ARCSS-ATLAS-AGC

Field Data Report of ATLAS Grids and Transects, 1998-1999

BARROW • ATQASUK • OUMALIK • IVOTUK

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INTRODUCTION

This data report is a compilation of data from two projects conducted on the North Slope of Alaska during the summers of 1998 and 1999. The first project involves environmental, climate, soil, vegetation, and remote-sensing data collected from 8 ATLAS grids established along a North-South transect from Barrow to Ivotuk, Alaska. All data were collected in the summers of 1998 and 1999, with the exception of the climate and NDVI data, which were later assembled from a variety of sources. The original purposes of the study were (1) to characterize the major zonal vegetation types found along the North Slope climate gradient, (2) to quantify differences between acidic and non-acidic tundra along the same gradient, and (3) to investigate relationships between plant biomass, Leaf Area Index (LAI), and Normalized Difference Vegetation Index (NDVI). We anticipate adding additional grids to our analysis to further investigate these results in the summer of 2000 and possibly 2001. This part also includes a brief analysis of interactions between plant functional type composition, LAI, NDVI, and summer temperature. This analysis is limited to moist acidic (MAT) and moist non-acidic (MNT) tundra comparisons using data from six of the eight grids that best represent acidic and non-acidic mesic vegetation. This project complements the data of Catharine Copass (University of Alaska-Fairbanks), who collected biomass, NDVI, and LAI data at the Ivotuk grids in 1998, and Howie Epstein (University of Virginia), who collected biweekly biomass, NDVI, and LAI data at the same grids in 1999.

The second project is an accuracy assessment of a Landsat MSS-derived landcover map of northern Alaska (Muller, Racoviteanu et al. 1999), which involved creating several large transects over northwest Alaska. Included here is a table of LAI measurements from eight random points along these transects, as well as the accompanying relevé and site factor data sheets. No analysis of these data is presented.

METHODS AND DATA COLLECTED

Site locations

Grid sites were selected subjectively to find mesic zonal vegetation and vegetation types important for the ATLAS flux study measurements (Figure 1). The sites were chosen to represent mesic sites for the three bioclimatic subzones of Yurtsev (Yurtsev 1994) that are present in northern Alaska. Barrow is in the southern variant of the Arctic Tundra subzone, Atqasuk is in the Northern Hypoarctic subzone, Oumalik straddles the boundary between the Northern Hypoarctic and Southern Hypoarctic subzones, and Ivotuk is in the Southern Hypoarctic subzone. The intial goal was to select paired sites on mesic acidic and non-acidic parent materials at each location. This, however, was possible only at the Oumalik and Ivotuk locations. Future sampling will be done along an eastern transect to provide replication and sampling of non-acidic situations missing in the 1998-1999 effort.

Most sites were selected and established in 1998, with the exception of the Oumalik grids, which were established in 1999. At each location, between one and four 100 x 100 m grids were delineated, with the exception of Oumalik, where two 50 x 50 m grids were established. Grid sites were located on the largest patch of homogenous, representative vegetation available. See Figures 2-9 for photos and descriptions of the eight grids.

All LAI, biomass, and thaw depth data in this report were collected June 27- July 18, 1999. The LAI and biomass data from the Ivotuk grids were collected by Howie Epstein's group. Other site characterization measurements that are not as sensitive to the weather patterns of any given year were spread out over the two field seasons. These included the physical site description, vegetation relevés, point sampling, soil profiles, and plant community distribution transects.

Grid Description

A variety of site data was collected from each grid, including thaw depth, notes on surficial geology, geomorphology, topographic position, slope, and soils. Brief soil descriptions were made. More detailed soil descriptions were done at all sites by Dr.

Chein-Lu Ping. All sites also have year-round climate stations established by either Dr. Larry Hinzman or Dr. Vladimir Romanovsky. At most grids a variety of plant data was collected at each grid point, including plant species composition (4 point samples at each grid point, 121 points = 484 samples), line transects recording cover of vegetation types, total cover of frost scars, height of the plant canopy, and thickness of the moss carpet. Much of these data is summarized in Table 1.

Relevés

Information on complete plant species composition was obtained from 10x10-m plots within the grids using the Braun-Blanquet approach (see Tables 2 and 3 for sample data sheets). These plots were chosen subjectively, with the purpose of finding good representations of plant community associations. Multiple relevé plots were established within grids with more than one important plant community. Plant species data from the relevés are presented in a sorted table to emphasize differences in the species composition on acidic and nonacidic substrates (Table 4). Additional relevés of Ivotuk's shrub grid (Ivotuk 2) are reported in Table 5.

Biomass Harvest

Clip harvests were collected from ten random 20 x 50-cm plots within each grid for aboveground biomass estimates. The clip harvests were sorted by major plant functional type (moss, lichen, forb, horsetail, deciduous shrub, evergreen shrub, graminoid) in the field. All vascular plants were clipped at the top of the moss surface. Green stem bases below the moss surface were also included in the clip harvest. Mosses were carefully clipped at the base of the green portion. The samples were frozen and returned to the UAF laboratory where they were further sorted into live and dead categories. Both shrub categories were also divided into their foliar, reproductive, and stem components. All biomass from each grid point was dried to constant weight at 50ºC, and the dry weights were then used to estimate total g/m^2 for each grid and functional type within the grid. A summary of the biomass data from six of the eight grids is in Table 7. Biomass data for the other two Ivotuk grids can be obtained from Howie Epstein and Catharine Copass.

Leaf Area Index Estimation

Leaf area index (LAI) was measured using the LI-COR LAI-2000 Plant Canopy Analyzer. LAI gives an indication of canopy cover based on difference in diffuse radiation above and below the canopy. An above-canopy reading (control) was followed by four below-canopy readings (which were taken above the moss layer) at 33 random points within each grid. A 90° FOV shield was used to prevent interference from the observers. At each point, the four below-canopy measurements were taken along the axes of the grid at 1 meter from the grid point. All measurements were taken facing away from the sun, and an umbrella was used to shade the sensor on sunny days. LAI was calculated for each point and a mean LAI was calculated for each of the six grids. The LAI data from Barrow, Atqasuk, and Oumalik are reported in Table 8.

NDVI Estimation

Normalized difference vegetation index (NDVI) is calculated by comparing the amount of red wavelengths (the wavelength that is absorbed by chloroplasts; near 0.6μm) that are reflected off the vegetation to the amount of near-infrared wavelengths (not absorbed; 0.7-0.9μm) that are reflected (Shippert, Walker et al. 1995) and is generally used as a measure of greenness.

The NDVI values in this report were taken from single AVHRR pixels that correspond to each of the grid locations (Jia, Epstein et al. 2000). Because each AVHRR pixel represents 1.1 km^2, it was not possible to calculate separate NDVI values for the MNT and MAT grids at Oumalik and Ivotuk. At these sites the NDVI values represent a mix of MAT and MNT.

Total Summer Warmth

Total Summer Warmth (TSW) is the sum of all monthly mean temperatures greater than 0°C, and is used here as a means of comparing growing season climate between the sites. Sources of monthly mean temperatures for grid locations are stated in Table 1.

LAI and Relevés from the Accuracy Assessment Transects

An accuracy assessment of the Arctic Slope Land Cover Map (Muller, Racoviteanu et al. 1999) Muller and Walker 2000) was undertaken during the period 11-18 July, 1999. The assessment was conducted with the aid of helicopter support along the transects shown in Figure 10. At eight of the ground stops, measurements of LAI and quick relevés were made to characterize the dominant vegetation.

LAI measurements were made at 10-m intervals along the transects (see Table 9). The number of samples varied from 10 to 100. The number of replications was decreased after it was determined that the smaller number of samples gave a mean and standard deviation similar to the larger number of samples. The LAI values of acidic mesic sites in the Northern Hypoarctic subzone are about half of those in the Southern Hypoarctic subzone (see Figure 11).

DISCUSSION

Trends in Biomass

All vascular plants showed significant exponential increases in total mean biomass with increases in TSW (Figure 12). Conversely, all cryptograms (mosses and lichens) exhibited a linear decline in total mean biomass along the same TSW gradient. Many of the shrub and graminoid species sampled in the transect are living near their northern range limit, and their exponential response to TSW suggests that summer temperatures are a major factor in controlling their distribution and growth. The concurrence of this trend with a decreasing linear response of moss and lichen production suggests that shrub and graminoid abundance have a negative effect on cryptogram growth. This seems likely when considering the canopy that is created by the larger-stature vascular plants, which would severely limit the radiation available to the mosses and lichens underneath.

To better test this negative interaction between vascular plants and cryptograms, a second set of regresssion analyses were performed which grouped all data points together regardless of their climate regime. Functional type percentages (dry weight [functional type category]/dry weight [Total Biomass]) were used (rather than absolute masses) to emphasize any shifts of dominance within the community (Figure 13). There are two

significant, opposing linear trends of relative moss and vascular plant abundance with increases in TSW. Furthermore, there are significant negative relationships between relative moss abundance and relative graminoid, total shrub, and evergreen shrub abundance. Surprisingly, there is no apparent relationship between moss and deciduous shrub abundance, which is an unexpected result. A possible hypothesis is that a deciduous leafing phenology produces a temporally changing canopy structure, such that there is enough radiation in the understory at certain times of year to permit continued growth of mosses. Although graminoids also produce leaves that last only a season, rather than shed their old leaves they often form dense tussocks of "standing dead" leaf, which persist for many years and provide the understory with extensive shading. The tussocks themselves also occupy considerable space and likely interfere with moss establishment.

Leaf Area Index

LAI exhibited a significant exponential increase along the TSW gradient (see Figure 14) similar to vascular plant biomass (Figure 12). This strong correspondence indicates that measuring LAI may be a good surrogate for biomass harvests when an estimate of total vascular plant biomass is desired. This is a positive outcome when considering the relative ease of collecting large amounts of data when using the LICOR LAI-2000 Plant Canopy Analyzer. However, his method does not capture any of the variation in the cryptogram component of the vegetation.

NDVI

Peak season NDVI is strongly correlated to total mean biomass for our four grid locations (see Figure 15). Because the NDVI signal represents a combination of MAT and MNT vegetation at the Oumalik and Ivotuk sites, biomass estimates in Figure 12 for these two locations are the combined mean of the MNT and MAT grids. Atqasuk had the lowest NDVI (0.33) of the four locations followed by Barrow (0.39). Oumalik and Ivotuk had similar NDVI values (0.53 and 0.52 respectively).

The very high correlations between NDVI and total mean biomass are encouraging given the historical difficulties in finding relationships between these

factors. The results suggest that satellite-derived NDVI measurements can be used to detect variations in tundra biomass due to the climatic gradient. This success implies that both careful selection of sites and limiting the analysis to large, homogenous zonal areas is a fruitful approach. However, the small size of the data set requires that additional data be collected before definitive conclusions can be drawn. We are planning to collect supplemental data from an eastern transect along the Haul Road in 2000-2001 (see Figure 1).

Differences between acidic and non-acidic tundra

Total biomass and LAI in the moist nonacidic tundra (MNT) at Oumalik and Ivotuk were substantially lower than their MAT counterparts at the same locations (Oumalik biomass: 530±57 g/m^2 vs. 830±68 g/m^2; Ivotuk biomass: 647±81 g/m^2 vs. 839±81 g/m^2. Oumalik LAI: 0.61±0.09 vs. 1.65±0.2, Ivotuk LAI: 0.71 vs. 2.15). This is consistent with biomass data on acidic and nonacidic sites at Sagwon, Alaska (Walker, Bockheim et al. 2000, in press). Discrepancies in LAI (see Figure 14) are easily explained when examined in terms of relative moss and vascular plant dominance between the two vegetation types (Figure 16).

Interestingly, while total biomass is much lower in MNT vegetation, mean species richness is higher (50±5 taxa vs. 37±5 taxa in 10 x 10 m plots, refer to Table 4 for complete species lists). These numbers are very similar to richness numbers from the Kuparuk River basin (Walker, Bockheim et al. 2000, in press).

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Figure 1. Vegetation Map of Northern Alaska (Muller et.al 1999), with grid locations. Stars represent a tentative replicate transect on non-acidic tundra to be surveyed in 2000.

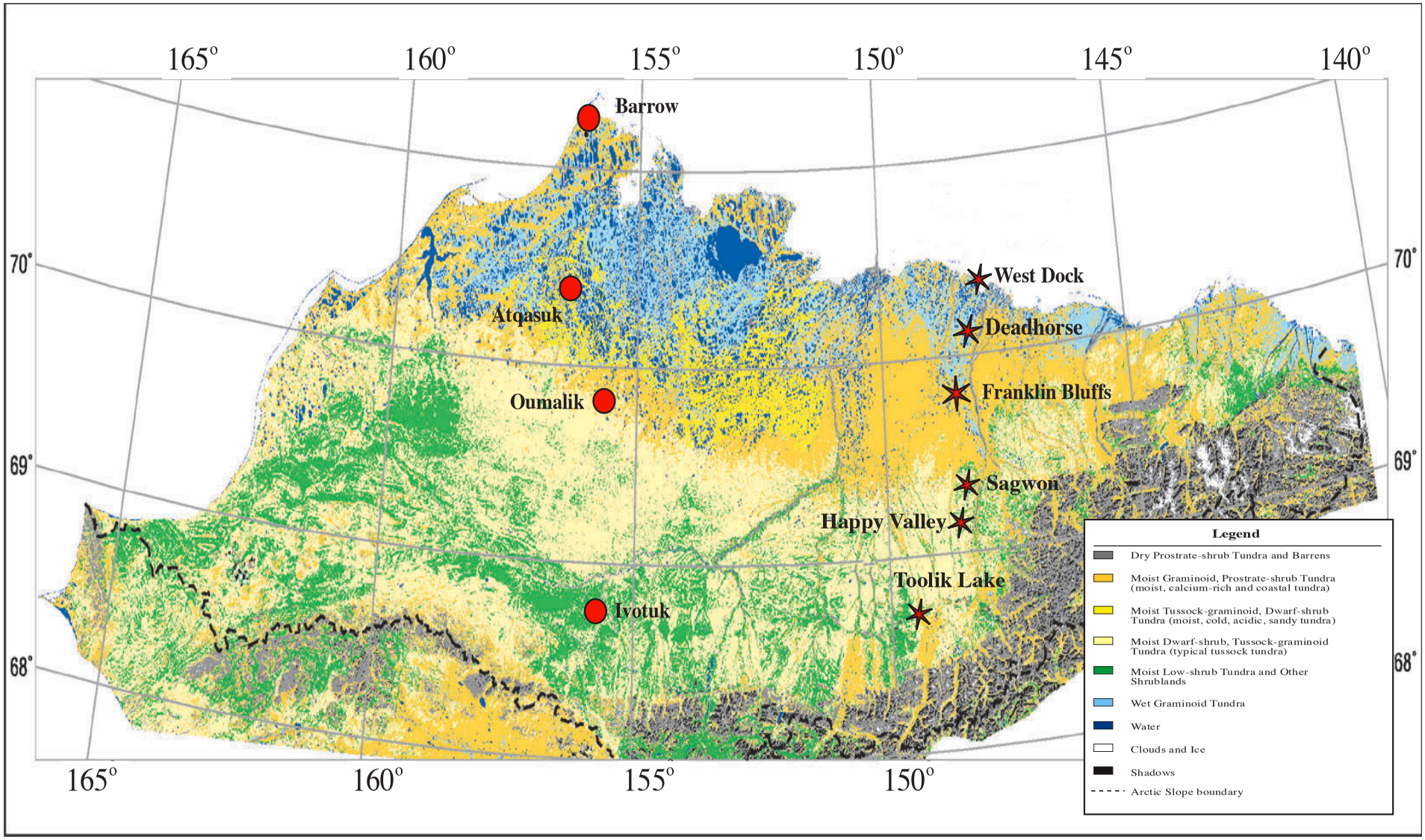


Figure 2. Barrow grid (coastal acidic tundra).
This grid is located east of the CMDL site near Oechel's Barrow flux tower. It is located on a fairly homogenous flat residual surface (unaffected by thaw-lake processes). Most of the surface is either featureless or has flat-centered ice-wedge polygons. The primary plant community is ***Saxifraga cernua–Carex aquatilis*** . This type commonly occurs on moderately drained, zonal sites near the coast. This moist tundra type is dominated by graminoids (*Alopecurus alpinus, Carex aquatilis, Dupontia fisheri, Eriophorum angustifolium, Poa arctica*), forbs (*Cardamine pratensis, Cerastium jenisejense, Chrysosplenium tetrandrum, Petasites frigidus, Saxifraga cernua, S. hirculis, S. hieracifolia, S. nelsoniana, Stellaria laeta*), and mosses (*Oncophorus wahlenbergii, Polytrichastrum alpinum, Polytrichum strictum* and *Sarmentypnum sarmentosum*). Prostrate and semi-erect willows (*Salix rotundifolia, S. planifolia* ssp. *pulchra*) are common in some areas. The unit is approximately equivalent to Type 7 and Noda IV . The phenology of the vegetation was sufficiently advanced at Barrow to sample a relevé or determine the percentage cover of plant species.

Figure 3. Atqasuk grid (sandy acidic tussock tundra). This grid is located on a broad flat stabilized sandy plain near the west end of the Atqasuk runway. The site is typical of residual surfaces unaffected by thaw-lake processes in the sand region of the Arctic Coastal Plain. The site is notable for its total lack of any nonsorted circles (frost scars). This is typical of tussock tundra in the sand region, but very unusual elsewhere on the Arctic Coastal Plain. The lack of cryoturbation promotes a leached soil and species-poor vegetation. The dominant community is tussock tundra with small tussocks (<15 cm high), (**Relevé A-1, *Ledum palustre* ssp. *decumbens–Eriophorum vaginatum***). Only six vascular species were recorded in the relevé of this site (*Eriophorum vaginatum, Ledum palustre* ssp. *decumbens, Vaccinium vitis-idaea, Cassiope tetragona, Pedicularis lapponica, and Carex bigelowii*). The moss canopy is poorly developed (*Aulacomnium turgidum, Dicranum elongatum, Oncophorus wahlenbergii, Polytrichum strictum, Sphagnum compactum*). Lichens are common between the tussocks, but are generally in poor condition. Common lichen species include *Alectoria nigricans, Bryocaulon divergens, Cladonia stygia, Cetraria cucullata, C. laevigata,* and *Ochrolechia frigida*. This community type is equivalent to Unit 8 of Map 2. In slightly moister areas, *Carex bigelowii* is the dominant sedge.

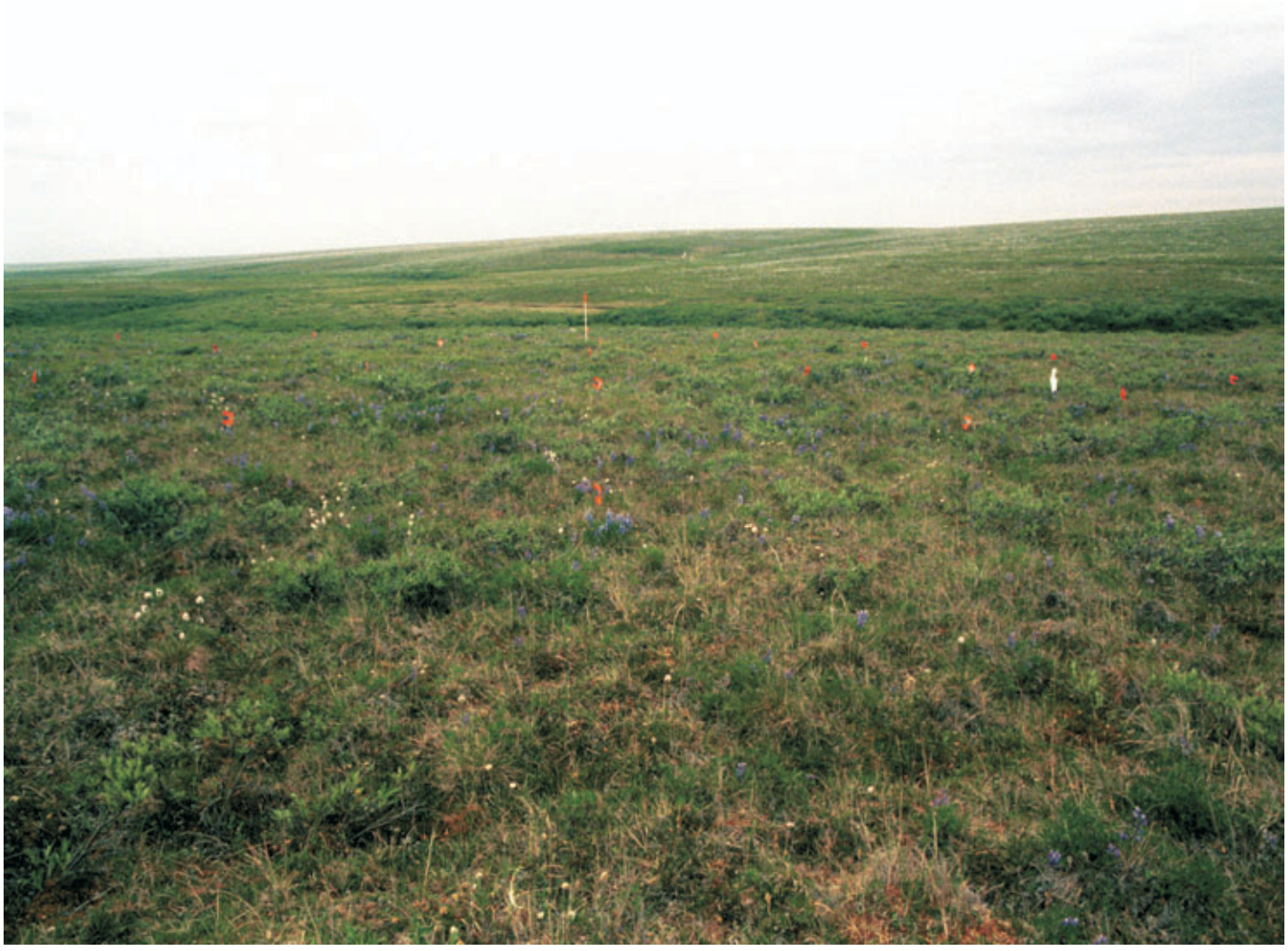


Figure 4. Oumalik-1 grid (moist nonacidic tundra).
This grid is located immediately north of the moist nonacidic-moist acidic tundra vegetation transition boundary at the northern edge of the Arctic Foothills. The site is a nonacidic loess site on a gentle slope (6-8º). Dominant species in the grid are *Dryas integrifolia* and *Carex bigelowii*. The MNT site is somewhat unusual in that the only acidic taxa (e.g. *Ledum decumbens* ssp. *pallustre*, *Vacinium vitus-ideae*) are found on frost scars or in areas with *Dicranum* hummocks. Frost scars affect about 50-60% of the site, but nearly all of these are well vegetated and appear stable. They are detectable by the lack of *Tomentypnum nitens* or a thick moss carpet. Thaw is highly variable. Thaw averages about 36±6-cm on frost scars. In inter-scar areas it averages 21±5-cm. The site is a spectacular display of ***Lupinus arcticus*** at time of sampling. There are abundant low shrubs of *Salix glauca* 25-30cm tall. Similar sites occur all along the Oumalik River on hill slopes and ridge crests, particularly north of this site.

Figure 5. Oumalik-2 grid (moist acidic tundra).
This grid is located immediately south of the moist nonacidic-moist acidic tundra boundary. The dominant species include *Eriophorum vaginatum* and *Betula nana*. The MAT site is about 1/2km south of the Oumalik-1 on an ecotone between MNT and shrubby MAT. The site is a good representative of MAT, but it has occasional MNT species (e.g. *Tomentypnum nitens*, *Dryas integrifolia*, ***Senecio atropurpureus, Saussurea angustifolia***) especially on frost scars. To the south the tundra becomes somewhat shrubbier. To the north the tundra has many more MNT species. Thaw at the acidic site is very shallow, averaging about 14cm in the intertussock areas, about 25cm on the tussocks, and 35cm on frost scars. Frost scars are much less common (7/121) than at the MNT site (36/121).

