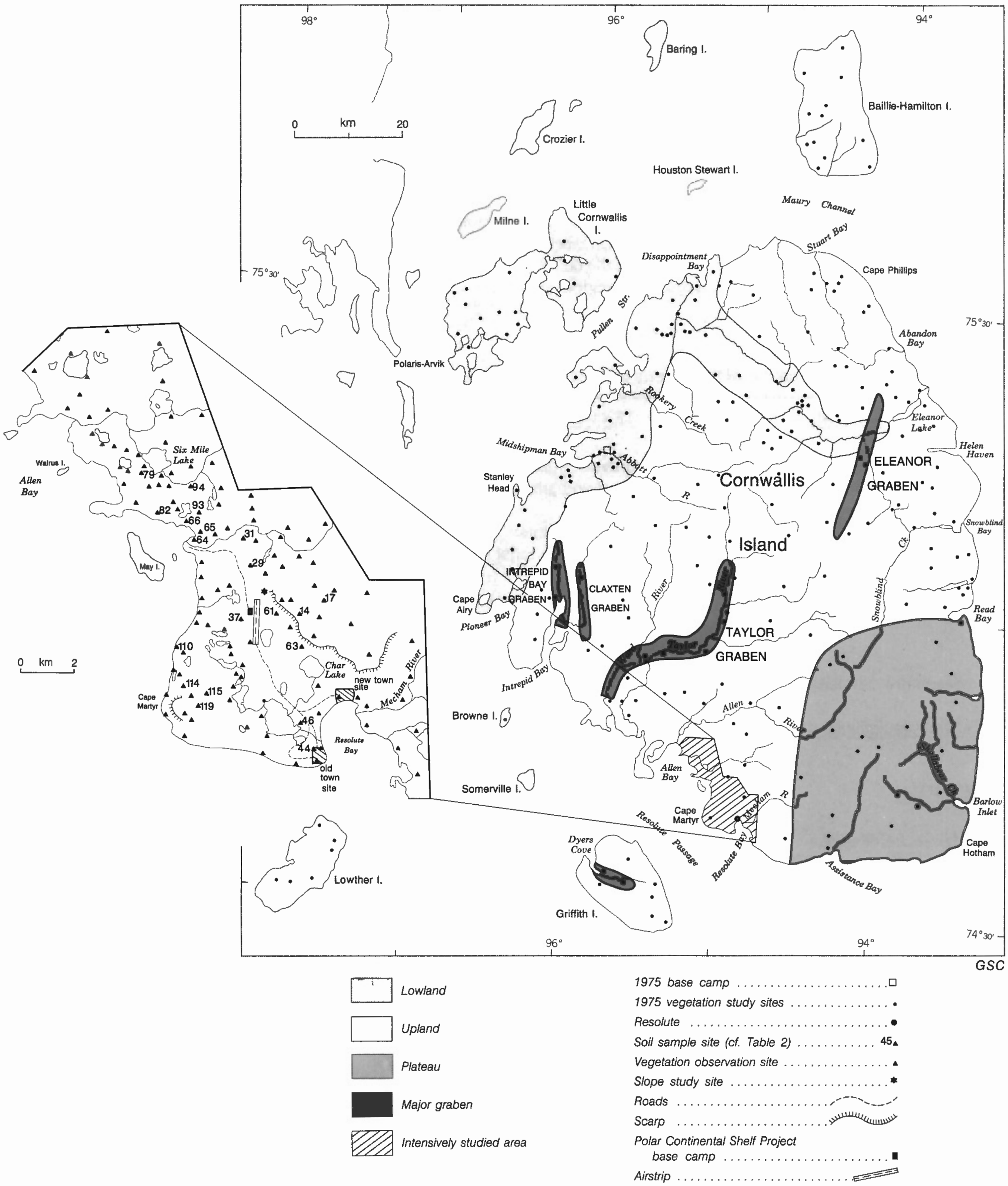


Figure 2. Map area showing study sites on Cornwallis and adjacent islands, the general physiographic regions, and major grabens in which lowlands have formed.

The term meadow is applied to wetland communities with a high proportion of grasses and sedges in the upper stratum; tundra is applied to communities with nearly continuous plant cover; marsh, to communities rooted in saturated substrates and shallow water; heath to communities with a high proportion of ericaceous plants; and barrens (Polunin, 1960) to communities with less than 25% plant cover, usually in a single stratum. Plant communities are named with regards to vascular plant species dominance and total ground cover.

Physical environment

Cornwallis Island lies in the south central Queen Elizabeth Islands, between 74°15' and 76°00'N, 93°00' and 98°00'W (Fig. 1), well within the High Arctic vegetation region of Polunin (1951, 1960). The vegetation is affected by several regional factors such as climate, reflected in the length and intensity of the melt season, and the physical and chemical composition of the surficial materials, which in turn affect the nutrients and moisture availability.

Physiography and surface materials

Cornwallis and neighboring islands are underlain mainly by Paleozoic limestone and dolomite with lesser amounts of gypsum and anhydrite, calcareous shale, siltstone, and sandstone (Thorsteinsson, 1955, 1958, 1972; Thorsteinsson and Kerr, 1968).

Table 1. Weathering products of the various parent materials: their textures and pH

PARENT MATERIAL	TEXTURE	pH
Fluvial deposits	gravels, cobbles, plates with or without sand and silt; local sand and silt	7.0-8.4
Colluvial deposits	silt or silty loam; scree of boulders and gravels with local fines	6.6-8.4
Marine deposits beach deposits	subangular to subrounded carbonate plates, cobbles gravels with few fines; local sand, silt or gravel beaches	7.2-8.4
nearshore deposits	sand and silt with minor clay and gravel	7.0-7.8
Till and glaciofluvial deposits	silty diamicton with clasts of local or foreign origins	7.0-8.0
BEDROCK		
Acidic sandstone (Hecla Bay and Eureka Sound fms.)	sand, fine sand, silt	6.6-7.0
Alkaline sandstone (Snowblind Bay and Bird Fiord fms.)	sand, fine sand; gravel, commonly as lag	7.2-7.8
Limestone, with siltstone and shale beds (Cape Phillips, Stuart Bay, and Irene Bay fms.)	sandy and silty loams with minor gravel; silty diamicton	7.2-8.0
Limestone and dolomite (Eleanor R., Thumb Mtn., Cape Phillips, Allen Bay, Snowblind Bay, Stuart Bay, Disappointment Bay, Read Bay, Blue Fiord, Bird Fiord, and unnamed fms.)	frost shattered platy or cobbly debris with or without silty fines; some silty loam with minor gravel and silty diamicton	7.6-8.4
Gypsum; anhydrite (Baumann Fd., Bay Fiord, and unnamed formations)	silty loam and silty diamicton; local frost shattered debris	7.6-8.4

Most of central Cornwallis Island (Fig. 2) is rolling terrain rising to 300 m elevation. The southeast is a plateau largely above 200 m, rising to 340 m elevation. Lowlands have developed on less resistant rocks in north-central and northwest Cornwallis, as well as the islands of McDougall Sound. Grabens on Cornwallis and Griffith islands form local lowlands.

The physiography was largely developed by pre-Quaternary planation, rifting and dissection. Quaternary glaciation has modified coastal areas to a certain extent. Glacial ice eroded bedrock, creating lake basins and deranged drainage patterns, and carved broad U-shaped valleys on the east coast. Holocene marine regression left littoral deposits up to 110 m elevation (Edlund, in press a).

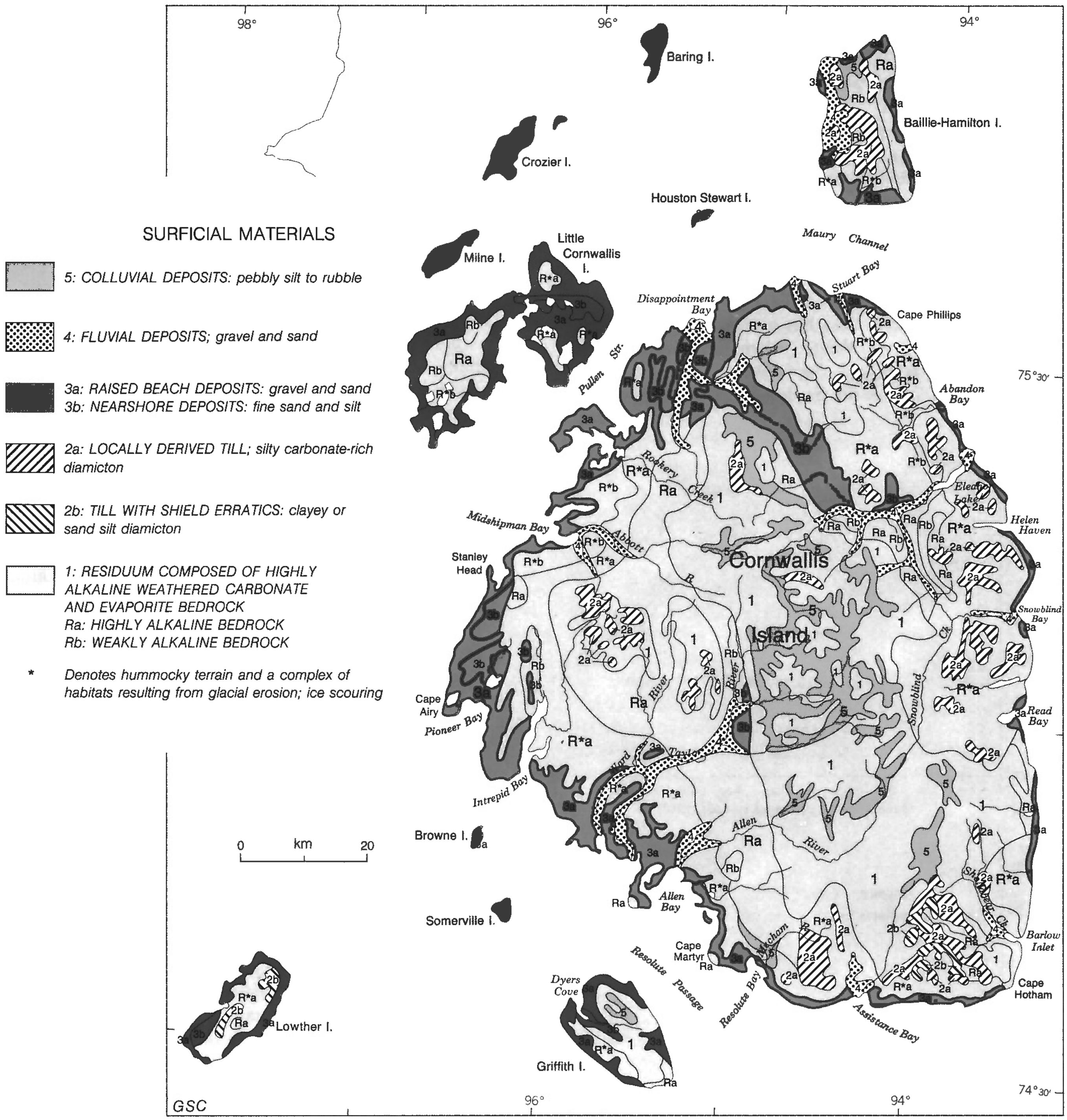


Figure 3. Surficial materials of the Cornwallis Island map area (generalized from Edlund, in press b).

The surface materials of Cornwallis Island are largely derived from weathered bedrock. Table 1 summarizes the weathered materials from the various parent materials and textures of other deposits, and Figure 3 shows the distribution of surficial materials in the map area (Edlund, in press a).

The study area lies well within the zone of continuous terrestrial permafrost. In this harsh climate, soil development is minimal (Tarnocai, 1976). This minimal profile development means little incorporation of organics into the active layer except in some wetlands. Because of the lack of soil development vascular plants are rooted directly in the surficial materials; therefore vegetation is directly influenced by the chemical and physical properties of these deposits.

The active layer thickness varies from around 10 cm in boggy areas, having a thick blanket of moss as insulation, to about 70 cm on coarse, extremely well drained materials (McCann and Hannell, 1971; Edlund, in press a); the average depth is less than 50 cm.

