THE FLORA AND VEGETATION OF CAPE HERSCHEL, ELLESMERE ISLAND, N. W. T.

JAMES PARSONS BRIDGLAND

THE FLORA AND VEGETATION OF CAPE HERSCHEL, ELLESMERE ISLAND, N.W.T.

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Department of Biology
Memorial University of Newfoundland

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Cape Herschel, Ellesmere Island, Northwest Territories.

Ellesmereland I.

Explorers say that harebells rise
from the cracks of Ellesmereland
and cod swim fat beneath the ice
that grinds its meagre sands
No man is settled on that coast
The harebells are alone
Nor is there talk of making man
from ice cod bell or stone.

Earle Birney, 1952.

ABSTRACT

Botanical explorations at Cape Herschel, a small peninsula on the relatively oceanic coast of eastern Ellesmere Island, Northwest Territories, have yielded a flora which includes 68 species of vascular plants, 121 species of mosses, and 44 species of lichens.

Field typification of seven vegetation types was tested with cluster analysis and the seven types were divided into eleven plant communities. Diagnostic species were identified for each community using species constancy and mean abundance in each cluster. Environmental factors determining the distribution of plant communities at Cape Herschel were tested with direct gradient analysis and with topographic analysis.

Floristic comparison of plant communities at Cape Herschel with those described from elsewhere in the Queen Elizabeth Islands identified 11 communities which appear to correspond directly enough to be useful for the purposes of regional vegetation mapping. A twelfth community was identified at Cape Herschel but it was not comparable to communites described elsewhere.

Moisture, snowcover, and substrate texture have the greatest influence, in that order, on the distribution of vegetation types at Cape Herschel. Altitude and aspect were also found to control the distribution of vegetation.

Cassiope heath, cottongrass and sedge meadows, and Luzula confusa steppe were the communities at Cape Herschel which were floristically most similar to communities described from other areas of the Queen Elizabeth Islands, but two barrens communities, two tundra communities, and a marsh community also show some similarity to communities described elsewhere.

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INTRODUCTION

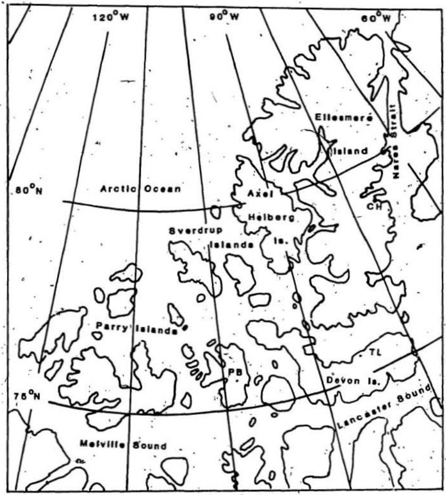
The Queen Elizabeth Islands, with a land area of approximately 427,500 km^2 (Taylor 1964), bordered by the Arctic Ocean, Nares Strait, Lancaster Sound and Melville Sound, form a rough triangle in the north end of the Canadian Arctic Archipelago (Fig. 1). In the last century, knowledge of the flora of the Queen Elizabeth Islands has increased to a point where the vascular flora is almost completely known (Barrett 1972). Studies on the cryptogamic flora, however, have been relatively few. Vegetation studies have concentrated on localities with unusually productive vegetation, in the continental regions of the island group. Of many plant communities described from these localities, only some are strictly comparable. A far larger area of the arctic comprises marginal or sub-optimal habitat. The vegetation of these situations will be more representative of the Queen Elizabeth Islands, than the vegetation found in thermically favoured "oases".

This study examines the flora and vegetation of Cape Herschel, a small peninsula on the relatively oceanic east coast of Ellesmere Island, and compares the plant communities there with communities described from other localities in the Queen Elizabeth Islands.

Early Botanical exploration of Ellesmere Island.

Botanical exploration of Ellesmere Island dates from 1861, when Dr. I.I. Hayes collected seven species of plants in the vicinity of Cape Isabella and Gale Point, on the southeast coasts (Hayes 1867; Durand et al. 1863(4)). The first expedition to make large collections of plants on Ellesmere Island was the British Polar Expedition of 1875-76, led by G.S. Nares. This expedition explored the east

Figure 1: The Queen Elizabeth Islands, location of study area, and other places referred to in text.



CH Cape Herschel PB Polar Bear Pass TL Truelove Lowland

and north coasts of Ellesmere from Cape Sabine to the shores of the Arctic Ocean. This expedition increased the known vascular flora of Ellesmere Island to 75 species (Hart 1880).

From 1898 to 1902, the Second Norwegian Arctic Expedition in the "Fram" spent four winters on Ellesmere Island, mapping its coast and those of other islands to the west. In 1898 the expedition wintered at Rice Strait, 15 km north of Cape Herschel; in 1899, at Harbour Fiord on the south coast; and in 1900 and 1901 at Goose Fiord to the west of Harbour Fiord. During this period, H.G. Simmons collected the plants on which he based his "Flora of Ellesmereland" (Simmons 1906). This work listed 115 species of vascular plants for the island. Simmons's subsequent (1913) survey of the phytogeography of the Arctic American Archipelago, was a landmark in the botany of the Canadian Arctic and at the time of its publication, the flora of Ellesmere Island was better described than that of ~~any other region~~ of the entire Canadian Arctic Archipelago (Polunin 1940). Simmons also collected bryophytes and lichens. The bryophytes were published by Bryhn (1906-07). Unfortunately the lichens were never properly identified (see Lynge 1947, p. 303).

The next botanist to visit Ellesmere Island was M.O. Malte, who visited the R.C.M.P. Post at Bache Peninsula in 1927, while preparing a flora of the Canadian Arctic. Unfortunately, this work was never completed, and only a few records were published posthumously (Malte 1934).

The next major advance in the botany of the Ellesmere Island was Polunin's (1940, 1947, 1948) three volume "Botany of the Canadian Eastern Arctic". Besides being the first work to record in one place the occurrence of all plant groups, this was the first work to qualitatively describe plant communities in the Canadian High Arctic. Included in Polunin's works were descriptions of the vegetation at Craig Harbour, on southern Ellesmere Island, and at Dundas Harbour, on Devon Island.

Recent botanical research in the Queen Elizabeth Islands.

Since 1950, botanical works have shifted from floristic works, with brief accounts of the vegetation and descriptions of the phenology of various species, to more complete descriptions of plant communities and investigations into productivity of various community types.

Early research centred on the hitherto relatively unknown regions of northern Ellesmere Island and Axel Heiberg Island (Bruggemann and Calder 1953; Schuster, Steere, and Thomson 1959; Savile 1964; Brassard 1968; Brassard and Beschel 1968; Brassard and Longton 1970; Kuc 1969, 1973a). The first works were mainly floristic, while studies in the 1960's began to describe vegetation in terms of substrate, microtopography, and moisture regime. Kuc's work on Axel Heiberg was largely concerned with the autecology of moss species found there. Beschel (1970) proposed a classification of plant communities that could be predicted to occur throughout the Queen Elizabeth Islands in stable habitats in various combinations of moisture and warmth. He divided the island group into five regions, each characterized by a predominant community type: polar desert, Luzula steppe, Dryas tundra, Cassiope tundra, and polar steppe.

Collecting in the southern and western islands of the Queen Elizabeth group proceeded gradually from the early 1950's to the present. Initial floristic works (Steere 1951, 1955; Brassard 1967; Brassard and Steere 1968), and floristic works with preliminary community descriptions (Schofield and Cody 1955; Savile 1961, Kuc 1970a, 1970b, 1973b) were supplemented in the 1980's with vegetation studies (Miller and Alpert 1984, Sheard and Geale 1983, Edlund 1980, 1983a, 1983b, Sohlberg and Bliss 1984, Bliss and Svoboda 1984, and Edlund and Alt [in prep.]). Savile (1961) was the first to recognize the existence of an area which has since been described as "the barren wedge" of the Sverdrup and Parry Islands. This region is characterized by an absence of many plant species occurring to the north, east, and south of it; and has been discussed at length by Beschel (1969), Young (1971), Edlund (1983a) and Edlund and Alt [in prep.].

Truelove Lowland, on the north coast of Devon Island, received much attention, in the late 1960's (Barrett 1972; Barrett and Teeri 1973; Barrett and Thomson 1975), and subsequently as a site of the International Biological Programme (Bliss 1977; Vitt 1975). Using the classical approach of the Zürich-Montpelier school of phytosociology, Barrett (1972) identified nine phytogeocoenoses, or plant-soil associations, which were referrable to a system of circumpolar plant communities, such as had been suggested by Rønning (1965). The I.B.P. Project recognized six major community types and six minor ones, which were described in terms of general growth form and cover values of the species present and in terms of the dominant species (Muc and Bliss 1977). The project included detailed investigations into productivity and phenology in the different community types (Muc and Bliss 1977; Svoboda 1977; Bliss, Kerik and Peterson 1977), as well as the productivity of mosses and lichens (Vitt and Pakarinen 1977; Richardson and Finegan 1977).

From 1980 to the present, Svoboda and Freedman (1980, 1981) have been conducting studies similar to those of the Truelove Lowland I.B.P. project at Alexandra Fiord on the east coast of Ellesmere Island, approximately 40 km northwest of Cape Herschel. Muc (1980, 1981) recognized twelve community types there, describing them in terms of general growth form, cover, and dominant species, but identifying only the vascular plants.

Comparisons of plant communities found in different regions of the Queen Elizabeth Islands have only recently become possible. While cryptogams form a substantial part of the biomass of arctic plant communities, it is only since the early 1970's that community descriptions have routinely included the cryptogamic component. Also, most early authors described the vegetation of habitats rather than "plant communities". This was a result of the poor expression of many community types in the marginal arctic environments (Beschel 1970). Savile (1960) even questioned the actual existence of true plant associations in the high arctic. The most successful attempts at defining commmunities in the high arctic have come from studies at northern Ellesmere (Brassard 1971), at Truelove Lowland (Muc 1977), at Alexandra Fiord (Muc 1981), and at Polar Bear Pass on Bathurst Island (Sheard and Geale 1983). A common theme of these papers is the atypically high productivity and floristic richness (for high arctic regions) of each of these areas.

If a classification of plant communities in the Queen Elizabeth Islands is to be useful, it should consider not only the vegetation of highly productive regions, but also the vegetation of less favoured marginal regions. If plant communities with floristic fidelity do exist, it is only the ones found in both productive and marginal regions which can be expected to truly represent the vegetation of the island group as a whole.

This study examines the vascular plants, mosses and lichens of one such marginal area, Cape Herschel. Plant communities are identified and described. Their distribution with respect to topography, moisture, snowcover, substrate texture and cryoturbation is discussed, as is their relation to communities described from other localities in the Queen Elizabeth Islands.

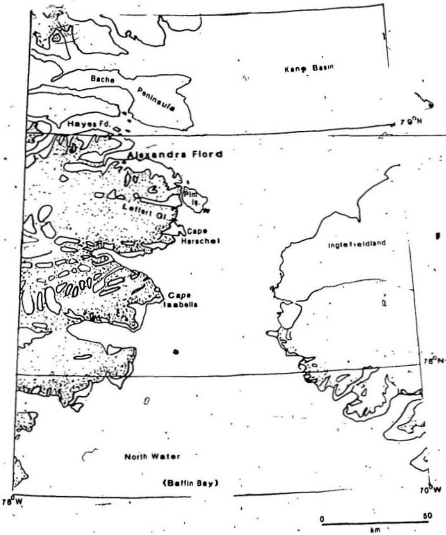
THE STUDY AREA.

Cape Herschel (78°37'N, 74°42'W) is a 40 km^2 peninsula on the east coast of Ellesmere Island (Fig. 2). It is in effect an island separated from the large ice-free regions of Hayes Sound and Sverdrup Pass to the north by Rosse Bay and the Leffert Glacier, and from the coastal land to the south by Herschel Bay and by the Alfred Newton and other glaciers. The large ice-free region of Inglefield Land (northwest Greenland) is some 30 km to the east across Smith Sound and Kane Basin. Cape Herschel is on the northwest edge of the North Water Polynia, a region of Baffin Bay which remains ice-free all year (Dunbar 1969).

Geology and Physiography.

Cape Herschel comprises a steep-walled plateau of massive, red, weathering, orthopyroxene granite near the northern end of the Precambrian Shield. To the north the Shield rocks include gneiss and a variety of metasediments as well as granite, and on Bache Peninsula are overlain by Proterozoic sedimentary rocks of the Thule group and by Paleozoic dolomite, sandstone, and limestone (Christie 1962, 1967, 1972; Frisch, Morgan and During 1978). The Cape Herschel plateau rises from over 250 m a.s.l. in the east to approximately 600 m in the extreme west, on the north side of Alfred Newton Glacier. The plateau is divided by a steep-walled glacial valley, Elison Pass, which is oriented north-south between Rosse Bay and Herschel Bay. Many bedrock outcrops with polished and striated north sides and plucked south sides indicate that the entire plateau was once overridden by ice flowing from north to south. This southward flow deposited till up to the highest points of the outer Cape Herschel plateau (285 m) and of Pim Island (550 m), 15 km to the north. The till includes both Proterozoic and

Figure 2: East central Ellesmere Island and adjacent Greenland.


Kane Basin
Bache
Peninsula
Hayes Fd.
79°N
Alexandra Fiord
Pim Is.
Leffert Gl.
Cape Herschel
Inglefieldland
Cape Isabella
78°N
North Water
(Baffin Bay)
78°W
70°W
0
50
km

Paleozoic rocks found only to the north of Cape Herschel, and a variety of igneous and metamorphic rocks (Blake 1977; Christie 1983). An end moraine of a proto-Leffert Glacier is found along the north slope of the Cape Herschel plateau, and lateral moraines are found in Elison Pass. End moraines are found at the south and east edges of the un-named glacier which separates the study area from the Leffert Glacier. Radiocarbon dates of organic pond sediments and Holocene marine mollusc shells (Blake 1977, 1978, 1981) indicate that terrestrial habitats have been available for plant colonization in the vicinity of Cape Herschel for the last 9,000 years. Isostatic uplift since the last glaciation has resulted in the emergence to at least 90 m of well-developed raised beach ridges and wave-polished rocks on the lowlands of the northern half of the peninsula proper.

The plateau has a number of raised deltas and hanging valleys, and is drained by a dozen small streams and a few broad seepage slopes. Small ponds are found mostly on the lowlands of the northwestern part of the peninsula and in Elison Pass. All of the ponds are shallow, and freeze to the bottom in winter. The marine shore is generally rocky except in the innermost portions of Rosse Bay and Herschel Bay, and at the foot of the Alfred Newton Glacier, where mudflats are present. Portions of the shore of Herschel Bay exhibit raised beaches. These rise to an elevation of over 30 m. An ice-foot persists into August throughout the area.

Frozen ground features (Washburn 1956) are found in many places at Cape Herschel. Stone nets and stripes are well-developed in the mesic cobble on back slopes of raised beach ridges on the north portion of the peninsula. Frost hummocks and solifluction slopes were more numerous and better developed on wet south-facing slopes.

Climate.

Climatic factors (insolation, temperature, snow-cover, and wind) which determine the occurrence of plants in the arctic have been discussed by numerous authors. Good reviews are given by Billings and Mooney (1968), Corbet (1972), and Savile (1972). Young (1971) suggested that an important factor determining the northward limits of plant species is the aggregate summer warmth of regions, envisaged as the total of degree-days above freezing, but simplified to the sum of the monthly means above zero Celsius.

Cape Herschel is located at the northern end of the Northern Baffin Bay - Lancaster Sound subregion of Maxwell's (1981) Eastern Arctic Climatic Region. The subregion includes southeastern Ellesmere Island, Devon Island east of the Grinnell Peninsula, and Baffin Island. The Northern Baffin Bay - Lancaster Sound subregion is greatly influenced by the North Water, and by the the mountainous coasts north of Bylot Island. The average annual precipitation is greater than 300 mm. The subregion has a somewhat maritime climate, with an annual mean temperature range of 33 to 36 Celsius degrees, and a range as low as 22 Celsius degrees over the North Water.

Weather data for the Cape Herschel area are available from Mohn (1907), from Müller et al. (1975, 1976), and from aviation weather reports made during the field seasons of 1979 and 1980.

Figure 3 shows the monthly mean temperatures in 1973-74. Figure 4 shows the mean daily temperatures in 1979 and 1980. The mean temperature in the 1979 field season (11 June to 24 July 1979) was 2.2°C with a mean daily range of

4.2°C. In 1983 (28 May to 23 July 1980) the mean was 0.0°C with a mean daily range of 4.6°C. Møller et al. (1975, 1976) reported that, while summer temperatures at Cape Herschel were not appreciably different from those at other stations in the Queen Elizabeth Islands, the winter temperatures were from five to eight degrees warmer than those at Resolute, reflecting the warming influence of the North Water.

Precipitation, from June 1973 to June 1974 was 265 mm, 100 mm greater than the annual precipitation at Resolute (Møller et al. 1975). While monthly precipitation totals varied considerably from 1973 to 1976, the means show that the most precipitation occurs in the months of July, October, and August, in descending order, with 59% of the mean annual precipitation falling within those three months. Cloud cover in the 1979 field season averaged 6/10 total, and 4.7/10 low cloud. In 1980 the average total cloud cover was 5.3/10, while the average low cloud cover was 3.8/10. Average total cloud cover in the 1983 field season was 6.2/10.

The average wind speed was 18.0 km/h (5.0 m/s) during the 1979 field season, 15.4 km/h (4.3 m/s) during the the 1980 season, and 19.7 km/h (5.5 m/s) in the 1983 field season. Figure 5 shows the wind roses for 1979 and 1980. The predominance of northerly and southerly winds through the winter was evidenced by the persistence of large snow drifts on the north and south slopes of the cape in four years (1978-1980 and 1983), and by the north-south orientation of "sastrugi" seen in 1978.

While, in the Queen Elizabeth Islands, weather data from one locality to the next may not be strictly comparable, due to variations of sampling year, or

Figure 3: Mean monthly temperatures, maxima and minima, and monthly extremes at Cape Herschel 1973-1974, (Müller et al 1975, 1976)

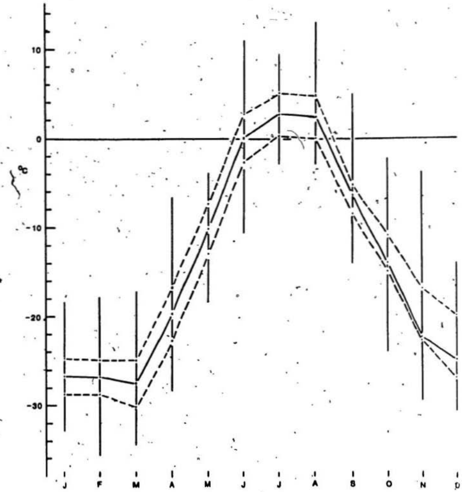

10
0
°C
-10
-20
-30
J
F
M
A
M
J
J
A
S
O
N
D

Figure 4: Mean daily temperatures at Cape Herschel during field seasons of 1979, 1980 and 1983.

