

ARCSS-ATLAS-NEAML
Data Report

**A Western Alaskan Transect to Examine
Interactions of Climate, Substrate, Vegetation,
and Spectral Reflectance:**

ATLAS Grids and Transects, 1998-1999



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TABLE OF CONTENTS

Introduction	3
Methods and data collected	4
Site locations.....	4
Grid Description	4
Relevés	5
Biomass Harvest	5
Leaf Area Index Estimation.....	6
NDVI Estimation	6
Total Summer Warmth.....	6
LAI and Relevés from the Accuracy Assessment Transects.....	7
Discussion	7
Trends in Biomass.....	7
Leaf Area Index	8
NDVI.....	8
Differences between acidic and non-acidic tundra	9
Acknowledgements.....	10
References	10
List of Tables and Figures	
Figure 1. Landcover Map of Northern Alaska with grid locations.....	11
Figure 2. Barrow grid photo and description.....	12
Figure 3. Atqasuk grid photo and description.	13
Figure 4. Oumalik 1 grid photo and description.....	14
Figure 5. Oumalik 2 grid photo and description.....	15
Figure 6. Ivotuk 1 grid photo and description.	16
Figure 7. Ivotuk 2 grid photo and description.	17
Figure 8. Ivotuk 3 grid photo and description.	18
Figure 9. Ivotuk 4 grid photo and description.	19
Table 1. Site factors for grids.	20

Table 2. Sample releve data sheet.....	21
Table 3. Sample site factor description data sheet.....	22
Table 4. Barrow, Atqasuk, Oumalik, and Ivotuk releve data.....	23
Table 5. Additional Ivotuk releve data.....	30
Table 6. Raw biomass harvest data.....	31
Table 7. LAI measurements for Barrow, Atqasuk, and Ivotuk.	33
Figure 10. Accuracy Assessment transects with stops.....	35
Table 8. LAI measurements for Accuracy Assessment.	36
Figure 11. Summary of LAI along Accuracy Assessment transects.	38
Figure 12. Trends in plant functional type abundance with increasing TSW.	39
Figure 13. Changes in plant functional type dominance with increasing TSW.	40
Figure 14. Interactions between moss and vascular plant abundance.....	41
Figure 15. Trends in LAI with increasing TSW.	42
Figure 16. NDVI vs. mean biomass.....	43
Figure 17. MNT vs. MAT comparisons for Oumalik and Ivotuk.....	44
Appendix	45
Releve data sheets from Accuracy Assessment transects.	45

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 Igotuk, 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 Igotuk 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 initial 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 50°C, 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 0.6 μm) that are reflected off the vegetation to the amount of near-infrared wavelengths (not absorbed; 0.7-0.9 μm) 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 km², it was not possible to calculate separate NDVI values for the MNT and MAT grids at Oumalik and Iivotuk. 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 regression 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/m² vs. 830 ± 68 g/m²; Ivotuk biomass: 647 ± 81 g/m² vs. 839 ± 81 g/m². 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.