Climate

The Cornwallis Island area has a climate typical of High Arctic regions (Fig. 4). Winter, when the ground is entirely frozen, stretches from early September to early June. Maximum snowfall occurs in September and October when temperatures are close to 0°C. Total snowfall is only 83 mm (water equivalents; Atmospheric Environment Service, 1982) but is not evenly distributed (Langley, 1960). Persistent northerly winds continually redistribute snow throughout winter, exposing some surfaces and forming substantial drifts in valleys and in sheltered sites. This snow cover enables vascular plants to survive the cold temperatures and abrasive, desiccating winds.

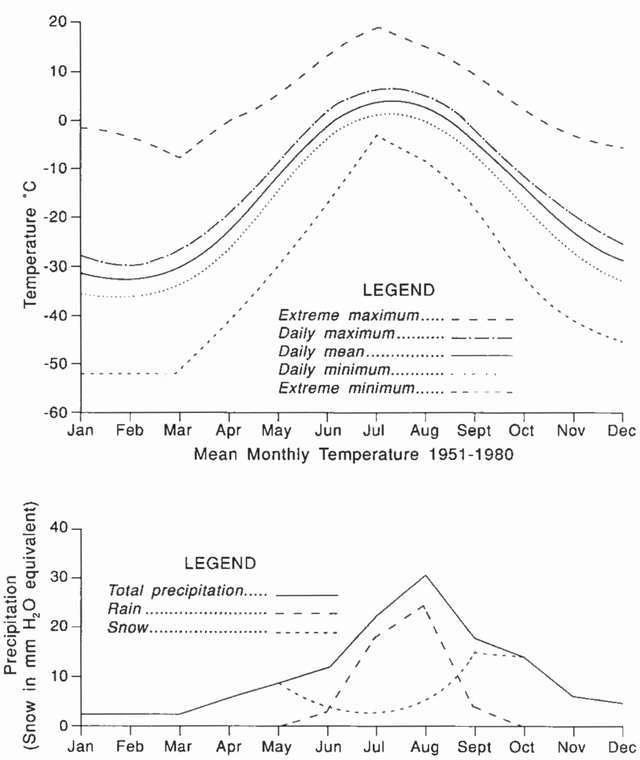


Figure 4. Summary of 30 years of mean monthly temperature and precipitation data from Resolute Bay, Cornwallis Island (from Atmospheric Environment Service, 1982).

Temperatures rise above freezing in early to mid June. Snowmelt occurs first at lower elevations and in more southerly parts of the map area. Snowmelt and ground thaw proceed rapidly. Rivers, inactive through winter, start to fill in mid to late June and peak during the first two weeks in July (Cogley and McCann, 1975; Walker and Lake, 1975). As the active layer thaws, it is usually saturated by melting snow and light rain. Snowmelt and ground ice thaw provide the bulk of moisture within the surficial materials. As snow disappears some plants break dormancy and some like *Saxifraga oppositifolia* (purple saxifrage) and *Ranunculus nivalis* (snow buttercup) immediately burst into flower at the time of thaw.

Snow has generally disappeared by July, except for a few persistent snowbeds some of which may last throughout the summer. Temperatures rarely fall below freezing during summer, but also rarely exceed 10°C. Throughout summer there is continuous light, diurnal temperature fluctuations are small, 2-3°C, and even less when there is a cloud cover. In summer about 44 mm of rain falls as light showers, and snow can fall at any time, though it does not persist. Once the bulk of the active layer dries, however, this summer precipitation rarely replenishes surface soil moisture, although freak storms can dump 25 mm rain in 24 hours and cause local flooding. Most rivers stop flowing by mid August and moisture availability at the soil surface in August is generally limited. Abundant moisture is found only in low lying areas and zones directly downslope from persistent snowbeds.

The surface of the soil at Resolute starts to freeze and rivers generally cease flowing in mid to late August. For a time soil remains thawed at depth and some vascular plants remain active, but from the end of continuous daylight in mid August, temperatures drop rapidly below freezing, and the frozen surface layer deepens until the ground is solidly frozen in early September. By this time vegetation is again dormant. This process occurs one to two weeks earlier on higher ground.

The mean July temperature for Resolute is 4.1°C (1953-1980; Atmospheric Environment Service, 1982), a temperature well below "growing season" which starts at 5.5°C in more temperate latitudes. The average melting season, when the air temperature is consistently above 0°C, starts June 17 at Resolute and lasts an average of 74 days (Atmospheric Environment Service, 1979). This roughly corresponds to the length of the growing season for arctic plants and is possibly representative of the warmest areas of Cornwallis Island.

PLANT COMMUNITIES

The Cornwallis area lies within the High Arctic vegetation region, an area of impoverishment of flora (Young, 1971) and lack of continuous vegetative ground cover (Polunin, 1951, 1960; Bliss, 1975, 1977).

The general lack of vegetation on Cornwallis Island is well known. The explorer Sherard Osborn (1855) summed up the area as one "increasing in barrenness as we approached the Queen's Channel, and that horrid limestone, of which we have such a dislike, increases in quantity every mile we advance". The vegetation map (Map 1767A) shows that close to 80% of the surface is completely unvegetated while 15% is sparsely vegetated (less than 20% cover). Only about 5% of the island has a substantial plant cover (greater than 75% cover).

Eighteen plant communities are described in the area, a surprisingly large number considering the general lack of vegetation. Appendices 1 and 2 show the distribution of vascular plant species on the various islands and within each major community respectively. These communities have been grouped by their average mid summer moisture regimes: wetlands, with abundant, continuous moisture or locally saturated conditions; mesic conditions, where materials are imperfectly to moderately drained; and xeric conditions where materials are well drained. Communities with special requirements are dealt with separately.

Within each moisture category, the communities are ranked as to degree of species diversity; communities with the greatest diversity are discussed first and followed by those of decreasing diversity. Not all communities are of a size that can be mapped on a regional scale. Those that can be are designated by an upper case letter (e.g., S = Sedge meadow; the S denotes sedge and the underscore indicates a nearly continuous ground cover, in this case, of mosses. The underscore can also indicate a lichen lower stratum; if the underscore is absent, there is no lower stratum. Communities having coverage insufficient to be mapped at a scale of 1:500 000 are denoted here by (*).

Wetland communities

Wetland communities, covering less than 1% of the area, are limited to lowland areas and old raised terraces with ponds, seepage slopes beneath snowbeds, and centres or troughs of ice wedge polygons, where the materials have abundant supply of moisture throughout most, if not all, of the growing season. Seven plant communities occur on wet materials, sedge-moss meadows: sedge, sedge-*Salix* and grass meadows, marsh vegetation, bryophytic mats, *Phippsia algida* barrens, and an algal crust.

1. Sedge meadow (S)

Sedge meadows are the most diverse (Appendix 2) and productive communities on Cornwallis and adjacent islands but are poorly represented in the area. They are generally found locally in the lowlands in association with wet grass meadows and drier tundra communities (Map 1767A), around ponds (Fig. 5), in areas with nearly continuous seepage, and in the basins of some low centre polygon systems (Fig. 6). They do not occur in wetlands with soils that have a pH of 7.8 or higher. This community is widespread throughout the arctic (Polunin, 1960) but has less coverage in the High Arctic (Bliss, 1975).

Carex aquatilis var. *stans* is the dominant vascular plant (5-30% cover) and may occur locally in pure stands. Common associates include *Eriophorum triste*, *E. scheuchzeri*, *Dupontia fisheri* and *Alopecurus alpinus*, which together total between 2 and 10% cover. *Arctagrostis latifolia* is sporadic and restricted to more mesic aspects of the meadow. In 1979 and 1980 the grasses had a high percentage of flowering stems (50 to 85%) whereas the cotton grass species showed less than 25% and *Carex aquatilis* var. *stans* less than 2% flowering stems.

Figure 5. Sedge meadow around pond north of Resolute. Note *Pleuropogon sabinei* scattered in the pond and the barren slopes of the ice-moulded ridge behind. 204464-C

Figure 6. *Dryas-Salix* barrens on slightly raised gravel surface in foreground; sedge meadow in broad, shallow depression behind. These wet meadows occur in the Lady Hamilton Syncline, Cornwallis Island. 203642-O

Typical forbs of this community, which generally occur on raised hummocks, include *Melandrium apetalum*, *Ranunculus sulphureus* and *R. nivalis*, *Draba alpina*, *Cardamine bellidifolia*, and *Saxifrage hirculus*, *S. foliolosa*, and *S. tenuis*.

The lower stratum consists of a nearly continuous bryophytic mat (2-20 cm thick) dominated by *Drepanocladus species*, including *D. revolvens* and *D. uncinatus*, commonly mixed with *Brachythecium turgidum*, *Calliergon*, *Meesia*, *Cinclidium*, *Hypnum* species and in some places *Tomenthypnum nitens*. This bryophytic mat commonly gives the terrain a hummocky appearance, due to the differential growth rate of bryophytes; in some areas the mat appears similar to string bogs. Lichens are poorly represented (less than 1% cover). A scum of blue-green algae may cover bryophytes and some exposed soil where ephemeral ponding has occurred.

2. Sedge-*Salix* meadow*

In a few places, the sedge meadow described above has a substantial component of *Salix arctica* and *Dryas integrifolia*, and the grass *Arctagrostis latifolia* on the drier aspects of the raised moss hummocks. This community is extremely rare on Cornwallis Island, but is more common to the south on Prince of Wales Island (Russell and Edmonds, 1977), to the west on southern Melville Island (Edlund, 1982a, 1986), and at Truelove Lowland, Devon Island (Bliss, 1977) to the east.

3. Grass meadow (G)

Grass meadows are the most common community of wet lowlands of Cornwallis, Little Cornwallis, and Griffith islands. They also occur in conjunction with sedge meadows around ponds and in seepage areas. This community is common in the western Queen Elizabeth Islands (Edlund, 1980, 1982a, b, 1983a, b, c) but local in the southern Arctic.

Alopecurus alpinus is generally the dominant grass and in some places the only grass present. Cover ranges from 5 to 25%. *Dupontia fisheri* may sporadically achieve co-dominance particularly in coastal wetlands. *Luzula nivalis* and *Juncus biglumis* occur regularly in small percentages (<1-2% cover). Cyperaceae and dwarf shrubs are not common in this community. Herb associates are similar to those of the sedge meadow; however, *Melandrium apetalum* is rare.

The lower stratum consists of a continuous or broken bryophytic mat similar to that in the sedge meadow, dominated by *Drepanocladus* spp.; however, *Aulacomnium acuminatum* and *Tomenthypnum nitens* are also common. Lichens are generally absent.

A variant of this community is an *Alopecurus alpinus* meadow in which *Alopecurus alpinus* is the dominant vascular plant (2-10% cover) and in many places is the only vascular plant. *Phippsia algida* is present in a few places generally where bare ground is exposed. The lower stratum is usually a broken algal or bryophytic cover or is restricted to a few tufts of moss.

4. Marsh emergent and aquatic vegetation*

In some areas with sedge and grass meadows, stands of *Pleuropogon sabinei* grow in shallow ponds (Fig. 5). It roots either in water-covered mineral substrate, in submerged moss mats, or less commonly on saturated slopes with little or no visible water. The density of *Pleuropogon* varies from less than 1% to about 10%. *Alopecurus alpinus*, *Carex aquatilis* var. *stans*, and *Eriophorum scheuchzeri* may also appear locally as emergents. *Ranunculus hyperboreus* (Fig. 7) may occur in this community as well, either entangled in the submerged moss mat or on the wet, bare, mineral soil.

5. Bryophytic mat*

In some areas a continuous to discontinuous moss mat may occur with little or no vascular component. This commonly occurs immediately downslope from late-lying snowbeds and only rarely in lowland settings. It consists of *Hypnum*, *Philonotis*, and *Calliergon* species, *Aulacomnium accuminatum*, *Tomenthypnum nitens*, and rare occurrences of *Drepanocladus* species. Cheonophyllous (ice-loving) mosses like *Orthothecium chryseum* and *Bryum cryophyllum* occur as strikingly red mats and stripes on seepage slopes in the vicinity of snowbeds.

6. Algal crust*

A wet algal crust appears in a few places almost exclusively directly downslope from late-lying snowbeds. This consists of a crust of jelly-like blue-green algae, which may form a continuous or broken cover over mineral soil. *Nostoc* seems to be a dominant algal species; the other cryptogams have not been identified.