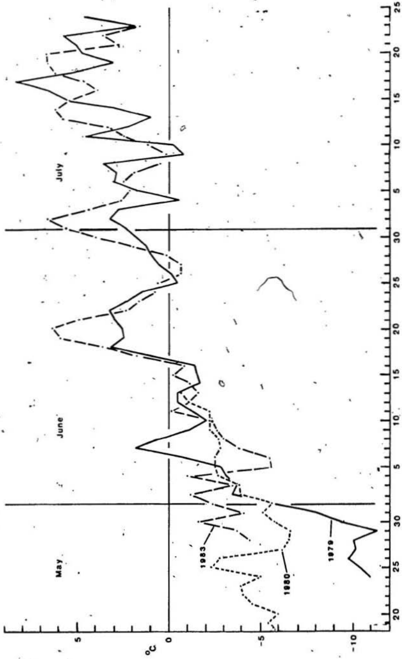
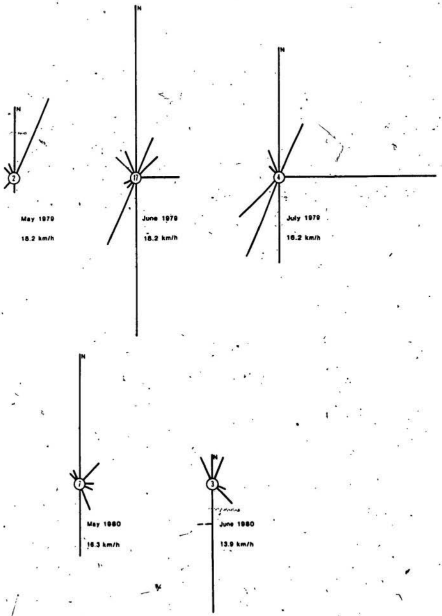

°C
5
0
-5
-10
May
June
July
1983
1980
1979
20
25
30
5
10
15
20
25
30
5
10
15
20
25

Figure 5: Windroses for Cape Herschel, field seasons of 1979 and 1980.


N
2
May 1979
18.2 km/h
N
17
June 1979
18.2 km/h
N
4
July 1979
18.2 km/h
N
1
May 1980
16.3 km/h
N
3
June 1980
13.9 km/h

differences of specific data published, some rough comparisons may be made between the climate at Cape Herschel, and the local climates of Truelove Lowland (Courtin and Labine 1977), Alexandra Fiord (Labine 1981; unpublished data from aviation weather reports collected for the Atmospheric Environment Service).

Young's (1971) Index of aggregate summer warmth was calculated for all stations. Using Måller's temperature records for 1973-74 (Måller et al. 1975, 1976) and extrapolating from the temperature data collected in 1979, Young's Index of aggregate summer warmth (a) was estimated for Cape Herschel at $a =$ 5.9, placing it in Young's first zone.

At Truelove Lowland, based on the summers of 1970 to 1973, the average value of a was 13.5, placing it in Young's third floristic zone. A value of $a = 11.9$ at Alexandra Fiord, was calculated from unpublished aviation weather reports from 1979 and 1980. This puts Alexandra Fiord in the second floristic zone.

Average wind velocities were lower at Alexandra Fiord (2.4 km/h, 0.7 m/s), and at Truelove Lowland (3.69 m/s and 3.24 m/s in 1972 and 1973 respectively).

Vegetation.

The vegetation at Cape Herschel is generally scant. Plant cover over much of the plateau and the more xeric to mesic portions of the lowland is generally less than 5% and often less than 1% (Freedman and Svoboda 1981). Only on seepage slopes, on the borders of ponds and streams, and in meadows irrigated by late-lying snow does plant cover approach or reach 100%.

In the barrens saxicolous lichens tend to dominate the outcrops and boulders, where they exhibit best growth on snow-sheltered and lee surfaces. The cobble pavement of the barrens supports a vegetation of cushion plants, which grades into mosses and dwarf shrubs in the frost cracks and at the borders of small ponds. Meadows, which are found on finer grained substrates, tend to be dominated by sedges in mesic locations, and by mosses in wetter locations. Dwarf shrub heath is restricted to south-facing slopes where much snow accumulates, which is rapidly lost in the spring.

Fauna.

The importance of vertebrate fauna, to plant life in the nitrogen - poor substrates of the arctic has been noted by many authors. As well as supporting distinct coprophilous communities (Brassard 1971), animals act as agents of dispersal for many plant species (Savile 1972).

The vertebrate fauna of Cape Herschel is depauperate when compared to other regions of the Queen Elizabeth Islands. Four visits to Cape Herschel, totalling ten weeks, between 1978 and 1983, yielded sightings or evidence of only five species of terrestrial mammals: arctic fox, Greenland collared lemming, arctic hare, ermine, and polar bear. Birds found at Cape Herschel varied considerably from year to year. Species observed there over four field seasons included thick-billed murre, black guillemot, snow goose, brant, common eider, king eider, oldsquaw, gyrfalcon, rock ptarmigan, Thayer's gull, glaucous gull, black-legged kittiwake, ringed plover, red knot, purple sandpiper, raven, and snow bunting.

METHODS.

This study was conducted in four stages. In the first stage, the flora and vegetation of Cape Herschel were examined using relatively few preconceptions on the makeup of plant communities. At the end of two field seasons, the floristic sites were classified using tabular comparison (Mueller-Dombois and Ellenberg 1974). This classification was compared with those of other authors, and a "field classification" was devised which would permit the typification of vegetation in the field.

In the second stage, the field classification was tested and modified in the field and used to map the vegetation of Cape Herschel at the supra-community or vegetation complex level. Vegetation complexes were defined as physiognomically distinct units dominated by a particular life-form, and having a particular range of total plant cover. Plant communities were defined as components of the vegetation complexes, but differing from them by having in addition a floristic similarity between sites of the same community type.

To test the objectivity of the field classification, and to refine the definition of communities in floristic terms, the sites were labelled according to their field classification and then sorted using cluster analysis. This approximates the method of Sheard and Geale (1983).

In the fourth stage, the ecological distribution of the communities defined above was tested using direct gradient analysis. Methods used in the first two stages are described in the section on sampling below. The third and fourth stages are described in the section describing community analysis.

Sampling and processing of samples.

Field studies were conducted during the summers of 1979, 1980, and 1983. Intensive floristic sampling and preliminary community analysis were done between 21 June and 23 July 1979, and between 19 May and 19 June 1980. An extensive vegetation mapping survey of the central portion of the peninsula was undertaken between 11 June and 14 July 1983. Snow cover in all three seasons was extensive on the lowlands and north-facing slopes, disappearing gradually during the month of June.

The main constraints on sampling were snowcover, accessibility, and time available. Travel from base camp to the sample sites was mostly on foot in 1979 and 1983. In 1980 much use was made of snowmobile and skis. On four occasions a helicopter was used for transport to more distant sites.

Over 100 sites were sampled in 1979, 1980 and 1983 for vascular plants, mosses, and lichens. Principal considerations in the selection of sample sites were substrate, microtopography, and moisture regime. These features were usually identifiable on monochrome stereo aerial photographs. The choice of sampling areas was made after detailed inspection of aerial photographs and extensive ground explorations.

At each site an area of approximately 10 m^2 was sampled. The specific location of the site was chosen to ensure that the site was representative of the surrounding vegetation and that it was homogenous with respect to substrate, microtopography and moisture. Each site was ranked on a qualitative scale of 1 to 5 for moisture, substrate texture, snow cover, altitude, and substrate instability due to frost (Table 1). Aspect was recorded for each site. Four aspect classes correspond to the four cardinal compass points; a fifth class accommodates level sites. At each site, estimates were made of the relative abundance or cover of individual vascular species, using a scale (Table 2) modified from the frequency scale of Tansley and Adamson (1913). Moss and lichen species were recorded for presence and absence. Total plant cover was also recorded. In most sites, voucher specimens were collected for each species found.

The 59 sites sampled in 1979 and 1980 were classified using classical tabulation procedures (Mueller-Dombois and Ellenberg 1974), based on dominant life form. Cushion plant, dwarf shrub, graminoid, moss, and lichen - dominated vegetation complexes were recognized. This classification was compared with other accounts of vegetation in the Queen Elizabeth Islands, and a composite "field classification" was devised. This "field classification" draws largely on the on physiognomic communities described by Beschel (1970) and by Edlund (1983b), but is the methodological equivalent of the "visual classification" of Sheard and Geale (1983). The field classification was tested and modified at Cape Herschel in 1983. The six vegetation complexes or supra-communities finally used in the field at Cape Herschel are described in Table 3.

The division of tundra from barrens at 40% total plant cover was arbitrary. It stretches the definitions given them by Edlund (1983b), who described barrens as having cover less than 20% and tundra as having nearly continuous plant cover. It was, however, found to be the most practical way to separate these communities which were variously dominated by Salix, Dryas, Saxifraga or Luzula nivalis. Two types of meadow, a cottongrass meadow and a Carex stans meadow, were also discernible in the field. Indicator species of communities described from

Table 1: Environmental Scales used to characterize sites in field.

Parameter \ Score:	1	2	3	4	5
moisture	xeric		mesic		wet
substrate texture	bedrock	talus	cobble	fine gravel	fine sand
snowcover	negligible		moderate		deep, persisting
altitude (m)	0-50	50-100	100-150	150-200	>200
substrate stability	stable		moderate cryoturbation		severe cryoturbation, or erosion

Table 2: Abundance Scale modified from Tansley and Adamson (1913)

Score	Descriptor	Characteristics
5	Abundant	Gregarious, obvious throughout the site, and having a cover greater than 10% of the total vegetation cover.
4	Common	Gregarious or scattered individuals, widespread throughout the site so that presence obvious from anywhere in site.
3	Frequent	Gregarious or scattered individuals, with discontinuous distribution; not obvious throughout the site.
2	Occasional	Scattered individuals with restricted distribution within site.
1	Rare	Single occurrence within site.

Table 3: Field characterization of vegetation complexes, and plant communities.

Complex	General Description
Lichen Outcrop	Communities with a high proportion of foliose and crustose lichens on bedrock substrate.
Barrens	Communities with total plant cover less than 40%, usually in a single stratum and without a high proportion of lichens.
Tundra	Communities with total plant cover greater than than 40%, not dominated by sedges or grasses, and not saturated with standing water.
Meadow	Communities dominated by graminoid species. Three types of meadow, dominated respectively by Carex stans, Eriophorum spp., and Alopecurus alpinus and a steppe communitydominated by Luzula confusa were recognized in the field.
Marsh	Communities on substrate saturated with standing water.
Heath	Communities with a high proportion of Cassiope tetragona.

other localities in the Queen Elizabeth Islands or other areas of the arctic were present at Cape Herschel. These community types included a halophytic community indicated by the presence of Puccinellia phryganodes and Carex maritima and a deep snowbed community indicated by the presence of Phippsia algida. These were physiognomically most similar to the barrens sites and were characterized as littoral or snowbed barrens.

The six complexes described in Table 3 were mapped for the central portion of the Cape Herschel peninsula between Rosse and Herschel Bays (total map area of 720 ha.) at a scale of 1 : 25,000 in the field using monochrome stereo aerial photographs and field inspection. For convenience of mapping the steppe and meadow areas were mapped with the same symbol.

Vascular plants were determined in the field, and verified at herbaria at Memorial University (NFLD) and the National Museum of Natural Sciences at Ottawa (CAN). Except for the genus Draba, where the classification of Mulligan (1976) was used, the taxonomy followed Porsild (1964). The first set of voucher specimens of the vascular plants is deposited at the Biosystematics Research Institute (DAO). Duplicate sets have been deposited at CAN and NFLD.

Mosses were determined at Memorial University. The principal sources used for identification of mosses were Nyholm (1954-1969), and Crum and Anderson (1981), but other taxonomic works (Bremer 1980; Koponen 1973, 1974; Mogensen 1973, Peterson 1979, Vitt 1973) were consulted for certain families and genera. The nomenclature used here generally follows Ireland et al. (1980). The first set of voucher specimens is deposited at the National Museum bryophyte collection (CANM); duplicates are deposited at NFLD.

Lichens were identified at Ottawa with reference to the National Museum lichen collection (CANL) and are deposited there. Principal references used in their identification were Thomson (1979) and Hale (1954), but other references (Brodo and Hawksworth 1977; Dibben 1980; Llano 1950) were also useful. The nomenclature follows the system employed at CANL.

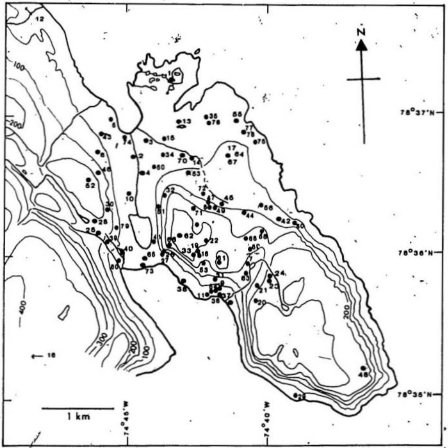
Community Analysis.

From the floristic and vegetation sites of the three field seasons eighty sites (Fig. 6, Appendix A) were selected for use in the vegetational analysis. Selection of sites was based on a minimum richness of five species present at the site. The sites were grouped by their field and tabular classifications to establish rank within and between groups. The regrouped sites were then renumbered from 1 to 80.

Cluster analysis (Wishart 1978) using Euclidean Distance as an index of dissimilarity and Ward's (1963) method of cluster grouping was performed on all 80 sites using the raw abundance scores for vascular species. In two genera, Draba and Eriophorum which were often difficult to identify to species prior to anthesis, the genus was used as the analytical unit rather than the species. Eliminated from consideration were species which occurred in fewer than five of the 80 sites.

The cluster analysis was run twice. All 80 sites were included in the first run. Comparison was made between the resulting clusters and the original field characterizations of the sites. Eleven Sites which fell into clusters predominantly of another community, as determined by the field characteriziation, were eliminated from further consideration. The second cluster analysis was run on the

Figure 6: Sample sites at Cape Herschel.
Countour interval: 50 m.


N
78°37'N
78°36'N
78°35'N
74°45'W
74°40'W
1 km
100
200
300
400

remaining sites in order to test the integrity of the clusters produced by the first analysis.

The importance of individual vascular species in each community or cluster was estimated by means of an index of species constancy within each cluster. This index, the Constancy-abundance product (P_{ca}) was calculated as the constancy of a species within a cluster multiplied by its mean abundance in that cluster times 100, or:

$$\begin{aligned} P_{cai} &= 100 \cdot c_i \cdot \bar{a}_i \\ &= 100 \cdot (n_i / n) \cdot (\Sigma a_i / n_i) \\ &= 100 \cdot \Sigma a_i / n. \end{aligned}$$

where the constancy c_i of species $\underline{i}$ is the number of occurrences n_i of that species in a cluster, divided by the number of sites $\underline{n}$ in that cluster. Mean abundance $\bar{a}_i$ refers to that species's abundance on those sites where it occurs. Values of (P_{ca}) in any cluster ranged from 13 to greater than 400. Species with (P_{ca}) values of 100 or greater were chosen as indicator species for the various clusters.

Mean species richness of each community was calculated as the mean of the number of species per site for all sites in the cluster. The total number of species found in the cluster was also determined.

Direct gradient analysis (Dix and Smeins 1967) was used to determine the environmental factors controlling the distribution of community types and of indicator species. This analysis employed the 25 most common vascular species used in the cluster analysis and was based on their abundances in all 80 of the sites. From this, the positions of the 69 sample sites used in the final cluster analysis were plotted with respect to indices of moisture, snowcover, substrate texture, and cryoturbation. The distribution of communities with respect to aspect and altitude were plotted directly.

RESULTS.

Floristic Results.

The flora of Cape Herschel includes 233 species: 68 species of vascular plants, 121 species of mosses, and 44 species of lichens (Appendix B.) Of these, the moss Amblystegium serpens has not been reported previously from the Canadian Arctic Archipelago.

Three moss species, found at Cape Herschel, are listed by Ireland et al. (1980) as having been reported from the Arctic Archipelago, but not seen by the authors. They are: Bryum aeneum, Bryum tortifolium, and Hypnum recurvatum.

Eight species are reported here for the first time from Ellesmere Island. They are: Calliergon cordifolium, Cratoneuron commutatum, Hygrohypnum alpestre, Kiaeria glacialis, Orthotrichum pylaisii, Rhizomnium andrewsianum, Schistidium agassizii, and Candelariella terrigena. Seven species of lichens including Buellia elegans, Caloplaca jungermanniae, Cladonia ecmocyna, Peltigera leucophlebia, Protoblastenia rupestris, Stereocaulon botryosum, and Umbilicaria torrefacta are reported here for the second time from Ellesmere Island. Annotations for all species listed above appear in Appendix C.

Thirty taxa are reported here for the first time from central east Ellesmere Island. They are:

Mosses

<u>Aloina brevirostris</u>
<u>Barbula icmadophila</u>
<u>Calliergon richardsonii</u>
<u>Cinclidium stygium</u>
<u>Cnestrum alpestre</u>
<u>Dicranum groenlandicum</u>
<u>Encalypta vulgaris</u>
<u>Fissidens adianthoides</u>
<u>Grimmia torquata</u>
<u>Hygrohypnum luridum</u>
<u>Hypnum cupressiforme</u>
<u>Plagiomnium ellipticum</u>
<u>Timmia bavarica</u>
<u>Timmia sibirica</u>

Lichens

<u>Buellia epigea</u>
<u>Caloplaca cirrochroa</u>
<u>Caloplaca tiroliensis</u>
<u>Cladonia coccifera</u>
<u>Cornicularia aculeata</u>
<u>Fulgensia bracteata</u>
<u>Lecanora behringii</u>
<u>Pertusaria coriacea</u>
<u>Pertusaria dactylina</u>
<u>Psora rubiformis</u>
<u>Rhizocarpon superficiale</u>
<u>Stereocaulon rivulorum</u>
<u>Thamnolia subuliformis</u>
<u>Toninia sp.</u>
<u>Umbilicaria cylindrica</u>
<u>Umbilicaria hyperborea</u>

Conspicuous at Cape Herschel was the extreme dwarfing of many vascular plants, particularly the woody plants, and herbs. Cassiope tetragona in particular was never well developed. Oxyria digyna, and Polygonum viviparum were always found with extremely dwarfed habit. Saxifraga cernua was never taller than 10 cm at Cape Herschel and was never observed in flower there but only with bulbils at the shoot apex.

Several vascular plants were found only at south-facing sites at Cape Herschel. These species included Cystopteris fragilis, Epilobium latifolium, Saxifraga hirculus, Saxifraga tricuspidata, Silene acaulis, and Taraxacum phymatocarpum.

Field Classification and Mapping.

The ease with which sites could be characterized in the field was variable. Certain types of communities defined by physiognomic and floristic criteria , such as the heath and the three graminoid communities, were readily recognizable; but a large number of sites which were categorized as physiognomically either barrens or tundra were extremely variable in terms of most abundant species and total plant cover. While certain of these were easily recognized as particular vegetation types such as "Saxifrage Barrens" or "Luzula nivalis Tundra", floristic intergradation between these sites and others made it impossible to subdivide the barrens and tundra communities on the basis of floristics alone.

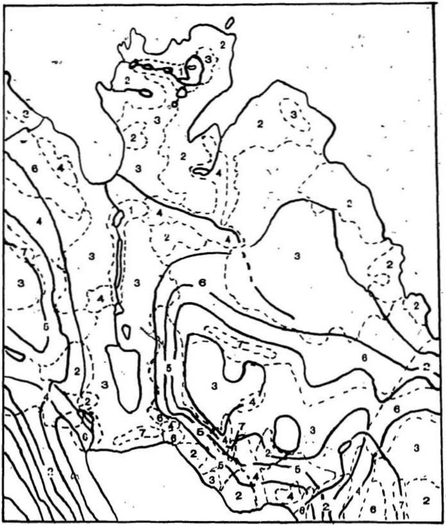
Some of the barrens sites contained species which were indicative of communities described from other parts of the arctic. Some of the littoral areas contained salt marsh species such as Puccinellia phryganodes, Cochlearia groenlandica and Carex maritima, but these occurred only as minor elements in sites in which other plants were more abundant and in no place at Cape Herschel did all three halophytes occur together. Similarly, some sites surrounding snowbeds on the plateau contained Phippsia algida but these sites were generally more diverse than the Phippsia snowbed community described by Edlund (1983b).