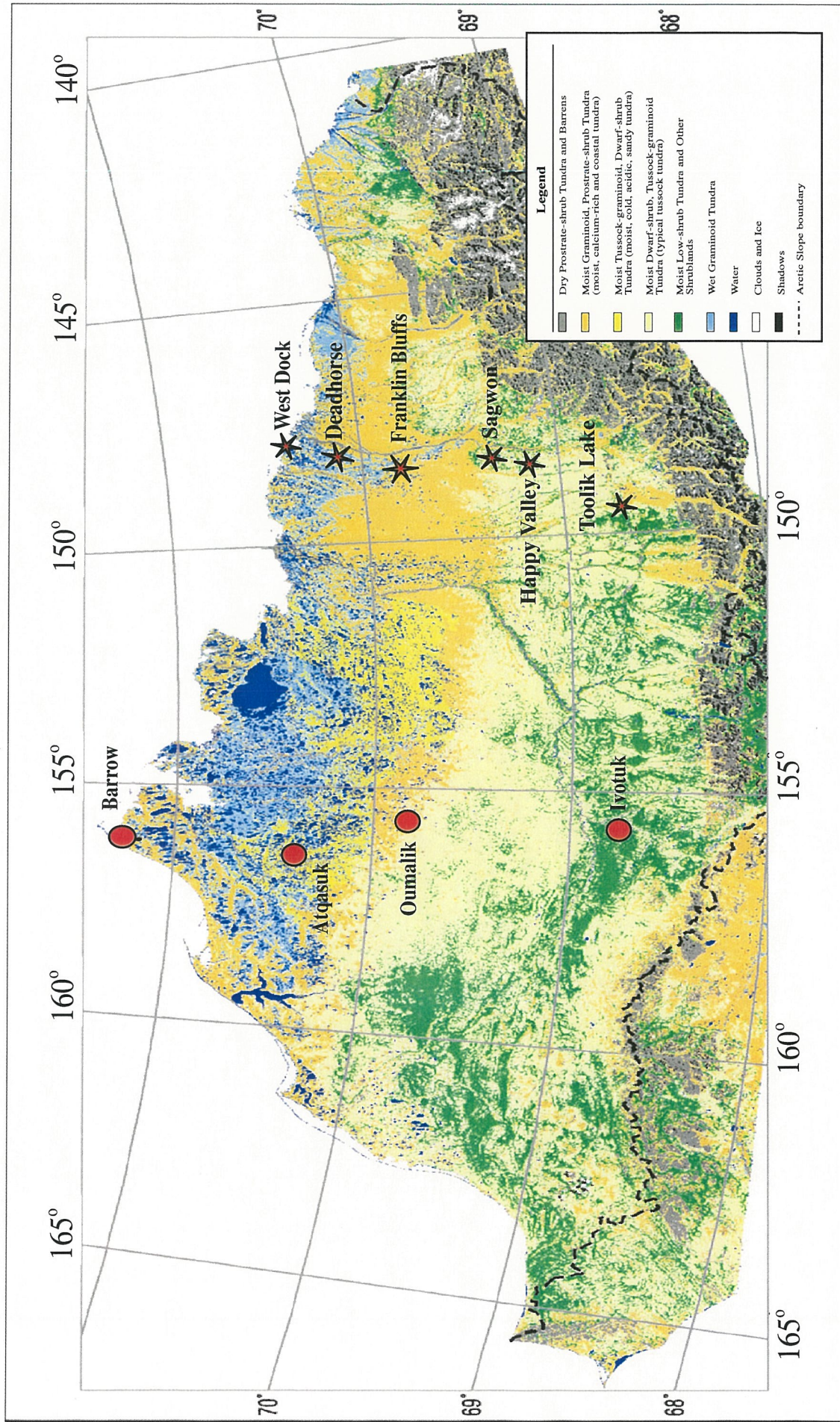




Figure 2. Barrow grid (coastal acidic tundra).

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 of . 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 (6-8°). 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*, *Vaccinium vitis-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 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 spadicum*, *Hylocomium splendens*, *Pleurozium schreberi*, *Sphagnum girgensohnii*, *S. lenense*, and *S. warnstroffii*). 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 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 (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 #1254; Walker, 1999 #12453]. 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. scirpoidea*, *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*, *Catascopium nigrum*, *Meesia uliginosum*, *Orthothecium chryseum*, *Aulacomnium acuminatum*, *A. turgidum*, *Dicranum spadicum*, *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*). 18



