THE VEGETATION AND FLORA OF AUYUITTUQ NATIONAL PARK RESERVE, BAFFIN ISLAND

JAMES E. HINES

AND

STEVE MOORE

DEPARTMENT OF RENEWABLE RESOURCES

GOVERNMENT OF THE NORTHWEST TERRITORIES

YELLOWKNIFE, NORTHWEST TERRITORIES, X1A 2L9

1988

A project completed under contract to Environment Canada, Canadian Parks Service, Prairie and Northern Region, Winnipeg, Manitoba.

Northwest Territories Renewable Resources

File Report No. 74

ABSTRACT

The purposes of this investigation were to describe the flora and major types of plant communities present in Auyuittuq National Park Reserve, Baffin Island, and to evaluate factors influencing the distribution of the local vegetation. Six major types of plant communities were recognized based on detailed descriptions of the physical environment, flora, and ground cover of shrubs, herbs, bryophytes, and lichens at 100 sites. Three highly interrelated variables (elevation, soil moisture, and texture of surficial deposits) seemed to be important in determining the distribution and abundance of plant communities. Continuous vegetation developed mainly at low elevations on mesic to wet, fine-textured deposits.

Wet tundra, characterized by abundant cover of shrubs, grasses, sedges, and forbs, occurred most frequently on wet, fine-textured marine and fluvial sediments. Dwarf shrub-graminoid communities were comprised of abundant shrubs, grasses, sedges and forbs and were found most frequently below elevations of 400 m on mesic till or colluvial deposits. Dwarf shrub communities were characterized by abundant dwarf shrub and lichen cover. They developed at similar elevations and on similar types of surficial deposits as dwarf-shrub graminoid communities. On average, the soil texture appeared to be somewhat coarser and the moisture conditions drier than in the dwarf shrub-graminoid communities.

High elevation barrens prevailed under a broad range of moisture regimes and on a variety of surficial deposits at elevations 600 m or more above sea level. Lichens were dominant at high elevations whereas the cover of vascular plants was sparse and relatively low in diversity. Early successional communities (which, if left undisturbed, would eventually support wet tundra, dwarf shrub-graminoid, or dwarf shrub communities) had a sparse cover of herbaceous plants and little shrub, moss, or lichen cover. Seashore communities featured a sparse cover of salt-tolerant herbs.

Lists of the 93 species of vascular plants, 61 bryophytes, and 70 lichens collected in the Park are provided. The list of vascular species is annotated with regard to the relative abundance, environmental preferences, and geographic distribution of each species. The general distribution of continuous plant cover and local variations in the diversity of vascular plants are discussed.

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INTRODUCTION

This report summarizes botanical investigations undertaken as part of a natural resource inventory of Auyuittuq National Park Reserve, Baffin Island, in 1986 and 1987. It is intended to provide background information that can be used in interpretive programs and the conservation and management of plant communities and wildlife habitat in the Park. Major objectives are to describe the plant communities present, analyze the effects of various environmental factors on the distribution and abundance of vegetation, and provide an annotated listing of the vascular flora. In addition, checklists of bryophyte and lichen floras are provided and some areas of possible botanical significance are identified.

Previous Studies

The history of botanical collecting in the Canadian Arctic Archipelago has been summarized by Polunin (1940), Baird and Robinson (1945), Porsild (1957), Porsild and Cody (1980), Soper and Powell (1985), and others. Cumberland Peninsula, on which Auyuittuq National Park Reserve is located, has been the site of several previous botanical studies of varying intensity and thoroughness. From 1934 to 1936, N.A. Polunin (1940, 1947, 1948) accompanied the Canadian Eastern Arctic patrol ship and described the flora and vegetation in the vicinity of several settlements, including Pangnirtung (located about 25 km south of the present Park). In 1953, the Penny Highlands of Cumberland Peninsula were the focus of the second Baird Expedition, organized by the Arctic Institute, to collect information in a variety of scientific disciplines. Accompanying the expedition was F.H. Schwarzenbach, a Swiss botanist from the University of Zurich. His undated report, translated into English in 1975, provides a wealth of information on the vascular plants of the area and the effects of environmental factors, such as elevation, on plant distribution.

To our knowledge, little or no botanical research was conducted on Cumberland Peninsula in the 1960s, but with the designation of Auyuittuq as a national park reserve in 1972, natural resource studies in the area received a new impetus. Elliott (1973) conducted a reconnaissance-level survey of the new park, and provided a very general description of the plant communities present and useful information on the distribution of vegetation. Lafarge-England (1975) investigated the botany of the Maktak Fiord-Broughton Island area in an attempt to test the hypothesis that a refugium, where plants survived the Wisconsin glaciation, existed locally. Her work contributed detailed information on the distribution of bryophytes as well as more general information on the vascular and lichen floras of the area. As part of a biophysical inventory of Pangnirtung Pass, Blouin et al. (1975) provided phytosociological descriptions of plant communities and detailed species lists. Later, Paradis et al. (1986) made a small reference collection of vascular plants, bryophytes, and lichens while conducting an ecological land classification of the entire park.

The preceding information indicates that data on floristics (i.e., species lists) are good for vascular plants although somewhat limited by the geographic coverage of most studies. In contrast, the lichen and moss floras and the plant communities of the park are less well known. Previous classifications of plant communities in or near Auyuittuq have limited practical application because they are: (1) unsynthesized, recognizing too many community types to be of practical value (i.e., Blouin et al. 1975); (2) too general and overly simplistic, providing little detail about the vegetation in a certain area (i.e., Elliott 1973); (3) applicable only to a limited geographical area (i.e., Schwarzenbach, no date); and (4) based on limited field work and highly synthetic classes containing groups of ecologically unrelated species (Paradis et al. 1986). Thus, there remains a need for a useful description and classification of plant communities of the park. In this report, we attempt to classify the vegetation of the park in a simple manner using characteristics that can be readily recognized by users. The classification is intended for application in future ecological, wildlife management, and remote sensing studies of the park.

THE STUDY AREA: AUYUITTUQ NATIONAL PARK RESERVE

Auyuittuq National Park Reserve is located on the Cumberland Peninsula of Baffin Island (Figure 1). It lies mainly above the Arctic Circle and is characterized by a harsh arctic climate, a rugged mountainous landscape, long steep-walled valleys and fiords, and extensive icefields. The area has been heavily glaciated and the terrain has been shaped by continental ice sheets, local ice caps, and valley glacier complexes. Bordered on the northeast by Davis Strait, the park includes within its boundaries 800 km of coastal shoreline and 1,157 km^2 of salt water (Welch 1984). The massive Penny Ice Cap and numerous smaller ice caps and glaciers cover about 40% of the 21,470 km^2 park. This preponderance of ice has given rise to the Inuit name for the area - Auyuittuq - which literally means "the land that does not melt".

Because it contains significant geological features and is representative of the Davis Natural Region, part of Cumberland Peninsula was set aside for a national park on 22 February 1972 through an Order-in-Council (P.C. 1972-299). The area was originally designated "Baffin Island National Park" but was given the name Auyuittuq in 1974, after consultation with the local communities of Pangnirtung and Broughton Island. Auyuittuq is managed according to the National Parks Act, although its official designation is a

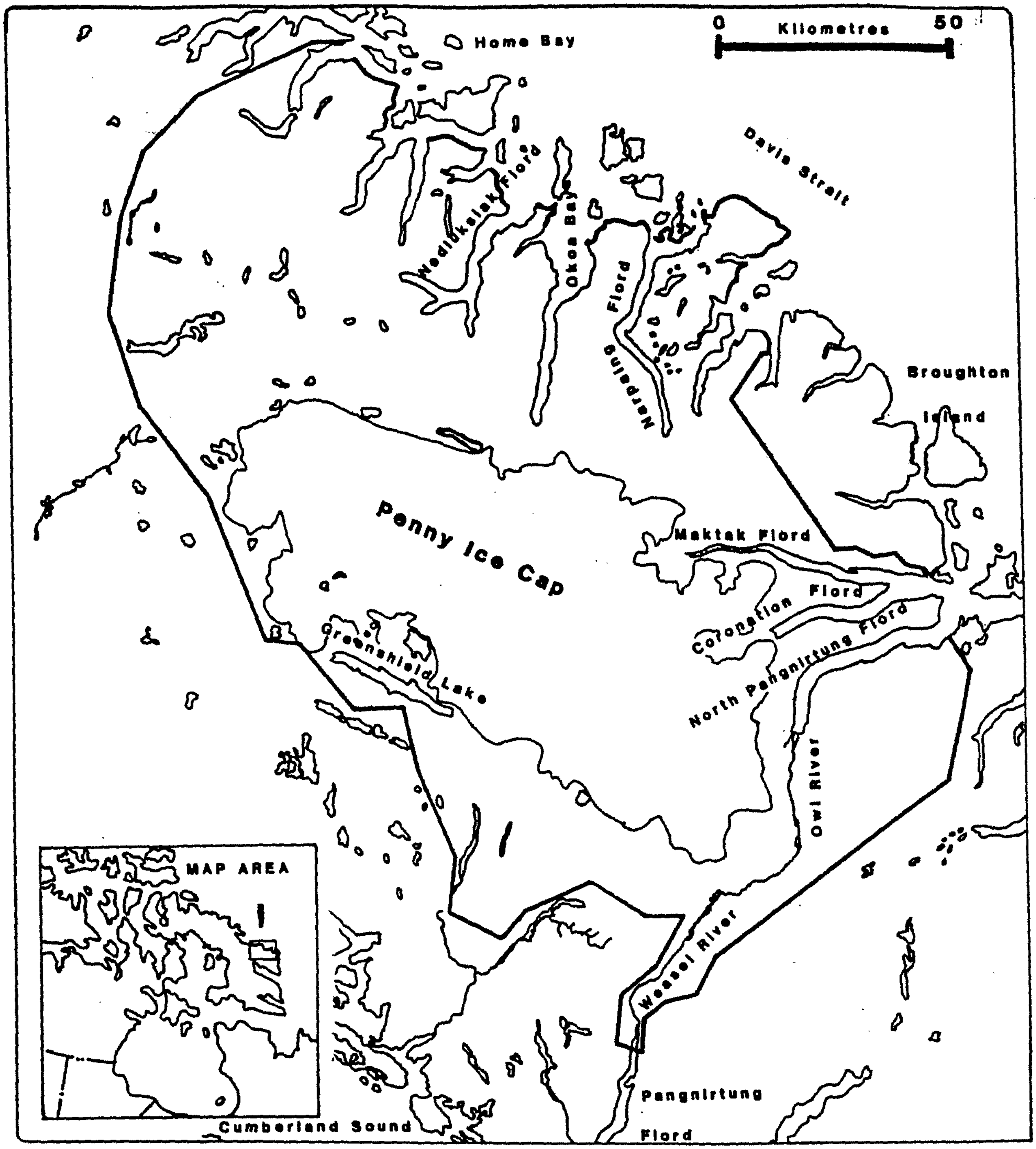

Figure 1. The location of Auyuittuq National Park Reserve.

"national park reserve". It will remain a national park reserve until Inuit land claims have been settled (Welch 1984).

Climate

The climate of Cumberland Peninsula is relatively harsh and unpredictable (Yorke 1972, Masterton and Findlay 1976, Seidel 1987) and is typified by: (1) a high incidence of cyclone or low-pressure activity; (2) the highest rates of precipitation for the arctic islands; (3) the formation of new ice cover on the ocean during most years; and (4) variable weather patterns. The local weather is greatly influenced by the mountainous nature of the local terrain, which scatters storm systems, causes cloud formation and precipitation, and channels and intensifies existing winds. The existence of nearby ice fields causes temperature inversions and strengthens down-slope, valley, and fiord winds. The ocean acts as "a heat sink" and has a cooling effect on nearby areas in summer and a warming influence during winter. Formation of clouds and fog is frequent in coastal areas during summer. Great variations in temperature occur seasonally and locally. Seidel (1987) reviewed data for 5 weather stations in the vicinity of Auyuittuq and reported that the mean daily temperature for these stations averaged above freezing only during June (0.5^{o} C), July (5.3^{o}), and

August (4.5°) (Figure 2). The growing season, defined as the period between the last 5 consecutive days in spring with mean daily temperatures less than 5° and the first five such days in autumn (Masterton and Findlay 1976:13), is short averaging only 20 days at Broughton Island (located 20 km from the park) and 46 days at Dewar Lakes (about 150 km northwest). Temperatures average -21.6° C for the November -April period and are generally lowest in January, February, and March.

About 3/4 of the annual precipitation (ca. 30 cm) occurs as snowfall, although this varies greatly depending on elevation and geographic location (Seidel 1987). Snow may fall during any month, with October and November having particularly high snowfall (Figure 3). Peak rainfall occurs in July and August. Because of the local diversity in topography, exposure, and proximity to modifying influences such as the Penny Ice Cap and the ocean, the climate varies with location.

Physiography and Geology

Auyuittuq National Park Reserve is part of the Davis Region of the Canadian Shield (Bostock 1970). Two physiographic divisions exist within the Davis Region, the Davis Highlands and the Baffin Upland. The Davis Highlands, which cover much of the park, are an "elevated belt of deeply

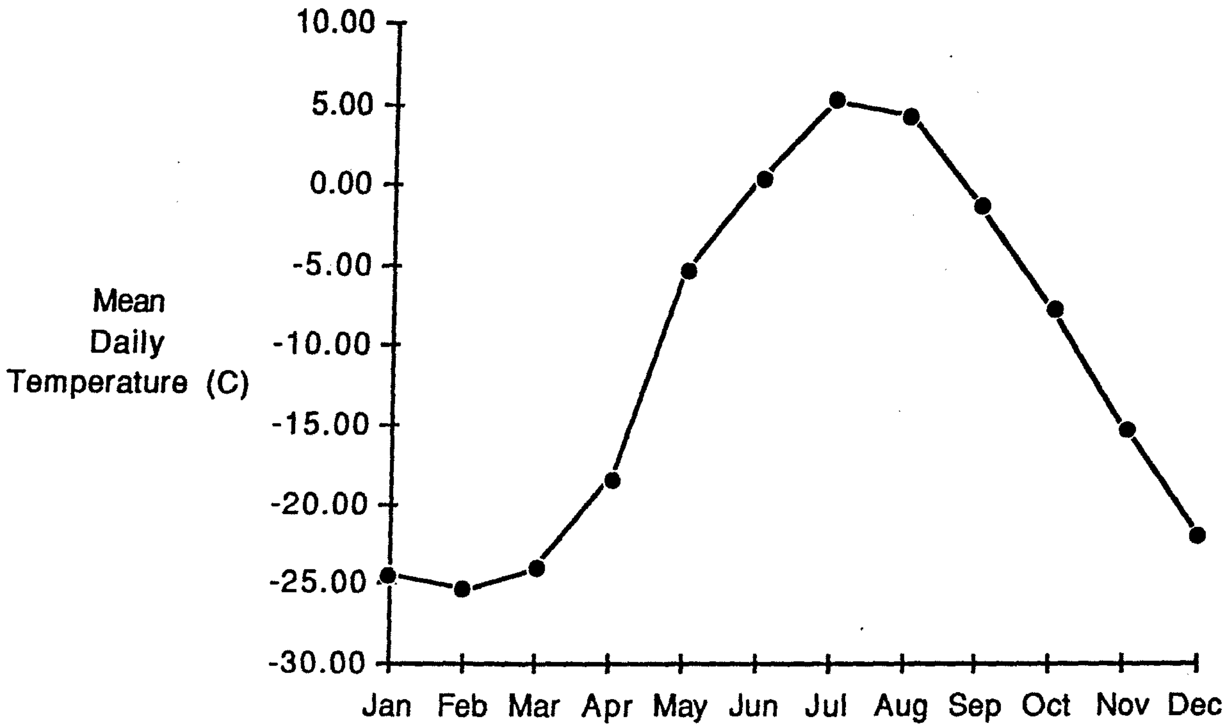

Figure 2. Mean daily temperatures for 5 weather stations in the vicinity of Auyuittuq National Park Reserve.

