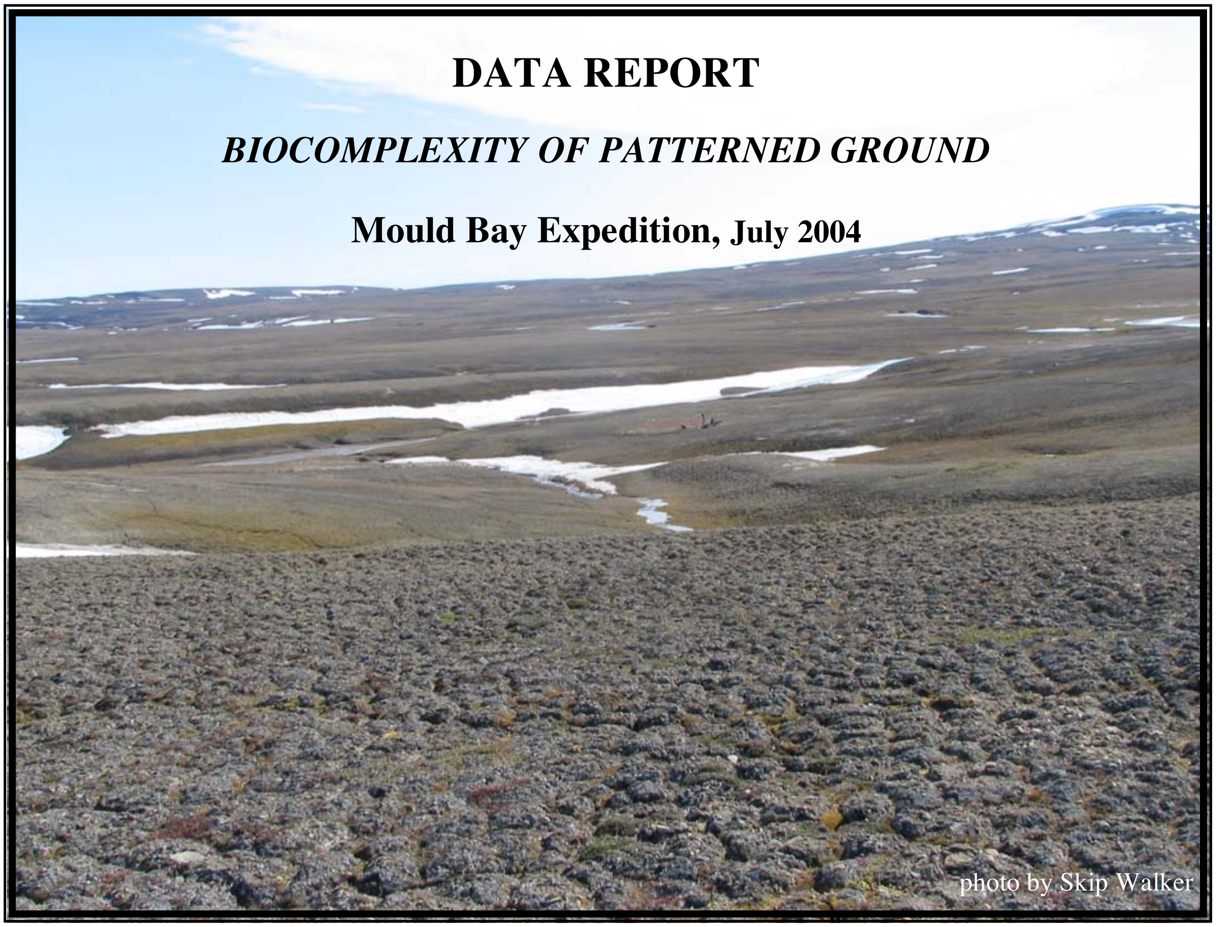
DATA REPORT

BIOCOMPLEXITY OF PATTERNED GROUND

Mould Bay Expedition, July 2004



Mould Bay, Prince Patrick Island, photo taken from near Grid 1, looking at Grid 2 in mid-ground.

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Summary

A team of 24 people from the University of Alaska Fairbanks and other organizations worked at Inuvik, NWT and Mould Bay, Prince Patrick Island, NWT during the period 12-27 July 2004, as part of the "Biocomplexity associated with biogeochemical cycles in arctic frost-boil ecosystems” project. The field party consisted of 11 research scientists, 1 teacher participating in the TREC (Teachers and Researchers Exploring and Collaborating) program, 5 graduate students, 4 students in an Arctic Field Ecology course, 2 native hunters from the village of Sachs Harbor, and a cook (see Participant List and Contact Information).

This year’s work was the third in a 5-year project. The main objective of the research is to investigate the properties of small-patterned-ground ecosystems along a climate gradient from the coldest parts of the Arctic to the northern boreal forest (Fig. 1). We are studying earth hummocks, non-sorted circles, small non-sorted polygons, and turf hummocks – how they form, how they vary with climate and substrate, and their role in total ecosystem functions. The project is examining five subzones of the circumpolar Arctic (Subzone A is the coldest, and Subzone E is the warmest). In 2002, the project examined non-sorted circles and earth hummocks along the Dalton Highway in Northern Alaska (Subzones C-E). The second year focused at Green Cabin on Banks Island (Subzone C), and this year the team worked at Mould Bay (Subzone B). In subzone B and C, turf hummocks and small non-sorted polygons are dominant on zonal sites. This year the research team also worked at Inuvik (northern boreal forest), where large earth hummocks are common, and also revisited Green Cabin to collect data from research plots established in 2003. In 2005, the project will examine Subzone A at Isachsen on Ellef Ringnes Island.

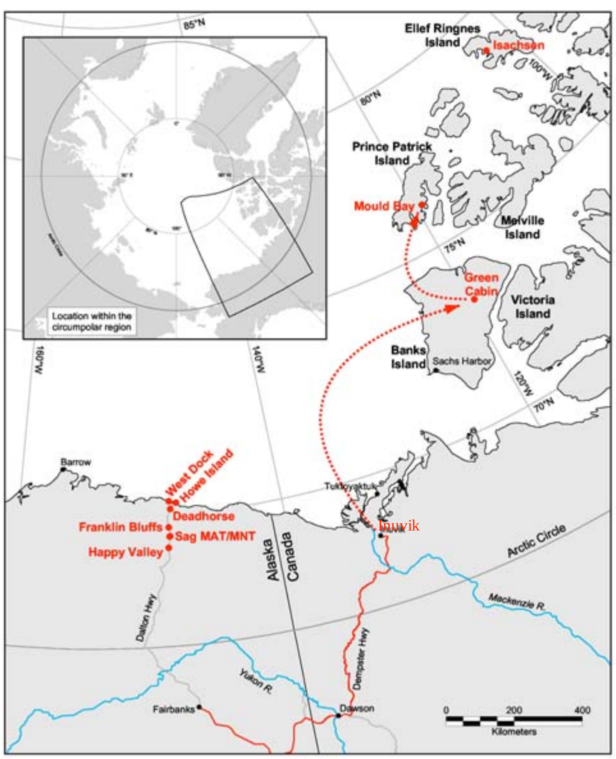


Figure 1. Map of patterned-ground study sites along climate gradient.

The team is investigating the complex interactions between climate, permafrost, geomorphology, soils, vegetation, and soil invertebrates within these unique ecosystems. One goal is to examine how these systems might change in different parts of the Arctic as the climate warms. This year the project established three new 10 x 10-m grids: one near Inuvik in a lichen-woodland with well developed mounds, and two at Mould Bay. We mapped the vegetation and thaw-layer depth within the grids, and characterized the vegetation of the patterned ground by collecting vegetation, site, and soil information from 41 relevé sites in the vicinity of the grids. We also established a climate station near one of the grids. The major accomplishment this year was the identification of how three major processes related to patterned-ground formation vary and interact along the climate gradient and within major soil-texture classes. The processes include the formation of contraction cracks, differential frost heave, and the development of a vegetation mat. The strength of these processes vary across the climate gradient and interact to form turf hummocks, sorted and non-sorted circles, and large well-vegetated mounds.

One teacher participated in the project as part of the NSF-sponsored TREC program that incorporates teachers into field research teams, integrating research, education, and outreach, and expanding the teacher's scientific knowledge base.

Students are a major part of the project. Four graduate students participated in the project this summer, and four undergraduate students were involved from the Arctic Field Ecology course organized by Dr. Bill Gould. The first two weeks of the course were spent along the Mara River near Bathurst Inlet and culminated in a camp with local Inuit. Students studied the local natural history, current trends in ecological research and Inuit traditional knowledge. The class then traveled to Inuvik to meet the biocomplexity team, and worked on field projects with the science team at Inuvik, Green Cabin, and Mould Bay.

This research is supported by the U.S. National Science Foundation, grant no. OPP-0120736. We also thank VECO Polar Resources, the Aurora Research Institute, the Polar Continental Shelf Program, Parks Canada, and the village of Sachs Harbor Hunters and Trappers Committee for help with logistics and information.

Description of Mould Bay:

Prince Patrick Island is in the Northwest Territories, in the western Canadian Arctic Archipelago. It is north of Banks Island and west of Melville Island, and is 15,848 km^2 in size. Mould Bay is the site of a Canadian weather station on the southeastern coast of Prince Patrick Island, at 76^o North latitude, 199^o West longitude.

Prince Patrick Island is a low relief island (mostly below 100 m, maximum elevation 280 m), composed mostly of Tertiary sands and gravels (Beaufort formation). The eastern portion of the island is more dissected and has a more complex coastline than the west. In the east, Mesozoic and Paleozoic sediments such as the sandstones of the Melville Island Formation are exposed, forming escarpments (Tozer and Thorsteinsson 1964).

The Mould Bay area is composed of folded sedimentary rocks, many of which are carbonate bearing. Tedrow et al (1968) mapped eight soil types in the Mould Bay vicinity, controlled mainly by topographic features and their effects on moisture regimes and texture of parent material. Polar Desert soils covered the tops of the local ridges, upland tundra soils cover more rounded hills, meadow tundra soils are found in lower-lying moist areas, and bog soils occur in isolated low wet areas. Areas of active solifluction, tundra soil with many outcrops, lithosol and bedrock, and recent stream and shore deposits were also mapped. Everett (1968) recognized two soil associations in the Mould Bay area. Those associated with the Jurassic Wilke Point Formation have a parent material of light gray, very-fine-grained sands, sandstones and siltstones. Those developed from the Devonian Griper Bay Formation have light -colored, fine- to medium-grained sandstone parent material.

Mould Bay is in the Tundra Bioclimate Zone, in Subzone B (CAVM Team 2003). For the period 1971-2000, the mean annual temperature was -17.5^{o} C, with monthly temperatures ranging from daily minimums of -37.8^{o} C (February) to daily maximums of 6.8^{o} C (July). Mean July temperature for that period was 4.0^{o} C. Annual precipitation was 111 mm, and average snow depth was 15 cm. On average, 89 days received snow-fall > 0.2 cm, and 16 days received rain-fall > 0.2 mm. Average wind speed was 14.9 km/h, predominantly from the NW. There were 221.9 degree days above 0^{o} C per year (Environment Canada, www.climate.weatheroffice.ec.gc.ca/climate_normals/).

Figure 2. Mould Bay Camp and crew.

Continuous vegetation in the Mould Bay area occurs in moist to wet areas with fine-grained soils, either on slopes below snowbeds or adjacent to lakes, streams, or the ocean. Even under the best of local conditions, the height of the vegetation is approximately15 cm. The only woody shrub is the prostrate dwarf shrub, *Salix arctica*. The flora is quite limited: Bird (1974) found only 40 vascular species, 59 mosses, 12 liverworts and 123 lichens.

Sparsely vegetated gravel covers most of the hills and ridges around Mould Bay. While mostly barren, these areas do support scattered vascular plants, rock lichens, and occasional patches of vegetation in moist areas with finer soils. Patterned ground, due to sorting of soil and stone, occurs as sorted circles, stone nets, and stripes on slopes. Most zonal areas on slopes and broad ridges are covered with hummocks (30-40 cm diameter), which sometimes have bare spots on the tops. The dominant vegetation on the hummocks is lichens and rushes, with mosses and

Salix arctica between. Wet areas below snowbeds or adjacent to ponds or streams are completely vegetated with mounded microrelief (1-2 m diameter) or ice-wedge polygons. Dominant vegetation is sedges and grasses and mosses. Lichens and *Salix arctica* are also common.

Table 1. Definitions of patterned ground features studied (based on Washburn 1980)

Earth hummocks	Mounds with a core of mineral soil usually 1-2 m in diameter (or larger), and up to 0.75 m high.
Non-sorted circles	Circular patterned ground features without a border of stones, usually with a barren or sparsely vegetated central area 0.5-3 m in diameter.
Small non-sorted polygons	Small polygonal features (< 1 m diameter), lacking a border of stones, usually on flat surfaces, often delimited by cracks
Turf hummocks	Small mounds 10-20 cm high and 15-50 cm diameter, commonly occurring on slopes.

Methods & Types of Data Collected

Inuvik grid:

One grid was set up 48 km south of Inuvik, on the west side of the Dempster Highway, near Charles Tarnocai's permanent plot. The grid was located in a hummocky black spruce-lichen woodland (Fig. 3). The earth hummocks were lichen-rich, vegetated with *Cladonia arbuscula* and *Cladonia stygia*, with *Flavocetraria cucullata* and *Ledum palustre* ssp. *decumbens*. The inter-hummock area had more shrubs (*Vaccinium vitis-idaea, Vaccinium uliginosum, Arctostaphylous rubra, Ledum*, and *Salix glauca*) and mosses (*Aulacomnium turgidum, A. palustre*, and *Hylocomium splendens*) Vegetation of the grid was mapped (Fig. 9), two relevés were described (see Tables 9-16). A soil pit was dug and described. LAI and vegetation canopy height were measured along two 50 m transects (Table 6).

Figure 3. Inuvik 10 x 10 m grid, Joe Bickley measuring tree height, flags every meter.

Climate: Instruments were installed at Grid 1 (Fig. 4) to measure air temperature, ground surface temperature and ground temperature. Standard Campbell Scientific L107 thermistors were used for air and ground surface temperature, and MRC thermistor rods for ground temperature. Two sets of ground temperature sensors were installed six meters apart, one in a hummock and another in an inter-hummock area. After pre-installment calibration, the precision of the sensors is better than 0.02°C. Ground temperatures are collected at ten different depths down to 106 cm (roughly every 10 cm), measured every 5 minutes, and averaged and saved every hour.

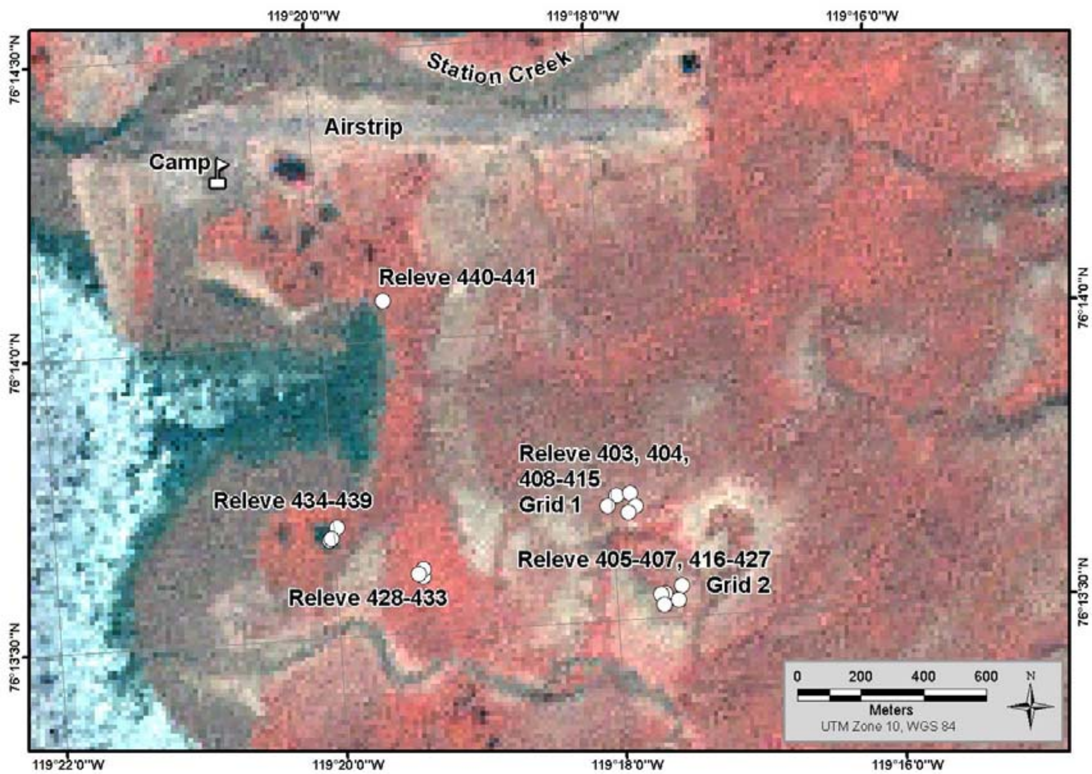


Figure 4. False-CIR satellite image of Mould Bay area, with sampling sites marked. Image is Landsat 7 (Path 63 row 06, acquired August 13, 1999) band 3,2,1 composite, pan-sharpened to 15 m resolution.

Ground moisture (including the unfrozen water content in winter) is measured at two different depths within the hummock and at two different depths in the inter-hummock area. VITEL volumetric water content sensors (based on TDR technique) were used. Each of the VITEL sensors was paired with an additional L107 temperature probe. Moisture content is recorded hourly during the entire year. Two Campbell Scientific heat flux probes were also installed at 8 cm depth, one within the hummock and another in the inter-hummock area.

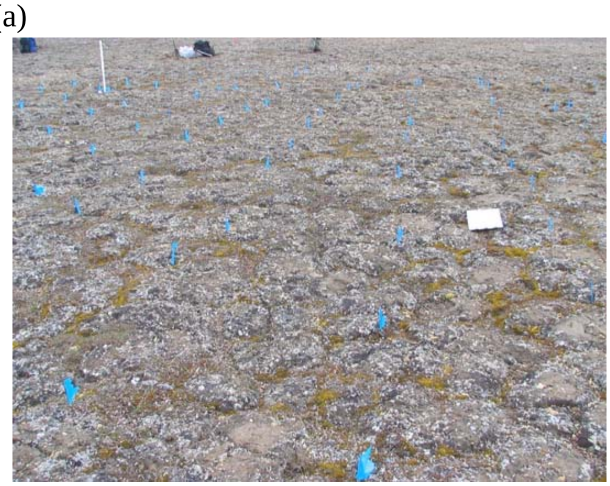
Snow depth is continuously recorded at the site (at hourly intervals) using a CSC Ultrasonic Distance Sensor. A Campbell Scientific CR10-X logger operates the station and saves the data.

A 20-watt regulated solar panel coupled with a 12 v battery is used for power supply. The air temperature sensor, the ultrasonic snow sensor and the solar panel are mounted on a 3 m tripod.

Five heave scribers had been set up at Grid 1 in 2003, in both hummock and inter-hummock vegetation. Heave measured at those sites in 2004 was 3 cm, 4 cm and 4 cm within the hummocks, and 1.2 cm and 2 cm in the inter-hummocks area. Three new heave scribers were placed around Grid 2, two within the bare non-sorted circle and one in the vegetated area. Four heave scribers were installed at the near-shore site south of the airstrip, with two on earth hummocks, and two between the hummocks. The heave scribers consist of a 2 m-long 1.5 cm-diameter solid copper grounding rod, with a steel scriber. The copper rod was driven 1.5 m into the ground, anchoring it in the permafrost. The steel plate and sleeve were placed on the rod, with the plate resting on the ground. The steel plate slides freely on the rod, rising with the frost heave in the fall, and falling back down with the spring thaw. A sharp spring steel scriber is attached to the sleeve by hose clamps. Its tip scratches the copper rod. The steel plate was rotated to make a complete circular scratch around the copper rod, marking the initial position. Any heaving of the ground during the winter raises the plate, causing the scribe to scratch the rod. The length of this vertical scratch was measured for the heave scribers installed in 2004, and will be measured at all sites in following years to determine the amount of heave.

Grids: Two grids (one established in 2003) were marked by 1-m re-bar and 1.5-m PVC pipe at the four corners, and labeled with aluminum tags. Labeled pin-flags were placed every meter within the grid. Grid 1 was located along a broad ridge-top (see cover), and was composed of small turf hummocks (< 50 cm diameter, 10 cm high) (Fig. 5a). The hummocks were covered with crustose lichens, such as *Hypogymnia subobscura* and *Lecanora epibryon*. The inter-hummock areas had more mosses (especially *Tortula ruralis*), *Luzula nivalis, Salix arctica, Saxifraga oppositifolia* and fruticose lichens. Grid 2 was located on a well-drained bench, and had large bare non-sorted circles (approx. 1.5 m diameter), with little micro-relief (Fig. 5b). Non-bare areas were vegetated with either a lichen crust (including *Hypogymnia subobscura, Leproloma* sp. *Megaspora verrucosa,* and *Protoblastenia siebenhaariana* var. *terricola*), or *Salix arctica* and *Luzula nivalis* with mosses (*Tortula ruralis, Hypnum revolutum*).

(a)



(b)

Figure 5. Grid 1(a) and Grid 2 (b), Mould Bay, Prince Patrick Island.

Vegetation mapping: Maps were made of the vegetation types within the two grids (Fig 10). First the different vegetation communities were identified (Fig. 11), then their location within the marked grid was mapped by hand on a 15-cm paper grid (1:66.7 scale). The vegetation patterns in Grid 1 were at such a fine scale (20-30 cm hummocks) that only 1/4 of the grid was mapped. In addition, two maps were made of 1-m^2 within each grid, using the same forms, but at larger scale (1:6.7), to show the cracking patterns and polygons which occur on the centimeter scale Fig. 12). The maps were hand-digitized as ARC/INFO polygon coverages.

Thaw depth: Thaw depths were sampled every half-meter within both grids with a metal probe. Vegetation community was noted at each point. The data were summarized by vegetation type (Table 5). The data were also used to create maps of thaw depth on the grids, using Transform software (Fig. 13). Ten thaw depth measurements were also taken at each relevé site.