Figure 9. Ivotuk-4 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 stabilized 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 Aspect (deg.)	Plant communities (% of grid pts)	Soil pH	Soil Units	Thaw Depth (cm ± s.d.)	Site Moisture	Vol. soil moisture top mineral horizon (%)	Microrrelief height (cm)	Canopy height (cm)	Moss depth (cm)
Barrow	N71 19 17.6 W155 39 29.3	MAT	90.1 ¹ 1949-1999	Undifferentiated marine clay	Featureless or with less than 20% frost scars Flat centered polygons	Flat	0	Saxon-Caracu: 44.6% ² Tonni-Caracu: 21.5% Luzon-sphigi: 19.2% Caracu-Luzarc: 10.8% Eriang-Duplis: 3.3% other: 1.6%	5.8	Pergelic Cryaquept, acid	15.3 ± 6.8 n=120 6/29/99	Mesic	4.2 n=12	8±4	7 ± 2	1.0 ± 0.73
Aqtasuk	N70 27 52.2 W157 27 02.6	MAT	20.1 ³ 1976	Eolian sand	Featureless	Flat	0	Ledpai-Eriang: 78% Ledpai-Carbig: 20% Ledpai-Rubohai: 2%	4.8	Pergelic Cryaquept, acid	12.2 ± 2.6 n=242 6/26/99	Mesic	4.2 n=1	9 ± 3	10 ± 4	2.5 ± 1.1
Oumalik 1	N69 44.12 W155 52.17	MAT	29.1 ^{4,5} 1979-1980	Eolian silt	Frost scars	Side slope	6-8	Dryint-Carbig: 100%	6.2	Rupic Pergelic Cryoquept	27.8 ± 9.0 n=121 inter frostscar: 21.3 ± 4.8 n=67 frost scar: 35.9 ± 5.8 n=54 7/15/99	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	Eriang-Beinan: 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 7/16/99	Mesic to subhygic	n.d.	22±5	27 ± 10	1.25 ± 0.94
Ivotuk 1	N68 28.23 W155 44.52	MAT	29.3 ⁶ 1999	Glacioluvial deposits	Frost scars	Mid-slopeslope	4	Beinan-Eriang: 83% Beinan-Carbig: 13% Anthur-Luzarc: 4%	4.9	Rupic Pergelic Cryaquept, acid and Hislic Pergelic Cryoquept, acid	25.9 ± 9.7 n=242 6/26/99	Mesic to subhygic Hygic in depressions	4.6 n=1	24 ± 7	29 ± 8	3.7 ± 2.9
Ivotuk 2	N68 28.75 W155 44.14	MAT	29.3 ⁶ 1999	Glacioluvial deposits	Well developed hill slope water tracks	Lower side slope and drainage channels	5	Beinan-Eriang: 34% Eriang-Salpa: 29% Rubcha-Beinan: 16% Non-acidic tundra: 8% Other: 13%	n.d.	Pergelic Cryaquept, acid and Hislic Pergelic Cryoquept, acid	21.1 ± 7.7 n=242 6/25/99	Eriang: mesic to subhygic Rubcha: mesic Calstr-Eriang: hygic	4.0	15 ± 7	42 ± 7	4.7 ± 2.5
Ivotuk 3	N68 28.72 W155 44.28	MAT	29.3 ⁶ 1999	Hill slope colluvium from small limestones outcrop	Gelifluction features and tanks; Sorted and non-sorted stripes, and frost scars	Mid-slopeslope	6	Dryint-Carbig-Eriang: 49% Dryint-Carbig: 20% Nongia-Dryint: 11% Leccei-Dryint: 7% Calstr-Nosom: 8% Others: 7%	6.8	Pergelic Cryaquept, nonacid Pergelic Cryoquept, nonacid Rupic Pergelic Cryaquept, nonacid	25.8 ± 11.9 n=242 6/25/99	Dryint-Carbig-Eriang: Mesic to subhygic	3.4 n=1	17 ± 10	14 ± 7	2.4 ± 1.3
Ivotuk 4	N68 28.82 W155 44.65	MAT	29.3 ⁶ 1999	Glacioluvial deposits	Featureless, less than 20% frost scars	Hill crest or shoulder	2	Sphlen-Eriang: 100%	4.4	Pergelic cryaquept	20.7 ± 5.5 n=242 6/25/99	mesic to subhygic	3.8 n=1	19 ± 6	21 ± 6	3.7 ± 2.6

¹ Western Regional Climate Center (1999), Alaska Climate Summary. www.wrcc.dli.edu/summary/dlimerak.html

² the vegetation types of Barrow need to be revisited - there may be distinct vegetation types within Caracu-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, 1990

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

Table 4. Barrow, Atkasuk, 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=1-10% cover; 2=10-25% cover; 3=25-50%; 4=50-75%; 5=75-100%.