Figure 6. Ivotuk-1 (MAT) grid (shrubby acidic tussock tundra). This grid is located on a gentle (4˚) east-facing slope (shoulder to midslope) of a very old (mid-Pleistocene?) outwash deposit. The shrubby tussock tundra is typical of many acidic sites on broad slopes in the region and is considered the zonal vegetation for the Ivotuk region. The site has numerous nonsorted circles and a few weakly developed water tracks. The dominant vegetation is a shrubby version of tussock tundra with abundant dwarf and low shrubs (*Betula nana, Salix planifolia* ssp. *pulchra, Ledum palustre* ssp. *decumbens, Rubus chamaemorus, Vaccinium uliginosum, V. vitis-idaea)* (**Relevé I-1A, *Betula nana* ssp. *exilis-Eriophorum vaginatum***). The height of many of the willows and dwarf birch exceeds 40 cm. The moss canopy includes *Aulacomnium turgidum, Dicranum spadiceum, Hylocomium splendens, Pleurozium schreberi, Sphagnum girgensohnii, S. lenense,* and *S. warnstrofii*). The vegetation is broadly equivalent to the acidic *Sphagno–Eriophoretum vaginati* described from Toolik Lake and elsewhere on the Arctic Slope, but it is shrubbier. The nonsorted circles are acidic and have a plant community dominated by the crustose liverwort *Anthelia juratzkana,* and the rushes*Juncus biglumis,* and *Luzula arctica* (**Relevé I-1B, *Anthelia juratzkana–Luzula arctica***).

Figure 7. Ivotuk-2 (Shrub) grid (shrub tundra, water track complex). This grid has several plant communities associated with a small water-track complex on a gentle (4-6˚) east-facing slope. The plant communities span the transition from tussock tundra to shrubby water tracks. There are also small areas of nonacidic tundra with nonsorted circles. The best developed portions of the water tracks are in areas marginal to the actual tracks with flowing water. These have the plant community ***Eriophorum angustifolium–Salix planifolia* ssp. *pulchra***) (**Relevé I-2A**). This community has tall willows exceeding 80 cm tall, and a fairly rich understory consisting of *Eriophorum angustifolium, Pedicularis langsdorfii, Petasites frigidus, Polemonium acutiflorum, Pyrola grandiflora, Rubus chamaemorus, Saxifraga nelsoniana, Stellaria laeta,* and *Valeriana capitata*. The common mosses include *Aulacomnium palustre, Calliergon stramineum, Dicranum angustum, D. elongatum, Hylocomium splendens, Plagiomnium ellipticum, Sanionia uncinata, Sphagnum girgensohnii, S. teres,* and *Tomentypnum nitens*. This community is equivalent to the *Eriophorum angustifolium–Salix pulchra* community described from Toolik Lake . Stable areas marginal to the water tracks have deep moss carpets with a dwarf birch community (**Relevé I-2B, *Rubus chamaemorus–Betula nana***). This community is equivalent to the *Sphagno-Eriophoretum vaginati betuletosum nanae* subass. described from Toolik Lake . The central portion of water tracks with flowing water have a community with relatively few shrubs and are usually dominated by *Eriophorum angustifolium,* (**Relevé I-2C, *Eriophorum angustifolium–Salix planifolia* ssp. *pulchra***).

Figure 8. Ivotuk-3 (MNT) (moist nonacidic tundra complex).
This grid contains a complex of nonacidic tundra types that is associated with a limestone substrate, and it is of special interest because of the importance of calcium-rich tundras to northern ecosystems (Walker, 1998, 1999). The small, flat limestone outcrop is about a 2-m high terrace. It includes dry tundra on the outcrop, a shallow nonacidic snowbed downslope of the outcrop, and an area of gelifluction lobes and flarks (small ponds between the gelifluction lobes) that is associated with wetter soils downslope of the snowbed. Drier portions of the grid that are unaffected by the snowdrift have nonsorted stripes and abundant nonsorted circles. The dominant vegetation is moist nonacidic tundra associated with the gelifluction lobes (**Relevé I-3A, *Dryas integrifolia–Carex bigelowii***). This tundra is equivalent to the *Dryado integrifoliae–Caricetum bigelowii equisetosum arvensis* subassociation described from Toolik Lake . This horsetail-rich variation of nonacidic tundra often occurs downslope of snowbeds on circumneutral mesic uplands and hillslopes in association with fine calcium-rich soils. Common plants include *Arctous rubra, Carex bigelowii, C. membranacea, Dryas integrifolia, Equisetum arvense, E. scripoidea, Eriophorum triste, Kobresia sibirica, Papaver macounii, Parrya nudicaulis, Pedicularis arctoeuropea, Pedicularis capitatum, Polygonum viviparum, Pyrola grandiflora, Salix arctica, S. reticulata*, *Thalictrichum alpinum*. The moss carpet is dominated by *Tomentypnum nitens, Hylocomium splendens, Catescopium nigritum, Meesia uliginosum, Orthothecium chryseum, Aulacomnium acuminatum, A. turgidum, Dicranum spadiceum, D. acutifolium* and numerous liverworts (e.g., *Ptilidium ciliare, Lophozia jurensis, L. ventricosa, Tritomaria quiquedentata*). The flarks have abundant algae *Nostoc commune* and a variety of mosses. The dry nonsorted stripes have a complex of vegetation communities. The most common community is a dry forb-rich nonacidic tundra, (**Relevé I-3B *Novosieversia–Dryas integrifolia***). This community is dominated by *Dryas integrifolia* and rich in other vascular plants (32 recorded species). An unusual aspect of this type compared to nonacidic tundra in the Toolik Lake region is the abundance of *Kobresia myosuroides*. This may be a good analog for Beringian steppe tundra found in the guts of Pleistocene grazers and areas on the Seward that were buried by tephra (Goetcheus and Birks, 1999). The nonsorted circles on the stripes (**Relevé I-3C, *Saxifraga oppositifolia–Pertussaria dactylina***) are relatively barren and are dominated by *Saxifraga oppositifolia, Carex capillaris,* and a wide variety of lichens (e.g., *Pertussaria* spp., *Lecanora epibryon, Flavocetraria* spp., *Thamnolia* spp., *Ochrolechia frigida*).

Figure 9. Ivotuk-4 (Moss) grid (mossy acidic tussock tundra). This grid has homogeneous acidic tussock tundra with abundant *Sphagnum* moss (**Relevé I-4, *Sphagnum lenense–Eriophorum vaginatum***). This unit is similar to Ivotuk 1, but has dwarf shrubs less than 25 cm tall, few nonsorted circles (<1% cover), abundant *Sphagnum* moss in the intertussock spaces, and is species poor (10 vascular plants in Relevé I-4). The unit is common on old uplands sites that lack input of nutrients from upslope. The dominant dwarf shrubs are *Ledum palustre* ssp. *decumbens* and *Rubus chamaemorus* with less amounts of *Betula nana* and *Vaccinium vitis-idaea*. The dominant mosses are *Sphagnum lenense* on the sides of tussocks, *S. balticum* between the tussocks and in depressions, and *Warnstorfia fluitans* in the deepest depressions covering stablized frost scars.

Table 1. Site factors for grids. For tussock height, canopy height, and moss depth, n=121 points.

Site	Coordinates	Vegetation Type	Total Summer Warmth (°C)	Surficial Geology	Surficial Geomorphology	Topographic Position	Slope (deg.)	Aspect (deg.)	Plant communities (% of grid pts)	Soil pH	Soil Units	Thaw Depth (cm ± s.d.)	Site Moisture	Vol. soil moisture (%), top mineral horizon	Microrelief height (cm)	Canopy height (cm)	Moss depth (cm)
Barrow	N71 19 17.6 W156 36 29.3	MAT	9.0 [1] 1949-1999	Undifferentiated marine clay	Featureless or with less than 20% frost scars Flat centered polygons	Flat	0	-	Saxcer-Caraqu: 44.6% [2] Tomnit-Caraqu: 21.5% Luzcon-sphglo: 18.2% Caraqu-Luzarc: 10.8% Eriang-Dupfis: 3.3% other:1.6%	5.8	Pergelic Cryaquept, acid	15.5 ± 6.8 n=120 6/29/99	Mesic	42 n=12	8±4	7 ±2	1.0 ±0.73
Atqasuk	N70 27 52.2 W157 27 02.6	MAT	20.1 [3] 1976	Eolian sand	Featureless	Flat	0	-	Ledpal-Erivag: 78% Ledpal-Carbig: 20% Ledpal-Rubcha: 2%	4.8	Pergelic Cryaquept, acid	12.2 ± 2.6 n=242 6/26/99	Mesic	42 n=1	9 ± 3	10 ± 4	2.5 ± 1.1
Oumalik 1	N69 44.12 W155 52.17	MNT	29.1 [4,5] 1979-1980	Eolian silt	Frost scars	Side slope	6-8	315	Dryint-Carbig: 100%	6.2	Ruptic Pergelic Cryoaquoll	27.8 ± 9.0 n=121 inter frostscar: 21.3 ± 4.8 n=67 frost scar: 35.9 ± 5.8 n=54 7/5/99	Subxeric to mesic	n.d.	12 ±4	11 ±6	0.97 ±0.86
Oumalik 2	N69 43.95 W155 51.78	MAT	29.1 [4,5] 1979-1980	Eolian silt	Featureless or with less than 20% frost scars	Side slope	0	-	Erivag-Betnan: 99% Dryas tussock tundra: 1%	4.9	Pergelic Cryaquept, acid	19.1 ± 8.5 n=121 inter frostscar: 18.2 ± 7.8 n=114 frost scar: 34.4 ± 4.8 n=7 7/6/99	Mesic to subhygric	n.d.	22±5	27 ±10	1.25 ±0.94
Ivotuk 1	N68 28.23 W155 44.52	MAT	29.3 [6] 1999	Glaciofluvial deposits	Frost scars	Mid sideslope	4	80	Betnan-Erivag: 83% Betnan-Carbig: 13% Anthjur-Luzarc: 4%	4.9	Ruptic Pergelic Cryaquept, acid and Histic Pergelic Cryoquept, acid	25.9 ± 9.7 n=242 6/26/99	Mesic to subhygric; Hygric in depressions	46 n=1	24 ± 7	29 ± 8	3.7 ± 2.9
Ivotuk 2	N68 28.75 W155 44.14	MAT	29.3 [6] 1999	Glaciofluvial deposits	Well developed hill slope water tracks	Lower side slope and drainage channels	5	120	Betnan-Erivag: 34% Eriang-Salpla: 29% Rubcha-Betnan: 16% Non-acidic tundra: 8% Other: 13%	n.d	Pergelic Cryaquept, acid and Histic Pergelic Cryoquept, acid	21.1 ±7.7 n=242 6/25/99	Eriang: mesic to subhygric Rubcha: mesic Calstr-Eriang: hygric	40	15 ± 7	42 ±1 7	4.7± 2.5
Ivotuk 3	N68 28.72 W155 44.28	MNT	29.3 [6] 1999	Hill slope colluvium from small limestone outcrop	Gelifluction features and flarks; Sorted and non-sorted stripes, and frost scars	Mid-sideslope	6	145	Dryint-Carbig-Equarv: 49% Dryint-Carbig: 20% Novgla-Dryint: 11% Lecepi-Dryint: 7% Calstr-Noscom: 6% Others: 7%	6.8	Pergelic Cryaquept, nonacid; Pergelic Cryoboroll; and Ruptic Pergelic Cryaquept, nonacid	25.8 ± 11.9 n=242 6/25/99	Dryint-Carbig-Equarv: Mesic to subhygric	34 n=1	17 ± 10	14 ± 7	2.4 ± 1.3
Ivotuk 4	N68 28.82 W155 44.65	MAT	29.3 [6] 1999	Glaciofluvial deposits	Featureless, less than 20% frost scars	Hill crest or shoulder	2	98	Sphlen-Erivag:100%	4.4	Pergelic cryaquept	20.7 ± 5.5 n=242 6/25/99	mesic to subhygric	38 n=1	19 ± 6	21 ± 6	3.7 ± 2.6

[1] Western Regional Climate Center (1999), Alaska Climate Summary. www.wrcc.dri.edu/summary/climsmak.html

[2] the vegetation types of Barrow need to be revisited - there may be distinct vegetation types within Caraqu-Luzarc communities, and the other communities may be redefined

[3] Haugen, 1982

[4] Total summer warmth may be slightly underestimated for Oumalik; no temperature data was available for May and September.

[5] Ebersole, 1980

[6] www.uaf.edu/water/projects/atlas/atlas.html

Table 2. Sample releve data sheet.

Study Site:	***Relevé Data***

Relevé No.: _______________ Date: __________________ Recording personnel: ________________________ Photo #: ___________________________

Vegetation (describe moisture status, dominant species in each layer, dominant growth forms, and physiognomic unit): Plot size (m): _______________

Site Description:

Braun Blanquet Cover Estimate Scale:	**Live cover (%)**		**Non-Living cover (%)**	
r = rare	*Low Shrubs:*	____	Rocks:	____
+ = common, but < 1% cover	*Dwarf Shrubs:*	____	Bare soil:	____
1 = 1 - 5%	*Evergreen shrubs:*	____	Water:	____
2 = 6 - 25%	*Deciduous shrubs:*	____	Frost scars:	____
3 = 25 - 50%	*Forbs:*	____	Total dead:	____
4 = 51 - 75 %	*Graminoids:*	____	Ht. of veg. canopy (cm):	____
5 = 76 - 100%	*Lichens:*	____		
	Bryophytes:	____		

Species Cover Estimates:

Vascular plants		***Bryophytes***		***Lichens***	
Species	*Cover*	*Species*	*Cover*	*Species*	*Cover*

Table 3. Sample site factor description data sheet.

Study Site: ***Site Description***

Relevé No.: _____ Date: _____ Recording personnel: _____ Weather: _____

Study area description: _____

Slope (deg): _____ Thaw depth (cm): A: _____ _____ _____ _____ _____ _____ _____ _____ _____ ___

Aspect: _____ B: _____ _____ _____ _____ _____ _____ _____ _____ _____ ___

Elevation: _____ C: _____ _____ _____ _____ _____ _____ _____ _____ _____ ___

Record numbers for all microsites.

Landforms

1 Hills (including kames and moraines)
2 Talus slope
3 Colluvial basin
4 Glaciofluvial and other fluvial terraces
5 Marine terrace
6 Floodplains
7 Drained lakes and flat lake margins
8 Abandoned point bars and sloughs
9 Estuary
10 Lake or pond
11 Stream
12 Sea bluff
13 Lake bluff
14 Stream bluff
15 Sand dunes
16 Beach
17 Disturbed
18 _____
19 _____
20 _____
21 _____

Surficial Geology (Parent Material)

1 Glacial tills
2 Glaciofluvial deposits
3 Active alluvial sands
4 Active alluvial gravels
5 Stabilized alluvium (sands & gravels)
6 Undifferentiated hill slope colluvium
7 Basin colluvium and organic deposits
8 Drained lake or lacustrine organic deposits
9 Lake or pond organic, sand, or silt
10 Undifferentiated sands
11 Undifferentiated clay
12 Roads and gravel pads
13 _____
14 _____
15 _____
16 _____

Surficial Geomorphology

1 Frost scars
2 Wetland hummocks
3 Turf hummocks
4 Gelifluction features
5 Strangmoor or aligned hummocks
6 High- or flat-centered polygons
7 Mixed high- and low-centered polygons
8 Sorted and non-sorted stripes
9 Palsas
10 Thermokarst pits
11 Featureless or with less 20% frost scars
12 Well-developed hillslope water tracks and small streams > 50 cm deep
13 Poorly developed hillslope water tracks, < 50 cm deep
14 Gently rolling or irregular microrelief
15 Stoney surface
16 Lakes and ponds
17 Disturbed
18 _____
19 _____
20 _____
21 _____

Microsites

1 Frost-scar element
2 Inter-frost scar element
3 Strang or hummock
4 Flark, interstrang, or interhummock area
5 Polygon center
6 Polygon trough
7 Polygon rim
8 Stripe element
9 Inter-stripe element
10 Point bar (raised element)
11 Slough (wet element)
12 _____
13 _____
14 _____
15 _____

Site Moisture (modified from Komárková 1983)

1 Extremely xeric - almost no moisture; no plant growth
2 Very xeric - very little moisture; dry sand dunes
3 Xeric - little moisture; stabilized sand dunes, dry ridge tops
4 Subxeric - noticeable moisture; well-drained slopes, ridges
5 Subxeric to mesic - very noticeable moisture; flat to gently sloping
6 Mesic-moderate moisture; flat or shallow depressions
7 Mesic to subhygric - considerable moisture; depressions
8 Subhygric - very considerable moisture; saturated but with < 5% standing water < 10 cm deep
9 Hygric - much moisture; up to 100% of surface under water 10 to 50 cm deep; lake margins, shallow ponds, streams
10 Hydric - very much moisture; 100% of surface under water 50 to 150 cm deep; lakes, streams

Soil Moisture (from Komárková 1983)

1 Very dry - very little moisture; soil does not stick together
2 Dry - little moisture; soil somewhat sticks together
3 Damp - noticeable moisture; soil sticks together but crumbles
4 Damp to moist - very noticeable moisture; soil clumps
5 Moist - moderate moisture; soil binds but can be broken apart
6 Moist to wet - considerable moisture; soil binds and sticks to fingers
7 Wet - very considerable moisture; water drops can be squeezed out of soil
8 Very wet - much moisture can be squeezed out of soil
9 Saturated - very much moisture; water drips out of soil
10 Very saturated - extreme moisture; soil is more liquid than solid

Glacial Geology

1 Till
2 Outwash
3 Bedrock
4 _____
5 _____
6 _____
7 _____

Topographic Position

1 Hill crest or shoulder
2 Side slope
3 Footslope or toeslope
4 Flat
5 Drainage channel
6 Depression
7 Lake or pond

Other notes:

Soil Units

1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryohemist, euic
4 Pergelic Cryosaprist, euic
5 Lithic Pergelic Cryosaprist
6 Pergelic Cryofibrist, euic
7 Histic Pergelic Cryaquept, acid
8 Histic Pergelic Cryaquept, nonacid
9 Pergelic Cryaquept, acid
10 Pergelic Cryaquept, nonacid
11 Pergelic Cryochrept
12 Pergelic Cryumbrept
13 Ruptic-Lithic Cryumbrept
14 Pergelic Cryaquoll
15 Histic Pergelic Cryaquoll
16 Pergelic Cryoboroll
17 _____
18 _____
19 _____
20 _____

Exposure Scale

1 Protected from winds
2 Moderate exposure to winds
3 Exposed to winds
4 Very exposed to winds

Estimated Snow Duration

1 Snow free all year
2 Snow free most of winter; some snow cover persistsafter storm but is blown free soon afterward
3 Snow free prior to melt out but with snow most of winter
4 Snow free immediately after melt out
5 Snow bank persists 1-2 weeks after melt out
6 Snow bank persists 3-4 weeks after melt out
7 Snow bank persists 4-8 weeks after melt out
8 Snow bank persists 8-12 weeks after melt out
9 Very short snow free period
10 Deep snow all year

Animal and Human Disturbance

0 No sign present
1 Some sign present; no disturbance
2 Minor disturbance or extensive sign
3 Moderate disturbance; small dens or light grazing
4 Major disturbance; multiple dens or noticeable trampling
5 Very major disturbance; very extensive tunneling or large pit

Stability

1 Stable
2 Subject to occasional disturbance
3 Subject to prolonged but slow disturbance such as solifluction
4 Annually disturbed
5 Disturbed more than once annually

Table 4. Barrow, Atqasuk, Oumalik, and Ivotuk releve data comparing Moist Acidic and Moist Non-Acidic tundra, summers 1998-1999.

Braun-Blanquet cover-abundance scores: r=rare, 1 or 2 occurrences; +=several occurrences, but <1% cover; 1=1-q0% cover; 2=10-25% cover; 3=25-50%; 4=50-75%; 5=75-100%.
Colored blocks delineate possible character taxa for MAT/MNT vegetation. Darkest colors represent constant taxa, middle shades represent faithful taxa, and lightest shades represent preferential taxa.
Species were sorted according to Daniels 1982.
Mosses and lichens were identified by Dr. Olga Afonina and Dr. Michael Zhubenko of the Komarov Botanical Institute, St. Petersburg, Russia.

	Moist Acidic Tundra						Moist Non-Acidic Tundra						
PLANT COMMUNITY	ANTJUR-LUZARC	BETNAN-ERIVAG	BETNAN-ERIVAG	SPHLEN-ERIVAG	LEDPAL-ERIVAG	LUZCON-DICELO	DRYINT-CARBIG	ERITRI-RACLAN	NOVGLA-DRYINT	DRYINT-CARBIG	SAXOPP-PERDAC	CARAQU-TOMNIT	
SITE	I-1B	I-1A	O-2	I-4	A-1	B-1B	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	Freq.
MOIST ACIDIC TUNDRA SPECIES	.	.	.	.	.	.	.	.	.	.	.	.	
Ledum palustressp. decumbens	1	3	2	2	2	.	+	+	.	.	.	.	7
Vaccinium vitis-idaea	1	2	2	1	2	.	+	1	.	.	.	.	7
Cladonia stygia	+	+	+	+	2	.	.	.	.	.	.	.	5
Cladonia amaurocraea	+	+	.	+	+	+	.	.	.	.	.	+	6
Betula nana ssp. exilis	+	3	3	1	.	.	.	.	.	.	.	.	4
Cladonia pleurota	+	+	+	.	.	+	.	.	.	.	.	.	4
Petasites frigidus	2	1	+	.	.	r	.	.	.	r	.	.	5
Peltigera scabrosa	+	+	r	.	.	.	.	.	.	.	.	.	3
Rubus chamaemorus	.	2	1	2	.	.	.	.	.	.	.	.	3
Salix planifoliassp. pulchra	.	2	2	.	.	+	.	.	.	.	.	.	3
Sphagnum warnstorfii	.	1	1	+	.	.	.	.	.	.	.	.	3
Nephroma arcticum	.	+	+	r	.	.	.	.	.	.	.	.	3
Scapania paludicola	+	.	.	+	.	.	.	.	.	.	.	.	2
Empetrum hermaphroditum	+	2	.	.	.	.	.	.	.	.	.	.	2
Pedicularis labradorica	.	+	r	.	.	.	.	.	.	.	.	.	2
Sphagnum girgensohnii	.	2	1	.	.	.	.	.	.	.	.	.	2
Dicranum angustum	.	.	1	+	.	.	.	.	.	.	.	.	2
Sphagnum lenense	.	1	.	3	.	.	.	.	.	.	.	.	2
Andromeda polifolia	.	r	.	+	.	.	.	.	.	.	.	.	2
Polytrichum strictum	.	.	+	.	2	.	.	.	.	.	.	.	2
Sphagnum compactum	.	.	.	+	1	.	.	.	.	.	.	.	2
Warnstorfia fluitans	.	.	.	1	+	.	.	.	.	.	.	.	2
Polytrichum jensenii	.	.	.	+	+	.	.	.	.	.	.	.	2
Sphagnum aongstromii	.	.	.	r	+	.	.	.	.	.	.	.	2
Polytrichastrum alpinum	.	.	.	.	+	2	.	.	.	.	.	.	2
Eriophorum vaginatum	+	3	3	4	4	r	+	+	.	r	.	.	9
Cladonia arbuscula	+	+	.	+	+	.	.	.	+	.	.	r	6
Peltigera rufescens	.	.	.	.	+	+	.	.	.	.	.	r	3
Baeomyces rufus	+	.	.	.	.	.	.	.	.	.	.	.	1
Baeomyces sp.	+	.	.	.	.	.	.	.	.	.	.	.	1
Anthellia juratzkana	.	3	.	.	.	.	.	.	.	.	.	.	1

Table 4 (continued).