7. *Phippsia algida* barrens*

Phippsia algida barrens are sparsely vegetated communities (usually less than 5% cover) and are commonly seen at higher elevation (greater than 300 m a.s.l.) or on exposed saturated soil immediately downslope from melting snowbeds. This is

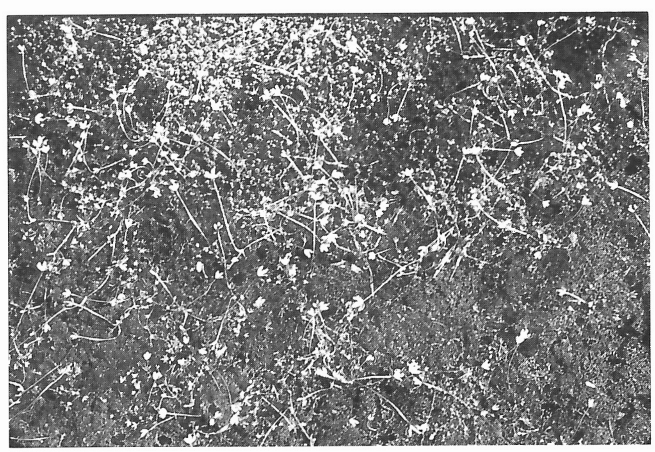


Figure 7. *Ranunculus hyperboreus* in saturated soil at the edge of a pond in the Assistance Bay area. 204464-F

the only wetland community found on extremely alkaline wet materials (8.0-8.4); however, it also occurs on less alkaline substrates.

Phippsia algida is the dominant species (1-5% cover) and commonly occurs alone. Other species which may accompany it include tufts of *Alopecurus alpinus*, *Colpodium vahlianum*, *Puccinellia angustata*, *Cerastium regelii*, *Papaver radicatum*, *Stellaria longipes*, *Saxifraga caespitosa* and *S. flagellaris*. Lichens and bryophytes are rarely present.

Mesic communities

Mesic communities occur on well watered materials that are saturated during spring thaw, slowly drain as the active layer thaws, and are moderately well drained at depth in late summer while the surface may be dry. Moisture is usually available near the base of the active layer.

Typical habitats include mid to lower slopes, especially in sheltered valleys, slopes of beach deposits and raised margins of low-centre polygons. Vegetation cover is generally nearly continuous, because of a substantial cryptogamic component.

Six communities occur on this moisture regime: four prostrate shrub communities (*Dryas-Salix* tundra, *Dryas-Salix-Saxifraga oppositifolia* tundra, *Salix* tundra, and *Cassiope* heath and two herbaceous communities (*Saxifraga oppositifolia* tundra and a sparse herb-cryptogam tundra).

Dwarf shrub tundra

8. *Dryas-Salix* tundra*

This community rarely occurs on Cornwallis and adjacent islands and is primarily restricted to pockets in the southern and western lowlands, but is more common on Somerset-Prince of Wales (Russell and Edmonds, 1977) and parts of the Dundas Peninsula, Melville Island (Edlund, 1982a). It consists of an upper stratum dominated by prostrate shrubs (Fig. 8), *Salix arctica* and *Dryas integrifolia* (25 to >50% cover). Calciphilous herbs are common but in low density (see Appendix 2).

Mosses, usually associated with the decumbent *Salix* branches and the *Dryas* mounds, include *Hypnum* species, particularly *Hypnum revolutum*, and *Tortula ruralis*. A broken cover of patina may cover the surface of fine grained materials but it is generally absent on gravels.

9. *Dryas-Salix-Saxifraga oppositifolia* tundra (D)

Dryas-Salix-Saxifraga oppositifolia tundra is the most diverse of the mesic communities. *Salix arctica* and *Dryas integrifolia* are the dominant plants (5-25% cover). Although they may appear as co-dominants, one is usually dominant over the other. Prostrate shrubs are commonly concentrated in depressions such as runnels or shallow ice wedge troughs and between rock fragments which provide protection from wind (Warren-Wilson, 1966). *Saxifrage oppositifolia* is a common associate (5 to 10% cover) which occurs both in the runnels and depressions on the more exposed aspects.

Figure 8. *Dryas integrifolia* dwarf shrub mat on gravel north of the road to Signal Hill; *Salix arctica* is also present. 204464-E

Other typical vascular plants include *Arctagrostis latifolia*, *Carex misandra*, *Papaver radicatum*, *Poa abbreviata*, *Braya purpurescens*, *Parrya arctica*, *Draba corymbosa*, and *D. alpina*.

The lower stratum consists of mosses, associated with the branches of the prostrate shrubs as mentioned above, and a lichen component scattered between the rock fragments; included are *Thamnolia vermicularis*, *Cladonia*, *Cladina*, *Alectoria ochruleuca*, *Cetraria nivalis*, *C. cucullata* and *C. telesii*. Where the substrate is sand there can be a substantial component of bryophytes and soil lichens in a "patina", including the liverwort *Gymnomitrion corralioides* and lichens such as *Polyblastia* sp., *Persuccaria* sp., and some foliose and fruticose lichens.

10. *Salix* tundra*

Salix tundra occurs locally on the silty soils of some sheltered lowland slopes. The upper stratum is dominated by *Salix arctica* (5-25% cover) which is concentrated in depressions and shallow troughs of ice wedges, as in communities 8 and 9. *Saxifraga oppositifolia* is a common associate (2-10% cover). *Dryas integrifolia* is rare.

The herb component, totalling less than 5% cover, commonly includes *Papaver radicatum*, *Oxyria digyna*, *Saxifrage cernua*, *Saxifraga caespitosa*, *Minuartic rossii*, *M. rubella*, *Cerastium alpinum*, *Stellaria longipes*, *Draba* spp., *Parrya arctica*, *Polygonum viviparum*, and in some places the grasses *Alopecurus* and *Arctagrostis*.

The cover of the lower stratum consists of 50-75% of patina and 10-25% assorted mosses in small cracks and depressions.

11. *Cassiope* heath*

While I did not observe any plants of *Cassiope tetragona* on Cornwallis and adjacent islands, Arkay (1972) reported this community from the Resolute Bay area, "commonly on gravel ridges and moist rills" around Char Lake. It seems to represent a snowpatch habitat. It is present farther south on Somerset and Prince of Wales Island (Russell and Edmonds, 1977; Woo and Zoltai, 1977) and locally on Melville Island (Edlund, in press b), generally on more acidic terrain. It represents a northern extension of heath tundra communities (Polunin, 1951, 1960), an impoverished form of a community with greatest extent near treeline.

Herbaceous communities

12. *Saxifraga oppositifolia* tundra (P)

Saxifraga oppositifolia tundra is a common community in the map area. *Saxifraga oppositifolia* is the dominant vascular plant (5-15% cover). Other saxifrages commonly associated with this community include *Saxifraga caespitosa*, *S. cernua*, *S. flagellaris*, and *S. tenuis*. Common forbs and grasses are *Alopecurus alpinus*, *Minuartia*, *Papaver*, and *Draba* spp. Prostrate shrubs are rare and generally absent.

The lower stratum consists of a thin, broken nearly continuous cover of cryptogamic "patina", with mosses in cracks and imperfectly drained depressions. Lichens commonly include *Lecanora* species, *Thamnolia* species, *Cetraria islandica*, *C. nivalis*, and *C. cucullata*.

13. Herb-cryptogam tundra*

This is the least productive mesic community. Herbaceous plant cover is low (less than 2%) while the per cent cover of cryptogamic species is high. The herbaceous stratum shows no dominants, but may include any or all of the following: *Alopecurus alpinus*, *Papaver radicatum*, *Oxyria digyna*, *Saxifraga oppositifolia*, *S. cernua*, *S. caespitosa*, *Festuca* spp., *Poa abbreviata*, *Stellaria longipes*, *Cerastium alpinum*, *C. arcticum* and *Draba* species.

The cryptogam layer is similar to that of *Saxifraga oppositifolia* tundra.

Xeric communities

Xeric communities occur on materials that are briefly wet at snowmelt but become rapidly well drained as the active layer thaws, and are commonly dry at the surface in mid summer. Some moisture may be available at the base of the active layer. Typical sites include upper slopes, beach knolls, hill crests, and high centres of ice-wedge polygons. These areas may have only a thin snow cover in winter. These communities account for less than 20% cover and the lower stratum is discontinuous or absent. Included in this group are one prostrate shrub community (*Dryas-Salix* barrens), and four herb communities (*Saxifraga oppositifolia-Salix* barrens, *Saxifraga oppositifolia*-herb barrens, *Saxifraga oppositifolia*-lichen barrens and a herb barrens).

14. *Dryas-Salix* barrens (D)

This community, like the *Dryas-Salix* tundra, is not common in the map area. It consists of *Dryas integrifolia* and *Salix arctica* as the major vascular plants; in most places *Dryas* is dominant but in a few places *Salix*, the common associate, becomes dominant (Fig. 9, 10). The density of these prostrate shrubs ranges from 5 to 25%. Herbs are present but in small amounts; typical species are *Saxifrage oppositifolia*, *Lesquerella arctica* (Fig. 11), *Papaver radicatum*, *Braya purpurescens*, *Parrya arctica*, *Poa abbreviata*, and *Festua brachyphylla*. The prostrate shrubs are confined to shallow depressions.

The lower stratum is usually absent. Mosses (particularly *Hypnum* species) may be associated with dwarf shrub branches. Lichens such as *Cetraria nivalis*, *C. cucullata*, and *Thamnolia vermicularis* may be scattered across the surface but in low per cent cover.

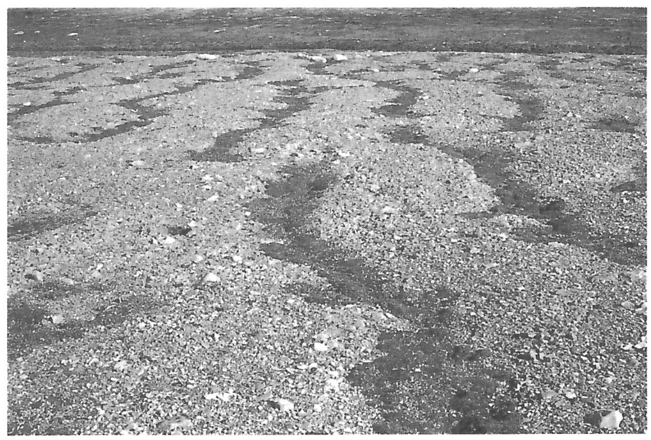


Figure 9. *Dryas-Salix* barrens on gravel fluvial terrace near the mouth of Taylor River. The gentle slope has shallow rills in which the dwarf shrubs commonly occur. 203643-M

Figure 10. *Dryas-Saxifraga oppositifolia* barrens on gravel beach near Sheringham Point, Cornwallis Island. Note ice wedge crack in the beach deposit on the right. 204464-D

This community is similar to the barrens communities reported by Polunin (1948) on Devon Island, and also occurs on Melville (Edlund, 1982a) and Bathurst (Edlund, 1983b) islands, where it also commonly occurs on alkaline materials.

Figure 11. *Lesquerella arctica,* a calciphilous herb, restricted to *Dryas-Salix* and *Saxifraga oppositifolia* barrens on Cornwallis Island. 204464-L

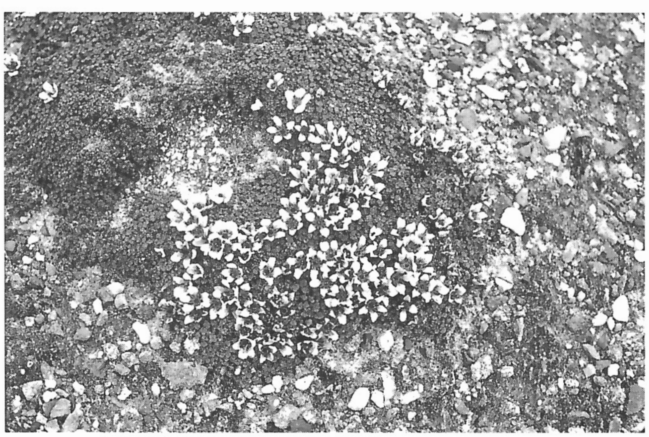


Figure 12. *Saxifraga oppositifolia* on sandy gravel terrace in the Abbott River area. *Saxifraga oppositifolia* is the most common vascular plant in the map area. 204604-B

15. *Saxifraga oppositifolia* barrens (P)

This community is the most common xeric community (Fig. 12). It has three variants:

Saxifraga oppositifolia-Salix barrens

Saxifraga oppositifolia is the dominant vascular plant species (5-20% cover) and there is a small but regularly appearing component of *Salix arctica* and in places *Dryas integrifolia.* The prostrate shrub component is restricted to depressions and does not achieve dominance, whereas *Saxifrage oppositifolia* tufts are scattered across the surface. Other herbs (see Appendix 2) are present but commonly total less than 3% cover. A lower stratum consisting of low percentage cover of mosses, predominantly *Hypnum* species, and lichens, such as *Cetraria cucullata*, *C. nivalis*, *C. tilesii* and *Thamnolia vermicularis*, may be present.