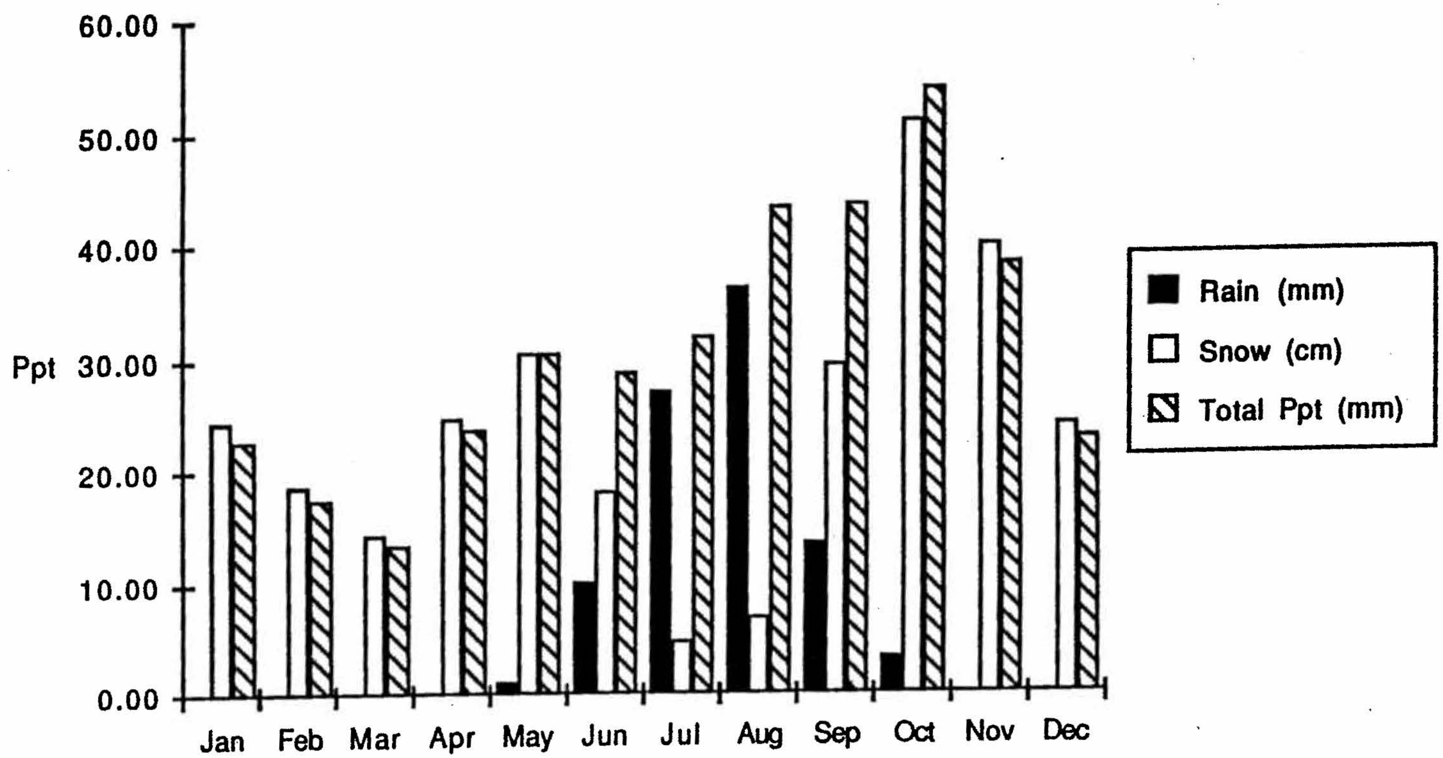

Figure 3. Monthly rainfall, snowfall and total precipitation for 5 weather stations in the vicinity of Auyuittuq National Park Reserve.

dissected crystalline rocks" (Bostock 1970:14). The Baffin Upland is lower in elevation and relief than the Davis Highlands. It occupies only a small part of the park west of the Penny Ice Cap. Elevations within the park boundary range from sea level to about 2100 m on the Penny Ice Cap. Permanent ice forms above 1200 m near the ice cap, but at somewhat lower elevations near the coast (Andrews and Miller 1972). Our measurements of biophysical maps indicate that approximately 4% of the park occurs between sea level and 250 m elevation, 15% between 250 and 500 m, 15% between 500 and 750 m, 25% between 750 and 1000 m, and 40% above 1000 m. Thus, much of the total park area is at high elevation where climatic conditions are not suitable for plant growth.

The complex geological history of the Cumberland Peninsula has been discussed in detail by Andrews and Dyke (1974), Miller and Bradley (1976), Dyke et al. (1982), and others (see Andrews and Andrews [1980] for other pertinent references). The present day landscape is largely the product of erosional and depositional processes involving continental ice sheets, local ice caps, and alpine glacier complexes (Dyke et al. 1982). Based on the distribution of major types of glacial-erosional landforms (broad summits, horns, aretes, glacierized and non-glacierized cirques, and U-shaped troughs and fiords), Dyke et al. (1982) recognized 5 major physiographic elements in the area which reflect a gradual erosion of previously existing surfaces. Four of these elements - plateau, dissected plateau, scalloped dissected plateau, and fretted mountains - are found in the park.

Plateau refers to a gently rolling area of relatively low relief lacking large distinct summits. In the park, plateau underlies much of the Penny Ice Cap and predominates southwest of the ice cap. Plateau areas consisting of broad, rounded summits separated by large U-shaped troughs and fiords are termed **dissected plateau.** This physiographic unit is characteristic of the coastal areas. Small ice caps are found on several summits in this area. The term **scalloped dissected plateau** applies to areas of dissected plateau which have been further eroded by cirque glaciers. Despite the erosion by cirque glaciers, the mountain tops still take on the form of rounded domes. The land underlying the eastern portion of the Penny Ice Cap and much of the area north and northeast of the ice cap is scalloped dissected plateau. **Fretted mountains** have been so eroded by cirque glaciers that cols (sharp-edged gaps), horns (pyramidal peaks), and arretes (sharpened crests) are formed. The rugged mountains surrounding the southern half of Pangnirtung Pass are typical fretted mountains (Dyke et al. 1982).

Excluding ice, which covers about 40% of the park, Paradis et al. (1986) recognized 8 major types of surficial deposits that could potentially support plant growth: bedrock, colluvium, bedrock-colluvium, till, fluvium, lacustrine, marine, and eolian deposits. These deposits, which represent potentially different environments for plant growth, are described in greater detail below. Maps showing the general distribution of surficial deposits are presented by Dyke et al. (1982).

Precambrian bedrock is comprised of granitic gneiss and is frequently covered by a thin layer of weathered bedrock or till. Thus, included in this category by Paradis et al. (1986) were deposits recognized as residuum by Dyke et al. (1982) because of the accumulation of rock debris. Bedrock, which covers about 18% of the park area, mainly occurs at higher elevations. Because of its coarse texture, bedrock usually discourages plant growth.

Colluvium or scree is material loosened by frost action and transported downhill by gravity. Such deposits are concentrated in areas of steep slope and generally extend 50 to 100 m up the walls of most fiords and valleys (Dyke et al. 1982). Colluvium consists of large boulders with a matrix of smaller fragments and sand. In many parts of Pangnirtung Pass and other areas close to a good source of fluvial deposits, much fine-textured sand has been wind-deposited amongst the scree. In areas where fine-textured materials are abundant and moisture conditions are adequate, a favourable environment for plant growth develops.

Bedrock-colluvium is a complex of steep bedrock cliffs and scree which is difficult to map separately as bedrock or colluvium. It covers only a small part of the park (1%), mostly along fiords and major valleys. Because of its coarse texture, bedrock-colluvium is a relatively hostile environment for plant growth.

Till, material deposited directly by glaciers, consists of rock fragments of a variety of sizes. The finer textured materials (matrix) are mainly sands and gravels and, to a lesser degree, clays (Dyke et al. 1982). Till sheets probably average about 1 or 2 m in thickness and their form is determined by the underlying rock. Thicker accumulations of till are termed moraines. In the park, moraines are usually sharp crested and less than 30 m in height (Dyke et al. 1982). Generally, till deposits consist of locally derived materials although occasional glacial erratics occur. Measurement of biophysical maps indicates that about 20% of the park is covered by till. Till supports a variety of plant communities with most abundant vegetation occurring under mesic to moist conditions at low elevation.

Fluvial deposits are sands and gravels transported and deposited by running water. Typically they occur in valleys receiving outwash from glaciers and near rivers draining glacial meltwaters. Although the area covered by fluvial deposits is small (about 1% of the park), such deposits are relatively low-lying, level, and located in wide valleys with good moisture conditions. Therefore, fluvium frequently supports continuous plant cover.

In Auyuittuq, lacustrine sediments were deposited in ice-dammed lakes, usually at higher elevations. With the subsequent melting of the ice, the water levels receded and the deposits were exposed. Lake sediments are fine-textured and form a thin layer on existing deposits. Lacustrine deposits cover only a small area of the park (<1%) and, because they are found mainly at high elevation, do not support a rich or varied flora.

On Cumberland Peninsula, marine deposits have been exposed where the earth's surface has risen above sea level. In areas where the ocean's currents were slow, fine-textured deposits were laid down. Coarser materials were deposited along shores subject to wave action. The most extensive marine deposits in the park occur on the Kivitoo Peninsula and smaller areas of marine deposits are associated with the mouths of some of the northern fiords. Marine deposits cover only 1% of the park, but these deposits are relatively level, fine-textured, and moist - a good environment for plant growth.

Eolian deposits, primarily sands or silts, have been carried and deposited by the wind. In Auyuittuq, eolian deposits are derived mainly from sand outwash in the valleys of some of the larger meltwater streams (most notably Pangnirtung Pass and the head of Maktak Fiord). Strong valley winds and the nature of the land surface play a significant role in the deposition of the sands

(McKenna-Neuman and Gilbert 1985, 1986). The map of Paradis et al. (1986) indicates that eolian deposits cover an exceedingly small percentage of the park (<0.01%) although many of the areas mapped as till and colluvium have been somewhat modified by wind-transported sediments. The amount of vegetation on eolian landforms is frequently limited by aridity and the abrasiveness of the drifting sands.

Soils

The Canada Soil Survey Committee (1978:19) defines soil as "the naturally occurring, unconsolidated mineral or organic matter at least 10 cm thick that occurs at the earth's surface and is capable of supporting plant growth." Although the soils of the park are not well understood, it is evident that according to this definition much of the park is covered by non-soil. In general, arctic soils are shallow, youthful, and frequently lacking distinct genetic horizons (Bird 1967). They are strongly influenced by the presence of permafrost which impedes drainage, and often show evidence of cryoturbation ("frost-churning") which disrupts existing horizons. Nutrient levels in the park soils are undoubtedly poor, and the few pH measurements made by Bockheim (1975) and Evans and Cameron (1979) suggest that the soils of the Cumberland Peninsula vary from strongly acidic to neutral (with acidic soils being prevalent).

"The classification of Arctic soils is still in its infancy" (Evans and Cameron 1979) and such soils do not fit easily within many of the existing soil classification schemes. Perhaps the most widely used system for classifying Arctic soils is that of Tedrow (1977). According to this work, Auyuittuq falls in the zone of subpolar desert soils (Tedrow 1977:141) and based on descriptions of local soils by Bockheim (1975) and Terasmae (1975), we believe that at least 5 of Tedrow's major soil types exist in the park including: (1) polar desert soils characterized by gravelly pavement, high drainage, and sparse vegetation cover (mainly lichens); (2) arctic brown soils which form on well-drained till and colluvium and are typically vegetated by shrubs and herbaceous plants; (3) tundra soils which are wet, poorly drained soils developing on permafrost and supporting sedges (_Carex_ spp.), cotton-grasses (_Eriophorum_ spp.), and other moisture-loving plants; (4) soils of hummocky ground; and (5) bog soils which develop in wet areas and are characterized by an accumulation of peat.

According to the Canadian System of Soil Classification, the local soils fall into the Cryosolic Order because of the existence of permafrost within 1 m of the earth's surface. Two types of cryosols are present: static cryosols which are not influenced by frost-churning (cryoturbation), and turbic cryosols which are highly frost-churned. Evans and Cameron (1979) recognized 3 types of soils developing on morainal deposits near the park. The soils were termed Regosolic Static Cryosols, Orthic Static Cryosols, and Brunisolic Static Cryosols according to the Canadian System of classification.

Permafrost and Periglacial Phenomena

Auyuittuq is located in the zone of continuous permafrost that covers much of northern Canada. In this zone, the earth's surface remains frozen year-round with the exception of summer thawing of a thin "active layer". Under such conditions, frost action can bring about the formation of patterned ground (Bird 1967). Polygons, circles, and frost-churned soils lacking distinct horizons are typical products of frost action. In addition, evidence of solifluction, a slow downhill movement of wet soil on the permafrost, is frequently seen in places where the soil is saturated with water from melting snow patches.

METHODS

Field work was conducted from 10 July - 2 August 1986 and 18 - 24 July in 1987. It involved general reconnaissance of the park by helicopter (totalling about 35 hours of flight time spread over 10 days) and more intensive surveys on foot of the most accessible region of the park, the Weasel River Valley, over a 2-week period. Based on preliminary assessment of vegetation distribution from maps, Landsat images, and previous reports on the park, sites of potential botanical interest were identified.

At 48 sites in 1986 and 52 sites in 1987, detailed descriptions of the flora and environment were recorded. For each site, the following information was entered onto standardized forms: (1) location, (2) moisture regime, (3) topographic position, (4) origin and texture of the surficial deposits, (5) landform, (6) aspect, (7) estimated slope, (8) elevation, (9) soil texture and depth, (10) ground cover of 4 vegetation strata, (11) plant community type, and (12) plant species present.

Moisture regime was subjectively ranked as dry, dry-mesic, mesic, mesic-wet, wet, or very wet. Seven types of surficial deposits were recognized after Paradis et al. (1986): bedrock, colluvium, bedrock-colluvium, moraine, fluvium, lacustrine, marine, and eolian. For analysis of the effects of surficial deposits on vegetation abundance and diversity, the deposits were ranked according to texture (from fine [eolian] to coarse [bedrock]). Elevation was usually determined from 1:250,000 topographic maps, or in some instances from the altimeter of the helicopter. Ground cover for the entire site (which consisted of an area of relatively homogeneous vegetation and environment) was estimated to 1 of 7 classes (modified from Daubenmire (1959)): 0-1%, 1-5%, 5-25%, 25-50%, 50-75%, 75-95%, and 95-100%. The cover of 4 different vegetation strata (shrubs, herbs, bryophytes, and lichens) and combined cover of all strata were recorded. At each site we attempted to identify all vascular plants present and collected samples of unidentified plants. Because it was difficult to collect and transport large numbers of plants in the field, lichens and bryophytes were collected at about half of the sites.

Vascular plants, lichens, and bryophytes were dried, tentatively identified (in the case of vascular plants only), and sent to the National Museum of Canada (Ottawa, Ontario) for final identification. Most vascular plants were identified by A. Dugal and S. Aiken. The willows were identified by G. Argus, the lichens by P. Wong, and the bryophytes by R. Ireland. Specimens of special botanical interest were retained by the National Museum of Natural Sciences but most plants will be incorporated into collections of the NWT Department of Renewable Resources, Yellowknife, and Environment Canada - Parks, Pangnirtung.

Except where otherwise noted, scientific names of vascular plants follow Porsild and Cody (1980) or, for species not listed in the former reference, Porsild (1957). Nomenclature of lichens follows Thompson (1984) and that of bryophytes follows Ireland et al. (1980).

Our intent was to develop a simple classification of vegetation which could have general application in ecological, wildlife management, and remote sensing studies of the park. Ideally, such a classification should recognize only a few major classes and be easily applied by Parks Canada personnel with limited training in botany or only a basic knowledge of the local flora. Habitat structure (growth form of plants), extent of ground cover (abundance of vegetation), and aspects of the physical environment are major attributes used in selection of habitats by wildlife (e.g., Hildén 1965). These features are easily recognized by the non-botanist, and are types of factors most readily identified through remote sensing. Therefore, these criteria were used in developing the classification of plant communities.

The general distribution of continuous vegetation was mapped through visual interpretation of imagery acquired by multispectral scanner (MSS) sensors on Landsat satellites (Harvie et al. 1982).