	Moist Acidic Tundra						Moist Non-Acidic Tundra						
PLANT COMMUNITY	ANTJUR-LUZARC	BETNAN-ERIVAG	BETNAN-ERIVAG	SPHLEN-ERIVAG	LEDPAL-ERIVAG	LUZCON-DICELO	DRYINT-CARBIG	ERITRI-RACLAN	NOVGLA-DRYINT	DRYINT-CARBIG	SAXOPP-PERDAC	CARAQU-TOMNIT	
SITE	I-1B	I-1A	O-2	I-4	A-1	B-1B	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	Freq.
MOIST ACIDIC TUNDRA SPECIES (cont)	.	.	.	.	.	.	.	.	.	.	.	.	
Juncus arcticus	.	1	.	.	.	.	.	.	.	.	.	.	1
Nardia japonica	.	1	.	.	.	.	.	.	.	.	.	.	1
Baeomyces carneus	.	1	.	.	.	.	.	.	.	.	.	.	1
Ptilium crista-castrensis	.	+	.	.	.	.	.	.	.	.	.	.	1
Pleurozium schreberi	.	+	.	.	.	.	.	.	.	.	.	.	1
Spirea stevenii	.	+	.	.	.	.	.	.	.	.	.	.	1
Arctocetraria nigricascens	.	+	.	.	.	.	.	.	.	.	.	.	1
Cladonia cornuta	.	+	.	.	.	.	.	.	.	.	.	.	1
Cladonia crispata	.	+	.	.	.	.	.	.	.	.	.	.	1
Cladonia cyanipes	.	+	.	.	.	.	.	.	.	.	.	.	1
Cladonia grayi	.	+	.	.	.	.	.	.	.	.	.	.	1
Cladonia macilenta	.	+	.	.	.	.	.	.	.	.	.	.	1
Stereocaulon alpinum	.	+	.	.	.	.	.	.	.	.	.	.	1
Dicranella sp.	.	+	.	.	.	.	.	.	.	.	.	.	1
Diplophyllum taxifolium	.	+	.	.	.	.	.	.	.	.	.	.	1
Nardia geoscyphus	.	+	.	.	.	.	.	.	.	.	.	.	1
Pohlia cruda	.	+	.	.	.	.	.	.	.	.	.	.	1
Scapania curta	.	+	.	.	.	.	.	.	.	.	.	.	1
Calliergon stramineum	.	+	.	.	.	.	.	.	.	.	.	.	1
Epilichen scabrosus	.	+	.	.	.	.	.	.	.	.	.	.	1
Pedicularis oederi	.	r	.	.	.	.	.	.	.	.	.	.	1
Aulacomnium palustre var. imbricatum	.	.	+	.	.	.	.	.	.	.	.	.	1
Pyrola secunda	.	.	+	.	.	.	.	.	.	.	.	.	1
Sphagnum balticum	.	.	.	2	.	.	.	.	.	.	.	.	1
Eriophorum angustifolia	.	.	.	r	.	.	.	.	.	.	.	.	1
Eriophorum scheuchzeri	.	.	.	r	.	.	.	.	.	.	.	.	1
Loeskypnum badium	.	.	.	.	+	.	.	.	.	.	.	.	1
Bleparostoma trichophyllaum	.	.	.	.	+	.	.	.	.	.	.	.	1
Cetraria kamczatica	.	.	.	.	+	.	.	.	.	.	.	.	1
Pedicularis lapponica	.	.	.	.	+	.	.	.	.	.	.	.	1
Peltigera malacea	.	.	.	.	r	.	.	.	.	.	.	.	1
Potentilla hyparctica	.	.	.	.	.	1	.	.	.	.	.	.	1
Ranunculus nivalis	.	.	.	.	.	r	.	.	.	.	.	.	1
Peltigera sp.	.	.	.	.	.	+	.	.	.	.	.	.	1
Cladonia squamosa	.	.	.	.	.	+	.	.	.	.	.	.	1
Cladonia coccifera	.	.	.	.	.	+	.	.	.	.	.	.	1

Table 4 (continued).

	Moist Acidic Tundra						Moist Non-Acidic Tundra						
PLANT COMMUNITY	ANTJUR-LUZARC	BETNAN-ERIVAG	BETNAN-ERIVAG	SPHLEN-ERIVAG	LEDPAL-ERIVAG	LUZCON-DICELO	DRYINT-CARBIG	ERITRI-RACLAN	NOVGLA-DRYINT	DRYINT-CARBIG	SAXOPP-PERDAC	CARAQU-TOMNIT	
SITE	I-1B	I-1A	O-2	I-4	A-1	B-1B	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	Freq.
MOIST NONACIDIC TUNDRA SPECIES	.	.	.	.	.	.	.	.	.	.	.	.	
Dryas integrifolia	.	.	.	.	.	.	3	1	4	2	+	.	5
Eriophorum triste	.	.	.	.	.	.	+	2	1	1	1	.	5
Tofieldia pusilla	.	.	.	.	.	.	+	1	+	+	+	.	5
Equisetum arvense	.	.	.	.	.	.	1	1	+	+	+	.	5
Salix reticulata	.	.	.	.	.	.	2	1	1	2	.	.	4
Ptilidium ciliare	.	.	1	.	.	.	1	1	+	2	.	+	6
Bistorta viviparum	.	.	.	.	.	.	+	+	+	+	.	.	4
Pedicularis capitata	.	.	.	.	.	.	+	+	+	+	.	.	4
Senecio atropurpureus	.	.	r	.	.	+	1	+	+	+	.	+	7
Flavocetraria nivalis	.	.	.	.	+	.	r	r	2	.	1	r	6
Racomitrium lanuginosum	1	.	.	.	.	.	+	2	1	.	1	.	5
Stellaria laeta	.	.	.	.	.	1	+	+	r	+	.	+	6
Arctagrostis latifolia ssp. latifolia	.	.	r	.	.	1	+	1	+	+	.	r	7
Sphenolobus minutus	.	.	+	.	.	.	+	+	+	+	.	.	5
Tomentypnum nitens	.	.	+	.	.	.	3	+	+	4	.	4	6
Rhododendron lapponicum	.	.	.	.	.	.	+	+	1	.	+	.	4
Sphaerophorus globosus	.	.	+	.	.	1	r	1	+	.	+	+	7
Rhytidium rugosum	.	.	.	.	.	.	1	2	2	.	.	.	3
Saussurea angustifolia	.	.	.	.	.	.	1	1	.	1	.	.	3
Cardamine digitata	.	.	.	.	.	.	+	+	.	+	.	.	3
Arctous rubra	.	.	.	.	.	.	r	.	1	1	.	.	3
Papaver macounii	.	.	.	.	.	.	r	.	+	+	.	.	3
Lecanora epibryon	.	.	.	.	.	.	.	1	+	.	+	.	3
Carex membranacea	.	.	.	.	.	.	.	.	+	1	+	.	3
Lupinus arcticus	.	.	.	.	.	.	2	+	.	.	.	.	2
Masonhalea richardsonii	.	.	.	.	.	.	+	+	.	.	.	.	2
Silene acaulis	.	.	.	.	.	.	+	+	.	.	.	.	2
Astragalus umbellatus	.	.	.	.	.	.	+	.	+	.	.	.	2
Ditrichum flexicaule	.	.	.	.	.	.	.	.	+	+	.	1	3
Saxifraga foliolosa	.	.	.	.	.	.	.	.	.	+	.	+	2
Limprichtia revolvens	.	.	.	.	.	.	.	.	.	+	.	+	2
Myurella julacea	.	.	.	.	.	.	.	.	+	.	.	+	2
Orthothecium chryseum	.	.	.	.	.	.	.	.	.	1	.	+	2
Equisetum scirpoides	.	.	.	.	.	.	.	.	+	+	.	.	2
Parrya nudicaulis	.	.	.	.	.	.	.	.	+	+	.	.	2
Hypogymnia vittata	.	.	.	.	.	.	.	.	+	.	1	.	2
Carex capillaris	.	.	.	.	.	.	.	.	.	r	+	.	2
Minuartia arctica	.	.	.	.	.	.	.	.	+	.	+	.	2
Asahinea chrysantha	.	.	.	.	.	.	.	.	+	.	+	.	2
Pyrola grandifolia	.	.	+	.	.	.	1	2	.	+	.	.	4
Cladonia pyxidata	.	.	.	.	.	+	r	+	.	.	.	+	4

Table 4 (continued).

	Moist Acidic Tundra						Moist Non-Acidic Tundra						
PLANT COMMUNITY	ANTJUR-LUZARC	BETNAN-ERIVAG	BETNAN-ERIVAG	SPHLEN-ERIVAG	LEDPAL-ERIVAG	LUZCON-DICELO	DRYINT-CARBIG	ERITRI-RACLAN	NOVGLA-DRYINT	DRYINT-CARBIG	SAXOPP-PERDAC	CARAQU-TOMNIT	
SITE	I-1B	I-1A	O-2	I-4	A-1	B-1B	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	Freq.
MOIST NONACIDIC TUNDRA SPECIES (cont)	.	.	.	.	.	.	.	.	.	.	.	.	
Salix glauca	.	.	.	.	.	.	2	.	.	.	.	.	1
Pedicularis langsdorffii	.	.	.	.	.	.	+	.	.	.	.	.	1
Saxifraga hieracifolia	.	.	.	.	.	.	+	.	.	.	.	.	1
Novosieversia glacialis	.	.	.	.	.	.	.	.	2	.	.	.	1
Carex scirpoidea	.	.	.	.	.	.	.	.	1	.	.	.	1
Carex misandra	.	.	.	.	.	.	.	.	+	.	.	.	1
Distichium capillaceum	.	.	.	.	.	.	.	.	+	.	.	.	1
Encalypta alpina	.	.	.	.	.	.	.	.	+	.	.	.	1
Hypnum bambergeri	.	.	.	.	.	.	.	.	+	.	.	.	1
Orthothecium strictum	.	.	.	.	.	.	.	.	+	.	.	.	1
Pertusaria panygra	.	.	.	.	.	.	.	.	+	.	.	.	1
Vulpicida tilesii	.	.	.	.	.	.	.	.	+	.	.	.	1
Campylium polygamum	.	.	.	.	.	.	.	.	r	.	.	.	1
Kobresia myosuroides	.	.	.	.	.	.	.	.	.	1	.	.	1
Salix arctica	.	.	.	.	.	.	.	.	.	1	.	.	1
Aulacominium acuminatum	.	.	.	.	.	.	.	.	.	1	.	.	1
Catoscopium nigritum	.	.	.	.	.	.	.	.	.	1	.	.	1
Nostoc commune	.	.	.	.	.	.	.	.	.	1	.	.	1
Equisetum variegatum	.	.	.	.	.	.	.	.	.	+	.	.	1
Lagotis glauca	.	.	.	.	.	.	.	.	.	+	.	.	1
Pedicularis arctoeuropea	.	.	.	.	.	.	.	.	.	+	.	.	1
Thalictrum alpinum	.	.	.	.	.	.	.	.	.	+	.	.	1
Cinclidium arcticum	.	.	.	.	.	.	.	.	.	+	.	.	1
Dicranum acutifolium	.	.	.	.	.	.	.	.	.	+	.	.	1
Lophozia jurensis	.	.	.	.	.	.	.	.	.	+	.	.	1
Lophozia ventricosa	.	.	.	.	.	.	.	.	.	+	.	.	1
Meesia triquetra	.	.	.	.	.	.	.	.	.	+	.	.	1
Pseudocalliergon turgescens	.	.	.	.	.	.	.	.	.	+	.	.	1
Tritomaria quiquidentata	.	.	.	.	.	.	.	.	.	+	.	.	1
Anemone parviflora	.	.	.	.	.	.	.	.	.	r	.	.	1
Kobresia sibirica	.	.	.	.	.	.	.	.	.	r	.	.	1
Mycobilimbia lobulata	.	.	.	.	.	.	.	.	.	.	2	.	1
Saxifraga oppositifolia	.	.	.	.	.	.	.	.	.	.	1	.	1
Lecidea ramulosa	.	.	.	.	.	.	.	.	.	.	.	1	1
Bryonora castanea	.	.	.	.	.	.	.	.	.	.	.	+	1
Cladonia phyllophora	.	.	.	.	.	.	.	.	.	.	.	+	1
Bryum subneodamense	.	.	.	.	.	.	.	.	.	.	.	+	1
Polytrichastrum fragile	.	.	.	.	.	.	.	.	.	.	.	+	1

Table 4 (continued).

	Moist Acidic Tundra						Moist Non-Acidic Tundra						
PLANT COMMUNITY	ANTJUR-LUZARC	BETNAN-ERIVAG	BETNAN-ERIVAG	SPHLEN-ERIVAG	LEDPAL-ERIVAG	LUZCON-DICELO	DRYINT-CARBIG	ERITRI-RACLAN	NOVGLA-DRYINT	DRYINT-CARBIG	SAXOPP-PERDAC	CARAQU-TOMNIT	
SITE	I-1B	I-1A	O-2	I-4	A-1	B-1B	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	Freq.
MOIST NONACIDIC TUNDRA SPECIES (cont)	.	.	.	.	.	.	.	.	.	.	.	.	
Leptogium gelatinosum	.	.	.	.	.	.	.	.	.	.	.	+	1
Lobaria linita	.	.	.	.	.	.	.	.	.	.	.	+	1
Lopadium coralloideum	.	.	.	.	.	.	.	.	.	.	.	+	1
Nephroma expallidum	.	.	.	.	.	.	.	.	.	.	.	+	1
Pannaria pezizoides	.	.	.	.	.	.	.	.	.	.	.	+	1
Peltigera venosa	.	.	.	.	.	.	.	.	.	.	.	+	1
Psoroma hypnorum	.	.	.	.	.	.	.	.	.	.	.	+	1
Rinodina turfacea	.	.	.	.	.	.	.	.	.	.	.	+	1
Saxifraga serpyllifolia	.	.	.	.	.	.	.	.	.	.	.	+	1
Bryum aeneum	.	.	.	.	.	.	.	.	.	.	.	r	1
Cladonia subsquamosa	.	.	.	.	.	.	.	.	.	.	.	r	1
Alopecurus alpina	.	.	.	.	.	.	.	.	.	.	.	r	1
COMPANION SPECIES	.	.	.	.	.	.	.	.	.	.	.	.	
Dactylina arctica	+	+	+	+	1	1	+	+	+	+	2	1	12
Flavocetraria cucullata	+	+	+	+	1	+	+	+	2	1	+	1	12
Thamnolia vermicularis var. subuliformis	+	+	+	+	1	2	+	+	2	+	2	1	12
Cassiope tetragona	+	+	1	+	1	.	1	1	2	1	.	.	9
Cetraria islandica	+	+	+	.	+	+	+	+	.	+	.	+	9
Aulacomnium turgidum	.	1	2	+	2	1	2	2	.	1	.	2	9
Peltigera aphthosa	+	1	1	.	.	+	+	+	+	.	.	1	8
Hylocomium splendens	+	4	2	.	.	.	2	1	.	2	.	+	7
Carex bigelowii	.	2	.	r	+	.	3	2	+	3	.	.	7
Dicranum elongatum	.	.	3	.	2	3	+	1	1	+	.	.	7
Ochrolechia frigida	.	.	.	.	2	2	+	2	+	.	+	+	7
Vaccinium uliginosum	.	1	.	r	.	.	+	+	1	r	.	.	6
Bistorta bistortoides	.	1	+	.	.	.	+	+	+	+	.	.	6
Dicranum spadiceum	.	1	.	1	.	+	.	.	.	1	.	1	5
Bryocaulon divergens	.	.	.	.	1	1	.	.	+	.	+	1	5
Luzula arctica	.	.	.	.	.	1	r	.	+	.	.	r	4
Saxifraga nelsoniana	.	.	+	.	.	+	+	+	.	.	.	.	4
Cladonia uncialis	.	.	+	.	.	+	.	r	+	.	.	.	4
Alectoria nigricans	.	.	.	.	1	2	.	.	+	.	+	.	4
Sanonia uncinata	.	.	r	.	.	+	.	.	.	.	.	+	3
Cladonia gracilis	.	.	+	.	.	+	.	.	.	.	.	+	3
Cetraria laevigata	.	.	.	.	r	1	.	.	.	.	.	2	3
Alectoria ochroleuca	.	.	.	.	+	.	.	.	+	.	+	.	3
Bryoria nitidula	.	.	.	.	+	.	.	.	+	.	+	.	3
Pertusaria dactylina	+	.	.	.	.	.	.	.	+	.	2	.	3

Table 4 (continued).

	Moist Acidic Tundra						Moist Non-Acidic Tundra						
PLANT COMMUNITY	ANTJUR-LUZARC	BETNAN-ERIVAG	BETNAN-ERIVAG	SPHLEN-ERIVAG	LEDPAL-ERIVAG	LUZCON-DICELO	DRYINT-CARBIG	ERITRI-RACLAN	NOVGLA-DRYINT	DRYINT-CARBIG	SAXOPP-PERDAC	CARAQU-TOMNIT	
SITE	I-1B	I-1A	O-2	I-4	A-1	B-1B	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	Freq.
COMPANION SPECIES (cont)	.	.	.	.	.	.	.	.	.	.	.	.	
Pedicularis lanata	.	.	.	.	.	+	.	.	+	.	+	.	3
Hypnum subimponens	.	.	+	.	.	.	+	+	.	.	.	.	3
Poa arctica	.	.	.	.	.	+	.	.	.	+	.	+	3
Oncophorus wahlenbergii	.	.	.	.	1	.	.	.	.	.	.	2	2
Hypgymnia subobscura	.	.	.	.	.	+	.	.	.	.	1	.	2
Warnstorfia sarmentosa	.	.	.	+	.	.	.	.	.	.	.	+	2
Juncus biglumis	1	.	.	.	.	.	.	.	.	.	.	r	2
Carex aquatilus	.	.	.	.	.	+	.	.	.	.	.	4	2
Cladina rangiferina	.	.	.	.	.	+	.	.	.	.	.	r	2
Cladonia scabriuscula	.	.	.	.	.	+	.	.	.	.	.	+	2
Cladonia subfurcata	.	.	.	.	.	r	.	.	.	.	.	+	2
Luzula confusa	.	.	.	.	.	3	.	.	.	.	.	r	2
Salix rotundifolia	.	.	.	.	.	+	.	.	.	.	.	3	2
Richness	22	55	40	30	34	43	50	45	59	59	27	57	

Table 5. Additional Ivotuk releve data, summer 1998.

Each releve represents a distinct community component of Ivotuk's shrub tundra grid. Braun-Blanquet cover-abundance scores: r=rare, 1 or 2 occurrences; +=several occurrences, but <1% cover;1=1-10% cover; 2=10-25% cover; 3=25-50%; 4=50-75%; 5=75-100%. Mosses and lichens were identified by Dr. Olga Afonina and Dr. Michael Zhubenko of the Komarov Botanical Institute, St. Petersburg, Russia.

PLANT COMMUNITY	RUBCHA-BETNAN	ERIANG-SALPLA	CALSTR-ERIANG
SITE	I-2B	I-2A	I-2C
PLANT SPECIES	.	.	.
Eriophorum angustifolia	1	3	4
Salix planifolia ssp. pulchra	1	4	3
Hylocomium splendens	4	4	+
Petasites frigidus	2	3	+
Poa arctica	+	+	+
Rubus chamaemorus	4	3	.
Betula nana ssp. exilis	4	1	.
Pyrola grandifolia	1	1	.
Peltigera leucophlebia	1	+	.
Polytrichum strictum	+	+	.
Saxifraga nelsoniana	+	+	.
Aulacomnium palustre var. imbricatum	.	2	1
Sphagnum teres	.	2	+
Eriophorum vaginatum	1	.	.
Sphagnum girgensohnii	1	.	.
Carex bigelowii	1	.	.
Aulacomnium turgidum	1	.	.
Peltigera aphthosa	1	.	.
Cladonia pleurota	+	.	.
Cladonia gracilis	+	.	.
Cladonia squamosa	+	.	.
Dicranum angustum	+	.	.
Dicranum elongatum	+	.	.
Dactylina arctica	+	.	.
Flavocetraria cucullata	+	.	.
Sphenolobus minutus	+	.	.
Vaccinium uliginosum	r	.	.
Polemonium acutiflorum	.	1	.
Valeriana capitata	.	1	.
Sanonia uncinata	.	1	.
Stellaria laeta	.	1	.
Plagiomnium ellipticum	.	+	.
Peltigera cf. Horizontalis	.	+	.
Tomentypnum nitens	.	+	.
Pedicularis lanata	.	r	.
Calliergon stramineum	.	.	3
Eriophorum scheuchzeri	.	.	2
Arctagrostis latifolia ssp. latifolia	.	.	1
Anemone richardsonii	.	.	+
Richness	25	21	11

Table 6. Raw biomass data harvested from 20 x 50 cm plots (.1m2) July 1999. Numbers are grams (dry weight)/.1m2)

site	veg type	grid#	moss	lichen	equisetum	forb	decid. shrub stem	live decid. leaf	dead decid. leaf	evergrn shrub stem	live evergrn leaf	dead evergrn leaf	live graminoid	dead graminoid	decid reproduction	evergrn reproduction	TOTAL	litter	total evergrn shrub	total decid shrub	total graminoid	total vascular	total shrub
Barrow	MAT	C-8	13.55	6.26	0	0.37	0	0	0	0	0	0	2.46	10.9	0	0	33.53	1.87	0	0	13.4	13.72	0
Barrow	MAT	K-7	19.67	19.91	0	0.53	3.02	1.57	4.28	0	0	0	0.59	3.35	0.16	0	53.08	2.4	0	9.03	3.94	13.5	9.03
Barrow	MAT	H-1	23.54	12.54	0	0.03	1.05	0.39	0.6	0	0	0	0.36	0.9	0.04	0	39.45	5.26	0	2.08	1.26	3.37	2.08
Barrow	MAT	D-7	23.74	9.15	0	0.32	0	0	0	0	0	0	1.76	6.83	0	0	41.8	0.65	0	0	8.59	8.91	0
Barrow	MAT	B-6	24.47	7.78	0	0.26	0	0	0	0	0	0	0.9	3.39	0	0	36.8	0.71	0	0	4.29	4.55	0
Barrow	MAT	E-8	26.89	13.54	0	0.22	1.5	0.33	0.75	0	0	0	1.55	3.4	0	0	48.18	3.08	0	2.58	4.95	7.75	2.58
Barrow	MAT	G-8	31.36	7.86	0	0.07	1.23	0.59	1.21	0	0	0	0.86	1.3	0.01	0	44.49	3.89	0	3.04	2.16	5.27	3.04
Barrow	MAT	J-5	33.51	13.29	0	0	0.9	0.93	0.64	0	0	0	2.03	2.92	0.06	0	54.28	3.23	0	2.53	4.95	7.48	2.53
Barrow	MAT	I-3	34.75	7.14	0	0	0.9	1.05	1	0	0	0	0.86	2.31	0.04	0	48.05	2.94	0	2.99	3.17	6.16	2.99
Barrow	MAT	F-4	35.01	5.62	0	0.11	0.77	0.82	0.77	0	0	0	2.93	5.76	0	0	51.79	6.96	0	2.36	8.69	11.16	2.36
Atqasuk	MAT	I-4	2.71	8.72	0	0	0	0.02	0	3.59	1.56	0.26	2.12	7.08	0	0.11	26.17	3.53	5.52	0.02	9.2	14.74	5.54
Atqasuk	MAT	J-11	2.94	14.18	0	0	0	0	0	2.81	3.23	0.48	3.09	7.8	0	0.06	34.59	3.29	6.58	0	10.9	17.47	6.58
Atqasuk	MAT	F-7	5.99	14.03	0	0	0	0	0	1.96	1.91	0.07	2.37	5.98	0	0.04	32.35	3	3.98	0	8.35	12.33	3.98
Atqasuk	MAT	D-2	6.06	6.89	0	0	0	0	0	2.23	2.69	0.57	3.38	8.49	0	0.14	30.45	2.29	5.63	0	11.9	17.5	5.63
Atqasuk	MAT	G-5	6.33	17.75	0	0	0	0	0	5.42	3.77	2.94	1.78	8.1	0	0.1	46.19	6.71	12.23	0	9.88	22.11	12.23
Atqasuk	MAT	A-2	8.89	7.02	0	0	0	0	0	2.23	3.1	0.34	3.71	13.7	0	0	38.99	5.42	5.67	0	17.4	23.08	5.67
Atqasuk	MAT	B-5	9.07	5.26	0	0	0	0	0	2.29	2.18	0.1	3.04	7.96	0	0.06	29.96	1.7	4.63	0	11	15.63	4.63
Atqasuk	MAT	E-5	11.44	11.56	0	0	0	0	0	3.22	3.35	0.57	1.31	4.24	0	0.08	35.77	2.99	7.22	0	5.55	12.77	7.22
Atqasuk	MAT	H-2	17.84	7.49	0	0	0	0.01	0	1.86	2.69	0.69	2.6	7.38	0	0.13	40.69	3.51	5.37	0.01	9.98	15.36	5.38
Atqasuk	MAT	C-10	25.05	6.42	0	0	0	0	0	1.55	1.69	0.19	1.58	4.94	0	0.01	41.43	2.51	3.44	0	6.52	9.96	3.44
Oumalik1	MNT	C-9	9.27	2.08	0.08	0.34	0.18	0.83	0.63	6.4	6.74	6.76	1.11	1.97	0	0.6	36.99	3.07	20.5	1.64	3.08	25.64	22.14
Oumalik1	MNT	K-5	13.42	5.4	0	6.34	0	0.07	0.04	2.96	3.83	4.21	0.57	1.53	0	0.22	38.59	3.15	11.22	0.11	2.1	19.77	11.33
Oumalik1	MNT	B-9	22.61	2.52	0.34	2.33	0.06	0.82	0.99	1.26	4.45	4.29	1.16	1.99	0	0.02	42.84	7.97	10.02	1.87	3.15	17.71	11.89
Oumalik1	MNT	H-8	30.93	7.6	0	1.51	14.52	0.69	1.83	3.92	4.54	3.67	0.7	0.95	0	0.29	71.15	5.3	12.42	17.04	1.65	32.62	29.46
Oumalik1	MNT	G-5	32.02	4.69	0.02	0.94	0.14	0.06	0.18	5.29	4.9	4.88	0.38	2.55	0	0.27	56.32	3.73	15.34	0.38	2.93	19.61	15.72
Oumalik1	MNT	D-3	20.6	4.99	0	1.19	12.62	2.84	2.42	6.53	6.5	5.52	1.15	1.97	0.95	0.56	67.84	4.99	19.11	18.83	3.12	42.25	37.94
Oumalik1	MNT	E-6	7.4	1.09	0.3	2.81	2.46	0.88	2.32	0.26	0.38	0.35	2.89	2.32	0	0	23.46	1.52	0.99	5.66	5.21	14.97	6.65
Oumalik1	MNT	F-2	26.32	4.43	0.44	1.89	11.21	4.45	3.71	6.67	9.12	4.68	0.8	1.1	0	0.32	75.14	6.18	20.79	19.37	1.9	44.39	40.16
Oumalik1	MNT	I-11	14.91	6.56	0	1.2	3.00E-03	0.06	0.11	4.88	6.47	5.34	0.88	5.9	0	0.1	46.41	4.21	16.79	0.17	6.78	24.943	16.96
Oumalik1	MNT	J-10	42.02	3.03	0	1.51	6.88	1.63	1.57	3.83	4.7	4.6	0.36	0.69	0.14	0.62	71.58	7.72	13.75	10.22	1.05	26.53	23.97
Oumalik2	MAT	C-5	3.84	1.2	0	0.18	30.61	3.45	3.87	15.06	6.81	1.05	12.66	40.2	0	0.56	119.53	0.62	23.48	37.93	52.9	114.49	61.41
Oumalik2	MAT	J-1	11.99	6.94	0	0.2	41.97	4.04	0.64	6.92	9.46	0.79	3.08	9.58	0	0.4	96.01	3.78	17.57	46.65	12.7	77.08	64.22
Oumalik2	MAT	F-4	14.48	6.91	0	0.3	8.76	2.23	1	4.62	6.28	0.38	4.26	8.29	0	0.17	57.68	4.77	11.45	11.99	12.6	36.29	23.44
Oumalik2	MAT	C-6	20.71	0.93	0	0.09	35.37	8.19	7.4	4.3	2.76	1.15	4.04	30.7	0	0.39	115.99	4.48	8.6	50.96	34.7	94.35	59.56
Oumalik2	MAT	H-6	22.77	2.93	0	0.26	18.08	3.14	1.86	0.87	1.57	0.04	3.81	9.03	0.01	0.12	64.49	4.17	2.6	23.09	12.8	38.79	25.69