Plant Biomass: Biomass was collected at three sites along two 50-m transects (5-m, 25-m and 45-m distances) adjacent to each grid. Biomass was also collected at each of the relevés. All above-ground vegetation within a 20 x 50-cm frame was clipped. Mosses were clipped at the base of the green portion. The samples were frozen for storage and then sorted by major plant functional type (moss, lichen, forb, horsetail, deciduous shrub, evergreen shrub, graminoid) and into live and dead categories. Shrubs were divided into foliar, reproductive, and woody components. Dry weights of each component biomass sample are reported (Table 16, Fig. 19).

LAI & NDVI: Leaf area index (LAI) was measured every meter along two 50-m transects adjacent to each grid, using a LICOR LAI-2000 Plant Canopy Analyzer (Table 6). An above/outside-canopy reading (control) was followed by four below-canopy readings, taken above the moss layer along the axes of the grid at 20 cm from the center of the grid. The LAI sensor sits a minimum of approximately 2 cm above the ground, so any plant canopy that has a height < 2 cm is not measured. This restriction prohibited reasonable measurements of LAI at Mould Bay. All LAI measurements were taken in the observer's shadow to provide as consistent ambient light conditions as possible. A 90^o field-of-view opening was used to prevent interference from the observer. The Normalized Difference Vegetation Index (NDVI) was measured using an Analytical Spectral Devices Field spectrometer, also every meter along the two 50-m transects (Fig. 14). The sensor was held 90 cm above the ground to include an area of ~314 cm^2. Cover at each point was noted as vegetated, bare, or mixed (Fig. 15).

Soil pits: A 1.5 x 1 m soil pit was dug at both grid sites to 1 m depth. A jackhammer was used to dig the frozen portion of the soil pit. Four additional pits were dug, including two at hummocky sites below snowbeds, and one in a hummocky site next to the shore. Cross-sections of the pits were drawn and the soil profiles described. Samples taken from these pits were analyzed for pH, bulk density, P, C, and N.

Vegetation relevés: Two relevés were sampled at the Inuvik grid. Thirty-nine relevés were sampled at Mould Bay, from the grids and other sites (Figs. 5, 18). Sites were chosen to represent the zonal vegetation and other major plant community types in the Mould Bay area. Riparian and other less common vegetation types were not sampled. Three to five replicates were collected for each plant community described in the Green Cabin vicinity. Relevé location and environmental site descriptions were collected, as well as cover data for all growth forms and species (Tables 9, 10, 12, 15). Nonvascular plant identification was verified by Mikhail Zhurbenko and Olga Afonina at the Komarov Botanical Institute, St. Petersburg, Russia. A complete plant species list was compiled for the relevés (Table 14). Soil samples were collected at each relevé, at the top of the mineral horizon. These were analyzed for chemical and physical properties (Table 11).

N-factor: Temperature sensors were buried at each relevé to record data for calculating the N-factor (a measure of insulation). For frost feature or hummock relevés, the sensor was buried in the soil at 1 cm depth. For vegetated, inter-hummock relevés, one sensor was buried at the live moss - dead organic matter interface, and a second in 1 cm of mineral soil. We recorded the depth of live moss and organic matter in the inter hummocks, and took thaw depth and soil moisture readings. We can calculate the N factor for each relevé (Klene 2001) and compare hummock vs. inter-hummock, and frost features along the climate gradient.

Onset Hobo H-8 temperature sensors that had been placed in Grid 1 in 2003, 1 cm deep in the mineral soil of a bare hummock top and in the inter-hummock vegetation, were retrieved and down-loaded (Fig. 20).

Biogeochemistry: Three representative patterned-ground features were selected at the two main sites: zonal (Grid 1), where small turf hummocks are dominant, and xeric (Grid 2), where non-sorted circles are dominant. At each sample site, several soil samples were collected within the feature and also between the features to determine the nitrogen and carbon content of the first 5 cm of soil in each area. The samples were then analyzed for percent carbon and nitrogen using a Carlo Erba elemental analyzer.

In order to determine the differences in nitrogen cycling, several processes were measured, including net nitrogen mineralization and nitrogen fixation. Nitrogen mineralization was measured using the buried bag method (Eno 1960) over a period of 6 days. At four locations within each frost feature and between the features, a soil core (2 cm in diameter and 5 cm in depth) was taken, and 10 g of the soil were extracted in 50 mL of 0.5 M K2SO4. Another soil core was taken as close as possible to the original core. This soil core was placed into a polyurethane plastic bag and incubated in the soil for six days. A 10 g sub-sample of the core was then extracted in 50 mL of 0.5 M K2SO4. The samples were then mixed on a shaking table for 2 hours. The extracts were filtered and then analyzed for NO3- and NH4+ with an Alpchem autoanalyzer.

Nitrogen fixation was assessed via the acetylene reduction assay (Knowles 1980). A small core (approximately 2 cm in diameter and 0.5 cm deep) was removed from the surface of two locations within each frost feature: bare soil, crust, and between the features. The soil was placed in an incubation chamber and 10% of the gas volume was replaced with acetylene (generated from calcium carbide and water). The incubation vials were incubated for 48 hours and then a sample of gas was removed from the incubation vial and placed in a sample vial. The samples were then analyzed for ethylene with a gas chromatograph. Calculations of nitrogen fixation were made based on a standard conversion from acetylene reduction to nitrogen reduction.

Measurements of NDVI were made at three points within each frost feature and between the frost features at each site, following the methods described above (Table 17). Aboveground biomass clippings were also taken, at each sample location. These samples were sorted by plant functional type, dried at 50^{o}C and the dry weight was taken of each sample (Table 18, Figure 21).

Physical properties of these areas were measured, including volumetric and gravimetric soil moisture, thaw depth, and soil temperature at a depth of 5 cm. These measurements were made at four points within sample site (Table 17).

Decomposition: We established a series of decomposition experiments to look at decay rates on hummock and inter-hummock areas along a toposequence at Mould Bay.
Experiment 1. We collected freshly senesced litter of *Luzula nivalis* at the Mould Bay site on Prince Patrick Island (subzone B) and created 60 litterbags (2x2 mm mesh). We weighed these and placed them along our biodiversity transects on hummock and inter-hummock ground surface and at 4 cm depth. A set of controls will be analyzed in the chemistry lab at the International Institute for Tropical Forestry, San Juan, Puerto Rico. Remaining bags will be sampled in 2005 to determine mass loss, decay rates and changes in litter chemistry.
Experiment 2. We prepared 107 additional litter bags of *Luzula nivalis* for placement in hummock and inter-hummock areas along a toposequence at the Mould Bay site. Three replicate litter bags were placed on the surface and below-ground at 4 cm depth within 3 replicate hummocks and inter-hummocks at ridge, slope and valley positions. Controls were retrieved after placement and additional bags will be retrieved in 2005.

Litter bags of *Luzula nivalis* were collected that had been placed at hummock and inter-hummock sites at Mould Bay in 2003. Litter bags of C*arex misandra* that were placed in bare non-sorted circles and vegetated areas along a toposequence at Green Cabin, Banks Island in 2003 were collected.

Mycorrhizae: The purpose of the trip was to survey fungal diversity in the patterned-ground ecosystems near Mould Bay on Prince Patrick Island. Soil samples, fungal fruiting bodies, and roots of vascular plants present in frost feature ecosystems were collected in order to assess their mycorrhizal status. The assessment will include ectomycorrhizal-, ericoid -, arbuscular mycorrhizal fungi and dark septate fungi.

Mycorrhizal survey/ assessment:
Plants were chosen with respect to their presence in the established 10x10m grids (Table 19). For each plant species, six individuals were chosen randomly in the area surrounding the grids. Plants were dug up and their root systems washed in water. Foreign roots were removed with tweezers to assure the identity of the root. Roots from each individual plant were divided into two sample sets, one for microscopy and the other for molecular analysis. All root samples were frozen in liquid nitrogen. Woody species and species which were known to be ectomycorrhizal were transported back alive to the lab. Here three individuals of each species were sampled per

site. Root systems were washed and all fine roots were sampled for morphotyping under a dissection scope (Agerer, 1987- 2002). After morphotyping, root tips from each morphotype were frozen at -80°C for further molecular analysis and also stored in ethanol for morphological description (Table 20).

Fungal fruiting bodies:
Fruiting bodies in the area were collected, described and dried in silica gel.

Turf hummocks: Turf hummocks are small, 11–20 cm high, 18–50 cm diameter mounds. They commonly occur on gently to steeply sloping Arctic terrain (Figs. 6a, 6b). The purpose of the turf hummock sub-study is to study the characteristics and genesis of turf hummocks in Arctic Bioclimate subzones A, B and C.

The objectives of this turf hummock sub-study are:

1. To examine the internal and external characteristics of turf hummocks on the basis of soil analytical data and of moisture and temperature measurements.
2. To determine their age and genesis.
3. To establish the role they play in the Arctic ecosystems.

During this fieldwork turf hummocks were studied at 11 locations in the Mould Bay area of Prince Patrick Island in Arctic Bioclimate Subzone B (Table 2).

Table 2. Locations of turf hummock study sites.

Site no.	Lat. (N)	Long. (W)	Slope (%)	Dominant vegetation
MB–1A	76° 13' 45"	119° 17' 56"	25	*Luzula*–lichen–moss
MB–1B	76° 13' 45"	119° 17' 56"	25	*Luzula*–lichen–moss
MB–1C	76° 13' 45"	119° 17' 56"	25	*Luzula*–lichen–moss
MB–1D	76° 13' 45"	119° 17' 56"	25	*Luzula*–lichen–moss
MB–2	76° 13' 44"	119° 17' 46"	10	Moss–lichen
MB–3	76° 13' 36"	119° 18' 09"	10	*Dryas*–lichen–moss
MB–4	76° 13' 35"	119° 18' 07"	15	*Dryas*–lichen–moss
MB–5A	76° 13' 34"	119° 18' 07"	8	*Dryas*–moss
MB–5B	76° 13' 34"	119° 18' 07"	8	*Dryas*–moss
MB–6	76° 14' 10"	119° 18' 21"	7	Lichen–moss
MB–7	76° 14' 06"	119° 18' 25"	5	Lichen–moss

Information collected:
Pits were dug diagonally across the hummock to the adjacent inter-hummock troughs to expose the internal morphology (Figs. 6c, 6d). Detailed cross section diagrams were prepared and the

various soil horizons and layers were identified. Soil samples were collected for laboratory analysis to determine their chemical and physical properties. Additional samples were collected for bulk density determinations and samples also were collected from organic-rich horizons for radiocarbon dating (Table 3).

Table 3. Types and numbers of turf hummock samples collected.

Site no.	Soil	Bulk Density	Radiocarbon
MB–1A	2	1	1
MB–1B	2	1	1
MB–1C	4	–	1
MB–1D	2	1	1
MB–2	4	1	3
MB–3	2	1	2
MB–4	2	1	2
MB–5A	3	1	1
MB–5B	3	1	3
MB–6	2	–	3
MB–7	2	–	2

– indicates no sample collected

At each site, the heights and diameters of five hummocks were measured. In addition, soil temperature measurements were taken at depths of 2.5 and 5 cm on the tops of three hummocks and under the adjacent inter-hummock troughs.

Soil and bulk density samples are being analyzed in Agriculture and Agri-Food Canada's soil laboratory and radiocarbon dating is being carried out by Beta Analytic, Inc.'s radiocarbon laboratory.

Turf hummocks represent a unique ecosystem, providing a nutritious and warm soil environment for plant growth, and a habitat and readily available food source for small mammals and insects.

(a)

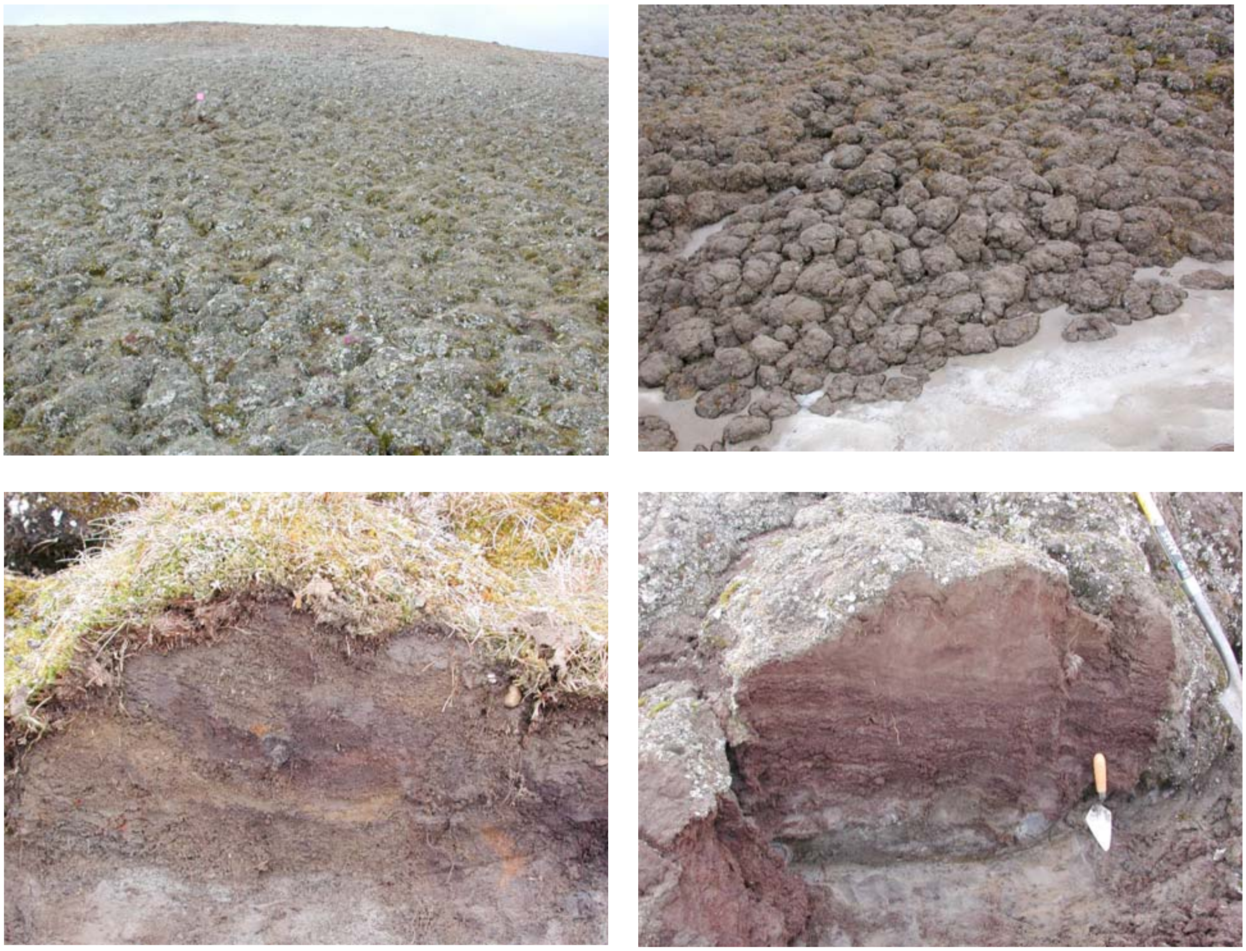


Figure 6. Photos of turf-hummocks (a) turf hummocks on a slope; (b) Close-up of turf hummocks above a melting snowbank; (c) Cross-section of a turf hummock at site MB-2; (d) Cross-section of a turf hummock at site MB-7. Note that the hummock has developed on a 20-cm-thick peat deposit.

Measurement of mound and polygon diameters: Several areas of earth mounds were noted near Mould Bay, primarily in wetter areas on foot slopes (Fig. 7a) and a flat wet saline area that has recently emerged from Mould Bay (Fig. 7b, c). We noticed that many of the mounds contained small nonsorted polygons that had formed by either frost cracking or desiccation cracking (Fig. 7d, e). The wettest areas appeared to be cracking soon after emergence from the bay, and then differential frost heave processes appear to form mounds. Some of the small nonsorted polygons contained an even finer cracking pattern (Fig. 7e). A schematic diagram (Fig. 8) shows the mounds and polygons in profile and planar view.

We set up four 10 x 10 m plots (Fig. 7f, no GPS coordinates) to count the density of the mounds

(Table 4a) and measured the size of the small nonsorted polygons (Table 4b). The diameters of the fine-scale polygons were measured in one plot and are in Table 4c.

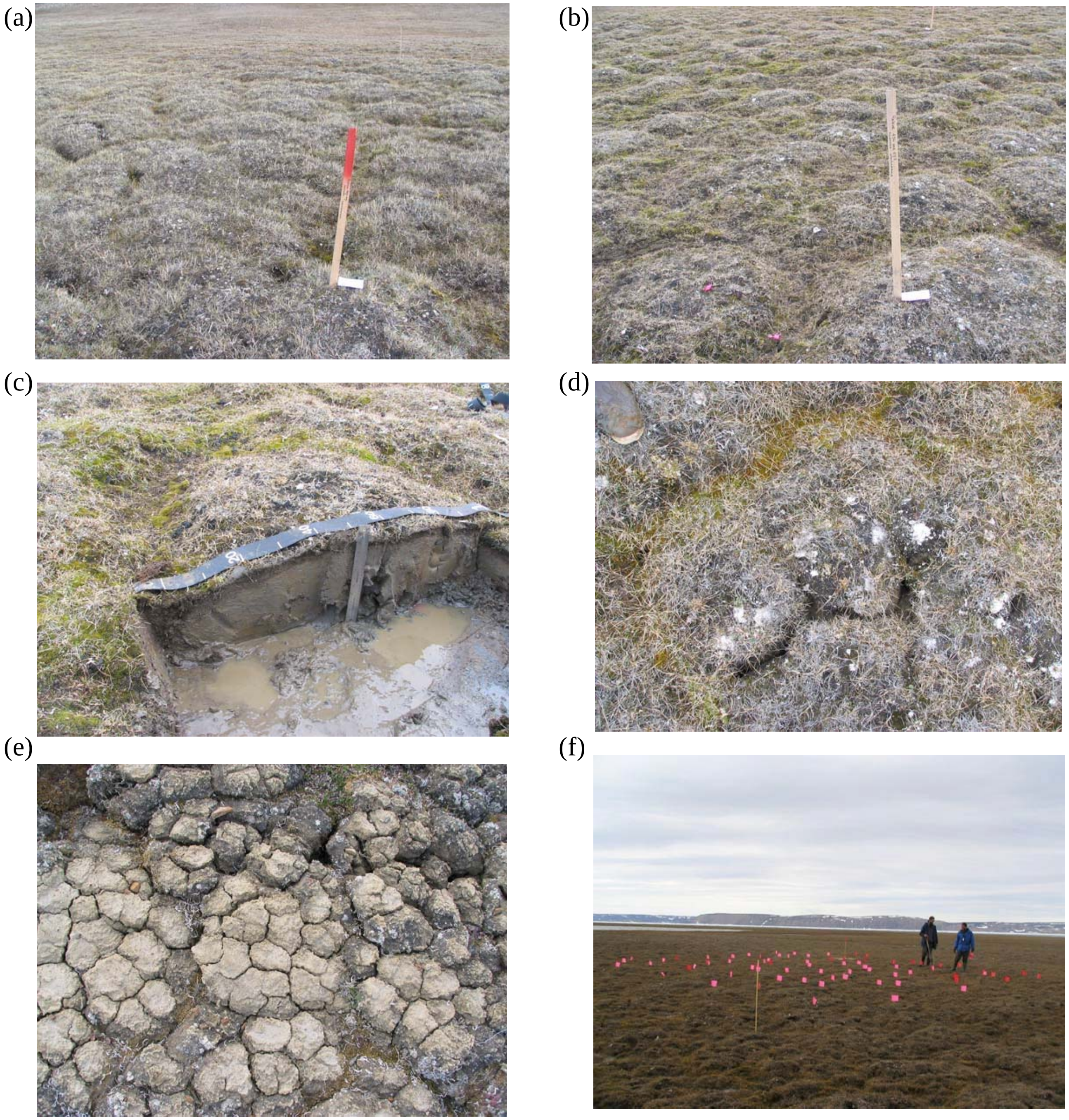


Figure 7. Photos of earth hummocks (a) earth hummocks on foot slope;(b) Earth hummocks in wet saline area adjacent to Mould Bay; (c) cross section of earth hummock in wet saline area; (d) weakly developed small nonsorted polygons on earth hummock. The cracks have been masked by vegetation development ;(e) Small barren nonsorted polygons with a finer scale cracking pattern within the polygons; (f) 10 x 10 m plot with pin flags marking the centers of earth hummocks.