RESULTS

Information on the locations, prevailing environmental conditions, and vegetation of the 100 sample sites is detailed in Appendix 1. The general distribution of continuous vegetation, as determined by visual interpretation of Landsat MSS imagery is indicated in Figure 4.

General Factors Influencing the Distribution and Diversity of Vegetation

A number of factors could potentially control the distribution of arctic vegetation including climate, moisture, and the nature of the surficial materials (Edlund 1982, 1983, 1986; Zoltai et al. 1983). To analyze the general factors controlling the distribution of vegetation in Auyuittuq National Park Reserve, we determined if the amount of shrub, herbaceous, bryophyte, and lichen cover was correlated with any of the important environmental variables for which we had good information (elevation, moisture, and soil texture). Because many of the data were ordinal in nature and probably not normally distributed, rank correlation procedures (Conover 1980) were used. Plant succession was apt to influence vegetation abundance and mask the effects of the other variables, so the analysis was

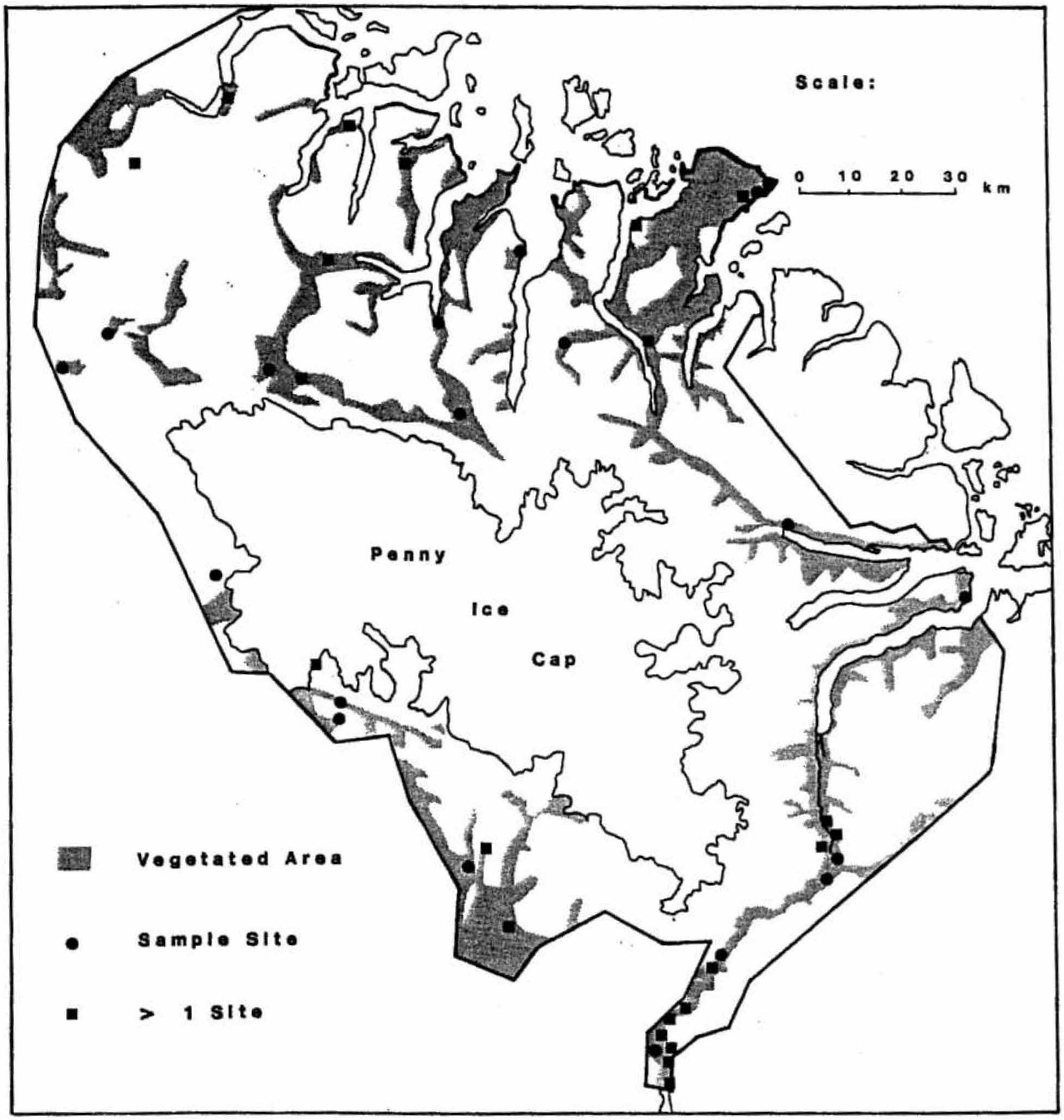

Figure 4. The general distribution of continuous vegetation in Auyuittuq National Park Reserve. Sites where vegetation was sampled in 1986 and 1987 are indicated.

conducted both with and without the data for early successional communities.

The correlation analysis indicated that moisture had a significant influence on vegetation; total, shrub, herb, and moss cover all increased with improved moisture conditions (Table 1). As indicated by relatively high correlation coefficients, the effect of moisture on herbs and mosses was most pronounced. Total vegetation cover, shrub cover, and herb cover decreased with increasing elevation but lichen and bryophyte cover followed no such relationship. Texture of the surficial deposits apparently influenced plant cover; relatively high total cover and herb cover was associated with fine-textured deposits, and high lichen cover was most frequently associated with rocky terrain. However, neither shrub nor moss cover was closely correlated with texture. The preceding analysis suggests that elevation, surficial materials, and moisture all greatly influence the distribution and abundance of vegetation in Auyuittuq National Park Reserve, with the different strata responding in somewhat different ways to changing environmental conditions.

The diversity of vascular plants was also correlated with changes in elevation ($\underline{r} = -0.23$, $\underline{P} < 0.05$) and surficial materials ($\underline{r} = -0.31$, $\underline{P} < 0.05$), with the greatest diversity of plants occurring on finer-textured deposits at lower

TABLE 1. The correlation between plant cover and elevation, soil moisture, elevation, and texture of surficial deposits. Correlation coefficients marked with asterisks are statistically significant ($P < 0.05$).

Stratum	Elevation	Moisture	Texture
All Sites (N = 100)[a]			
Shrub	-0.29*	0.22*	-0.15
Herb	-0.18	0.59*	-0.25*
Bryophyte	0.02	0.46*	-0.07
Lichen	0.04	-0.02	0.22*
Total cover	-0.23*	0.52*	-0.26*
Early Successional Stages Excluded (N = 85)[b]			
Shrub	-0.39*	0.05	-0.15
Herb	-0.23*	0.59*	-0.30*
Bryophyte	-0.03	0.45*	-0.11
Lichen	0.00	-0.21*	0.28*
Total cover	-0.35*	0.49*	-0.32*

[a] Critical value of r (0.05, 98 df) = 0.196

[b] Critical value of r (0.05, 83 df) = 0.213

elevations. No obvious linear relationship between diversity and soil moisture was apparent ($\underline{r} = 0.03$, $\underline{P} > 0.10$), probably because diversity peaked in mesic communities (see following discussion of plant communities).

Description of Plant Communities

Six major types of plant communities covering areas of relatively large extent were recognized by the general abundance of vegetation in each stratum and prevailing environmental conditions: (1) wet tundra, (2) shrub-graminoid, (3) dwarf shrub, (4) high elevation barrens, (5) early successional, and (6) seashore. Environmental and biotic characteristics of these communities (presented in Tables 2, 3, 4, 5, and 6, and Figures 5, 6, and 7) are discussed below.

(1) Wet Tundra

Wet tundra was characterized by a lush herb layer (especially grasses and sedges), abundant mosses, and smaller amounts of shrubs and lichens. It was found most frequently on wet, fine-textured materials at low elevations. Small ponds were frequently present and the effects of frost action were readily observed in the form of polygons, other types of patterned ground, and tussock-tundra. Dominant plants were usually grass-like plants such as Eriophorum angustifolium, Carex bigelowii, and Luzula confusa. Shrub cover, which included the heath plants Cassiope tetragona and Vaccinium uliginosum, and the willows Salix herbacea, S. arctica, and S. arctophila, occurred mainly on drier tussocks and on

TABLE 2. The mean canopy cover (± SE) of different vegetation strata in 5 plant communities, Auyuittuq National Park Reserve.

Community	Shrubs	Herbs	Lichens	Mosses	Total
Wet tundra (13)	11 ± 3	30 ± 4	16 ± 6	39 ± 7	78 ± 5
Shrub-graminoid (24)	23 ± 3	26 ± 3	19 ± 3	17 ± 4	74 ± 4
Dwarf shrub (25)	26 ± 3	6 ± 1	26 ± 4	12 ± 3	60 ± 5
High elevation (19)	3 ± 1	11 ± 4	22 ± 4	10 ± 3	34 ± 6
Successional (15)	1 ± 0	4 ± 2	1 ± 1	2 ± 1	6 ± 4
Total (100)*	14 ± 2	14 ± 2	19 ± 2	15 ± 2	52 ± 3

*Total includes 4 other communities which did not fit into the above classification.

TABLE 3. The frequency (%) of different vascular plants in 5 plant communities, Auyuittuq National Park Reserve.

Species	Wet Tundra	Shrub-graminoid	Dwarf Shrub	High Elevation	Succes-sional	Total
Dryopteris fragrans	-	4	4	5	-	3
Equisetum arvense	8	8	12	-	7	7
Lycopodium selago	31	21	16	26	-	19
Alopecurus alpinus	23	8	-	-	-	5
Arctagrostis latifolia	15	46	20	21	7	23
Dupontia fisheri	23	4	4	-	-	5
Festuca brachyphylla	-	4	12	-	20	8
Hierochloe alpina	-	54	52	16	13	32
Pleuropogon sabinei	8	-	-	11	-	3
Poa arctica	15	67	44	11	67	41
Poa glauca	-	4	16	-	20	8
Puccinellia sp.	-	-	-	-	-	1
Trisetum spicatum	-	8	12	5	13	8
Carex atrofusca	8	-	4	-	-	2
Carex bigelowii	77	50	32	42	40	44
Carex capillaris	-	-	12	-	7	4
Carex maritima	-	-	-	-	7	1
Carex membranacea	15	13	-	11	-	8
Carex nardina	-	4	12	5	7	7
Carex rariflora	15	4	-	-	-	3

TABLE 3. (continued)

Species	Wet Tundra	Shrub-graminoid	Dwarf Shrub	High Elevation	Succes-sional	Total
Carex supina	-	-	8	-	-	2
Eriophorum angustifolium	85	25	-	37	7	26
Eriophorum scheuchzeri	23	-	-	11	-	5
Kobresia myosuroides	-	13	12	-	-	6
Kobresia sympliciuscula	-	-	8	-	-	2
Juncus albescens	15	-	4	-	-	3
Juncus biglumis	8	-	-	16	13	6
Juncus castaneus	15	-	-	-	7	3
Luzula confusa	54	75	72	95	73	74
Luzula nivalis	8	8	-	-	-	4
Luzula wahlenbergii	15	-	-	-	-	2
Tofieldia coccinea	-	4	4	-	7	3
Tofieldia pusilla	8	8	-	-	-	3
Salix arctica	46	54	52	47	20	45
Salix arctophila	38	21	16	-	-	14
Salix glauca	-	8	12	-	7	6
Salix herbacea	62	46	24	47	-	35
Salix reticulata	15	29	20	-	-	14
Salix arctica x arctophila	8	8	8	16	7	9
Salix arctica x glauca	-	8	4	-	-	3
Salix sp.	23	38	36	-	60	31

TABLE 3. (continued)

Species	Wet Tundra	Shrub-graminoid	Dwarf Shrub	High Elevation	Succes-sional	Total
Betula glandulosa	-	8	4	-	-	3
Oxyria digyna	38	38	28	5	33	28
Koenigia islandica	8	-	-	5	-	2
Polygonum viviparum	54	63	52	16	67	49
Arenaria humifusa	-	-	4	-	-	1
Cerastium alpinum	15	8	8	5	40	14
Honckenya peploides	-	-	-	-	7	3
Melandrium affine	8	21	12	11	33	18
Melandrium apetalum	-	4	-	-	-	1
Minuartia rubella	-	-	4	-	-	1
Sagina caespitosa	-	4	-	-	-	1
Silene acaulis	15	25	24	16	33	23
Stellaria longipes	-	54	44	-	40	30
Ranunculus nivalis	23	8	12	16	-	12
Ranunculus pygmaeus	15	-	-	-	-	2
Papaver radicatum	15	42	32	32	80	41
Arabis arenicola	-	-	4	-	7	2
Braya purpurascens	8	-	4	-	-	2
Cardamine bellidifolia	-	4	8	32	13	12
Cochlearia officinalis	15	-	-	-	-	2
Draba glabella	-	4	4	-	-	2

TABLE 3. (continued)

Species	Wet Tundra	Shrub-graminoid	Dwarf Shrub	High Elevation	Succes-sional	Total
Draba lactea	8	25	8	5	13	12
Draba nivalis	-	21	16	5	27	15
Saxifraga caespitosa	-	4	-	-	7	2
Saxifraga cernua	15	33	4	-	27	15
Saxifraga foliolosa	38	8	4	32	7	16
Saxifraga nivalis	-	17	4	5	7	7
Saxifraga oppositifolia	8	13	20	5	47	17
Saxifraga rivularis	-	8	-	-	-	2
Saxifraga tenuis	-	-	-	5	-	1
Saxifraga tricuspidata	-	33	48	5	33	27
Saxifraga sp.	-	-	-	5	-	1
Dryas integrifolia	31	63	44	26	20	39
Potentilla hyparctica	-	25	20	11	-	13
Potentilla vahliana	-	13	16	11	7	11
Empetrum nigrum	15	29	28	5	-	17
Epilobium latifolium	15	46	40	5	100	40
Pyrola grandiflora	23	38	36	-	-	21
Arctostaphylos alpina	-	4	4	-	-	3
Cassiope tetragona	46	79	92	84	7	67
Ledum decumbens	8	25	20	-	-	12
Rhododendron lapponicum	-	21	12	-	-	8

TABLE 3. (continued)

Species	Wet Tundra	Shrub-graminoid	Dwarf Shrub	High Elevation	Succes-sional	Total
Vaccinium uliginosum	62	63	56	11	7	40
Diapensia lapponica	-	8	4	5	-	4
Armeria maritima	-	4	-	-	-	1
Pedicularis hirsuta	54	58	32	11	13	33
Pedicularis lapponica	-	4	4	-	-	2
Campanula rotundifolia	-	4	4	5	-	3
Campanula uniflora	-	4	-	-	-	1
Antennaria alpina	-	-	4	-	-	2
Arnica alpina	-	-	8	-	-	2
Taraxacum lacerum	-	8	4	5	7	6

TABLE 4. The total and average number of vascular plant species found in 5 plant communities, Auyuittuq National Park Reserve.

Community	N	Total number of species	Mean number of species per site (±SE)
Wet tundra	13	46	11.9 ± 1.4
Shrub-graminoid	24	65	15.8 ± 1.3
Dwarf shrub	25	65	13.1 ± 1.3
High elevation	19	43	8.1 ± 1.1
Successional	15	43	10.9 ± 2.6

TABLE 5. Typical lichens found in 6 types of plant communities, Auyuittuq National Park Reserve.

WET TUNDRA	DWARF SHRUB-GRAMINOID	DWARF SHRUB
Cetraria delisei	Alectoria nigricans	Alectoria ochroleuca
Cetraria nivalis	Bryoria nitidula	Cetraria nigricans
Cladina mitis	Cetraria nivalis	Cetraria nivalis
	Cladina mitis	Cladina mitis
	Ochrolechia frigida	Cladonia stricta
	Peltigera malacea	Ochrolechia frigida
	Pertusaria dactylina	Pertusaria oculata
	Solorina crocea	Solorina crocea
	Stereocaulon alpinum	Sphaerophorus globosus
	Stereocaulon incrustatum	Sphaerophorus tuckermanii
		Stereocaulon paschale
HIGH ELEVATION BARRENS	**EARLY SUCCESSIONAL**	**SEASHORE**
Alectoria ochroleuca	Sparse lichen cover	Sparse lichen cover
Arctoparmelia centrifuga		
Cetraria delisei		
Cetraria islandica		
Cetraria nigricans		
Cetraria nivalis		
Cladina mitis		
Cladonia coccifera		
Pertusaria dactylina		
Pseudephebe pubescens		
Solorina crocea		
Sphaerophorus globosus		
Stereocaulon arenarium		
Stereocaulon botryosum		

TABLE 6. Typical bryophytes found in 6 types of plant communities, Auyuittuq National Park Reserve.