Table 6 (cont).

site	veg type	grid#	moss	lichen	equisetum	forb	decid. shrub stem	live decid. leaf	dead decid. leaf	evergrn shrub stem	live evergrn leaf	dead evergrn leaf	live graminoid	dead graminoid	decid reproduction	evergrn reproduction	TOTAL	litter	total evergrn shrub	total decid shrub	total graminoid	total vascular	total shrub
Oumalik2	MAT	A-11	5.79	3.17	0	0	7.46	1.13	0.38	10.2	10.41	0.86	5.79	20.4	0	0.3	65.86	2.03	21.77	8.97	26.2	56.9	30.74
Oumalik2	MAT	B-3	33.28	1.48	0	0.07	22.24	3.62	2.32	1.2	2.2	0.06	1.46	3.77	0	0.06	71.76	4.96	3.52	28.18	5.23	37	31.7
Oumalik2	MAT	E-1	29.54	1.5	0	0	32.61	6.37	1.44	2.92	3.86	0.54	0.18	1.09	0.03	0.09	80.17	4.42	7.41	40.45	1.27	49.13	47.86
Oumalik2	MAT	G-4	21.25	3.52	0	0.04	21.07	3.17	0.96	10.69	11.09	3.84	1.51	11.7	0.02	0.19	89.07	3.61	25.81	25.22	13.2	64.3	51.03
Oumalik2	MAT	I-9	12.55	11.13	0	0.47	7.92	1.97	0.33	4.35	10.3	1.59	5.16	13.3	0	0.3	69.37	5.02	16.54	10.22	18.5	45.69	26.76
Ivotuk1	MAT	I-8	25.23	1.49	0	0	13.6	3.05	1.08	10.35	12.33	2.63	7.7	42.6	0	0	120.01	.	25.31	17.73	50.3	93.29	43.04
Ivotuk1	MAT	D-9	19.89	0	0	0.02	28.18	4.37	0.85	2.72	3.8	0.75	33.33	69.1	0	0	162.96	.	7.27	33.4	102	143.07	40.67
Ivotuk1	MAT	F-2	17.56	5.29	0	0	13.92	5.49	0.9	3.01	7.3	2.15	5.41	7.6	0	0	68.63	.	12.46	20.31	13	45.78	32.77
Ivotuk1	MAT	J-11	15.05	3.43	0	0.75	7.71	2.04	0.36	7.45	15.79	2.54	13.11	60.9	0	0	129.15	.	25.78	10.11	74	110.67	35.89
Ivotuk1	MAT	B-2	0.57	3.15	0	0	1.58	1.28	0.17	5.69	7.98	1.1	3.74	8.59	0	0	33.85	.	14.77	3.03	12.3	30.13	17.8
Ivotuk1	MAT	C-6	14.69	1.46	0	1.7	19.97	2.29	0.47	13.44	7.78	9.07	9.83	27.6	0	0	108.28	.	30.29	22.73	37.4	92.13	53.02
Ivotuk1	MAT	F-1	13.38	0.17	0	0	15.43	6.37	1.15	1.91	3.12	1.53	6	4.03	0	0	53.09	.	6.56	22.95	10	39.54	29.51
Ivotuk1	MAT	A-9	17.36	6.66	0	0.19	13.04	4.18	1.28	18.61	14.89	1.7	8.28	21.1	0	0	107.32	.	35.2	18.5	29.4	83.3	53.7
Ivotuk1	MAT	J-2	1.62	1.59	0	0	10.08	3.15	0.68	8.6	9.8	2.41	12.6	22.9	0	0	73.45	.	20.81	13.91	35.5	70.24	34.72
Ivotuk1	MAT	A-4	0.89	0.52	0	0	8.7	2.25	0	6.55	8.66	1.3	7.73	8.46	0	0	45.06	.	16.51	10.95	16.2	43.65	27.46
Ivotuk1	MAT	I-4	18.31	1.06	0	1.49	3.9	2.52	0.37	6.88	11.36	3.52	2.5	4.65	0	0	56.56	.	21.76	6.79	7.15	37.19	28.55
Ivotuk1	MAT	E-1	11.8	5.75	0	0.07	3.97	3.26	1.27	4	3.36	4.61	4.58	5.04	0	0	47.71	.	11.97	8.5	9.62	30.16	20.47
Ivotuk1	MAT	K-4	19.38	2.41	0	0	0.99	0.91	0.12	6.01	8.52	3	9.43	18.9	0	0	69.62	.	17.53	2.02	28.3	47.83	19.55
Ivotuk1	MAT	J-3	7.7	0.62	0	0.1	6	2.09	0.07	10.89	17.75	0.93	7.71	16.2	0	0	70.08	.	29.57	8.16	23.9	61.76	37.73
Ivotuk1	MAT	B-10	32.14	1.55	0	0.05	20.05	7.09	1.42	8.24	8.55	1.67	6.53	12.9	0	0	100.17	.	18.46	28.56	19.4	66.48	47.02
Ivotuk1	MAT	G-5	0	0.25	0	1.05	3.63	2.59	0.08	11.51	8.39	3.08	16.38	18.2	0	0	65.15	.	22.98	6.3	34.6	64.9	29.28
Ivotuk1	MAT	C-5	6.32	0.86	0	0	9.68	1.77	0.89	13.81	10.39	1.87	16.86	62.1	0	0	124.53	.	26.07	12.34	78.9	117.35	38.41
Ivotuk1	MAT	F-6	12.57	11.54	0	0.38	0.2	0.36	0.07	3.8	5.22	1.66	3.21	2.69	0	0	41.7	.	10.68	0.63	5.9	17.59	11.31
Ivotuk1	MAT	F-10	54.97	0	0	0	1.38	2.76	1.41	4.72	15.57	41.76	4.16	5.74	0	0	132.47	.	62.05	5.55	9.9	77.5	67.6
Ivotuk1	MAT	H-5	0.74	13.31	0	0	13.73	1.27	0.2	10.37	17.19	5.43	2.02	4.13	0	0	68.39	.	32.99	15.2	6.15	54.34	48.19
Ivotuk1	MNT	I-4	74.53	0.63	0.97	1.54	0.37	1.45	0.78	0	8.69	0.99	4.02	5.12	0	0	99.09	.	9.68	2.6	9.14	23.93	12.28
Ivotuk3	MNT	J-6	47.84	1.3	4.66	0.52	1.82	2.21	1.03	1.16	5.04	1.68	6.18	10.1	0	0	83.52	.	7.88	5.06	16.3	34.38	12.94
Ivotuk3	MNT	H-3	78.47	2.44	0.96	1.53	0.82	1.19	1.07	0.33	7.47	1.59	2.62	3.9	0	0	102.39	.	9.39	3.08	6.52	21.48	12.47
Ivotuk3	MNT	F-6	55.37	0.03	2.91	7.49	1.88	1.62	0.82	0	8.26	1.94	0.98	1.03	0	0	82.33	.	10.2	4.32	2.01	26.93	14.52
Ivotuk3	MNT	G-9	38.45	0.2	1.46	0.56	0.7	1.69	0.85	0	6.87	0.34	3.84	4.09	0	0	59.05	.	7.21	3.24	7.93	20.4	10.45
Ivotuk3	MNT	D-10	23.49	0.04	2.13	0.27	0.36	1.78	1.11	0.13	2.62	0.08	4.21	4.08	0	0	40.3	.	2.83	3.25	8.29	16.77	6.08
Ivotuk3	MNT	A-5	3.05	0	0.62	0	0	0	0	0	0	0	10.09	20	0	0	33.72	.	0	0	30.1	30.67	0
Ivotuk3	MNT	D-7	33.81	0	2.12	0.49	0.96	2.11	2.25	0.96	6.52	0.92	4.05	5.09	0	0	59.28	.	8.4	5.32	9.14	25.47	13.72
Ivotuk3	MNT	C-5	22.96	0	1.69	1.3	0.13	0.51	0.33	0	5.31	0.68	2.17	1.2	0	0	36.28	.	5.99	0.97	3.37	13.32	6.96
Ivotuk3	MNT	B-3	36.86	0.04	0	0.98	0.11	0.55	0.52	0.51	8.94	0.95	0.91	0.77	0	0	51.14	.	10.4	1.18	1.68	14.24	11.58

Table 7. LAI measurements from Barrow, Atqasuk, and Oumalik grid points, July 1999. Measurements made with LICOR-2000 Plant Canopy Analyzer.

DATE	GRID	POINT	LAI		DATE	GRID	POINT	LAI		DATE	GRID	POINT	LAI		DATE	GRID	POINT	LAI
17-Jul	BARROW	A2	1.28		15-Jul	ATQASUK	A2	0.77		5-Jul	OUMALIK1	K05	1.92		9-Jul	OUMALIK2	A05	4.39
17-Jul	BARROW	A4	0.05		15-Jul	ATQASUK	A5	0.87		5-Jul	OUMALIK1	K07	1.35		9-Jul	OUMALIK2	A10	1.35
17-Jul	BARROW	A7	1.45		15-Jul	ATQASUK	A8	0.86		5-Jul	OUMALIK1	K08	0.51		9-Jul	OUMALIK2	B08	3.13
17-Jul	BARROW	B6	0.73		15-Jul	ATQASUK	B5	0.91		5-Jul	OUMALIK1	J10	0.19		9-Jul	OUMALIK2	B05	2.75
17-Jul	BARROW	B8	1.42		15-Jul	ATQASUK	B6	1.21		5-Jul	OUMALIK1	J08	1.07		9-Jul	OUMALIK2	B03	2.21
17-Jul	BARROW	B10	1.11		15-Jul	ATQASUK	B9	0.77		5-Jul	OUMALIK1	J02	0.35		9-Jul	OUMALIK2	C05	1.49
17-Jul	BARROW	C1	0.24		15-Jul	ATQASUK	C1	1.32		5-Jul	OUMALIK1	I06	0.59		9-Jul	OUMALIK2	C08	1.09
17-Jul	BARROW	C8	1.4		15-Jul	ATQASUK	C3	1.09		5-Jul	OUMALIK1	I07	0.27		9-Jul	OUMALIK2	C11	0.64
17-Jul	BARROW	C9	0.41		15-Jul	ATQASUK	C10	2.07		5-Jul	OUMALIK1	I11	0.31		9-Jul	OUMALIK2	D06	2.79
17-Jul	BARROW	D7	0.39		15-Jul	ATQASUK	D1	0.74		5-Jul	OUMALIK1	H08	1.28		9-Jul	OUMALIK2	D05	1.8
17-Jul	BARROW	D9	0.43		15-Jul	ATQASUK	D10	1.15		5-Jul	OUMALIK1	H06	0.33		9-Jul	OUMALIK2	E01	1.23
17-Jul	BARROW	D11	0.99		15-Jul	ATQASUK	E5	1.62		5-Jul	OUMALIK1	H03	0.18		9-Jul	OUMALIK2	E05	3.09
17-Jul	BARROW	E1	1		15-Jul	ATQASUK	E7	1.03		5-Jul	OUMALIK1	G02	1.48		9-Jul	OUMALIK2	E06	2.05
17-Jul	BARROW	E4	0.79		15-Jul	ATQASUK	E11	1.36		5-Jul	OUMALIK1	G05	0.71		9-Jul	OUMALIK2	F04	0.72
17-Jul	BARROW	E8	0.63		15-Jul	ATQASUK	D2	1.79		5-Jul	OUMALIK1	G06	0.42		9-Jul	OUMALIK2	D03	1.47
17-Jul	BARROW	F1	0.18		15-Jul	ATQASUK	F2	1.36		5-Jul	OUMALIK1	F04	0.55		9-Jul	OUMALIK2	F02	1.63
17-Jul	BARROW	F3	1.01		15-Jul	ATQASUK	F7	1.62		5-Jul	OUMALIK1	F03	0.42		9-Jul	OUMALIK2	F01	1.33
17-Jul	BARROW	F4	0.88		15-Jul	ATQASUK	F10	0.8		5-Jul	OUMALIK1	F02	0.56		9-Jul	OUMALIK2	G02	0.68
17-Jul	BARROW	G1	0.75		15-Jul	ATQASUK	G4	0.66		5-Jul	OUMALIK1	E02	1.87		9-Jul	OUMALIK2	G04	1.51
17-Jul	BARROW	G7	0.49		15-Jul	ATQASUK	G5	1.21		5-Jul	OUMALIK1	E06	0.08		9-Jul	OUMALIK2	G04	1.41
17-Jul	BARROW	G8	1.28		15-Jul	ATQASUK	G10	1.1		5-Jul	OUMALIK1	E08	0.79		9-Jul	OUMALIK2	H04	2.15
17-Jul	BARROW	H1	0.62		15-Jul	ATQASUK	H2	2.36		5-Jul	OUMALIK1	D09	0.42		9-Jul	OUMALIK2	H05	1.86
17-Jul	BARROW	H2	0.45		15-Jul	ATQASUK	H5	0.21		5-Jul	OUMALIK1	D08	0.36		9-Jul	OUMALIK2	H06	1.14
17-Jul	BARROW	H10	0.46		15-Jul	ATQASUK	H10	0.84		5-Jul	OUMALIK1	D03	0.4		9-Jul	OUMALIK2	I04	1.24
17-Jul	BARROW	I3	0.41		15-Jul	ATQASUK	I4	0.95		5-Jul	OUMALIK1	C02	0.31		9-Jul	OUMALIK2	I06	1.21
17-Jul	BARROW	I7	0.74		15-Jul	ATQASUK	I7	1		5-Jul	OUMALIK1	B01	0.06		9-Jul	OUMALIK2	I09	0.89
17-Jul	BARROW	I10	0.64		15-Jul	ATQASUK	I9	0.78		5-Jul	OUMALIK1	A02	0.22		9-Jul	OUMALIK2	J10	1.09
17-Jul	BARROW	J1	0.3		15-Jul	ATQASUK	J1	1.16		5-Jul	OUMALIK1	A06	0.07		9-Jul	OUMALIK2	J06	0.83
17-Jul	BARROW	J4	0.85		15-Jul	ATQASUK	J8	0.99		5-Jul	OUMALIK1	A10	0.68		9-Jul	OUMALIK2	J01	1.4
17-Jul	BARROW	J5	0.98		15-Jul	ATQASUK	J11	1.04		5-Jul	OUMALIK1	B10	0.62		9-Jul	OUMALIK2	K02	1.63
17-Jul	BARROW	K3	1.18		15-Jul	ATQASUK	K1	0.33		5-Jul	OUMALIK1	B09	0.21		9-Jul	OUMALIK2	K04	1.44
17-Jul	BARROW	K4	0.38		15-Jul	ATQASUK	K3	1.7		5-Jul	OUMALIK1	C09	0.39		9-Jul	OUMALIK2	K05	1.28
17-Jul	BARROW	K7	0.94		15-Jul	ATQASUK	K6	0.77		5-Jul	OUMALIK1	C11	1.12					

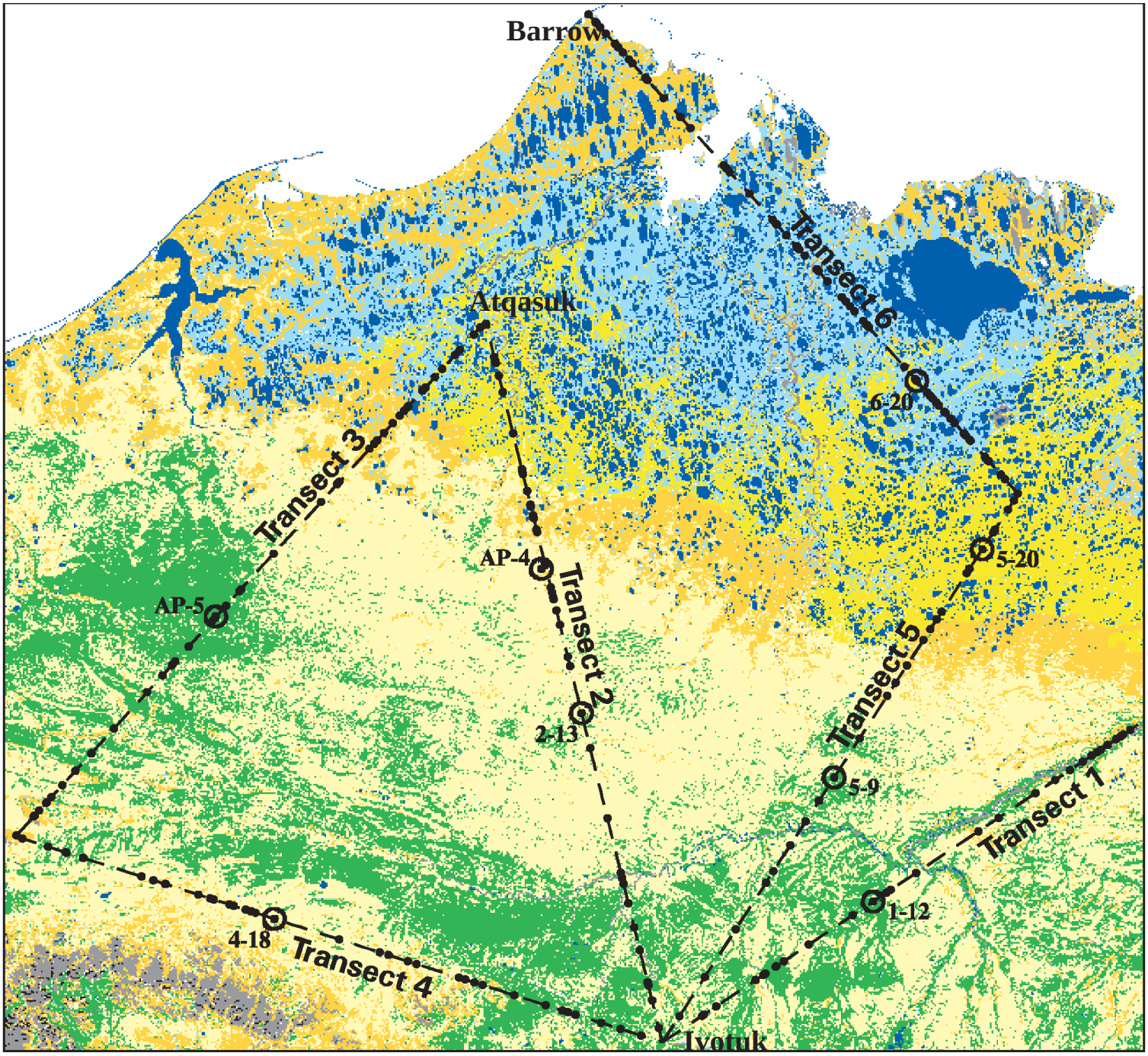
Table 8. LAI measurements for Accuracy Assessment ground stops, 11-18 July 1999.