The marsh and lichen outcrop sites, while being very recognizable physiognomically, tended to vary floristically from site to site. This was especially so with the lichen sites, which, although they had the common feature of a high percentage of lichen cover on the outcrops, tended to support in the hollows between the outcrops, species from all the other community types found at Cape Herschel.

Six vegetation complexes were mapped at Cape Herschel (Fig. 7) on the basis of physiognomy and total plant cover. These include: an outcrop lichen community, meadows, marsh, heath, tundra, and barrens. Large snowbeds which persisted into July were mapped as well. Criteria used to identify the vegetation complexes are listed in Table 3. For mapping purposes, the four graminoid dominated communities, including cottongrass meadow, sedge meadow, eutrophic meadow and steppe, were mapped as a single meadow element.

The lichen community was restricted to the large areas of granite outcrop on the north side of the map area and to the cliffs and talus slopes overlooking Herschel Bay and Elison Pass. Heath vegetation was restricted to south facing hillsides and ledges, while tundra occurred mostly on north facing hillsides with seepages. Barrens were found on the lowlands of Elison Pass and on the raised beach ridges to the north of the central plateau and on the tops of all parts of the plateau. Within the map area sedge meadows were restricted to the lowlands north of the central plateau, particularly in the vicinity of Erik Harbour. Cottongrass meadow was more widespread, being found on wet slopes at altitudes from sea level to 200 m. Steppe was found on upper slopes and eutrophic meadow was restricted to a small area overlooking Herschel Bay. Marsh communities were restricted to the borders of watercourses in the lowlands.

Figure 7: The distribution of vegetation at Cape Herschel. 1 Marsh, 2 Lichen Outcrop, 3 Barrens, 4 Meadow, 5 Heath, 6 Tundra, 7 Snowbed. Contour interval: 50 m.



Cluster Analysis

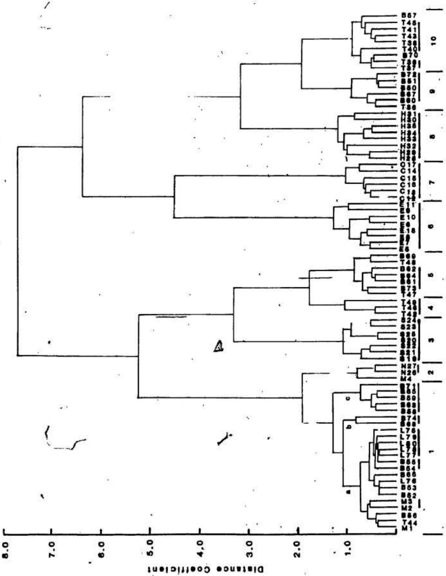
In the first cluster analysis of all 80 sites, ten groups were identified with a distance coefficient of 1.3 (Fig. 8). Clusters 3, 4, 6, 7 and 8 (representing respectively steppe, Luzula nivalis tundra, cottongrass meadow, sedge meadow and heath) showed complete identity between the field classification and the groupings produced by cluster analysis. One site (E-18), classified as cottongrass meadow in the field, had been reclassified as steppe on the basis of the tabular comparison. The cluster analysis returned it to the cottongrass group of sites.

Clusters 1, 2, 5, 9 and 10 comprised mixtures of sites classified in the field as barrens, tundra, marsh or lichen outcrop. Cluster 1 included three subgroups separated at a distance coefficient of 1.0. The first subgroup combined barrens, marsh and lichen outcrop sites. The second and third subgroups were distinct clusters of barrens sites. For the second cluster analysis the tundra and barrens sites were removed from cluster 1A.

Cluster 2 grouped one of the marsh sites with the two eutrophic meadow sites. The marsh site was removed from the second cluster analysis. Clusters 5 and 9 were predominantly filled by barrens sites. The tundra sites were removed for the subsequent CLUSTAN run. Cluster 10 contained mostly tundra sites. The barrens sites were removed for the second analysis.

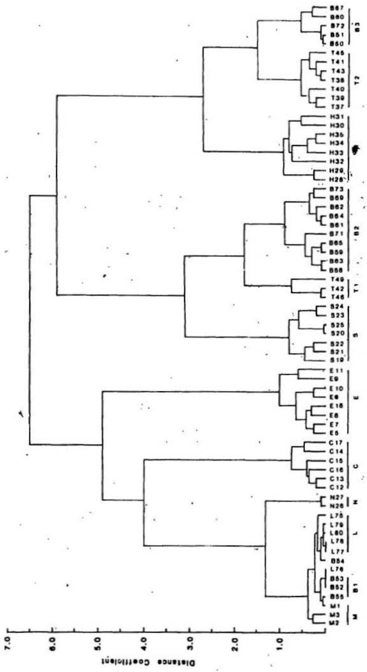
The second cluster analysis (Fig. 9) showed the noise of the first analysis effectively eliminated by the removal of the non-conforming sites. Twelve communities were distinguished in ten clusters at a distance coefficient of 1.0. Cluster 1 still showed some confusion of marsh, lichen outcrop and barrens, but all other clusters corresponded directly with the field classification. Despite the

Figure 8: Dendrogram of cluster analysis run on 80 sites


Distance Coefficient
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0

mixing in Cluster 1, the marsh and lichen outcrop classifications were retained for the vegetational analysis, on the basis of their physiognomic distinctness. The remaining barrens sites were treated as a single group in order to assess whether or not they did form a distinct or cohesive community.

Figure 9: Dendrogram of cluster analysis run on 69 sites


B67
B60
B72
B51
B50
B3
T45
T41
T43
T38
T40
T39
T37
T2
H31
H30
H35
H34
H33
H32
H29
H28
B73
B69
B62
B64
B61
B71
B65
B59
B63
B58
B2
T49
T42
T46
T1
S24
S23
S25
S20
S22
S21
S19
S
E11
E9
E10
E6
E18
E8
E7
E5
E
C17
C14
C15
C16
C13
C12
C
N27
N26
N
L75
L79
L80
L78
L77
B54
L76
L
B53
B52
B55
M1
M3
M2
B1
M
7.0
6.0
5.0
4.0
3.0
2.0
1.0
Distance Coefficient

The Vegetation

Table 4 shows the distribution of indicator species among the twelve communities identified in the second cluster analysis (Fig. 9). Indicator species are those with constancy-abundance products of 100 or greater. Constancy-abundance products were very low in the first three clusters (1A, 1B, 1C) reflecting the lack of constancy and generally low abundances of vascular species in the marsh, lichen outcrop and moss barrens communities. The other clusters show distinct assemblages of indicator species.

Barrens

Barrens occupy approximately 35 % (252 ha) of the map area at Cape Herschel. They occur on raised beach cobble, talus, and finer substrates usually in xeric situations where snowcover is low. Three barrens communities were present at Cape Herschel; one dominated by cushion plants, one dominated by dwarf shrubs, and one in which mosses were more common than vascular plants.

Cushion Plant Barrens.

Cushion plant barrens (cluster B2 on Fig. 9) occupied the largest area at Cape Herschel, being found on much of the plateau, and at the crests of raised beach ridges and moraines on the lowlands and through Elison Pass. These (Table 5) were dominated by Saxifraga oppositifiolia and Cerastium alpinum with Papaver radicatum and Poa abbreviata also being relatively common. Cover values for this community varied from <5 to 40 % (mean = 15.0 %). Fifty-two plant species were encountered on the cushion plant barrens; the mean species richness was 12.2 species.

Table 4 : Constancy-Abundance Products of indicator species in twelve clusters.

Species / Community *	Cluster 1A M	1B L	1C B1	2 N	3 S	4 T1	5 B2	6 E	7 C	8 H	9 B3	10 T2
Salix arctica	100	-	75	-	114	133	40	163	233	275	340	414
Luzula nivalis	100	17	-	50	100	367	50	175	67	50	-	71
Poa abbreviata	-	33	-	50	57	-	110	13	-	-	20	-
Draba sp.	-	33	25	100	43	67	60	63	33	50	20	71
Cerastium alpinum	-	-	25	50	57	167	160	-	33	50	40	-
Saxifraga oppositifolia[b]	-	17	25	50	257	167	290	75	33	150	240	143
Alopecurus alpinus	67	-	-	400	-	-	-	13	-	-	-	-
Poa glauca	-	-	-	400	-	-	-	-	-	-	-	-
Papaver radicatum	-	-	-	100	86	133	90	13	-	38	-	71
Stellaria longipes	67	-	-	100	43	67	30	38	50	25	20	86
Saxifraga cernua	67	17	-	100	29	-	20	50	-	-	-	-
Luzula confusa	-	17	-	50	386	33	30	-	-	125	20	57
Potentilla hyparctica	-	17	-	100	157	33	10	-	-	50	-	71
Saxifraga caespitosa	-	17	-	-	43	200	60	13	17	25	-	29
Phippsia algida	-	-	-	-	-	133	-	-	-	-	-	-
Oxyria digyna	-	-	-	-	57	133	20	25	17	38	-	29
Eriophorum sp.	67	-	-	-	-	-	-	438	33	-	-	-
Carex stans	-	-	-	-	-	-	-	63	417	-	-	-
Arctagrostis latifolia	33	-	-	-	-	-	-	-	133	-	-	-
Cassiope tetragona	-	-	-	-	57	-	-	13	17	325	20	-
Dryas integrifolia	-	17	-	-	-	-	-	75	50	200	300	-
Carex misandra	-	-	-	-	14	-	-	85	17	138	20	29

* M - Marsh, L - Lichen Outcrop, B1 - 'Moss' Barrens, N - Eutrophic Meadow, S - Steppe, T1 - Graminoid - Cushion Plant Tundra, B2 - Cushion Plant Barrens, C - Sedge Meadow, H - Heath, E - Cotton-grass Meadow, B3 - Dwarf Shrub Barrens, T2 - Dwarf Shrub Tundra.

Lichens were more common than mosses in the cushion plant barrens, but neither group had any species which were particularly constant in this community type. Twelve bryophyte and 18 lichen species were found in these sites. Drepanocladus uncinatus, Orthothecium chryseum and Racomitrium lanuginosum were the most common mosses. Alectoria species, Cetraria nivalis and Dactylina ramulosa were the most common lichens.

Two subgroups were apparent from the second cluster analysis (Fig. 9, Table 5). The principal floristic difference between the two subgroups is the relative abundance of Saxifraga oppositifolia.

Table 5 : Cover and constancy-abundance products of species found on cushion plant barrens. (Subgroups a and b separated on the relative dominance of Saxifraga oppositifolia.)

	Sites										
Species	58 (a)	59	63	65	71	61 (b)	62	64	69	73	P_{ca}
Saxifraga oppositifolia	2	2	1	1	2	4	4	5	3	5	290
Cerastium alpinum	1	2	1	1	4	2	2	1	1	1	160
Poa abbreviata	2	2	1	1	0	2	1	1	0	1	110
Papaver radicatum	1	0	1	0	1	1	1	2	1	1	90
Arenaria rubella	0	1	0	1	1	1	0	1	0	1	60
Saxifraga caespitosa	0	1	1	1	0	1	1	0	1	0	60
Draba sp.	0	0	0	0	1	1	0	1	2	1	60
Luzula nivalis	1	0	0	0	0	1	1	0	1	1	50
Salix arctica	0	0	0	1	0	1	0	1	0	1	40
Colpodium vahlianum	0	0	0	0	1	0	0	0	1	2	40
Stellaria longipes	1	0	0	0	0	0	0	0	1	1	30
Luzula confusa	1	0	1	0	0	0	1	0	0	0	30
Saxifraga tricuspidata	0	1	0	1	0	0	1	0	0	0	30
Oxyria digyna	0	0	0	1	0	0	0	0	1	0	20
Saxifraga cernua	0	0	0	0	0	1	0	0	1	0	20
Melandrium apetalum	0	0	0	0	0	0	0	0	1	1	20
Poa arctica	0	0	0	0	0	0	1	0	0	0	20
Potentilla hyparctica	0	0	0	0	0	0	1	0	0	0	10
Carex maritima	0	0	0	0	0	0	0	0	0	1	10
Cochlearia officinalis	0	0	0	0	0	0	0	0	0	1	10
Saxifraga tenuis	0	0	1	0	0	0	0	0	0	0	10
Phippsia algida	0	0	0	0	1	0	0	0	0	0	10
Species Richness:											
Vascular	7	6	7	8	7	10	10	7	11	13	22
Bryophyte	3	1	2	2	1	5	0	0	0	0	12
Lichen	0	1	5	14	0	0	1	1	0	0	18

Dwarf shrub Barrens.

Dwarf shrub barrens (cluster 9 in Fig. 8, B3 in Fig. 9) occurred in lowland situations, mostly surrounding Elison Pass. They were dominated by Salix arctica and Dryas integrifolia (Table 6). Saxifraga oppositifolia was also important in this community but was never more abundant than the two dwarf shrub species. Total plant cover varied from 5 to 20 % (mean = 14.0 %). Mean species richness was 10.2 species per site. Thirty-two species were collected from dwarf shrub barrens sites.

Drepanocladus uncinatus and Tortula ruralis were the most common of the 14 bryophyte species found on these barrens. Thamnolia subuliformis was the most common of three lichen species.

Table 6: Cover and constancy-abundance products of species found on dwarf shrub barrens.

SPECIES	Site 50	51	60	67	72	P_{ca}
Salix arctica	2	3	4	5	3	340
Dryas integrifolia	2	3	4	5	1	300
Saxifraga oppositifolia	2	3	1	3	3	240
Pedicularis hirsuta	1	1	1	0	1	80
Cerastium alpinum	0	1	1	0	0	40
Luzula confusa	0	0	1	0	0	20
Poa abbreviata	0	0	1	0	0	20
Cassiope tetragona	0	0	0	1	0	20
Oxyria digyna	0	0	1	0	0	20
Draba sp.	0	0	1	0	0	20
Juncus biglumis	0	0	0	1	0	20
Colpodium vahlianum	0	0	0	0	1	20
Carex nardina	0	0	1	0	0	20
Stellaria longipes	0	0	1	0	0	20
Carex misandra	0	0	1	0	0	20
Species Richness:						
Vascular	4	5	12	5	5	15
Bryophyte	2	3	2	8	1	14
Lichen	0	0	1	1	2	3

Moss Barrens.

These barrens (cluster B1 on Fig. 9) were found both on the plateau and near sea level by both Rosse Bay and Herschel Bay. Table 7 shows there was no vascular species indicative of this community. Cover values were generally low, varying from 5 to 20 % (mean = 10.0 %). With 40 plant species on these sites, the mean species richness was 11.25.

The bryophyte flora of these sites comprised a series of highly distinct assemblages with only 5 of 29 taxa occurring more than once. These were *Bryum algovicum*, *Distichium* sp., *Drepanocladus uncinatus*, *Encalypta rhaptocarpa* and *Myurella tenerrima*. Only two species of lichens were found on these sites.

Table 7: Cover and constancy-abundance products for species found on Moss Barrens.

Species	Site 52	53	54	55	P_{ca}
Salix arctica	1	1	0	1	75
Dryas integrifolia	1	1	0	0	50
Saxifraga oppositifolia	1	1	0	0	50
Draba sp.	0	0	1	0	25
Pedicularis hirsuta	1	0	0	0	25
Melandrium apetalum	0	0	1	0	25
Eutrema edwardsii	0	0	1	0	25
Saxifraga flagellaris	0	0	1	0	25
Cerastium alpinum	0	0	0	1	25
Species Richness:					
Vascular	4	2	4	2	9
Bryophyte	2	10	6	13	29
Lichen	1	0	1	0	2

Lichen Outcrop.

Lichen outcrop communities (cluster L on Fig. 9) extended over all areas occupied by bedrock outcrops, cliffs and stable talus (approx. 180 ha or 25% of the map area). Total plant cover varied from < 1 to 10 % (mean = 5.3%). Mean species richness per site was 15.6; a total of 44 species were recorded from these sites.

Vascular plants and bryophytes found in the lichen-dominated areas (Table 8) varied from site to site, depending on the microtopographic characteristics of the particular hollow they occupied. While they might dominate or completely cover the hollows in which they occur, their contribution to the overall cover was very low.

The actual density of lichens was variable. It was greatest in areas of moderate snowcover. It was least in areas of late-lasting snow and short growing seasons. It was also low in areas of neglible snowcover and with much exposure to winter winds. The density of lichen growth was also influenced by drainage, being greatest on horizontal to gently sloping surfaces and least on steeper to vertical surfaces.

Eighteen species of lichen were recorded on the outcrop sites. The principal species of lichen found on the rock itself were Umbilicaria arctica, U. hyperborea, U. torrefacta, and Pseudephebe minuscula, while in some areas crustose genera such as Rhizocarpon and Xanthoria were more prevalent. Umbilicaria spp. and Pseudephebe minuscula were the most common species on rock surfaces, especially where protected from the wind. Five lichen species, Candelariella terrigena, Lecanora behringii, Umbilicaria hyperborea, U. torrefacta, and

Table 8: Cover and constancy-abundance products for species found on lichen outcrops.

Species	75	76	77	78	79	80	P_{ca}
Poa abbreviata	0	0	0	1	1	0	33
Draba sp.	0	0	0	0	1	1	33
Cardamine bellidiflora	1	0	0	0	0	0	17
Papaver radicatum	1	0	0	0	0	0	17
Potentilla hyparctica	1	0	0	0	0	0	17
Luzula nivalis	1	0	0	0	0	0	17
Saxifraga oppositifolia	0	1	0	0	0	0	17
Dryas integrifolia	0	1	0	0	0	0	17
Poa arctica	0	0	1	0	0	0	17
Saxifraga cernua	0	0	0	0	1	0	17
Saxifraga caespitosa	0	0	0	0	1	0	17
Luzula confusa	0	0	0	0	0	1	17
Species richness:							
Vascular	4	2	1	1	4	2	12
Bryophyte	12	2	6	4	14	4	14
Lichen	7	5	10	6	6	4	18

Xanthoria candelaria, were found only in these sites.

The soil-filled crevices of the outcrops and cliffs supported a different lichen flora which included various *Alectoria* spp., *Cetraria nivalis*, *Stereocaulon* spp., *Thamnolia subuliformis* and often *Physconia muscigena.* Eleven bryophytes including *Drepanocladus uncinatus*, *Orthothecium chryseum* and *Racomitrium lanuginosum* grew in cracks and hollows with a wide range of substrate and drainage characteristics.

Tundra.

Tundra occupies the third largest area at Cape Herschel (181 ha or 18 % of the map area). Field observations showed two principal tundra types; a Graminoid - Cushion Plant Tundra and a Dwarf Shrub Tundra. Tundra communities occurred on moderately moist sites with relatively fine-grained substrates.

Graminoid - Cushion Plant Tundra.

This community (cluster 4 on Fig. 8, cluster T1 on Fig. 9) was found on north-facing slopes at altitudes between 50 and 150 metres, below late-lying snowbeds on talus intermixed with finer gravels and sands. Total plant cover ranged from 40 to 50 % (mean = 43.3 %). Twenty-nine plant species were found on these tundra sites. The mean species richness was 18.3 species.

Luzula nivalis was the dominant species (Table 9), but the abundance of Saxifraga caespitosa and Phippsia algida was also important in diagnosing this community (Table 4).