WET TUNDRA	DWARF SHRUB-GRAMINOID	DWARF SHRUB
Anastrophyllum minutum	Anastrophyllum minutum	Dicranum elongatum
Aulacomnium palustre	Aulacomnium turgidum	Rhacomitrium lanuginosum
Blepharostoma trichophyllum	Conostomum tetragonum	
Calliergon sarmentosum	Dicranum elongatum	
Conostomum tetragonum	Oncophorus wahlenbergii	
Drepanocladus exannulatus	Polytrichum piliferum	
Polytrichum strictum	Rhacomitrium lanuginosum	
Rhacomitrium lanuginosum		
Sphagnum teres		
Sphagnum sp.		
HIGH ELEVATION	**EARLY SUCCESSIONAL**	**SEASHORE**
Andreaea rupestris	Sparse bryophyte cover	Sparse bryophyte cover
Aulacomnium turgidum		
Chandonanthus setiformis		
Conostomum tetragonum		
Gymnomitrion corallioides		
Rhacomitrium lanuginosum		

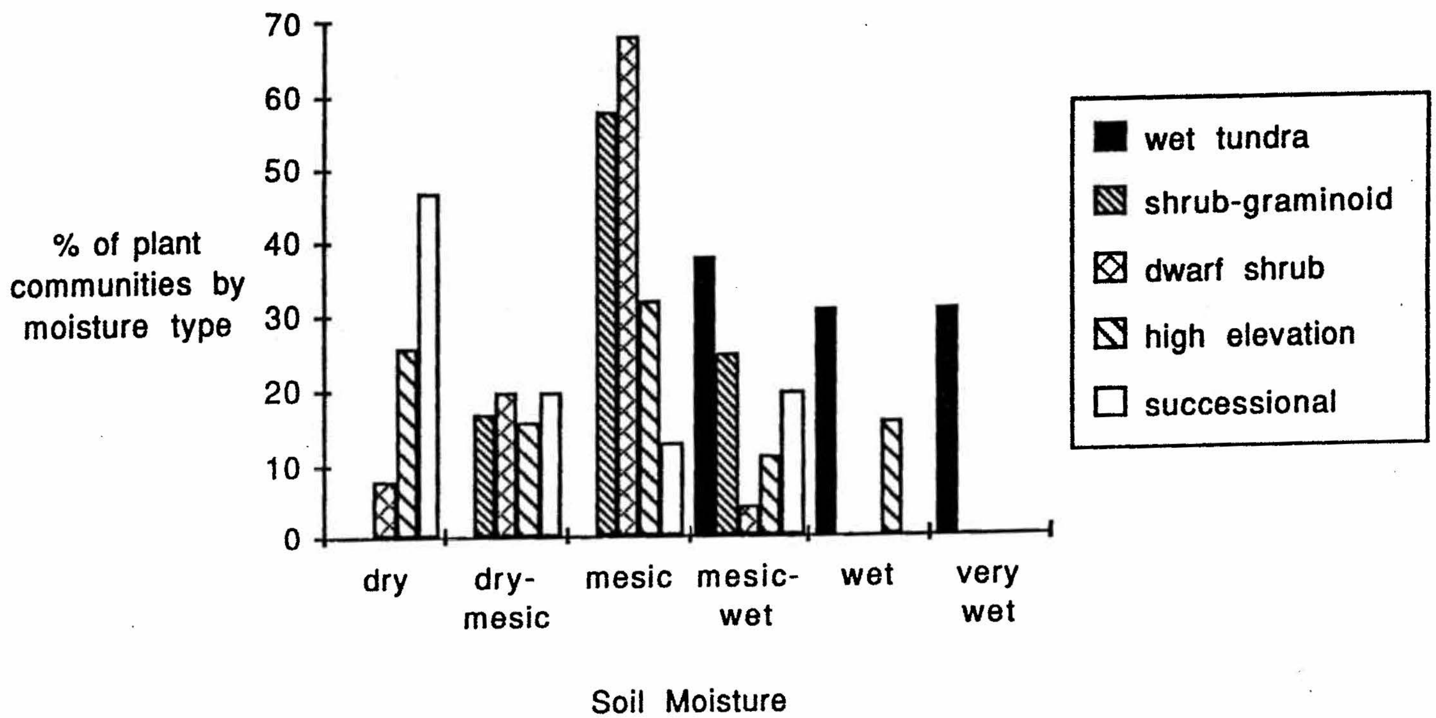

Figure 5. The influence of moisture on the distribution of 5 plant communities in Auyuittuq National Park Reserve.

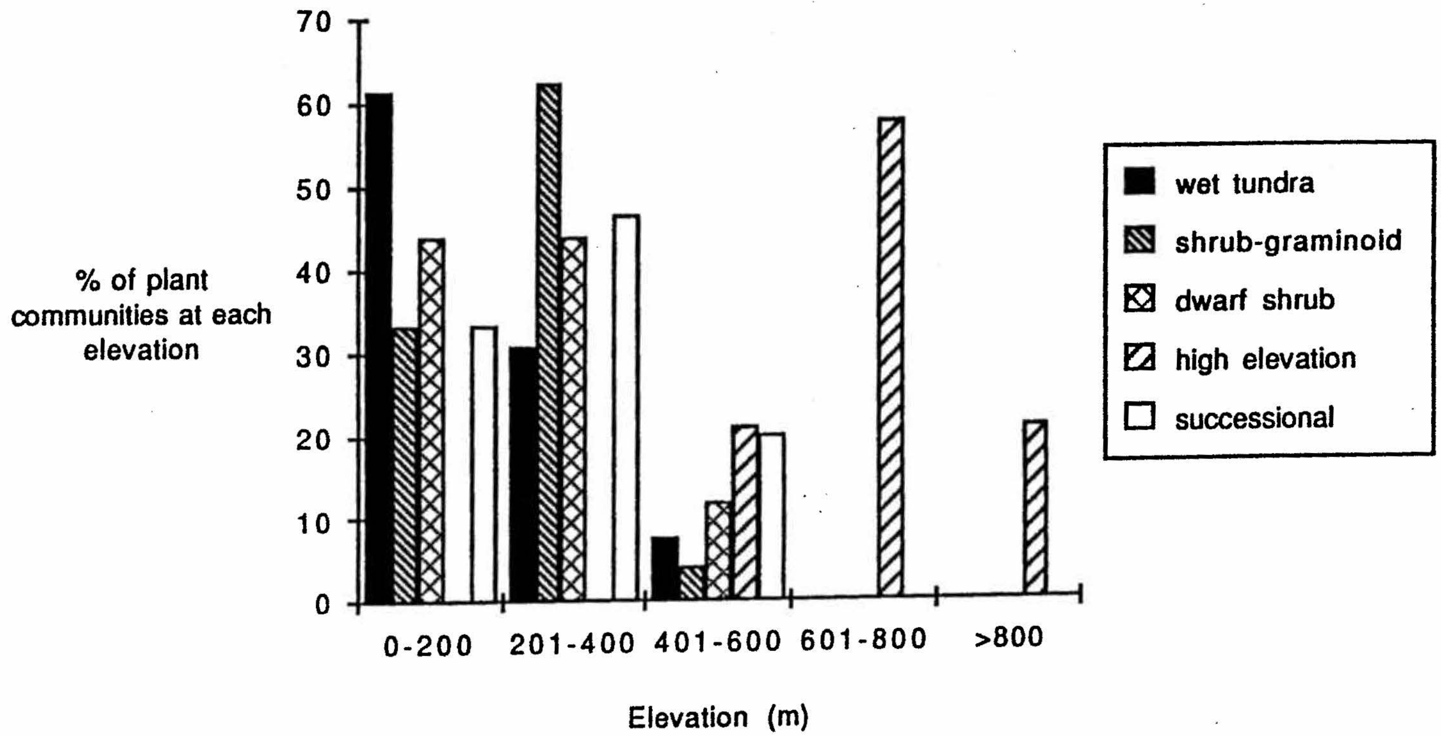

Figure 6. The influence of elevation on the distribution of 5 plant communities in Auyuittuq National Park Reserve.

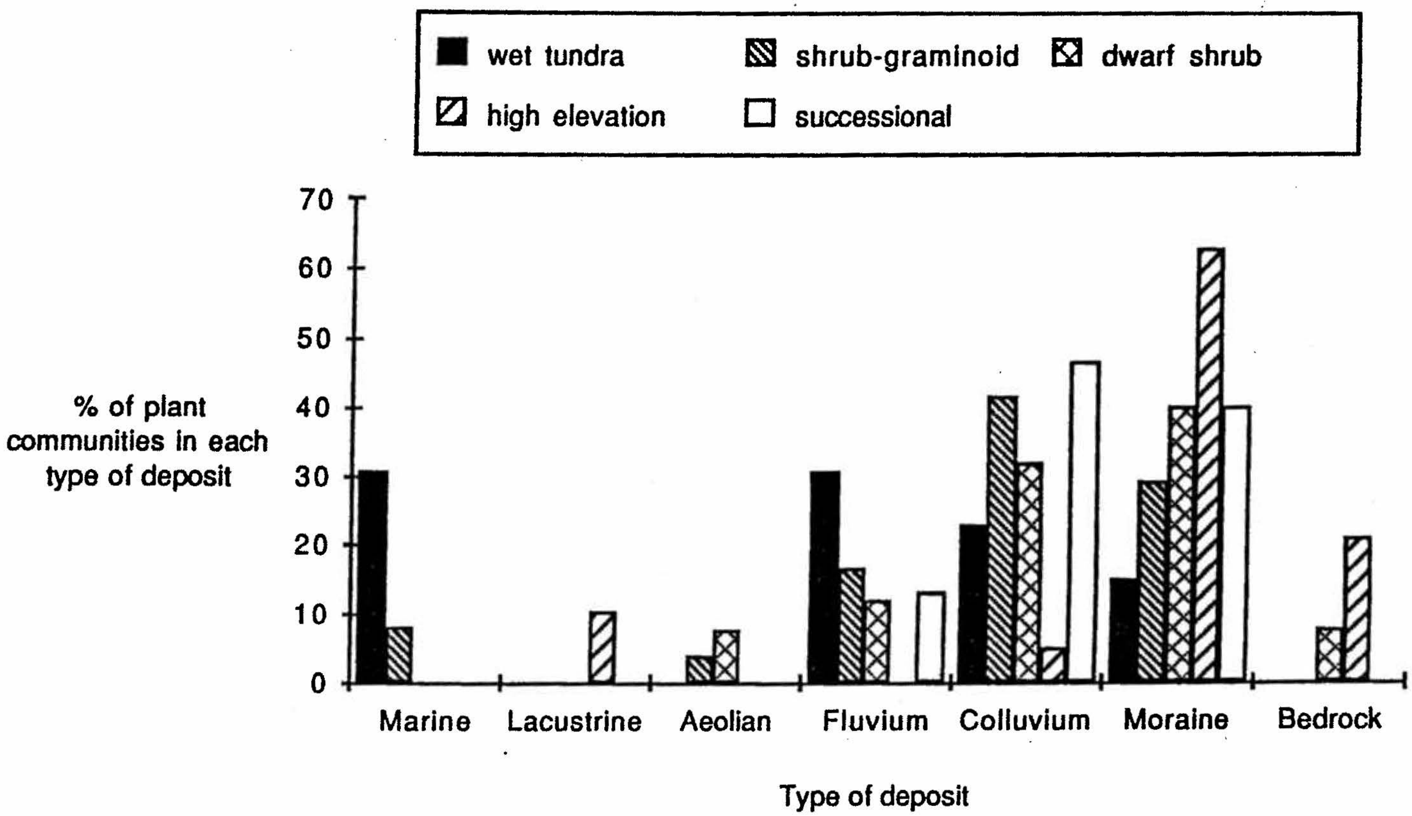

Figure 7. The influence of surficial deposits on the distribution of 5 plant communities in Auyuittuq National Park Reserve.

stream banks. Typical forbs were Polygonum viviparum, Oxyria digyna, and Saxifraga foliolosa. The diversity of vascular plants in wet tundra was moderate, averaging 12 species per site.

Extensive tracts of wet tundra were found only in the Owl River Valley, although significant patches occurred at the head of Maktak Fiord, on the Kivitoo Peninsula, and near the southwestern edge of the park (Figure 4). Wet tundra typically occurred on fine-textured soils of marine or fluvial origin, but also occurred near seepage areas and small streams on colluvial or morainal slopes. In the latter instance, shrub cover was more abundant than in the lowlands (which had water-saturated soils).

(2) Dwarf Shrub-graminoid community

The dwarf shrub-graminoid community featured abundant shrubs, grasses, sedges, and forbs. It was found most frequently under mesic moisture conditions at elevations <400m, and on a wide variety of surficial deposits (especially moraine and colluvium). Total plant cover, herbaceous cover, and lichen cover were similar to those found in wet tundra but shrubs were more abundant and mosses were less abundant than in wet tundra. The dwarf shrub-graminoid community supported an average of 16 species per site - the greatest diversity of vascular plants for any of the communities.

Frequently occurring plants included grasses and sedges (Poa arctica, Arctagrostis latifolia, Carex bigelowii, and Luzula confusa), shrubs (Salix arctica, Salix herbacea, Cassiope tetragona, Vaccinium uliginosum, and Dryas integrifolia), and forbs (Polygonum viviparum, Stellaria longipes, Papaver radicatum, Epilobium latifolium, and Pedicularis hirsuta).

(3) Dwarf Shrub Community

The dwarf shrub community was characterized by more abundant shrub and lichen cover and less abundant herb and moss cover than in wet tundra and dwarf shrub-graminoid communities. Dwarf shrub communities develop at similar elevations (<400 m) and on similar types of surficial materials (colluvium and till) as dwarf shrub-graminoid communities. On average, the soils appeared to be somewhat coarser textured and drier than those that supported dwarf shrub-graminoid communities.

Dwarf shrubs (mostly <15 cm in height) were dominant plants. Abundant shrubs included Salix arctica, Dryas integrifolia, Saxifraga tricuspidata, Cassiope tetragona, and Vaccinium uliginosum. Most abundant herbaceous plants were Hierochloe alpina, Luzula confusa, Epilobium latifolium, and

Stellaria longipes. Bryophytes were poorly represented, but lichens were relatively abundant in the dwarf shrub community.

(4) High Elevation Barrens

Plant communities existing at higher elevations are subject to a harsh environment. They were characterized by sparse cover and a relatively low diversity of vascular plants, particularly shrubs. Lichens, which are well-adapted to dry and cold conditions, were dominant. High elevation barrens prevailed at elevations above 600 m under a wide range of moisture conditions on till, bedrock, colluvium, and lacustrine deposits.

The average ground cover of all vegetation strata computed for the high elevation barrens (34%) likely was an overestimate. We selectively sampled areas of more diverse and abundant vegetation in the high elevation barrens in order to make a complete collection of species and likely "undersampled" areas of sparse plant cover.

The dominant vascular plants at high elevations were *Luzula confusa* (which occurred at 95% of the sample sites), *Cassiope tetragona* (84%), and *Papaver radicatum* (80%). Of the vascular plants, *Luzula confusa* invariably occurred at the highest elevations. Upper limits to the distribution of *Luzula* varied from area to area, averaging 800-900 m at the sites we visited. Generally, vascular vegetation occurred at higher elevations on the south side of the park than in the north. At high elevations, virtually all rock surfaces (except those that had recently become ice free) supported some lichen growth.

(5) Early Successional Communities

Early successional communities were largely devoid of vegetation. They occurred in newly created environments that would eventually support wet tundra, dwarf shrub-graminoid, or dwarf shrub communities if disturbance stopped. Therefore, they differed from the high elevation barrens which developed only a sparse cover of vascular plants, even after long periods of plant succession. Herbaceous plants were the dominant form of ground cover in successional communities whereas shrubs, mosses, and lichens were poorly represented.