transect point	LAI	transect poir	LAI	transect point	LAI	transect point	LAI	transect point	LAI
AA2-13	1.71	AA1-12	1.07	AA5-09	2.24	AA 4-18	1.34	AA5-20	0.51
AA2-13	1.88	AA1-12	5.12	AA5-09	2.51	AA 4-18	1.03	AA5-20	1
AA2-13	1.53	AA1-12	3.06	AA5-09	2.17	AA 4-18	0.96	AA5-20	1.21
AA2-13	1.47	AA1-12	1.27	AA5-09	3.17	AA 4-18	5.15	AA5-20	1.02
AA2-13	2.31	AA1-12	1.59	AA5-09	2.66	AA 4-18	0.94	AA5-20	0.67
AA2-13	1.34	AA1-12	1.89	AA5-09	1.21	AA 4-18	2.41	AA5-20	1.54
AA2-13	1.19	AA1-12	5.59	AA5-09	1.76	AA 4-18	3.8	AA5-20	1.5
AA2-13	1.41	AA1-12	1.46	AA5-09	2.53	AA 4-18	0.78	AA5-20	0.4
AA2-13	1.25	AA1-12	1.77	AA5-09	1.13	AA 4-18	4.73	AA5-20	0.62
AA2-13	1.37	AA1-12	0.2	AA 4-18	0.33	AA 4-18	1.09	AA5-20	0.73
AA2-13	1.02	AA1-12	1.94	AA 4-18	0.55	AA 4-18	2.65	AA5-20	0.53
AA1-12	2.36	AA1-12	0.75	AA 4-18	0.88	AA 4-18	1.12	AA6-20	0.51
AA1-12	4.5	AA1-12	3.84	AA 4-18	2.03	AA 4-18	1.12	AA6-20	1.16
AA1-12	4.87	AA1-12	3.21	AA 4-18	1.03	AA 4-18	2.06	AA6-20	0.91
AA1-12	1.82	AA1-12	1.15	AA 4-18	2.95	AA 4-18	3.53	AA6-20	0.54
AA1-12	3.63	AA1-12	4.36	AA 4-18	0.85	AA 4-18	1.28	AA6-20	0.41
AA1-12	2.34	AA1-12	0.75	AA 4-18	2.78	AA 4-18	1.13	AA6-20	1.13
AA1-12	5.69	AA1-12	1.91	AA 4-18	1.66	AA 4-18	1.09	AA6-20	0.36
AA1-12	4.91	AA1-12	0.84	AA 4-18	3.27	AA 4-18	2.4	AA6-20	0.48
AA1-12	1.06	AA1-12	1.07	AA 4-18	2.2	AA 4-18	0.5	AA6-20	0.43
AA1-12	7	AA1-12	2.32	AA 4-18	0.73	AA 4-18	3.7	AA6-20	0.3
AA1-12	5.99	AA1-12	0.42	AA 4-18	3.66	AA 4-18	0.14	AA-AP4	0.92
AA1-12	1.46	AA1-12	0.44	AA 4-18	1.48	AA 4-18	1.43	AA-AP4	0.71
AA1-12	2.22	AA1-12	2.7	AA 4-18	4.44	AA 4-18	0.28	AA-AP4	1.08
AA1-12	1.92	AA1-12	3.27	AA 4-18	1.32	AA 4-18	3.95	AA-AP4	0.86
AA1-12	1.94	AA1-12	0.74	AA 4-18	1.01	AA 4-18	0.47	AA-AP4	1.4
AA1-12	0.73	AA1-12	2.88	AA 4-18	1.82	AA 4-18	0.09	AA-AP4	0.64
AA1-12	3.93	AA1-12	3.2	AA 4-18	2.18	AA 4-18	0.49	AA-AP4	0.2
AA1-12	1.3	AA1-12	3.17	AA 4-18	1.17	AA 4-18	1.55	AA-AP4	1.18
AA1-12	0.93	AA1-12	1.87	AA 4-18	0.89	AA 4-18	1.16	AA-AP4	0.98
AA1-12	2.08	AA1-12	1.75	AA 4-18	1.47	AA 4-18	0.02	AA-AP4	1.8
AA1-12	2.8	AA1-12	1.25	AA 4-18	0.92	AA 4-18	0.21	AA-AP5	1.41
AA1-12	5.45	AA1-12	1.76	AA 4-18	1.03	AA 4-18	1.66	AA-AP5	0.82
AA1-12	1.44	AA1-12	2.96	AA 4-18	0.98	AA 4-18	2.64	AA-AP5	1.64
AA1-12	6.24	AA1-12	2.9	AA 4-18	2.54	AA 4-18	0.09	AA-AP5	1.5
AA1-12	1.52	AA1-12	5.96	AA 4-18	0.87	AA 4-18	0.58	AA-AP5	1.94
AA1-12	7.51	AA1-12	2.29	AA 4-18	2.67	AA 4-18	0.22	AA-AP5	1.9
AA1-12	2.75	AA1-12	1.32	AA 4-18	0.15	AA 4-18	1.09	AA-AP5	1.33

Table 8 (continued).

transect point	LAI	transect poir	LAI	transect point	LAI	transect point	LAI	transect point	LAI
AA1-12	1.89	AA1-12	7.64	AA 4-18	3.69	AA 4-18	0.2	AA-AP5	2.08
AA1-12	1.47	AA1-12	0.66	AA 4-18	5.32	AA 4-18	3.63	AA-AP5	2.34
AA1-12	2.24	AA1-12	3.48	AA 4-18	0.93	AA 4-18	0.83	AA-AP5	1.43
AA1-12	0.91	AA1-12	2.03	AA 4-18	0.37	AA 4-18	0.71		
AA1-12	0.26	AA1-12	3.24	AA 4-18	0.49	AA 4-18	0.97		
AA1-12	3.25	AA1-12	0.95	AA 4-18	0.48	AA 4-18	1.86		
AA1-12	1.3	AA1-12	0.39	AA 4-18	0.2	AA 4-18	0.37		
AA1-12	0.81	AA1-12	4.99	AA 4-18	1.09	AA 4-18	0.24		
AA1-12	3.22	AA1-12	1.02	AA 4-18	0.28	AA 4-18	2.46		
AA1-12	2.34	AA1-12	6.56	AA 4-18	1.38	AA 4-18	3.18		
AA1-12	0.99	AA1-12	0.4	AA 4-18	2.94	AA 4-18	2.12		
AA1-12	1.25	AA1-12	2.01	AA 4-18	0.11	AA 4-18	0.59		
AA1-12	5.22	AA1-12	5.18	AA 4-18	0.61	AA 4-18	0.12		
AA1-12	4.21	AA1-12	2.34	AA 4-18	0.96	AA 4-18	1.38		
AA1-12	1.66	AA1-12	1.46	AA 4-18	0.1	AA 4-18	1.59		
AA1-12	2.76	AA1-12	0.42	AA 4-18	0.58	AA 4-18	1.24		
AA1-12	1.66	AA1-12	3.43	AA 4-18	0.58				
AA1-12	1.1								

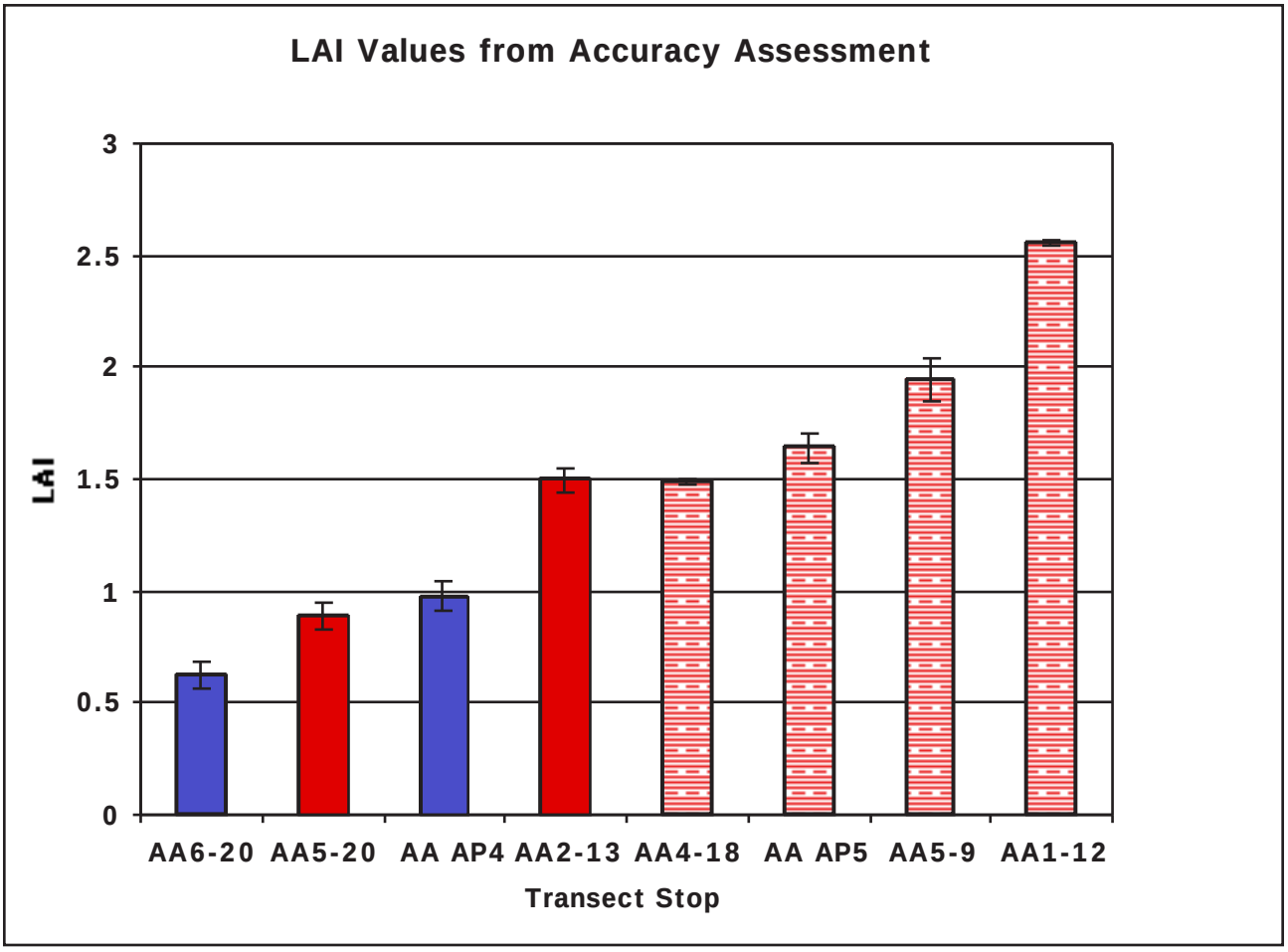
Figure 10. Accuracy Assessment Transects, 1999. Stops are labeled.



Legend

- Dry Prostrate-shrub Tundra and Barrens
- Moist Graminoid, Prostrate-shrub Tundra (moist, calcium-rich and coastal tundra)
- Moist Tussock-graminoid, Dwarf-shrub Tundra (moist, cold, acidic, sandy tundra)
- Moist Dwarf-shrub, Tussock-graminoid Tundra (typical tussock tundra)
- Moist Low-shrub Tundra and Other Shrublands
- Wet Graminoid Tundra
- Water
- Clouds and Ice
- Shadows

Figure 11. Summary of LAI along Accuracy Assessment transects, July 1999.



Moist Acidic Tundra of the Southern Hypoarctic vegetation subzone

Moist Acidic Tundra of the Northern Hypoarctic vegetation subzone

Moist Non-acidic Tundra of the Northern Hypoarctic vegetation subzone

Transect	Microsite
AA1-12	Homogenous shrubby tussock tundra
AA4-18	Gentle side slope and frost scar
AA2-13	Broad hill slope with tussock tundra
AA5-9	Alder savanna on hill slope
AA5-20	Sandy tussock tundra
AA6-20	MNT
AA AP4	MNT on loess hill at coastal boundary
AA AP5	Open low shrubland on broad interfluve

Figure 12. Trends in plant functional type abundance with increasing total summer warmth.

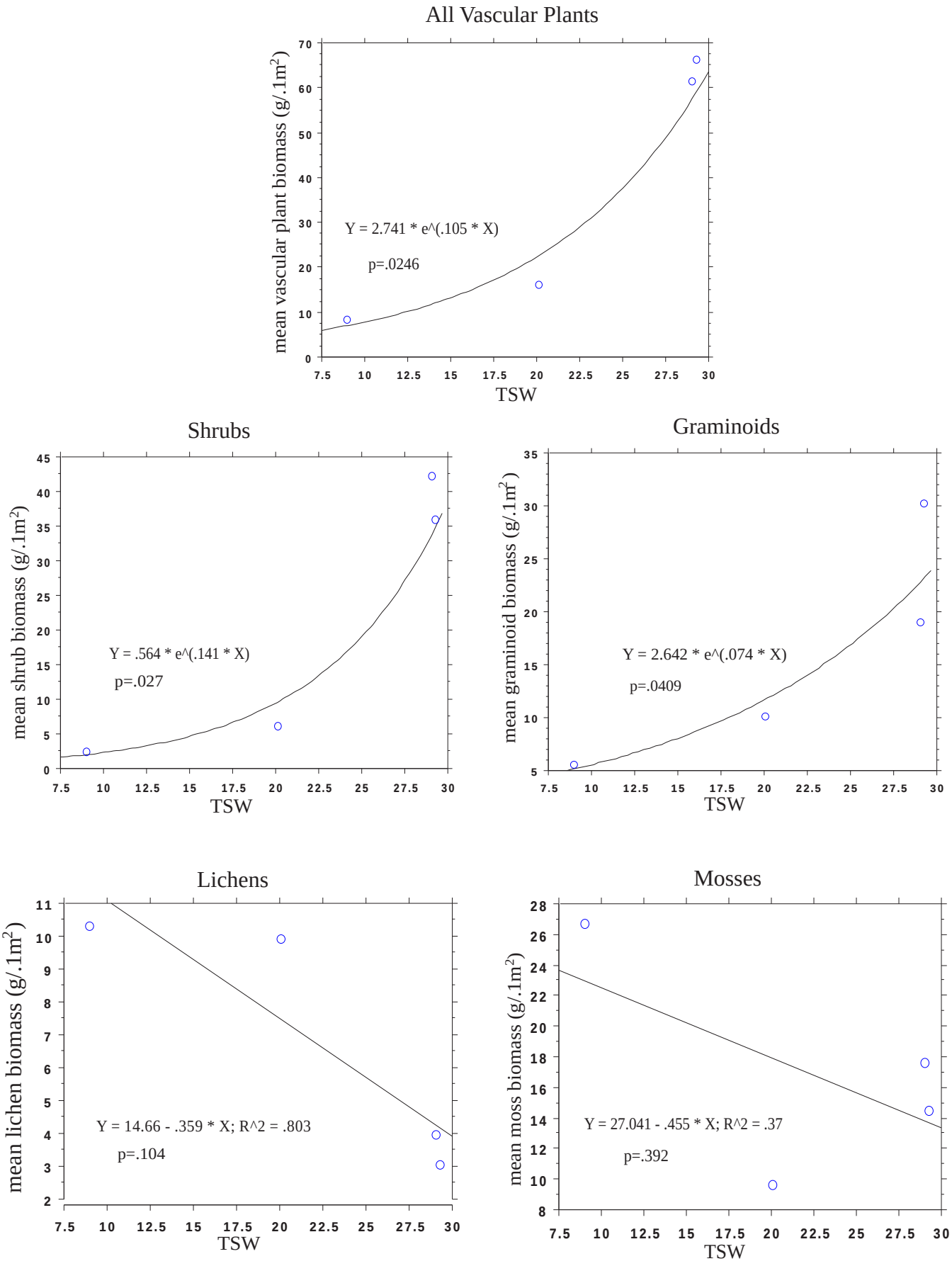
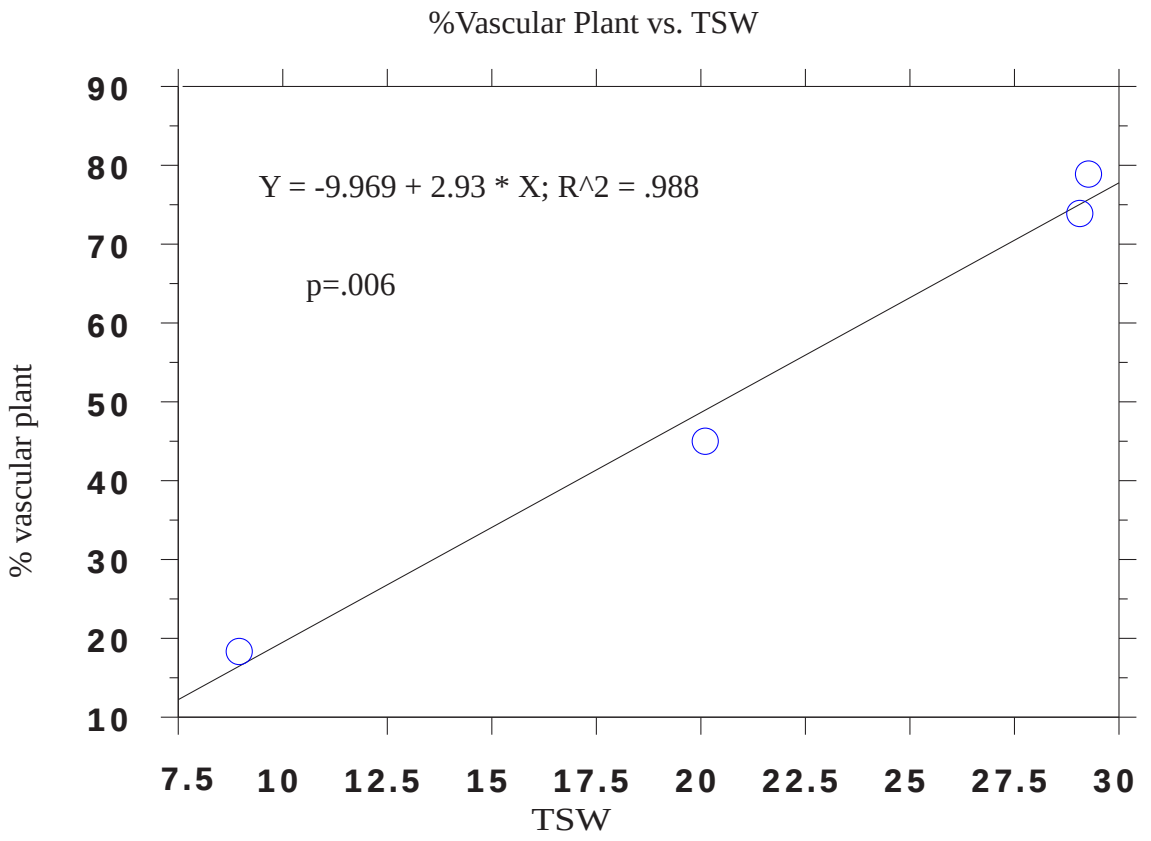


Figure 13. Changes in plant functional type dominance with increasing Total Summer Warmth.



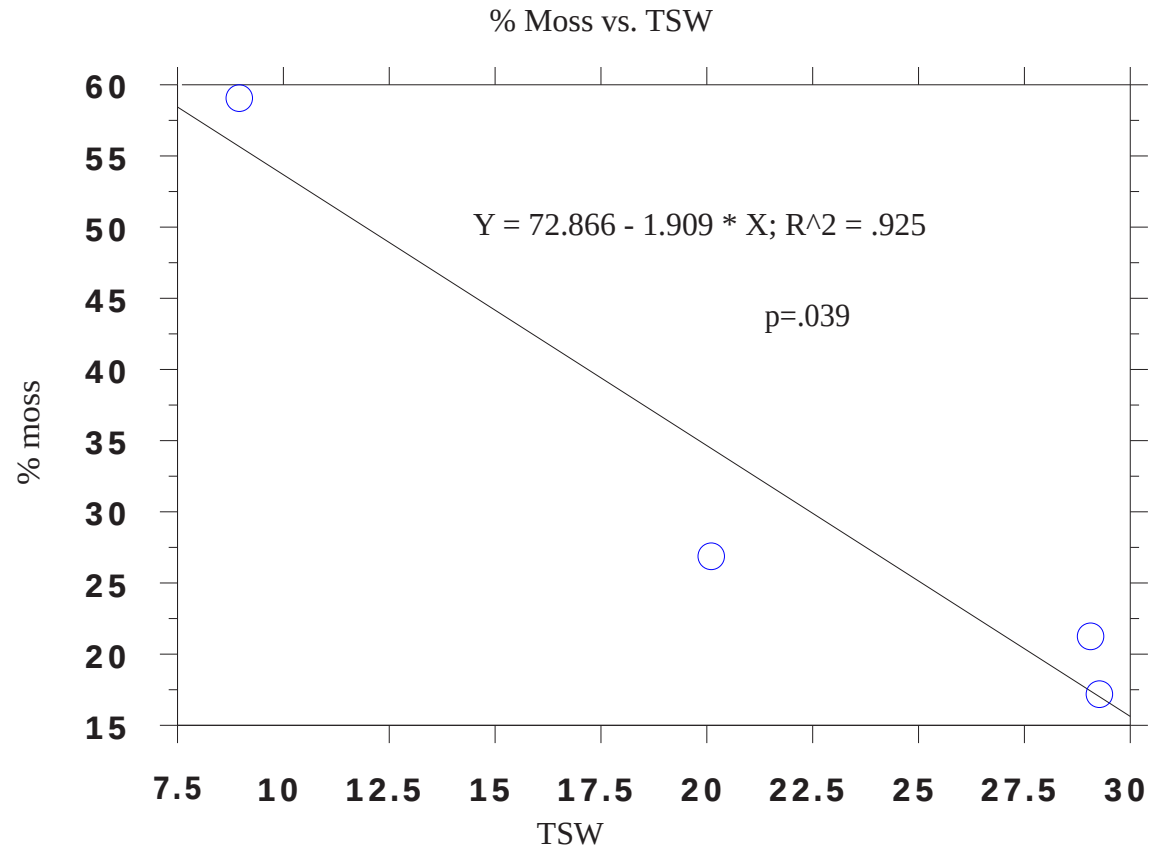
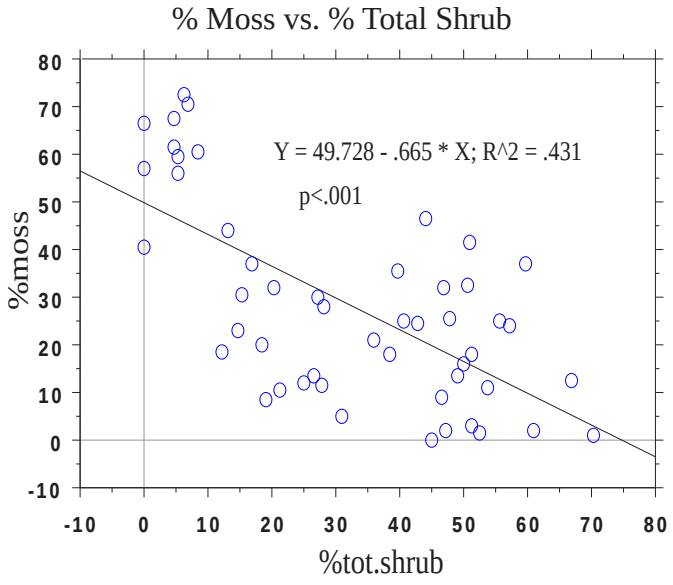
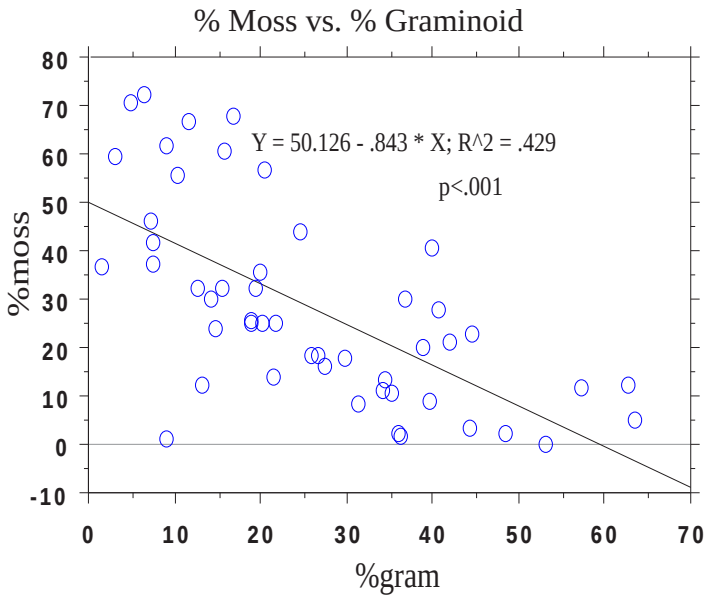
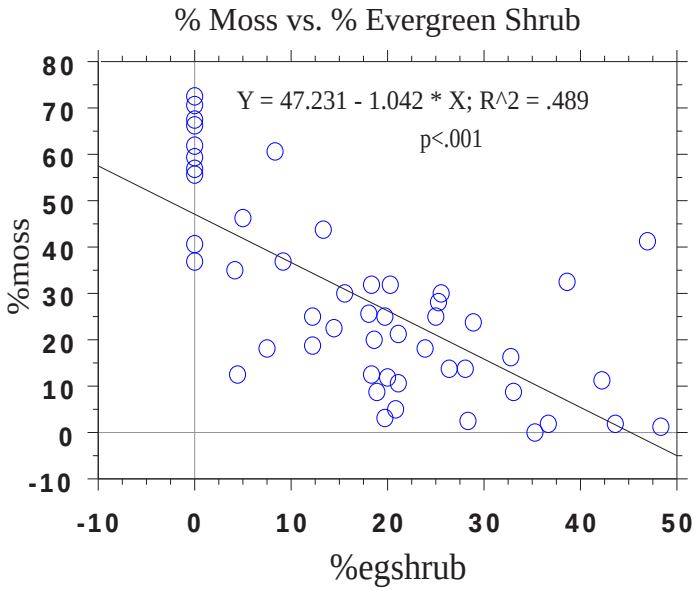


Figure 14. Interactions between moss and vascular plant abundance.