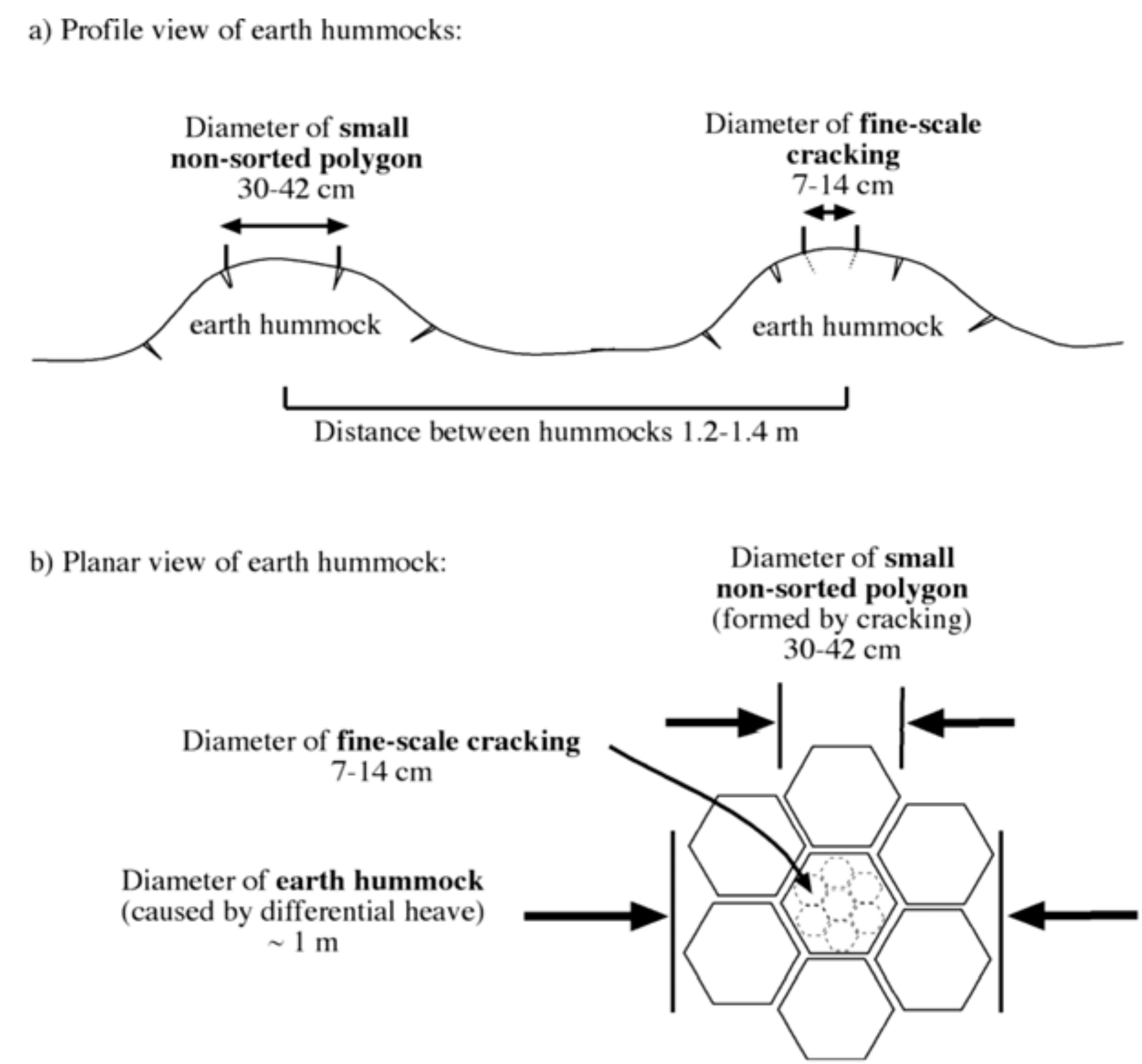


Figure 8. Earth hummock configuration at Mould Bay.

Table 4. (a) Earth hummock count in 10x10 m grid; (b) non-sorted polygon diameter; (c) fine-scale cracking diameter.

(a) Number of earth hummocks (formed by differential heave) in 10x10-m plots
70
84
82
79
mean=78.75 hummocks/100m2

	(b) Diameter of non-sorted polygon (cm)			
	38	35	31	33
	41	36	40	33
	37	33	23	33
	37	44	21	26
	45	49	31	29
	40	34	35	41
	31	32	37	35
	58	34	31	26
	40	40	23	29
	42	40	35	44
	43	33	28	32
	49	34	33	33
	48	38	32	20
	38	39	29	23
	37	40	24	31
mean=	**41.6**	**37.4**	**30.2**	**31.2**
	Overall mean=35.1 (cm)			

(c) Diameter of cracking (cm)		
9	11	12
10	8	9
9	10	9
14	8	8
10	11	11
8	8	8
9	7	10
12	9	11
11	11	9
12	11	9
mean=9.8 (cm)		

Class transects: We investigated three 20-m transects at six of the biocomplexity research sites, sampling in the southern three of five bioclimatic subzones in the Arctic. Each transect was selected to bisect at least 5 hummock and inter-hummock areas. Thaw depth, microrelief, and vegetation cover were sampled at 10 cm intervals along the transect. Thaw depth was measured by pushing a thaw probe into the ground until reaching a layer of frozen soil below the permafrost. We sampled species composition in 25 cm^2 quadrants in each hummock and inter-hummock area and characterized the vegetation at each of our thaw probe positions as bare, cryptogamic crust, moss, or vascular-plant covered. The soil samples were taken at each hummock and inter-hummock area at a depth of 10 cm. These are being analyzed for pH and soil nutrients at the International Institute of Tropical Forestry in Puerto Rico. Pitfall traps were set up at each hummock and inter-hummock area for 1-4 days in order to collect surface active soil arthropods. These measures will be used to develop profiles of typical frost features along the climatic gradient and to look at differences in plant and insect community composition and diversity on hummock and inter-hummock areas.

Studies of *Puccinellia* and *Parrya arctica*: Laurie Consaul, of the Macdonald Campus, McGill University, Montreal, Canada and Annie Archambault, of the Canadian Museum of Nature, Ottawa, Canada collected data and specimens for the studies of two genera of vascular plants that are characteristic of very sparsely vegetated alkaline and coastal soils of the Arctic.

Our main goals were to 1) clarify the taxonomy, search for the origins, and characterize the ecology of *Puccinellia* species (alkali grass), and 2) begin an investigation into the genetic diversity of the widespread North American endemic species *Parrya arctica*.

The Mould Bay area, Prince Patrick Island is the holotype locality of *Puccinellia bruggemannii* and, therefore, was an important location to obtain material for this species.

We collected several small populations of different species of *Puccinellia* from the area around Mould Bay, plus two larger collections for population analysis. One of our collections was sampled on a 50 x 20 m transect, in which we collected 24 samples by stratified random sampling and took measures of vegetation cover in meter-diameter circle quadrats. This transect and quadrat data will be compared with parallel data that we collected in 2003 on Axel Heiberg, Baffin, Banks, Ellesmere, and Cornwallis Islands for similar species.

We collected dried leaves on silica gel, live plants, and herbarium vouchers. The live plants are studied for ploidy level determinations and common garden experiments because we hypothesize that plants of higher ploidy level can have a higher range of environmental phenotypic expression. *Puccinellia bruggemannii* is putatively tetraploid, *P. vahliana* a diploid, and *P. angustata* is probably consistently hexaploid.

Therefore, for our specimens, we collected habitat data in the field on: associated plant species, percent vegetation cover; soil pH; soil particle size (sand/silt/clay).
In the laboratory, we will be collecting data on: ploidy level by chromosome counts and flow cytometry; morphology from field specimens; morphology from common garden experiments; DNA (internal transcribed spacer sequences, amplified fragment length polymorphism analyses).

In the study of *Parrya arctica*, DNA sequence data of the plants collected will be analyzed (the optimal region to sequence is currently being selected) and used to analyze the genetic diversity in different locations across the Arctic. This data will provide information on the centre of origin of this species and the geographical spread to its current distribution.

In addition to providing what we foresee as being informative taxonomic data for the Biocomplexity Study, these projects will contribute information to studies of the evolution of Arctic plant species at the Canadian Museum of Nature and McGill University.

Microbial biomass and population density measurements, *Francisco Rivera Figueroa*: The purpose of this project was to determine the difference in microbial biomass between the patterned ground ecosystems. Last summer (July 1-26, 2004) we collected 96 soil samples: 48 from Subzone C - Banks Island Green Cabin site and 48 from Subzone B - Prince Patrick Island Mould Bay site. We collected the samples at each site from three 20 m transects that bisect at least 5 frost features. Also, we took samples from three frost features at three sites aligned in a topographic sequence. We estimated the total microbial biomass and heterotrophic bacterial population densities using substrate induced respiration (SIR) (Anderson and Domsch 1973) and the most probable number (MPN) method for soil analysis. We also isolated fungi using different nutrient media to determine the fungal biodiversity in the frost features. The SIR measurements were done at the International Institute of Tropical Forestry Laboratories at San Juan, Puerto Rico. The MPN and fungal studies were conducted at the Biotechnology Laboratory in Universidad del Turabo at Gurabo, Puerto Rico.

Results

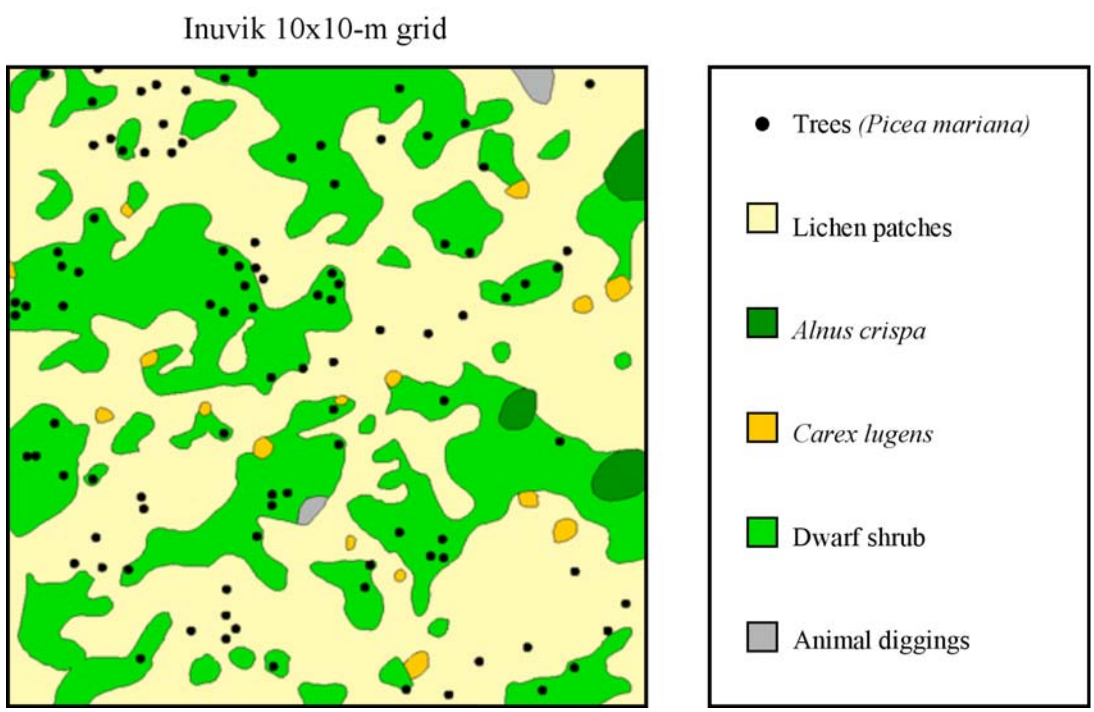


Figure 9. Map of plant communities at Inuvik Grid.

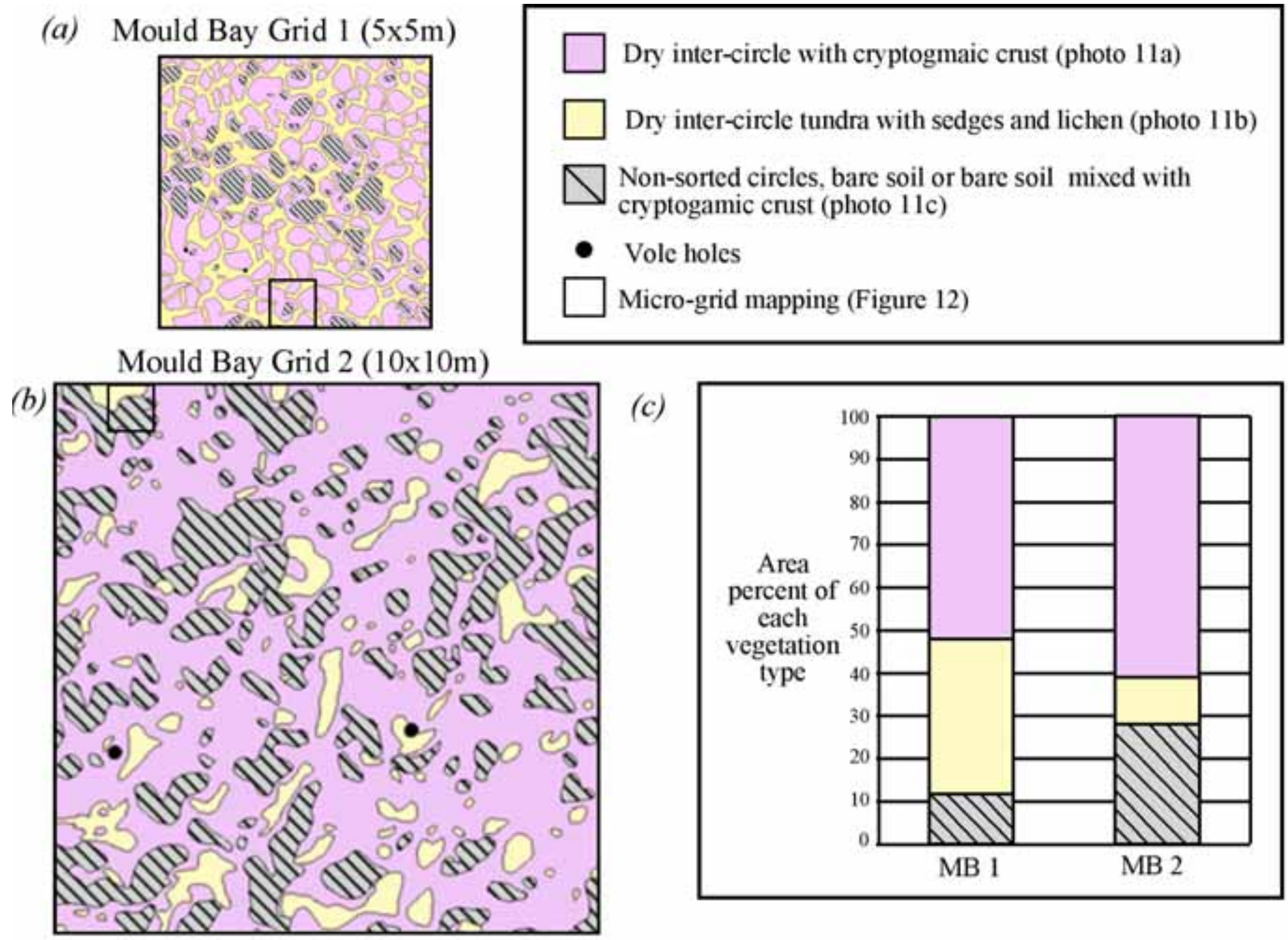


Figure 10. Map of plant communities at Mould Bay (a) grid 1, (b) grid 2, and (c) chart of percent area of each plant community type. Note scale of both maps is the same. Grid 1 has small turf hummocks whereas Grid 2 has barren non-sorted circles.

(a)

(b)

(c)

Figure 11. Photos of vegetation types mapped on grids:
(a) Mixed crustose lichens with Thamnolia subuliformis *and* Flavocetraria cucullata*;*
(b) Prostrate dwarf shrub with Dryas integrifolia, Salix arctica*, and* Luzula nivalis *mixed with lichens and mosses;*
(c) bare soil.

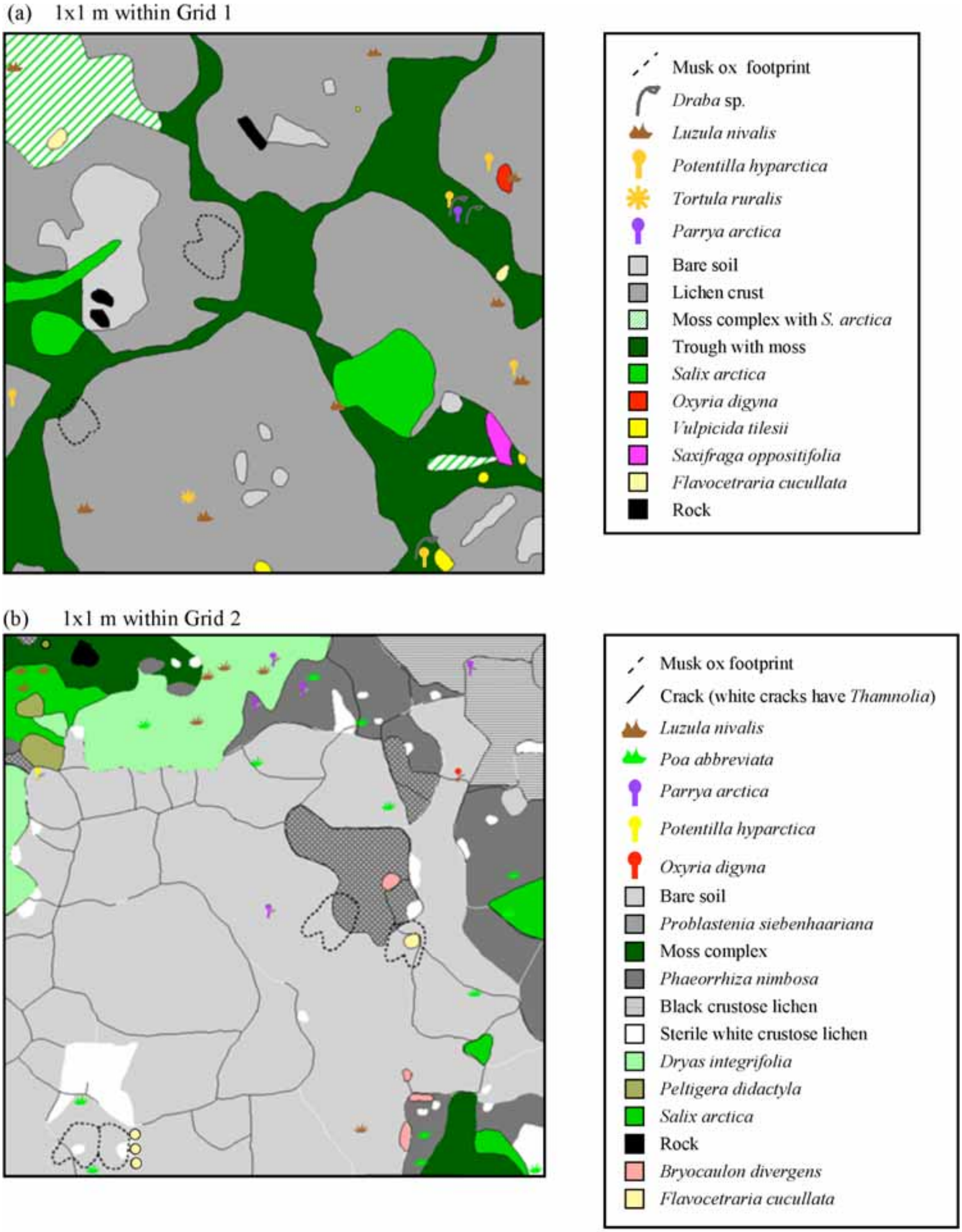


Figure 12. Maps of 1x1 m, showing polygonal cracking and vegetation: (a) 1 m² within Mould Bay Grid 1, (b) 1 m² within Mould Bay Grid 2.

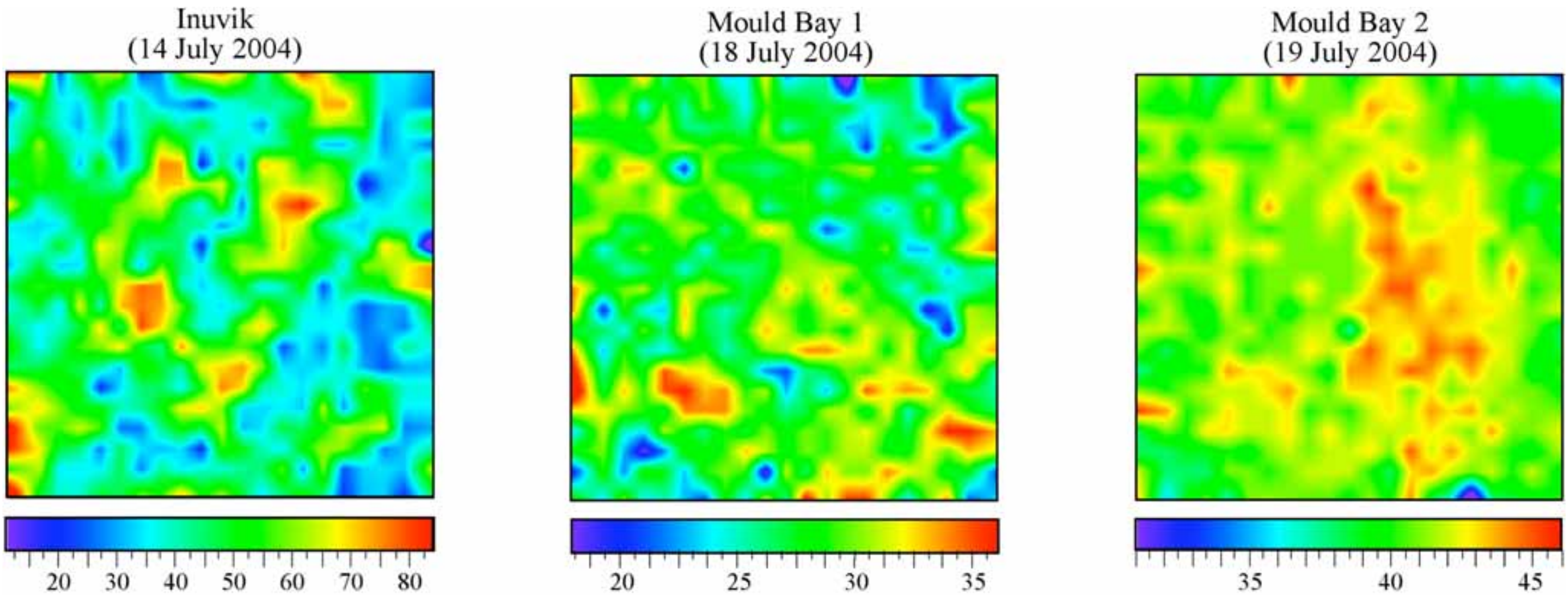


Figure 13. Maps of thaw depth on 10x10-m grids (note different scales for the thaw depths).

Table 5. Grid thaw depth data.