Successional communities developed in 2 main types of environments: (a) fluvial deposits along rivers that were denuded of vegetation by the frequent formation of aufeis or icings (Miller and Bradley 1976), and (b) coarser, recently deposited materials such as moraines and scree. The fluvial deposits were usually moist and, given adequate time for plant succession to occur, would eventually support wet tundra or dwarf shrub-graminoid communities. The moraines and colluvium were usually dry or mesic and usually would support dwarf shrub-graminoid or dwarf shrub communities. The species composition of early successional stages varied somewhat with the type of surficial deposits present and the prevailing moisture conditions. A characteristic species, found at all successional sites that we studied, was Epilobium latifolium. Papaver radicatum, Luzula confusa, Poa arctica, and Saxifraga oppositifolia were other important colonizers.

(6) Seashore Communities

We were able to sample only one seashore community. Consequently, the following description of this association is based on our general observations in the park and the work of Polunin (1948) and Blouin et al. (1975). Seashore communities were characterized by a sparse cover of salt-tolerant herbs and little or no shrub, moss, or lichen cover.

Species reported for lower areas included the grass Puccinellia phryganodes and the sedge Carex maritima. Forbs such as Honckenya peploides, Cochlearia officinalis, and Stellaria humifusa, and the grass, Puccinellia langeana, were found at slightly higher elevations. Elymus arenarius, a coarse grass, prevailed on the upper edge of the seashore habitat, usually in areas of drifting sand.

Local Geographic Variations in Flora and Vegetation

Elliott (1973) suggested that the diversity and abundance of the flora was less in the north side of the park than in Pangnirtung Pass or the area south of the Penny Ice Cap. To further address this possibility, we compared the diversity of plants found in 4 parts of the park: the Weasel River Valley, the Owl River Valley, the area north of the Penny Ice Cap (including the Kivitoo Peninsula), and that part of the park south of the ice cap. In contrast to Elliott (1973), our data suggest that the flora was more diverse in Pangnirtung Pass than in other parts of the park (Table 7).

Of the areas we were able to visit, the Weasel River and Owl River valleys supported the most abundant and diverse floras, including well-developed dwarf shrub, dwarf shrub-graminoid, and wet tundra communities. Development of wet tundra was extensive on wet fluvial deposits in the Owl River Valley but not in the Weasel River Valley. The sparseness of vegetation on the floodplain of the Weasel River likely occurred because of the annual formation of aufeis (icings) there.

Like the valleys of the Owl and Weasel Rivers, the southwestern part of the park supported continuous plant cover in many places. The small number of sites we sampled in

TABLE 7. Diversity of vascular plants in 4 geographic areas, Auyuittuq National Park Reserve.

Location	Number of species	Average number of species/site ± SE (N): All sites	Average number of species/site ± SE (N): Dwarf shrub, shrub grass, and wet tundra only*
Weasel River	72	13.8 ± 1.1 (41)	15.1 ± 1.3 (28)
Owl River	51	13.8 ± 2.0 (15)	17.6 ± 2.0 (9)
North	53	10.2 ± 0.8 (30)	11.0 ± 0.8 (21)
Southwest	38	9.6 ± 1.3 (14)	12.1 ± 2.8 (7)

*Sparsely vegetated successional and high elevation sites excluded from analysis.

the southwest suggest that the flora was less diverse than that found in Pangnirtung Pass. Elliott (1973), however, was able to spend more time in this area and suggested that it supported a relatively diverse and lush vegetation.

In general, plant cover in that part of the park north of the Penny Ice Cap was less continuous and less diverse than that found in Pangnirtung Pass. Localized pockets of fairly diverse and abundant vegetation were found at Maktak Fiord, Nedlukseak Fiord, and the Kivitoo Peninsula. Although more intensive field studies would likely reveal other areas of relatively lush vegetation in the northern part of the park, our overall impression is that the vegetation there is relatively sparse and low in species diversity.

Species Accounts: Vascular Plants

We recorded 93 species, representing 25 families of vascular plants, in Auyuittuq National Park Reserve. Five families (Gramineae, Cyperaceae, Caryophyllaceae, Cruciferae, and Saxifragaceae) accounted for more than half of the species total (Table 8).

An annotated listing of the vascular flora is given below. Plants are ranked as abundant (occurring at more than 25% of the sample sites), common (11-25%), infrequent (5-10%), or very infrequent (1-4%). The highest elevation at which we found each species is indicated, as is the general geographic distribution of the species (after Porsild and Cody 1980).

Polypodiaceae (Fern Family)

Dryopteris fragrans (L.) Schott

Collected 3 times on dry-mesic, relatively coarse deposits. Elevation: to 1500 feet. Distribution: circumpolar, arctic-alpine.

Equisetaceae (Horsetail Family)

Equisetum arvense L.

Infrequent on mesic or moist, fine-textured deposits. Elevation: to 1000 feet. Distribution: circumpolar, wide-ranging.

TABLE 8. Number of species of vascular plants by family for Auyuittuq National Park Reserve.

Family	Number of Species	Percent
Polypodiaceae	1	1.1
Equisetaceae	1	1.1
Lycopodiaceae	1	1.1
Gramineae	10	10.8
Cyperaceae	13	14.0
Juncaceae	6	6.5
Liliaceae	2	2.2
Salicaceae	5	5.4
Betulaceae	1	1.1
Polygonaceae	3	3.2
Caryophyllaceae	9	9.7
Ranunculaceae	3	3.2
Papaveraceae	1	1.1
Cruciferae	7	7.5
Saxifragaceae	8	8.6
Rosaceae	3	3.2
Empetraceae	1	1.1
Onagraceae	1	1.1
Pyrolaceae	1	1.1
Ericaceae	5	5.4
Diapensiaceae	1	1.1
Plumbaginaceae	1	1.1
Scrophulariaceae	3	3.2
Campanulaceae	2	2.2
Compositae	4	4.3
Total	93	99.3

Lycopodiaceae (Clubmoss)

Lycopodium selago L.

Common on mesic or moist soils of various geological origins. Elevation: to 2000 feet. Distribution: circumpolar, high arctic-alpine.

Gramineae (Grass Family)

Alopecurus alpinus J.E. Smith

Infrequent on moist or wet marine deposits which have been nitrogen enriched by animal droppings. Elevation: to 150 feet. Distribution: circumpolar, arctic.

Arctagrostis latifolia (R. Br.) Griseb.

Widespread and common on mesic-moist sandy soils. Elevation: to 2500 feet. Distribution: circumpolar, arctic-alpine.

Dupontia fisheri R. Br. ssp. psilopsantha (Rupr) Hultén

Uncommon. Found mainly in low lying areas in the Weasel and Owl River Valleys. Elevation: to 1000 feet. Distribution: circumpolar, low arctic.

Elymus arenarius L. ssp. mollis (Trin.) Hultén

Collected only once in a sandy area above the high tide line. Elevation: 25 feet. Distribution: circumpolar, low arctic.

Festuca brachyphylla Schultes

Infrequent on well-drained, sandy till and colluvium. Elevation: to 1000 feet. Distribution: circumpolar, high arctic-alpine.

Hierochloe alpina (Sw.) R. & S.

Abundant in dwarf shrub and dwarf shrub-graminoid communities often on gravelly deposits. Elevation: to 2750 feet. Distribution: circumpolar, arctic-alpine.

Pleuropogon sabinei R. Br.

Collected only 3 times, in shallow water. Elevation: to 2500 feet. Distribution: nearly circumpolar, high arctic.

<u>Poa arctica</u> R. Br.

Abundant and widely distributed over a broad range of moisture conditions, surficial deposits, and community types.

Elevation: to 2500 feet. Distribution: circumpolar, arctic-alpine.

<u>Poa glauca</u> M. Vahl.

Infrequent in mesic, sandy, dwarf shrub and successional communities. Elevation: to 1000 feet. Distribution: circumpolar, arctic-alpine.

<u>Trisetum spicatum</u> (L.) Richt.

Infrequent on dry or mesic slopes. Elevation: to 1500 feet. Distribution: circumpolar, arctic-alpine.

Cyperaceae (Sedge Family)

<u>Carex atrofusca</u> Schk.

Collected only twice on sandy deposits in the Weasel River Valley. Elevation: to 500 feet. Distribution: circumpolar, high arctic.

<u>Carex bigelowii</u> Torr.

Widely distributed under a variety of environmental conditions, especially wetter, fine-textured soils. Elevation: to 2750 feet. Distribution: Amphi-Atlantic, arctic.

<u>Carex capillaris</u> R. Br.

Collected 4 times in the Weasel River Valley on dry or mesic slopes. Elevation: to 1000 feet. Distribution: circumpolar, arctic-alpine.

<u>Carex glareosa</u> Wahlenb.

Collected once near the south end of the Weasel River Valley. Distribution: cicumpolar, arctic.

<u>Carex maritima</u> Gunn

Collected once on sandy deposits near the high tide line in the Weasel River Valley. Elevation: sea level. Distribution: circumpolar, arctic.

<u>Carex membranacea</u> Hook.

Infrequent on wet, fine-textured deposits. Elevation: to 2500 feet. Distribution: North American, arctic.

<u>Carex nardina</u> Fr.

Infrequent on dry or mesic slopes. Elevation: to 1500 feet. Distribution: Amphi-Atlantic, arctic.

<u>Carex rariflora</u> (Wahlenb.) Smith

Collected 3 times on wet floodplains. Elevation: to 500 feet. Circumpolar, low arctic.

<u>Carex supina</u> Wahlenb.

Collected twice on mesic, sandy soils (dwarf shrub communities). Elevation: to 100 feet. Distribution: North American, low arctic.

<u>Eriophorum angustifolium</u> Honck.

Abundant and widely distributed on wet tundra. Elevation: to 2500 feet. Distribution: circumpolar, low arctic.

<u>Eriophorum scheuchzeri</u> Hoppe

Infrequent in wet areas. Elevation: to 2750 feet. Distribution: circumpolar, arctic-alpine.

<u>Kobresia myosuroides</u> (Vill.) Fiori + Paol.

Infrequent on dry-mesic slopes. Elevation: to 1000 feet. Distribution: circumpolar, wide-ranging.

<u>Kobresia simpliciuscula</u> (Wahlenb.) Mack.

Collected twice in dwarf shrub communities in the Weasel River Valley. Elevation: to 1000 feet. Distribution: circumpolar, arctic-alpine.

Juncaceae (Rush Family)

Juncus albescens (Lge.) Fern.

Collected 3 times on moist, sandy deposits in the Weasel River Valley. Elevation: to 500 feet. Distribution: North American, arctic-alpine.

Juncus biglumis L.

Infrequent but widely distributed on mesic-wet soils. Elevation: to 2500 feet. Distribution: circumpolar, high arctic-alpine.

Juncus castaneus Sm.

Collected 3 times on wet, sandy soils in the Weasel River Valley. Elevation: to 1000 feet. Distribution: circumpolar, arctic-alpine.

Luzula confusa Lindebl.

Perhaps the most widely distributed plant in the park. Tolerant of a broad range of moisture conditions, surficial deposits, and elevations. An important colonizer at low elevations and a dominant plant in high elevation barrens. Elevation: to 3000 feet. Distribution: circumpolar, arctic-alpine.

Luzula nivalis (Laest.) Beurl. var. _nivalis_

Collected 4 times on mesic to wet soils. Elevation: to 2500 feet. Distribution: cicumpolar, high arctic.

Luzula wahlenbergii Rupr.

Collected twice in wet tundra communities. Elevation: to 1200 feet. Distribution: circumpolar, low arctic.

Liliaceae (Lily Family)

Tofieldia coccinea Richards

Collected 3 times on mesic or moist sands and gravels in the Weasel River Valley. Elevation: to 1000 feet. Distribution: eastern Greenland to eastern Asia (with gaps), arctic-alpine.

Tofieldia pusilla (Michx.) Pers.

Collected 2 times on moist to wet soils. Elevation: to 1000 feet. Distribution: circumpolar, arctic-alpine.

Salicaceae (Willow Family)

Salix arctica Pallas

Widely distributed and abundant, especially on dry-mesic till or colluvium. Elevation: to 2500 feet. Distribution: circumpolar, arctic-alpine.

Salix arctophila Cockerell ex A.A. Heller

Common on mesic or moist fine-textured deposits. Elevation: to 1800 feet. Distribution: North American, eastern arctic.

Salix glauca L. ssp. _callicarpaea_ (Trautr.) Bocher

Uncommon on dry or mesic slopes - usually warm, sun-exposed sites. Elevation: to 1000 feet. Distribution: circumpolar.

Salix herbacea L.

Widely distributed and abundant on mesic-wet colluvium or till. Elevation: up to 2500 feet. Distribution: Amphi-Atlantic, low arctic.

Salix reticulata L.

Common on mesic to moist slopes in dwarf shrub and dwarf shrub-graminoid communities. Elevation: to 1000 feet. Distribution: circumpolar, arctic-alpine.

Salix hybrids

Twelve probable hybrid willows were collected at 10 sites. Nine specimens appeared to be intermediates between _Salix arctica_ and _S. arctophila_, three appeared to be crosses between _S. arctica_ and _S. glauca_.

Betulaceae (Birch Family)

Betula glandulosa Michx. and Betula nana L.

The taxonomic status of dwarf birches in the Canadian eastern arctic is somewhat confusing (Terasmae et al. 1966, Hultén 1968, Andrews et al. 1980) and for the present purposes the 2 species recognized by Porsild (1957) will be considered as distinct taxa. It should be noted, however, that many of the birches found on Baffin Island likely represent intergrades between these extremes (Terasmae et al. 1966, Andrews et al. 1980).

We collected dwarf birches at only 3 sites in the park, all located in a valley south of the Penny Ice Cap (66°45'N, 66°15'W). All specimens had the resinous glands on the young twigs typical of Betula glandulosa. To our knowledge, this is the only collection of birch from the park although other collections have been made nearby (Schwarzenbach, no date; Andrews et al. 1980). We collected one specimen of Betula nana outside the park (near Pangnirtung). This species is reported to occur east of the park in the valleys of the June and Naksakjua Rivers where it apparently grows in mixed stands with Betula glandulosa (Schwarzenbach, no date). Elevation: to 1000 feet. Distribution: North American, boreal and subarctic.

Polygonaceae (Buckwheat Family)

Koenigia islandica L.

Collected twice on wet till. Elevation: to 2500 feet. Distribution: circumpolar, arctic-alpine.

Oxyria digyna (L.) Hill

Abundant in a wide range of plant communities, moisture regimes, and surficial deposits. Elevation: to 1850 feet. Distribution: circumpolar, arctic-alpine.

Polygonum viviparum L.

Abundant and widely distributed throughout a variety of plant communities especially where soils are moist. Elevation: to 2000 feet. Distribution: circumpolar, arctic-alpine.

Caryophyllaceae (Pink Family)

Arenaria humifusa Wahlenb.

Collected only once on a dry, rocky slope near the sea. Elevation: 100 feet. Distribution: Amphi-Atlantic, arctic-alpine.

Cerastium alpinum L.

Common and widely distributed under a broad range of moisture conditions. Elevation: to 2000 feet. Distribution: Amphi-Atlantic, arctic-alpine.

Honckenya peploides (L.) Ehrh.

Found infrequently in sandy areas, especially near salt water. Elevation: to 1000 feet. Distribution: circumpolar, low arctic.

Melandrium affine J. Vahl.

Common in a variety of plant communities on colluvial and till deposits. Apparently tolerant of a variety of moisture conditions. Elevation: to 2000 feet. Distribution: circumpolar, arctic-alpine.

Melandrium apetalum (L.) Fenzl. ssp. arcticum (Fr.) Hult.

Found only once in a mesic dwarf shrub-graminoid community. Elevation: 100 feet. Distribution: circumpolar, high arctic.

Minuartia rubella (Wahlenb.) Hiern.

Collected once in the Owl River Valley in a dry dwarf shrub community. Elevation: 1000 feet. Distribution: circumpolar, arctic-alpine.

Sagina caespitosa (J. Vahl.) Lge.

Collected once in a moist dwarf shrub-graminoid community between Narpaing and Quajon Fiords. Elevation: 1000 feet. Distribution: Amphi-Atlantic, arctic.

Silene acaulis L.

Common under a wide range of moisture conditions. Elevation: to 2300 feet. Distribution: circumpolar, arctic-alpine.