The graminoid - cushion plant tundra sites had relatively few species of cryptogams. Nine bryophyte taxa and four lichen species were recorded. Orthothecium chryseum and Drepanocladus uncinatus were the most common mosses. Dactylina ramulosa, Umbilicaria cylindrica and Thamnolia subuliformis were the most common lichens.

Table 9: Cover and constancy-abundance products for species found on Graminoid - Cushion Plant Tundra.

Species	Site 42	46	49	P_{ca}
Luzula nivalis	4	3	4	367
Saxifraga caespitosa	2	2	2	200
Saxifraga oppositifolia	2	1	2	167
Cerastium alpinum	2	1	2	167
Papaver radicatum	1	1	2	133
Phippsia algida	2	1	1	133
Salix arctica	2	2	0	133
Oxyria digyna	0	0	4	133
Draba sp.	1	1	0	67
Pedicularis hirsuta	1	1	0	67
Stellaria longipes	1	1	0	67
Saxifraga tenuis	0	0	2	67
Potentilla hyparctica	0	1	0	33
Festuca brachyphylla	0	0	1	33
Luzula confusa	0	1	0	33
Saxifraga foliolosa	1	0	0	33
Species Richness:				
Vascular	11	12	9	16
Bryophyte	2	4	7	9
Lichen	3	4	3	4

Dwarf shrub Tundra

Dwarf Shrub Tundra (cluster 10 on Fig. 8, cluster T2 on Fig. 9) occurred on and around seepages and streams at lower elevations (up to 100m), most often on south-facing slopes with sandy to cobble subtrates. Cover values varied from 40 to 100 percent (Mean = 62.9%). Mean species richness of the dwarf shrub tundra sites was 14.9 species; 47 species were found on these sites.

Table 10 shows it is dominated by Salix arctica with Saxifraga oppositifolia as an associate of lesser abundance.

The number of cryptogams found in this community type was relatively large, but few species occurred in more than one site. Of 22 taxa of bryophytes recorded from the dwarf shrub tundra sites, ten occurred more than once. These included Bryum algovicum, Campylium stellatum, Cirriphyllum cirrosum, Distichium spp., Ditrichum flexicaule, Drepanocladus revolvens, Hygrohypnum luridum, Orthothecium chryseum and Pogonatum alpinum. Only three species of lichen were recorded.

Table 10: Cover and constancy-abundance products for species found on dwarf shrub tundra.

	Site							
Species	37	38	39	40	41	43	45	P_{ca}
Salix arctica	5	3	4	5	5	3	4	414
Saxifraga oppositifolia	1	2	0	1	2	2	2	143
Stellaria longipes	1	0	0	1	0	1	3	86
Luzula nivalis	0	1	0	1	1	1	1	71
Draba sp.	1	0	1	3	0	0	0	71
Pedicularis hirsuta	1	1	1	0	1	1	0	71
Papaver radicatum	0	0	1	2	1	0	1	71
Potentilla hyparctica	1	0	1	2	0	0	1	71
Luzula confusa	0	0	1	1	1	0	1	57
Polygonum viviparum	1	1	0	1	0	0	0	43
Oxyria digyna	1	0	1	0	0	0	0	29
Carex misandra	1	1	0	0	0	0	0	29
Poa arctica	0	0	0	1	1	0	0	29
Saxifraga caespitosa	0	0	0	0	1	1	0	29
Ranunculus sulphureus	0	0	0	1	0	0	1	29
Festuca brachyphylla	1	0	0	0	0	1	1	29
Melandrium apetalum	0	0	0	0	0	1	0	14
Alopecurus alpinus	0	1	0	0	0	0	0	14
Saxifraga tenuis	0	0	0	0	0	0	1	14
Taraxacum phymatocarpum	1	0	0	0	0	0	0	14
Epilobium latifolium	1	0	0	0	0	0	0	14
Species richness:								
Vascular	13	7	7	11	8	8	7	22
Bryophyte	6	2	1	7	3	3	13	22
Lichen	0	0	0	2	3	0	0	3

Graminoid Communities.

Graminoid-dominated vegetation occupied approximately 9.6% (69 ha) of the map area at Cape Herschel. Meadows, dominated by grasses, or sedges occurred mostly in wet lowland situations or on lower slopes. Steppe, dominated by the woodrush Luzula confusa were found in more xeric situations at the crests of the plateaus. The four types of graminoid community were readily recognizable in the field on the basis of dominant species.

Cottongrass Meadow.

Cottongrass meadows (cluster 6 on Fig. 8, cluster E on Fig. 9) were the most common graminoid community found at Cape Herschel. They were most often found on fine substrates on lower slopes with moderate to heavy snowcover. The cottongrass meadows sampled were all irrigated by surface runoff. Cover values varied from 50 to 100% (mean = 78.6%).

Table 11 shows cottongrass dominant. This was generally Eriophorum triste, but Eriophorum scheuchzeri replaced it on one site (Site 5). Otherwise, Eriophorum scheuchzeri was principally found as an associate species in sedge meadows and marshes. The mean species richness in these sites was 13.1 species. Forty-eight species were found in cottongrass meadows.

Bryophytes were quite variable from site to site. Catoscopium nigritum and Orthothecium chryseum were the only species which were encountered in more than one site. Sixteen moss taxa and five lichen taxa were recorded from the cottongrass meadow sites.

Table 11: Cover and constancy-abundance products for species found on cottongrass meadows.

	Site								
Species	5	6	7	8	9	10	11	18	P_{ca}
Eriophorum sp.	4	5	4	4	5	5	5	3	438
Luzula nivalis	1	2	2	3	4	0	1	1	175
Salix arctica	3	1	4	2	1	0	1	1	163
Carex misandra	2	1	0	0	3	0	1	0	88
Pedicularis hirsuta	1	1	0	1	2	1	1	0	88
Dryas integrifolia	0	0	0	0	1	0	5	0	75
Saxifraga oppositifolia	0	1	1	0	1	1	1	1	75
Draba sp.	1	0	0	1	1	0	1	1	63
Carex stans	1	3	0	0	0	1	0	0	63
Saxifraga cernua	1	0	0	1	1	0	0	1	50
Ranunculus sulphureus	1	0	0	0	0	2	0	0	38
Melandrium apetalum	1	0	0	0	1	0	0	1	38
Saxifraga tenuis	0	0	0	1	1	0	0	1	38
Stellaria longipes	1	0	0	1	0	0	0	1	38
Polygonum viviparum	0	0	0	0	1	0	0	1	25
Papaver radicatum	0	0	0	1	0	0	0	1	25
Oxyria digyna	0	0	0	0	1	0	0	1	25
Cerastium alpinum	0	0	0	1	0	0	0	1	25
Equisetum arvense	0	0	0	0	1	0	1	0	25
Juncus biglumis	0	0	0	0	1	0	0	1	25
Colpodium vahlianum	0	0	0	1	0	0	0	0	13
Eutrema edwardsii	0	0	0	0	1	0	0	0	13
Poa arctica	0	0	0	1	0	0	0	0	13
Poa abbreviata	0	0	0	0	0	0	0	1	13
Saxifraga caespitosa	0	0	0	1	0	0	0	0	13
Cassiope tetragona	0	0	0	0	1	0	0	0	13
Alopecurus alpinus	0	0	0	0	0	0	0	1	13
Species Richness									
Vascular	11	7	4	12	16	6	9	16	27
Bryophyte	1	2	4	2	8	0	0	2	16
Lichen	0	1	1	0	1	0	0	2	5

Sedge Meadow.

Sedge meadows (cluster 7 on Fig. 8, cluster C on Fig. 9) were much less common at Cape Herschel than were cottongrass meadows. Only four of the six sites sampled were located in the map area. Like the cottongrass meadow, sedge meadows occurred on saturated fine substrates with moderate snow cover. In the map area they were confined to relatively low and usually very gently sloping terrain in the northern half of the area. None of the sedge meadows sampled was subject to surface runoff. They were either built up on moss hummocks in standing water, or developed on wet ground adjacent to well channelled streams. Plant cover varied from 60 to 100 % (mean = 86.7 %).

Table 12 shows the vascular species found on the sedge meadows. Carex stans and Arctagrostis latifolia are the indicator species for this community. With 70 species encountered, sedge meadows were the most diverse community found at Cape Herschel. The mean species richness was 17.0 species.

The wetter sedge meadow sites were dominated by stoloniferous graminoid species including Carex stans and Arctagrostis latifolia. They were found mostly on snow-sheltered lower slopes on the northwest portion of the peninsula, and on both north and south sides of the mainland, on poorly drained soils.

Forty-two moss taxa were found in the sedge meadow sites. Bryum algovicum, Catoscopium nigritum, Cinclidium arcticum, Drepanocladus revolvens, Gymnostomum recurvirostrum, Myurella julacea, Orthothecium chryseum and Tortula mucronifolia occurred on a third to half of these sites. The only lichen recorded on these sites was Physconia muscigena.

Small hummocks (approximately 10 cm high, and separated by broad wet

Table 12: Cover and constancy-abundance products for species found on sedge meadows.

Species	Site 12	13	14	15	16	17	P_{ca}
Carex stans	4	4	5	3	4	5	417
Salix arctica	1	1	5	3	2	2	233
Arctagrostis latifolia	3	1	0	3	1	0	133
Equisetum variegatum	0	1	1	1	1	0	67
Luzula nivalis	0	0	0	0	1	3	67
Pedicularis hirsuta	0	0	1	1	0	1	50
Polygonum viviparum	1	1	0	0	1	0	50
Dryas integrifolia	0	1	0	0	2	0	50
Stellaria longipes	0	0	0	0	0	2	33
Eriophorum sp.	0	0	0	1	1	0	33
Cerastium alpinum	0	1	0	0	1	0	33
Saxifraga oppositifolia	0	0	0	1	1	0	33
Draba sp.	0	1	0	0	0	1	33
Ranunculus sulphureus	0	1	0	1	0	0	33
Melandrium apetalum	0	1	0	1	0	0	33
Equisetum arvense	0	1	1	0	0	0	33
Saxifraga hirculus	0	0	0	0	1	0	17
Saxifraga caespitosa	0	1	0	0	0	0	17
Cassiope tetragona	0	0	0	0	1	0	17
Oxyria digyna	0	0	0	0	0	1	17
Silene acaulis	0	0	0	0	1	0	17
Arenaria rubella	0	0	0	0	1	0	17
Cardamine pratensis	0	1	0	0	0	0	17
Eutrema edwardsii	0	0	0	1	0	0	17
Saxifraga cernua	0	0	0	0	1	0	17
Carex misandra	0	1	0	0	0	0	17
Cerastium arcticum	0	0	0	0	0	1	17
Species Richness							
Vascular	4	13	5	10	14	7	27
Bryophyte	6	10	3	1	24	4	42
Lichen	0	0	0	0	1	0	1

hollows) developed on three of the sites. These hummocks were the result of accumulations of moss and turf rather than being ice-cored as were the hummocks found in the hummocky graminoid meadow. On the sides and tops of the hummocks grew Bryum algovicum, Catoscopium nigritum, Distichium capillaceum, Gymnostomum recurvirostrum, Myurella tenerrima, and Scorpidium turgescens. Calliergon spp., Campylium arcticum, C. stellatum, Cinclidium stygium, C. subrotundum, Cratoneuron arcticum, sterile Distichium sp., Ditrichum flexicaule, Drepanocladus badius, Myurella julacea, and Tortella arctica, were found in the wet troughs separating the hummocks.

Steppe.

Steppe communities (cluster 3 on Fig. 8, cluster S on Fig. 9) were found on the plateau crest slopes at altitudes between 100 and 200 metres. The slopes generally faced east or west and were characterized by good drainage, relatively little snow accumulation in winter, and a high frequency of orographic fog in the summer. Luzula confusa was commonly accompanied by Saxifraga oppositifolia, Potentilla hyparctica, Salix, and Luzula nivalis (Table 13). Total plant cover varied from 20 to 80 % (mean = 52.9 %). Average species richness on the steppe sites was 12.7 species; 31 species were recorded for this community. At Cape Herschel this community tended to intergrade with the heath and lichen outcrop communities.

The majority of the plants found in the steppe sites were xerophytes, but mesophilic and hydrophilic species such as Cassiope tetragona and Oxyria digyna occurred in small pockets which collected snow.

Five moss and five lichen species were recorded in the steppe sites. These included Drepanocladus uncinatus, Pogonatum alpinum and species of Alectoria and allied genera.

Table 13: Cover and constancy-abundance products for species found on steppe.

Species	Site 19	20	21	22	23	24	25	P_{ca}
Luzula confusa	4	5	4	4	3	3	4	386
Saxifraga oppositifolia	3	4	2	3	1	1	4	257
Potentilla hyparctica	3	0	2	4	0	1	1	157
Salix arctica	4	0	1	1	1	1	0	114
Luzula nivalis	1	1	1	0	1	1	2	100
Poa arctica	1	1	2	0	0	1	1	86
Papaver radicatum	1	1	1	1	0	1	1	86
Oxyria digyna	1	0	1	1	1	0	1	71
Cassiope tetragona	1	0	1	1	1	0	0	57
Cerastium alpinum	1	1	1	0	0	0	1	57
Poa abbreviata	0	0	2	1	0	1	0	57
Saxifraga caespitosa	1	0	1	1	0	0	0	43
Draba sp.	1	0	0	0	1	1	0	43
Stellaria longipes	1	1	0	0	0	1	0	43
Saxifraga cernua	1	0	0	0	1	0	0	29
Saxifraga tenuis	0	0	1	1	0	0	0	29
Silene acaulis	0	0	1	0	1	0	0	29
Juncus biglumis	0	0	0	0	0	1	0	14
Melandrium apetalum	1	0	0	0	0	0	0	14
Saxifraga flagellaris	0	0	0	0	1	0	0	14
Carex misandra	0	0	0	0	1	0	0	14
Species richness:								
Vascular	15	7	14	10	11	11	7	21
Bryophyte	2	2	0	3	0	0	0	5
Lichen	1	5	0	1	0	0	0	5

Eutrophic Meadow.

This type of meadow (cluster 2 in Fig. 8, cluster N in Fig. 9) was restricted at Cape Herschel to a few small areas (about 2 ha. total) along the south facing base of a bird cliff. It was the only habitat in which frost hummocks were found. Poa glauca, and the nitrophilous grass Alopecurus alpinus were dominant (Table 14), especially on the sides of the hummocks, while Potentilla hyparctica, and Luzula confusa were common on the tops of the hummocks. The dominance of Alopecurus was greater towards the base of the cliff, and other nitrophilous species, Poa abbreviata and Bryum argenteum were found there as well. Cover on both sites was 100 %. With an average of 25 species per site, the eutrophic meadow had the highest mean species richness of any community at Cape Herschel. A total of 37 species were found in the two sites.

Moss species restricted to the tops and drier sides of the hummocks included Distichium capillaceum, Gymnostomum recurvirostrum, Schistidium tenerum, and Tortula ruralis. The lower sides and the troughs between the hummocks were occupied by Aulacomnium palustre, Brachythecium turgidum, and Drepanocladus revolvens.

Table 14: Cover and constancy-abundance products for species found on eutrophic meadow.

Species	Site 26	Site 27	P_{ca}
Alopecurus alpinus	4	4	400
Poa glauca	4	4	400
Papaver radicatum	1	1	100
Potentilla hyparctica	1	1	100
Stellaria longipes	1	1	100
Saxifraga cernua	1	1	100
Draba sp.	1	1	100
Luzula nivalis	1	0	50
Saxifraga oppositifolia	1	0	50
Poa abbreviata	1	0	50
Luzula confusa	0	1	50
Poa arctica	0	1	50
Cerastium alpinum	0	1	50
Ranunculus sulphureus	0	1	50
Species Richness:			
Vascular	10	11	14
Bryophyte	13	15	22
Lichen	1	0	1

Heath.

Heath communities (cluster 8 on Fig. 8, cluster H on Fig. 9) occupy 66 hectares or 9.2 % of the map area at Cape Herschel. Total plant cover ranged from 20 to 80 % (mean = 43.8 %). Heath sites generally occurred on ledges of south facing cliffs, where winter accumulations of snow were moderate, at altitudes from sea level to 200 m.

Table 15 shows the vascular species found in heath sites. Cassiope, Salix and Dryas dominated this community. Carex misandra and Luzula confusa were common associate species. Heath sites had an average species richness of 17.0 and the heath community as a whole included 59 species, second only to the sedge meadows.

The bryophyte flora included 22 species. Drepanocladus uncinatus, Pogonatum alpinum and Racomitrium lanuginosum were the most common mosses in the heath sites. Thamnolia subuliformis and Cetraria nivalis were the commonest of 10 lichen species found in these sites.

Table 15: Cover and constancy-abundance products for species found on heath.

Species	Sites 28	29	30	31	32	33	34	35	P_{ca}
Cassiope tetragona	3	3	4	4	4	3	3	2	325
Salix arctica	4	2	4	5	1	2	3	1	275
Dryas integrifolia	0	0	2	4	2	2	3	3	200
Saxifraga oppositifolia	1	1	2	1	3	2	1	1	150
Carex misandra	0	0	4	2	3	1	1	0	138
Luzula confusa	3	1	1	1	3	1	0	0	125
Poa arctica	1	1	0	1	2	0	0	0	63
Luzula nivalis	0	0	2	0	0	1	0	1	50
Draba sp.	0	0	1	0	1	1	0	1	50
Polygonum viviparum	0	0	2	0	0	0	1	1	50
Potentilla hyparctica	1	1	1	1	0	0	0	0	50
Cerastium alpinum	1	1	1	0	0	1	0	0	50
Papaver radicatum	1	0	1	1	0	0	0	0	38
Pedicularis hirsuta	1	0	0	1	0	0	1	0	38
Oxyria digyna	0	0	1	0	0	1	1	0	38
Eriophorum sp.	0	1	0	0	1	0	0	1	38
Saxifraga tricuspidata	1	0	0	1	0	1	0	0	38
Carex nardina	0	0	0	1	0	2	0	0	38
Stellaria longipes	0	0	0	1	1	0	0	0	25
Saxifraga flagellaris	0	0	1	0	0	1	0	0	25
Cardamine bellidiflora	0	1	0	1	0	0	0	0	25
Saxifraga caespitosa	0	0	0	1	0	1	0	0	25
Taraxacum phymatocarpum	0	0	0	1	0	0	0	0	13
Cystopteris fragilis	0	0	0	1	0	0	0	0	13
Festuca brachyphylla	0	0	0	0	0	1	0	0	13
Juncus biglumis	0	0	0	0	0	1	0	0	13
Arenaria rubella	0	1	0	0	0	0	0	0	13
Species Richness									
Vascular	10	10	14	17	10	16	8	8	27
Bryopyte	3	16	4	0	5	0	1	0	22
Lichen	2	2	4	1	1	0	0	4	10

Marsh.

Marsh communities (cluster M on Fig. 9) occupied approximately 15 hectares or 2 % of the map area. They were restricted to the borders of permanent ponds and streams on the lowlands in Elison Pass and along the shore of Rosse Bay on poorly drained sands and silts. Plant cover of the marsh communities was 100 % of the land surface above the water table in all sites.

The vascular plants present in this community (Table 16) varied radically from site to site. There was no vascular species common to all sites, but Luzula nivalis, Eriophorum scheuchzeri and Alopecurus alpinus were commonly present.

Mosses were dominant in a variety of wet habitats, which ranged from stream banks, to seepage slopes, to wet lowland meadows by ponds. In the wettest situations cover values were as low as 5% on mineral soil, but the majority of sites had total plant cover greater than 50%, and nearly half had 100% plant cover.