Inuvik			**Mould Bay 1**			**Mould Bay 2**		
Crack (c)	Mean	40.97	**Hummock (h)**	Mean	29.98	**Bare (b)**	Mean	41.13
	s.d.	15.77		s.d.	2.49		s.d.	1.47
	n	34		n	255		n	135
	s.e.	2.70		s.e.	0.16		s.e.	0.13
Hummock top (h)	Mean	51.10	**Inter-hummock (i)**	Mean	26.12	**Cryptogamic crust (c)**	Mean	41.64
	s.d.	13.78		s.d.	2.89		s.d.	1.71
	n	239		n	186		n	247
	s.e.	0.89		s.e.	0.21		s.e.	0.11
Hummock side (s)	Mean	44.16	**Total**	Mean	28.35	**Vegetated (v)**	Mean	40.85
	s.d.	12.46		s.d.	3.28		s.d.	1.96
	n	120		n	441		n	59
	s.e.	1.14		s.e.	0.16		s.e.	0.26
Trough (t)	Mean	35.96				**Frost boil (b+c)**	Mean	41.46
	s.d.	10.64					s.d.	1.65
	n	48					n	382
	s.e.	1.54					s.e.	0.08
Frost boil (h+s)	Mean	48.78				**Total**	Mean	41.37
	s.d.	13.73					s.d.	1.70
	n	359					n	441
	s.e.	0.72					s.e.	0.08
Total	Mean	46.78						
	s.d.	14.24						
	n	441						
	s.e.	0.68						

LAI & NDVI:

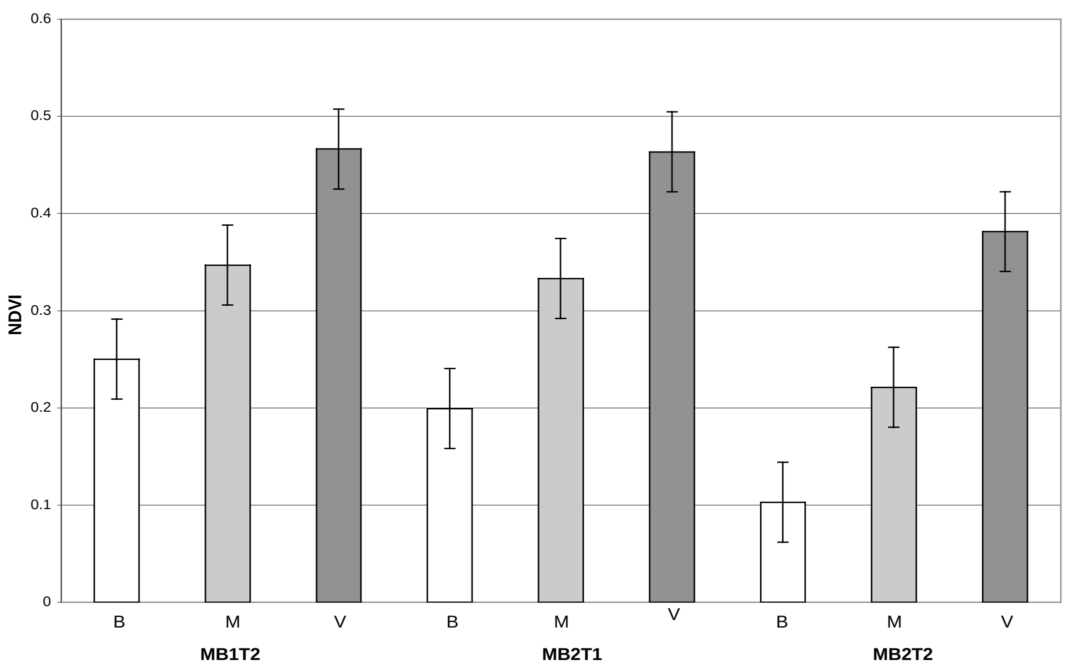


Figure 14. NDVI values for three Mould Bay transects on bare, mixed, and vegetated surfaces.

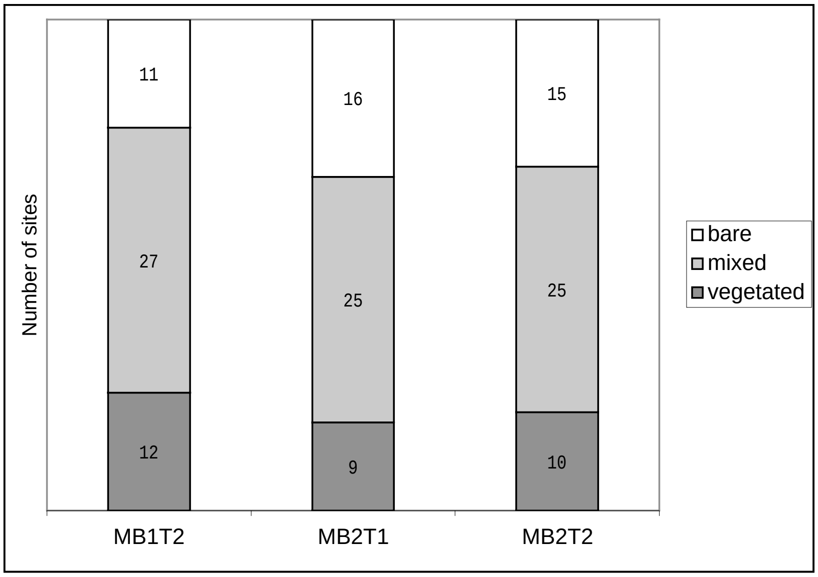


Figure 15. Proportion of vegetation types along transects (50 sites/transect).

Table 6. Inuvik LAI and vegetation canopy height.

	Mean LAI	Mean height (cm)
Transect 1	0.998	31.08
Transect 2	1.298	19.34

Soils

Description of studied sites:
Mould Bay, Prince Patrick Is., NWT, Canada, July 3, 2003

Figure 16. Photos 2003 soil pit.

Mould Bay #1

USDA-NRCS-NSSC S 03-FN-260-001

Location: Mould Bay, Prince Patrick Island
GPS position: 76°13'42" N
119°17'43.4" W
Elevation: 32m

Physiography: Arctic Lowland Province
Landform: Rolling hills
Landscape position: broad ridgetop
Micro relief: flat polygon, ave. dia. 40 cm (25-50 cm)
Slope: 3% SE, vertical: slightly convex, horizontal: slightly convex
Parent material: Alluvium over weathered shale (Beaufort Formation)
Climate: MAAT: - 17.8 (Mould Bay)
MAP: 8.7 cm
MAST: - 10°C, est.
Landcover type: Mesic tundra, Subzone B
Vegetation: *Luzula nivalis; Saxifraga oppositafolia; Salix arctica; Thamnolia subuliforis; Papaver* spp.
Classification: Interboil – Course-silty, mixed, superactive, hypergelic Mollic Aquiturbel
Boil - Coarse-silty, mixed, superactive, hypergelic Typic Aquiturbel
Described and sampled by: C.L. Ping, G.J. Michaelson, C. Tarnocai

Hummock:

0 – 14 cm; Bwjj; dark grayish brown (2.5Y4/2) very fine sandy loam; weak, fine lenticular and moderate medium granular structures; friable, slightly sticky and slightly plastic; few fine roots; common vesicular pores; silt coating around some granulars and ped faces; clear irregular boundary (0-15 cm) (#1)

14 – 32 cm; B/Ajj; olive brown (2.5Y4/3, 60%) with cryoturbated humus-rich very dark grayish brown (2.5Y 3/2) very fine sandy loam; moderate fine granular structures; friable, slightly sticky and slightly plastic; few fine roots; many fine vesicular pores; silt coating on ped faces; clear irregular boundary (14-22 cm) (#4)

32 – 50 cm; Bgf; dark gray (5Y4/1, 70%) and olive brown (2.5Y4/4) very fine sandy loam; frozen; very firm, slightly sticky and slightly plastic; (#5)

Inter Hummock:

0 – 4 cm; Oi; very dark brown (10YR3/2) peat; common fine roots; (0-4 cm) (#6)

4 – 10 cm; Ajj1; olive brown (2.5Y4/3, 60%) and very dark grayish brown (2.5Y 3/2) very fine sandy loam; moderate fine granular structures; friable, slightly sticky and slightly plastic; few fine roots many fine vesicular pores; occurring around the boil; clear irregular boundary (0-4 cm) (#2)

4 – 15 cm; Ajj2; very dark grayish brown (10YR3/2, 60%), black (10YR2/1, 30%) and dark grayish brown (2.5Y4/2) very fine sandy loam; black humus-rich zones cryoturbated into B&Ajj; granular structure; friable, slightly sticky and slightly plastic; common fine roots; black humus, decayed vegetative part filled in voids; abrupt irregular boundary; (0-20 cm) (#3)

Table 7. Analysis of 2003 soil pit samples.

Site ID/date NRCS ID#	#	Soil Horizon	Depth Range	pH	EC	Mehlich 3 Extr. P	Field H_2O	BD	TC	TN	TIC	>2 mm
			cm	1:1	ds	mg kg^{-1}	% wt.	g cm^{-3}	%	%	%	% wt.
Mould Bay		**Boil**										
07/03/03	1	Bwjj	0 – 14	7.79	0.83	16	23	1.47	1.09	0.08	0.07	0.2
S 03-FN-	4	B/Ajj	14 – 32	7.74	0.35	70	16	1.64	0.90	0.01	0.12	1.3
260-001	5	Bgf	32 – 50	7.57	0.77	38	19	1.48	1.01	0.03	0.15	1.2
		Inter Boil										
	6	Oi	0 – 4	6.75	0.44	209	59	0.44	3.80	0.22	0.01	<0.1
	2	Ajj1	4 – 10	6.94	0.29	28	24	1.46	1.47	0.09	0.01	0.3
	3	Ajj2	4 – 15	6.95	0.23	49	38	1.31	2.55	0.20	<.01	0.9

Soil crust sampling sites and analysis:

Figure 17. Photo of soil crust on small non-sorted polygon.

Table 8. Analysis of soil crust, July 2003.

							KCl	**Mehlich-3 Extractable**					**Total**		
Boil Microsite	**ID**	**Depth**	**pH**	**EC**	**Field H_2O**	**BD**	**Extr. N**	**P**	**K**	**Ca**	**Mg**	**Na**	**IC**	**OC**	**N**
		cm	*1:1*	*ds*	*%vol*	*g cm^{-3}*	*mg kg^{-1}*	----------------*mg kg^{-1}*---------------					----------%----------		
Barren	2	0-1	8.2	1.3	31	0.96	8	<1	156	4798	1389	135	0.1	1.2	0.11
Center	3	1-3	7.9	0.5	23	1.11	6	2	84	1498	544	55	<0.1	1.3	0.15
	4	3-5	7.6	0.4	28	1.29	5	2	71	1661	497	51	<0.1	1.6	0.17
	5	5-7	7.5	0.4	31	1.20	3	3	70	1979	476	48	<0.1	2.0	0.13

Relevé Data

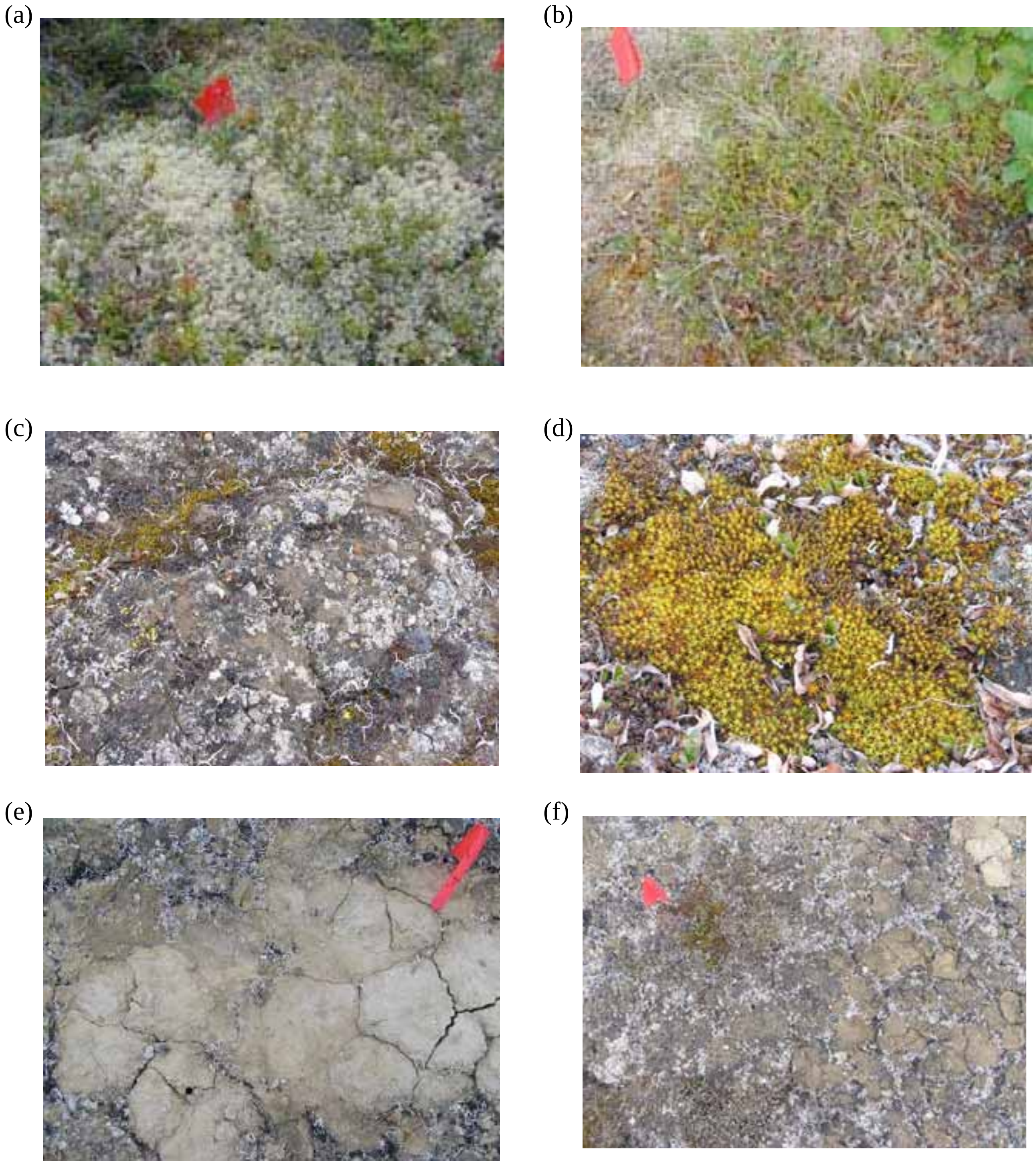
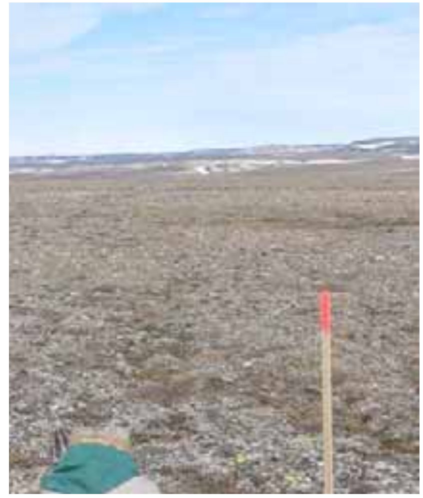


Figure 18. (a) Relevé 401; (b) Relevé 402; (c) Relevé 403; (d) Relevé 404; (e) Relevé 405; (f) Relevé 406.

(g)

(h)



(i)

(j)

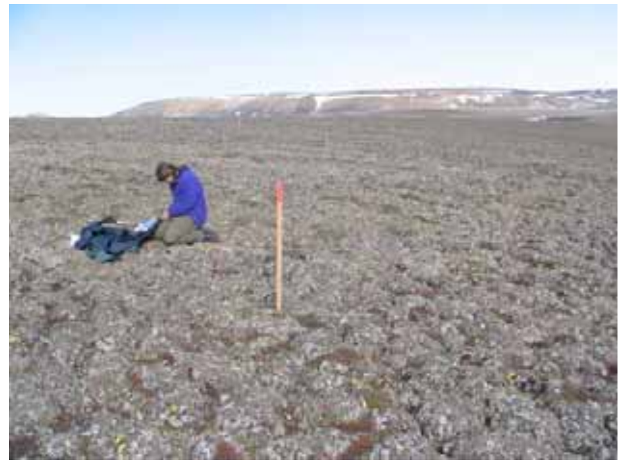
(k)

(l)

Figure 18 (continued). (g) Relevé 407; (h) Relevé 408; (i) Relevé 409; (j) Relevé 410; (k) Relevé 411; (l) Relevé 412.

(m)

(n)



(o)

(p)

(q)

(r)

Figure 18 (continued). (m) Relevé 413; (n) Relevé 414-415; (o) Relevé 416; (p) Relevé 417; (q) Relevé 418; (r) Relevé 419.

(s)

(t)

(u)

(v)

(w)

(x)

Figure 18 (continued). (s) Relevé 420; (t) Relevé 421; (u) Relevé 422; (v) Relevé 423; (w) Relevé 424; (x) Relevé 425.

(y)

(z)

(aa)

(ab)

(ac)

(ad)

Figure 18 (continued). (y) Relevé 426; (z) Relevé 427; (aa) Relevé 428; (ab) Relevé 429; (ac) Relevé 430; (ad) Relevé 431.

(ae)

(af)

(ag)

(ah)

(ai)

(aj)

Figure 18 (continued). (ae) Relevé 432; (af) Relevé 433; (ag) Relevé 434; (ah) Relevé 435; (ai) Relevé 436; (aj) Relevé 437.

(ak)

(al)

(am)

(an)

Figure 18 (continued). (ak) Relevé 438; (al) Relevé 439; (am) Relevé 440; (an) Relevé 441.

Table 9. Relevé type and location

Releve #	Location	Type	Characteristic species	Study site	Date species data collected	Observer	Photo (site,soil)	Plot size (m2)	GPS north	GPS west	Elev. (m)	Slope (°)	Aspect
401	Inuvik	hummock	Picmar, Leddec, Claste,Claarb	Inuvik-1	14-Jul-04	SW,FB,FR	M04-1 105	4	68 06 39.3	133 28 38.2	34	0	none
402	Inuvik	inter-hummock	Leddec,Vacvit,Vaculi, Arcrub,Aultur	Inuvik-1	14-Jul-04	SW,FB,FR	M04-1 106	4	68 06 39.3	133 28 38.2	34	0	none
403	Mould Bay	hummock	Lecepi,Hypsub, Luzniv	MB -1	18-Jul-04	SW,PK	0013-0014	4	76 13 42.8	119 17 57.9	40	3	SE
404	Mould Bay	inter-hummock	Torrur,Sanunc,Salarc	MB -1	18-Jul-04	SW,PK	0015-0017	1	76 13 42.8	119 17 57.9	40	3	SE
405	Mould Bay	barren	bare	MB - 2	19-Jul-04	SW, PK	100-124,123	5	76 13 33.2	119 17 32.0	14	2	SE
406	Mould Bay	crust	black crust, Lepro,Prosie,Thaver	MB - 2	19-Jul-04	SW,PK	100-125,123	5	76 13 33.2	119 17 32.0	14	2	SE
407	Mould Bay	vegetated	Dryint,Salarc, Luzniv	MB - 2	19-Jul-04	SW,PK	100-126,123	5	76 13 33.2	119 17 32.0	14	2	SE
408	Mould Bay	hummock	Lecepi,Hypsub, Luzniv	MB -1	20-Jul-04	SW,TR	100-73,71	10	76 13 43.0	119 17 51.8	40	3	SE
409	Mould Bay	inter-hummock	Torrur,Sanunc,Salarc	MB -1	20-Jul-04	SW,TR	100-72,71	2	76 13 43.0	119 17 51.8	40	3	SE
410	Mould Bay	hummock	Lecepi,Hypsub, Luzniv	MB -1	20-Jul-04	SW,TR	100-75,74	10	76 13 41.6	119 17 49.7	37	5	S
411	Mould Bay	inter-hummock	Torrur,Sanunc,Salarc	MB -1	20-Jul-04	SW,TR	100-76,77,74	3	76 13 41.6	119 17 49.7	37	5	S
412	Mould Bay	hummock	Lecepi,Hypsub, Luzniv	MB -1	21-Jul-04	TR,JB	100-117,116	10	76 13 41.8	119 18 01.9	40	2	S
413	Mould Bay	inter-hummock	Torrur,Sanunc,Salarc	MB -1	21-Jul-04	TR,JB	100-118,116	3	76 13 41.8	119 18 01.9	40	2	S
414	Mould Bay	hummock	Lecepi,Hypsub, Luzniv	MB -1	20-Jul-04	SW,TR	100-83,82	10	76 13 41.0	119 17 52.9	38	5	S
415	Mould Bay	inter-hummock	Torrur,Sanunc,Salarc	MB -1	20-Jul-04	SW,TR	100-84,82	3	76 13 41.0	119 17 52.9	38	5	S
416	Mould Bay	barren	bare	MB - 2	21-Jul-04	SW,TR	100-120,119	1	76 13 32.5	119 17 39.3	14	2	SE
417	Mould Bay	crust	black crust, Lepro,Prosie,Thaver	MB - 2	21-Jul-04	SW,TR	100-121,119	10	76 13 32.5	119 17 39.3	14	2	SE
418	Mould Bay	vegetated	Dryint,Salarc,Luzniv	MB - 2	21-Jul-04	SW,TR	100-122,119	5	76 13 32.5	119 17 39.3	14	2	SE
419	Mould Bay	barren	bare	MB - 2	22-Jul-04	TR,JB	M04-01 22,23	2	76 13 31.4	119 17 40.2	14	2	SE
420	Mould Bay	crust	black crust, Lepro,Prosie,Thaver	MB - 2	22-Jul-04	TR,JB	M04-01 22,24	5	76 13 31.4	119 17 40.2	14	2	SE
421	Mould Bay	vegetated	Dryint,Salarc, Luzniv	MB - 2	22-Jul-04	TR,JB	M04-01 22,25	2	76 13 31.4	119 17 40.2	14	2	SE
422	Mould Bay	barren	bare	MB - 2	22-Jul-04	TR,JB	M04-01 19,18	3	76 13 32.5	119 17 41.3	14	2	SE
423	Mould Bay	crust	black crust, Lepro,Prosie,Thaver	MB - 2	22-Jul-04	TR,JB	M04-01 20,18	3	76 13 32.5	119 17 41.3	14	2	SE
424	Mould Bay	vegetated	Dryint,Salarc,Luzniv	MB - 2	22-Jul-04	TR,JB	M04-01 21,18	2	76 13 32.5	119 17 41.3	14	2	SE