Saxifraga oppositifolia-herb barrens

Saxifraga oppositifolia herb barrens is another common community of somewhat higher elevations in the map area. *Saxifraga oppositifolia* is dominant (2-10% cover), and common associates can be *Minuartia rossii*, *Cerastium arcticum*, *Draba corymbosa*, *Papaver radicatum*, *Festuca brachyphylla*, and *Poa abbreviata.* In some areas *Saxifraga oppositifolia* may be the only vascular plant present. Prostrate shrubs are generally absent from this community. The lower stratum is similar to that of the *Saxifraga oppositifolia-Salix* barrens.

Saxifraga oppositifolia-lichen barrens

This community is similar to the *Saxifraga oppositifolia*-herb barrens, except that the lichen component is more substantial; in places it may equal or exceed the per cent cover of vascular plants. It consists of a broken patina cover and includes lichen species such as *Cetraria cucullata*, *C. nivalis*, *C. tilsesii*, *Thamnolia vermicularis*, as well as *Alectoria nigricans*, *Cornicularia divergens*, *Lecanora*, and *Persicaria* species which grow on lag gravels. Sporadic mosses such as *Hypnum*, *Thuidium*, and *Torella* species may also be present. This community occurs primarily on sandy deposits.

16. Grass barrens (G)

Sparse grass barrens occur on a few moderately to well drained, extremely silty and clayey diamictons in the northern lowlands and locally on silty and clayey till on the highlands and plateaus. *Alopecurus alpinus* is generally the dominant grass, although *Puccinellia angustata*, *Poa abbreviata*, *P. arctica*, *P. alpigena*, *P. hartzii*, and *Festuca* sp. may be present and locally abundant. Total cover is less than 10%, and for much of the area is less than 5%. *Braya purpurescens*, *Draba corymbosa*, and to a lesser extent, *Parrya arctica*, *Cerastium arcticum*, *Stellaria longipes*, and *Papaver radicatum* are common herbs, although their total cover is less than 1%. Woody plants are absent, as in any lower stratum.

17. Herb barrens (H)

The uplands of the Cornwallis Island area are generally unvegetated; however, in some areas there are plant assemblages with a low per cent cover (commonly less than 5%) and no clear dominant. The herb barrens community is composed primarily of herbaceous vascular plants, which are commonly spaced far apart - 2 or 3/m^2- and can be any of the following: *Alopecurus alpinus*, *Festuca brachyphylla*, *Poa abbreviata*, *Papaver radicatum*, *Puccinellia angustata*, *Stellaria longipes*, *Cerastium arcticum*, *Saxifraga oppositifolia*, *Saxifraga nivalis*, and *Draba* species. There are no shrubs in this community and generally is little or no cryptogamic component (less than 1% cover). This community is common at higher elevations in the central and western Queen Elizabeth Islands (Edlund, 1980, 1982b, 1983a,c, 1986).

Communities with specialized habitats

Several plant assemblages have a restricted distribution due to special requirements. These include the halophytic marsh community and also enriched sites around carcasses, animal burrows,and archeological sites.

18. Salt marsh community*

The salt marsh community of the study area is poorly represented and sporadically distributed. The mean tidal range at 1.28 m (Resolute Bay) allows sparse halophytic communities to colonize the upper littoral zone. Salt marshes also occur locally in swales behind modern storm beaches. This community has widespread coverage throughout the Arctic (Jefferies, 1977), but is extremely restricted in the Queen Elizabeth Islands.

The community is dominated by the goose grass, *Puccinellia phryganodes*, which relies almost entirely on clonal reproduction; fertile stolons were never observed. This grass may form mats with a coverage ranging from 1-5% to more than 50%. It occurs in pure stands or may be accompanied in a few places by mats of *Stellaria humifusa* (Fig. 13) and by rosettes of *Cochlearia officinalis*. Although lower stratum is generally lacking, a scum of algae may be present.

The sporadic distribution of halophytic communities is perhaps explained by the lack of two important edaphic features which promote salt marsh growth: a rooting medium of fine grained sediments and sheltered undisturbed coastline. Much of the modern coastline of Cornwallis is composed of coarse carbonate fragments with few fines, and most of the coast is subjected to ice thrust.

Small patches of this community also occur several kilometres inland along Eleanor and Coal rivers where old marine sediments have been recently eroded. This inland phenomenon is also reported by Jefferies (1977).

19. Enriched sites*

Mineral enrichment occurs around lemming burrows, fox dens, animal carcasses, and meat caches, bird perches, and abandoned eskimo dwellings where excrement and wastes have accumulated. Organic and inorganic compounds stimulate luxuriant vascular and cryptogamic plant growth.

The vegetation around animal burrows, called "islets of vegetation" by Schofield and Cody (1955) show no clear dominants. Species include *Alopecurus alpinus*, *Cerastium alpinum*, *C. regelii*, *Papaver radicatum*, *Draba* species, *Stellaria longipes*, *Saxifraga cernua*, *S. nivalis*, *Poa abbreviata*, and *Cardamine bellidifolia*. Dwarf shrubs are generally absent (Fig. 14). Where the materials are wetter *C. regelii*, *Juncus biglumis*, *Puccinellia angustata*, and *Alopecurus* are common.

Old Thule archeological dwellings surrounded by sod, mammal remains, urine and feces provide an unusually rich habitat. Collins (1955) recorded dense *Sphagnum* moss from excavated House C at Resolute Bay, a first record for Cornwallis Island and probably dates from a time when climate was warmer; it does not exist in the current moss flora of the area (Steere, 1951). The sites that were disturbed by excava-

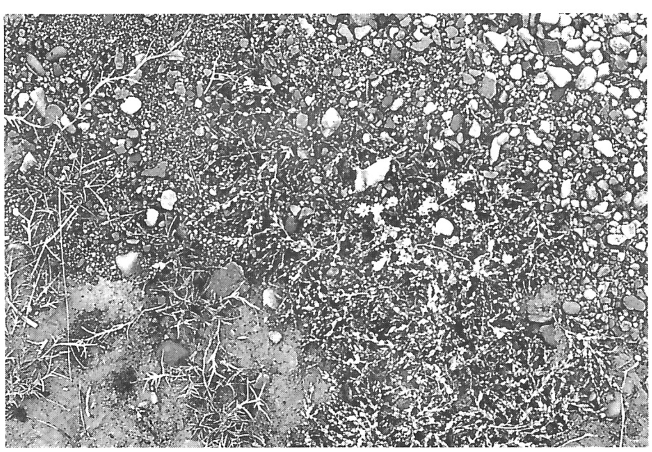


Figure 13. *Stellaria humifusa* (white flowers) and *Puccinellia phryganodes* (trailing grass) just above the high tide zone northwest of Mecham River delta. 204464-H

Figure 14. Raised fox den, showing enhanced vegetation adjacent to *Saxifraga oppositifolia* tundra. 204464-G

tion activity in the early 1950s have abundant herbaceous vegetation (Appendix 1) which is commonly much more robust than vegetation in undisturbed communities, as reported by Kuc (1972). The rare *Chrysosplenium tetrandrum* is found only associated with these sites.

RELATIONSHIPS BETWEEN PLANT COMMUNITIES AND SURFICIAL MATERIALS

The mineral composition and grain size of the soils of the Cornwallis Island area, which are for the most part derived from the local carbonate and clastic rocks (Table 1), have a marked influence on vegetation. Vast areas of the uplands and plateau and some coastal areas are completely unvegetated. Vegetation, found only on weakly to moderately alkaline materials, is dominated by calciphilous species such as *Saxifraga oppositifolia* and *Dryas integrifolia*; calciphilous herb species are also common associates. This section discusses the major reasons for the absence of vegetation over much of the area and how the surface materials control distribution of plant communities.

Vegetation-free areas

Several reasons can be offered for the characteristically unvegetated surfaces of much of the Cornwallis Island area. Materials derived directly from pure carbonate and evaporite bedrock are severely deficient in basic plant nutrients such as nitrogen, phosphorous, potassium, sodium, and organics (Table 2, no. 1-3). The soils are composed primarily of calcium and magnesium carbonate fragments (Fig. 15). In areas such as below the sea bird colonies at Washington Point, Baillie-Hamilton Island, and in isolated spots along the cliffs of eastern Cornwallis Island, dense, bright green vegetation appears wherever nitrogen-rich guano supplements the pure carbonate materials. But over the vast tracts of Cornwallis Island, the presence of overwhelming amounts of calcium and magnesium carbonate, without the buffering effects of adequate nitrogen and other plant nutrients, are unsuitable for vascular plant growth.

In some areas the physical properties of the surficial materials may also prohibit plant growth. Areas covered by coarse gravel and felsenmeer, with fine grained sediment, do not provide a medium for root development (Fig. 16). Coarse materials are generally extremely well drained, so that moisture availability is limited.

Even the pure carbonate gravel and boulders are unvegetated, although granite and igneous erratics in the same area are commonly covered with crustose lichens. Beschel (1970) suggested that bouldery carbonate terrain may be unvegetated because the "surfaces of limestone boulders weather faster than.....lichens can grow there". Thorsteinsson (1958) suggested that lack of vegetation can also be attributed to high rates of mass wasting and cryoturbation. Mudboils are common on terrain with a high proportion of fines. Injection of materials to the surface periodically disrupts plants. This process may be so common in some areas that plants have not been able to become established.

Table 2. Chemical analysis of surficial materials around Resolute Bay, Cornwallis Island*

No.	1980 Edlund Sample Site	No. repli-cates	Depth cm	average pH	Organic Carbon	% Calcite/ Dolomite	% Total N	% NO_3-N	Available Nutrients (ppm) P	K	Na	Remarks
1	37	3	10	8.4	0.0	18/79	0.01	0	0	5	2	unvegetated weathered carbonate bedrock
2	94	3	10	8.2	0.0	8/35	0.01	0	4	8	3	unvegetated weathered carbonate bedrock
3a	93	3	10	8.4	0.0	5/64	0.00	0	4	5	2	unvegetated weathered carbonate bedrock
3b	93	3	30	8.8	0.0	6/84	0.00	0	0	3	2	same site
4a	79	5	10	7.2	5.1	39/3	0.8	9	2	16	15	sedge meadow
4b	79	5	50	8.4	0.1	30/19	0.2	2	3	6	2	same site
5a	66	3	10	7.6	6.8	9/14	1.4	20	5	12	12	grass meadow
5b	66	3	50	8.0	0.2	13/25	0.01	0	2	3	2	same site
6a	17	3	10	7.8	6.2	10/35	0.5	12	5	9	10	wet bryaphitic mat
6b	17	3	50	8.0	0.0	20/80	0.0	0	1	2	2	same site
7	82	3	5	8.0	0.0	6/54	0.1	1	7	19	36	beach ridge *Saxifraga oppositifolia* barrens
8	115	4	5	8.0	0.0	9/76	0.01	3	5	23	52	beach ridge *Saxifraga oppositifolia* barrens
9	119	3	5	8.2	0.0	17/64	0.01	1	6	11	35	beach ridge *Saxifraga oppositifolia* barrens
10a	114	3	5	7.6	9.1	41/70	0.1	4	9	12	27	beach ridge *Dryas-Saxifraga oppositifolia* barrens
10b	114	3		8.0								same site
11	64	3	10	8.2	0.0	–	0.0	25	5	150	78	halophytic vegetation littoral zone
12	110	2	10	8.0	3.1	–	1.2	16	10	134	87	algal crust incorporated
13	61	3	10	7.8	2.2	10/19	0.9	12	1	2	2	well vegetated colluvium herb-cryptogam tundra
14	63	3	10	8.2	0.0	10/42	0.0	1	3	3	1	unvegetated colluvium
15a	29	6	5	8.0	2.8	29/16	1.1	5	16	22	35	*Saxifraga oppositifolia* barrens-till
15b	29	3	10	8.2	1.2	45/26	0.0	3	12	31	40	same site
16a	31	4	10	8.2	0.8	20/12	0.5	2	5	18	29	*Saxifraga oppositifolia* barrens-till
16b	31	3	30	8.4	0.5	31/17	0.1	2	4	14	22	same site
17	46	3	10	6.2	19.1	13/15	13.1	53	19	32	51	Thule ring excavation sites
18	44	3	10	5.8	25.3	9/3	9.8	35	17	21	20	Thule ring excavation sites
19a	44	3	20	8.0	0.18	5/2	11.2	43	21	29	19	Thule ring excavation sites
19b	44	3	50	8.2	0.0	6/84	0	0	0	2	3	same site
20	25	2	10	8.2	0.0	-	0	0	3	112	63	Holocene marine deposits - local halophytes

*fine fraction taken for analysis.