Of the 21 species of bryophytes found in the marsh sites, Drepanocladus revolvens, Calliergon spp., Catscopium nigritum, Cinclidium arcticum, Cratoneuron arcticum and Orthothecium chryseum were the most commomn.

The wetness of the sites dominated by mosses is reflected in the hydrophilic nature of the species found in them. Eleven of these, Cinclidium arcticum, Campylium arcticum, Campylium stellatum, Catoscopium nigritum, Cratoneuron arcticum, Ditrichum flexicaule, Drepanocladus badius, Drepanocladus revolvens, Orthothecium chryseum, Scorpidium turgescens, and Tortella fragilis, were also collected in the wet graminoid meadow sites.

Table 16: Cover and constancy-abundance products for species found on marsh.

Species	Site 1	2	3	4	P_{ca}
Salix arctica	1	0	2	0	75
Luzula nivalis	1	1	1	0	75
Stellaria longipes	1	0	1	1	75
Eriophorum sp.	0	1	1	1	75
Alopecurus alpinus	0	1	1	1	75
Saxifraga cernua	0	1	1	1	75
Arctagrostis latifolia	0	1	0	1	50
Pleuropogon sabinei	0	0	1	1	50
Juncus biglumis	0	0	1	1	50
Poa arctica	0	1	0	0	25
Ranunculus sulphureus	0	0	1	0	25
Melandrium apetalum	0	0	1	0	25
Poa alpigena	0	1	0	0	25
Cardamine pratensis	0	1	0	0	25
Ranunculus hyperboreus	0	0	1	0	25
Species Richness:					
Vascular	3	8	10	7	14
Bryophyte	5	10	7	6	21
Lichen	0	0	0	0	0

Minor Plant Communities.

A number of minor community types have been described from Truelove Lowland (Barrett 1972; Muc and Bliss 1977) and from Alexandra Fiord (Muc 1981). A few of these were found at Cape Herschel. The tidal salt marsh community (Muc and Bliss 1977; Jefferies 1977) was very poorly developed at Cape Herschel, comprising the single species Puccinellia phryganodes. Unvegetated shorelines (Muc and Bliss 1977) with the single halophytic species Cochlearia officinalis were also observed on the rockier portions of shore line. One of the Dwarf shrub communities found on a well-drained stream bank at Cape Herschel, had a large amount of Epilobium latifolium, similar to the channel community described by Muc (1980, 1981) from Alexandra Fiord.

Ecological Distribution of Plant Communities.

Topographic Analysis.

Figure 10 shows the distribution of the twelve communities with respect to altitude and aspect. Graminoid communities (Fig. 10(b)) as a whole occupied the widest range of topography. Marshes (Fig. 10(a)) occupied the narrowest range, being restricted to lowlands. Within each of the three large vegetation complexes (meadows, barrens and tundra) there is some division between the communities. The separation is most obvious in the tundra communities (Fig. 10(d)) and is most obscure in the graminoid communities (Fig. 10(b)) where the cottongrass, sedge and eutrophic meadows overlap to some extent in their topographical distributions. South-facing slopes at all altitudes exhibit the greatest overlap between vegetation groups and communities.

Figure 11 shows the distribution of plant communities observed in the field (Fig. 7) along four transects through the map area. Heath was more or less restricted to south facing slopes. Lichen outcrop communities were more prevalent in the northern portion of the map area, mostly at low altitudes, but were found at higher altitudes on south facing slopes. Marsh habitat was restricted to lowlands in the northern portion of the map area.

Figure 10: Distribution of communities with respect to altitude class and aspect.

a) H - Heath, L - Lichen Outcrop, M - Marsh.
b) Meadows: C - Sedge, E - Cottongrass, N - Eutrophic. S - Steppe
c) Barrens: Bcp - Cushion plant, Bcp(a) with low abundance of Saxifrage, Bcp(b) with high of Saxifrage, Bds - Dwarf shrub, Bm - Moss.
d) Tundra: Tgcp - Graminoid - cushion plant, Tds - Dwarf shrub.

Altitude class: 1: 0 - 50 m, 2: 50 - 100 m, 3: 100 - 150 m, 4: 150 - 200 m, 5: >200 m.

Aspect: N - north, E - east, S - south, W - west, O - level, without aspect.

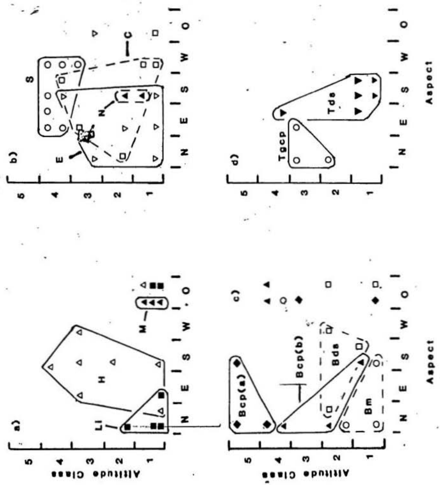
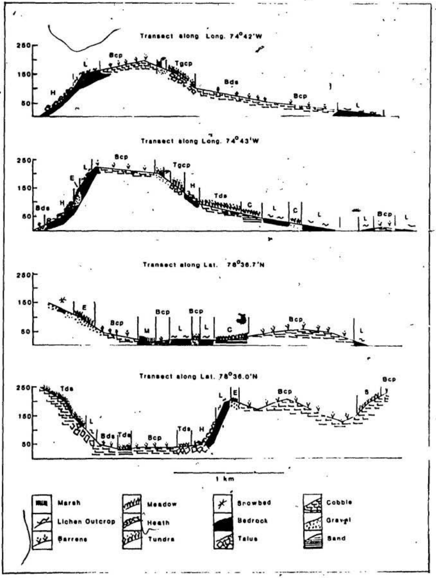

a)
b)
c)
d)
Altitude Class
Aspect
N E S W O
S
C
E
N
H
M
Li
Bcp(a)
Bcp(b)
Bds
Bm
Tgcp
Tds

Figure 11: Distributon of Cape Herschel plant communities along transects through map area.

Bcp - Cushion plant barrens
Bds - Dwarf shrub barrens
C - Sedge meadow
E - Cottongrass meadow
H - Heath
L - Lichen outcrop
M - Marsh
S - Steppe
Tds - Dwarf shrub tundra
Tgcp - Graminoid cushion plant tundra

Altitudes in metres.


Transect along Long. 74°42'W
Transect along Long. 74°43'W
Transect along Lat. 78°36.7'N
Transect along Lat. 78°36.0'N
1 km
Marsh
Lichen Outcrop
Barrens
Meadow
Heath
Tundra
Snowbed
Bedrock
Talus
Cobble
Gravel
Sand

Direct Gradient Analysis

Direct gradient analysis identified three environmental gradients, upon which the sites at Cape Herschel could be usefully compared. Plant community response to moisture, snowcover, and substrate showed the largest amplitudes of variation. Values of the moisture index varied from 100 to 480; snowcover index values varied from 100 to 385; substrate index values ranged from 100 to 500. Appendix D lists the site values for these three indices, by clusters of the second cluster analysis (Fig. 9). The site values of the soil stability index varied from 100 to 200 and were not found to be useful.

Figure 12 shows the distribution of the plant communities with respect to snowcover and moisture. Low values of the moisture index (100) reflect relatively xeric sites; high values (400+) indicate wet sites. Low values of the snowcover index (100) indicate sites with little snow accumulation, while high values (>300) indicate sites with deep, relatively late-lasting snowcover. Good separation is found between meadows, tundra, and barrens vegetation groups; meadows being found on wettish sites with moderate snowcover and barrens being found on xeric to mesic sites with light snowcover. Tundra was found on sites intermediate between barrens and meadows. Dwarf shrub tundra occurs on moister ground than do dwarf shrub barrens, and on snowier sites than do cushion plant barrens. Steppe occurs on drier, more snowfree sites than do any of the other graminoid communities, and occupies much the same regime as the cushion plant barrens. Heath sites had a similar moisture regime to the steppe but had higher snowcover than the steppe sites.

Figure 12: Distribution of communities with respect to indices of snowcover and moisture.

a)H - Heath, Li - Lichen Outcrop, M - Marsh.
b)Meadows: C - Sedge, E - Cottongrass,
N - Eutrophic. S - Steppe
c)Barrens: Bcp - Cushion plant, Bcp(a) with low abundance of Saxifrage, Bcp(b) with high abundance of Saxifrage, Bds - Dwarf shrub, Bm - Moss.
d)Tundra: Tgcp - Graminoid - cushion plant, Tds - Dwarf shrub.
Snowcover : 100 = low, 500 = high.
Moisture : 100 = xeric, 500 = wet.

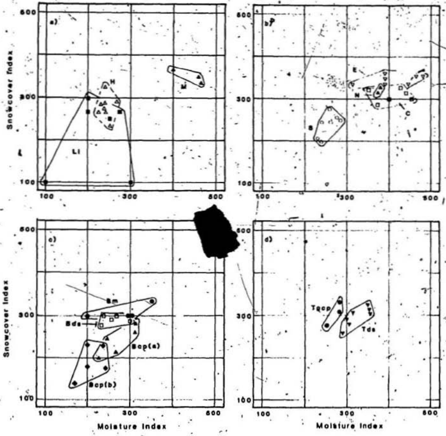

a)
b)
c)
d)
Snowcover Index
Moisture Index
600
300
100
500
H
B
M
Li
E
N
C
S
Sm
Bds
Bcp(a)
Bcp(b)
Tgcp
Tds

Figure 13 shows the distribution of Cape Herschel plant communities with respect to substrate and moisture. Low values of the substrate index reflect a ~~large amount of~~ bedrock or coarse talus present in a site. High values reflect a high proportion of fine sands and silts in the substrate. The communities at Cape Herschel were widely distributed along a continuum of substrates, with lichen outcrop communities overlapping with heath, steppe and cushion plant barrens on sites with a large amount of bedrock present. Barrens and tundra communities were found on sites with intermediate substrate indices which correspond to cobble and to colluviums of bouldery sand. Meadow and marsh sites were typified by fine substrates of sand, silt and clay with indices greater than 400.

Figure 13: Distribution of communities with respect to indices of substrate and moisture.

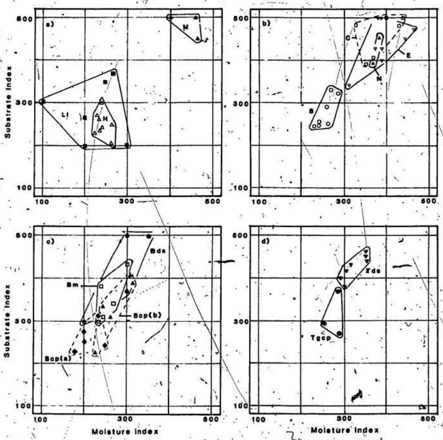
a) H - Heath, Li - Lichen Outcrop, M - Marsh.

b) Meadows: C - Sedge, E - Cottongrass, N - Eutrophic. S - Steppe.

c) Barrens: Bcp - Cushion plant, Bcp(a) with low abundance of Saxifrage, Bcp(b) with high abundance of Saxifrage, Bds - Dwarf shrub, Bm - moss.

d) Tundra: Tgcp - Graminoid - cushion plant, Tds - Dwarf shrub.

Substrate : 100 = coarse, 500 = fine.
Moisture : 100 = xeric, 500 = wet.


a)
b)
c)
d)
Substrate Index
Moisture Index
100
300
500
M
LI
G
H
C
E
N
S
Bds
Bm
Bcp(b)
Bcp(a)
Tgcp

DISCUSSION.

The flora of Cape Herschel.

Cape Herschel is located in a region which should afford it a larger vascular flora than it in fact has. Both Beschel (1969) and Young (1971) have drawn attention to the floristic richness of the east coast of Ellesmere Island. Beschel identified the Hayes Sound - Thule region as one of three centres of floristic disversity in the Nearctic, with more than 120 vascular taxa. Young's Zone III (which has the potential for 150 and possibly as many as 250 vascular species) extends along the east coast of Ellesmere Island to latitude 80° N on Nares Strait.

With 68 species, the vascular flora of Cape Herschel is moderately depauperate when compared to the floras of other localities in this floristically rich portion of the Queen Elizabeth Islands. Truelove Lowland, which has a similar area (43 km^2) has 97 species of vascular plants. The lowland at Alexandra Fiord, which occupies only 12 km^2, has a vascular flora of 85 species.

The paucity of vascular species at Cape Herschel could be explained either in terms of biogeographical isolation or in terms of severity of climate stemming from its coastal location. Cape Herschel is isolated from larger source areas at Sverdrup Pass, Inglefieldland and the lowlands of Makinson Inlet. The Cape Herschel peninsula and its contiguous mainland also have a relatively small island area. Isolation would produce a flora that is poor in vascular species with heavy propagules, and rich in species with airborne seed. The absence of berried shrubs, such as Empetrum nigrum and Vaccinium uliginosum which are present at Alexandra Fiord could be expected (even with a small migratory population of geese and ducks). Many species which travel more easily, however, are not present at Cape Herschel. Several species of Composites, found throughout Eastern Ellesmere Island (Ball and Hill 1981, Bridgland and Gillett 1983), are not found at Cape Herschel. The single Composite species found at Cape Herschel (Taraxacum phymatocarpum) was never observed to reach anthesis there. Several marsh and meadow species (eg. Carex membranacea, C. rupestris) which are common at Alexandra Fiord are not at Cape Herschel.

The low diversity of the vascular flora at Cape Herschel is more likely related to the severity of the local climate, which has a smaller aggregate summer warmth and is also windier than either Truelove Lowland or Alexandra Fiord. As significant as the scarcity of species, is the frequent stunting of vascular species and the restriction of one tenth of the vascular species to climatically favourable south-facing slopes. The absence at Cape Herschel, of Vaccinium uliginosum is as easily explained by poor climate as by geographic isolation. There is relatively little Cassiope tetragona at Cape Herschel, compared to Alexandra Fiord. These shrubs, both important at Alexandra Fiord, are limited in their development there by summer warmth (Nietfield-Nams 1981).

The composition of the Cape Herschel vascular flora is different from the vascular flora of the whole of Ellesmere Island (Table 17). The great representation of circumpolar and amphi-Atlantic species and the relative lack of of Arctic Archipelago endemics at Cape Herschel suggest that the flora is a young one that is still in an extended pioneer stage. Cool summer temperatures are likely the greatest factor limiting establishment of vascular species.

Mosses are perhaps more easily distributed in arctic regions, than are vascular plants. Wind blown gametophyte fragments have been propagated

Table 17: Floristic Affinities of the Ellesmere Island and Cape Herschel vascular floras. No. of spp. and (% of flora).

	Ellesmere*	Cape Herschel
Circumpolar	72 (53.3)	44 (69.9)
North American Radiant	22 (16.3)	4 (6.3)
Arctic Archipelago Endemic	20 (14.8)	4 (6.3)
Amphi Beringian	1 (0.7)	0
Amphi Atlantic	20 (14.8)	11 (17.5)
	135 (99.9)	63 (100.0)

* Porsild 1955, Table 18, p. 59.

successfully (Miller and Ambrose 1976). Even so, Sphagnum is found at MacMillan Glacier, ca. 10 km to the southwest of Cape Herschel (1983 Field Notes), but is absent from the study area. As a genus, Sphagnum is a northern outlier in the Queen Elizabeth Islands (Brassard 1971). Edlund [in press] has described it as being restricted to warm sites at Melville Island.

The bryophyte flora of 122 moss species at Cape Herschel compares favourably with the 132 mosses reported by Vitt (1975) from Truelove Lowland. It is perhaps not surprising that mosses, being for the most part very diminutive and greatly influenced by microhabitat, should be less affected by less favourable regional climate.

The Queen Elizabeth Island distributions of the mosses found at Cape Herschel are compared with those of the whole Queen Elizabeth Island moss flora in Table 18. The composition of Cape Herschel's moss flora shows the same type of difference from that of the whole moss flora as is exhibited by the vascular flora. Ubiquitous and widespread taxa are far more important at Cape Herschel than they are in the rest of the Queen Elizabeth Islands. Other distributional categories, including eastern arctic species, are poorly represented at Cape Herschel by comparison.

With only 44 species, the lichen flora must be either depauperate or incompletely known. Barrett and Thomson (1975) reported 143 species of lichens from Truelove Lowland. There is no reason to assume that extensive collections made by a trained lichenologist would not add species. The difficulties of identification, presented by non-fruiting crustose forms observed by Maass (1981) are a problem, especially in the field. The lichen flora collected at Cape Herschel

Table 18: Distributional elements of the Cape Herschel and Queen Elizabeth Island bryophyte floras. No. of spp. and (% of flora).

	Queen Elizabeth Islands*		Cape Herschel	
Ubiquitous	24	(10.3)	24	(22.9)
Widespread	75	(32.2)	50	(47.6)
Eastern	32	(13.7)	11	(10.5)
Southwestern	6	(2.6)	0	
Northern Outlier	13	(5.6)	4	(3.8)
Rare	26	(11.2)	6	(5.7)
Temperate Disjunct	5	(2.1)	0	
Unknown	50	(22.3)	10	(9.5)
Total:	233	(100.0)	105	(100.0)
High Arctic Element	43	(18.5)	12	(11.4)

* Modified from Brassard 1971, Table 6, p. 260.

shows composition similar to that of the vascular and bryophyte floras, predominantly circumpolar species (Table 19). The extent to which this differs from the composition of other lichen floras in the Queen Elizabeth Islands is difficult to determine.

Table 10. Composition of the Cape Herschel Lichen Flora by Floristic Elements - number of species and (percentage of flora).

Circumpolar		North American	
Arctic Alpine	19 (47.5)	Arctic Alpine	2 (5.0)
Arctic Boreal	6 (15.0)	Arctic Boreal	1 (2.5)
Arctic Temperate	6 (15.0)	Amphi-Beringian	2 (5.0)
Amphi-Atlantic		Cosmopolitan	
Arctic Boreal	1 (2.5)	Arctic Temperate	3 (7.5)
		Total:	40 (100.0)

Plant communities at Cape Herschel.

Two major factors affecting arctic vegetation are the severity of the environment and the low number of species in the arctic flora. Savile (1960) noted that plant associations in poorer arctic habitats are difficult to define because plants tend to associate in apparently random combinations. Also, plants with different morphologies in more favourable habitats often converge in outward morphology when they occur together in severe situations (Savile 1960). Beschel (1970) observed that, because the arctic flora is a small one, largely composed of holarctic species with little regional endemism, plant communities in the arctic are more recognizable by differences in the quantity of their components than by differences of floristic composition. At Cape Herschel the species with the highest constancy in given communities had very wide tolerances and very low fidelity to those communities. Conversely, the species with the highest fidelity to a given community type usually had very low constancy in that community. This made the description of communities in terms of the presence or absence of character species difficult, if not impossible.

Attempts to classify the vegetation of arctic regions using floristic associations and alliances (Barrett 1972; Rønning, 1965; Aleksandrova 1980) were not without justification, however. As erratic and random as arctic plant communities appear to be, there are definite constellations of species which frequently occur together, either as definite communities, or as components of other communities. There do exist assemblages which repeat themselves, and are to a some extent predictable on the basis of moisture, topography and snowcover. This is particularly evident in the case of cryptogamic communities (Brassard

1971; Vitt 1975; Richardson and Finegan 1977; Holmen 1955).