Stellaria longipes Goldie

Abundant in dwarf shrub and dwarf shrub-graminoid communities. Elevation: to 1500 feet. Distribution: circumpolar, wide-ranging.

Ranunculaceae (Crowfoot Family)

Ranunculus lapponicus L.

Collected only once in a valley south of the Penny Ice Cap. Elevation: 1000 feet. Distribution: circumpolar, low arctic.

Ranunculus nivalis L.

An uncommon but widely distributed snowpatch species. Elevation: to 2500 feet. Distribution: circumpolar, arctic.

Ranunculus pygmaeus Wahlenb.

Collected twice on loamy, marine soils (wet tundra). Elevation: to 20 feet. Distribution: circumpolar, arctic-alpine.

Papaveraceae (Poppy Family)

Papaver radicatum Rottb.

Abundant and widely distributed in a variety of communities. An important pioneer species. Elevation: to 2700 feet. Distribution: circumpolar.

Cruciferae (Mustard Family)

Arabis arenicola (Richards) Gel.

Collected twice on sandy soils in the Weasel River Valley. Elevation: to 1000 feet. Distribution: eastern North America, arctic and subarctic.

Braya purpurascens (R. Br.) Bunge

Collected twice, on mesic and mesic-wet sands and gravels. Elevation: to 1000 feet. Distribution: circumpolar, high arctic.

Cardamine bellidifolia L.

Common in dry, sparsely-vegetated areas, most frequently at high elevation. Elevation: to 2800 feet. Distribution: circumpolar, high arctic-alpine.

Cochlearia officinalis L.

Found twice on wet marine deposits near sea level. Elevation: to 30 feet. Distribution: circumpolar.

Draba glabella Pursh.

Collected twice on dry or mesic colluvium. Elevation: to 1000 feet. Distribution: circumpolar, arctic-alpine.

Draba lactea (L.) Adams

Common on mesic lower slopes and valley bottoms. Elevation: 2000 feet. Distribution: circumpolar, high arctic.

Draba nivalis Liljebl.

A common snowpatch plant on dry-mesic colluvium and till. Elevation 500-1500 feet. Distribution: circumpolar, arctic-alpine.

Saxifragaceae (Saxifrage Family)

Saxifraga caespitosa L.

Collected twice on dry or mesic scree slopes. Elevation: to 1000 feet. Distribution: Amphi-Atlantic, arctic.

Saxifraga cernua L.

Common on till and colluvium deposits in the dwarf shrub-graminoid community. Elevation: to 1500 feet. Distribution: circumpolar, arctic-alpine.

Saxifraga foliolosa R. Br.

Common in wet areas at a broad range of elevations. Elevation: to 2500 feet. Distribution: circumpolar, high arctic.

<u>Saxifraga</u> <u>nivalis</u> L.

Infrequent on slopes in the dwarf shrub-graminoid community. Elevation: to 1850 feet. Distribution: circumpolar, arctic.

<u>Saxifraga</u> <u>oppositifolia</u> L.

Common on dry or mesic slopes with sparse ground cover. Elevation: to 2000 feet. Distribution: circumpolar, arctic-alpine.

<u>Saxifraga</u> <u>rivularis</u> L.

Collected 2 times in mesic, dwarf shrub-graminoid communities. Elevation: to 1400 feet. Distribution: circumpolar, arctic-alpine.

<u>Saxifraga</u> <u>tenuis</u> (Wahlenb.) H. Sm.

Collected only once in a mesic, high elevation community. Elevation: 2000 feet. Distribution: Amphi-Atlantic, arctic.

<u>Saxifraga</u> <u>tricuspidata</u> Rottb.

Abundant on gravelly, dry or mesic slopes. Elevation: to 1500 feet. Distribution: North American, arctic-alpine.

Rosaceae (Rose Family)

<u>Dryas</u> <u>integrifolia</u> M. Vahl.

Abundant on gravelly, dry-mesic sites especially colluvium and moraine. Elevation: to 2500 feet. Distribution: North American, arctic-alpine.

<u>Potentilla</u> <u>hyparctica</u> Malte.

Abundant on mesic slopes in the dwarf shrub and dwarf shrub-graminoid communities. Elevation: to 2500 feet. Distribution: circumpolar, low arctic.

<u>Potentilla</u> <u>vahliana</u> Lehm.

Common on dry-mesic, gravelly slopes. Elevation: to 2300 feet. Distribution: Canadian Arctic Archipelago, high arctic.

Empetraceae (Crowberry Family)

Empetrum nigrum L.

Common mainly at lower elevations in mesic or moist dwarf shrub and shrub-grass communities. Elevation: to 1500 feet. Distribution: circumpolar, wide-ranging.

Onagraceae (Evening Primrose Family)

Epilobium latifolium L.

Very abundant in early successional stages and apparently tolerant of a wide range of moisture conditions. Unlike most of the pioneer species, it was not common at high elevations. Elevation: to 1500 feet. Distribution: circumpolar, arctic-alpine.

Pyrolaceae (Wintergreen Family)

Pyrola grandiflora Radius

Common on mesic slopes in shrub-grass and dwarf shrub communities. Elevation: to 1000 feet. Distribution: circumpolar, arctic-alpine.

Ericaceae (Heath Family)

Arctostaphylos alpina (L.) Spreng.

Found 3 times in the Weasel River Valley on dry-mesic till or colluvium. Elevation: to 1000 feet. Distribution: circumpolar, arctic.

Cassiope tetragona (L.) D. Don

Abundant under a broad range of environmental conditions in all community types except early stages of plant succession. Elevation: to 2800 feet. Distribution: circumpolar, arctic.

Ledum decumbens (Ait.) Lodd.

Common on mesic-moist sites in the Weasel River Valley. Elevation: to 1200 feet. Distribution: from eastern Asia and Alaska to western Greenland, arctic.

<u>Rhododendron</u> <u>lapponicum</u> (L.) Wahlenb.

Infrequent on mesic slopes amongst dwarf shrub and shrub-grass vegetation. Elevation: to 1000 feet. Distribution: circumpolar, arctic-alpine.

<u>Vaccinium</u> <u>uliginosum</u> L.

Abundant on colluvium, till, and fluvium in dwarf shrub, shrub-grass, and wet tundra communities. Elevation: to 1800 feet. Distribution: circumpolar.

Diapensiaceae (Diapensia Family)

<u>Diapensia</u> <u>lapponica</u> L.

Infrequent, usually found on finer textured deposits under a broad range of moisture conditions. Elevation: to 1700 feet. Distribution: Amphi-Atlantic, arctic-alpine.

Plumbaginaceae (Leadwort Family)

<u>Armeria</u> <u>maritima</u> (Mill.) Willd.

Very infrequent on sandy soils. Elevation: to 1000 feet. Distribution: circumpolar, arctic.

Scrophulariaceae (Figwort Family)

<u>Pedicularis</u> <u>flammea</u> L.

Collected only once in the Owl River Valley. Elevation: 1000 feet. Distribution: Amphi-Atlantic, arctic-alpine.

<u>Pedicularis</u> <u>hirsuta</u> (L.) Cham. Schlecht.

Widely distributed and abundant especially on mesic wet colluvium and till. Elevation: to 1000 feet. Distribution: Amphi-Atlantic, arctic.

<u>Pedicularis</u> <u>lapponica</u> L.

Collected in a valley south of the Penny Ice Cap (66^{0}45'N, 66^{0}15'W) on a southwest-facing slope amongst rich dwarf shrub and shrub-grass vegetation. Elevation: 1000 feet. Distribution: circumpolar, subarctic.

Campanulaceae (Bluebell Family)

Campanula rotundifolia L.

Collected 3 times on dry-mesic slopes. Elevation: to 1500 feet. Distribution: circumpolar, arctic-alpine.

Campanula uniflora L.

Collected only once in a mesic shrub-grass community on a lower slope in the Weasel River Valley. Elevation: 1000 feet. Distribution: circumpolar, high arctic-alpine.

Compositae (Composite Family)

Antennaria alpina (L.) Gaerth.

Collected only 2 times on dry to mesic sandy or gravelly soils. Elevation: 1000 feet. Distribution: circumpolar, arctic.

Arnica alpina (L.) Olin

Infrequent in dwarf shrub communities. Elevation: to 1000 feet. Distribution: North American, arctic-alpine.

Erigeron eriocephalus J. Vahl.

Collected only once on a gravelly slope in the Weasel River Valley. Elevation: 500 feet. Distribution: circumpolar, arctic-alpine.

Taraxacum lacerum Greene

Infrequent on dry to mesic slopes. Elevation: to 1500 feet. Distribution: arctic and subarctic.

Geographical Affinities of the Vascular Flora

Auyuittuq is situated near the boundary between the low arctic and the high arctic (Bliss 1981) and it is not surprising that the flora of the park shows affinities to both regions (Table 9). In general, the low arctic species are found only at lower elevation in the park whereas the high arctic species are more widely distributed.

Arctic plants characteristically occupy broad geographic ranges. Thus, most (73%) of the vascular plants found in Auyuittuq have circumpolar distributions whereas only 11% are restricted to North America and 12% have Amphi-Atlantic distributions (i.e., are found on both sides of the Atlantic Ocean). A few species (4% of the total) did not fit any of the above categories.

Lichens and Bryophytes

Our collection of the cryptogamic flora was less thorough than for vascular plants. In total, 70 species of lichens and 61 bryophytes were identified (Appendices 2 and 3) but this likely represents only a proportion of the cryptogamic flora. For example, Zoltai et al. (1983:SS) recorded at least 105 species of bryophytes and 178 taxa of lichens on Bylot Island about 600 km north of Auyuittuq.

TABLE 9. Geographic affinity of vascular plants found in Auyuittuq National Park Reserve.

Geographic affinity	Number of species	Percent
Arctic or Arctic-alpine	58	62.4
High Arctic or High Arctic-alpine	13	14.0
Low Arctic	10	10.8
Subarctic*	4	4.3
Wide-ranging	4	4.3
Unknown	4	4.3
Total	93	100.1

*Includes two species with Arctic and Subarctic affinities and one species with Boreal and Subarctic affinities.

DISCUSSION

Vegetation Distribution

The distribution and abundance of vegetation in Auyuittuq National Park Reserve appeared to be controlled by climate (as expressed through elevation), the availability of soil moisture, and the nature of the surficial deposits. Of these variables, elevation (climate) appeared to have an overriding effect with moisture and surficial deposits following in importance. Extensive vegetation cover developed only at lower elevations, on finer-textured deposits, and under mesic-wet moisture conditions. Environments capable of supporting abundant vegetation were restricted mainly to valley bottoms and the lower slopes of some of the major valleys and fiords (Figures 4 and 8).

Our observations suggest that many of the vascular plant species had broad ecological amplitudes and could grow under a wide range of environmental conditions. Therefore, it is not surprising that the correlations between types of plant communities and geomorphology were poor. Further, the surficial deposits in Auyuittuq were derived mainly from local rocks (mainly granitic gneiss), and there was likely not a great degree of variability in minerals, nutrient levels, and pH of the surface materials. Given the broad niches of arctic plants, close correlations between surficial

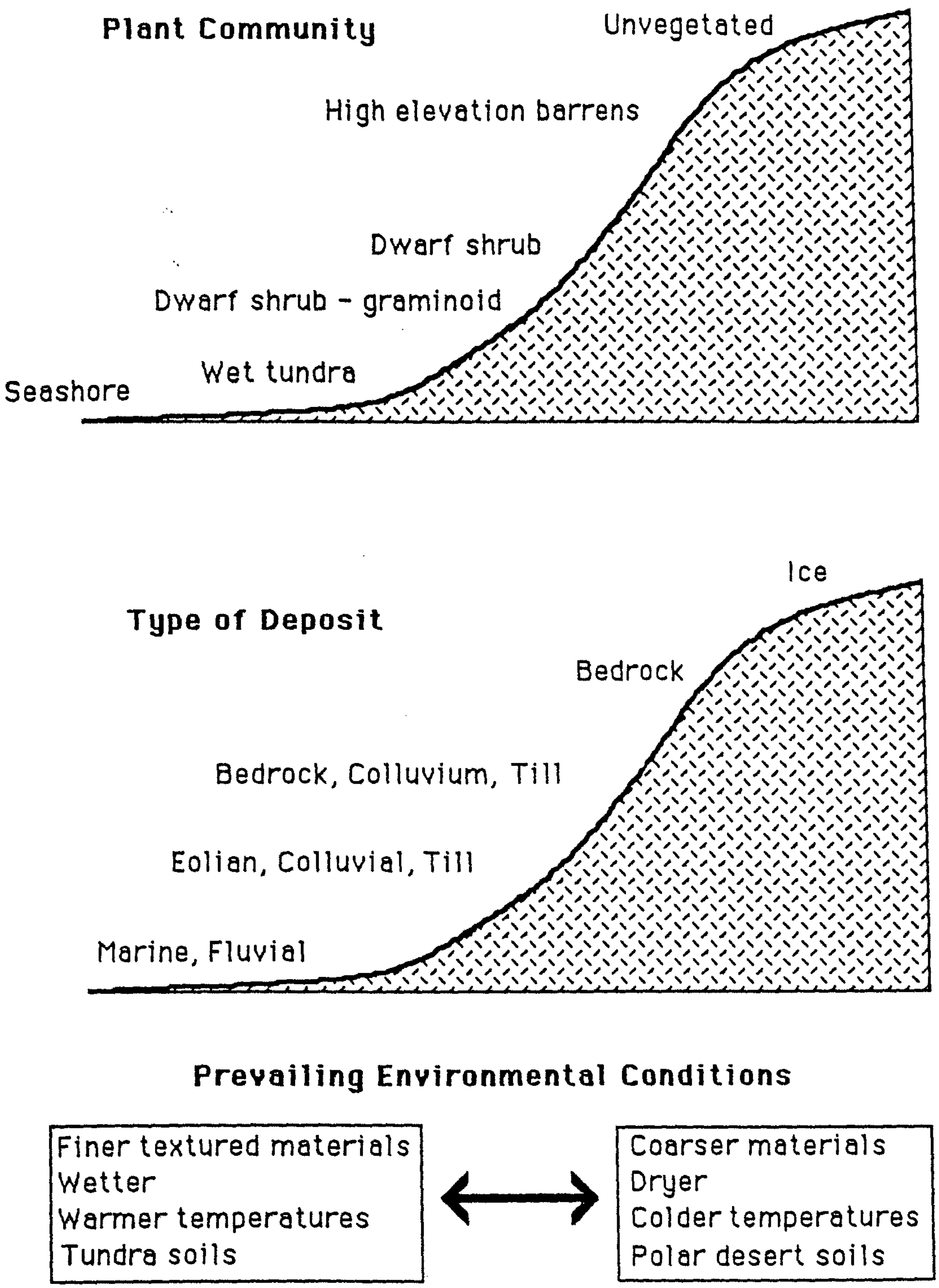

Figure 8. The influence of topography, surficial deposits, and other environmental factors on the distribution of 5 plant communities in Auyuittuq National Park Reserve.

deposits and vegetation as reported by Edlund (1982) for the central arctic may require wide differences in the chemical properties of the different surficial deposits present. In Auyuittuq, relationships between plant communities and surficial deposits are further masked by the effects of plant succession, elevation, and the availability of soil moisture.

Vegetation Classification

Our classification of plant communities was based on simple characteristics such as ground cover, growth form, and prevailing environmental factors. It contrasts with an earlier attempt by Blouin et al. (1975) to classify the vegetation of Pangnirtung Pass based on phytosociological methods. Blouin et al. (1975) identified 41 distinct community types at only 63 sites, many of the entities recognized as discrete communities differing only in the abundance of 1 or 2 species of secondary importance. We believe that use of an extreme phytosociological approach to the classification of vegetation in the park can be criticized on both theoretical and practical grounds. First, arctic plants tend to have broad ecological amplitudes, and discrete repeating assemblages of plants adapted to, or tolerant of, specific habitats are unlikely to occur. Second, the approach is not practical. We had great difficulty in recognizing the community types of Blouin et al. (1975) in the field and feel that the classification could only be applied by people who were intimately familiar with it.