Table 9 (continued) Relevé type and location

425	Mould Bay	barren	bare	MB - 2	21-Jul-04	SW,TR	100-128,127	4	76 13 31.8	119 17 33.8	14	2	S
426	Mould Bay	crust	black crust, Lepro,Prosie,Thaver	MB - 2	21-Jul-04	SW,TR	100-129,127	4	76 13 31.8	119 17 33.8	14	2	S
427	Mould Bay	vegetated	Dryint,Salarc,Luzniv	MB - 2	21-Jul-04	SW,TR	100-130,127	3	76 13 31.8	119 17 33.8	14	2	S
428	Mould Bay	hummock	Eritri,Salarc, Arclat,Ochine	slope below snowbed	23-Jul-04	TR,JB	0139,0140	4	76 13 36.1	119 19 24.8	16	7	SSW
429	Mould Bay	inter-hummock	Eritri,Salarc, Aulpal,Ortchr	slope below snowbed	23-Jul-04	TR,JB	0139,0141	3	76 13 36.1	119 19 24.8	16	7	SSW
430	Mould Bay	hummock	Eritri,Salarc, Arclat,Ochine	slope below snowbed	22-Jul-04	SW,TR,JB	0142,0143	5	76 13 35.8	119 19 22.5	18	7	SSW
431	Mould Bay	inter-hummock	Eritri,Salarc, Aulpal,Ortchr	slope below snowbed	22-Jul-04	SW,TR,JB	0142,0144	3	76 13 35.8	119 19 22.5	18	7	SSW
432	Mould Bay	hummock	Eritri,Salarc, Arclat,Ochine	slope below snowbed	22-Jul-04	SW,TR,JB	0145,0146	5	76 13 36.5	119 19 22.5	19	7	SSW
433	Mould Bay	inter-hummock	Eritri,Salarc, Aulpal,Ortchr	slope below snowbed	22-Jul-04	SW,TR,JB	0145,0147	3	76 13 36.5	119 19 22.5	19	7	SSW
434	Mould Bay	hummock	Luzniv,Stell,Disinc, Onco	wet hummock near shore	23-Jul-04	SW,TR	100-165,164	-	76 13 40.2	119 20 01.2	3	0	none
435	Mould Bay	inter-hummock	Luzniv,Onco,Noscom	wet hummock near shore	23-Jul-04	SW,TR	100-166,164	-	76 13 40.2	119 20 01.2	3	0	none
436	Mould Bay	hummock	Luzniv,Stell,Disinc, Onco	wet hummock near shore	23-Jul-04	SW,TR	100-162,161	7	76 13 40.1	119 20 01.7	3	0	none
437	Mould Bay	inter-hummock	Luzniv,Onco,Noscom	wet hummock near shore	23-Jul-04	SW,TR	100-163,161	3	76 13 40.1	119 20 01.7	3	0	none
438	Mould Bay	hummock	Luzniv,Stell,Disinc, Onco	wet hummock near shore	23-Jul-04	SW,TR	100-159,158	8	76 13 41.3	119 19 58.4	3	0	none
439	Mould Bay	inter-hummock	Luzniv,Onco,Noscom	wet hummock near shore	23-Jul-04	SW,TR	100-160,158	2	76 13 41.3	119 19 58.4	3	0	none
440	Mould Bay	hummock	Caraqu,Arclat, Salarc,Ochine	slope near coast	24-Jul-04	SW,TR	100-173,172	6	76 14 04.2	119 19 32.9	5	2	W
441	Mould Bay	inter-hummock	Caraqu,Salarc, Tomnit, Oncwah	slope near coast	24-Jul-04	SW,TR	100-174,172	3	76 14 04.2	119 19 32.9	5	2	W

Table 10. Relevé site characteristics.

	Height (cm)						Site Information														
Releve #	**Veg. canopy**	**Moss**	**Organic**	**A hori-zon**	**Micro-relief**	**Mean thaw depth**	**Land form**	**Surficial geology**	**Parent Material**	**Surficial geom..**	**Micro-site**	**Site moist.**	**Soil moist.**	**Glacial geol.**	**Topo-graphic position**	**Soil unit**	**Est. snow duration**	**Distur-bance degree**	**Distur-bance type**	**Stab-ility**	**Expo-sure**
401	40	9	20	0	10	55	20	1	-	3	3	5.5	5	1	4	Histic Eutric Turbic Cryosol	4	3	7	3	2
402	40	5	30	0	25	30	20	1	-	3	4	5.5	7	1	4	Histic Eutric Turbic Cryosol	4	3	7	3	2
403	0.5	0	0	0	5	28	1	3	4	3	3	4	5	0	1	aquic haploturbel/ glacic haploturbel	3	1	6,8	4	3
404	1	3	5	0	5	26	1	3	4	3	4	5	6	0	1	aquic haploturbel/ glacic haploturbel	3	1	7,2,1	1	2.5
405	0	0	0	0	1	40	21	6	-	1	1	3	3	0	3	typic haploturbel	2	2	1,2	4	3
406	0.5	0	0	0	3	40	21	6	-	1	2	3	3	0	3	typic haploturbel	2	2	1,2	2	3
407	1	1	1	0	3	40	21	6	-	1	2	4	3	0	3	typic haploturbel	2	2	1,2	1	3
408	0.5	0	0	0	5	33	1	3	4	3	3	4	4	0	1	aquic haploturbel/ glacic haploturbel	3	2	2,3,6	4	3
409	1	2	5	0	10	26	1	3	4	3	4	5	5	0	1	aquic haploturbel/ glacic haploturbel	3	3	6	1	2
410	0.5	0	0	0	5	32	1	3	4	3	3	4	4	0	2	aquic haploturbel/ glacic haploturbel	3	1	2	4	3
411	3	1	2	2	5	23	1	3	4	3	4	5	5	0	2	aquic haploturbel/ glacic haploturbel	3	2	6	1	2
412	0	0	0	0	-	33	1	3	4	3	3	4	4	0	1	aquic haploturbel/ glacic haploturbel	3	-	-	4	3
413	-	-	-	-	-	24	1	3	4	3	4	5	5	0	1	aquic haploturbel/ glacic haploturbel	3	-	-	1	2
414	0.5	0	0	0	10	31	1	3	4	3	3	4	4	0	2	aquic haploturbel/ glacic haploturbel	3	1	2	4	3

Table 10 (continued) Relevé site characteristics.

	Height (cm)						Site Information														
Releve #	Veg. canopy	Moss	Organic	A horizon	Micro-relief	Mean thaw depth	Land form	Surficial geology	Parent Material	Surficial geom..	Micro-site	Site moist.	Soil moist.	Glacial geol.	Topo-graphic position	Soil unit	Est. snow duration	Distur-bance degree	Distur-bance type	Stab-ility	Expo-sure
415	5	1	3	0	5	22	1	3	4	3	4	5	5	0	2	aquic haploturbel/ glacic haploturbel	3	1	6	1	2
416	0	0	0	0	1	40	21	6	-	1	1	3	2	0	3	typic haploturbel	2	2	1,2	4	3
417	0.5	0	0	0	3	40	21	6	-	1	2	3	3	0	3	typic haploturbel	2	2	1,2	2	3
418	1	1	1	3	3	40	21	6	-	1	2	4	4	0	3	typic haploturbel	2	2	1,2	1	3
419	1	0	0	0	1	38	21	6	-	1	1	3	3	0	3	typic haploturbel	2	2	2,3	4	3
420	3	0	0	0	3	41	21	6	-	1	2	3	3	0	3	typic haploturbel	2	3	2,3	2	3
421	5	1	1	2	5	41	21	6	-	1	2	4	4	0	3	typic haploturbel	2	2	2,3	1	3
422	1	0	0	0	2	36	21	6	-	1	1	3	3	0	3	typic haploturbel	2	2	1,2	4	3
423	3	0	0	0	5	35	21	6	-	1	2	3	4	0	3	typic haploturbel	2	2	1,2	2	3
424	5	1	1	0	5	37	21	6	-	1	2	4	3	0	3	typic haploturbel	2	2	1,2	1	3
425	0	0	0	0	3	42	21	6	-	1	1	3	2	0	3	typic haploturbel	2	2	1,2	4	3
426	1	0	0	0	4	42	21	6	-	1	2	3	3	0	3	typic haploturbel	2	2	1,2	2	3
427	2	1	1	3	5	40	21	6	-	1	2	4	4	0	3	typic haploturbel	2	2	1,2	1	3
428	4	1	1	5	3	33	1	6	-	3	3	6	7	0	2	-	3	2	2,3	2	2
429	4	1	7	0	5	23	1	6	-	3	4	7	9	0	2	-	3	2	3,6	2	2
430	5	0.5	0.5	0	10	36	1	6	-	3	3	6	7	0	2	-	3	2	3	2	2
431	5	1	1	5	15	34	1	6	-	3	4	7	9	0	2	-	3	2	6	2	2
432	3	0.5	1	0	5	40	1	6	-	3	3	6	7	0	2	-	3	2	3	2	2
433	4	1	5	0	10	23	1	6	-	3	4	7	9	0	2	-	3	2	6	2	2
434	3	0.5	2	3	5	27	5	15	-	2	3	7	5	0	4	-	4	2	4	1	2
435	3	0.5	2	5	10	17	5	15	-	2	4	8	6	0	4	-	4	2	4	1	2
436	3	0.5	1.5	1	5	21	5	15	-	2	3	7	6	0	4	-	4	2	4	1	2
437	3	0.5	7	3	7	18	5	15	-	2	4	8	7	0	4	-	4	2	4	1	2
438	3	0.5	1.5	1	5	26	5	15	-	2	3	7	6	0	4	-	4	2	4	1	2
439	3	1	6	3	5	15	5	15	-	2	4	8	6	0	4	-	4	3,2	4,6	1	2
440	3	0.25	1	2	10	42	1	6	-	3	3	6	6	0	3	-	3	2	1,3	2	2
441	4	2	8	0	10	19	1	6	-	3	4	7	6	0	3	-	4	2	3,6	1	1

Table 11. Relevé soil moisture.

Releve #	date	gravimetric water (%)	volumetric moisture (%)	bulk density (g/cm3)
401	14-Jul-04	95.22	0.41	0.72
402	14-Jul-04	94.98	0.55	0.14
403	20-Jul-04	94.76	0.30	1.42
404	20-Jul-04	94.52	0.32	1.46
405	21-Jul-04	94.29	0.22	1.40
406	21-Jul-04	94.06	0.17	1.34
407	21-Jul-04	93.83	0.27	1.20
408	20-Jul-04	93.60	0.27	1.61
409	20-Jul-04	93.37	0.36	1.11
410	20-Jul-04	93.14	0.30	1.08
411	20-Jul-04	92.91	0.26	0.77
412	21-Jul-04	92.69	0.34	1.18
413	21-Jul-04	92.47	0.33	1.23
414	20-Jul-04	92.24	0.27	1.35
415	20-Jul-04	92.02	0.22	0.81
416	21-Jul-04	91.80	0.21	1.45
417	21-Jul-04	91.58	0.18	1.31
418	21-Jul-04	91.36	0.25	1.42
419	21-Jul-04	91.14	0.24	1.38
420	21-Jul-04	90.93	0.19	1.20
421	21-Jul-04	90.71	0.30	1.52
422	21-Jul-04	90.50	0.29	1.43
423	21-Jul-04	90.28	0.34	1.40
424	21-Jul-04	90.07	0.34	1.06
425	21-Jul-04	89.86	0.23	1.40
426	21-Jul-04	89.65	0.29	1.40
427	21-Jul-04	89.44	0.25	1.42
428	23-Jul-04	89.23	0.35	1.34
429	23-Jul-04	89.02	0.39	1.30
430	22-Jul-04	88.81	0.34	1.41
431	22-Jul-04	88.61	0.56	0.54
432	22-Jul-04	88.40	0.34	1.37
433	22-Jul-04	88.20	0.39	1.16
434	23-Jul-04	88.00	0.42	1.34
435	23-Jul-04	87.80	0.36	1.17
436	23-Jul-04	87.59	0.30	1.16
437	23-Jul-04	87.39	0.36	1.30
438	23-Jul-04	87.19	0.34	1.53
439	23-Jul-04	87.00	0.32	1.11
440	24-Jul-04	86.80	0.47	1.09
441	24-Jul-04	86.60	0.50	0.86

Table 12. Relevé lifeform percent cover.

Releve #	Tree	Shrub					Forb		Graminoid		Lichen			Bryophyte		Liver-wort	Horse-tail	Algae	Rocks	Bare soil	Water	Total dead
		Low	Erect dwarf	Prostrate dwarf	Ever-green	Decid-uous	Erect	Mat & cushion	Non-tussock	Tussock	Foliose	Fruti-cose	Crustose	Pleuro-carpous	Acro-carpous							
401	5	20	10	5	10	10	+	0	+	5	+	75	0	5	0	0	2	0	0	0	0	5
402	1	5	20	10	25	25	+	0	+	0	+	10	0	25	+	0	2	0	0	0	0	15
403	0	0	0	2	1	1	0	+	2	0	35	3	50	0	+	0	0	0	5	15	0	1
404	0	0	0	25	5	20	+	+	+	0	1	7	+	1	70	0	0	0	0	0	0	5
405	0	0	0	0	0	0	+	0	+	0	+	2	+	0	0	0	0	0	0	99	0	+
406	0	0	0	+	+	+	+	0	2	0	15	20	65	+	5	0	0	0	0	20	0	5
407	0	0	0	50	25	25	+	0	5	0	5	5	10	5	25	0	0	0	0	5	0	25
408	0	0	0	5	1	4	2	5	5	0	2	5	80	+	+	0	0	0	1	5	0	5
409	0	0	0	20	+	20	+	2	2	0	0	1	0	5	90	0	0	0	0	0	0	5
410	0	0	0	5	4	1	+	2	+	0	7	3	60	0	3	0	0	0	15	20	0	1
411	0	0	0	25	15	10	+	1	+	0	0	2	0	2	75	0	0	0	0	0	0	5
412	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
413	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
414	0	0	0	+	+	+	5	1	3	0	5	2	70	+	2	0	0	0	3	20	0	5
415	0	0	0	1	1	1	5	25	3	0	0	10	0	25	60	0	0	0	0	0	0	2
416	0	0	0	0	0	0	+	0	+	0	0	+	+	0	+	0	0	0	0	100	0	0
417	0	0	0	+	+	+	+	0	1	0	20	30	80	+	+	0	0	0	0	20	0	2
418	0	0	0	20	10	10	+	0	6	0	2	5	5	30	30	0	0	0	0	5	0	20
419	0	0	0	+	0	+	0	0	0	0	0	2	5	0	+	0	0	0	0	95	0	+
420	0	0	0	3	0	3	+	+	2	0	+	5	80	+	3	0	0	0	0	15	0	1
421	0	0	0	40	5	35	+	+	15	0	0	1	10	10	20	0	0	0	0	0	0	20
422	0	0	0	0	0	0	+	0	1	0	0	0	5	0	+	0	0	0	0	99	0	+
423	0	0	0	2	0	3	1	+	7	0	5	7	80	+	10	0	0	0	0	15	0	3
424	0	0	0	35	5	30	+	+	20	0	0	3	15	15	15	0	0	0	0	0	0	10
425	0	0	0	0	0	0	+	0	+	0	0	+	+	0	0	0	0	0	0	100	0	+
426	0	0	0	+	+	+	+	0	5	0	10	15	70	+	+	0	0	0	0	40	0	5
427	0	0	0	20	10	10	+	0	10	0	+	2	5	20	20	0	0	0	0	5	0	30
428	0	0	0	15	0	15	3	0	30	0	+	+	20	20	15	0	0/0	0	0	0	0	25
429	0	0	0	20	0	20	1	0	40	0	0	+	2	50	35	0	0/+	+	0	0	+	20
430	0	0	0	25	2	20	2	0	30	0	+	+	30	15	25	0	0/+	+	0	0	0	15
431	0	0	0	15	0	18	+	0	40	0	0	+	5	30	55	0	0/5	5	0	0	+	10
432	0	0	0	20	0	20	+	0	20	0	+	+	35	10	15	0	0/+	+	0	0	0	15
433	0	0	0	15	0	15	+	0	35	0	+	+	0	30	55	0	0/2	2	0	0	+	10
434	0	0	0	0	0	0	30	+	25	0	+	2	20	5	25	20	0/0	0	0	0	0	40
435	0	0	0	0	0	0	5	+	10	0	+	+	5	15	50	20	0/+	+	0	0	0	15
436	0	0	0	0	0	0	15	0	15	0	0	2	30	5	40	10	0/0	0	0	0	0	30
437	0	0	0	0	0	0	1	0	20	0	+	+	0	35	65	10	0/+	+	0	0	+	25
438	0	0	0	0	0	0	7	1	25	0	+	2	15	15	40	30	0/0	0	0	0	0	25
439	0	0	0	0	0	0	1	0	10	0	0	+	0	25	70	10	0/15	15	0	0	+	15
440	0	0	0	15	0	15	1	0	30	0	+	1	40	+	10	0	0/0	0	0	0	0	25
441	0	0	0	10	0	10	1	0	20	0	0	+	+	40	50	0	0/0	0	0	0	+	15

Table 13. Inuvik relevé plant species list

Vascular species	**Bryophyte species**
Alnus crispa	*Aulacomnium acuminatum*
Andromeda polifolia	*Aulacomnium turgidum*
Arctagrostis latifolia	*Bryum* sp.
Arctostaphylous rubra	*Dicranum bergeri*
Carex lugens	*Dicranum elongatum*
Carex vaginata	*Hylocomium splendens*
Dasiphora floribunda	*Hypnum subimponens*
Dryas integrifolia	*Sphagnum warnstorfii*
Empetrum nigrum	*Tomentypnum nitens*
Equisetum scirpoides	
Eriophorum vaginatum	**Lichen species**
Ledum palustre ssp. *decumbens*	*Cetraria islandica* ssp. *crispifomis*
Ledum groenlandicum	*Cladonia amaurocraea*
Orthilia secunda	*Cladonia arbuscula* ssp. *arbuscula*
Pedicularis labradorica	*Cladonia arbuscula* ssp. *mitis*
Pedicularis oederi	*Cladonia cornuta*
Picea mariana	*Cladonia stellaris*
Pyrola grandiflora	*Cladonia stygia*
Salix glauca	*Cladonia chlorophea*
Salix richardsonii	*Flavocetraria cucullata*
Saussurea angustifolia	*Flavocetraria nivalis*
Tephroseris atropurpurea	*Peltigera leucophlebia*
Vaccinium uliginosum	
Vaccinium vitis-idaea	

Table 14. Mould Bay relevé plant species list

Vascular species

Alopecurus alpinus	*Petasites frigidus*
Arctagrostis latifolia	*Poa* sp.
Carex aquatilis	*Poa abbreviata*
Carex heleonastes	*Polygonum viviparum*
Cerastium arcticum	*Potentilla hyparctica*
Cerastium regelii	*Ranunculus nivalis*
Cochlearia officinalis	*Ranunculus sulphureus*
Draba sp.	*Salix arctica*
Draba alpina	*Saxifraga caespitosa*
Draba cinerea	*Saxifraga cernua*
Dryas integrifolia	*Saxifraga flagellaris*
Eriophorum triste	*Saxifraga foliolosa*
Festuca hyperborea	*Saxifraga hirculus*
Juncus biglumis	*Saxifraga nivalis*
Luzula arctica	*Saxifraga oppositifolia*
Minuartia rossii	*Stellaria* sp.
Oxytropis digyna	*Stellaria longipes*
Papaver radicatum	*Taraxicum phymatocarpum*
Parrya arctica	

Table 14 (cont.).

Bryophyte species	
Aneura pinguis	*Hylocomium splendens*
Anthelia juratzkana	*Hypnum bambergeri*
Aplodon wormskjoldii	*Hypnum revolutum*
Aulacomnium acuminatum	*Hypnum vaucheri*
Aulacomnium turgidum	*Hypnum* sp.
Bartramia ithyphylla	*Limprichtia revolvens*
Bryoerythrophyllum recurvirostrum	*Loeskypnum badium*
Bryum cyclophyllum	*Meesia triquetra*
Bryum pseudotriquetrum	*Mnium thomsonii*
Bryum rutilans	*Myurella julacea*
Bryum sp.	*Myurella tenerrima*
Callialaria curvicaule	*Nostoc commune*
Calliergon giganticum	*Oncophorum virens*
Campylium arcticum	*Oncophorus wahlenbergii*
Campylium stellatum	*Orthotrichum speciosum*
Catascopium nigritum	*Orthothecium chryseum*
Cinclidium arcticum	*Orthothecium strictum*
Cinclidium latifolium	*Philonotis fontana*
Cirriphyllum cirrosum	*Philonotis tomentella*
Ctenidium procerrimum	*Platydictya jungermannioides*
Cyrtomnium hymenophyllum	*Pohlia berengensis*
Dicranum acutifolium	*Pohlia cruda*
Dicranum spadiceum	*Pohlia* sp.
Dicranium sp.	*Polytrichastrum alpinum*
Didymodon asperifolius	*Racomitrium lanuginosum*
Didymodon icmadophyllus	*Racomitrium panschii*
Didymodon rigidulus	*Sanionia uncinata*
Didymodon sp.	*Schistidium andreaeopsis*
Distichium capillaceum	*Schistidium papillosum*
Distichium inclinatum	*Tetraplodon mnioides*
Distichium sp.	*Thuidium abietina*
Ditrichum flexicaule	*Timmia austriaca*
Drepanocladus brevifolius	*Tomentypnum nitens*
Drepanocladus sp.	*Tortella arctica*
Encalypta alpina	*Tortula leucostoma*
Encalypta raptocarpa	*Tortula mucronifolia*
Encalypta sp.	*Tortula ruralis*
Fissidens arcticus	*Warnstorfia sarmentosa*
Hennediella heimii	

Table 14 (cont.).