The vegetation at Cape Herschel showed considerable variation in the consistency with which sites of a community were grouped by cluster analysis. The clusters representing the heath and the sedge meadow sites identified in the field were consistently placed in discrete clusters by the CLUSTAN runs. The steppe and cottongrass meadow clusters showed similar consistency, with the exception of the upland site (E-18), in which both Eriophorum and Luzula confusa were abundant.

Tundra, barrens, marsh, and lichen dominated communities were divided less satisfactorily by the cluster analysis, although certain subgroups such as the graminoid-cushion-plant tundra were consistent from one run to the next.

The predictability of plant communities at Cape Herschel and their consistency from one site to the next varied quite dramatically from one type of vegetation to the next. The greatest consistency was found in vegetation types such as the heath and graminoid communities, which were generally characterized by high plant cover. The lowest consistency was found in barrens vegetation and in lichen and marsh communities. This lack of consistency, especially noticeable in the field among the barrens sites, was confirmed by the the inability to resolve these communities as diagnosed in the field with groupings produced by the cluster analysis.

The apparent floristic randomness of the lichen outcrop and marsh communities is an artifact of using, in the cluster analysis only in vascular plants. The arbitrary retention of the field communities is justified in consideration of their physiognomic distinctness, and when using cryptogams as diagnostic species.

Both communities could doubtless be better described using cover values for cryptogamic species in the cluster analysis. Due to problems with positive identification of cryptogams in the field this would require more quantitative sampling, and would be better suited to a study of a single vegetation complex. Such analysis would likely reveal subdivisions of these communities, such as those found at Truelove Lowland (Vitt and Pakarinen 1977, Richardson and Finegan 1977).

The barrens, and to a lesser extent the tundra vegetation, are more problematic. A certain randomness occurs in these sites and it is tempting to question if floristically predictable communities do exist in these vegetation types. Two factors, the absence of snowcover and the real limitation of their xeric situation, contribute largely to the randomness on barrens sites.

Barrens and tundra communities can also be better described, concentrating further on these complexes alone. Several authors (eg. Svoboda 1977, Miller and Alpert 1984) have described in detail the microtopographic distributions of barrens-like and tundra-like communities on raised beach ridges and near snowbeds. What is needed are extensive surveys of these vegetation types across a braoder geographical range. Qualitative sampling, as employed here, is perfectly satisfactory, patterns of ecological and geographic distribution will only be resolved from the analysis of a large number of sites.

Cottongrass meadows and sedge meadows formed distinct clusters. The restricted nature of sedge meadows at Cape Herschel, their floristic richness, and their tendency to occur on drier ground or in sites with less surface runoff suggests it may require more warmth than the cottongrass meadow. At Truelove

Lowland, Carex stans meadows are found in sites with more standing water and a longer snowfree period than Cottongrass meadow sites (Muc 1977).

Steppe appears to be more cold adapted than either of the above meadow communities. Mean species richness in steppe sites was comparable to that found in the cushion plant and dwarf shrub barrens. Steppe development also appears to require a longer growing season than heath or graminoid cushion plant tundra if the snowcover index is used as an estimate (Fig. 12).

The low aggregate summer warmth at Cape Herschel is reflected in the distribution of the vegetation in two obvious ways. First, the study area is dominated by vegetation complexes with very low total plant cover. Two complexes, barrens and lichen outcrop, accounted for 60 % of the map area. With 22 vascular species and no dwarf shrubs, the cushion plant barrens at Cape Herschel are equivalent to Edlund's (1983a) Bioclimatic Zone 1. The Lichen outcrop map unit would fall into the same zone, although portions of it fall into the Zone 0 of (Edlund and Alt, [in prep.]) which is devoid of vegetation. At Cape Herschel, vegetation-free portions of the lichen outcrop community occurred on north-facing outcrops with late-lying snow. Similar vegetation can be expected to occur at increasing altitudes, and on north-facing slopes west of Cape Herschel, towards the continental interior of Ellesmere Island.

The second result of the low summer warmth at Cape Herschel is the influence of aspect on the distribution of vegetation. Corbet (1972) demonstrated the importance of slope and aspect in determining the amount of radiation received by an arctic site. At Cape Herschel, a greater diversity of plant communities was found on south-facing slopes than on north-facing ones.

Included among these communities were both heath and graminoid communities, which collectively occupied only 20% of the map area. The Cassiope heaths at Cape Herschel are indicative of Edlund's Zone 3, while Eriophorum meadows are indicative of her warmest zone (Zone 4). Both these communities can be expected to show greater development and a greater topographic distribution in more continental lowland localities.

The distribution of plant communities in the Queen Elizabeth Islands.

Much of the vegetation at Cape Herschel is quite comparable to vegetation described from other localities in the Queen Elizabeth Islands. Table 20 shows the distribution of Cape Herschel plant communities found elsewhere in the Queen Elizabeth Islands. Figure 14 shows the relation of these sites to Young's floristic zones in this portion of the Arctic Archipelago. The communities represented at Cape Herschel are distributed across three of Young's floristic regions, and have a latitudinal range of 13° (ca 1000 km). Alert (Bruggemann and Calder 1953), Lake Hazen (Savile 1964, Soper and Powell 1985), Van Hauen Pass (Brassard and Longton 1970) and Axel Heiberg Island (Beschel 1963, 1970) are found in the northern portion of Young's Zone II. Zone I is represented by northwest Ellef Ringnes Island (Savile 1961), Lougheed Island (Edlund 1980), southeast Ellef Ringnes, King Christian and Melville Islands (Bliss and Svoboda 1984). A third region, equivalent to the southern portion of Young's Zone II includes Polar Bear Pass on Bathurst Island (Sheard and Geale 1983), Cornwallis Island (Schofield and Cody 1955, Edlund 1983b), Craig Harbour (Polunin 1948) and Truelove Lowland on Devon Island (Muc and Bliss 1977). Alexandra Fiord (Muc 1981) is the only other site besides Cape Herschel which Young (1971) placed in Zone III.

Barrens complexes are among the most widespread of vegetation types found in the Queen Elizabeth Islands. The easily recognizable Saxifraga oppositifolia barrens are reported from most of the eastern Queen Elizabeth Islands. They also are found on Ward Hunt Island (Brassard, pers. com.). They are absent at localities (Lake Hazen, Alexandra Fiord and Truelove Lowland) which have been described as thermal oases. They are also more or less absent

Table 20 : Distribution of Plant Communities found at Cape Herschel across the Queen Elizabeth Islands.

Cape Herschel	Alert (Bruggemann & Calder 1953)	Lake Hazen (Savile 1964)	Van Hauen Pass (Brassard & Longton 1970)	Axel Heiberg & Fosheim Pen. (Beschel 1970)	Astro Ridge (Beschel 1963)
Bcp Cushion Plant Barrens	Saxifrage Barrens	-	Clay slopes, Polygons	: Fellfield : * : & open : : Fellfield :	Barren Heath & Open Pioneer
Bds Dwarf shrub Barrens	-	: Gravel : : Delta :	: Dry Heath :	-	Dry Mesic Heath
Tds Dwarf Shrub Tundra	-	: Dryas Hummocks : : & Dryas - : : Kobresia Tundra :	: Dryas : : Heath :	: Dry Heath :	-
Tgcp Graminoid - Cushion Plant Tundra	-	Springy Slope North face of Mt. McGill	-	Alpine Wet Sward	-
H Heath	-	-	Snow beds	Heath & Mesic Heath	Mesic Heath
S Steppe	-	-	-	Luzula Steppe	Upper Steppe
E Cottongrass Meadow	Station 4, Cape Belknap	Springy slopes South facing.	-	Wet Heath	-
C Sedge Meadow	-	Muddy delta, Snowgoose Ck.	Sedge Meadow	Wet Sedge Meadow	-
N Eutrophic Meadow	-	-	Enriched Areas	-	-
M Marsh	-	-	-	Emergent Vegetation	-

* : equivalent floristically but not physiognomically :

(Table 20 Continued)

Cape Herschel	Alexandra Fiord (Muc 1981)	Ellef Ringnes (Savile 1961)	Lougheed Island (Edlund 1980)	Western Q.E.I. (Bliss & Svoboda 1984)	Bathurst Is. (Sheard & Geale 1983)
Bcp Cushion Plant Barrens	-	-	Saxifrage - Herb Barrens	-	Upland Ridge
Bds Dwarf shrub Barrens	Heath, cushion plant graminoid (unconsolidated, closed substrate)	-	-	-	Polar Desert
Tds Dwarf Shrub Tundra	Dwarf Shrub & Dryas Heath	-	-	** Moss - Graminoid Meadow & Phippsia Barrens	-
Tgcp Graminoid - Cushion Plant Tundra	-	Springy Slope Diabase Hill	Luzula nivalis on silt & clay		Upland Snowbed
H Heath	Heath (Cassiope)	-	-	-	-
S Steppe	-	-	Luzula confusa Tussocks	Graminoid Steppe	-
E Cottongrass Meadow	Meadow (Sedge)	-	-	Wet Graminoid Moss Meadow	Grass Forb Meadow
C Sedge Meado		-	-		Sedge Meadow
N Eutrophic Meadow	-	-	-	-	-
M Marsh	-	Marsh	-	-	Emergent Meadow

** | floristically similar to more than one community at Cape Herschel.

(Table 20 Concluded)

Cape Herschel	Cornwallis Is. (Schofield & Cody 1955)	Cornwallis Is. (Edlund 1983b)	Truelove Lowland (Muc & Bliss 1977)	Truelove Lowland (Barrett 1972)	Craig Harbour (Polunin 1948)
Bcp Cushion Plant Barrens	Rocky Beach Lines & Fjaeldmark	Saxifrage herb barrens	Moss - herb (Polar Desert)	-	Scree and other slopes
Bds Dwarf shrub Barrens	Fjaeldmark	Dwarf shrub barrens	Cushion Plant Lichen	Nardino - Dryado Alectorietum & Pedicularo - Dryadetum integrifoliae	-
Tds Dwarf Shrub Tundra	-	Willow patina, Saxifrage patina & herb cryptogam Tundras	Cushion Plant - Moss	-	-
Tgcp Graminoid - Cushion Plant Tundra	Islets of soil on Fjaeldmark	: Phippsia algida : Barrens	Herb moss Snowbed	: Catoscopio - : Ranunculo : Phippsietum :	
H Heath	-	Cassiope Heath	Dwarf Shrub Heath Moss	-	snow effect
S Steppe	-	-	Graminoid - moss (Bliss, Kerik & Peterson 1977)	-	-
E Cottongrass Meadow	-	-	Frost Boil Sedge Moss Meadow	Eriophoro - salico - arctagrostidetum latifoliae	-
C Sedge Meadow	-	Sedge moss Meadow	Wet Sedge Moss Meadow	Caricetum stantis	-
N Eutrophic Meadow	Eskimo Houses	Enriched Sites	-	-	-
M Marsh	-	Marsh vegetation	-	-	-

Figure 14: Localities in the Queen Elizabeth Islands with one or more plant communities similar to communities found at Cape Herschel.

1. Alert (Bruggemann and Calder 1953)
2. Lake Hazen (Savile 1964, Soper and Powell 1985)
3. Van Hauen Pass (Brassard and Longton 1970)
4. Axel Heiberg Island and Fosheim Peninsula (Beschel 1970)
5. Astro Ridge (Beschel 1963)
6. Alexandra Fiord (Muc 1981)
7. Ellef Ringnes Island (Savile 1961)
8. Lougheed Island (Edlund 1980)
9. Ellef Ringnes, King Christian and Melville Islands (Bliss and Svoboda 1984)
10. Polar Bear Pass, Bathurst Island (Sheard and Geale 1983)
11. Cornwallis Island (Schofield and Cody 1955, Edlund 1983c)
12. Truelove Lowland, Devon Island (Muc and Bliss 1977)
13. Craig Harbour (Polunin 1948).


120°W
90°W
60° W
80° N
75° N
Zone I
Zone II
Zone III
1
2
3
4
5
6
7
8
9
10
11
12
13

from the "Barren Wedge" of the Sverdrup Islands. At Astro Ridge Saxifraga hyperborea replaces S. oppositifolia. At Cornwallis Island Schofield and Cody (1955) reported two communities that have floristic and physiognomic equivalents to the cushion plant barrens found at Cape Herschel.

Directly comparable dwarf shrub barrens, dominated by Dryas and Salix, are less common in the Queen Elizabeth Islands, and more variation is apparent. Directly comparable communities are found at Astro Ridge, at Alexandra Fiord, at Bathurst Island, at Cornwallis Island, and at Truelove Lowland. On northern Ellesmere, at Lake Hazen and at Van Hauen Pass, it appears as a variant of streambed vegetation, with a high representation of Epilobium latifolium, and as a sparse heath on well-drained gentle slopes. In the southern Queen Elizabeth Islands it is found mostly along raised beach ridges.

The closest floristic equivalents of dwarf shrub tundra (which at Cape Herschel differs from the dwarf shrub barrens mostly in total plant cover) are found only at Van Hauen Pass, Alexandra Fiord and at Truelove Lowland. In these localities the plant cover approaches 100 % and Dryas forms a hummocky microtopography. A similar hummocky Dryas microtopography has been reported from Lake Hazen (Savile 1964) where Carex rupestris and Kobresia myosuroides appear as common associates.

The graminoid cushion plant tundra has direct equivalents at Lake Hazen, at Axel Heiberg, at all of the "Barren Wedge" localities, and with small or related forms at localities in the southern Queen Elizabeth Islands. Its position on a north slope at Lake Hazen and its ubiquity among the western stations, suggests that it develops best in cold wet situations. At the more northerly locations, Alopecurus appears as an important constituent of the community.

Heath communities dominated by Cassiope are very recognizable. They are found at Van Hauen Pass, at dry warm locations at Middle Fiord and Iceberg Glacier on Axel Heiberg (Beschel 1970) and at cooler damp sites on the Fosheim Peninsula. Polunin (1948) found Cassiope heath near snowbeds at Craig Harbour. At Alexandra Fiord Cassiope heath is a variant of a series of heath communities, dominated by either Dryas or Vaccinium. Cassiope heath is not found in the "Barren Wedge" of the Sverdrup Islands, but has been reported from Cornwallis Island and Devon as a community with low coverage. This suggested that Cassiope dominates a cold portion of the spectrum of environmental conditions occupied by heath vegetation. Comparing the distribution of heaths and dwarf shrub tundras it is tempting to surmise that, just as decreasing summer warmth limits the northwest expansion of a zone dominated by dwarf shrubs (Edlund 1983a), snowcover (either as insulation or as a limiter of growing season) determines which species of dwarf shrub will dominate. Savile (1972) has noted that Cassiope is associated with snowbeds throughout the Canadian Arctic.

Communities dominated by graminoid species are found throughout the Queen Elizabeth Islands. Steppe communities are not found on northern Ellesmere Island but do exist on the inner portion of the "Barren Wedge" on Lougheed Island and Ellef Ringnes Island. A small area of steppe is apparent in the analysis by Bliss et al. (1977) of upland communities at Truelove on Devon. Steppe dominated by Luzula confusa is found at Middle Fiord, Iceberg Glacier and Expedition Fiord on Axel Heiberg, being found at increasingly higher and colder situations towards the continental interior of the Queen Elizabeth Islands.

Wet meadow communities dominated either by Carex stans or by Eriophorum species are widespread in the Queen Elizabeth Islands, occurring at Alert, Lake Hazen, Van Hauen Pass, Axel Heiberg, the Sverdrup Islands, Alexandra Fiord, Bathurst Island, Cornwallis Island and Truelove Lowland. Three species (Carex rupestris, Carex membrancea and Eriophorum angustifolium) none of which is found at Cape Herschel, are important constituents of these two communities at other localities. The Carex stans meadow in which Carex membranacea is an important associate species is found at Alexandra Fiord and at Truelove Lowland. At Truelove Lowland Barrett (1972) recognized two expressions of the Carex stans meadow one with C. membranacea as an important constituent and the other dominated almost solely by C. stans.

The eutrophic meadow at Cape Herschel has no direct equivalents among the nitrogen-enriched communities reported from Van Hauen Pass and Cornwallis Island. Alopecurus, Cerastium alpinum and Polygonum viviparum appear frequently in the community. Edlund (1983b) has found no consistently dominant species on these sites. The hummocky microtopography that this community exhibits at Cape Herschel has not been reported from the other localities, and is more likely related to microclimate than to nutrient status.

Marsh communities have been reported from Axel Heiberg Island, Ellef Ringnes Island, Bathurst Island, Cornwallis Island, and Truelove Lowland. Pleuropogon sabinei and Ranunculus hyperborea appear restricted to this community. Alopecurus alpinus and Eriophorum scheuchzeri are often found in it. On Axel Heiberg Island (Beschel 1970) this community is found in warm, wet situations. Calliergon giganteum and Scorpidium turgescens are reported as indicator species for this community at Bathurst Island, suggesting the Drepanocladus brevifolius community of northern Ellesmere Island (Brassard 1971), which seems to be a component there of marshes, sedge meadows and cottongrass meadows.

Few lichen communities have been described from the Queen Elizabeth Islands. Richardson and Finegan (1977) describe the lichen communities of raised beach ridges at Truelove Lowland, but do mention the existence of an outcrop lichen community dominated by Umbilicaria spp. and various crustose species. It is likely that this community is fairly widespread, particularly in the Precambrian Shield area of southeast Ellesmere Island.

Thus, despite a small flora and a predominance of barrens, Cape Herschel exhibits a range of plant communities which are representative of communities found throughout the Queen Elizabeth Islands. These communities are recognizable in the field on the basis of physiognomy, cover and floristic dominance, and have floristic identities sufficient to allow their separation by cluster analysis. The communities distribute themselves across gradients of moisture, snowcover and substrate texture calculated from direct gradient analysis of the principal vascular species, and are especially responsive to altitude and aspect.

The survey and mapping techniques used here were found efficient and suitable for mapping vegetation at the scale used (1 : 25,000) and could be useful at a broader regional scale (1 : 50,000 to 1 : 200,000). The vegetation classification appears to work best for communities in which moisture is not a limiting factor. Further delineation of the classification of barrens and tundra complexes is needed before the distributions of their component communities can be accurately predicted.