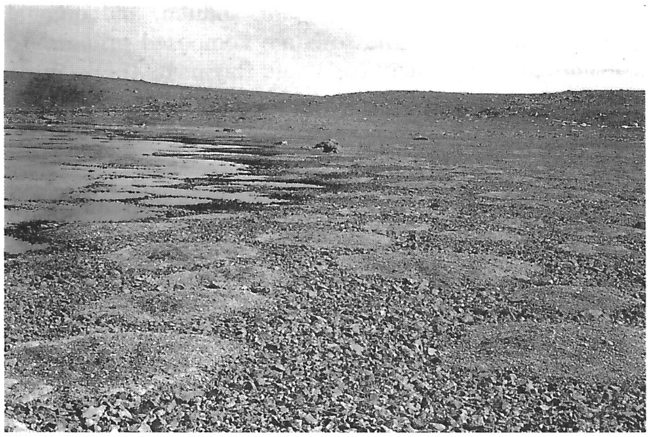


Figure 15. Unvegetated weathered limestone fragments sorted into nets, with coarsest fragments on the borders, silt with limestone gravel in the centres. Near Intrepid Bay, Cornwallis Island. 203642-N

Figure 16. Unvegetated weathered dolomite with little or no fines present; this frost-heaved bedrock occurs on the highest elevation of Lowther Island. 204604-A

Vegetated areas

Vegetation in the Cornwallis Island area is restricted to weathered bedrock and soils which provide at least minimum amounts of a variety of plant nutrients. On such materials the plant communities still reflect the alkaline substrate. *Saxifraga oppositifolia* dominates or is a common associate in nearly every community found on moderately to well drained materials. Indeed, is an indicator of alkaline conditions in other parts of the High Arctic (Hodgson and Edlund, 1975, 1978; Edlund, 1980, 1982a, b, c). *Dryas integrifolia*, well known indicator of alkaline conditions, is locally abundant. Even the moss flora of the Resolute area is calciphilious (Steere, 1951).

Map 1767A shows the distribution of plant communities throughout the Cornwallis Island area. *Saxifraga oppositifolia* barrens are the most common plant communities in the area. This reflects the generally coarse, well drained nature of most of the weakly to moderately calcareous surficial materials.

Sedge and grass meadows, with a nearly continuous moisture supply, are restricted in the area to valley bottoms, lower slopes, and edges of ponds and lakes. Locally they appear downslope from persistent snowbeds. Only in the coastal area around Cape Airy, Disappointment Bay, Cornwallis Island, and a central valley in eastern Little Cornwallis Island, are there extensive wet meadow communities, primarily grass meadows.

Mesic habitats, although locally present, do not contribute significantly to the regional vegetation cover. They occur only locally where the materials are sufficiently fine grained so that moisture is retained through a major part of the growing season. Such habitats occur on nearshore marine deposits and on sheltered colluvial slopes in the central lowland, on the west coast of Cornwallis Island, and on fine grained beach deposits on Little Cornwallis Island.

Materials derived from weakly to moderately alkaline clastic rock and limestone

Some materials above the marine limit also support vegetation. A few bedrock formations and facies, primarily argillaceous limestone and calcareous sandstone and shale, are less alkaline than the pure carbonates and evaporites. The materials generally weather to a silty loam with varying amounts of gravels and platy fragments. These materials have a pH of 7.2 to 7.8 and have a greater variety of plant nutrients than is found on the pure carbonates (Table 3). This material supports a calciphious vegetation. Thorsteinsson (1958) noted that outcrops of shale and siltstone facies of the Cape Phillips Formation south of Eleanor Lake could be mapped on airphotos by the tonal contrast provided by their vegetation cover, as opposed to vegetation-free carbonates.

When vegetation is present on northeastern uplands of Cornwallis Island it generally consists of *Saxifraga oppositifolia* tundra and *Saxifraga oppositifolia*-herb barrens. The *Saxifraga* tundra communities are found in areas which receive protection by snow during winter and have a moisture source during at least part of the summer while *Saxifraga*-herb barrens occurs on less protected, drier sites. The driest, most exposed sites generally have no vegetation. Where these materials occur at lower elevations, on the lowlands of northwestern and north-central Cornwallis and on Little Cornwallis and Baillie Hamilton islands, the materials support sparse *Saxifraga* tundra and *Dryas-Salix-Saxifraga* tundra on protected mesic sites, and *Saxifraga-Salix* and *Saxifraga*-lichen barrens communities on drier, protected sites. Grass meadows and rare sedge meadows appear locally on poorly drained sites, primarily in zones of seepage from snowbeds, and around shallow ponds and lakes.

Vegetation on neutral to acidic sandstone

Remnants of neutral to weakly acidic sediments derived from the poorly consolidated sand and silt of Eureka Sound Formation sandstone occur in a few valleys such as Dyer Cove, Griffith Island, Taylor and Intrepid grabens, and along Rookery Creek. These sediments are generally covered by a veneer of marine deposits or alkaline colluvium from nearby

Table 3. Chemical analysis of surficial materials overlying the Cape Phillips Formation (Miidshipman Bay area)

1975 no.	GSC Lab. No. samples	Depth cm	Average pH	% Organic C	% T Carb.	% NO_3-N	P	ppm K	Na	Remarks
45a	1	10	7.2	0.1	0.01	1	9	19	16	*Saxifraga oppositifolia*
45b	1	30	7.4	0.0	0.0	0	5	16	4	barrens
96a	3	10	7.2	0.1	0.01	3	3	13	27	*Saxifraga oppositifolia*
96b	3	30	7.4	0.0	0.0	1	1	11	26	tundra
46a	3	10	7.4	1.7	0.2	0	6	27	46	marine washed;
46b	3	50	7.8	0.8	0.0	0	1	11	26	*Saxifraga oppositifolia* barrens

carbonate-rich slopes. Where exposed at the surface, these materials are white quartz sands with some silt. At a depth of 60 cm the pH is neutral – pH 6.8 to 7.0. The materials are generally unvegetated, probably due to the tendency of such materials to be readily deflated. This is also true wherever the sandy facies of Eureka Sound and other white sand formations occur, such as on northern Sabine Peninsula, Melville Island (Barnett et al., 1976, 1977), Amund Ringnes Island (Hodgson and Edlund, 1978), and Lougheed Island (Edlund, 1980). Although the bedrock is acidic, the sandy deposits in most lowland locations on Cornwallis and Griffith islands are slightly alkaline (pH 7.2) because they are washed by alkaline water, particularly during spring snowmelt. No truly neutral or acidic soils occur at the surface; such pH is reached only at depths of approximately 50 cm. These sands support some of the densest *Dryas* tundra and sedge meadows in the area.

Resolute area

The Resolute area, where detailed soil sampling was conducted (Table 2; Fig. 2), is a zone of sparse but locally rich vegetation. The underlying bedrock consists of highly alkaline carbonates of the Allen and Read Bay Formations (Thorsteinsson and Kerr, 1968). Where this material occurs at the surface or where the surface is masked by weathered carbonate rock, no vegetation grows.

The area, however, has been glaciated by both local ice and perhaps by continental-based ice sheets predating the Late Wisconsinan (Edlund, in press a) which left mounds and veneers of till as well as ice-scoured bedrock. The terrain has also been modified by the Holocene marine regression which reworked materials into beaches up to elevations of 80-106 m a.s.l. Vegetation occurs on these tills, beach deposits, some raised fluvial terraces, and colluvial deposits containing materials with a variety of origins. The predominant vegetation is a sparse *Dryas-Salix-Saxifraga oppositifolia* barrens. Sedge and grass meadows occur only locally, around the edges of ponds, seepage slopes, and wherever sufficient moisture and nutrients are present.

The alkalinity of soils underlying a wet meadow north of Resolute is reduced in the top 10 cm, but at a depth of 50 cm the high alkalinity is evident (Table 2, no. 3, 4). The per cent organic carbon at the surface is higher than that found on carbonate terrain. Other nutrient levels are also elevated.

Soils under some grass meadows have a higher pH than that of the sedge meadow, but in both organic carbon is higher as are other nutrients than on drier soils.

The effect of marine inundation on vegetation is best seen up to 30 m a.s.l. by comparing the soil chemistry of modern beach deposits with that of beaches at higher elevations. Marine washed till with red sandstone clasts and a few granitic pebbles, as well as carbonate fragments, shows an increase in available nutrients but is poor in nitrogen (Table 2, no. 15, 16). These materials support the best developed *Dryas-Salix* barrens communities in the area.

At the modern coast, sparse halophytic communities just above the littoral zone grow in highly alkaline materials (Table 2, no. 11) with no organic carbon. These materials show a marked increase in available nutrients, particularly sodium and potassium, and to a lesser extent phosphorous, which presumably come from evaporation of sea water.

Where raised marine sediments were recently exposed and eroded, such as north of Resolute, halophytic vegetation occurrs well inland of the coast. This increase in sodium and potassium is similar to that of the coastal litoral zone, and reflects a recently exhumed nearshore deposit from earlier times (Table 2, no. 20).

Soils developed on Thule sites (campsites built on carbonate beach ridges), which were excavated in the early 1950s, showed the greatest alteration of pH. The surface, underneath moss mats, and locally dense herbaceous species showed the most intense leaching. The pH was as low as 5.8 to 6.2 and nitrogen, phosphorous, potassium, and sodium levels were much higher than those of adjacent terrain. The available nutrients are probably from human excrement and refuse.

REGIONAL DISTRIBUTION OF VASCULAR PLANTS

Of all the islands in the map area, Cornwallis Island, the most intensely surveyed island, has the greatest vascular plant species diversity. I found 63 of the 71 vascular species reported by Porsild (1964); 8 have not appeared in the other recent collections (Schofield and Cody, 1955; Arkay, 1972).

Floristics

The greatest diversity of flora occurs on weakly to moderately alkaline materials such as till pockets in the ice-moulded terrain north of Resolute, the sheltered fluvial deposits along Ward, Taylor, and Eleanor rivers, and, as noted earlier, in disturbed areas around excavated archeological sites, where almost the entire flora of Cornwallis Island occurs, often in atypical association and abundance.

The vascular flora of Cornwallis Island is typical of the High Arctic; no unusual species or species with disjunct distributions (except possibly *Chrysosplenium tetrandrum* growing at an archeological excavation site) were found.

The vascular flora on the surrounding islands is smaller (Appendix 1). This may be due in part to the short time available for collecting on these islands, and in part due to the dominance of highly alkaline soils on these islands which inhibits many species.

The flora and vegetation in the region are not randomly distributed. Thorsteinsson (1958) noted an impoverishment of the flora with increasing elevation. My studies also confirm this trend. Comparisons of the flora of weakly to moderately alkaline materials at various elevations show decreasing diversity of vascular flora with increasing elevation, and to a lesser extent, with increasing latitude.

The most diverse and productive plant communities in the area occur in southern and western coastal areas, and in the north-central lowland, commonly below 50 m a.s.l. but tens of metres inland from the shore. The suite of plant communities on these materials includes sedge meadows on the wetter materials, *Dryas-Salix-Saxifraga oppositifolia* tundra on mesic materials and *Dryas-Salix-Saxifraga oppositifolia* barrens on the well drained materials. Cyperaceae (*Carex aquatilis* var. *stans*, *Eriophorum triste* and *E. scheuchzeri*), grasses (such as *Arctagrostis latifolia* and *Pleuropogon sabinei*), dwarf shrubs (*Salix arctica* and *Dryas integrifolia*), and the herb *Lesquerella arctica* are concentrated in these areas, while the vegetated upland regions and northernmost areas have the least diversity and usually lack these Cyperaceae and prostrate shrubs (Appendix 2). *Salix* reaches its maximum growth in this zone, although its annual growth rate is extremely low (Warren-Wilson, 1957, 1964, 1966).