Colored blocks delineate possible character taxa for MAT/MINT 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.

Plant community	Moist Acidic tundra						Moist Non-Acidic tundra						
	Aniur-Luzarc	Beran-Envag	Beran-Envag	Spihen-Envag	Ledpal-Envag	Luzcon-Dicelo	Drynt-Carbig	Enri-Facian	Novga-Drynt	Drynt-Carbig	Saxpp-Perdac	Cararu-Tomni	
Species	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													
<i>Ledum palustre</i> ssp. <i>decumbens</i>	1	3	2	2	2	.	+	+	.	.	.	.	7
<i>Vaccinium vitis-idaea</i>	1	2	2	1	2	.	+	1	.	.	.	.	7
<i>Cladonia stygia</i>	+	+	+	+	2	.	.	.	.	.	.	.	5
<i>Cladonia amaurocraea</i>	+	+	.	+	+	+	.	.	.	.	.	+	6
<i>Betula nana</i> ssp. <i>exilis</i>	+	3	3	1	.	.	.	.	.	.	.	.	4
<i>Cladonia pleurota</i>	+	+	+	.	.	+	.	.	.	.	.	.	4
<i>Petasites frigidus</i>	2	1	+	.	.	r	.	.	.	r	.	.	5
<i>Peltigera scabrosa</i>	+	+	r	.	.	.	.	.	.	.	.	.	3
<i>Rubus chamaemorus</i>	.	2	1	2	.	.	.	.	.	.	.	.	3
<i>Salix planifolia</i> ssp. <i>pulchra</i>	.	2	2	.	.	+	.	.	.	.	.	.	3
<i>Sphagnum warnstorffii</i>	.	1	1	+	.	.	.	.	.	.	.	.	3
<i>Nephroma arcticum</i>	.	+	+	r	.	.	.	.	.	.	.	.	3
<i>Scapania paludicola</i>	+	.	.	+	.	.	.	.	.	.	.	.	2
<i>Empetrum hermaphroditum</i>	+	2	.	.	.	.	.	.	.	.	.	.	2
<i>Pedicularis labradorica</i>	.	+	r	.	.	.	.	.	.	.	.	.	2
<i>Sphagnum girgensohnii</i>	.	2	1	.	.	.	.	.	.	.	.	.	2
<i>Dicranum angustum</i>	.	.	1	+	.	.	.	.	.	.	.	.	2
<i>Sphagnum lenense</i>	.	1	.	3	.	.	.	.	.	.	.	.	2
<i>Andromeda polifolia</i>	.	r	.	+	.	.	.	.	.	.	.	.	2
<i>Polytrichum strictum</i>	.	.	+	.	2	.	.	.	.	.	.	.	2

Table 4 continued.