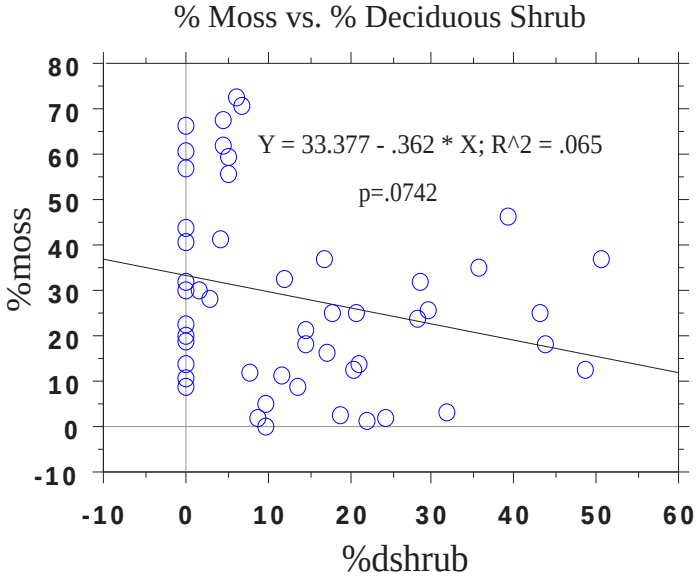


Figure 15. Trends in LAI with increasing TSW.

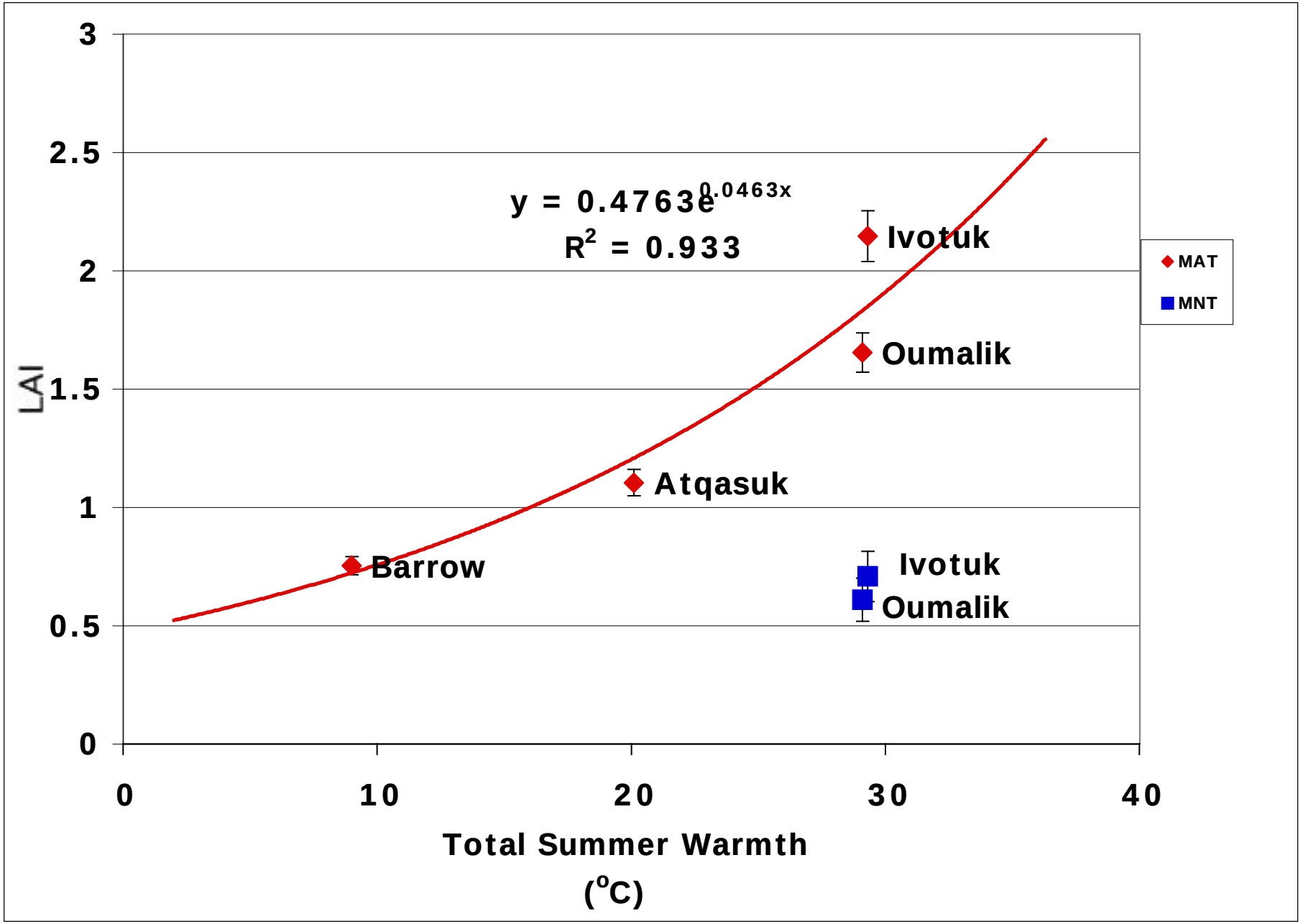


Figure 16. Relationship between NDVI and mean biomass for grid locations.

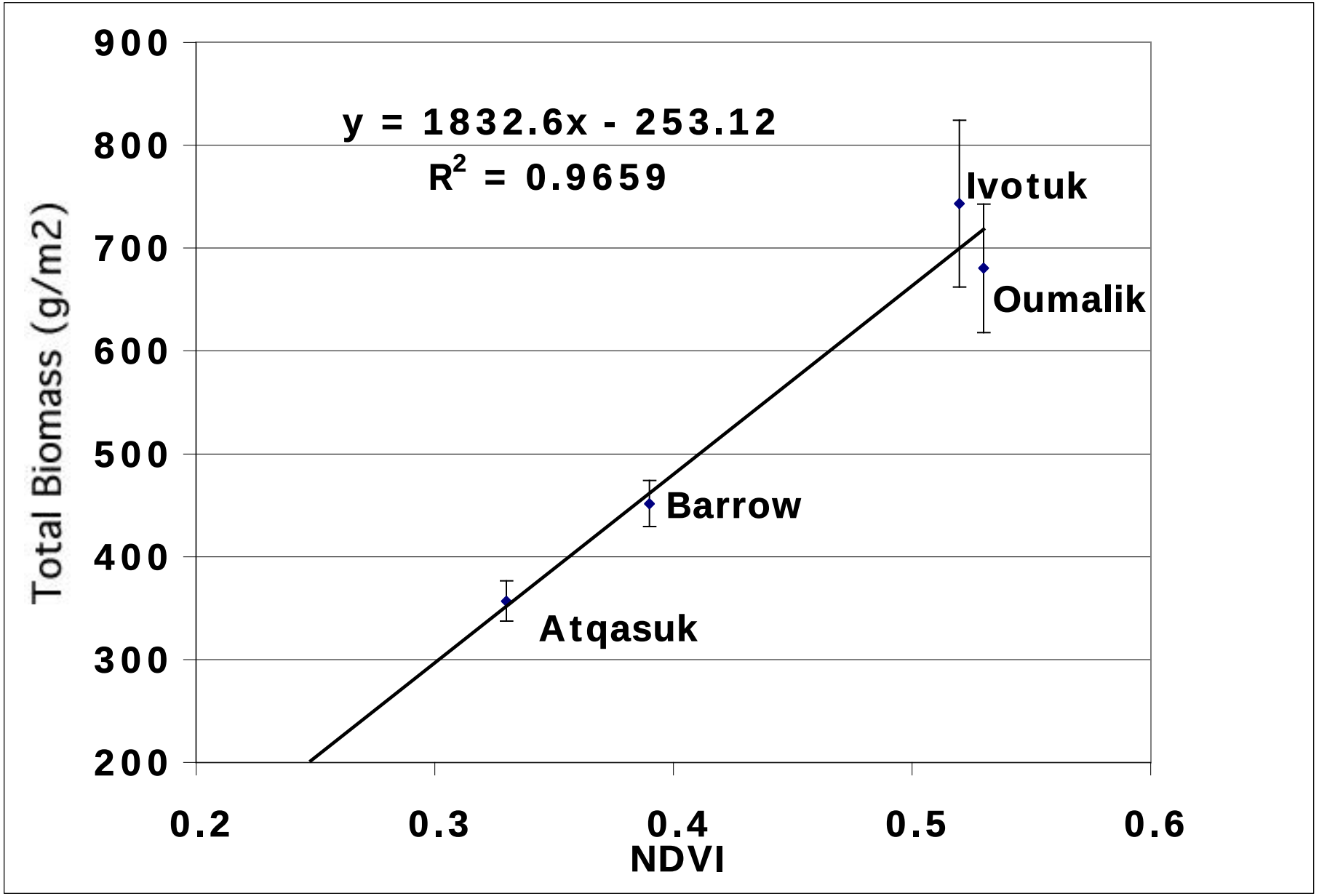
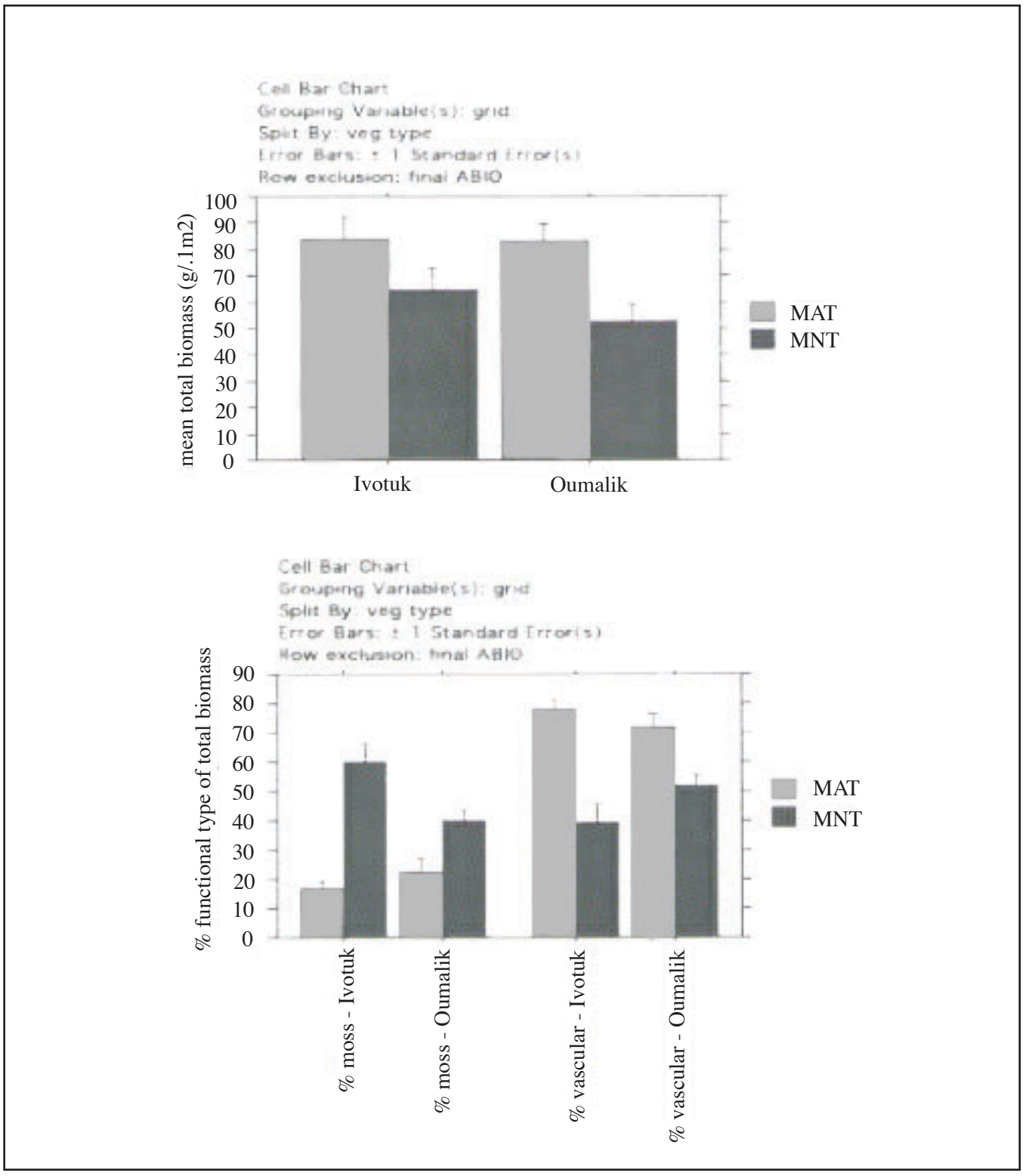


Figure 17. MNT vs. MAT comparisons for Oumalik and Ivotuk locations. MAT sites have greater total biomass and greater vascular plant cover. MNT sites have proportionally more moss cover, which may account for their lower LAI values (see figure 15).



APPENDIX

Releve data sheets from Accuracy Assessment transects.

Study Site: X

1999 Accuracy Assessment Releve Data

Releve No. 1-12 Date: 7/12/99 Observer: Walton

Point ID #: 1-12 Close-Up Photo # 12 99-12-2 Panorama Photo # 99-12-1

Vegetation (describe moisture status, dominant species in each layer, dominant growth forms, and physiognomic unit):

Microsite: A: Homogeneous shrub tussock tundra
B:
C: Moist Betnan Erivag Ledec Sphagnum lowshrub, tuss-gram tund

Site Description A:
B:
C:

Braun-Blanquet Cover Estimate Scale:
r = rare
+ = common, but < 1% cover
1 = 1 - 5%
2 = 6 - 25%
3 = 25 - 50%
4 = 51 - 75%
5 = 76 - 100%

Live Cover (%)	A/B/C	Non-Living Cover (%)	A/B/C
Low Shrubs:	25/_/_	Rocks:	0/_/_
Dwarf Shrubs:	40/_/_	Bare Soil:	0/_/_
Evergreen Shrubs:	35/_/_	Water:	0/_/_
Deciduous Shrubs:	25/_/_	Frost Scars:	0/_/_
Forbs:	5/_/_	Total Dead:	10/_/_
Graminoids:	30/_/_	Ht. Of Veg. Canopy (cm):	40/_/_
Lichens:	+/_/_		
Bryophytes:	25/_/_ tuss ht ~30 cm		Salpu

Species Cover Estimates

Vascular plants Species	Cover	Bryophytes Species	Cover	Lichens Species	Cover
Betnan	3/_/_	Sphagnum	1/_/_	Cladang	+/_/_
Erivag	2/_/_	Aultur	1/_/_	Cetcuc	+/_/_
12-1-2 Vaccul/uli	2/_/_	Hylspl	1/_/_	Pelaph	+/_/_
Vacvit	2/_/_	Dic lineare	1/_/_	Cetisl	+/_/_
Empher	1/_/_	Sphang	+/_/_	Cladran	+/_/_
Leddec	2/_/_		_/_/_	Dacarc	+/_/_
Caslet	+/_/_		_/_/_		_/_/_
Rubchr	1/_/_		_/_/_		_/_/_
Polbis	+/_/_		_/_/_		_/_/_
Salpla	1/_/_		_/_/_		_/_/_
Carbig	2/_/_		_/_/_		_/_/_
Arcla?	1/_/_		_/_/_		_/_/_
Pedlab	+/_/_		_/_/_		_/_/_
Salala	+/_/_		_/_/_		_/_/_
12-1-1 Armlbs ? (ws	_/_/_		_/_/_		_/_/_
~~Sanhof~~	_/_/_		_/_/_		_/_/_
	_/_/_		_/_/_		_/_/_
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	_/_/_		_/_/_		_/_/_
	_/_/_		_/_/_		_/_/_

Study Site: 1-12   1-12

1999 Accuracy Assessment: Site Description

Relevé No.: [illegible]1 Point ID #: [illegible] Date: 7/12/99 Recording personnel: S Walker 3/4 mi W of

Study area description: Shrubby Tuss Tundra on S facing slope Colamanagurek R in EW [illegible] valley

GPS Coordinates: N: 68°53.06 W: 154°11.10[illegible] Slope(deg): ~~15~~ 12° Aspect: SSE Elevation: 700

Record numbers for all microsites.

Landforms

(1) Hills (including kames and moraines)
2 Talus slope
3 Colluvial basin
4 Glaciofluvial and other fluvial terraces
5 Marine terrace
6 Floodplains
7 Drained lakes and flat lake margins
8 Abandoned point bars and sloughs
9 Estuary
10 Lake or pond
11 Stream
12 Sea bluff
13 Lake bluff
14 Stream bluff
15 Sand dunes
16 Beach
17 Disturbed
18 ______
19 ______
20 ______
21 ______

Surficial Geology (Parent Material)

1 Glacial tills
2 Glaciofluvial deposits
3 Active alluvial sands
4 Active alluvial gravels
5 Stabilized alluvium (sands & gravels)
6 Undifferentiated hill slope colluvium
7 Basin colluvium and organic deposits
8 Drained lake or lacustrine organic deposits
9 Lake or pond organic, sand, or silt
10 Undifferentiated sands
11 Undifferentiated clay
12 Roads and gravel pads
(13) Unglaciated
14 ______
15 ______
16 ______

Surficial Geomorphology

1 Frost scars
2 Wetland hummocks
3 Turf hummocks
4 Gelifluction features
5 Strangmoor or aligned hummocks
6 High- or flat-centered polygons
7 Mixed high- and low-centered polygons
8 Sorted and non-sorted stripes
9 Palsas
10 Thermokarst pits
(11) Featureless or with less 20% frost scars
12 Well-developed hillslope water tracks and small streams > 50 cm deep
13 Poorly developed hillslope water tracks, < 50 cm deep
14 Gently rolling or irregular microrelief
15 Stoney surface
16 Lakes and ponds
17 Disturbed
18 ______
19 ______
20 ______
21 ______

Microsites

1 Frost-scar element
2 Inter-frost scar element
3 Strang or hummock
4 Flark, interstrang, or interhummock area
5 Polygon center
6 Polygon trough
7 Polygon rim
8 Stripe element
9 Inter-stripe element
10 Point bar (raised element)
11 Slough (wet element)
(12) Featureless slope
13 ______
14 ______
15 ______

Site Moisture (modified from Komárková 1983)

1 Extremely xeric - almost no moisture; no plant growth
2 Very xeric - very little moisture; dry sand dunes
3 Xeric - little moisture; stabilized sand dunes, dry ridge tops
4 Subxeric - noticeable moisture; well-drained slopes, ridges
5 Subxeric to mesic - very noticeable moisture; flat to gently sloping
(6) Mesic-moderate moisture; flat or shallow depressions
7 Mesic to subhygric - considerable moisture; depressions
8 Subhygric - very considerable moisture; saturated but with < 5% standing water < 10 cm deep
9 Hygric - much moisture; up to 100% of surface under water 10 to 50 cm deep; lake margins, shallow ponds, streams
10 Hydric - very much moisture; 100% of surface under water 50 to 150 cm deep; lakes, streams

Soil Moisture (from Komárková 1983)

1 Very dry - very little moisture; soil does not stick together
2 Dry - little moisture; soil somewhat sticks together
(3) Damp - noticeable moisture; soil sticks together but crumbles
4 Damp to moist - very noticeable moisture; soil clumps
5 Moist - moderate moisture; soil binds but can be broken apart
6 Moist to wet - considerable moisture; soil binds and sticks to fingers
7 Wet - very considerable moisture; water drops can be squeezed out of soil
8 Very wet - much moisture can be squeezed out of soil
9 Saturated - very much moisture; water drips out of soil
10 Very saturated - extreme moisture; soil is more liquid than solid

Glacial Geology

1 Till
2 Outwash
3 Bedrock
4 Unglaciated, Sandstone
5 ______
6 ______
7 ______

Topographic Position

1 Hill crest or shoulder
(2) Side slope
3 Footslope or toeslope
4 Flat
5 Drainage channel
6 Depression
7 Lake or pond

Soil Units

1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryohemist, euic
4 Pergelic Cryosaprist, euic
5 Lithic Pergelic Cryosaprist
6 Pergelic Cryofibrist, euic
7 Histic Pergelic Cryaquept, acid
8 Histic Pergelic Cryaquept, nonacid
(9) Pergelic Cryaquept, acid
10 Pergelic Cryaquept, nonacid
11 Pergelic Cryochrept
12 Pergelic Cryumbrept
13 Ruptic-Lithic Cryumbrept
14 Pergelic Cryaquoll
15 Histic Pergelic Cryaquoll
16 Pergelic Cryoboroll
17 ______
18 ______
19 ______
20 ______

Exposure Scale

1 Protected from winds
2 Moderate exposure to winds (1.5?)
3 Exposed to winds
4 Very exposed to winds

Estimated Snow Duration

1 Snow free all year
2 Snow free most of winter; some snow cover persistafter storm but is blown free soon afterward
3 Snow free prior to melt out but with snow most of winter
3.5
4 Snow free immediately after melt out
5 Snow bank persists 1-2 weeks after melt out
6 Snow bank persists 3-4 weeks after melt out
7 Snow bank persists 4-8 weeks after melt out
8 Snow bank persists 8-12 weeks after melt out
9 Very short snow free period
10 Deep snow all year

Animal and Human Disturbance

0 No sign present
(1) Some sign present; no disturbance
2 Minor disturbance or extensive sign
3 Moderate disturbance; small dens or light grazing
4 Major disturbance; multiple dens or noticeable trampling
5 Very major disturbance; very extensive tunneling or large pit

Stability

(1) Stable Some solifluction ?
2 Subject to occasional disturbance
3 Subject to prolonged but slow disturbance such as solifluction
4 Annually disturbed
5 Disturbed more than once annually

Other notes: Well developed shrubby tussock tundra [illegible] on S facing slopes [illegible]

Study Site: 1999 Accuracy Assessment: Site Description

Relevé No.: 5-20 Point ID #: 5-20 Date: July 14 1999 Recording personnel: S. Walker

Study area description: broad dune crest with tussock tundra in sand region.

GPS Coordinates N: _____ W: _____ Slope(deg): flat Aspect: - Elevation: 150 feet

Record numbers for all microsites.