At elevations from 50 to 150 m on southern Cornwallis Island and from sea level to 100 m in the north, the total number of vascular plants averages 40 to 50 species. The common suites of plant communities consist of grass meadows, *Saxifraga oppositifolia* tundra, and *Saxifraga oppositifolia* barrens. These communities are also common on the adjacent low lying islands in McDougall Sound, and on Lowther and Griffith islands. Prostrate shrubs are locally present at some places, but are not a major component of the plant communities. Emergent marsh species and Cyperaceae are absent.

Above 100 to 150 m in the south and around 100 m in the north, vegetation shows the least diversity and productivity and is generally absent. Where it occurs, communities are primarily herbaceous; dwarf shrubs, sedges, and marsh species are absent, as are a number of other herbaceous species. Vascular plants number less than 35, and more typically less than 20. *Alopecurus alpinus* and *Phippsia algida* occur on wet materials. On moderately to well drained materials dominance is less clear; *Saxifraga oppositifolia* is dominant in many places, but in others, *Papaver radicatum*, Caryophyllaceae, and other Saxifragaceae may be locally dominant, or no dominance may occur.

This trend of decreasing diversity with increasing elevation occurs in other High Arctic area: Amund Ringnes, Cornwall, and Table islands (Hodgson and Edlund, 1978; Edlund, 1983c), and Melville and Bathurst islands (Edlund, 1982a, 1983b). This trend, summarized in Edlund (1983a), reflects the variability in the summer temperatures and the length of the melt season. In a region where the maximum length of the melt season is roughly two months, a delay of a week or more in the onset of thaw, and the advancement of freeze-up by a week or more, which is a common occurrence at higher elevations, could shorten the length of the growing season by 25%, and this limits the number of species able to tolerate such harsh conditions.

Bioclimatic zonation

As described above, the plant communities of the Cornwallis Island study area fall into broad zones on the basis of species diversity, abundance, community composition (Fig. 17). The zones vary with elevation and to a lesser degree with latitude. These may reflect broad regions with similar growing season conditions in a fashion similar to those used for agricultural subdivisions in more temperate regions. Even though the exact lengths of growing season are not determined, the characteristics of each zone can still be described.

Zone 1

Zone 1 represents the most impoverished flora in the Cornwallis Island area, as well as in the High Arctic. The total vascular plant flora is less than 35 species, and is commonly much fewer. Plant communities are extremely sparse and have low productivity. The vascular plant flora is entirely herbaceous, and species dominance is commonly unclear. Prostrate shrubs, sedges, and some herbs generally associated with warmer Arctic regions are absent. This zone commonly occurs at sea level on islands to the north and west of the map area (Edlund, 1983a).

Zone 2

Diversity of vascular plant species increases in zone 2 to between 35 and 60 species. Dwarf shrubs, however, occur only locally; herbaceous species still dominate the plant communities, with *Alopecurus alpinus* and *Dupontia fisheri* being common in meadows and *Saxifraga oppositifolia* on moderately to well drained materials. This is the most common zone on Cornwallis Island and encompasses most of the adjacent islands.

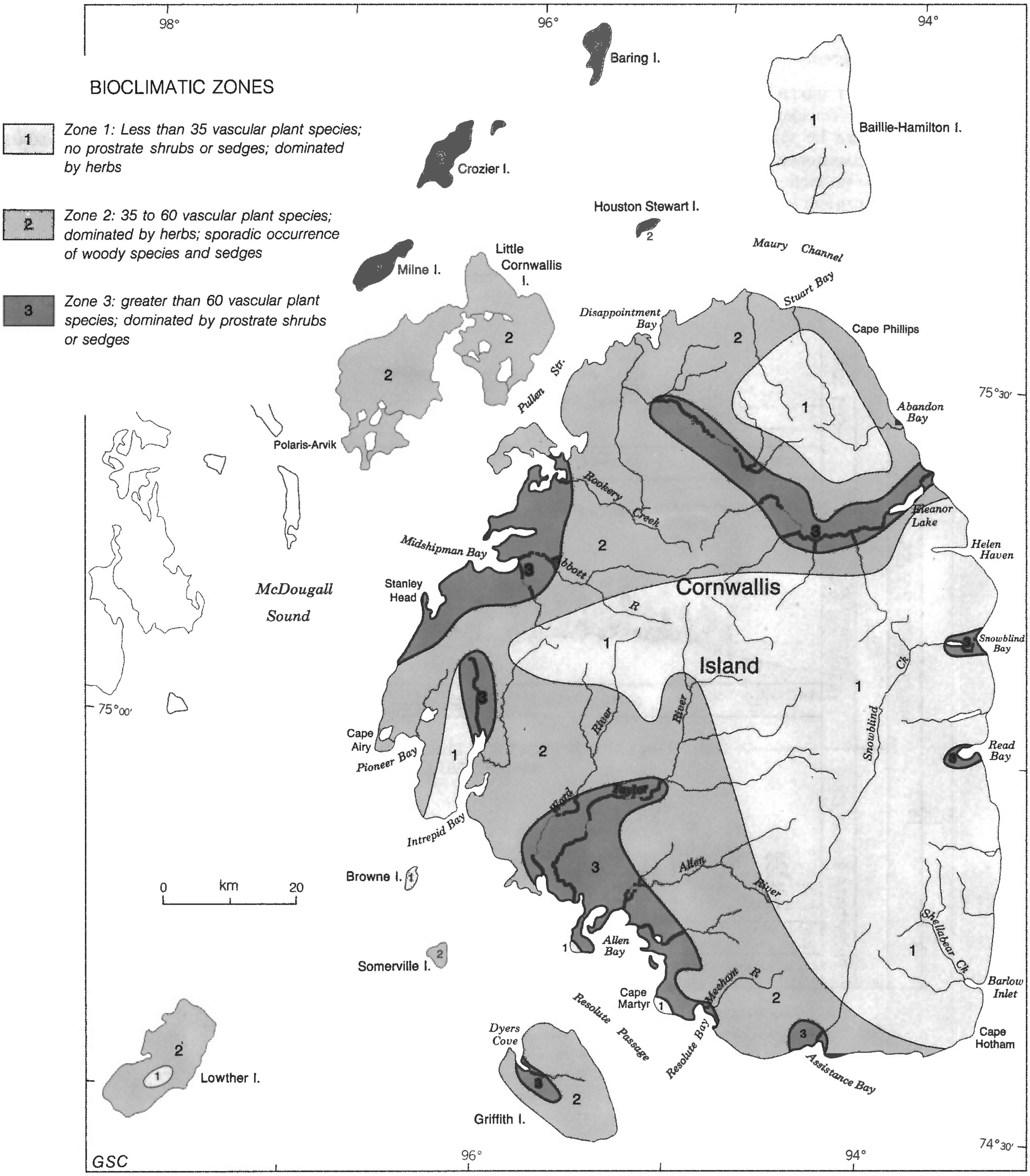


Figure 17. Bioclimatic zones of the Cornwallis Island map area.

Zone 3

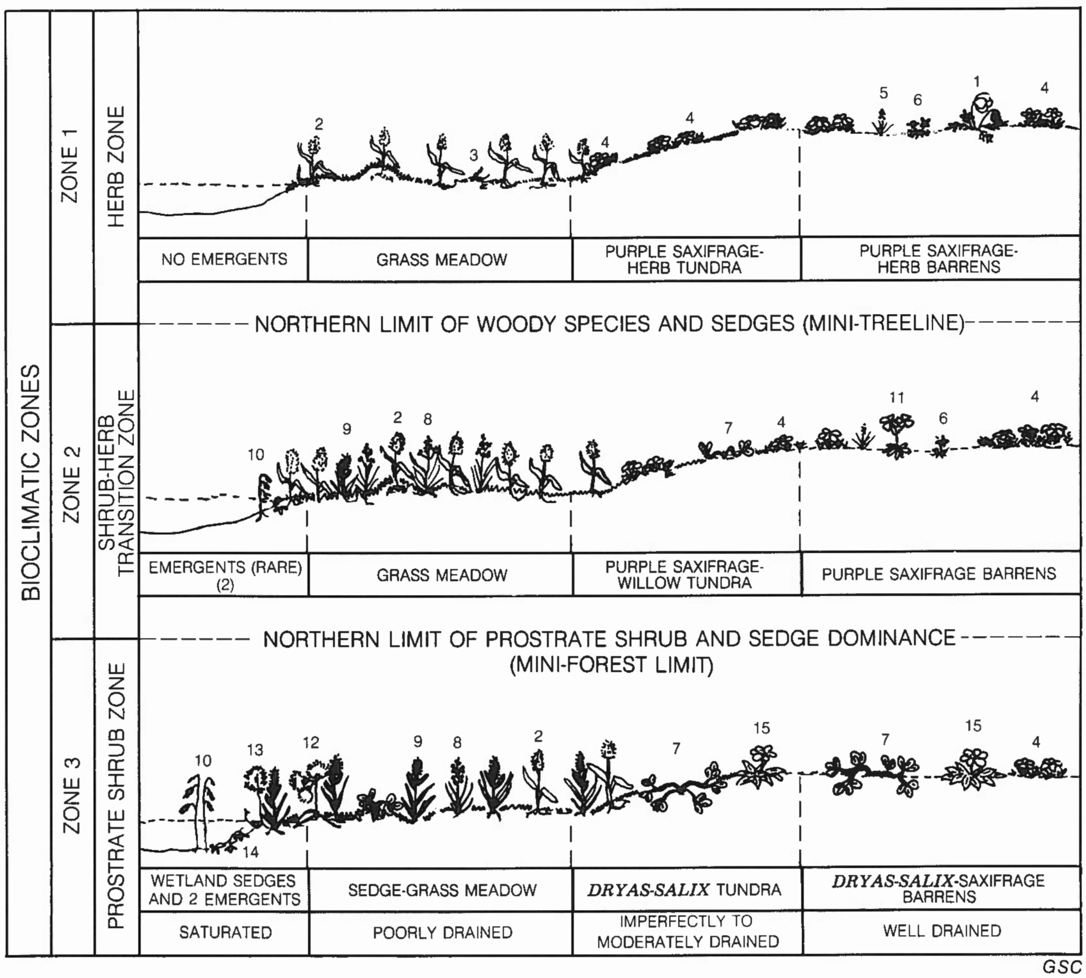
The vascular flora of zone 3 contains more than 60 species. Sedges and dwarf shrubs are dominants or major associates of most plant communities. Herbaceous species are common but are subordinate to woody species and sedges. In this zone emergent marsh species, *Pleuropogon sabinei* and *Ranunculus hyperboreus*, commonly occur. This zone dominates the lowlands of Cornwallis Island and Dyer Cove, on Griffith Island. It is the most productive zone in the map area.

This zonation on a regional basis reflects both elevational and latitudinal trends. The major plant communities of Cornwallis Island area can be segregated on the basis of the probability of their occurrence within each bioclimatic zone. Figure 18 shows the ordination of communities through the three bioclimatic zones and for the various moisture regimes.

A zone of even greater diversity reflecting even warmer conditions (zone 4) occurs in the Queen Elizabeth Islands but does not occur in the Cornwallis Island area. It is found on southwestern and western Melville Island (Edlund, 1982, 1986, in press b) and is typical of similar terrain farther south.

Local scale zonation

While this zonation outlines the general diminishing diversity in plant communities from sea level to higher elevations, there is also a local inversion of this progression in a narrow zone adjacent to the coast. In the Resolute area and western Cornwallis Island (Zone 3), where dwarf shrubs are a common component of the drier species of raised beaches, *Saxifraga oppositifolia* and grass communities with little or no prostrate shrubs occur in the first 3 to 5 m above sea level.