The present classification likely has its shortcomings also. We recognized only 6 major community types and may have overgeneralized or lumped ecologically dissimilar groups together. Further subdivision of some of the major community types (dwarf shrub-graminoid, wet tundra) may be required. Our classification considered bryophyte and lichen cover but it was not based on the species composition of the cryptogamic flora. Given the importance of lichens and mosses in arctic ecosystems, the classification might be improved if these species were considered in greater detail.

Various authorities have attempted to classify tundra vegetation (Drury 1962, Larsen 1972, Bliss 1981, Rowe et al. 1977, Edlund 1982, and others). Although no standard agreement on the exact types of plant communities present in the arctic has been determined, there is a trend to recognize a continuum of communities along a gradient of dry to wet soils or harsh to favourable environments. The present classification allows us to rank the vegetation types along an environmental gradient with wet, lowland tundra on one extreme and cold, dry, high elevation barrens on the other. This broad relationship is diagrammed in Figure 8.

Local Geographic Variations in Flora and Vegetation

Gradients in the diversity of vascular plants between Pangnirtung Pass and the rest of the park, if real and not an artifact of less than rigorous sampling procedures, could result from a number of factors. The climate in the northern part of the park is harsher and the geological conditions there are possibly less suitable for plant growth. The northern and southern parts of the park are somewhat distant from the June-Naksakjua Valleys, a probable refugium where plants survived recent glaciations of Cumberland Peninsula (Schwarzenbach, no date; Andrews et al. 1980). After recession of the ice, many of the slowly spreading species may not have reached the north or south sides of the park. At present, our knowledge of the geographical distribution of vascular plants in the park does not allow us to adequately assess the climate, geological environment, or refugium hypotheses.

Each of the previous botanical studies in or near Auyuittuq National Park Reserve has contributed to our understanding of the local flora and plant communities, but much remains to be learned. Because of its well documented geological history and wide range in ages and types of surficial deposits present, Auyuittuq is an excellent location for the study of historic, successional, and environmental factors on arctic plant communities. The encouragement and support of such research by Parks Canada would help provide much needed background information for natural resource management and interpretive programs in the park.

ACKNOWLEDGMENTS

We thank J. Ellesworth, T. Elliott, and D. Kooneeliusie (Canadian Parks Service) for their assistance while we were on Baffin Island, and A. Theriault (Indian and Northern Affairs Canada, Iqaluit) who made the the Bell 206B helicopter available for our use. The staff of the Botany Division, National Museum of Natural Sciences, Ottawa, including I. Brodo (Director), S. Aiken, A. Dugal, R. Ireland, and P. Wong, provided expert identification of the plant specimens. Special thanks to J. Bird, A. Downey, S. Fleck, B. Ferguson, M. Fournier, L. Wakelyn, and L. Wilkinson, who edited and criticized the manuscript, and S. Tong who assisted in word processing.

LITERATURE CITED

ANDREWS, J.T., and A.S. DYKE. 1974. A geomorphological - geological inventory of Baffin Island National Park and surrounding area. Final report to Applied Research Division, Parks Canada. Ottawa, Ontario.

ANDREWS, J.T., and G.H. MILLER. 1972. Quaternary history of northern Cumberland Peninsula, Baffin Island, NWT, Canada: Part IV: Maps of the present glaciation limits and lowest equilibrium line altitude for north and south Baffin Island. Arctic and Alpine Research 4:45-59.

ANDREWS, J.T., W.N. MODE, P.J. WEBBER, G.H. MILLER, and J.D. JACOBS. 1980. Report on the distribution of dwarf birches and present pollen rain, Baffin Island, NWT, Canada. Arctic 33:50-58.

ANDREWS, M., and J.T. ANDREWS. 1980. Baffin Island Quaternary environments: an annotated bibliography. Institute of Arctic and Alpine Research, Occasional Paper 33. University of Colorado, Boulder, Colorado. 123 pp.

BAIRD, P.D., and J.L. ROBINSON. 1945. A brief history of exploration and research in the Canadian Eastern Arctic. Canadian Geographic Journal 30:137-157.

BIRD,J.B. 1967. The physiography of arctic Canada. Johns Hopkins Press. Baltimore, Maryland. 336 pp.

BLISS, L.C. 1981. North American and Scandinavian tundras and polar deserts. Pages 8-24 in L.C. Bliss, O.W. Heal, and J.J. Moore, editors, Tundra ecosystems: a comparative analysis. Cambridge University Press, Cambridge, England. 815 pp.

BLOUIN, J. L., C. DESLOGES, and A. GUIMOND. 1975. Auyuittuq National Park biophysical classification of Pangnirtung Pass. Unpublished report. Parks Canada, Ottawa, Ontario. 371 pp.

BOCKHEIM, J. G. 1975. Soils of Cumberland Peninsula, Baffin Island, NWT. Unpublished report prepared for Parks Canada. Institute of Arctic and Alpine Research, University of Colorado, Boulder, Colorado. 107 pp.

BOSTOCK, H.S. 1970. Physiographic subdivisions of Canada. Pages 11-32 in R.J.W. Douglas, editor, Geological and economic minerals of Canada. Economic Geology Report Number 1. Department of Energy, Mines, and Resources, Ottawa, Ontario. 364 pp.

CANADA SOIL SURVEY COMMITTEE. 1978. The Canadian system of soil classification. Department of Agriculture Publication 1646. Ottawa, Ontario. 164 pp.

CONOVER, W.J. 1980. Practical nonparametric statistics. 2nd ed. John Wiley and Sons, New York, N.Y. 493 pp.

DAUBENMIRE, R. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33:43-64.

DRURY, W.H. 1962. Patterned ground and vegetation on southern Bylot Island, Northwest Territories, Canada. Contributions from the Gray Herbarium of Harvard University Number CXC 90. Cambridge, Mass.

DYKE,A.S., J.T. ANDREWS, and G.H. MILLER. 1982. Quaternary geology of Cumberland Peninsula, Baffin Island, District of Franklin. Geological Survey of Canada Memoir 403. Ottawa, Ontario. 32 pp.

EDLUND, S.A. 1982. Plant communities on the surficial materials of north-central Keewatin. Current Research, Part A, Geological Survey of Canada Paper 80-1A:329-333.

EDLUND, S.A. 1983. Bioclimatic zonation in a High Arctic region: central Queen Elizabeth Islands. Current Research, Part A, Geological Survey of Canada Paper 84-1A.

EDLUND, S.A. 1986. Modern arctic vegetation distribution and its congruence with summer climate patterns. Pages 84-99 in Proceedings: impact of climatic change on the Canadian climate. Environment Canada, Atmospheric Environment Service. Ottawa, Ontario.

ELLIOTT, R.C. 1973. A report on the reconnaissance of the National Park on Baffin Island, 1972. Final report to Applied Research Division, Parks Canada, Department of Indian and Northern Affairs, Ottawa, Ontario. 210 pp.

EVANS, L.J., and B.H. CAMERON. 1979. A chronosequence of soils developed from granitic morainal material, Baffin Island, NWT. Canadian Journal of Soil Science 59:203-210.

HARVIE, J.M., J. CIHLAR, and C. GOODFELLOW. 1982. Surface cover mapping in the arctic through satellite remote sensing. Canada Center for Remote Sensing, Department of Energy, Mines, and Resources. Ottawa, Ontario.

HILDEN, O. 1965. Habitat selection in birds. Annales Zoologici Fennici 2:53-75.

HULTEN, E. 1968. Flora of Alaska and neighbouring territories. Stanford University Press, Stanford, California. 1008 pp.

IRELAND, R.R., C.D. BIRD, G.R. BRASSARD, W.B. SCHOFIELD, and D.H. VITT. 1980. Checklist of the mosses of Canada. National Museums of Canada, Publications in Botany, Number 8. Ottawa, Ontario. 75 pp.

LAFARGE-ENGLAND, C. 1975. A contribution to the botany of Maktak Fiord - Broughton Island area of the Cumberland Peninsula. Contract report to Parks Canada. Institute of Arctic and Alpine Research, University of Colorado, Boulder, Colorado. 67 pp.

LARSEN, J.A. 1972. The vegetation of northern Keewatin. Canadian Field-Naturalist 86:45-72.

MASTERTON, J.M., and B.F. FINDLAY. 1976. The climate of Auyuittuq National Park, Baffin Island, NWT. Environment Canada, Atmospheric Environment Service, Meteorological Applications Branch, Project Report Number 22. Toronto, Ontario. 109 pp.

MCKENNA-NEUMAN, C., and R. GILBERT. 1985. Aeolian processes, controls, and features in the eastern Canadian arctic. 14th Arctic Workshop, Arctic land-sea interaction. Bedford Institute of Oceanography. Dartmouth, Nova Scotia. pp78-81.

MCKENNA-NEUMAN, C., and R. GILBERT. 1986. Aeolian processes in glaciofluvial environments of southeastern Baffin Island, NWT, Canada. Proceedings of the Annual Binghamton Geomorphology Symposium 17:213-235.

MILLER, G.H., and R.S. BRADLEY. 1976. The shaping of a land: geology, climate, and ice age history. Pages 1-61 in R. Wilson, ed., The land that never melts, Auyuittuq National Park. Environment Canada - Parks. Ottawa, Ontario.

PARADIS, S., N.R. MORRISON, and V.N. RAMPTON. 1986. Ecosections of Auyuittuq National Park Reserve. Unpublished report prepared for NWT Department of Renewable Resources, Yellowknife. Terrain Analysis and Mapping Services. Carp, Ontario. 63 pp.

POLUNIN, N.A. 1940. Botany of the Canadian eastern Arctic, Part I. Pteridophyta and Spermatophyta. National Museum of Canada Bulletin 92. Ottawa, Ontario. 408 pp.

POLUNIN, N. 1947. Botany of the Canadian eastern Arctic, Part II. Thallophyta and bryophyta. National Museum of Canada Bulletin 97. Ottawa, Ontario. 573 pp.

POLUNIN, N. 1948. Botany of the Canadian eastern Arctic, Part III. Vegetation and ecology. National Museum of Canada Bulletin 104. Ottawa, Ontario. 304 pp.

PORSILD, A.E. 1957. Illustrated flora of the Canadian Arctic Archipelago. Department of Northern Affairs and Natural Resources Bulletin Number 146. Biological Series Number 50. Ottawa, Ontario. 216 pp.

PORSILD, A.E., and W.J. CODY. 1980. Vascular plants of continental Northwest Territories, Canada. National Museum of Natural Sciences. Ottawa, Ontario. 667 pp.

ROWE,J.S., G.R. COCHRANE, and D.W. ANDERSON. 1977. The tundra landscape near Rankin Inlet, NWT. Musk-ox 20:66-82.

SCHWARZENBACH, F.H. No Date. Botanical observations on the Penny Highlands of Baffin Island. Unpublished report (translated into English in 1975). Institute of Arctic and Alpine Research, University of Colorado, Boulder, Colorado.

SEIDEL, K.H. 1987. The climate of Auyuittuq National Park Reserve: a review. Northwest Territories Department of Renewable Resources Manuscript Report. Yellowknife, NWT

SOPER, J.H., and J.M. POWELL. 1985. Botanical studies in the Lake Hazen Region, northern Ellesmere Island, Northwest Territories, Canada. National Museums of Canada, Publications in Natural Sciences Number 5. Ottawa, Ontario. 67 pp.

TEDROW, J.C.F. 1977. Soils of the polar landscapes. Rutgers University Press, New Brunswick, New Jersey. 638 pp.

TERASMAE, J. 1975. A study and evaluation of palynological methods for an interpretation of the arctic milieu and the surrounding area. Final report to Parks Canada. Institute of Arctic and Alpine Research, University of Colorado, Boulder, Colorado.

TERASMAE, J., P.J. WEBBER, and J.T. ANDREWS. 1966. A study of Late-Quaternary plant-bearing beds in north-central Baffin Island, Canada. Arctic 14:296-318.

THOMPSON, J.W. 1984. American arctic lichens. 1. The macrolichens. Columbia University Press, New York, New York. 594 pp.

WELCH, D.M. 1984. Auyuittuq National Park Reserve, park data plan. Parks Canada. Ottawa, Ontario. 63 pp.

YORKE, B.J. 1972. Climatic inventory of Baffin Island National Park. Preliminary report (phase I), November 1972. Parks Canada, Applied Research Division, Ottawa, Ontario. 66 pp.

ZOLTAI, S.C., K.J. MCCORMICK, and G.W. SCOTTER. 1983. A natural resource survey of Bylot Island and adjacent Baffin Island, Northwest Territories. Report prepared for Parks Canada. Canadian Forestry Service and Canadian Wildlife Service, Edmonton, Alberta. 176 pp.

APPENDIX 1. Enivronmental and biotic characteristics of 100 sites chosen for detailed vegetation analysis, Auyuittuq National Park Reserve, 1986-87.

No.	Map	UTM Grid	Plant Comm[a]	Geo[b]	Moist[c]	Elev (ft)	Aspect (°)	Slope (°)	Canopy Cover: Shrub (%)	Herb (%)	Moss (%)	Lichen (%)	Total (%)	Number of Species[d]
10-1	26I	MK27E08N	DWS	flu	m-w	1000	315	5	63	3	3	3	85	10
10-2	26MN	MK55E57N	HE	bed	dry	1500	180	15	3	3	3	38	38	20
10-3	16MN	ML21E36N	WT	mar	wet	10	180	5	3	15	63	1	98	14
10-4	26P	MK23E74N	DWS	flu	mes	30	90	5	38	15	1	15	85	13
11-1	26O	EE92E43N	HE	til	d-m	1700	360	10	15	1	15	15	38	8
11-2	26J	FE18E12N	DSG	flu	mes	750	180	10	15	15	63	1	98	13
12-1	26I	MK22E02N	LIC	flu	dry	1000	0	0	1	3	1	15	15	15
17-1	26I	MJ02E90N	DWS	col	mes	1500	90	20	15	3	3	38	38	6
18-1	26I	LJ99E89N	DWS	col	mes	1000	90	20	38	3	38	38	63	14
18-2	26I	LJ99E88N	DWS	til	mes	1000	90	10	15	1	3	85	85	5
18-3	26I	LJ98E88N	DSG	col	mes	1000	90	25	3	15	38	15	85	5
19-1	26I	LJ95E82N	SU	col	dry	1000	90	15	1	3	1	1	3	16
19-2	26I	LJ94E82N	DSG	til	d-m	1000	90	10	15	38	15	38	38	3
19-3	26I	LJ94E82N	WT	col	m-w	1000	90	5	3	1	63	38	85	6
19-4	26I	LJ92E81N	DWS	eol	d-m	500	90	40	15	3	3	3	38	7
19-5	26I	LJ92E81N	DSG	col	mes	500	270	10	38	38	38	38	85	11
21-1	26I	LJ89E66N	DWS	col	mes	200	270	35	38	15	15	38	85	20
21-2	26I	LJ89E66N	SU	col	dry	100	225	15	0	3	3	1	3	7
29-1	26I	LJ89E66N	DWS	col	mes	50	315	10	38	15	0	15	63	10
29-2	26I	LJ89E66N	SEA	flu	wet	10	315	0	0	3	0	1	3	2
29-3	26I	LJ89E679N	SU	col	mes	15	315	5	0	3	1	1	3	18

APPENDIX 1. (continued)