Landforms
1 Hills (including kames and moraines)
2 Talus slope
3 Colluvial basin
4 Glaciofluvial and other fluvial terraces
5 Marine terrace
6 Floodplains
7 Drained lakes and flat lake margins
8 Abandoned point bars and sloughs
9 Estuary
10 Lake or pond
11 Stream
12 Sea bluff
13 Lake bluff
14 Stream bluff
15 Sand dunes stabilized
16 Beach
17 Disturbed
18 _____
19 _____
20 _____
21 _____

Surficial Geology (Parent Material)
1 Glacial tills
2 Glaciofluvial deposits
3 Active alluvial sands
4 Active alluvial gravels
5 Stabilized alluvium (sands & gravels)
6 Undifferentiated hill slope colluvium
7 Basin colluvium and organic deposits
8 Drained lake or lacustrine organic deposits
9 Lake or pond organic, sand, or silt
10 Undifferentiated sands
11 Undifferentiated clay
12 Roads and gravel pads
13 Eolian dunes
14 _____
15 _____
16 _____

Surficial Geomorphology
1 Frost scars
2 Wetland hummocks
3 Turf hummocks
4 Gelifluction features
5 Strangmoor or aligned hummocks
6 High- or flat-centered polygons
7 Mixed high- and low-centered polygons
8 Sorted and non-sorted stripes
9 Palsas
10 Thermokarst pits
11 Featureless or with less 20% frost scars
12 Well-developed hillslope water tracks and small streams > 50 cm deep
13 Poorly developed hillslope water tracks, < 50 cm deep
14 Gently rolling or irregular microrelief
15 Stoney surface
16 Lakes and ponds
17 Disturbed
18 _____
19 _____
20 _____
21 _____

Microsites
1 Frost-scar element
2 Inter-frost scar element
3 Strang or hummock
4 Flark, interstrang, or interhummock area
5 Polygon center
6 Polygon trough
7 Polygon rim
8 Stripe element
9 Inter-stripe element
10 Point bar (raised element)
11 Slough (wet element)
12 trackedness
13 _____
14 _____
15 _____

Site Moisture (modified from Komárková 1983)
1 Extremely xeric - almost no moisture; no plant growth
2 Very xeric - very little moisture; dry sand dunes
3 Xeric - little moisture; stabilized sand dunes, dry ridge tops
4 Subxeric - noticeable moisture; well-drained slopes, ridges
5 Subxeric to mesic - very noticeable moisture; flat to gently sloping
6 Mesic-moderate moisture; flat or shallow depressions
7 Mesic to subhygric - considerable moisture; depressions
8 Subhygric - very considerable moisture; saturated but with < 5% standing water < 10 cm deep
9 Hygric - much moisture; up to 100% of surface under water 10 to 50 cm deep; lake margins, shallow ponds, streams
10 Hydric - very much moisture; 100% of surface under water 50 to 150 cm deep; lakes, streams

Soil Moisture (from Komárková 1983)
1 Very dry - very little moisture; soil does not stick together
2 Dry - little moisture; soil somewhat sticks together
3 Damp - noticeable moisture; soil sticks together but crumbles
4 Damp to moist - very noticeable moisture; soil clumps
5 Moist - moderate moisture; soil binds but can be broken apart
6 Moist to wet - considerable moisture; soil binds and sticks to fingers
7 Wet - very considerable moisture; water drops can be squeezed out of soil
8 Very wet - much moisture can be squeezed out of soil
9 Saturated - very much moisture; water drips out of soil
10 Very saturated - extreme moisture; soil is more liquid than solid

Glacial Geology Uncertain

1 Till
2 Outwash
3 Bedrock
4 Eolian sand
5 _____
6 _____
7 _____

Topographic Position
1 Hill crest or shoulder
2 Side slope
3 Footslope or toeslope
4 Flat
5 Drainage channel
6 Depression
7 Lake or pond

Other notes: Near crest of dune

Soil Units
1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryohemist, euic
4 Pergelic Cryosaprist, euic
5 Lithic Pergelic Cryosaprist
6 Pergelic Cryofibrist, euic
7 Histic Pergelic Cryaquept, acid
8 Histic Pergelic Cryaquept, nonacid
9 Pergelic Cryaquept, acid sandy
10 Pergelic Cryaquept, nonacid
11 Pergelic Cryochrept
12 Pergelic Cryumbrept
13 Ruptic-Lithic Cryumbrept
14 Pergelic Cryaquoll
15 Histic Pergelic Cryaquoll
16 Pergelic Cryoboroll
17 _____
18 _____
19 _____
20 _____

Exposure Scale
1 Protected from winds
2 Moderate exposure to winds
3 Exposed to winds
4 Very exposed to winds

Estimated Snow Duration
1 Snow free all year
2 Snow free most of winter; some snow cover persistsafter storm but is blown free soon afterward
3 Snow free prior to melt out but with snow most of winter
4 Snow free immediately after melt out
5 Snow bank persists 1-2 weeks after melt out
6 Snow bank persists 3-4 weeks after melt out
7 Snow bank persists 4-8 weeks after melt out
8 Snow bank persists 8-12 weeks after melt out
9 Very short snow free period
10 Deep snow all year

Animal and Human Disturbance
0 No sign present
1 Some sign present; no disturbance
2 Minor disturbance or extensive sign
3 Moderate disturbance; small dens or light grazing
4 Major disturbance; multiple dens or noticeable trampling
5 Very major disturbance; very extensive tunneling or large pit

Stability
1 Stable
2 Subject to occasional disturbance
3 Subject to prolonged but slow disturbance such as solifluction
4 Annually disturbed
5 Disturbed more than once annually

Study Site: *1999 Accuracy Assessment Releve Data*

Releve No. 99-5-20 Date: July 14, 1999 Observer: S. Walker

Point ID #: 5-20 Close-Up Photo #99-18-11 Panorama Photo # 99-18-10

Vegetation (describe moisture status, dominant species in each layer, dominant growth forms, and physiognomic unit):

Microsite: A: Moist Erivag Leddec Betnan CeTcuc Tuss Sdg Dwarf Shrub tundra
B:
C:

Site Description A: Sandy Tussock Tundra
B:
C:

Braun-Blanquet Cover Estimate Scale:
r = rare
+ = common, but < 1% cover
1 = 1 - 5%
2 = 6 - 25%
3 = 25 - 50%
4 = 51 - 75%
5 = 76 - 100%

Live Cover (%)	A/B/C	Non-Living Cover (%)	A/B/C
Low Shrubs:	0/_/_	Rocks:	0/_/_
Dwarf Shrubs:	20/_/_	Bare Soil:	0/_/_
Evergreen Shrubs:	15/_/_	Water:	0/_/_
Deciduous Shrubs:	5/_/_	Frost Scars:	0/_/_
Forbs:	+1/_/_	Total Dead:	20/_/_
tuss Graminoids:	60/_/_	Ht. Of Veg. Canopy (cm):	15/_/_ tussock 10-15
Lichens:	18/_/_		shrubs 10-1
Bryophytes:	5/_/_		

Species Cover Estimates

Vascular plants Species	Cover	Bryophytes Species	Cover	Lichens Species	Cover
Erivag	4/_/_	Olive Dicranum		Thaxub	1/_/_
Betnan	1/_/_	Hylspl		Cetcuc	+/_/_
Salpul	1/_/_	Aulturr	+/_/_	Cladarb	1/_/_
Vacvit	2/_/_	Sphagnum	1/_/_	Dacarc	+/_/_
Empnig	+2/_/_	Sphang	1/_/_	Cladran	2/_/_
Leddec	2/_/_	Raclan	1/_/_	Claunc	+/_/_
Castet	1/_/_		_/_/_	Clagra	+/_/_
Carbig	1/_/_		_/_/_	Clastyg	1/_/_
Pyrgrand	r/_/_		_/_/_		_/_/_
Pedlanata	r/_/_		_/_/_		_/_/_
Rubcha	r/_/_		_/_/_		_/_/_
Polbis	r/_/_		_/_/_		_/_/_

Releve 620
GPS 70°20.027 153°50.673 120ft elev
Transect #3
photo 30-7,6

Note: See field book for species data

Study Site: Transect

1999 Accuracy Assessment: Site Description

Releve No: AR-5 Point ID #: AP-5 Date: [illegible] Recording personnel: [illegible]

Study area description: [illegible]

GPS Coordinates N: 69°35.76 W: 159°21.05' Slope(deg): 6 Aspect: Elevation: 450 ft

Record numbers for all microsites.

Landforms
1 Hills (including kames and moraines)
2 Talus slope
3 Colluvial basin
4 Glaciofluvial and other fluvial terraces
5 Marine terrace
6 Floodplains
7 Drained lakes and flat lake margins
8 Abandoned point bars and sloughs
9 Estuary
10 Lake or pond
11 Stream
12 Sea bluff
13 Lake bluff
14 Stream bluff
15 Sand dunes
16 Beach
17 Disturbed
18 ______
19 ______
20 ______
21 ______

Surficial Geology (Parent Material)
1 Glacial tills
2 Glaciofluvial deposits
3 Active alluvial sands
4 Active alluvial gravels
5 Stabilized alluvium (sands & gravels)
6 Undifferentiated hill slope colluvium (circled)
7 Basin colluvium and organic deposits
8 Drained lake or lacustrine organic deposits
9 Lake or pond organic, sand, or silt
10 Undifferentiated sands
11 Undifferentiated clay
12 Roads and gravel pads
13 ______
14 ______
15 ______
16 ______

Surficial Geomorphology
1 Frost scars
2 Wetland hummocks
3 Turf hummocks
4 Gelifluction features
5 Strangmoor or aligned hummocks
6 High- or flat-centered polygons
7 Mixed high- and low-centered polygons
8 Sorted and non-sorted stripes
9 Palsas
10 Thermokarst pits
11 Featureless or with less 20% frost scars
12 Well-developed hillslope water tracks and small streams > 50 cm deep
13 Poorly developed hillslope water tracks, < 50 cm deep
14 Gently rolling or irregular microrelief
15 Stoney surface
16 Lakes and ponds
17 Disturbed
18 ______
19 ______
20 ______
21 ______

Microsites
1 Frost-scar element (circled)
2 Inter-frost scar element (circled)
3 Strang or hummock
4 Flark, interstrang, or interhummock area
5 Polygon center
6 Polygon trough
7 Polygon rim
8 Stripe element
9 Inter-stripe element
10 Point bar (raised element)
11 Slough (wet element)
12 ______
13 ______
14 ______
15 ______

Site Moisture (modified from Komárková 1983)
1 Extremely xeric - almost no moisture; no plant growth
2 Very xeric - very little moisture; dry sand dunes
3 Xeric - little moisture; stabilized sand dunes, dry ridge tops
4 Subxeric - noticeable moisture; well-drained slopes, ridges
5 Subxeric to mesic - very noticeable moisture; flat to gently sloping
6 Mesic-moderate moisture; flat or shallow depressions (circled)
7 Mesic to subhygric - considerable moisture; depressions
8 Subhygric - very considerable moisture; saturated but with < 5% standing water < 10 cm deep
9 Hygric - much moisture; up to 100% of surface under water 10 to 50 cm deep; lake margins, shallow ponds, streams
10 Hydric - very much moisture; 100% of surface under water 50 to 150 cm deep; lakes, streams

Soil Moisture (from Komárková 1983)
1 Very dry - very little moisture; soil does not stick together
2 Dry - little moisture; soil somewhat sticks together
3 Damp - noticeable moisture; soil sticks together but crumbles
4 Damp to moist - very noticeable moisture; soil clumps
5 Moist - moderate moisture; soil binds but can be broken apart
6 Moist to wet - considerable moisture; soil binds and sticks to fingers
7 Wet - very considerable moisture; water drops can be squeezed out of soil
8 Very wet - much moisture can be squeezed out of soil
9 Saturated - very much moisture; water drips out of soil
10 Very saturated - extreme moisture; soil is more liquid than solid

Glacial Geology
1 Till
2 Outwash
3 Bedrock
4 ______
5 ______
6 ______
7 ______

Topographic Position
1 Hill crest or shoulder
2 Side slope (circled)
3 Footslope or toeslope
4 Flat
5 Drainage channel
6 Depression
7 Lake or pond

Soil Units
1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryohemist, euic
4 Pergelic Cryosaprist, euic
5 Lithic Pergelic Cryosaprist
6 Pergelic Cryofibrist, euic
7 Histic Pergelic Cryaquept, acid
8 Histic Pergelic Cryaquept, nonacid
9 Pergelic Cryaquept, acid ? (circled)
10 Pergelic Cryaquept, nonacid
11 Pergelic Cryochrept
12 Pergelic Cryumbrept
13 Ruptic-Lithic Cryumbrept
14 Pergelic Cryaquoll
15 Histic Pergelic Cryaquoll
16 Pergelic Cryoboroll
17 ______
18 ______
19 ______
20 ______

Exposure Scale
1 Protected from winds
2 Moderate exposure to winds
3 Exposed to winds
4 Very exposed to winds

Estimated Snow Duration
1 Snow free all year
2 Snow free most of winter; some snow cover persistsafter storm but is blown free soon afterward
3 Snow free prior to melt out but with snow most of winter
4 Snow free immediately after melt out
5 Snow bank persists 1-2 weeks after melt out
6 Snow bank persists 3-4 weeks after melt out
7 Snow bank persists 4-8 weeks after melt out
8 Snow bank persists 8-12 weeks after melt out
9 Very short snow free period
10 Deep snow all year

Animal and Human Disturbance
0 No sign present
1 Some sign present; no disturbance (circled)
2 Minor disturbance or extensive sign
3 Moderate disturbance; small dens or light grazing
4 Major disturbance; multiple dens or noticeable trampling
5 Very major disturbance; very extensive tunneling or large pit

Stability
1 Stable
2 Subject to occasional disturbance
3 Subject to prolonged but slow disturbance such as solifluction (circled)
4 Annually disturbed
5 Disturbed more than once annually

Other notes: [illegible]

Location Ketik R Date 7/16/99

Project / Client Releve AP-5 Transect #3

Fuel Cache at Ketik R. 69° 48.17', 159° 19.27'

(Site data is on data form)

Releve AP-5 Photos 99-25-5, 9, 3

Moist Salgla Carbig Erivag Open low shrubland on broad inter fluve

Salgla 2	+ Camste +	* Pelaph +
Salpla 2	- Tomnit 2	
Carbig 2	* Aulpal * 1	
Petfri +	+ Auleur 2	
Erivag 2	+ Poblic +	
Polach +	Hylspl * 1	
Vaccap 1	Dicranum +	
Saumag +	Ptilcrista-castr. +	
Pyrgra +	Petfri +	
Vaccul +		
Ledde +		
Salbar +		
Betnan +		
Erivag 3		
Salari +		

tussock ht 30
veg ht 40
shrub ht 40

tussocks	50 / 40	C-cov 0
evergreen shrubs	1	Sod 0
	5+	W 0
deciduous shrubs	50	SS 0
	1	Rock 0
Mosses	40	
Lichens	+	
Bryophytes	5	

* collected

Study Site: Transect #2 — ***1999 Accuracy Assessment: Site Description***

Relevé No.: AP-4 Point ID #: AP-4 Date: ________ Recording personnel: S. Walker

Study area description: [illegible] 10-m [illegible] hill [illegible] at coastal plain/foothill transition w/ MNT

GPS Coordinates N: 69° 27 28 W: 156° 27.16 Slope(deg): 5° Aspect: W Elevation: 400 ft

Record numbers for all microsites.

Landforms

1 Hills (including kames and moraines)
2 Talus slope
3 Colluvial basin
4 Glaciofluvial and other fluvial terraces
5 Marine terrace
6 Floodplains
7 Drained lakes and flat lake margins
8 Abandoned point bars and sloughs
9 Estuary
10 Lake or pond
11 Stream
12 Sea bluff
13 Lake bluff
14 Stream bluff
15 Sand dunes
16 Beach
17 Disturbed
18 ________
19 ________
20 ________
21 ________

Surficial Geology (Parent Material)

1 Glacial tills
2 Glaciofluvial deposits
3 Active alluvial sands
4 Active alluvial gravels
5 Stabilized alluvium (sands & gravels)
6 Undifferentiated hill slope colluvium
7 Basin colluvium and organic deposits
8 Drained lake or lacustrine organic deposits
9 Lake or pond organic, sand, or silt
10 Undifferentiated sands
11 Undifferentiated clay
12 Roads and gravel pads
13 Silt Loess
14 ________
15 ________
16 ________

Surficial Geomorphology

1 Frost scars
2 Wetland hummocks
3 Turf hummocks
4 Gelifluction features
5 Strangmoor or aligned hummocks
6 High- or flat-centered polygons
7 Mixed high- and low-centered polygons
8 Sorted and non-sorted stripes
9 Palsas
10 Thermokarst pits
11 Featureless or with less 20% frost scars
12 Well-developed hillslope water tracks and small streams > 50 cm deep
13 Poorly developed hillslope water tracks, < 50 cm deep
14 Gently rolling or irregular microrelief
15 Stoney surface
16 Lakes and ponds
17 Disturbed
18 ________
19 ________
20 ________
21 ________

Microsites

1 Frost-scar element
2 Inter-frost scar element
3 Strang or hummock
4 Flark, interstrang, or interhummock area
5 Polygon center
6 Polygon trough
7 Polygon rim
8 Stripe element
9 Inter-stripe element
10 Point bar (raised element)
11 Slough (wet element)
12 ________
13 ________
14 ________
15 ________

Site Moisture (modified from Komárková 1983)

1 Extremely xeric - almost no moisture; no plant growth
2 Very xeric - very little moisture; dry sand dunes
3 Xeric - little moisture; stabilized sand dunes, dry ridge tops
4 Subxeric - noticeable moisture; well-drained slopes, ridges
5 Subxeric to mesic - very noticeable moisture; flat to gently sloping
6 Mesic-moderate moisture; flat or shallow depressions
7 Mesic to subhygric - considerable moisture; depressions
8 Subhygric - very considerable moisture; saturated but with < 5% standing water < 10 cm deep
9 Hygric - much moisture; up to 100% of surface under water 10 to 50 cm deep; lake margins, shallow ponds, streams
10 Hydric - very much moisture; 100% of surface under water 50 to 150 cm deep; lakes, streams

Soil Moisture (from Komárková 1983)

1 Very dry - very little moisture; soil does not stick together
2 Dry - little moisture; soil somewhat sticks together
3 Damp - noticeable moisture; soil sticks together but crumbles
4 Damp to moist - very noticeable moisture; soil clumps
5 Moist - moderate moisture; soil binds but can be broken apart
6 Moist to wet - considerable moisture; soil binds and sticks to fingers
7 Wet - very considerable moisture; water drops can be squeezed out of soil
8 Very wet - much moisture can be squeezed out of soil
9 Saturated - very much moisture; water drips out of soil
10 Very saturated - extreme moisture; soil is more liquid than solid

Glacial Geology

1 Till
2 Outwash
3 Bedrock
4 Unglaciated
5 ________
6 ________
7 ________

Topographic Position

1 Hill crest or shoulder
2 Side slope
3 Footslope or toeslope
4 Flat
5 Drainage channel
6 Depression
7 Lake or pond

Soil Units

1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryohemist, euic
4 Pergelic Cryosaprist, euic
5 Lithic Pergelic Cryosaprist
6 Pergelic Cryofibrist, euic
7 Histic Pergelic Cryaquept, acid
8 Histic Pergelic Cryaquept, nonacid
9 Pergelic Cryaquept, acid
10 Pergelic Cryaquept, nonacid
11 Pergelic Cryochrept
12 Pergelic Cryumbrept
13 Ruptic-Lithic Cryumbrept
14 Pergelic Cryaquoll
15 Histic Pergelic Cryaquoll
16 Pergelic Cryoboroll
17 ________
18 ________
19 ________
20 ________

Exposure Scale

1 Protected from winds
2 Moderate exposure to winds
3 Exposed to winds
4 Very exposed to winds

Estimated Snow Duration

1 Snow free all year
2 Snow free most of winter; some snow cover persistsafter storm but is blown free soon afterward
3 Snow free prior to melt out but with snow most of winter
4 Snow free immediately after melt out
5 Snow bank persists 1-2 weeks after melt out
6 Snow bank persists 3-4 weeks after melt out
7 Snow bank persists 4-8 weeks after melt out
8 Snow bank persists 8-12 weeks after melt out
9 Very short snow free period
10 Deep snow all year

Animal and Human Disturbance

0 No sign present
1 Some sign present; no disturbance
2 Minor disturbance or extensive sign Caribou
3 Moderate disturbance; small dens or light grazing
4 Major disturbance; multiple dens or noticeable trampling
5 Very major disturbance; very extensive tunneling or large pit

Stability

1 Stable
2 Subject to occasional disturbance
3 Subject to prolonged but slow disturbance such as solifluction
4 Annually disturbed
5 Disturbed more than once annually

Other notes: ________

Study Site: on Transect #2 IVO-ATQ *1999 Accuracy Assessment Releve Data*

Releve No. AP-4 Date: 7/15/9 Observer: S. Walker

Point ID #: Transect #2 AP-4 Close-Up Photo # 99-21-19 Panorama Photo # 99-21-19

Vegetation (describe moisture status, dominant species in each layer, dominant growth forms, and physiognomic unit):

Microsite: A: Moist Carbig, Dryint Salret, Tomnit ~~Eq~~ ~~Salgla~~ Salpu ~~Se~~ Graminoid, Dwarf-Shrub (Prostrate-Shrub Tundra)

B:

C: Looks like Artemisia

Site Description A: MNT on loess hill at coastal plain boundary

B:

C:

Braun-Blanquet Cover Estimate Scale:
r = rare
+ = common, but < 1% cover
1 = 1 - 5%
2 = 6 - 25%
3 = 25 - 50%
4 = 51 - 75%
5 = 76 - 100%

Live Cover (%)	A/B/C
Low Shrubs:	5/_/_
prostrate Dwarf Shrubs:	35/_/_
Evergreen Shrubs:	20/_/_
Deciduous Shrubs:	30/_/_
Forbs: (Horsetails 5%)	5/_/_
Graminoids:	25/_/_
Lichens:	3/_/_
Bryophytes:	25/_/_

Non-Living Cover (%)	A/B/C
Rocks:	0/_/_
Bare Soil:	2/_/_
Water:	0/_/_
Frost Scars:	20/_/_
Total Dead:	15/_/_
Ht. Of Veg. Canopy (cm):	20/_/_

Ht of shrubs 35 cm
Ht of grasses 10-15 cm

Species Cover Estimates

Vascular plants Species	Cover	Bryophytes Species	Cover	Lichens Species	Cover
Salgla	1/_/_	Hylspl	2/_/_	Cetcuc	+/_/_
Salpu	2/_/_	Tomnit	3/_/_	Cetisl	[illegible]/_/_
Erivag	2/_/_	Rhyrug	1/_/_	Thasub	+/_/_
Eritri	1/_/_	+ Dicranum	+/_/_	Dacarc	+/_/_
Salret	2/_/_	Ptcil	+/_/_	Ochfri	+/_/_
Dryint	2/_/_		_/_/_	+ Clapyx?	+/_/_
Castet	1/_/_		_/_/_	Pelaph	+/_/_
Arcrub	+/_/_		_/_/_	+ Clacom?	+/_/_
Stelong	+/_/_		_/_/_		_/_/_
Petfri	+/_/_		_/_/_		_/_/_
Vacvit	+/_/_		_/_/_		_/_/_
Vacuni	1/_/_		_/_/_		_/_/_
Carbig	2/_/_		_/_/_		_/_/_
Equarv	+/_/_		_/_/_		_/_/_
Senatr	+/_/_		_/_/_		_/_/_
Arcrub	+/_/_		_/_/_		_/_/_
Polbis	+/_/_		_/_/_		_/_/_
Legglab	+/_/_		_/_/_		_/_/_
Polviv	+/_/_		_/_/_		_/_/_
Bistom	+/_/_		_/_/_		_/_/_
Leddec	+/_/_		_/_/_		_/_/_
Luparc	+/_/_		_/_/_		_/_/_
Pedcap	+/_/_		_/_/_		_/_/_
Rholap	+/_/_		_/_/_		_/_/_
Equsci	+/_/_		_/_/_		_/_/_
Pedcyn	+/_/_		_/_/_		_/_/_
Saxnel	+/_/_		_/_/_		_/_/_
Stalae	+/_/_		_/_/_		_/_/_
	_/_/_		_/_/_		_/_/_
	_/_/_		_/_/_		_/_/_
	_/_/_		_/_/_		_/_/_
	_/_/_		_/_/_		_/_/_
	_/_/_		_/_/_		_/_/_

Study Site:

1999 Accuracy Assessment: Site Description

Relevé No.: 5-9 Point ID #: 5-9 Date: July Recording personnel: S. Wall

Study area description: Alder Savannah south of Moose Creek

GPS Coordinates N: 64° 12. 716' W: 154° 24. 312' Slope(deg): 5° Aspect: SE Elevation: 600 ft

Record numbers for all microsites.