Plant community	Moist Acidic tundra				Moist Non-Acidic tundra				Freq.				
	Aniur-Luzarc	Batnan-Envag	Batnan-Envag	Sphlen-Envag	Luzcon-Envag	Drynt-Dicelo	Drynt-Carbig	Errt-Raclan		Novda-Dyint	Dyint-Carbig	Saxpp-Pardac	Caraqu-Tomnit
Species	I-1B	I-1A	O-2	I-4	A-1	B-1B	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	
<i>Sphagnum compactum</i>	.	.	.	+	1	.	.	.	.	.	.	.	2
<i>Warnstorfia fluitans</i>	.	.	.	1	+	.	.	.	.	.	.	.	2
<i>Polytrichum jensenii</i>	.	.	.	+	+	2
<i>Sphagnum aongstromii</i>	.	.	.	r	+	.	.	.	.	.	.	.	2
<i>Polytrichastrum alpinum</i>	+	2	.	.	.	.	.	.	2
<i>Eriophorum vaginatum</i>	+	3	3	4	4	r	+	+	.	r	.	.	9
<i>Cladonia arbuscula</i>	+	+	.	+	+	.	.	.	+	.	.	r	6
<i>Peltigera rufescens</i>	+	r	3
<i>Baeomyces rufus</i>	+	1
<i>Baeomyces</i> sp.	+	1
<i>Anthelia juratzkana</i>	1
<i>Juncus arcticus</i>	.	1	.	.	.	.	.	.	.	.	.	.	1
<i>Nardia japonica</i>	.	1	.	.	.	.	.	.	.	.	.	.	1
<i>Baeomyces carneus</i>	.	1	.	.	.	.	.	.	.	.	.	.	1
<i>Ptilium crista-castrensis</i>	.	+	1
<i>Pleurozium schreberi</i>	.	+	1
<i>Spirea stevenii</i>	.	+	1
<i>Arctocetraria nigricascens</i>	.	+	1
<i>Cladonia cornuta</i>	.	+	1
<i>Cladonia crispata</i>	.	+	1
<i>Cladonia cyanipes</i>	.	+	1
<i>Cladonia grayi</i>	.	+	1
<i>Cladonia macilenta</i>	.	+	1
<i>Stereocaulon alpinum</i>	.	+	1
<i>Dicranella</i> sp.	.	+	1
<i>Diplophyllum taxifolium</i>	.	+	1
<i>Nardia geoscyphus</i>	.	+	1
<i>Pohlia cruda</i>	.	+	1
<i>Scapania curta</i>	.	+	1
<i>Calliergon stramineum</i>	.	+	1
<i>Epilichen scabrosus</i>	.	+	1

Table 4 continued.

Plant community	Moist Acidic tundra						Moist Non-Acidic tundra									
	Antyr-Luzarc		Berman-Ervag		Sphlen-Ervag		Luzcon-Dicelo		Errri-Ractan		Novgia-Drynt		Saxopp-Pardac		Caragu-Tornit	
	I-1B	I-1A	O-2	I-4	A-1	B-1B	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	B-1A	B-1A	Freq.	
<i>Pedicularis oederi</i>	.	r	.	.	.	.	.	.	.	.	.	.	.	.	1
<i>Aulacomnium palustre</i> var. <i>imbricatum</i>	.	.	+	1	
<i>Pyrola secunda</i>	.	.	+	1	
<i>Sphagnum balticum</i>	.	.	.	2	.	.	.	.	.	.	.	.	.	.	1
<i>Eriophorum angustifolia</i>	.	.	.	r	.	.	.	.	.	.	.	.	.	.	1
<i>Eriophorum scheuchzeri</i>	.	.	.	r	.	.	.	.	.	.	.	.	.	.	1
<i>Loeskygnun badium</i>	+	1	
<i>Bleparostoma trichophylla</i>	+	1	
<i>Cetraria kamczatica</i>	+	1	
<i>Pedicularis lapponica</i>	+	1	
<i>Peltigera malacea</i>	r	.	.	.	.	.	.	.	.	.	1	
<i>Potentilla hyparctica</i>	1	.	.	.	.	.	.	.	.	1	
<i>Ranunculus nivalis</i>	r	.	.	.	.	.	.	.	.	1	
<i>Peltigera</i> sp.	+	1	
<i>Cladonia squamosa</i>	+	1	
<i>Cladonia coccifera</i>	+	1	
Moist Nonacidic Tundra	
<i>Dryas integrifolia</i>	3	1	4	.	.	.	.	.	5	
<i>Eriophorum triste</i>	+	2	1	1	+	.	.	.	5	
<i>Tofieldia pusilla</i>	+	1	+	+	+	.	.	.	5	
<i>Equisetum arvense</i>	1	1	+	+	+	.	.	.	5	
<i>Salix reticulata</i>	2	1	1	2	.	.	.	.	4	
<i>Ptilidium ciliare</i>	1	1	+	2	.	.	.	.	6	
<i>Bistorta viviparum</i>	+	+	+	+	4	
<i>Pedicularis capitata</i>	+	+	+	+	4	
<i>Senecio atropurpureus</i>	1	+	+	+	.	.	.	.	7	
<i>Flavoctraria nivalis</i>	+	r	r	2	.	1	r	.	.	6	
<i>Racomitrium lanuginosum</i>	+	2	1	.	1	.	.	.	5	
<i>Stellaria laeta</i>	+	+	r	+	.	+	.	.	6	
<i>Arctagrostis latifolia</i> ssp. <i>latifolia</i>	+	1	+	+	.	r	.	.	7	
<i>Sphenolobus minutus</i>	+	+	+	+	5	
<i>Tomentygnun nitens</i>	+	+	+	+	6	