Plant No.	Map	UTM Grid	Comm[a]	Geo[b]	Moist[c]	Elev (ft)	Aspect (°)	Slope (°)	Canopy Cover: Shrub (%)	Herb (%)	Moss (%)	Lichen (%)	Total (%)	Number of Species[d]
29-4	26I	LJ91E72N	LIC	til	dry	1000	315	10	1	1	15	15	38	9
29-5	26I	LJ91E72N	DSG	col	mes	500	270	25	15	38	3	15	63	21
29-6	26I	LJ89E74N	SU	til	dry	500	270	5	1	1	1	1	1	4
29-7	26I	LJ89E74N	DWS	eol	dry	500	0	5	3	1	1	1	3	26
30-1	26I	LJ89E75N	SU	flu	m-w	500	0	0	3	3	0	0	3	4
30-2	26I	LJ89E76N	SU	col	dry	500	270	30	1	1	0	1	3	9
30-3	26I	LJ89E78N	DSG	eol	mes	500	270	5	63	15	38	15	98	20
30-4	26I	LJ91E79N	DSG	til	mes	1000	315	20	15	15	15	15	63	18
30-5	26I	LJ92E79N	DSG	col	mes	1000	360	10	38	38	15	15	85	28
30-6	26I	LJ92E80N	SU	til	dry	1000	45	20	0	1	0	1	1	4
31-1	26I	LJ93E78N	DSG	til	d-m	1000	315	35	15	3	3	15	63	11
31-2	26I	LJ93E75N	SU	til	dry	1000	315	40	0	1	3	2	3	6
31-3	26I	LJ93E78N	SU	til	m-w	1000	0	0	1	1	1	0	1	18
31-4	26I	LJ94E79N	DWS	til	mes	1000	315	40	38	15	15	15	85	16
31-5	26I	LJ94E79N	DWS	til	mes	1000	315	30	15	3	15	38	85	12
31-6	26I	LJ95E79N	DSG	til	d-m	1000	315	30	15	15	3	38	63	17
31-7	26I	LJ95E79N	DWS	til	mes	1000	315	35	15	3	38	38	63	19
A1-1	26I	LJ91E81N	SU	til	d-m	1000	135	20	1	1	0	1	3	17
A1-2	26I	LJ91E81N	DWS	til	mes	1000	135	5	15	3	38	38	63	15
A1-3	26I	LJ89E79N	DWS	til	mes	100	180	15	15	15	3	15	63	22
A1-4	26I	LJ89E79N	SU	til	mes	1000	180	5	3	38	15	15	63	23

APPENDIX 1. (continued)

Plant No.	Map	UTM Grid	Comm[a]	Geo[b]	Moist[c]	Elev (ft)	Aspect (°)	Slope (°)	Canopy Cover: Shrub (%)	Herb (%)	Moss (%)	Lichen (%)	Total (%)	Number of Species[d]
A1-5	26I	LJ89E79N	DSG	col	m-w	1000	135	5	15	38	38	15	85	19
A1-6	26I	LJ89E79N	DSG	col	d-m	1000	135	35	15	15	3	38	85	22
A1-7	26I	LJ92E79N	SU	col	dry	1500	315	45	1	3	1	1	3	17
A2-1	26I	LJ89E73N	WT	flu	m-w	500	0	0	15	38	3	1	38	18
A2-2	26I	LJ88E74N	WT	flu	m-w	500	0	0	15	38	15	63	85	20
A2-3	26I	LJ89E74N	DWS	col	mes	1000	270	45	38	15	15	15	85	22
87.01	26O	EF90E31N	DWS	flu	mes	150	0	0	38	3	15	15	63	12
87.02	26O	EF90E31N	DSG	flu	m-w	150	0	0	38	38	15	15	63	16
87.03	26O	EF48E15N	HE	til	mes	2000	225	5	15	3	38	63	63	13
87.04	26N	EF36E09N	HE	til	d-m	2000	360	5	15	3	15	15	15	5
87.05	26O	EF78E07N	DWS	bed	d-m	1500	180	5	15	3	15	38	38	9
87.06	26P	LL77E31N	DWS	bed	d-m	100	90	10	15	1	3	15	15	7
87.07	26P	ML22E37N	WT	mar	m-w	20	180	5	15	38	38	38	85	20
87.08	26P	ML25E41N	WT	mar	m-w	150	0	0	1	15	15	15	38	9
87.09	26P	ML21E38N	LIC	til	m-w	500	180	5	1	15	3	85	85	10
87.10	27A	FF04E49N	DWS	col	mes	500	0	5	15	3	15	38	38	6
87.11	27A	FF04E49N	WT	col	wet	500	0	0	15	15	15	15	63	10
87.12	27A	FF04E49N	WT	col	v-w	300	270	5	15	38	15	38	85	10
87.13	26O	FF11E18N	DSG	flu	mes	150	0	0	15	15	3	38	63	9
87.14	26O	FE15E99N	HE	til	m-w	2500	0	0	1	15	15	38	38	7
87.15	26O	EF85E06N	HE	lac	mes	2000	360	0	3	15	3	15	38	17

Appendix 1. (continued)

Plant No.	Map	UTM Grid	Comm[a]	Geo[b]	Moist[c]	Elev (ft)	Aspect (°)	Slope (°)	Canopy Cover Shrub (%)	Herb (%)	Moss (%)	Lichen (%)	Total (%)	Number of Species[d]
87.16	26O	EF85E06N	HE	lac	wet	2500	360	0	3	63	15	15	85	10
87.17	27A	EF94E56N	DWS	til	mes	200	180	0	38	3	15	38	85	11
87.18	27A	EF94E56N	WT	mar	v-w	200	0	0	3	38	38	3	85	10
87.19	27A	EF70E63N	DSG	mar	mes	100	0	0	15	15	1	15	63	18
87.20	27A	EF70E63N	DSG	mar	m-w	30	0	0	15	38	3	15	63	15
87.21	27A	EF47E48N	HE	til	wet	2500	0	0	0	3	3	0	3	8
87.22	27A	EF47E48N	HE	til	mes	2500	360	5	0	3	3	15	15	3
87.23	26P	LL98E38N	DSG	til	mes	1000	315	5	15	15	15	38	63	7
87.24	26P	LL98E38N	DWS	til	d-m	1000	315	10	15	3	3	38	38	8
87.25	26P	LL99E20N	HE	til	mes	1850	0	0	1	1	3	15	15	5
87.26	26P	ML00E12N	DSG	til	m-w	1000	0	0	38	15	15	15	85	11
87.27	26P	ML00E12N	DWS	til	mes	1000	0	35	38	3	3	15	63	5
87.28	26P	LL81E14N	HE	bed	d-m	2300	135	30	1	1	3	63	63	7
87.29	26P	MK26E14N	DSG	flu	mes	1000	0	5	15	15	1	1	38	18
87.30	26P	MK26E14N	WT	flu	wet	1000	0	0	38	38	85	1	98	15
87.31	26P	MK27E14N	DSG	col	mes	1000	270	40	38	38	3	15	85	28
87.32	26P	MK27E14N	SU	col	d-m	1500	270	40	0	3	1	1	3	3
87.33	26P	MK27E13N	WT	flu	v-w	1000	0	0	3	63	63	1	85	9
87.34	26P	MK27E12N	DSG	col	mes	1000	0	5	15	38	38	38	98	19
87.35	26P	MK27E11N	SU	flu	m-w	1000	0	0	0	3	0	0	3	7
87.36	26P	MK27E12N	DWS	col	dry	1000	270	30	38	15	1	3	38	24

APPENDIX 1. (continued)

No.	Map	UTM Grid	Plant Comm[a]	Geo[b]	Moist[c]	Elev (ft)	Aspect (°)	Slope (°)	Canopy Cover: Shrub (%)	Herb (%)	Moss (%)	Lichen (%)	Total (%)	Number of Species[d]
87.37	26P	MK27E12N	DSG	col	m-w	1000	270	20	38	38	38	15	95	20
87.38	26P	MK27E12N	SU	col	d-m	1500	315	25	1	3	3	1	3	10
87.39	26P	MK24E11N	HE	bed	m-w	2750	180	10	3	15	38	38	38	8
87.40	26P	MK24E11N	HE	col	dry	2800	360	30	0	3	3	38	38	1
87.41	26J	FE25E00N	DWS	til	d-m	1800	225	10	3	3	3	38	38	9
87.42	26J	FE25E00N	WT	til	wet	1800	0	0	15	38	38	3	85	6
87.43	26J	FE25E00N	DSG	til	mes	1400	135	20	15	38	15	3	63	13
87.44	26J	FE25E00N	WT	til	v-w	1200	0	0	1	15	63	1	85	8
87.45	260	EE78E49N	HE	til	mes	2025	180	5	3	3	3	15	15	12
87.46	260	EE78E49N	HE	til	wet	1900	315	5	3	63	38	3	85	11
87.47	260	EE67E67N	HE	bed	dry	2700	180	15	0	1	1	3	3	5
87.48	260	EE88E50N	HE	til	dry	2500	180	10	1	1	1	15	15	5
87.49	260	EE88E50N	HE	til	mes	2500	180	10	3	15	3	15	38	5
87.50	26J	EE92E40N	HE	til	dry	2800	0	5	1	1	3	3	3	3
87.51	26J	FE21E15N	DWS	col	mes	1000	225	15	38	15	38	15	98	19
87.52	26J	FE21E15N	DSG	col	m-w	1000	225	20	38	38	3	3	98	17

[a] Plant communities: dwarf shrub (DWS), dwarf shrub-graminoid (DSG), high elevation barnens (HE), wet tundra (WT), seashore (SEA), lichen dominated (LIC), and successional (SUC).
[b] Geological deposits: bedrock (bed), colluvium (col), eolian (eol), fluvium (flu), lacustrine (lac), marine (mar), till (til).
[c] Moisture conditions: dry, dry-mesic (d-m), mesic (mes), mesic-wet (m-w), wet, very wet (v-w).
[d] Number of species of vascular plants found at the site.

APPENDIX 2. Lichens collected in Auyuittuq National Park Reserve in 1986-87.

Alectoria nigricans (Ach.) Nyl.

Alectoria ochroleuca (Hoffm.) Mass.

Allantoparmelia alpicola (Th. Fr.) Essl.

Arctoparmelia centrifuga (L.) Hale

Arctoparmelia separata (Th. Fr.) Hale

** Bryoria chalybeiformis (L.) Brodo & Hawksw.

Bryoria nitidula (Th. Fr.) Brodo & Hawksw.

Bryoria nitidula (Th. Fr.) Brodo & Hawksw.

** Bryoria simplicior (Vain.) Brodo & Hawksw.

Cetraria andrejevii Oxn.

Cetraria cucullata (Bell.) Ach.

Cetraria delisei (Bory ex. Schaer.) Nyl.

Cetraria ericetorum Opiz

Cetraria islandica (L.) Ach. ssp. islandica

** Cetraria laevigata Rass.

Cetraria nigricans Nyl.

Cetraria nivalis (L.) Ach.

Cetraria tilesii Ach.

Cladina mitis (Sandst.) Hustich

Cladina rangiferina (L.) Nyl.

Cladonia amaurocraea (Floerke) Schaer.

APPENDIX 2 (continued)

Cladonia bellidiflora (Ach.) Schaer.

Cladonia coccifera (L.) Willd.

Cladonia cornuta (L.) Hoffm.

Cladonia gracilis (L.) Willd. ssp. gracilis

Cladonia stricta (Nyl.) Nyl.

Cladonia sulphurina (Michx.) Spreng.

Cladonia uncialis (L.) Wigg

Coelocaulon divergens (Ach.) R.H. Rowe syn. Bryocaulon divergens (Ach.) Karnef.

Dactylina arctica (Richards.) Nyl.

Dactylina ramulosa (Hook.) Tuck.

Haematomma lapponicum Ras.

Lecidea ramulosa Th. Fr.

** Lecidea sp.

Melanelia stygia (L.) Essl.

** Micarea sp. ?

** Mykoblastus tornoensis (Nyl.) R. Anderson

Nephroma arcticum (L.) Torss.

Nephroma expallidum (Nyl.) Nyl.

Ochrolechia frigida (Sw.) Lynge

Ochrolechia inaequatula (Nyl.) Zahlbr.

Pannaria conoplea (Ach.) Bory

Parmelia omphalodes (L.) Ach. ssp. glacialis Skult

APPENDIX 2 (continued)

Parmelia sulcata Tayl.

Peltigera aphthosa (L.) Willd.

Peltigera leucophlebia (Nyl.) Gyelm.

Peltigera malacea (Ach.) Funk

Pertusaria dactylina (Ach.) Nyl.

Pertusaria geminipara (Th. Fr.) Knight ex Brodo

Pertusaria oculata (Dicks.) Th. Fr.

Pseudephebe minuscula (Nyl. ex Arn.) Brodo & Hawksw.

Pseudephebe pubescens (L.) Choisy

Psoroma hypnorum (Vahl.) S. Gray

Rhizocarpon geographicum (L.) DC.

Rinodina turfacea (Wahlenb.) Korb.

Solorina crocea (L.) Ach.

Sphaerophorus globosus (Huds.) Vain.

Sphaerophorus tuckermanii Ras.

Stereocaulon alpinum Laur.

** Stereocaulon arenarium (Sav.) Lamb

Stereocaulon botryosum Ach.

Stereocaulon grande (Magn.) Magn.

Stereocaulon incrustatum Floerke

Stereocaulon paschale (L.) Hoffm.

Stereocaulon rivulorum Magn.

Thamnolia subuliformis (Ehrh.) W. Culb.

APPENDIX 2 (Continued)

Thamnolia vermicularis (Sw.) Ach. ex Schaer.

Umbilicaria havaasii Llano

Umbilicaria hyperborea (Ach.) Hoffm.

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* Identifications determined by P.Y. Wong, National Museum of Natural Sciences, Ottawa.

** Specimens retained by National Museum.

? Identification uncertain.

APPENDIX 3. Bryophytes collected in Auyuittuq National Park Reserve in 1986-87.*

Anastrophyllum minutum (Schreb.) Schust.

Anastrophyllum minutum var. grandis (Gott. ex Lindb.) Schust.

Andreaea blyttii B.S.G.

Andreaea rupestris Hedw.

Anthelia sp.

** Aulacomnium palustre (Hedw.) Schwaegr.

** Aulacomnium turgidum (Wahlenb.) Schwaegr.

** Barbilophozia kunzeana (Hub.) Gams

Blepharostoma trichophyllum ssp. brevirete (Bryhn & Kaal.) Schust.

Brachythecium salebrosum (Web. & Mohr.) B.S.G.

Bryum sp.

Calliergon sarmentosum (Wahlenb.) Kindb.

Calliergon stramineum (Brid.) Kindb.

Calypogeja muelleriana (Schiffn.) K. Mull.

Ceratodon purpureus (Hedw.) Brid.

Cephaloziella arctica Bryhn & Douin

Chandonanthus setiformis (Ehrh.) Lindb.

** Conostomum tetragonum (Hedw.) Lindb.

Dicranoweisia crispula (Hedw.) Lindb. ex Milde

Dicranum elongatum Schleich. ex Schwaegr.

Dicranum groenlandicum Brid.

Dicranum spadiceum Zett.

Dicranum sp.

Distichium sp.

Drepanocladus aduncus (Hedw.) Warnst.

Drepanocladus exannulatus (B.S.G.) Warnst.

Gymnocolea inflata (Huds.) Dum.

Gymnomitrion concinnatum (Lightf.) Corda

Gymnomitrion corallioides Nees

Hypnum revolutum (Mitt.) Lindb.

Kiaeria starkei (Web. & Mohr) Hag.

Lophozia alpestris (Schleich. ex Web.) Evans

Oligotrichum falcatum Steere

Oncophorus wahlenbergii Brid.

Paludella squarrosa (Hedw.) Brid.

Pogonatum alpinum (Hedw.) Rohl.

Pogonatum dentatum (Brid.) Brid.

Pohlia crudoides (Sull. & Lesq.) Broth.

Pohlia nutans (Hedw.) Lindb.

Pohlia sp.

Polytrichum hyperboreum R. Br.

** Polytrichum piliferum Hedw.

Polytrichum strictum Brid.

APPENDIX 3 (continued)

Psilopilum cavifolium (Wils.) Hag.

** Ptilidium ciliare (L.) Hampe.

Rhacomitrium canescens (Hedw.) Brid.

** Rhacomitrium lanuginosum (Hedw.) Brid.

Scapania sp.

Scorpidium turgescens (T. Jens.) Loeske

Sphagnum angustifolium (C. Jens. ex Russ.) C. Jens.

Sphagnum capillifolium (Ehrh.) Hedw.

Sphagnum compactum DC. ex Lam. & DC.

Sphagnum fimbriatum Wils. ex J. Hook

Sphagnum rubellum Wils.

Sphagnum squarrosum Crome

** Sphagnum teres (Schimp.) Angstr. ex C. Hartm.

Sphagnum sp.

Tomenthypnum nitens (Hedw.) Loeske

Tortella fragilis (Drumm.) Limpr.

Tritomaria quinquidentata (Huds.) Buch

Tritomaria sp.

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* Identifications by R.R. Ireland, National Museum of Natural Sciences, Ottawa.

** Specimens retained by National Museum.