Landforms

1 Hills (including kames and moraines)
2 Talus slope
3 Colluvial basin
4 Glaciofluvial and other fluvial terraces
5 Marine terrace
6 Floodplains
7 Drained lakes and flat lake margins
8 Abandoned point bars and sloughs
9 Estuary
10 Lake or pond
11 Stream
12 Sea bluff
13 Lake bluff
14 Stream bluff
15 Sand dunes
16 Beach
17 Disturbed
18 _____
19 _____
20 _____
21 _____

Surficial Geology (Parent Material)

1 Glacial tills
2 Glaciofluvial deposits
3 Active alluvial sands
4 Active alluvial gravels
5 Stabilized alluvium (sands & gravels)
6 Undifferentiated hill slope colluvium
7 Basin colluvium and organic deposits
8 Drained lake or lacustrine organic deposits
9 Lake or pond organic, sand, or silt
10 Undifferentiated sands
11 Undifferentiated clay
12 Roads and gravel pads
13 _____
14 _____
15 _____
16 _____

Surficial Geomorphology

1 Frost scars
2 Wetland hummocks
3 Turf hummocks
4 Gelifluction features
5 Strangmoor or aligned hummocks
6 High- or flat-centered polygons
7 Mixed high- and low-centered polygons
8 Sorted and non-sorted stripes
9 Pulsas
10 Thermokarst pits
11 Featureless or with less 20% frost scars
12 Well-developed hillslope water tracks and small streams > 50 cm deep
13 Poorly developed hillslope water tracks, < 50 cm deep
14 Gently rolling or irregular microrelief
15 Stoney surface
16 Lakes and ponds
17 Disturbed
18 _____
19 _____
20 _____
21 _____

Microsites

1 Frost-scar element
2 Inter-frost scar element
3 Strang or hummock
4 Flark, interstrang, or interhummock area
5 Polygon center
6 Polygon trough
7 Polygon rim
8 Stripe element
9 Inter-stripe element
10 Point bar (raised element)
11 Slough (wet element)
12 Tussock Edges
13 _____
14 _____
15 _____

Site Moisture (modified from Komárková 1983)

1 Extremely xeric - almost no moisture; no plant growth
2 Very xeric - very little moisture; dry sand dunes
3 Xeric - little moisture; stabilized sand dunes, dry ridge tops
4 Subxeric - noticeable moisture; well-drained slopes, ridges
5 Subxeric to mesic - very noticeable moisture; flat to gently sloping
6 Mesic-moderate moisture; flat or shallow depressions
7 Mesic to subhygric - considerable moisture; depressions
8 Subhygric - very considerable moisture; saturated but with < 5% standing water < 10 cm deep
9 Hygric - much moisture; up to 100% of surface under water 10 to 50 cm deep; lake margins, shallow ponds, streams
10 Hydric - very much moisture; 100% of surface under water 50 to 150 cm deep; lakes, streams

Soil Moisture (from Komárková 1983)

1 Very dry - very little moisture; soil does not stick together
2 Dry - little moisture; soil somewhat sticks together
3 Damp - noticeable moisture; soil sticks together but crumbles
4 Damp to moist - very noticeable moisture; soil clumps
5 Moist - moderate moisture; soil binds but can be broken apart
6 Moist to wet - considerable moisture; soil binds and sticks to fingers
7 Wet - very considerable moisture; water drops can be squeezed out of soil
8 Very wet - much moisture can be squeezed out of soil
9 Saturated - very much moisture; water drips out of soil
10 Very saturated - extreme moisture; soil is more liquid than solid

Glacial Geology

1 Till
2 Outwash
3 Bedrock
4 Terrace Gravel
5 _____
6 _____
7 _____

Topographic Position

1 Hill crest or shoulder
2 Side slope
3 Footslope or toeslope
4 Flat
5 Drainage channel
6 Depression
7 Lake or pond

Soil Units

1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryochrept, euic
4 Pergelic Cryoaquept, euic
5 Lithic Pergelic Cryoaquept
6 Pergelic Cryofibrist, euic
7 Histic Pergelic Cryaquept, acid
8 Histic Pergelic Cryaquept, nonacid
9 Pergelic Cryaquept, acid
10 Pergelic Cryaquept, nonacid
11 Pergelic Cryochrept
12 Pergelic Cryumbrept
13 Ruptic-Lithic Cryumbrept
14 Pergelic Cryaquoll
15 Histic Pergelic Cryaquoll
16 Pergelic Cryoboroll
17 _____
18 _____
19 _____
20 _____

Exposure Scale

1 Protected from winds
2 Moderate exposure to winds
3 Exposed to winds
4 Very exposed to winds

Estimated Snow Duration

1 Snow free all year
2 Snow free most of winter; some snow cover persistsafter storm but is blown free soon afterward
3 Snow free prior to melt out but with snow most of winter
4 Snow free immediately after melt out
5 Snow bank persists 1-2 weeks after melt out
6 Snow bank persists 3-4 weeks after melt out
7 Snow bank persists 4-8 weeks after melt out
8 Snow bank persists 8-12 weeks after melt out
9 Very short snow free period
10 Deep snow all year

Animal and Human Disturbance

0 No sign present
1 Some sign present; no disturbance
2 Minor disturbance or extensive sign
3 Moderate disturbance; small dens or light grazing
4 Major disturbance; multiple dens or noticeable trampling
5 Very major disturbance; very extensive tunneling or large pit

Stability

1 Stable
2 Subject to occasional disturbance
3 Subject to prolonged but slow disturbance such as solifluction
4 Annually disturbed
5 Disturbed more than once annually

Other notes: _____

Study Site: *1999 Accuracy Assessment Releve Data*

Releve No. 99-5-9 Date: July 14, 1999 Observer: S. Walker

Point ID #: 99-5-9 Close-Up Photo # 99-19-20 Panorama Photo # 99-19-~~20~~ 18, 19

Vegetation (describe moisture status, dominant species in each layer, ~~dominant growth~~ forms, and physiognomic unit):

Microsite: A: Moist Alncri, Erivag, Betnan Savanna Tundra

B:

C:

Site Description A: Alder savanna on Hill Slopes Frost scars are unvegetated

B:

C:

Braun-Blanquet Cover Estimate Scale:

r = rare
+ = common, but < 1% cover
1 = 1 - 5%
2 = 6 - 25%
3 = 25 - 50%
4 = 51 - 75%
5 = 76 - 100%

Tussock Height 25 25-30

Live Cover (%)	A/B/C
Low Shrubs:	35/_/_
Dwarf Shrubs:	35/_/_
Evergreen Shrubs:	20/_/_ 50
Deciduous Shrubs:	~~60~~ /_/_
Forbs:	+/_/_
Graminoids:	40/_/_
Lichens:	+/_/_
Bryophytes:	5/_/_

Non-Living Cover (%)	A/B/C
Rocks:	0/_/_
Bare Soil:	(10) ~~60~~/_/_
Water:	0/_/_
Frost Scars:	0/_/_
Total Dead:	10/_/_
Ht. Of Veg. Canopy (cm):	_/_/_

tussocks 25-35, Alders 50-100 cm 150 cm understory ~ 35 cm

Species Cover Estimates

Vascular plants Species	Cover	Bryophytes Species	Cover	Lichens Species	Cover
Alncri	5/_/_	* Sphsqu	2/_/_	* Pelt scu	+/_/_
Betnan	2 ~~3~~/_/_	* Hylspl	1/_/_	Pelaph	+/_/_
Spibea	1/_/_	* Aultur	1/_/_		_/_/_
Leddec	2/_/_	* Dicran sp scop	1/_/_		_/_/_
Vacuhule	1/_/_	* Sphgir	2/_/_		_/_/_
Vacvit	1/_/_		_/_/_		_/_/_
Erivag	3/_/_		_/_/_		_/_/_
Rumarc	+/_/_		_/_/_		_/_/_
Betgla	?/_/_		_/_/_		_/_/_
Empher	+/_/_		_/_/_		_/_/_

Study Site: ***1999 Accuracy Assessment: Site Description***

Relevé No.: 4-18 Point ID #: 4-18 Date: July 13 1999 Recording personnel: S. Walker

Study area description: Gentle N facing slope with tussock tundra near Liberator Ridge (7.5 SW)

GPS Coordinates N: 68 48 W: 158 42 Slope(deg): 5° Aspect: NW Elevation: ~1200 ft

Record numbers for all microsites.

Landforms
1 Hills (including kames and moraines) (circled)
2 Talus slope
3 Colluvial basin
4 Glaciofluvial and other fluvial terraces
5 Marine terrace
6 Floodplains
7 Drained lakes and flat lake margins
8 Abandoned point bars and sloughs
9 Estuary
10 Lake or pond
11 Stream
12 Sea bluff
13 Lake bluff
14 Stream bluff
15 Sand dunes
16 Beach
17 Disturbed
18 ______
19 ______
20 ______
21 ______

Surficial Geology (Parent Material)
1 Glacial tills
2 Glaciofluvial deposits
3 Active alluvial sands
4 Active alluvial gravels
5 Stabilized alluvium (sands & gravels)
6 Undifferentiated hill slope colluvium (circled)
7 Basin colluvium and organic deposits
8 Drained lake or lacustrine organic deposits
9 Lake or pond organic, sand, or silt
10 Undifferentiated sands
11 Undifferentiated clay
12 Roads and gravel pads
13 ______
14 ______
15 ______
16 ______

Surficial Geomorphology
1 Frost scars (circled) (hidden ~20-25%)
2 Wetland hummocks
3 Turf hummocks
4 Gelifluction features
5 Strangmoor or aligned hummocks
6 High- or flat-centered polygons
7 Mixed high- and low-centered polygons
8 Sorted and non-sorted stripes
9 Palsas
10 Thermokarst pits
11 Featureless or with less 20% frost scars (circled)
12 Well-developed hillslope water tracks and small streams > 50 cm deep
13 Poorly developed hillslope water tracks, < 50 cm deep
14 Gently rolling or irregular microrelief
15 Stoney surface
16 Lakes and ponds
17 Disturbed
18 ______
19 ______
20 ______
21 ______

Microsites
1 Frost-scar element
2 Inter-frost scar element (circled)
3 Strang or hummock
4 Flark, interstrang, or interhummock area
5 Polygon center
6 Polygon trough
7 Polygon rim
8 Stripe element
9 Inter-stripe element
10 Point bar (raised element)
11 Slough (wet element)
12 hummocks (circled)
13 ______
14 ______
15 ______

Site Moisture (modified from Komárková 1983)
1 Extremely xeric - almost no moisture; no plant growth
2 Very xeric - very little moisture; dry sand dunes
3 Xeric - little moisture; stabilized sand dunes, dry ridge tops
4 Subxeric - noticeable moisture; well-drained slopes, ridges
5 Subxeric to mesic - very noticeable moisture; flat to gently sloping (circled)
6 Mesic-moderate moisture; flat or shallow depressions
7 Mesic to subhygric - considerable moisture; depressions
8 Subhygric - very considerable moisture; saturated but with < 5% standing water < 10 cm deep
9 Hygric - much moisture; up to 100% of surface under water 10 to 50 cm deep; lake margins, shallow ponds, streams
10 Hydric - very much moisture; 100% of surface under water 50 to 150 cm deep; lakes, streams

Soil Moisture (from Komárková 1983)
1 Very dry - very little moisture; soil does not stick together
2 Dry - little moisture; soil somewhat sticks together
3 Damp - noticeable moisture; soil sticks together but crumbles
4 Damp to moist - very noticeable moisture; soil clumps
5 Moist - moderate moisture; soil binds but can be broken apart (5.5 circled)
6 Moist to wet - considerable moisture; soil binds and sticks to fingers
7 Wet - very considerable moisture; water drops can be squeezed out of soil
8 Very wet - much moisture can be squeezed out of soil
9 Saturated - very much moisture; water drips out of soil
10 Very saturated - extreme moisture; soil is more liquid than solid

Glacial Geology
1 Till
2 Outwash
3 Bedrock
4 [illegible]
5 [illegible]
6 [illegible]
7 ______

Topographic Position
1 Hill crest or shoulder
2 Side slope (circled)
3 Footslope or toeslope
4 Flat
5 Drainage channel
6 Depression
7 Lake or pond

Soil Units
1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryohemist, euic
4 Pergelic Cryosaprist, euic
5 Lithic Pergelic Cryosaprist
6 Pergelic Cryofibrist, euic
7 Histic Pergelic Cryaquept, acid
8 Histic Pergelic Cryaquept, nonacid
9 Pergelic Cryaquept, acid
10 Pergelic Cryaquept, nonacid
11 Pergelic Cryochrept
12 Pergelic Cryumbrept
13 Ruptic-Lithic Cryumbrept
14 Pergelic Cryaquoll
15 Histic Pergelic Cryaquoll
16 Pergelic Cryoboroll
17 ______
18 ______
19 ______
20 ______

Exposure Scale
1 Protected from winds
2 Moderate exposure to winds (circled)
3 Exposed to winds
4 Very exposed to winds

Estimated Snow Duration
1 Snow free all year
2 Snow free most of winter; some snow cover persists after storm but is blown free soon afterward
3 Snow free prior to melt out but with snow most of winter
4 Snow free immediately after melt out (circled)
5 Snow bank persists 1-2 weeks after melt out
6 Snow bank persists 3-4 weeks after melt out
7 Snow bank persists 4-8 weeks after melt out
8 Snow bank persists 8-12 weeks after melt out
9 Very short snow free period
10 Deep snow all year

Animal and Human Disturbance
0 No sign present
1 Some sign present; no disturbance (circled)
2 Minor disturbance or extensive sign
3 Moderate disturbance; small dens or light grazing
4 Major disturbance; multiple dens or noticeable trampling
5 Very major disturbance; very extensive tunneling or large pit

Stability
1 Stable (circled)
2 Subject to occasional disturbance (circled) Cryoturbation in frost scars
3 Subject to prolonged but slow disturbance such as solifluction
4 Annually disturbed
5 Disturbed more than once annually

Other notes: Fairly large tussocks w/ lots of shrubs 50% shrubs

Study Site: *1999 Accuracy Assessment Releve Data*

Releve No. 4-19 A and B Date: 6/13/99 Observer: S. Walk[illegible]

Point ID #: 4-9 Close-Up Photo # 99-15-24 Panorama Photo # 99-15-23

Vegetation (describe moisture status, dominant species in each layer, dominant growth forms, and physiognomic unit):

~~Microsite~~: A: Moist Betnan Erivag Hylspl Dwarf shrub, tussock-grass tundra
B: Luzarc Juncus [illegible] (frost scars)
C:

Site Description A: [illegible] Side slope (1-2%) [illegible]
B: Frost [illegible] ?
C:

Braun-Blanquet Cover Estimate Scale:

- r = rare
- + = common, but < 1% cover
- 1 = 1 - 5%
- 2 = 6 - 25%
- 3 = 25 - 50%
- 4 = 51 - 75%
- 5 = 76 - 100%

Live Cover (%)	A/B/C
Low Shrubs:	29/ /
Dwarf Shrubs:	30/ /
Evergreen Shrubs:	15/ /
Deciduous Shrubs:	19/ /
Forbs:	4/ /
Graminoids:	15/ /
Lichens:	+/ /
Bryophytes:	15/ /

Tussock [illegible] 20% ; 45% bare soil

Non-Living Cover (%)	A/B/C
Rocks:	0/ /
Bare Soil:	05/95/
Water:	0/ /
Frost Scars:	20/ /
Total Dead:	15/ /
Ht. Of Veg. Canopy (cm):	/ / 30-35cm

Species Cover Estimates

Vascular plants Species	Cover	Bryophytes Species	Cover	Lichens Species	Cover
Erivag	3/0/	Hylspl (4-19-2)	2/ /	Peltapr (4-19-7)	+/0/
Betnan	3/0/	Sphang (4-19-3)	1/ /	Clagyx (4-19-8)	0/+/
Leddec	2/0/	Sphwar (4-19-4)	1/ /	Dicarc	+/0/
Vacvit	1/+/	Dic (white Gr.) (4-19-5)	1/ /	[illegible]	[illegible]
Salpla	1/0/	Aultur	1/ /	Cetisl	+/0/
Vaculi	1/0/	Sphcom (4-19-6)	1/ /	Thasub	+/0/
Senatr	+/+/	Bryum sp	0/+/	Polaph	+/0/
Saxmel	+/0/		/ /		/ /
Polbis	+/0/		/ /		/ /
Carbig	1/0/		/ /		/ /
Castet	+/+/		/ /		/ /
Minmac	0/+/		/ /		/ /
Luz mul (4-19-1)	0/+/		/ /		/ /
Luzarc	0/+/		/ /		/ /
Juncus	0/+/		/ /		/ /
Carcap	0/+/		/ /		/ /
Fesbar (4-19-9)	0/+/		/ /		/ /
Betglan	+/0/		/ /		/ /
Arclat	+/+/		/ /		/ /
Pedlap	+/0/		/ /		/ /
Salphl	0/5/		/ /		/ /
Pottup	+/0/		/ /		/ /

Transect #2

Study Site: *1999 Accuracy Assessment: Site Description*

Relevé No.: 99-2-13 Point ID #: 2-13 Date: July 15, 1999 Recording personnel: S. Walker

Study area description: Broad expanse of lowly shrubby tussock tundra (Class 3.1) on broad hill 30 N of Colville River

GPS Coordinates N: 69° 23.48 W: 150° 27.38 Slope(deg): 2° Aspect: NW Elevation: 80.2 ft ?

Record numbers for all microsites.

Landforms
(1) Hills (including kames and moraines)
2 Talus slope
3 Colluvial basin
4 Glaciofluvial and other fluvial terraces
5 Marine terrace
6 Floodplains
7 Drained lakes and flat lake margins
8 Abandoned point bars and sloughs
9 Estuary
10 Lake or pond
11 Stream
12 Sea bluff
13 Lake bluff
14 Stream bluff
15 Sand dunes
16 Beach
17 Disturbed
18 ______
19 ______
20 ______
21 ______

Surficial Geology (Parent Material)
1 Glacial tills
2 Glaciofluvial deposits
3 Active alluvial sands
4 Active alluvial gravels
5 Stabilized alluvium (sands & gravels)
(6) Undifferentiated hill slope colluvium
7 Basin colluvium and organic deposits
8 Drained lake or lacustrine organic deposits
9 Lake or pond organic, sand, or silt
10 Undifferentiated sands
11 Undifferentiated clay
12 Roads and gravel pads
13 ______
14 ______
15 ______
16 ______

Surficial Geomorphology
1 Frost scars
2 Wetland hummocks
3 Turf hummocks
4 Gelifluction features
5 Strangmoor or aligned hummocks
6 High- or flat-centered polygons
7 Mixed high- and low-centered polygons
8 Sorted and non-sorted stripes
9 Palsas
10 Thermokarst pits
(11) Featureless or with less 20% frost scars
12 Well-developed hillslope water tracks and small streams > 50 cm deep
13 Poorly developed hillslope water tracks, < 50 cm deep
14 Gently rolling or irregular microrelief
15 Stoney surface
16 Lakes and ponds
17 Disturbed
18 ______
19 ______
20 ______
21 ______

Microsites
1 Frost-scar element
(2) Inter-frost scar element
3 Strang or hummock
4 Flark, interstrang, or interhummock area
5 Polygon center
6 Polygon trough
7 Polygon rim
8 Stripe element
9 Inter-stripe element
10 Point bar (raised element)
11 Slough (wet element)
12 ______
13 ______
14 ______
15 ______

Site Moisture (modified from Komárková 1983)
1 Extremely xeric - almost no moisture; no plant growth
2 Very xeric - very little moisture; dry sand dunes
3 Xeric - little moisture; stabilized sand dunes, dry ridge tops
4 Subxeric - noticeable moisture; well-drained slopes, ridges
5 Subxeric to mesic - very noticeable moisture; flat to gently sloping
(6) Mesic-moderate moisture; flat or shallow depressions
7 Mesic to subhygric - considerable moisture; depressions
8 Subhygric - very considerable moisture; saturated but with < 5% standing water < 10 cm deep
9 Hygric - much moisture; up to 100% of surface under water 10 to 50 cm deep; lake margins, shallow ponds, streams
10 Hydric - very much moisture; 100% of surface under water 50 to 150 cm deep; lakes, streams

Soil Moisture (from Komárková 1983)
1 Very dry - very little moisture; soil does not stick together
2 Dry - little moisture; soil somewhat sticks together
3 Damp - noticeable moisture; soil sticks together but crumbles
4 Damp to moist - very noticeable moisture; soil clumps
5 Moist - moderate moisture; soil binds but can be broken apart
(6) Moist to wet - considerable moisture; soil binds and sticks to fingers
7 Wet - very considerable moisture; water drops can be squeezed out of soil
8 Very wet - much moisture can be squeezed out of soil
9 Saturated - very much moisture; water drips out of soil
10 Very saturated - extreme moisture; soil is more liquid than solid

Glacial Geology
1 Till
2 Outwash
3 Bedrock
(4) Ungla[illegible]
5 ______
6 ______
7 ______

Topographic Position
(1) Hill crest or shoulder
2 Side slope
3 Footslope or toeslope
4 Flat
5 Drainage channel
6 Depression
7 Lake or pond

Soil Units
1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryohemist, euic
4 Pergelic Cryosaprist, euic
5 Lithic Pergelic Cryosaprist
6 Pergelic Cryofibrist, euic
7 Histic Pergelic Cryaquept, acid
8 Histic Pergelic Cryaquept, nonacid
(9) Pergelic Cryaquept, acid
10 Pergelic Cryaquept, nonacid
11 Pergelic Cryochrept
12 Pergelic Cryumbrept
13 Ruptic-Lithic Cryumbrept
14 Pergelic Cryaquoll
15 Histic Pergelic Cryaquoll
16 Pergelic Cryoboroll
17 ______
18 ______
19 ______
20 ______

Exposure Scale
1 Protected from winds
(2) Moderate exposure to winds
3 Exposed to winds
4 Very exposed to winds

Estimated Snow Duration
1 Snow free all year
2 Snow free most of winter; some snow cover persists after storm but is blown free soon afterward
3 Snow free prior to melt out but with snow most of winter
(4) Snow free immediately after melt out
5 Snow bank persists 1-2 weeks after melt out
6 Snow bank persists 3-4 weeks after melt out
7 Snow bank persists 4-8 weeks after melt out
8 Snow bank persists 8-12 weeks after melt out
9 Very short snow free period
10 Deep snow all year

Animal and Human Disturbance
(0) No sign present
1 Some sign present; no disturbance
2 Minor disturbance or extensive sign
3 Moderate disturbance; small dens or light grazing
4 Major disturbance; multiple dens or noticeable trampling
5 Very major disturbance; very extensive tunneling or large pit

Stability
(1) Stable
2 Subject to occasional disturbance
3 Subject to prolonged but slow disturbance such as solifluction
4 Annually disturbed
5 Disturbed more than once annually

Other notes: Broad expanse of tussock tundra [illegible] [illegible] portion of [illegible], 1st [illegible] end of 3.1

Study Site: *1999 Accuracy Assessment Releve Data*

Releve No. 99-2-13 Date: July 15, 1999 Observer: S. [illegible]

Point ID #: 2-13 Close-Up Photo # 99-21-11 Panorama Photo # 99-21-10

Vegetation (describe moisture status, dominant species in each layer, dominant growth forms, and physiognomic unit):

Microsite: A: Moist Erivag Betnan
B:
C:

Site Description A: Broad hill slope w/ Tussock Tundra
B:
C:

Braun-Blanquet Cover Estimate Scale:
r = rare
+ = common, but < 1% cover
1 = 1 - 5%
2 = 6 - 25%
3 = 25 - 50%
4 = 51 - 75%
5 = 76 - 100%

Live Cover (%)	A/B/C
20-50 Low Shrubs:	30/_/_
< 20 cm Dwarf Shrubs:	20/_/_
Evergreen Shrubs:	15/_/_
Deciduous Shrubs:	35/_/_
Forbs:	+/_/_
Graminoids:	45/_/_
Lichens:	+/_/_
Bryophytes:	20/_/_

Ht. of tussock, 10-15 cm

Non-Living Cover (%)	A/B/C
Rocks:	0/_/_
Bare Soil:	0/_/_
Water:	0/_/_
Frost Scars:	5/_/_
Total Dead:	10/_/_
Ht. Of Veg. Canopy (cm):	35/_/_

Ht of Tussocks 25 cm
Ht of shrubs 30-35 cm

Species Cover Estimates

Vascular plants Species	Cover	Bryophytes Species	Cover	Lichens Species	Cover
Erivag	3/_/_	* Aultur	1/_/_	* Polsce	+/_/_
Betnan	3/_/_	* Sphwar	1/_/_	* Pelaph	+/_/_
Salpla	3/_/_	* Sphang	2/_/_	* Dacarc	+/_/_
Leddec	2/_/_	* Hylspl	1/_/_	Thasub	+/_/_
Vaculi	1/_/_	* Sphgir	2/_/_	Claama	+/_/_
Vacvit	1/_/_	* Dicelong	+/_/_	Clagum	+/_/_
Arnles	1/_/_	* Brown Sphag	+/_/_		_/_/_
Carbig	+/_/_	Aue D'cr[illegible]	+/_/_		_/_/_
Empher	+/_/_		_/_/_		_/_/_
Polbis	+/_/_		_/_/_		_/_/_
Potfru: low (frost scars)	(+)/_/_		_/_/_		_/_/_
Arclat	(+)/_/_		_/_/_		_/_/_
Castet	+/_/_		_/_/_		_/_/_