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APPENDIX A

Sample Sites

Site	Lat.	Long.		Map	Cover	Classification:					
No.	° ' N	° ' W	Date	Unit	%	M	G	C	H	A	F[#]
1	78 37.2	74 43.4	15.7.79	M	100	5	5	2	1	-	1
2	78 36.7	74 44.8	15.7.79	M	100	5	5	1	1	-	1
3	78 36.8	74 44.5	23.6.83	M	100	5	5	4	1	-	1
4	78 36.6	74 44.6	14.7.83	M	100	5	5	4	1	-	1
5	78 37.0	74 45.5	29.6.83	E	60	5	5	4	1	2	1
6	78 36.7	74 46.0	29.6.83	E	50	5	4	3	2	2	3
7	78 36.0	74 40.5	25.6.79	E	80	3	4	2	3	-	1
8	78 36.3	74 42.1	27.6.83	E	60	5	5	3	3	1	1
9	78 36.8	74 41.6	30.6.79	E	100	4	5	5	1	3	5
10	78 36.4	74 45.0	15.7.83	E	100	5	5	5	1	1	1
11	78 35.7	74 42.2	13.7.83	E	100	3	4	4	1	3	2
12	78 38	74 51	16.6.80	C	100	3	5	3	3	2	5
13	78 36.9	74 43.2	8.7.79	C	100	5	5	3	1	-	1
14	78 36.7	74 42.8	14.7.83	C	100	3	4	3	1	4	3
15	78 36.8	74 44.6	23.6.83	C	70	4	5	3	1	4	2
16	78 35	74 52	12.6.80	C	>90	4	5	4	4	3	3
17	78 36.1	74 40.8	24.6.79	C	60	5	5	4	2	-	2
18	78 36.0	74 42.5	11.7.79	E	70	5	4	2	4	3	4
19	78 36.0	74 42.5	12.7.83	S	80	2	2	2	4	2	1
20	78 35.7	74 40.4	10.7.83	S	80	1	3	2	4	4	3
21	78 35.8	74 40.5	10.7.83	S	80	3	2	2	3	4	1
22	78 36.1	74 42.2	13.7.83	S	50	2	1	2	4	2	1
23	78 35.9	74 42.4	14.7.79	S	20	2	2	3	4	3	1
24	78 35.9	74 40.0	14.7.79	S	40	3	4	4	4	4	1
25	78 36.2	74 46.2	15.7.83	S	20	1	2	3	4	2	3
26	78 36.0	74 43.8	5.6.80	N	80	4	5	4	2	3	5
27	78 36.0	74 43.8	5.6.80	N	100	4	5	5	1	3	5
28	78 36.3	74 46.3	15.7.83	H	30	2	1	2	3	3	1

29	78 35.0	74 39.0	9.6.80	H	20	1 1 2 1 3 1
30	78 36.3	74 45.8	15.7.83	H	30	2 1 2 3 2 1
31	78 35.8	74 41.8	13.7.83	H	70	2 1 3 2 3 1
32	78 36.4	74 43.7	28.6.83	H	50	3 1 3 3 4 1
33	78 36.0	74 42.8	12.7.83	H	50	2 2 3 4 3 1
34	78 36.7	74 43.8	15.7.83	H	80	3 1 3 1 1 1
35	78 36.9	74 42.2	29.6.79	H	20	3 1 5 1 - 1
36	78 35.8	74 42.0	13.7.83	T	60	2 4 4 1 3 2
37	78 35.7	74 41.7	30.6.79	T	90	3 5 5 1 3 5
38	78 35.8	74 43.2	13.7.83	T	50	3 3 5 1 3 2
39	78 36.1	74 45.9	15.7.83	T	70	5 2 2 4 2 1
40	78 36.0	74 45.3	7.7.79	T	50	3 2 3 1 3 3
41	78 36.1	74 44.2	14.7.83	T	50	3 3 4 1 4 1
42	78 36.2	74 39.5	9.7.83	T	40	4 4 3 2 1 4
43	78 36.9	74 46.0	29.6.83	T	40	5 5 2 1 2 3
44	78 36.3	74 40.8	24.6.79	T	45	5 2 4 3 1 2
45	78 36.4	74 41.6	10.7.79	T	40	5 4 3 1 3 1
46	78 36.6	74 46.0	29.6.83	T	40	3 2 4 8 2 3
47	78 36.4	74 42.2	31.5.80	T	50	5 5 5 2 1 1
48	78 35.2	74 36.5	12.7.79	T	40	4 4 3 4 - 2
49	78 36.3	74 41.9	27.6.83	T	50	4 2 4 3 1 1
50	78 36.6	74 44.1	14.7.83	B	20	2 5 3 1 - 3
51	78 36.4	74 44.0	28.6.83	B	5	1 2 1 2 4 5
52	78 36.5	74 46.5	29.6.83	B	10	1 3 1 4 - 3
53	78 36.6	74 42.8	28.5.80	B	5	1 3 1 2 1 2
54	78 35.7	74 41.9	30.6.79	B	5	5 5 5 1 3 2
55	78 36.9	74 41.1	5.7.79	B	20	3 5 2 1 1 1
56	78 36.4	74 40.3	2.7.79	B	10	3 4 4 2 1 3
57	78 35.7	74 41.3	13.7.83	B	10	2 4 2 1 3 2
58	78 36.2	74 40.2	12.7.83	B	10	3 4 1 3 1 2
59	78 36.1	74 40.6	12.7.83	B	40	1 2 1 4 3 1
60	78 36.0	74 45.4	14.7.83	B	20	1 2 2 1 3 1
61	78 35.9	74 41.7	12.7.83	B	10	1 3 1 4 - 3
62	78 36.1	74 43.2	12.7.83	B	15	1 3 1 4 - 2
63	78 35.9	74 40.9	25.6.79	B	<5	1 4 1 3 - 2
64	78 36.7	74 41.5	28.6.79	B	<5	1 3 3 2 1 3
65	78 36.0	74 44.5	7.7.79	B	<5	2 3 1 1 - 3
66	78 36.1	74 43.5	11.7.79	B	5	1 1 1 4 4 1
67	78 36.7	74 41.5	28.6.79	B	20	3 3 3 2 - 3
68	78 36.1	74 40.8	24.6.79	B	<5	5 5 4 4 1 1
69	78 36.2	74 42.6	13.7.83	B	20	2 2 2 4 1 3
70	78 36.7	74 43.0	14.7.83	B	30	1 4 3 1 4 3
71	78 36.3	74 42.7	27.6.83	B	10	3 2 5 4 1 4

72	78 36.4	74 72.3	28.6.83	B	5	2 3 2 2 1 4
73	78 35.9	74 44.5	11.6.83	B	30	3 3 2 1 3 3
74	78 36.9	74 45.0	23.6.83	B	25	4 5 1 1 - 2
75	78 36.8	74 40.4	23.6.79	L	<5	1 1 1 1 - 1
76	78 36.9	74 42.1	29.6.79	L	<5	1 3 2 1 - 3
77	78 36.9	74 40.9	29.6.79	L	10	2 1 2 1 1 1
78	78 36.9	74 40.9	29.6.79	L	<1	1 1 1 1 1 1
79	78 36.2	74 45.5	3.6.80	L	<1	1 1 1 1 2 1
80	78 36.2	74 39.0	9.7.83	L	10	1 1 3 2 1 1

 # Classification : M - Moisture, G - Substrate Texture, C - snowcover, H - Altitude, A - Aspect, F - Cryoturbation. Values defined on Table 1. Map Units: M - marsh, E - cottongrass Meadow, C - sedge meadow, S - steppe, N - Eutrophic meadow, H - heath, T - Tundra, B - barrens, L - Lichen.

APPENDIX B

Flora of Cape Herschel.

* Legend

L - Lichen Outcrop, B1 - 'moss' Barrens, B2 - Cushion Plant Barrens, B3 - Dwarf Shrub Barrens, B - sites classified as barrens in field but not included in second cluster analysis, T1 - Graminoid - Cushion Plant Tundra, T2 - Dwarf Shrub Tundra, T - sites classified as tundra in field but not included in second cluster analysis, H - Heath, C - Sedge Meadow, E - Cotton-grass Meadow, N - Eutrophic Meadow, S - Steppe, M - Marsh, R - sites used in floristic survey but not in vegetation analysis.

SPECIES	OCCURRENCE IN DIFFERENT CLUSTERS *															
		L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
Vascular Plants	n =	45	4	10	5		3	7		8	6	8	2	7	3	
Alopecurus alpinus L.		.	.	1	.	1	.	1	.	.	.	.	2	.	2	8
Arctagrostis latifolia (R. Br.) Griseb.		.	.	.	.	.	.	.	.	.	4	.	.	.	1	.
Arenaria rubella (Wahlenb.) Sm.		.	.	6	1	1	.	1	.	1	1	.	.	.	.	6
Braya purpurascens (R. Br.) Bunge.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Campanula uniflora L.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Cardamine bellidifolia L.		1	.	.	.	.	.	.	.	2	.	.	.	.	.	1
Cardamine pratensis L. var. angustifolia Hook.		.	.	.	.	.	.	.	.	.	1	.	.	.	1	1
Carex maritima Gunn.		.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Carex misandra R. Br.		.	.	1	1	.	.	2	1	5	1	5	.	1	.	3
Carex nardina Fr.		.	.	.	1	1	.	.	.	2	.	.	.	.	.	2
Carex stans Drej.		.	.	.	.	.	.	.	.	.	6	.	.	.	.	1
Cassiope tetragona (L.) D. Don.		.	.	.	.	.	.	.	.	8	1	.	.	4	.	1
Cerastium alpinum L.		.	1	10	2	.	3	2	.	4	1	2	1	4	.	9
Cerastium arcticum Lge.		.	.	1	1	.	.	.	.	1	1	.	.	.	.	1
Cerastium regellii Ostf. Blake s.n. 1981		.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Cochlearia officinalis L. ssp. groenlandicum (L.) Pors.		.	.	1	.	1	.	.	.	.	.	.	.	.	.	.

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
Colpodium vahlianum (Liebm.) Nevski	.	.	3	1	2	.	.	.	.	.	1	.	.	.	3
Cystopteris fragilis (L.) Bernh.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
Draba alpina L.	.	.	2	.	.	2	1	1	.	1	1	.	.	.	8
Draba corymbosa R. Br. ex DC.	.	1	2	1	.	1	.	.	1	.	.	.	.	.	.
Draba fladnizensis Wulf.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Draba lactea Adams	.	1	.	1	.	.	.	.	1	1	2	.	.	.	2
Draba nivalis Liljebl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Draba subcapitata Simm.	.	.	1	1	.	1	2	.	2	.	.	2	.	.	2
Dryas integrifolia M. Vahl	2	2	1	5	1	.	.	1	6	2	3	.	.	.	9
Epilobium latifolium L.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Equisetum arvense L.	.	.	.	.	.	.	.	.	.	2	2	.	.	.	.
Equisetum variegatum Schleich.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Eriophorum angustifolium Honck.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
Eriophorum scheuchzeri Hoppe	.	.	.	.	.	.	.	.	1	1	1	.	.	2	.
Eriophorum triste (Th. Fr.) Hadac and Love	.	.	.	.	.	.	.	.	1	2	7	.	.	.	3
Eutrema edwardsii R. Br.	.	1	.	.	.	.	.	.	.	1	1	.	.	.	.
Festuca baffinensis Polunin	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Festuca brachyphylla Schultes	.	.	.	.	.	1	3	.	1	.	.	.	.	.	1
Juncus biglumis L.	.	.	.	1	1	.	.	.	1	.	1	.	1	2	4

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
Luzula confusa Lindebl.	1	.	3	1	1	1	4	.	6	.	.	1	7	.	5
Luzula nivalis (Laest.) Beurl.	1	.	5	.	.	5	3	.	2	1	7	1	4	3	13
Melandrium apetalum (L.) Fenzl. ssp. arcticum (Fr.) Hult.	.	1	2	.	2	.	1	.	.	2	2	.	1	1	3
Oxyria digyna (L.) Hill	.	.	2	1	1	1	2	.	3	1	2	.	4	.	6
Papaver radicatum Rottb.	1	.	8	.	1	3	4	.	3	1	1	2	6	.	13
Pedicularis hirsuta L.	.	1	.	4	1	3	5	1	3	3	5	.	.	.	1
Phippsia algida (Sol.) R. Br.	.	.	1	.	.	3	.	.	.	.	.	.	.	.	.
Pleuropogon sabinei R. Br.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	2
Poa abbreviata R.Br.	2	.	8	.	.	.	.	.	.	.	.	1	4	.	6
Poa alpigena (Fr.) Lindem.	1	.	.	.	1	.	.	.	.	.	.	.	.	1	.
Poa arctica R. Br.	1	.	1	.	.	.	2	.	4	.	1	1	5	1	2
Poa glauca M. Vahl	.	.	.	.	.	.	.	.	.	1	.	2	.	.	3
Polygonum viviparum L.	.	.	.	.	2	.	3	1	3	2	1	.	.	.	4
Potentilla hyparctica Malte	1	.	1	.	1	1	4	.	4	1	1	2	5	.	2
Potentilla vahliana Lehm	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Puccinellia phryganodes (Trin.) Scribn. and Merr.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
Ranunculus hyperboreus Rottb.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
Ranunculus nivalis L.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
Ranunculus sulphureus Sol.	.	.	.	.	.	.	2	.	.	2	2	1	.	1	2
Salix arctica Pall.	.	3	4	5	2	2	7	1	8	5	7	.	5	2	13
Saxifraga caespitosa L. ssp. uniflora (R. Br.) Pors.	1	.	6	.	.	3	2	.	2	1	1	.	3	.	2
Saxifraga cernua L.	1	.	2	.	.	.	.	.	.	.	3	2	2	2	7
Saxifraga flagellaris Willd. ssp. platysepala (Trautv.) Pors.	.	1	.	.	1	.	1	.	2	.	1	.	1	.	4
Saxifraga foliolosa R. Br.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Saxifraga hirculus L. var. propinqua (R.Br.) Simm.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga oppositifolia L.	1	2	10	5	2	3	6	1	8	2	6	1	7	.	15
Saxifraga tenuis Sm.	.	.	1	.	.	1	1	.	.	.	2	.	2	.	7
Saxifraga tricuspidata Rottb.	.	.	3	.	.	.	.	.	2	.	.	.	.	.	3
Silene acaulis L. var. exscapa (All.) D.C.	.	.	.	.	.	.	.	.	.	1	1	.	2	.	.
Stellaria longipes Goldie s.l.	.	.	3	1	.	2	4	.	2	1	2	2	3	2	10
Taraxacum phymatocarpum J. Vahl	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.
Trisetum spicatum (L.) Richt. Blake s.n. 1981	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Woodsia glabella R. Br. Smol s.n. 1983	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1

Mosses

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
<u>Aloina</u> <u>brevirostris</u> (Hook. and Grev.) Kindb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<u>Amblystegium</u> <u>serpens</u> (Hedw.) B.S.G.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Andreaea</u> <u>rupestris</u> Hedw. L	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Anoectangium</u> <u>tenuinerve</u> (Limpr.) Par.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<u>Aplodon</u> <u>wormskjoldii</u> (Hornem.) R. Br.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Aulacomnium</u> <u>palustre</u> (Hedw.) Schwaegr.	.	.	.	.	.	.	.	.	1	.	1	1	1	.	.
<u>Aulacomnium</u> <u>turgidum</u> (Wahlenb.) Schwaegr.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.
<u>Barbula</u> <u>icmadophila</u> Schimp. <u>ex</u> C. Mull.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	1
<u>Bartramia</u> <u>ithyphylla</u> Brid.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	1
<u>Blindia</u> <u>acuta</u> (Hedw.) B.S.G.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.
<u>Brachythecium</u> <u>turgidum</u> (C.J. Hartm.) Kindb.	.	1	.	.	.	.	.	.	.	.	.	2	.	.	3
<u>Bryoerthrophyllum</u> <u>recurvirostrum</u> (Hedw.) Chen	1	1	.	.	.	.	.	.	1	1	.	1	.	.	4
<u>Bryum</u> <u>sp.</u>	2	1	.	.	.	.	.	.	.	1	.	1	.	1	5

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
Bryum aeneum Blytt ex B.S.G.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Bryum algovicum Sendtn. ex C. Mull.	.	2	.	.	.	.	2	.	.	2	1	1	.	.	6
Bryum arcticum (R. Br.) B.S.G.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	1
Bryum argenteum Hedw.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Bryum bimum (Brid.) Turn.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bryum creberrimum Taylor	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bryum cryophilum Mart.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	3
Bryum stenotrichum C. Mull.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	2
Bryum tortifolium Funck ex Brid.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Bryum turbinatum (Hedw.) Turn.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Calliergon cordifolium (Hedw.) Kindb.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Calliergon giganteum (Schimp.) Kindb.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2
Calliergon richardsonii (Mitt.) Kindb. ex Warnst.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
Calliergon sarmentosum (Wahlenb.) Kindb.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Calliergon trifarium (Web. and Mohr) Kindb.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
<u>Campylium</u> <u>arcticum</u> (Williams) Broth.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2
<u>Campylium</u> <u>polygamum</u> (B.S.G.) C. Jens	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Campylium</u> <u>stellatum</u> (Hedw.) C. Jens	.	1	.	.	.	.	2	.	.	1	.	.	.	1	2
<u>Catoscopium</u> <u>nigritum</u> (Hedw.) Brid.	.	1	.	.	.	.	1	.	1	2	2	.	.	2	.
<u>Cinclidium</u> <u>arcticum</u> (B.S.G.) Schimp.	.	.	.	.	.	.	.	.	.	3	.	.	.	2	2
<u>Cinclidium</u> <u>stygium</u> Sw.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.
<u>Cinclidium</u> <u>subrotundum</u> Lindb.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
<u>Cirriphyllum</u> <u>cirrosum</u> (Schwaegr. <u>ex</u> Schultes) Grout	.	.	.	.	.	.	2	.	.	.	1	.	.	.	1
<u>Cnestrum</u> <u>alpestre</u> (Wahl.) Nyh.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<u>Cratoneuron</u> <u>arcticum</u> Steere	.	.	.	.	.	.	.	.	.	1	1	.	.	2	4
<u>Cratoneuron</u> <u>commutatum</u> (Hedw.) Roth.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<u>Cratoneuron</u> <u>filicinum</u> (Hedw.) Spruce	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<u>Cynodontium</u> <u>polycarpum</u> (Hedw.) Schimp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
Cyrtomnium hymenophylloides (Hueb.) Kop.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
Cyrtomnium hymenophyllum (B.S.G.) Kop.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Desmatodon heimii (Hedw.) Mitt.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
Desmatodon latifolius (Hedw.) Brid.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Dichodontium pellucidum (Hedw.) Schimp.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Dicranoweisia crispula (Hedw.) Lindb. ex Milde	1	.	.	.	.	.	.	.	1	.	.	.	.	.	3
Dicranum angustum Lindb.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Dicranum elongatum Schleich. ex Schwaegr.	.	.	1	1	.	.	.	.	.	.	.	.	1	.	1
Dicranum groenlandicum Brid.	1	.	.	.	.	1	.	.	1	.	.	.	.	.	1
Dicranum scoparium Hedw.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Distichium sp.	1	2	1	1	.	1	3	.	.	1	2	.	.	1	13
Distichium capillaceum (Hedw.) B.S.G.	2	1	.	.	.	.	.	.	.	1	1	1	.	.	8
Distichium hagenii Ryan ex Philib.		.	.	.	.	.	.	.	.	.	.	.	.	.	1