Table 4 continued.

Plant community	Moist Acidic tundra						Moist Non-Acidic tundra						Freq.
	Arviur-Luzarc	Barnan-Ervag	Barnan-Ervag	Spiher-Ervag	Ledpal-Ervag	Luzcon-Drcalo	Drynt-Carbig	Errri-Raelen	Novgla-Drynt	Drynt-Carbig	Saxopp-Perdac	Caragu-Tornit	
Species	I-1B	I-1A	O-2	I-4	A-1	B-1B	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	
<i>Rhododendron lapponicum</i>	+	+	1	.	+	.	4
<i>Sphaerophorus globosus</i>	.	.	+	.	.	1	r	1	+	.	+	.	7
<i>Rhizidium rugosum</i>	1	2	2	.	.	.	3
<i>Saussurea angustifolia</i>	+	1	.	1	.	.	3
<i>Cardamine digitata</i>	+	+	.	+	.	.	3
<i>Arctous rubra</i>	r	.	1	1	.	.	3
<i>Papaver macounii</i>	r	.	+	+	.	.	3
<i>Lecanora epibryon</i>	1	+	.	+	.	3
<i>Carex membranacea</i>	+	+	.	.	.	3
<i>Lupinus arcticus</i>	+	.	1	+	.	2
<i>Masonhalea richardsonii</i>	2	+	.	.	.	.	2
<i>Silene acaulis</i>	+	+	2
<i>Astragalus umbellatus</i>	+	+	2
<i>Ditrichum flexicaule</i>	+	2
<i>Saxifraga foliolosa</i>	+	+	.	1	3
<i>Saxifraga foliolosa</i>	+	+	.	.	2
<i>Limprichtia revolvens</i>	+	.	.	2
<i>Myurella julacea</i>	+	.	.	2
<i>Orthothecium chryseum</i>	1	.	.	2
<i>Equisetum scirpoides</i>	+	.	.	2
<i>Parrya nudicaulis</i>	+	.	.	2
<i>Hypogymnia vittata</i>	+	.	.	2
<i>Carex capillaris</i>	1	.	2
<i>Minuartia arctica</i>	r	+	.	2
<i>Asahinea chrysantha</i>	+	.	2
<i>Pyrola grandifolia</i>	.	.	+	.	.	.	1	2	.	+	.	.	4
<i>Cladonia pyxidata</i>	+	r	+	.	.	.	+	4
<i>Salix glauca</i>	2	.	.	.	.	.	1
<i>Pedicularis langsdorffii</i>	+	1
<i>Saxifraga hieracifolia</i>	+	1
<i>Novosieversia glacialis</i>	2	.	.	.	1
<i>Carex scirpoidea</i>	1	.	.	.	1
<i>Carex misandra</i>	+	.	.	.	1

Table 4 continued.