1. *Papaver radicatum*
2. *Alopecurus alpinus*
3. *Phippsia algida*
4. *Saxifraga oppositifolia*
5. *Poa abbreviata*
6. *Draba* sp.
7. *Salix arctica*
8. *Dupontia fisheri*
9. *Carex aquatilis* var.
10. *Pleuropogon sabinei*
11. *Parrya arctica*
12. *Eriophorum triste*
13. *Eriophorum scheucheri*
14. *Ranunculus hyperboreus*
15. *Dryas integrifolia*

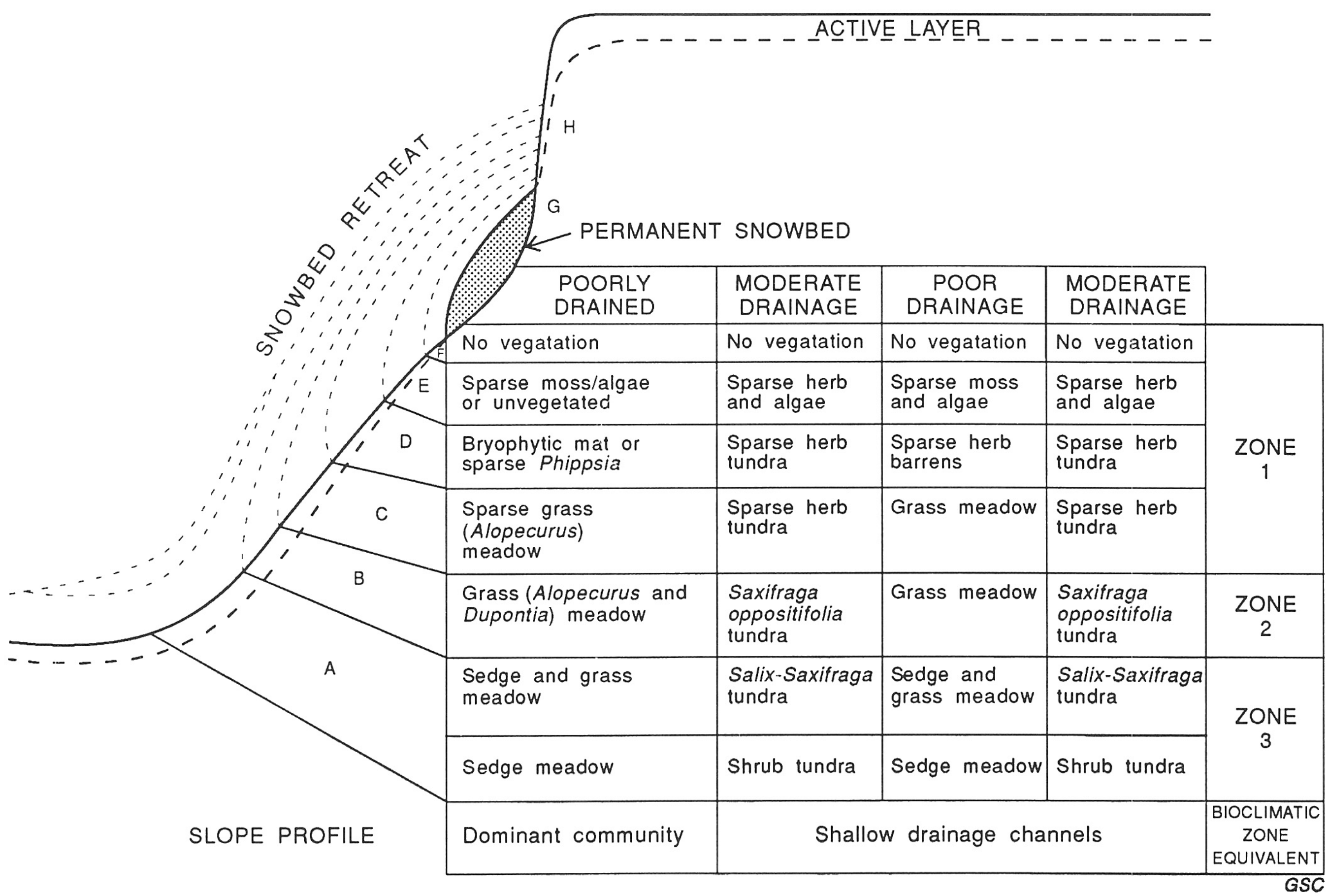
Figure 18. Catena summarizing the plant communities on the different moisture regimes on weakly to moderately alkaline materials in each of the three bioclimatic zones.

Figure 19. Permanent snowbed on the southwest facing slope of Signal Hill, Resolute Bay, Cornwallis Island. Several wetland communities occur on the seepage slopes downslope from the snowbed. Note the small bedrock-cored knolls that protrude halfway down the slope, interrupting the seepage slope. (Photo by J.A. Heginbottom). 203642-P

Here the communities are characteristic of zone 2 rather than zone 3. At the lowland coast in the northern part of Cornwallis Island (generally zone 2) the region immediately adjacent to the sea has zone 1 plant communities. This may be due to the local cooling that occurs at the coast.

Bioclimatic zonation also occurs at another extremely local level. The uneven distribution of snow and the persistence of snowbeds in all bioclimatic regions causes local areas to thaw out at different times. Most dramatic are the areas directly downslope from major persistent snowbeds (Fig. 19). These areas receive meltwater from the snowbed continuously during the summer and as the snow melts, more ground is uncovered; thus a variety of growing seasons is telescoped in the area immediately downslope from snowbed.

These changes follow the trends seen in the regional bioclimatic zonation. Figure 20 shows this phenomenon in zone 3 (the Resolute area). Zone A lies downslope from the persistent snowdrift but is not directly under it. It becomes snow free in early summer but receives continuous moisture throughout summer. Sedge and sedge-*Salix* meadows, and *Pleuropogon* marsh occur in this zone. Moving upslope, the zones are covered by the snowbed for varying lengths of time.



POORLY DRAINED	MODERATE DRAINAGE	POOR DRAINAGE	MODERATE DRAINAGE	
No vegatation	No vegatation	No vegatation	No vegatation	ZONE 1
Sparse moss/algae or unvegetated	Sparse herb and algae	Sparse moss and algae	Sparse herb and algae	
Bryophytic mat or sparse *Phippsia*	Sparse herb tundra	Sparse herb barrens	Sparse herb tundra	
Sparse grass (*Alopecurus*) meadow	Sparse herb tundra	Grass meadow	Sparse herb tundra	
Grass (*Alopecurus* and *Dupontia*) meadow	*Saxifraga oppositifolia* tundra	Grass meadow	*Saxifraga oppositifolia* tundra	ZONE 2
Sedge and grass meadow	*Salix-Saxifraga* tundra	Sedge and grass meadow	*Salix-Saxifraga* tundra	ZONE 3
Sedge meadow	Shrub tundra	Sedge meadow	Shrub tundra	
Dominant community	Shallow drainage channels			BIOCLIMATIC ZONE EQUIVALENT

Figure 20. Plant communities downslope from a permanent snowbed.

Zone B, the lower edge of the snowbed and presumably the first exposed when the snowbed thaws, typically has grass meadow vegetation. In zones C and D, immediately upslope from zone B, the grass wet meadow becomes sparser and grades into an *Alopecurus* wet meadow, then into continuous to broken bryophytic mat (commonly with cheonophilous mosses) with few vascular plants, or into a *Phippsia algida* barrens. Farther upslope in zones E and F, vegetation may be absent or consist of an algal crust with no vascular plants. Zone G is continually under snow. The zone directly upslope from the snowbed (zone H), with little or no moisture available during the summer, is commonly unvegetated.

The zonation of snowbed communities can be further complicated by differing moisture conditions caused by the channelling of the meltwater into rills. In such places, wet communities appear in the troughs and lower sides of the runnels, with more mesic communities occurring on raised interfluves.

Under these more mesic conditions, *Dryas-Salix-Saxifraga oppositifolia* and *Salix* tundras occur in zone A, *Dryas-Salix-Saxifraga oppositifolia* tundra in zone B, herb-patina in zone C and cryptogamic communities in zones D and E. Patterns of alternating wet and mesic conditions, as in the case of drainage runnels, give a vertical striped appearance to the slope.

This full sequence does not occur beneath or downslope from all snowbeds; in many areas of Cornwallis Island the sequence may be truncated; only one or two zones typically occur, most commonly the graminoid-moss and bryophytic mat communities. However, in several places in the Resolute Bay area, Six Mile Lake north of Resolute, and the slopes around Read Bay, on eastern Cornwallis Island, the full sequence was observed.

This local telescoped zonation explains in part why such a variety of plant communities occurs within one bioclimatic zone; as Figure 6 shows, the region may be predominantly within zone 3, but communities from the other two zones may occur regularly in areas where snow persists longer, and in areas of close proximity to the sea.

The sorting of plant communities into bioclimatic zones also established important regional boundaries with implications for paleoclimatic interpretations. The boundary between zones 1 and 2 is in effect a "mini-treeline" beyond which prostrate shrubs do not occur. The boundary between zones 2 and 3 is a "mini forest zone"; it separates the regions where prostrate shrub communities are common from areas where dwarf shrubs occur only sporadically.

Most of the Cornwallis Island area lies within zones 2 and 1. It is possible that the zone 3 vegetation in the area is a relict from a slightly warmer time. The low per cent of sedges and cotton grasses, which annually produce flowers and seeds, and the low per cent flowering and/or seed set among *Salix arctica* and *Dryas integrifolia* in the years of this study suggest that these may be no longer climatically viable communities. Seed set and flowering among the grasses and herbs is high, and probably reflects vegetation best suited to the climatic conditions of the map area.

SUMMARY

Much of the Cornwallis Island area is unvegetated, primarily due to the extreme alkalinity and coarseness of the surface materials which are derived from relatively pure carbonate and evaporite bedrock, and the well drained nature of coarse materials such as in beach ridges, bedrock controlled areas, and talus. Severity of climate, rate of weathering, and active cryoturbation may also play a major role especially at higher elevations.

Vegetation is limited to the weakly to moderately alkaline materials, such as impure sandstone, siltstone, and shales of the Cape Phillips Formation, marine deposits, some coastal tills, and some fluvial deposits which have had an addition of foreign materials. The type of community is determined by the local moisture regime (Fig. 20). The presence of snow cover during the winter is imperative for the survival of vegetation, as well as supplying sufficient moisture for plant growth during at least part of the growing season.

Vegetation on mesic and drier materials has a predominance of calciphilous species, particularly *Saxifraga oppositifolia* and in some places *Dryas integrifolia*, which reflects the alkaline nature of the majority of the substrate of the area.

Numerous plant communities appear to share similar moisture regimes (Fig. 18) but vary because of local influences of soil chemistry and climate. Wetland communities include sedge, grass, and sedge-*Salix* meadows, marsh vegetation, bryophytic mats, algal crusts, and *Phippsia algida* barrens. Mesic communities include *Dryas-Salix*, *Dryas-Salix-Saxifraga oppositifolia* and *Salix* tundra, *Cassiope* heath, and *Saxifraga oppositifolia* and herb-cryptogam tundra. Drier communities, with little or no lower stratum development, include *Dryas-Salix*, *Saxifraga oppositifolia*, *Saxifraga oppositifolia-Salix*, *Saxifraga oppositifolia*-herb, *Saxifraga oppositifolia*-lichen, and herb barrens. The reason for the large number of plant communities found under each major moisture regime seems to be attributable to the microclimate and macroclimate of each site, and the variability in length of the growing season within an area. In addition, salt marsh communities and enriched sites are greatly influenced by the chemistry of the substrate.

Climatic changes related to latitudinal and elevational gradients are major determinants of plant species diversity of frequency. Three zones, based on vascular species diversity, and the presence of absence of prostrate shrubs and Cyperaceae and other "indicator" species, are defined and a "mini-tree line" and "mini-forest zone" are established in the area. This zonation is also found in telescoped form in areas immediately adjacent to major snowbeds. Persistence and early reappearance of snow cover appears to be a major controlling factor in determining the type of plant communities present. Shrub and sedge-based communities grow in areas with the warmest summer temperatures, and longest growing season (zone 3), while only sparse herb communities and cryptogams grown in the coldest area which also have the shortest growing season. *Saxifraga oppositifolia*, herb, and grass communities are the major community types in the map area.

ACKNOWLEDGMENTS

I extend my appreciation to W.G. Green and C.T. Carmody for their field assistance, particularly in per cent cover determinations; to D.M. Barnett (DINA) who led the 1975 Cornwall-Bathurst Island field program; to L.A. Dredge (GSC) and C. Tarnocai (Agriculture Canada) who provided useful discussion and criticism during the field and office phases of the project; to J.J.B. Dugal, 1975 field manager; to M. Robinson, camp cook; and to Polar Continental Shelf Project for field logistics support and radio communication in 1975 and lodging in 1978, 1980, and 1982. Thanks also go to Kaye L. MacInnes, D.A. Hodgson, and J.A. Heginbottom whose critical reviews assisted in revision of the text.