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
Distichium inclinatum (Hedw.) B.S.G.	1	.	1	.	.	.	1	.	.	.	.	.	.	.	3
Ditrichum flexicaule (Schwaegr.) Hampe	1	.	.	.	.	.	2	.	1	1	.	.	.	1	9
Drepanocladus aduncus (Hedw.) Warnst.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
Drepanocladus badius (C.J. Hartm.) Roth.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	2
Drepanocladus brevifolius (Lindb.) Warnst.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3
Drepanocladus exannulatus (B.S.G.) Warnst.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Drepanocladus revolvens (Sw.) Warnst.	1	.	.	.	.	.	2	.	1	3	1	1	.	3	6
Drepanocladus uncinatus (Hedw.) Warnst.	.	2	2	3	.	3	1	.	2	.	.	.	2	.	1
Drepanocladus vernicosus (Lindb. ex C. Hartm.) Warnst.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
Encalypta alpina Sm.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	4
Encalypta procera Bruch	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2
Encalypta rhaptocarpa Schwaegr.	2	2	1	1	.	.	.	.	.	1	.	2	.	.	5
Encalypta vulgaris Hedw.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
Fissidens adianthoides Hedw.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Fissidens arcticus Bryhn	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Grimmia torquata Hornsh. ex Grev.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gymnostomum recurvirostrum Hedw.	.	1	1	.	.	.	.	.	.	2	.	1	.	1	4
Hygrohypnum alpestre (Hedw.) Loeske	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Hygrohypnum luridum (Hedw.) Jenn.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
Hygrohynum polare (Lindb.) Loeske	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
Hypnum bambergeri Schimp.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	4
Hypnum cupressiforme Hedw.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Hypnum recurvatum (Lindb. and H. Arnell) Kindb.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum revolutum (Mitt.) Lindb.	2	1	.	1	.	.	1	.	1	.	.	1	.	.	9
Hypnum vaucheri Lesq.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
Isopterygium pulchellum (Hedw.) Jaeg. and Sauerb.	.	1	.	1	.	.	.	.	.	1	.	.	.	.	3
Kiaeria glacialis (Berggr.) Hag.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leptobryum pyriforme (Hedw.) Wils.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Meesia triquetra (Richt.) Aongstr.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
Myurella julacea (Schwaegr.) B.S.G.	.	1	.	.	.	.	.	.	.	2	.	.	.	.	6
Myurella tenerrima (Brid.) Lindb.	1	2	.	.	.	.	.	.	1	.	1	.	.	.	1
Oncophorus wahlenbergii Brid.	1	.	.	1	.	.	.	.	1	.	.	.	.	.	.
Orthothecium chryseum (Schwaegr. ex Schultes) B.S.G.	.	.	2	.	.	3	2	.	1	3	2	.	.	2	9
Orthothecium rufescens (Brid.) B.S.G.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Orthothecium strictum Lor.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Orthotrichum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Orthotrichum pylaisii Brid.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Orthotrichum speciosum Nees ex Sturm.	1	.	.	1	.	.	.	.	.	1	.	2	.	.	4
Philonotis fontana (Hedw.) Brid.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Plagiomnium ellipticum (Brid.) Kop.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	3
Plagiomnium medium (B.S.G.) Kop.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Platydictya jungermannioides (Brid.) Crum	.	.	.	.	.	.	.	.	1	1	.	.	.	.	3

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
Pogonatum alpinum (Hedw.) Rohl	2	1	1	.	.	1	2	.	4	.	1	1	3	.	5
Pogonatum urnigerum (Hedw.) P. Beauv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Pohlia cruda (Hedw.) Lindb.	2	1	.	1	.	.	.	.	.	.	.	2	.	.	8
Pohlia nutans (Hedw.) Lindb.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Polytrichum juniperinum Hedw.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Racomitrium canescens (Hedw.) Brid.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Racomitrium heterostichum (Hedw.) Brid.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Racomitrium lanuginosum (Hedw.) Brid.	1	.	2	1	.	.	.	.	4	.	.	.	1	.	6
Rhizomnium andrewsianum (Steere) Kop.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Schistidium agassizii Sull. and Lesq.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Schistidium apocarpum (Hedw.) B.S.G.	1	.	.	.	.	1	.	.	1	.	.	1	.	.	5
Schistidium tenerum (Zett.) Nyh.	.	.	.	.	.	.	.	.	.	1	.	2	.	.	.
Scorpidium turgescens (T. Jens) Loeske	.	1	.	.	.	.	1	.	.	1	.	.	.	1	2

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
Seligeria polaris Berggr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Stegonia latifolia (Schwaegr. *ex* Schultes) Vent. *ex* Broth.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.
Tetraplodon mnioides (Hedw.) B.S.G.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	1
Timmia austriaca Hedw.	1	1	.	.	.	1	1	.	.	.	.	1	.	1	8
Timmia bavarica Hessl.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	3
Timmia norvegica Zett.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Timmia sibirica Lindb. and Arnell	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Tomenthypnum nitens (Hedw.) Loeske	1	.	.	.	.	.	.	.	.	1	1	.	.	.	.
Tortella arctica (H. Arnell) Crundw. and Nyh.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	3
Tortella fragilis (Drumm.) Limpr.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	3
Tortula mucronifolia Schwaegr.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	1
Tortula norvegica (Web.) Wahlenb. *ex* Limpr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Tortula ruralis (Hedw.) Gaert., Meyer and Scherb.	2	1	1	3	.	1	.	.	1	2	1	2	.	.	10

Lichens	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
<u>Alectoria</u> <u>nigricans</u> (Ach.) Nyl.	3	.	2	.	.	.	1	.	1	.	.	.	3	.	1
<u>Alectoria</u> <u>ochroleuca</u> (Hoffm.) Mass.	1	.	1	1	.	.	.	.	1	.	.	.	1	.	1
<u>Bryoria</u> <u>chalybeiformis</u> (L.) Brodo & Hawksw.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
<u>Buellia</u> <u>elegans</u> Poelt	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Buellia</u> <u>epigea</u> (Pers.) Tuck.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<u>Buellia</u> <u>papillata</u> (Somm.) Tuck.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
<u>Caloplaca</u> <u>cirrochroa</u> (Ach.) Th. Fr.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
<u>Caloplaca</u> <u>jungermanniae</u> (Vahl) Th. Fr.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Caloplaca</u> <u>stillicidiorum</u> (Vahl) Lynge	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Caloplaca</u> <u>tiroliensis</u> Zahlbr.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
<u>Candelariella</u> <u>terrigena</u> Ras	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Cetraria</u> <u>nivalis</u> (L.) Ach.	1	.	2	.	.	.	.	.	2	.	.	.	.	.	1
<u>Cladonia</u> <u>coccifera</u> (L.) Willd.															
<u>Cladonia</u> <u>ecmocyna</u> (Ach.) Nyl.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
<u>Cladonia</u> <u>pyxidata</u> (L.) Hoffm.	1	1	.	.	.	.	.	.	.	.	1	.	.		2
<u>Cornicularia</u> <u>aculeata</u> (Schreb.)	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<u>Dactylina</u> <u>arctica</u> (Hook.) Nyl.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
<u>Dactylina</u> <u>ramulosa</u> (Hook.) Tuck.	1	.	2	.	.	2	.	.	.	.	1	.	.	.	1
<u>Fulgensia</u> <u>bracteata</u> (Hoffm.) Ras.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	1
<u>Lecanora</u> <u>behringii</u> Nyl.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Lecanora</u> <u>epibryon</u> (Ach.) Ach.	.	.	1	.	.	.	.	.	.	.	1	.	.	.	2
<u>Omphalodiscus</u> <u>decussatus</u> (Vill.) Schol.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	1
<u>Peltigera</u> <u>canina</u> (L.) Willd.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<u>Peltigera</u> <u>leucophlebia</u> (Nyl.) Gyeln.	.	.	.	.	.	2,	1	.	1	.	1	.	.	.	.
<u>Pertusaria</u> <u>coriacea</u> (Th. Fr.) Th. Fr.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	8
<u>Pertusaria</u> <u>dactylina</u> (Ach.) Nyl.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<u>Physconia</u> <u>muscigena</u> (Ach.) Poelt	3	.	1	1	.	.	.	.	.	1	1	.	.	.	2
<u>Protoblastenia</u> <u>rupestris</u> (Scop.) Stein.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
<u>Pseudephebe</u> <u>minuscula</u> (Nyl.) Brodo & Hawksw.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	1

	L	B1	B2	B3	B	T1	T2	T	H	C	E	N	S	M	R
<u>Psora</u> <u>rubiformis</u> (Wahlenb. <u>ex</u> Ach.) Wahl.															
<u>Rhizocarpum</u> <u>geographicum</u> (L.) DC.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	3
<u>Rhizocarpmun</u> <u>superficiale</u> (Schaer.) Vain.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.
<u>Rinodina</u> <u>roscida</u> (Somm.) Arn.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2
<u>Rinodina</u> <u>turfacea</u> (Wahlenb.) Korb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<u>Stereocaulon</u> <u>botryosum</u> Ach. <u>em</u> Frey	1	.	.	.	.	.	.	.	.	.	.	.	1	.	2
<u>Stereocaulon</u> <u>rivulorum</u> Magn.	1	.	1	.	.	3	1	.	.	.	.	.	.	.	.
<u>Thamnolia</u> <u>subuliformis</u> (Ehrh.) W. Culb.	2	1	1	2	.	3	1	.	4	.	.	.	1	.	7
<u>Toninia</u> sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<u>Umbilicaria</u> <u>arctica</u> (Ach.) Nyl.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Umbilicaria</u> <u>cylindrica</u> (L.) Del.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	2
<u>Umbilicaria</u> <u>hyperborea</u> (Ach.) Hoffm.	3	.	1	.	.	.	.	.	.	.	.	.	.	.	.
<u>Umbilicaria</u> <u>torrefacta</u> (Lightf.) Schrad.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Xanthoria</u> <u>candelaria</u> (L.) Arn.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<u>Xanthoria</u> <u>elegans</u> (Link.) Th. Fr.	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.

APPENDIX C

Annotations for selected species.

Mosses

Amblystegium serpens (Hedw.) B.S.G. 997. This weed species, reported from every other part of Canada, is reported here for the first time from the Arctic Archipelago. It has probably been overlooked, due its small size. It was found growing with Gymnostomum recurvirostrum, Brachythecium turgidum, and Myurella julacea amidst clumps of Melandrium apetalum in a creek on a south-facing raised sand beach.

Bryum aeneum Blytt ex B.S.G. 79-28-5B, 80-033. Mitten's (1878) report of this species, from the winter quarters of H.M.S. "Discovery" (Discovery Harbour, northern Ellesmere Island) was questioned by Brassard (1971), but the species was subsequently found on the Carey Islands (Brassard and Blake 1978). It was reported by Kuc (1970a) from Meighen Island. At Cape Herschel it was found on wet cliffs and rocks.

Bryum tortifolium Funck ex Brid. 79-31-13. Bryhn (1906-1907) reported this species [as B. cyclophyllum (Schwaegr.) B.S.G.] from four localities in the Hayes Sound region. Brassard (1971) questioned the record, suggesting that the plants were probably B. cryophilum. The plant at Cape Herschel grew on the banks of a creek which drains a fennish moss meadow.

Bryum turbinatum (Hedw.) Turn. 1007. This was reported by Steere (1947) from Igloolik, Pangnirtung, and Southampton Island, in the Low Arctic. At Cape Herschel it grew on wet seepy gravel.

Calliergon cordifolium (Hedw.) Kindb. 79-30-6, 79-32-3. Brassard (1971) listed this species as present in the southwestern portion of the Queen Elizabeth Islands. Both specimens at Cape Herschel were collected from moss meadows with subsurface runoff.

Cratoneuron commutatum (Hedw.) Roth. 79-32-2B. Not listed as occurring in the Arctic Archipelago by Ireland et al. (1980), this species was collected by Kuc (1973b) in uplands at Purchase Bay on Melville Island. At Cape Herschel it was found in a fen-like moss meadow mixed with Cinclidium arcticum and Meesia triquetra.

Dicranum angustum Lindb. 80-185. This species was reported from the southwest Queen Elizabeth Islands, by Brassard (1971), as D. laevidens, and from Devon Island by Vitt (1975). At Cape Herschel it was found on the tops and sides of frost hummocks, dominated by Poa glauca, Luzula confusa, and Potentilla hyparctica.

Hygrohypnum alpestre (Hedw.) Loeske 79-33-5B Steere (Schuster et al. 1959) reported this species from northern Ellesmere Island, but the record was questioned by Brassard (1971). Kuc (1969) found it on Axel Heiberg Island. The only other known locality in the Arctic Archipelago is southern Baffin Island (Brassard, Fife and Webber 1979.)

Hypnum recurvatum (Lindb. and H. Arnell) Kindb. 80-017. Steere (1947) reported this species from Craig Harbour.

Kiaeria glacialis (Berggr.) Hag. 79-5-11, 80-163. This species has been collected on southern Baffin Island, and is widespread in Greenland (Brassard et al. 1979).

Orthotrichum pylaisii Brid. 80-242. In the Arctic Archipelago this species is known from Baffin Island (Vitt 1973), and from Truelove Lowland on Devon Island (Vitt 1975). At Cape Herschel it was found on a dry granite ledge.

Plagiomnium ellipticum (Brid.) Kop. 953, 982, 1031, 79-22-7. Ireland et al. (1980) indicate literature reports only, for this species in the Arctic Archipelago. It appears, however to be quite widespread, reported under the synonym Mnium rugicum Laur. from both northern and southern Baffin Island (Brassard et al. 1979), and from Melville Island (Kuc 1973b). Koponen (1971) reported it from the Fosheim Peninsula on Ellesmere Island, from Cornwallis Island, from Lake Harbour on Baffin Island and from Southampton Island. Vitt (1975) reports it as an uncommon element of wet meadows and shores on Devon Island. The plants at Cape Herschel grew mostly in seepy situations.

Racomitrium heterostichum (Hedw.) Brid. 889, 975, 79-19-10, 79-22-4C, 79-27-1B. At Cape Herschel this grew commonly on loose gravel on granite outcrops and cliffs. According to Ireland et al. (1980), it has been reported in the literature from the Arctic Archipelago. It is common throughout Labrador (Brassard and Weber 1978.)

Rhizomnium andrewsianum (Steere) Kop. 953. Kuc (1970a, 1973b) reported this species from Fitzwilliam Owen Island and from Melville Island. Koponen (1977) mapped it as also present on Cornwallis Island, on northern and southern Baffin Island. At Cape Herschel it grew with Plagiomnium ellipticum and Arnellia fennica in a small patch of sedge-moss meadow.

Schistidium agassizii Sull. and Lesq. 80-881B In the Canadian Arctic this species has been reported from Melville Island (Kuc 1973b), from southern Baffin Island (Brassard et al. 1979), and from northern Labrador (Brassard and Weber 1978.) The northernmost record in Greenland is from Disko Island (Bremer 1980.) At Cape Herschel it grew on rocks in a creek at the bottom of a deep south-facing valley.

Lichens

Buellia elegans Poelt 796. This species was recently separated by Poelt (Poelt and Sulzer 1974) from the B. epigaea species group. Thomson (1982) suggests that all B. epigaea previously reported for North America is in fact B. elegans, and that his published map for B. epigaea (Thomson 1972) is in fact that of the North American range of B. elegans. Schuster's collection of B. epigea from Alert (Schuster et al. 1959) is the only other record from Ellesmere Island.

Caloplaca jungermanniae (Vahl) Th. Fr. 79-5-11. The last reports of this species occurring on Ellesmere Island were by Fries (1879) who reported it from Cape Union, Floeberg Beach, Discovery Bay, and Cape Sabine. Barrett and Thomson (1975) found it on Devon Island.

Candelariella terrigena Ras 857. This species has been reported from Devon Island (Barrett and Thomson 1975), from Axel Heiberg Island (Thomson and Scotter 1985) and from Somerset Island (McCartney 1978).

Cladonia ecmocyna (Ach.) Nyl. 80-297. Thomson (1984) shows this species on Axel Heiberg Island and Eglington Island. Previous collections of this plant from the Canadian eastern Arctic appear to be from south of the Arctic Archipelago. It has been reported from Leonard Island, Hobewan Sound; and from Christopher (Shell) Lake (Evans 1952); from many localities in Labrador (Lynge 1947), and from Churchill Manitoba (Thomson 1953). Hansen (1962, 1971) reported it as being common especially in oceanic regions of central west and southwest Greenland, although almost absent from more continental regions.

Peltigera leucophebia (Nyl.) Gyeln. 804, 805, 860. This species is considered by some (Thomson 1979) to be a variety of Peltigera apthosa. Lynge (1937) considered it a good species and called it "the commonest Pelt. apthosa in the Arctic." While having lumped much of Polunin's material into P. apthosa before returning it Lynge (1947) suspected that both it and the material collected by Lennert and Greely from Grinnell Land was actually P. leucophlebia. The P. leucophlebia he determined from Polunin's Baffin material was later redetermined by Thomson as P. apthosa var. variolosa (Hale 1954). Thomson (1984) shows it present at Alert and at Dundas Harbour.

Protoblastenia rupestris (Scop.) Stein. 79-17-31 Previously reported from Grant Land (Fries 1879) and from Devon Island (Barrett and Thomson 1975).

Stereocaulon botryosum Ach. em. Frey 813, 817. This species was reported from

Ellesmere Island by Fries (1879) from Alexandra Haven, as Stereocaulon evolutum b. fastigiatum. Thomson (1984) shows it in the Yelverton Bay region of northwest Ellesmere Island. It is also known from Devon Island (Barrett and Thomson 1975), and from western and southwestern Greenland (Hansen 1962, Brodo and Alstrup 1981).

Umbilicaria torrefacta (Lightf.) Schrad. 79-13-19. Apparently common throughout Greenland except in the central west and sothwestern regions (Hansen 1962), this species has been reported from Dundas (Hansen 1980) and from Disko (Lynge 1937, Brodo and Alstrup 1981). The only record for Ellesmere Island appears to be Fries record from Alexandra Haven (Lynge 1947). Thomson (1984) shows it present at Truelove Lowland.

Appendix D

Site indices derived from direct gradient analysis.

Site	Moisture	Snowcover	Substrate
L – Lichen outcrop			
75	200.0	266.7	266.7
76	200.0	300.0	100.0
77	300.0	100.0	100.0
78	100.0	300.0	300.0
79	275.0	266.7	375.0
80	250.0	250.0	350.0
B1 – Moss Barrens			
52	300.0	300.0	366.7
53	200.0	300.0	300.0
54	350.0	333.3	300.0
55	300.0	300.0	500.0
B2 – Cushion Plant Barrens			
(a) 58	237.5	228.6	314.3
59	175.0	140.0	228.6
63	242.9	175.0	250.0
65	200.0	180.0	257.1
71	200.0	237.0	277.8
(b) 61	246.2	244.4	336.4
62	223.1	200.0	222.2
64	263.6	216.7	314.3
69	316.7	280.0	390.9
73	314.4	258.3	407.7
B3 – Dwarf Shrub Barrens			
50	271.4	300.0	340.0
51	245.5	287.5	312.5
60	235.3	275.0	300.0
67	240.0	300.0	281.8
72	300.0	283.3	433.3

T1 - Graminoid - Cushion Plant Tundra

42	292.3	326.7	370.6
46	283.3	307.7	371.4
49	257.1	276.9	294.1

T2 - Dwarf Shrub Tundra

37	315.4	307.7	430.8
38	350.0	325.0	450.0
39	290.0	260.0	400.0
40	305.6	282.4	418.8
41	300.0	288.9	381.8
43	355.6	314.3	462.5
45	357.1	308.3	441.7

H - Heath

28	252.9	233.3	266.7
29	241.7	266.7	245.5
30	233.3	285.0	273.9
31	236.0	277.8	228.0
32	261.1	291.7	205.6
33	226.3	263.6	229.4
34	238.5	290.0	261.5
35	240.0	325.0	300.0

C - Sedge Meadow

12	455.6	300.0	500.0
13	373.3	285.7	406.7
14	400.0	300.0	500.0
15	440.0	313.3	500.0
16	350.0	320.0	388.9
17	425.0	326.7	480.0

E - Cottongrass Meadow

5	442.9	335.3	452.9
6	463.6	353.8	469.2
7	388.9	360.0	500.0
8	386.7	337.5	426.3
9	389.5	343.5	400.0
10	480.0	355.6	500.0
11	313.3	337.5	340.0
18	376.5	306.7	425.0

N - Eutrophic Meadow			
26	381.8	327.3	450.0
27	376.9	316.7	391.7
S - Steppe			
19	275.0	257.9	331.6
20	261.5	244.4	250.0
21	231.6	207.7	241.2
22	238.9	200.0	245.5
23	260.0	277.8	290.9
24	283.3	250.0	320.0
25	241.7	244.4	255.0
M - Marsh			
1	400.0	366.7	500.0
2	466.7	333.3	450.0
3	460.0	350.0	500.0