Plant community	Moist Acidic tundra				Moist Non-Acidic tundra				Freq.		
	Artur-Luzarc Bairan-Ervag Sptien-Ervag Ladpal-Ervag Luzcon-Drcalo	Bairan-Ervag A-1 I-4	B-1B A-1	O-1A	Dyint-Carbig Errit-Raelen Novgia-Dyint	I-3B I-3A	I-3C	B-1A			
Species	I-1B	I-1A	O-2	I-4	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	Freq.
<i>Distichium capillaceum</i>	1
<i>Encalypta alpina</i>	1
<i>Hypnum bambergeri</i>	1
<i>Orthothecium strictum</i>	1
<i>Pertusaria panygra</i>	1
<i>Vulpicida tilesii</i>	1
<i>Campylium polygamum</i>	1
<i>Kobresia myosuroides</i>	1
<i>Salix arctica</i>	1
<i>Aulacomnium acuminatum</i>	1
<i>Catoclopium nigratum</i>	1
<i>Nostoc commune</i>	1
<i>Equisetum variegatum</i>	1
<i>Lagotis glauca</i>	1
<i>Pedicularis arctoeuropea</i>	1
<i>Thalictrum alpinum</i>	1
<i>Cinclidium arcticum</i>	1
<i>Dicranum acutifolium</i>	1
<i>Lophozia jurensis</i>	1
<i>Lophozia ventricosa</i>	1
<i>Meesia triquetra</i>	1
<i>Pseudocalliergon turgescens</i>	1
<i>Tritomaria quiquidentata</i>	1
<i>Anemone parviflora</i>	1
<i>Kobresia sibirica</i>	1
<i>Mycobilimbia lobulata</i>	1
<i>Saxifraga oppositifolia</i>	1
<i>Lecidea ramulosa</i>	1
<i>Bryonora castanea</i>	1
<i>Cladonia phyllophora</i>	1
<i>Bryum subneodamense</i>	1
<i>Polytrichastrum fragile</i>	1

Table 4 continued.

Plant community	Moist Acidic tundra						Moist Non-Acidic tundra															
	Beran-Ervag		Spjten-Ervag		Ladpal-Ervag		Luzcon-Dicelo		Drynt-Carbig		Errit-Racian		Novga-Drynt		Drynt-Carbig		Saxopp-Perdac		Caragu-Tomiti			
	I-1B	I-1A	O-2	I-4	A-1	B-1B	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	B-1A	I-3C	B-1A	I-3C	B-1A	I-3C	B-1A	I-3C	Freq.	
<i>Leptogium gelatinosum</i>	1
<i>Lobaria linita</i>	1
<i>Lopadium coralloideum</i>	1
<i>Nephroma expallidum</i>	1
<i>Pannaria pezizoides</i>	1
<i>Peltigera venosa</i>	1
<i>Psoroma hypnorum</i>	1
<i>Rinodina turfacea</i>	1
<i>Saxifraga serpyllifolia</i>	1
<i>Bryum aeneum</i>	1
<i>Cladonia subsquamosa</i>	1
<i>Alopecurus alpina</i>	1
Companion Species	1
<i>Dactylina arctica</i>	+	+	+	+	1	1	+	+	+	+	2	1	2	1	2	1	2	1	2	1	12	
<i>Flavocetraria cucullata</i>	+	+	+	+	1	1	+	+	+	2	1	+	1	2	1	2	1	2	1	2	12	
<i>Thamnolia vermicularis</i> var. <i>subuliformis</i>	+	+	+	+	1	1	.	.	.	1	2	1	2	1	2	1	2	1	2	1	12	
<i>Cassiope tetragona</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	9	
<i>Cetraria islandica</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	9	
<i>Aulacomnium turgidum</i>	.	1	2	+	2	1	2	2	2	2	1	.	.	.	.	.	.	.	.	.	.	9
<i>Peltigera aphthosa</i>	+	1	1	.	.	.	+	+	+	+	+	1	1	.	.	.	.	.	.	.	8	
<i>Hylocomium splendens</i>	+	4	2	.	.	.	.	2	1	1	.	.	.	.	.	.	.	.	.	.	.	7
<i>Carex bigelowii</i>	.	2	.	3	.	2	3	2	2	1	1	+	+	2	3	1	+	+	+	+	7	
<i>Dicranum elongatum</i>	2	2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	7	
<i>Ochrolechia frigida</i>	2	2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	7	
<i>Vaccinium uliginosum</i>	.	1	.	.	.	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	6	
<i>Bistorta bistortoides</i>	.	1	+	.	.	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	6	
<i>Dicranum spadicaceum</i>	.	1	.	1	.	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	5	
<i>Bryocaulon divergens</i>	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
<i>Luzula arctica</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
<i>Saxifraga nelsoniana</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	4	
<i>Cladonia uncialis</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	4	
<i>Alectoria nigricans</i>	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4