Lichen species

Alectoria nigricans	*Lecidea* sp.
Alectoria ochroleuca	*Leproloma* sp. *nov.*
Arctocetraria nigricascens	*Leptogium gelatinosum*
Baeomyces rufus	*Leptogium* sp.
Bryocaulon divergens	*Megaspora verrucosa*
Buellia species	*Micarea* sp.
Caloplaca ammiospila	*Nephroma expallidum*
Caloplaca cerina	*Ochrolechia frigida*
Caloplaca tetraspora	*Ochrolechia inequatila*
Caloplaca tiroliensis	*Parmelia omphalodes* ssp. *glacialis*
Caloplaca xanthostigmoidea	*Peltigera didactyla*
Catapyrenium	*Peltigera leucophlebia*
Cetraria aculeata	*Peltigera rufescens*
Cetraria islandica ssp. islandica	*Pertusaria dactylina*
Cetrariella delisei	*Phaeorrhiza nimbosa*
Cetrariella fastigiata	*Physconia muscigena*
Cladonia macroceras	*Protoblastenia siebenhaariana* var. *terricola*
Cladonia pocillum	*Protopannaria pezizoides*
Cladonia sp.	*Psoroma hypnorum*
Collema sp.	*Rinodina roscida*
Dacampia hookeri	*Rinodina turfacea*
Dactylina arctica	*Solorina* sp.
Dactylina ramulosa	*Stereocaulon alpinum*
Evernia perfragilis	*Thamnolia vermicularis* var. *subuliformis*
Flavocetraria cucullata	*Thamnolia vermicularis* var. *vermicularis*
Flavocetraria nivalis	*Vulpicida tilesii*
Fulgensia bracteata	sterile black crust
Hypogymnia subobscura	sterile yellow crust
Lecanora epibryon	white crust w/black *apothecia*
Lecanora luteovernalis	black crust w/ *apothecia*
Lecidea ramulosa	

Braun-Blaunquet Cover Estimate Scale for Table 15

r = rare

+ = common, but < 1% cover

p = identified, but abundance not known

1 = 1 -5 %

2 = 6-15%

3 = 25 -50 %

4 = 51 -75 %

5 = 76 -100%

Table 15. Releve species cover.

Relevé	**401**	**402**	**403**	**404**	**405**	**406**	**407**	**408**	**409**	**410**	**411**	**412**	**413**
Alectoria nigricans	.	.	+	+	.	+	.	+	.	+	.	.	+
Alectoria ochroleuca	.	.	.	.	R	+	.	.	.	.	.	+	.
Alnus crispa	1	.	.	.	.	.	.	.	.	.	.	.	.
Alopecuris alpinus	.	.	+	+	.	+	+	+	+	.	+	1	1
Andromeda polifolia	.	+	.	.	.	.	.	.	.	.	.	.	.
Aneura pinguis	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthelia juratzkana	.	.	.	.	.	.	.	.	.	.	.	.	.
Aplodon wormskjoldii	.	.	.	.	.	.	.	.	.	.	.	.	.
Arctagrostis latifolia	+	+	.	.	.	.	.	.	.	.	.	.	.
Arctocetraria nigricascens	.	.	.	.	.	.	.	.	.	.	.	.	.
Arctostaphylous rubra	+	2	.	.	.	.	.	.	.	.	.	.	.
Aulacomnium acuminatum	.	1	.	.	.	.	.	.	.	.	.	.	.
Aulacomnium turgidum	+	2	.	.	.	.	R	.	.	.	.	.	.
Baeomyces rufus	.	.	.	.	.	.	.	.	.	.	.	.	.
Bartramia ithyphylla	.	.	.	.	.	.	.	.	.	.	.	.	.
black crust w/ *apothecia*	.	.	.	.	.	.	.	.	.	.	.	.	.
Bryocaulon divergens	.	.	.	.	+	2	+	.	.	.	.	.	.
Bryoerythrophyllum recurvirostrum	.	.	.	.	.	.	p	.	.	p	p	.	.
Bryum cyclophyllum	.	.	.	.	.	.	.	.	.	.	.	.	.
Bryum pseudotriquetrum	.	.	.	.	.	.	.	p	p	.	.	.	.
Bryum rutilans	.	.	.	.	.	.	.	.	.	+	.	+	+
Bryum sp.	+	+	.	+	.	.	.	.	.	.	.	.	.
Buellia sp.	.	.	.	.	.	.	.	.	.	+	.	+	.
Callialaria curvicaule	.	.	.	.	.	.	.	.	.	.	.	.	.
Calliergon giganticum	.	.	.	.	.	.	.	.	.	.	.	.	.
Caloplaca ammiospila	.	.	p	.	.	.	.	.	.	.	.	.	.
Caloplaca cerina	.	.	p	.	.	.	.	.	.	p	.	.	.
Caloplaca tetraspora	.	.	p	.	.	.	.	.	.	.	.	.	.
Caloplaca tiroliensis	.	.	+	.	.	p	.	+	.	+	.	+	.
Caloplaca xanthostigmoidea	.	p	.	.	.	.	.	.	.	p	.	.	.
Campylium arcticum	.	.	.	.	.	.	.	p	p	.	.	.	.
Campylium stellatum	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex aquatilis	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex heleonastes	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex lugens	1	.	.	.	.	.	.	.	.	.	.	.	.
Carex vaginata	+	+	.	.	.	.	.	.	.	.	.	.	.
Catapyrenium	.	.	.	.	.	p	.	.	.	.	.	p	.
Catascopium nigritum	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium arcticum	.	.	.	+	.	.	.	.	.	.	.	.	+
Cerastium regelii	.	.	.	.	.	.	.	.	.	.	.	.	.
Cetraria aculeata	.	.	.	.	.	.	R	.	.	.	.	.	.
Cetraria islandica ssp. *crispifomis*	+	+	.	.	.	.	.	.	.	.	.	.	.
Cetraria islandica ssp. *islandica*	.	.	+	+	.	.	.	+	+	1	+	1	+
Cetrariella delisei	.	.	.	.	.	+	.	.	.	.	.	.	.
Cetrariella fastigiata	.	.	.	.	.	.	.	.	.	.	.	.	.
Cinclidium arcticum	.	.	.	.	.	.	.	.	.	.	.	.	.
Cinclidium latifolium	.	.	.	.	.	.	.	.	+	.	.	.	.
Cirriphyllum cirrosum	.	.	.	p	.	.	.	.	.	p	p	.	.
Cladonia chlorophea	+	+	.	.	.	.	.	.	.	.	.	.	.
Cladonia amaurocraea	+	+	.	.	.	.	.	.	.	.	.	.	.
Cladonia arbuscula ssp. *arbuscula*	2	1	.	.	.	.	.	.	.	.	.	.	.
Cladonia arbuscula ssp. *mitis*	2	+	.	.	.	.	.	.	.	.	.	.	.

Table 15 (cont.).	**401**	**402**	**403**	**404**	**405**	**406**	**407**	**408**	**409**	**410**	**411**	**412**	**413**
Cladonia cornuta	+	+	.	.	.	.	.	.	.	.	.	.	.
Cladonia macroceras	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia pocillum	.	.	R	.	.	p	.	.	.	p	.	+	.
Cladonia sp.	.	.	.	.	.	.	R	.	.	.	.	.	.
Cladonia stellaris	3	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia stygia	1	1	.	.	.	.	.	.	.	.	.	.	.
Cochlearia officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.
Collema sp.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ctenidium procerrimum	.	.	.	.	.	.	.	p	p	p	p	p	p
Cyrtomnium hymenophyllum	.	.	.	.	.	.	.	.	.	.	.	.	.
Dacampia hookeri	.	.	.	.	.	.	.	.	.	.	.	.	.
Dactylina arctica	.	.	.	.	.	.	.	.	.	.	.	.	.
Dactylina ramulosa	.	.	R	.	.	.	.	.	.	.	.	.	.
Dasiphora floribunda	+	.	.	.	.	.	.	.	.	.	.	.	.
Dicranium sp.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dicranum acutifolium	.	.	.	.	.	.	.	.	.	.	.	.	.
Dicranum bergeri	.	p	.	.	.	.	.	.	.	.	.	.	.
Dicranum elongatum	1	+	.	.	.	.	.	.	.	.	.	.	.
Dicranum spadiceum	.	.	.	.	.	.	.	.	.	.	.	.	.
Didymodon asperifolius	.	.	.	p	.	.	.	.	p	p	p	.	.
Didymodon icmadophyllus	.	.	.	.	.	.	.	p	p	p	p	p	p
Didymodon rigidulus	.	.	.	.	.	.	p	.	.	.	.	.	.
Didymodon sp.	.	.	.	.	.	.	.	.	.	.	.	.	.
Distichium capillaceum	.	.	.	p	.	+	+	.	1	+	+	+	+
Distichium inclinatum	.	.	.	1	.	.	p	.	p	p	p	.	.
Distichium sp.	.	.	.	.	.	+	1	.	.	.	.	.	.
Ditrichum flexicaule	.	.	.	+	.	+	1	1	2	+	1	1	+
Draba alpina	.	.	.	+	.	+	+	.	.	+	.	+	.
Draba cinerea	.	.	.	.	.	.	.	.	.	.	.	.	.
Draba sp.	.	.	+	+	.	+	+	+	+	R	.	+	.
Drepanocladus brevifolius	.	.	.	.	.	.	.	.	.	.	.	.	.
Drepanocladus spp.	.	.	.	.	.	.	+	.	.	.	.	.	.
Dryas integrifolia	.	1	+	1	.	+	1	+	+	1	3	+	2
Empetrum nigrum	1	.	.	.	.	.	.	.	.	.	.	.	.
Encalypta alpina	.	.	.	.	.	.	.	1	1	+	.	+	.
Encalypta raptocarpa	.	.	.	.	.	+	+	.	.	.	.	.	.
Encalypta sp.	.	.	+	.	.	.	.	.	.	.	.	.	.
Equisetum scirpoides	+	1	.	.	.	.	.	.	.	.	.	.	.
Eriophorum triste	.	.	.	.	.	.	.	.	.	.	.	.	.
Eriophorum vaginatum	.	+	.	.	.	.	.	.	.	.	.	.	.
Evernia perfragilis	.	.	p	.	.	.	.	.	.	.	.	.	.
Festuca hyperborea	.	.	+	.	.	+	+	.	.	.	+	+	+
Fissidens arcticus	.	.	.	.	.	.	.	.	.	.	.	.	.
Flavocetraria cucullata	+	.	+	1	+	1	+	+	+	+	1	+	1
Flavocetraria nivalis	2	+	.	.	.	+	.	.	.	.	.	.	.
Fulgensia bracteata	.	.	+	.	.	+	.	1	.	+	.	+	.
Hennediella heimii	.	.	.	p	.	.	.	.	.	.	.	.	.
Hylocomium splendens	+	1	.	.	.	.	.	.	.	.	+	.	.
Hypnum bambergeri	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum revolutum	.	.	.	+	.	+	2	.	+	p	p	p	p
Hypnum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum subimponens	p	p	.	.	.	.	.	.	.	.	.	.	.
Hypnum vaucheri	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 15 (cont.).	**401**	**402**	**403**	**404**	**405**	**406**	**407**	**408**	**409**	**410**	**411**	**412**	**413**
Hypogymnia subobscura	.	.	3	.	+	2	+	1	.	2	.	2	.
Juncus biglumis	.	.	+	.	.	.	.	+	.	+	.	1	.
Lecanora epibryon	.	.	3	.	.	+	.	3	.	3	.	2	.
Lecanora luteovernalis	.	.	+	.	.	.	.	.	.	+	.	1	.
Lecidea ramulosa	.	.	1	.	.	1	.	1	.	2	.	1	.
Lecidea sp.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ledum groenlandicum	1	.	.	.	.	.	.	.	.	.	.	.	.
Ledum palustre ssp. *decumbens*	2	2	.	.	.	.	.	.	.	.	.	.	.
Leproloma sp. *nov.*	.	.	p	.	+	2	.	p	.	.	.	.	.
Leptogium gelatinosum	.	.	.	.	.	p	.	.	.	.	.	.	.
Leptogium sp.	.	.	p	.	.	.	.	.	.	.	.	.	.
Limprichtia revolvens	.	.	.	.	.	.	.	.	.	.	.	.	.
Loeskypnum badium	.	.	.	.	.	.	.	.	.	.	.	.	.
Luzula nivalis	.	.	1	1	.	+	2	1	+	+	.	1	+
Meesia triquetra	.	.	.	.	.	.	.	.	.	.	.	.	.
Megaspora verrucosa	.	.	+	.	.	2	.	.	.	.	.	1	.
Micarea sp.	.	.	.	.	.	.	.	.	.	.	.	.	.
Minuartia rossii	.	.	+	.	.	+	+	.	.	.	.	+	.
Mnium thomsonii	.	.	.	.	.	.	.	.	.	p	p	p	p
Myurella julacea	.	.	.	.	.	.	p	.	.	.	.	p	p
Myurella tenerrima	.	.	.	.	.	.	.	p	p	.	.	.	.
Nephroma expallidum	.	.	.	.	.	.	.	.	.	.	.	.	.
Nostoc commune	.	.	.	.	.	.	.	.	.	.	.	.	.
Ochrolechia frigida	.	.	p	.	.	p	.	p	.	.	.	p	.
Ochrolechia inequatila	.	.	.	.	.	p	.	p	.	.	.	.	.
Oncophorum virens	.	.	.	.	.	.	.	.	.	.	.	.	.
Oncophorus wahlenbergii	.	.	.	.	.	.	.	.	.	.	.	.	.
Orthilia secunda	+	+	.	.	.	.	.	.	.	.	.	.	.
Orthothecium chryseum	.	.	.	.	.	.	.	.	.	.	.	p	p
Orthothecium strictum	.	.	.	.	.	.	R	+	.	.	.	.	.
Orthotrichum speciosum	.	.	.	2	.	.	.	.	3	+	3	.	2
Oxytropis digyna	.	.	+	+	+	+	+	+	+	+	+	+	.
Papaver radicatum	.	.	+	+	+	1	+	+	+	+	.	+	.
Parmelia omphalodes ssp. *glacialis*	.	.	+	.	.	p	.	+	.	+	.	2	.
Parrya arctica	.	.	+	+	+	+	+	+	+	+	.	+	.
Pedicularis labradorica	+	.	.	.	.	.	.	.	.	.	.	.	.
Pedicularis oederi	+	.	.	.	.	.	.	.	.	.	.	.	.
Peltigera didactyla	.	.	.	.	.	.	+	.	.	.	.	.	.
Peltigera leucophlebia	+	+	.	.	.	.	.	.	.	.	.	.	.
Peltigera rufescens	.	.	.	.	.	.	+	.	.	.	.	.	.
Pertusaria dactylina	.	.	1	.	.	.	.	1	.	.	.	2	.
Petasites frigidus	.	.	.	.	.	.	.	.	.	.	.	.	.
Phaeorrhiza nimbosa	.	.	p	.	.	+	.	.	.	.	.	.	.
Philonotis fontana	.	.	.	.	.	.	.	.	.	.	.	.	.
Philonotis tomentella	.	.	.	.	.	.	.	.	.	.	.	.	.
Physconia muscigena	.	.	p	.	.	.	.	.	.	p	.	p	.
Picea mariana	2	1	.	.	.	.	.	.	.	.	.	.	.
Platydictya jungermannioides	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa abbreviata	.	.	.	+	.	.	.	.	+	.	+	.	+
Poa sp.	.	.	.	.	+	1	1	.	.	.	.	.	.
Pohlia berengensis	.	.	.	.	.	.	.	.	.	.	.	.	.
Pohlia cruda	.	.	.	p	.	.	.	p	p	.	.	p	p
Pohlia sp.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 15 (cont.).	**401**	**402**	**403**	**404**	**405**	**406**	**407**	**408**	**409**	**410**	**411**	**412**	**413**
Polygonum viviparum	.	.	.	.	.	.	.	.	.	.	.	.	.
Polytrichastrum alpinum	.	.	.	.	.	.	p	+	1	+	+	.	.
Potentilla hyparctica	.	.	+	+	+	+	1	1	+	+	+	+	+
Protoblastenia siebenhaariana var. *terricola*	.	.	.	.	.	2	.	.	.	.	.	.	.
Protopannaria pezizoides	.	.	.	.	.	.	.	.	.	.	.	.	.
Psoroma hypnorum	.	.	.	.	.	.	.	.	.	.	.	.	.
Pyrola grandiflora	.	+	.	.	.	.	.	.	.	.	.	.	.
Racomitrium lanuginosum	.	.	.	1	.	.	1	.	.	.	.	+	+
Racomitrium panschii	.	.	.	.	.	.	.	.	.	.	.	p	p
Ranunculus nivalis	.	.	.	.	.	R	.	.	.	.	.	.	.
Ranunculus sulphureus	.	.	.	.	.	.	.	.	.	.	.	R	.
Rinodina roscida	.	.	p	.	.	.	.	p	.	p	.	.	.
Rinodina turfacea	.	.	p	.	.	.	.	p	.	.	.	.	.
Salix arctica	.	.	+	2	.	+	3	1	2	+	2	+	3
Salix glauca	1	1	.	.	.	.	.	.	.	.	.	.	.
Salix richardsonii	+	+	.	.	.	.	.	.	.	.	.	.	.
Sanionia uncinata	.	.	.	1	.	.	1	+	1	.	1	1	2
Saussurea angustifolia	1	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga caespitosa	.	.	.	R	.	.	+	+	+	.	r	+	.
Saxifraga cernua	.	.	.	.	.	R	.	.	.	.	+	.	+
Saxifraga flagellaris	.	.	.	.	.	.	.	.	.	.	.	.	+
Saxifraga foliolosa	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga hirculus	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga nivalis	.	.	.	+	.	.	+	+	+	+	.	.	+
Saxifraga oppositifolia	.	.	+	1	.	.	.	1	1	1	1	+	1
Schistidium andreaeopsis	.	.	.	.	.	.	.	.	.	.	.	.	.
Schistidium papillosum	.	.	.	.	.	.	.	.	.	p	p	.	.
Solorina sp.	.	.	.	.	.	.	R	.	.	.	.	.	.
Sphagnum warnstorfii	.	+	.	.	.	.	.	.	.	.	.	.	.
Stellaria longipes	.	.	+	+	.	.	.	R	+	.	+	+	+
Stellaria sp.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stereocaulon alpinum	.	.	.	.	.	.	.	.	.	+	.	.	.
sterile black crust	.	.	2	.	.	.	.	2	.	1	.	2	.
sterile yellow crust	.	.	.	.	.	R	.	.	.	.	.	.	.
Taraxicum phymatocarpum	.	.	.	.	.	.	.	.	.	.	.	.	.
Tephroseris atropurpureus	+	+	.	.	.	.	.	.	.	.	.	.	.
Tetraplodon mnioides	.	.	.	.	.	.	.	.	p	.	.	.	.
Thamnolia vermicularis var. *subuliformis*	.	.	1	2	+	2	1	2	+	+	1	+	1
Thamnolia vermicularis var. *vermicularis*	.	.	p	.	.	.	.	.	.	.	.	.	.
Thuidium abietina	.	.	.	.	.	.	.	.	R	.	.	.	.
Timmia austriaca	.	.	+	+	.	.	.	p	p	p	p	+	.
Tomentypnum nitens	.	+	.	1	.	.	+	.	1	.	1	.	1
Tortella arctica	.	.	.	.	.	.	.	.	.	.	.	.	.
Tortula leucostoma	.	.	.	p	.	.	.	.	.	.	.	p	p
Tortula mucronifolia	.	.	.	.	.	.	.	.	.	.	.	.	.
Tortula ruralis	.	.	.	4	.	.	2	.	2	.	2	.	2
Vaccinium uliginosum	1	2	.	.	.	.	.	.	.	.	.	.	.
Vaccinum vitis-idaea	1	3	.	.	.	.	.	.	.	.	.	.	.
Vulpicida tilesii	.	.	+	.	.	.	.	1	.	1	+	1	.
Warnstorfia sarmentosa	.	.	.	.	.	.	.	.	.	.	.	.	.
white crust w/black apothecia	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 15 (cont.)..	**414**	**415**	**416**	**417**	**418**	**419**	**420**	**421**	**422**	**423**	**424**	**425**	**426**	**427**
Alectoria nigricans	.	.	.	p	.	.	.	.	.	.	.	.	.	.
Alectoria ochroleuca	.	.	.	.	.	.	.	.	.	.	.	.	R	.
Alnus crispa	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alopecuris alpinus	+	+	+	+	+	+	1	+	+	2	1	+	1	1
Andromeda polifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aneura pinguis	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthelia juratzkana	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aplodon wormskjoldii	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arctagrostis latifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arctocetraria nigricascens	.	.	.	.	.	.	.	.	.	.	.	.	p	.
Arctostaphylous rubra	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aulacomnium acuminatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aulacomnium turgidum	.	.	.	.	.	.	.	R	.	.	.	.	.	.
Baeomyces rufus	p	.	.	.	.	.	.	.	.	.	.	.	.	.
Bartramia ithyphylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.
black crust w/ *apothecia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bryocaulon divergens	.	.	.	+	+	+	1	.	.	.	.	.	1	.
Bryoerythrophyllum recurvirostrum	p	p	.	.	p	.	.	p	.	.	p	.	.	p
Bryum cyclophyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bryum pseudotriquetrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bryum rutilans	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Bryum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Buellia sp.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Callialaria curvicaule	.	.	.	.	.	.	.	.	.	.	.	.	.	p
Calliergon giganticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Caloplaca ammiospila	.	.	.	p	.	.	p	.	.	p	.	.	p	.
Caloplaca cerina	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Caloplaca tetraspora	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Caloplaca tiroliensis	+	.	.	+	.	.	.	.	.	.	.	.	p	.
Caloplaca xanthostigmoidea	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campylium arcticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campylium stellatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex aquatilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex heleonastes	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex lugens	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex vaginata	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Catapyrenium	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Catascopium nigritum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium arcticum	.	+	.	.	.	.	.	.	.	.	.	.	+	+
Cerastium regelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cetraria aculeata	.	.	.	p	.	.	p	.	.	p	.	.	p	.
Cetraria islandica ssp. *crispifomis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cetraria islandica ssp. *islandica*	+	+	.	+	+	.	.	.	.	.	+	.	p	.
Cetrariella delisei	.	.	.	+	+	.	+	.	.	+	.	.	+	.
Cetrariella fastigiata	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cinclidium arcticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cinclidium latifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cirriphyllum cirrosum	p	p	.	.	.	.	+	+	.	.	+	.	.	+
Cladonia chlorophea	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia amaurocraea	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia arbuscula ssp. *arbuscula*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia arbuscula ssp. *mitis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 15 (cont.)..	**414**	**415**	**416**	**417**	**418**	**419**	**420**	**421**	**422**	**423**	**424**	**425**	**426**	**427**
Cladonia cornuta	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia macroceras	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia pocillum	.	.	.	+	.	.	1	.	.	+	.	.	.	.
Cladonia sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia stellaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia stygia	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cochlearia officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Collema sp.	.	.	.	p	.	.	.	.	.	+	.	.	.	.
Ctenidium procerrimum	p	p	.	.	p	.	.	.	.	.	p	.	.	p
Cyrtomnium hymenophyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dacampia hookeri	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dactylina arctica	.	.	.	.	R	.	.	.	.	.	.	.	.	.
Dactylina ramulosa	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Dasiphora floribunda	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dicranium sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dicranum acutifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dicranum bergeri	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dicranum elongatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dicranum spadiceum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Didymodon asperifolius	.	.	.	.	p	.	.	p	.	.	p	.	.	.
Didymodon icmadophyllus	p	p	.	.	p	.	.	p	.	.	.	.	.	.
Didymodon rigidulus	.	.	.	.	.	.	.	.	.	.	.	.	.	p
Didymodon sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Distichium capillaceum	1	+	.	.	.	.	1	2	.	2	1	.	1	2
Distichium inclinatum	p	p	.	+	1	.	p	p	.	p	p	.	.	p
Distichium sp.	.	.	.	.	.	.	.	.	.	.	.	.	1	2
Ditrichum flexicaule	.	1	.	+	+	.	+	1	.	1	1	.	1	2
Draba alpina	+	.	.	.	.	.	.	.	.	.	.	.	+	+
Draba cinerea	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Draba sp.	+	.	.	+	.	.	+	.	.	+	.	.	+	.
Drepanocladus brevifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Drepanocladus spp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dryas integrifolia	+	+	.	.	2	.	.	1	.	+	1	.	.	2
Empetrum nigrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Encalypta alpina	1	+	.	+	+	.	.	.	.	+	.	.	.	.
Encalypta raptocarpa	.	.	.	.	.	.	.	.	.	+	.	.	+	+
Encalypta sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Equisetum scirpoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eriophorum triste	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eriophorum vaginatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Evernia perfragilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca hyperborea	1	+	+	+	.	.	+	+	+	1	.	.	+	.
Fissidens arcticus	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Flavocetraria cucullata	+	1	+	1	1	.	1	.	.	1	+	.	+	+
Flavocetraria nivalis	+	.	.	+	+	.	+	.	.	+	.	.	+	.
Fulgensia bracteata	+	.	.	+	.	.	+	.	.	+	.	.	+	.
Hennediella heimii	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hylocomium splendens	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum bambergeri	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum revolutum	p	p	.	.	2	.	.	2	.	.	1	.	1	2
Hypnum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum subimponens	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum vaucheri	.	.	.	.	p	.	.	.	.	.	p	.	.	.