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APPENDIX 1

Vascular plants in the study area

Vascular Plants+	Cornwallis Island	Griffith Island	Lowther Island	Little Cornwallis Island	Baillie Hamilton Island	Browne Island
**Equisetum variegatum* Schleich; (P)	x					
Allopecurus alpinus L. (P)	x	x	x	x	x	x
Phippsia algida (Sol.) R. Br.; (P)	x	x	x	x	x	x
Arctagrostis latifolia (R. Br.) Gr. Seb.; (P)	x	x	x	x		
Poa alpigena R. Br.; (P)	x			x		
Poa arctica R. Br.; (P)	x					
**Poa abbreviata* R. Br.; (P)	x		x	x	x	x
Poa hartzii Gand.; (P)	x					
Pleuropogon sabinei R. Br.; (P)	x		x			
Colpodium vahlianum (Liebm.) Neuski; (P)	x	x	x	x		
Dupontia fisheri R. Br.; (P)	x	x	x	x		
Puccinellia angustata (R. Br.) Rand & Redf.; (P)	x	x	x	x	x	
Puccinellia bruggemannii Th. Sør.; (P)	x	x		x		
Puccinellia phryganodes (Trin.) Scribn. & Merr.; (S & C)	x		x	x		
**Festuca baffinensis* Polunin; (S & C)	x			x		
Festuca brachyphylla Schultes; (P)	x	x	x	x		
Eriophorum triste (Th. Fr.) Hadac & Love; (P)	x	x	x	x		
Eriophorum scheuchzeri Hoppe (P)	x					
Carex aquatilis Wahlenb. var. *stans* (P)	x	x	x			
Carex misandra R. Br. (P)	x					
Juncus biglumis L. (P)	x	x	x	x	x	
Luzula nivalis Laest. Beurl.; (P)	x	x	x	x	x	
Luzula confusa Lindebl.; (P)	x		x			
Salix arctica Pall.; (P)	x	x	x	x		
Oxyria digyna (L.) Hill; (P)	x	x	x	x	x	
Polygonum viviparum L.; (P)	x	x	x			
Stellaria longipes Goldie; (P)	x	x	x	x	x	x
Stellaria humifusa Rottb.; (E)	x					
Cerastium alpinum L.; (P)	x	x	x	x	x	
Cerastium arcticum Lge (P)	x	x			x	
Cerastium regelii Ostf.; (P)	x	x	x	x	x	
Sagina intermedia Fenzl. (P)	x	x				
**Minuartia rubella* (Wablenb.) Sm.; (P)	x	x	x	x	x	
**Minuartia rossii* R. Br.; (P)	x	x	x	x	x	
Melandrium apetalum L. Fenzl. ssp. *arcticum* (Fr.) Hult.; (P)	x	x		x		
Ranunculus hyperboreus Rottb.; (P)	x					
Ranunculus nivalis L.; (P)	x	x	x	x	x	
Ranunculus sulphureus Sol.; (P)	x	x	x	x	x	
Papaver radicatum Rottb.; (P)	x	x	x	x	x	x
Cochlearia officinalis L.; (P)	x	x	x	x	x	
Eutrema edwardsii R. Br.; (P)	x					
Cardamine bellidifolia L.; (P)	x	x	x	x		
Draba alpina L. (P)	x	x	x	x	x	
**Draba corymbosa* Holm.; (P)	x	x	x	x	x	x
**Draba subcapitata* Simm.; (P)	x	x	x	x	x	
Draba lactea Adams; (P)	x	x	x	x	x	
Draba fladnizensis wulfen; (S & C)						
Draba oblongata R. Br.; (P)	x			x		
**Braya purpurescens* (R. Br.) Bunge; (P)	x			x		
**Lesquerella arctica* (Wormskj-) Wats.; (E)	x					
**Parrya arctica* R. Br.; (P)	x			x		
**Saxifraga caespitosa* (R. Br.) Porsild; (P)	x	x	x	x	x	x
Saxifraga cernua L.; (P)	x	x	x	x	x	x
**Saxifraga flagellaris* Willd. ssp. *platysepala* (Trautv.) Porsild; (P)	x	x	x	x	x	
Saxifraga foliolosa R. Br.; P	x		x	x		
Saxifraga hirculus L. var. propinqua (R. Br.) Simm.; (P)	x	x	x	x		
Saxifraga nivalis L.; (P)	x	x	x	x	x	
**Saxifraga oppositifolia* L.; (P)	x	x	x	x	x	x
Saxifraga rivularis L.; (P)	x					
Saxifraga tenuis Sm.; (P)	x	x				
Chrysosplenium tetrandrum (Lund) Fries; (P)	x					
Potentilla hyparctica Malte; (P)	x					
**Dryas integrifolia* M. Vahl.; (P)	x	x	x	x		
TOTAL NUMBER OF SPECIES	63	41	42	43	26	10

SPECIES REPORTED BUT NOT OBSERVED BY AUTHOR

Hierochloe alpina (Sw) R. & S. (P)	x
Eriophorum angustifolium Honck; (S & C)	x
Melandrium affine (J. Vahl.) Hartm.; (P)	x
Saxifraga tricuspidata Rottb.; (P)	x
Cassiope tetragona (L.) D. Don (P, A)	x
Vaccinium uliginosum L.; (P)	x
Cerastium beeringianum cham & Schecht.; (P)	x
Arenaria humifusa Wahlen b.j (P)	x
	8

\+ nomenclature after Porsild and Cody (1980)
* calciphilous species
Initial reporting of species
(P) Porsild, 1964
(S & C) Schofield & Cody, 1955
(A) Arkay, 1972
(E) Edlund, this paper

APPENDIX 2

Distribution of vascular plant species in the major plant communities of Cornwallis Island

	Community numbers in paper					Plant Communities*									
	Emergent	Wetlands				Mesic				Xeric					
Vascular Plants	4	1	3	5	7	9	10	12	13	14	15	16	17	18	19
Equisetum variegatum	-	p	-	-	-	-	-	-	-	-	-	-	-	-	r
Hierochloe alpina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	?
Alopecurus alpinus	p-c	p	d-c	p	r	p	p	p	p	p	p	p	p	-	c
Phippsia algida	-	-	-	-	p	-	-	-	p	-	-	-	-	-	r
Arctagrostis latifolia	-	p	-	-	-	p	-	-	-	-	-	-	-	-	r
Poa alpigena	-	-	-	-	-	-	-	-	-	-	-	-	-	-	p
Poa arctica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	p
Poa abbreviata	-	-	-	-	-	p	-	p	p	p	p	r	-	-	r
Poa hartzii	-	-	-	-	-	-	-	-	-	r	r	-	-	-	r
Pleuropogon sabinei	d	r	-	-	-	-	-	-	-	-	-	-	-	-	-
Colpodium vahlianum	-	-	-	-	-	r	-	-	p-r	-	-	-	-	-	r
Dupontia fisheri	-	p	c-d	-	-	-	-	-	-	-	-	-	-	-	-
Puccinellia angustata	-	-	-	r-p	r	-	-	-	-	-	-	-	-	-	r
P. bruggemannii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r
P. phryganodes	-	-	-	-	-	-	-	-	-	-	-	-	-	d-p	-
Festuca baffinensis	-	-	-	-	-	-	-	r	r	r	r	r	r	-	r
Festuca brachyphylla	-	-	-	-	-	r	r	p	p	p	r	r	r	-	p
Eriophorum triste	-	c-d	r	-	-	-	-	-	-	-	-	-	-	-	-
E. scheuchzeri	r	d-c	r	-	-	-	-	-	-	-	-	-	-	-	-
Carex aquatilis var. *stans*	r	d-c	r	-	-	-	-	-	-	-	-	-	-	-	-
Carex misandra	-	r	-	-	-	p	-	-	-	-	-	-	-	-	-
Juncus biglumis	-	p	p	p	-	r	-	-	-	-	-	-	-	-	r
Luzula nivalis	-	p	p	-	r	-	-	-	-	-	-	-	-	-	-
L. confusa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r
Salix arctica	-	r	r	-	-	d-c	d	r	-	d	r	-	-	-	-
Oxyria digyna	-	-	-	r	-	r	p-r	r	r	-	-	r	-	-	r
Polygonum viviparum	-	-	-	-	-	p	r	r	-	-	-	-	-	-	-
Stellaria longipes	-	p	p	p	-	r	r	r	r	-	-	-	-	-	p
Stellaria humifusa	-	-	-	-	-	-	-	-	-	-	-	-	-	r	-
Cerastium alpinum	-	-	-	-	-	p	p	p	p	p	p	r	r	-	p
Cerastium arcticum	-	-	-	-	-	p	p	r	r	r	r	r	-	-	r
Cerastium beeringianum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	?
Cerastium regelii	-	-	r	p	p	r	r	r	r	-	-	-	-	-	-
Sagina intermedia	-	-	-	-	-	-	p	p	p	-	-	-	-	-	r
Arenaria humifusa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	?
Minuartia rossii	-	-	-	-	-	-	p	p	r	-	-	-	-	-	r
Minuartia rubella	-	-	-	-	-	-	-	-	-	r	r	r	-	-	r
Melandrium apetalum	-	p	r	-	-	r	r	-	-	-	-	-	-	-	r
M. affine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	?
Ranunculus hyperboreus	p-r	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. nivalis	-	p	p	p	-	-	-	-	-	-	-	-	-	-	-
R. sulphureus	-	p	p	p	-	r	r	r	-	-	-	-	-	-	r
Papaver radicatum	-	p	p	p	-	p	p	p	p	p	p	p	p	-	c
Cochlearia officinalis	-	r	r	-	-	-	r	r	-	-	-	-	-	r	r
Eutrema edwardsii	-	r	r	-	-	r	-	-	-	-	-	-	-	-	-
Cardamine bellidifolia	-	p	p	r	-	-	-	-	-	-	-	-	-	-	-
C. pratensis	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-
Lesquerella arctica	-	-	-	-	-	r	-	-	-	p	-	-	-	-	-
Draba alpina	-	p-r	r	r	-	r	r	r	-	-	-	-	-	-	p
Draba corymbosa	-	-	-	-	-	p	r	r	-	p	p	p	p	-	p
Draba subcapitata	-	-	-	-	-	-	-	-	-	p	p	p	r	-	r
D. lactea	-	-	-	-	-	p	p	-	-	-	-	-	-	-	-
D. oblongata	-	p-r	-	-	-	-	-	-	-	-	-	-	-	-	-
Braya purpurescens	-	-	-	-	-	p	p	r	-	r	r	r	-	-	-
Parrya arctica	-	-	-	-	-	p	r	r	-	p	r	-	-	-	r
Saxifraga caespitosa	-	-	r	r	r	r	p-r	r	r	r	r	r	r	-	p
S. cernua	-	r	p	p	p	p	p	p	p	p	r	r	r	-	r
S. flagellaris	-	-	-	-	r	-	-	r	r	r	-	-	-	-	-
S. foliolosa	-	p	p	r	-	-	-	-	-	-	-	-	-	-	-
S. hirculus	-	p	r	-	-	-	-	-	-	-	-	-	-	-	-
S. nivalis	-	-	-	-	-	p	r	r	-	-	-	-	-	-	r
S. oppositifolia	-	r	r	r	-	c	c	d	p	d	d	d	c	-	p
S. rivularis	-	r	r	-	-	-	-	-	-	-	-	-	-	-	-
S. tenuis	-	r	r	-	-	-	-	-	-	-	-	-	-	-	-
Chrysosplenium tetrandrum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	p
Potentilla hyparctica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	r
Dryas integrifolia	-	r	-	-	-	d-c	p	r	-	c-d	r	-	-	-	-
Cassiope tetragona	-	-	-	-	-	?	-	-	-	-	-	-	-	-	-

*Plant Communities as numbered in text

4 Marsh emergent and aquatic vegetation
1 Sedge meadow
3 Grass meadow
5 Bryophytic mat
7 *Phippsia algida* barrens
9 *Dryas-Salix-Saxifraga oppositifolia* tundra
10 *Salix* tundra
12 *Saxifraga oppositifolia* tundra
13 Herb tundra
14 *Dryas-Salix* barrens
15 *Saxifraga oppositifolia* barrens
16 Grass barrens
17 Herb barrens
18 Salt marsh community
19 Enriched sites

p = present or locally abundant
r = rare
c = common
d = dominant
\- = absent
? = possible occurrence