Table 15 (cont.)..	**414**	**415**	**416**	**417**	**418**	**419**	**420**	**421**	**422**	**423**	**424**	**425**	**426**	**427**
Hypogymnia subobscura	2	.	.	2	+	.	1	.	.	+	.	.	2	+
Juncus biglumis	+	.	.	+	.	.	+	.	.	+	.	.	R	.
Lecanora epibryon	1	.	.	+	.	.	.	.	.	1	.	.	+	.
Lecanora luteovernalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lecidea ramulosa	2	.	+	1	.	+	2	.	.	+	.	+	1	.
Lecidea sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ledum groenlandicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ledum palustre ssp. *decumbens*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leproloma sp. *nov.*	p	.	.	2	.	+	2	.	+	2	.	+	2	.
Leptogium gelatinosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leptogium sp.	.	.	.	p	.	.	.	.	.	.	.	.	.	.
Limprichtia revolvens	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Loeskypnum badium	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Luzula nivalis	1	+	.	1	2	.	1	3	.	1	3	+	1	2
Meesia triquetra	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Megaspora verrucosa	2	.	.	p	.	.	.	.	.	.	.	.	.	.
Micarea sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Minuartia rossii	+	.	.	+	.	.	.	.	.	.	.	.	R	.
Mnium thomsonii	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myurella julacea	p	p	.	.	p	.	.	.	.	.	p	.	.	p
Myurella tenerrima	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Nephroma expallidum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Nostoc commune	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ochrolechia frigida	p	.	.	1	.	.	.	.	.	.	.	.	p	.
Ochrolechia inequatila	.	.	.	.	.	.	p	.	.	p	.	.	.	.
Oncophorum virens	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oncophorus wahlenbergii	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Orthilia secunda	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Orthothecium chryseum	p	p	.	.	.	.	1	+	.	+	.	.	+	p
Orthothecium strictum	.	.	.	.	.	.	.	.	.	.	p	.	.	+
Orthotrichum speciosum	+	3	.	.	.	.	.	.	.	.	.	.	.	.
Oxytropis digyna	1	+	+	+	+	.	+	+	+	1	+	.	1	1
Papaver radicatum	1	+	.	+	+	.	.	.	.	.	.	+	+	.
Parmelia omphalodes ssp. *glacialis*	+	.	.	1	+	.	+	.	.	+	.	.	1	.
Parrya arctica	+	+	.	+	+	.	.	.	.	.	.	1	1	+
Pedicularis labradorica	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pedicularis oederi	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Peltigera didactyla	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Peltigera leucophlebia	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Peltigera rufescens	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Pertusaria dactylina	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Petasites frigidus	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phaeorrhiza nimbosa	p	.	.	2	.	.	.	.	.	.	.	.	2	1
Philonotis fontana	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Philonotis tomentella	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Physconia muscigena	p	.	.	p	.	.	p	.	.	p	.	.	p	.
Picea mariana	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Platydictya jungermannioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa abbreviata	1	+	.	.	.	.	.	.	.	.	.	.	.	.
Poa sp.	.	.	.	.	.	.	.	.	.	.	.	+	.	+
Pohlia berengensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pohlia cruda	.	.	.	.	.	.	.	p	.	.	.	.	.	.
Pohlia sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 15 (cont.)..	**414**	**415**	**416**	**417**	**418**	**419**	**420**	**421**	**422**	**423**	**424**	**425**	**426**	**427**
Polygonum viviparum	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Polytrichastrum alpinum	+	1	.	.	.	.	+	1	.	1	1	.	.	.
Potentilla hyparctica	1	+	.	+	+	.	+	.	+	+	+	.	.	+
Protoblastenia siebenhaariana var. *terricola*	.	.	+	1	.	.	.	.	.	.	.	+	1	.
Protopannaria pezizoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Psoroma hypnorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pyrola grandiflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Racomitrium lanuginosum	.	+	.	.	.	.	.	+	.	.	.	.	.	.
Racomitrium panschii	.	.	.	.	.	.	.	p	.	.	.	.	.	.
Ranunculus nivalis	.	.	.	.	.	.	.	.	.	+	.	.	+	+
Ranunculus sulphureus	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Rinodina roscida	p	.	.	.	.	.	.	.	.	.	.	.	.	.
Rinodina turfacea	.	.	.	.	.	.	.	.	.	.	.	.	p	.
Salix arctica	.	+	.	+	2	+	1	2	.	+	3	.	+	3
Salix glauca	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Salix richardsonii	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sanionia uncinata	+	2	.	+	2	.	.	1	.	1	2	.	.	1
Saussurea angustifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga caespitosa	+	+	.	.	.	.	.	.	.	.	.	.	R	+
Saxifraga cernua	.	+	.	.	.	.	.	.	.	.	.	.	.	+
Saxifraga flagellaris	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga foliolosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga hirculus	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga nivalis	.	+	.	.	.	.	.	.	.	.	.	.	.	+
Saxifraga oppositifolia	1	3	.	.	.	.	.	.	.	.	.	.	.	.
Schistidium andreaeopsis	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Schistidium papillosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Solorina sp.	.	.	.	.	.	.	+	.	.	+	.	.	.	.
Sphagnum warnstorfii	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stellaria longipes	+	.	.	.	.	.	.	+	.	.	.	.	+	.
Stellaria sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stereocaulon alpinum	.	+	.	.	.	.	.	.	.	.	.	.	.	.
sterile black crust	2	.	.	+	.	+	3	1	+	4	1	.	.	.
sterile yellow crust	.	.	.	2	.	.	2	.	.	+	.	.	+	.
Taraxicum phymatocarpum	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Tephroseris atropurpureus	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tetraplodon mnioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thamnolia vermicularis var. *subuliformis*	+	1	+	2	1	+	2	+	.	1	+	+	2	+
Thamnolia vermicularis var. *vermicularis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thuidium abietina	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Timmia austriaca	.	.	.	.	.	.	.	+	.	1	2	.	.	+
Tomentypnum nitens	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Tortella arctica	.	.	.	.	.	.	.	.	.	.	p	.	.	.
Tortula leucostoma	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tortula mucronifolia	.	.	.	.	.	.	.	.	.	.	p	.	.	.
Tortula ruralis	.	3	.	.	1	.	.	1	.	.	1	.	.	1
Vaccinium uliginosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vaccinum vitis-idaea	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vulpicida tilesii	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Warnstorfia sarmentosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.
white crust w/black *apothecia*	.	.	.	1	.	+	1	+	.	.	.	.	1	.

Table 15 (cont.).	**428**	**429**	**430**	**431**	**432**	**433**	**434**	**435**	**436**	**437**	**438**	**439**	**440**	**441**
Alectoria nigricans	.	.	.	.	.	.	.	.	.	.	.	.	R	.
Alectoria ochroleuca	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alnus crispa	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alopecuris alpinus	.	.	.	.	.	.	2	+	1	+	1	+	.	.
Andromeda polifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aneura pinguis	+	+	+	.	+	+	.	.	+	.	.	.	+	.
Anthelia juratzkana	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Aplodon wormskjoldii	.	p	.	.	.	.	.	.	.	.	.	.	.	.
Arctagrostis latifolia	2	1	2	1	2	2	.	.	.	.	.	.	2	1
Arctocetraria nigricascens	.	.	.	.	.	.	.	.	.	.	.	.	p	.
Arctostaphylous rubra	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aulacomnium acuminatum	2	2	.	1	2	1	.	.	.	.	+	.	1	.
Aulacomnium turgidum	1	1	1	1	1	2	.	.	.	.	.	.	+	1
Baeomyces rufus	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bartramia ithyphylla	.	.	.	.	.	.	3	2	3	2	3	1	.	.
black crust w/ *apothecia*	2	.	2	.	2	.	.	.	.	.	.	.	2	.
Bryocaulon divergens	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bryoerythrophyllum recurvirostrum	.	p	p	p	p	p	.	p	.	.	p	p	.	p
Bryum cyclophyllum	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Bryum pseudotriquetrum	+	+	+	1	1	1	.	+	+	+	+	+	+	+
Bryum rutilans	.	.	p	p	.	.	.	.	.	.	.	.	p	p
Bryum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Buellia sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Callialaria curvicaule	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Calliergon giganticum	.	p	.	p	.	p	.	.	.	.	.	p	.	+
Caloplaca ammiospila	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Caloplaca cerina	.	.	.	.	.	.	.	.	p	.	.	.	.	.
Caloplaca tetraspora	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Caloplaca tiroliensis	p	.	.	.	p	.	.	.	.	.	.	.	p	.
Caloplaca xanthostigmoidea	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campylium arcticum	.	.	.	p	.	p	.	.	.	p	.	1	.	p
Campylium stellatum	.	p	.	.	.	.	.	.	.	.	.	.	.	.
Carex aquatilis	+	.	+	.	.	.	.	.	.	.	.	.	3	2
Carex heleonastes	.	+	.	+	.	+	+	+	.	+	.	+	.	.
Carex lugens	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex vaginata	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Catapyrenium	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Catascopium nigritum	.	2	.	1	.	1	.	.	.	.	.	.	.	.
Cerastium arcticum	.	.	.	.	.	.	.	.	.	+	+	.	.	.
Cerastium regelii	.	.	.	.	.	.	.	+	1	1	1	+	.	.
Cetraria aculeata	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cetraria islandica ssp. *crispifomis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cetraria islandica ssp. *islandica*	+	+	+	.	+	.	+	.	+	.	+	.	+	.
Cetrariella delisei	.	.	.	.	.	.	+	+	+	.	+	.	.	.
Cetrariella fastigiata	.	.	.	.	.	.	p	.	.	.	.	.	.	.
Cinclidium arcticum	.	p	.	p	.	p	.	.	.	.	.	p	.	.
Cinclidium latifolium	.	.	.	.	.	.	.	p	.	.	+	+	.	.
Cirriphyllum cirrosum	.	.	.	.	.	.	.	.	.	+	.	+	.	p
Cladonia chlorophea	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia amaurocraea	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia arbuscula ssp. *arbuscula*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia arbuscula ssp. *mitis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 15 (cont.).	**428**	**429**	**430**	**431**	**432**	**433**	**434**	**435**	**436**	**437**	**438**	**439**	**440**	**441**
Cladonia cornuta	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia macroceras	.	.	.	.	.	.	+	.	+	.	+	.	p	.
Cladonia pocillum	1	.	1	+	1	+	+	.	1	.	1	.	1	.
Cladonia sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia stellaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia stygia	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cochlearia officinalis	.	.	.	.	.	.	+	+	+	+	+	+	.	.
Collema sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ctenidium procerrimum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cyrtomnium hymenophyllum	.	p	.	p	.	p	.	.	.	.	.	.	.	p
Dacampia hookeri	.	.	.	.	p	.	.	.	.	.	.	.	.	.
Dactylina arctica	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dactylina ramulosa	.	.	.	.	.	.	.	.	.	.	.	.	p	.
Dasiphora floribunda	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dicranium sp.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Dicranum acutifolium	.	.	p	p	.	.	.	.	.	.	.	.	p	.
Dicranum bergeri	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dicranum elongatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dicranum spadiceum	.	.	p	p	.	.	.	.	.	.	.	.	p	.
Didymodon asperifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Didymodon icmadophyllus	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Didymodon rigidulus	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Didymodon sp.	.	p	p	p	.	p	.	.	.	.	.	.	.	.
Distichium capillaceum	.	p	p	p	p	p	.	.	p	p	p	p	.	+
Distichium inclinatum	1	2	3	2	1	2	1	+	3	3	3	1	1	1
Distichium sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ditrichum flexicaule	2	2	2	3	2	1	.	.	p	p	p	.	p	p
Draba alpina	.	.	.	.	.	.	.	.	.	.	.	.	.	R
Draba cinerea	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Draba sp.	.	.	.	R	.	+	+	+	+	+	+	+	.	.
Drepanocladus brevifolius	.	p	.	.	.	p	1	2	.	3	2	3	.	p
Drepanocladus spp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dryas integrifolia	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Empetrum nigrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Encalypta alpina	p	.	+	.	.	.	p	.	.	.	p	.	.	.
Encalypta raptocarpa	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Encalypta sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Equisetum scirpoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eriophorum triste	2	2	2	3	3	2	.	.	.	.	.	.	+	+
Eriophorum vaginatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Evernia perfragilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca hyperborea	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fissidens arcticus	.	.	.	.	.	.	.	p	.	.	.	.	.	.
Flavocetraria cucullata	+	+	+	.	+	.	.	.	+	.	.	.	+	.
Flavocetraria nivalis	.	.	p	.	.	.	.	.	.	.	.	.	.	.
Fulgensia bracteata	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hennediella heimii	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hylocomium splendens	.	.	.	.	.	.	.	.	.	.	.	.	p	.
Hypnum bambergeri	.	.	.	.	.	.	.	.	.	.	.	.	.	p
Hypnum revolutum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum subimponens	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum vaucheri	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 15 (cont.).	**428**	**429**	**430**	**431**	**432**	**433**	**434**	**435**	**436**	**437**	**438**	**439**	**440**	**441**
Hypogymnia subobscura	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Juncus biglumis	.	.	.	.	.	.	+	+	+	.	+	.	.	.
Lecanora epibryon	1	.	2	+	1	.	.	.	.	.	.	.	.	.
Lecanora luteovernalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lecidea ramulosa	.	.	.	.	.	.	1	1	1	.	+	.	.	.
Lecidea sp.	+	.	.	1	.	.	1	2	1	.	2	.	.	.
Ledum groenlandicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ledum palustre ssp. *decumbens*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leproloma sp. *nov.*	.	.	.	.	.	.	.	.	.	.	p	.	.	.
Leptogium gelatinosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leptogium sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Limprichtia revolvens	.	p	+	1	.	p	.	.	.	1	.	1	.	1
Loeskypnum badium	.	.	.	.	.	.	.	.	.	.	.	.	.	p
Luzula nivalis	+	+	+	.	+	+	2	1	1	1	2	2	+	+
Meesia triquetra	.	.	.	.	.	p	.	.	.	.	.	.	.	.
Megaspora verrucosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Micarea sp.	.	.	.	.	.	.	.	.	.	.	.	.	p	.
Minuartia rossii	.	.	.	.	R	.	.	.	.	.	.	.	.	.
Mnium thomsonii	.	p	.	.	.	.	.	.	.	.	.	.	.	p
Myurella julacea	.	p	.	+	.	p	.	p	.	p	p	.	.	p
Myurella tenerrima	.	p	.	p	.	.	.	.	.	.	.	.	.	p
Nephroma expallidum	.	.	.	.	.	.	.	.	.	.	.	.	p	.
Nostoc commune	.	1	.	1	.	1	.	+	.	+	+	3	.	.
Ochrolechia frigida	.	.	.	.	2	.	.	.	.	.	.	.	p	.
Ochrolechia inequatila	+	+	2	.	.	.	+	.	2	.	+	.	2	+
Oncophorum virens	.	.	.	.	.	.	.	.	.	.	.	.	.	p
Oncophorus wahlenbergii	.	1	.	+	.	+	.	p	.	p	+	+	.	2
Orthilia secunda	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Orthothecium chryseum	+	2	+	2	.	2	.	1	.	1	.	1	+	2
Orthothecium strictum	p	p	.	.	.	.	.	.	.	.	.	.	.	.
Orthotrichum speciosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oxytropis digyna	.	.	.	.	.	.	.	.	+	.	+	+	.	.
Papaver radicatum	.	.	+	.	.	.	+	+	+	+	+	.	.	.
Parmelia omphalodes ssp. *glacialis*	.	.	.	.	.	.	p	.	.	.	.	.	p	.
Parrya arctica	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pedicularis labradorica	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pedicularis oederi	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Peltigera didactyla	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Peltigera leucophlebia	+	.	+	.	.	+	+	.	.	+	+	.	+	.
Peltigera rufescens	p	.	.	.	.	.	.	.	.	.	.	.	.	.
Pertusaria dactylina	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Petasites frigidus	.	.	+	+	.	.	.	.	.	.	.	.	+	+
Phaeorrhiza nimbosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Philonotis fontana	.	p	.	p	.	p	.	.	.	.	.	.	.	p
Philonotis tomentella	.	.	.	p	.	.	.	.	.	.	.	.	.	.
Physconia muscigena	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Picea mariana	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Platydictya jungermannioides	p	p	.	p	.	.	.	.	.	.	.	.	.	.
Poa abbreviata	.	.	.	.	.	.	2	+	2	1	1	1	.	.
Poa sp.	+	.	.	.	+	.	.	.	.	.	.	.	.	+
Pohlia berengensis	.	.	.	.	.	.	.	.	.	.	.	.	p	.
Pohlia cruda	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pohlia sp.	.	.	.	.	.	.	.	p	.	.	.	.	.	.

Table 15 (cont.).	**428**	**429**	**430**	**431**	**432**	**433**	**434**	**435**	**436**	**437**	**438**	**439**	**440**	**441**
Polygonum viviparum	1	+	2	+	+	.	.	.	.	.	.	.	1	+
Polytrichastrum alpinum	p	+	p	p	p	p	1	+	2	1	1	+	.	+
Potentilla hyparctica	.	.	.	.	.	.	.	.	+	.	+	.	.	.
Protoblastenia siebenhaariana var. *terricola*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Protopannaria pezizoides	.	.	.	.	p	.	.	.	.	.	.	.	.	.
Psoroma hypnorum	.	.	.	.	.	.	.	.	+	.	.	.	p	.
Pyrola grandiflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Racomitrium lanuginosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Racomitrium panschii	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus nivalis	.	.	.	.	.	.	+	.	+	.	+	+	.	.
Ranunculus sulphureus	.	.	.	+	.	+	.	.	.	.	.	.	R	+
Rinodina roscida	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rinodina turfacea	p	.	.	.	p	.	.	.	.	.	.	.	p	.
Salix arctica	2	2	2	2	2	2	.	.	.	.	.	.	2	2
Salix glauca	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Salix richardsonii	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sanionia uncinata	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saussurea angustifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga caespitosa	.	.	.	.	.	.	.	.	+	.	+	+	.	.
Saxifraga cernua	.	.	.	R	.	.	+	+	+	+	+	+	.	.
Saxifraga flagellaris	.	.	.	.	.	.	.	.	.	.	R	.	.	.
Saxifraga foliolosa	.	.	.	R	.	.	+	+	+	.	+	+	.	.
Saxifraga hirculus	.	.	.	R	.	+	.	.	.	.	.	.	.	.
Saxifraga nivalis	.	.	.	.	.	.	+	+	+	+	+	+	.	.
Saxifraga oppositifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Schistidium andreaeopsis	.	.	.	.	.	.	.	.	.	p	.	.	.	p
Schistidium papillosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Solorina sp.	+	+	.	.	+	+	p	.	p	.	.	.	.	.
Sphagnum warnstorfii	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stellaria longipes	.	.	+	.	.	.	.	.	.	.	.	.	.	+
Stellaria sp.	.	.	.	.	.	.	3	1	3	1	2	1	.	.
Stereocaulon alpinum	.	.	.	.	.	.	.	.	.	.	.	.	R	.
sterile black crust	.	.	.	.	.	.	1	.	2	.	.	.	.	.
sterile yellow crust	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Taraxicum phymatocarpum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tephroseris atropurpureus	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tetraplodon mnioides	.	p	.	.	.	.	.	.	.	.	.	.	.	.
Thamnolia vermicularis var. *subuliformis*	.	.	+	+	+	+	+	+	+	+	1	+	1	+
Thamnolia vermicularis var. *vermicularis*	+	+	.	.	.	.	.	.	.	.	.	.	p	.
Thuidium abietina	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Timmia austriaca	.	.	.	+	p	p	.	.	.	.	.	.	.	p
Tomentypnum nitens	2	1	2	+	2	1	.	.	.	.	.	.	+	3
Tortella arctica	.	p	.	p	.	p	1	4	2	4	2	3	.	.
Tortula leucostoma	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tortula mucronifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tortula ruralis	.	2	.	.	1	.	.	.	.	.	.	.	.	+
Vaccinium uliginosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vaccinum vitis-idaea	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vulpicida tilesii	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Warnstorfia sarmentosa	.	.	.	.	.	.	.	p	.	.	p	p	.	.
white crust w/black *apothecia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 16. Mould Bay relevé biomass (g/m^2).

Releve #	Decid. live foliar	Decid. dead foliar	Decid. stem	Decid. repro.	E-green live foliar	E-green dead foliar	E-green stem	E-green repro.	Gram. live	Gram. dead	Horse-tail	Moss	Forb	Algae	Lichen	TOTAL g/m^2
403	.	.	.	.	.	.	.	.	0.11	0.15	.	1.63	0.73	.	3.43	**6.1**
404	.	.	3.76	.	.	.	.	.		0.40	.	48.00	0.95	.	0.14	**53.2**
405	.	.	.	.	.	.	.	.			.	.	0.04	.	.	**0.0**
406	.	0.18	0.15	.	.	.	.	.	0.05	0.15	.	0.07	0.12	.	7.61	**8.3**
407	2.33	0.99	4.11	0.44	.	.	.	.	0.38	0.90	.	7.39		.	0.14	**16.7**
408	.	0.03	.	.	.	.	.	.	0.05	0.31	.	0.71	0.23	.	0.94	**2.3**
409	.	0.48	3.43	0.50	.	.	.	.		0.09	.	23.85	12.14	.	0.70	**41.2**
410	.	0.00	.	.	.	.	.	.		0.14	.	0.29	0.38	.	2.49	**3.3**
411	0.37	0.08	5.04	.	1.37	0.77	2.97	.	0.01	0.01	.	37.12	0.56	.	0.87	**49.2**
412	.	0.02	.	.	.	.	.	.	0.06	0.48	.	0.20	3.59	.	4.67	**9.0**
413	0.15	0.28	2.59	.	0.28	0.07	0.51	.	0.02	0.09	.	60.48	1.06	.	3.95	**69.5**
414	.	.	.	.	.	.	.	.	0.19	2.54	.	0.03	5.58	.	0.20	**8.5**
415	.	0.12	.	.	.	.	.	.	0.05	0.89	.	60.39	2.04	.	3.68	**67.2**
416	.	.	.	.	.	.	.	.	0.03	0.13	.	.		.	0.80	**1.0**
417	.	3.16	.	.	.	.	.	.	0.15	0.45	.	2.62	0.36	.	11.37	**18.1**
418	3.65	1.48	6.73	0.66	.	.	.	.	0.19	0.76	.	7.06		.	0.13	**20.7**
419	.	0.01	.	.	.	.	.	.	0.04	0.23	.	.		.	0.72	**1.0**
420	0.02	0.06	0.13	0.01	.	.	.	.	0.02	0.08	.	0.10	0.03	.	5.21	**5.6**
421	2.07	0.60	5.56	0.13	.	2.25	0.93	.	0.04	0.13	.	0.99	0.37	.	0.14	**13.2**
422	.	0.01	.	.	.	.	.	.		0.07	0.18	.		.	0.07	**0.3**
423	.	0.11	.	.	.	.	.	.	0.04	0.27	.	1.58	0.90	.	6.41	**9.3**
424	0.09	1.29	1.77	0.06	0.08	17.08	3.67	.	2.37	3.53	.	20.21	0.99	.	0.51	**51.6**
425	0.27	.	0.50	0.02	.	.	.	.	0.03	0.08	.	.		.	0.19	**1.1**
426	0.06	0.72	1.82	0.07	.	.	.	.	0.34	1.07	.	2.56	2.54	.	2.84	**12.0**
427	4.12	4.69	9.00	0.53	.	.	.	.	0.28	0.73	.	2.96	0.50	.	0.03	**22.8**
428	.	1.21	3.52	0.45	.	.	.	.		1.32	.	16.36		.	1.38	**24.2**
429	0.04	0.19	0.27	.	.	.	.	.	0.43	1.79	.	27.32		.	0.03	**30.1**
430	0.78	1.67	3.16	0.16	.	0.02	.	.	1.09	1.76	.	15.17		.	0.65	**24.5**
431	0.12	0.95	2.25	.	.	.	.	.	1.02	1.60	.	19.30		.	0.05	**25.3**
432	0.59	1.03	2.48	0.10	.	.	.	.	0.53	1.93	.	13.04	0.03	0.03	1.86	**21.6**
433	.	0.64	0.27	.	.	.	.	.	0.53	1.98	.	28.42	0.03	.	0.06	**31.9**
434	.	.	.	.	.	.	.	.	0.64	8.51	.	13.19	1.02	.	4.06	**27.4**
435	.	.	.	.	.	.	.	.		0.14	.	18.27	0.36	.	0.01	**18.8**
436	.	0.00	.	0.02	.	.	.	.	0.46	5.33	.	1.18	1.94	.	0.14	**9.1**

Table 15 (cont.)

Releve #	Decid. live foliar	Decid. dead foliar	Decid. stem	Decid. repro.	E-green live foliar	E-green dead foliar	E-green stem	E-green repro.	Gram. live	Gram. dead	Horse-tail	Moss	Forb	Algae	Lichen	TOTAL g/m^2
437	.	.	.	.	.	.	.	.	0.30	1.70	.	5.36	0.10	0.06	.	**7.5**
438	.	.	.	.	.	.	.	.	0.20	1.90	.	12.74	0.38	.	0.59	**15.8**
439	.	.	.	.	.	.	.	.	0.23	1.20	.	28.58	0.21	9.93	.	**40.2**
440	0.63	0.87	1.19	0.03	.	.	.	.	0.66	2.31	.	16.55	0.00	.	0.01	**22.3**
441	0.45	0.61	4.96	0.20	.	.	.	.	0.33	3.06	.	14.25		.	0.83	**24.7**

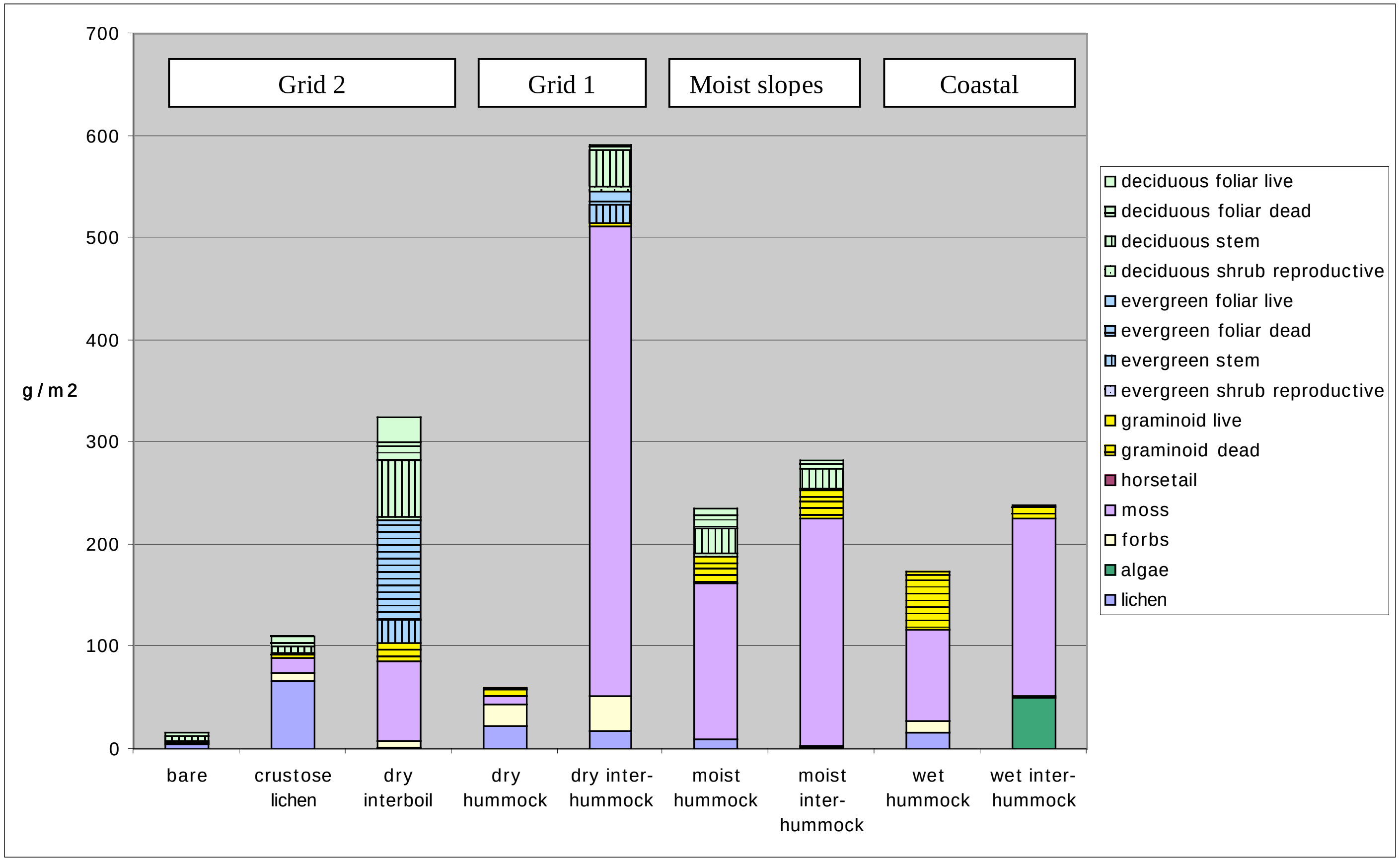


Figure 19. Mould Bay relevé biomass by vegetation type.

N-factor

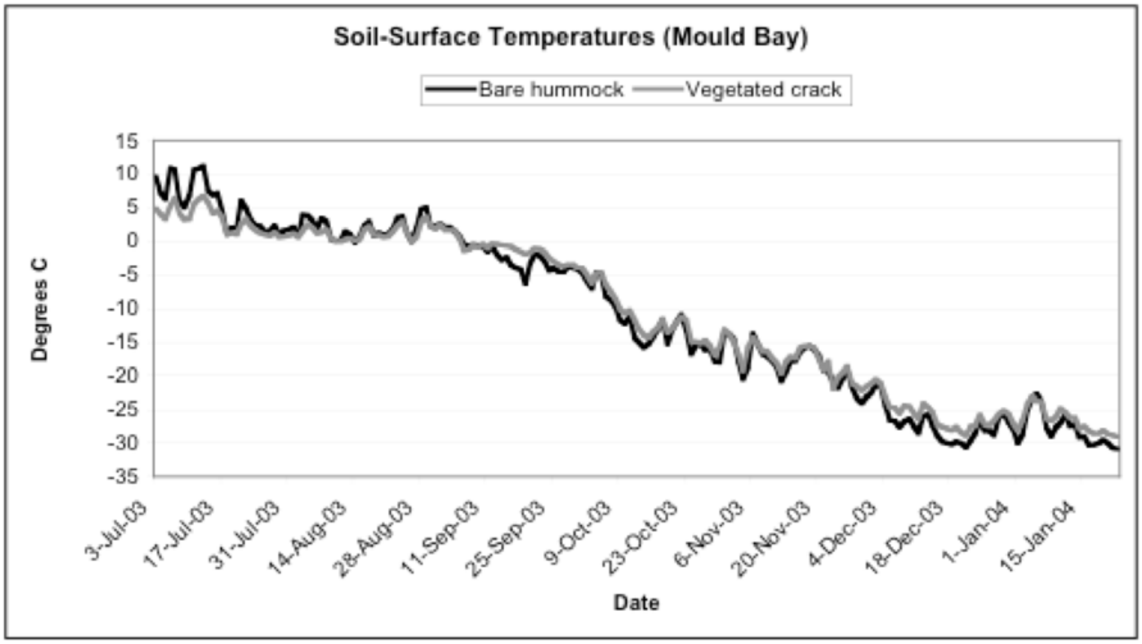


Figure 20. Soil-surface temperature, Grid 1, Mould Bay.

Biogeochemistry:

Table 17. NDVI, soil moisture, thaw depth, and biomass at biogeochemistry sites.

		Grid # 1		Grid # 2	
		Frost Boil	Inter-boil Area	Frost Boil	Inter-boil Area
Rate of Nitrogen Mineralization	Mean	*	*	*	*
units: micrograms N/g soil/day)	Standard Error	*	*	*	*
Rate of Nitrogen Fixation	Mean	*	*	*	*
units: microequivalents of ethylene/hour	Standard Error	*	*	*	*
Total Carbon	Mean	*	*	*	*
units: % Carbon	Standard Error	*	*	*	*
Organic Carbon	Mean	*	*	*	*
units: % Carbon	Standard Error	*	*	*	*
Total Nitrogen	Mean	*	*	*	*
units: % Carbon	Standard Error	*	*	*	*
NDVI	Mean	0.14	0.48	0.11	0.35
unitless	Standard Error	0.01	0.02	0.01	0.04
Volumetric Soil Moisture (0 - 12 cm depth)	Mean	13.92	31.83	21.17	19.75
units: % Volume	Standard Error	2.25	1.59	0.75	0.91
Gravimetric Soil Moisture (0 - 5cm depth)	Mean	0.70	0.21	0.20	0.14
	Standard Error	0.05	0.01	0.01	0.01
Thaw Depth	Mean	27.92	33.75	40.67	41.67
units: cm	Standard Error	0.62	0.46	0.64	0.58
Total Aboveground Biomass	Mean	9.55	126.73	9.74	91.12
units: g/m^2	Standard Error	5.80	18.80	4.48	34.46

*Data analysis in progress.

Table 18. Aboveground biomass by plant functional type at biogeochemistry sites.

Site		Lichen	Moss	Equi-setum	Forb	Graminoid	Evergreen shrubs	Deciduous Shrubs	Total
MB1 Boil	mean	6.46	2.22	0.00	0.69	0.17	0.00	0.00	9.55
	standard error	4.27	2.07	0.00	0.67	0.06	0.00	0.00	5.80
MB1 Inter-boil	mean	6.40	37.22	0.00	1.41	0.94	0.00	80.76	126.73
	standard error	1.96	21.60	0.00	0.74	0.61	0.00	10.95	18.80
MB2 Boil	mean	5.89	0.15	0.00	3.70	0.00	0.00	0.00	9.74
	standard error	4.79	0.15	0.00	3.70	0.00	0.00	0.00	4.48
MB2 Inter-boil	mean	7.75	32.94	0.00	0.02	1.18	1.34	47.90	91.12
	standard error	4.51	17.73	0.00	0.01	0.32	1.34	19.21	34.46

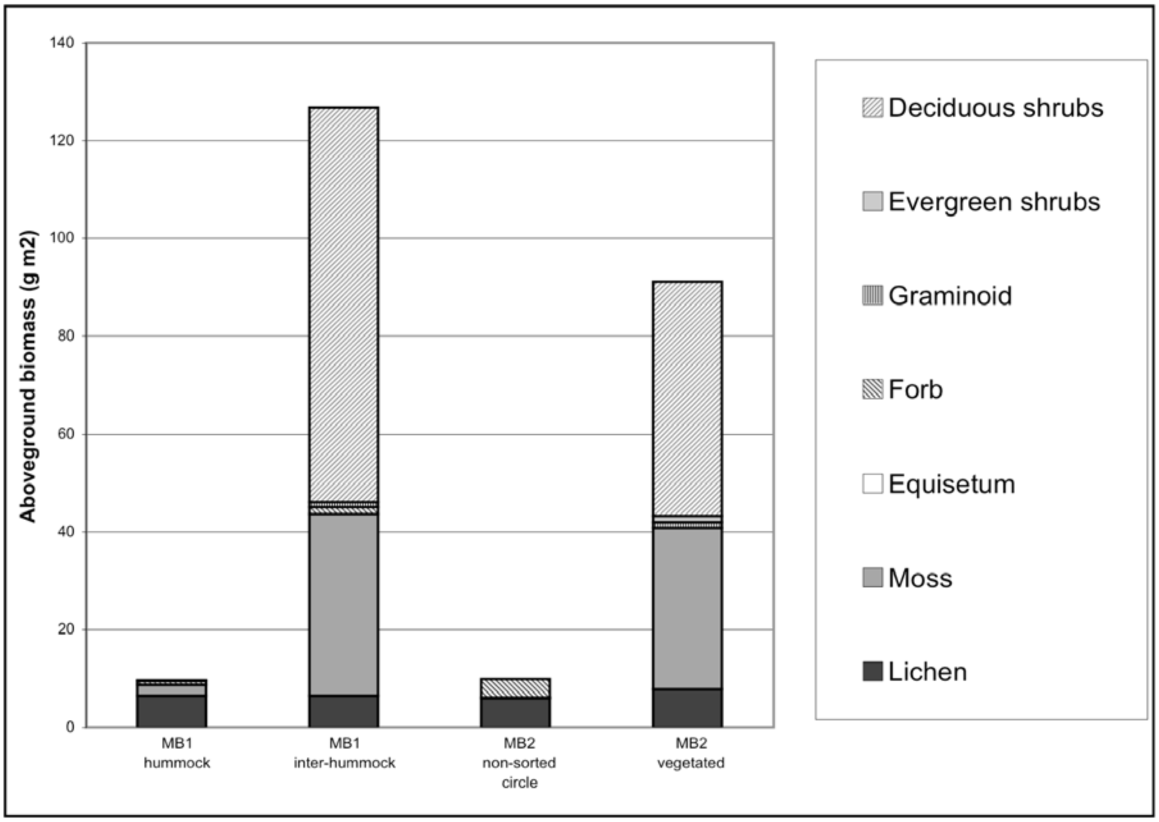


Figure 21. Chart of aboveground biomass by plant functional type at biogeochemistry sites.

Mycorrhizae data

Sampling – roots:

Seventeen plant species were sampled around the mesic grid, 20 around the dry grid, and five species from the wet site (Table 19). In the lab, roots tips of *Dryas integrifolia*, *Salix arctica* and *Polygonum viviparum* were morphotyped (Table 20). *Salix arctica* showed the highest number of ectomycorrhizal morphotypes.

Fruiting bodies:

In total 11 fruiting bodies were collected. They are mainly decomposing asco- and basidiomycetes and one rust on *Salix arctica* (*Melampsora*). Fruiting bodies collected included: *Calvatia arctica, Sclerotinia sulcata, Sclerotinia* spp.*, Omphalia* spp.*, Phaeogalera* spp.*, Coprobia grannulata, Arrhenia lobeta, Galerina* spp.*, Agaricus* spp.*, Omphalina postii*.

Table 19. Species sampled for micorrhizae at Mould Bay.

Species	MB1-mesic	MB2 - dry	MB3 - wet
Draba alpina	+	+	
Draba spp.	+	+	
Parrya arctica	+	+	
Saxifraga oppositifolia	+		
Saxifraga flagellaris	+		
Ranunculus nivalis	+	+	
Cerastium arcticum	+		
Oxyria digyna	+	+	
Saxifraga caespitosa	+	+	
Poa abbreviata	+	+	
Festuca hyperborea	+	+	
Alopercurus alpinus	+	+	
Papaver radicatum	+	+	
Potentilla hyperborea	+	+	
Saxifraga nivalis	+	+	
Luzula nivalis	+	+	
Minuartia rossii		+	
Taraxacum phymatocarpum		+	
Cerastium arcticum		+	
Saxifraga cernua		+	
Stellaria longipes		+	
Dupontia fisherii			+
Arctagrostis latifolia			+
Eriophorum angustifolium triste			+
Petasites spp.			+
Dryas integrifolia	+	+	
Salix arctica	+	+	
Polygonum viviparum			+

Table 20. Number of morphotypes from Mould Bay.

Species	mesic	dry	wet
Salix arctica	8	9	-
Dryas integrifolia	3	7	-
Polygonum viviparum	-	-	4

Microbial biomass and population density measurements

We found differences in soil microbial biomass and bacterial population densities between frost boil and inter-boil areas at both study sites. Based on SIR, the boils tend to have less microbial biomass than the interboil areas. The bacterial population densities as measured by MPN are lower in the boils than the interboils. The boils at the transect site in Green Cabin had a biomass average of 0.49 mg C g^{-1} wt soil and interboils had 0.95 mg C g^{-1} wt soil. At Mould Bay the boils had 0.54 mg C g^{-1} wt soil and the interboils 0.74

mg C g^{-1} wt soil. In terms of bacteria, the population densities at Green Cabin varied from 1.2 x 10^{6} cell g^{-1} wt soil in the boils to 2.8 x 10^{-6} cell g^{-1} wt soil in the interboils. At Mould Bay the bacteria ranged from 2.1 x 10^{-6} cells g^{-1} wt soil in the boils to 5.5 x 10^{-6} cells g^{-1} wt soil in the interboils.

From the catena studies at each site, the data show that bacterial biomass and total biomass vary between frost boils located at mesic, dry and wet areas. The Green Cabin SIR and MPN measurements, and the Mould Bay MPN data showed that microbial biomass and density in the interboil areas tended to decrease with moisture. The Mould Bay SIR data were slightly higher for the interboil mesic site than the dry, followed by the wet site. The data showed the opposite pattern in the frost boils: the wet areas had more microbial biomass than mesic followed by dry.

We just finished the data recording and are now doing a statistical analysis to determine the significance of our findings. The next step of these studies is to characterize the fungal isolates. We have 58 isolates from Green Cabin so far and we haven't started with Mould Bay soils. We will do DNA analysis on some of these fungi for a better description and classification. The soils from the catena studies at each site are kept frozen at – 20^{0}C for DNA analysis using TRFLP (Terminal Restriction Fragment Length Polymorphism) technique and EL-FAME analysis.

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