Table 4 continued.

Plant community	Moist Acidic tundra					Moist Non-Acidic tundra					Caragu-Tomtit			
	Arfjur-Luzarc	Berhan-Ervag	Berhan-Ervag	Sphien-Ervag	Ladpal-Ervag	Luzcon-Dicelo	Drynt-Carbig	Errit-Racian	Novgia-Drynt	Drynt-Carbig		Saxopp-Perdac		
Species	I-1B	I-1A	O-2	I-4	A-1	B-1B	O-1A	O-1B	I-3B	I-3A	I-3C	B-1A	B-1A	Freq.
<i>Sanonia uncinata</i>	.	.	r	.	.	+	.	.	.	.	.	.	+	3
<i>Cladonia gracilis</i>	.	.	+	.	.	+	+	3
<i>Cetraria laevigata</i>	r	1	.	.	.	.	.	.	2	3
<i>Alectoria ochroleuca</i>	+	.	+	.	.	3
<i>Bryoria nitidula</i>	+	.	.	+	.	+	.	.	3
<i>Pertusaria dactylina</i>	+	+	.	2	.	.	3
<i>Pedicularis lanata</i>	+	.	.	+	.	+	.	.	3
<i>Hypnum subimponens</i>	.	.	+	3
<i>Poa arctica</i>	+	.	.	.	+	.	.	+	3
<i>Oncophorus wahlenbergii</i>	2	2
<i>Hypgymnia subobscura</i>	1	.	.	.	.	.	.	.	2	2
<i>Warnstorfia sarmentosa</i>	+	1	.	.	2
<i>Juncus biglumis</i>	1	.	.	.	.	.	.	.	.	.	.	.	r	2
<i>Carex aquatilis</i>	+	4	2
<i>Cladina rangiferina</i>	+	r	2
<i>Cladonia scabriuscula</i>	+	+	2
<i>Cladonia subfurcata</i>	r	.	.	.	.	.	.	+	2
<i>Luzula confusa</i>	3	.	.	.	.	.	.	r	2
<i>Salix rotundifolia</i>	+	3	2
Richness	22	55	40	30	34	43	50	45	59	59	27	57	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 Species	<div style="display: flex; justify-content: space-around; text-align: center;"> <div style="transform: rotate(-45deg); font-size: small;">Rubcha-Betnan</div> <div style="transform: rotate(-45deg); font-size: small;">Eriang-Salpa</div> <div style="transform: rotate(-45deg); font-size: small;">Calstr-Eriang</div> </div>		
	I-2B	I-2A	I-2C
<i>Eriophorum angustifolia</i>	1	3	4
<i>Salix planifolia</i> ssp. <i>pulchra</i>	1	4	3
<i>Hylocomium splendens</i>	4	4	+
<i>Petasites frigidus</i>	2	3	+
<i>Poa arctica</i>	+	+	+
<i>Rubus chamaemorus</i>	4	3	.
<i>Betula nana</i> ssp. <i>exilis</i>	4	1	.
<i>Pyrola grandifolia</i>	1	1	.
<i>Peltigera leucophlebia</i>	1	+	.
<i>Polytrichum strictum</i>	+	+	.
<i>Saxifraga nelsoniana</i>	+	+	.
<i>Aulacomnium palustre</i> var. <i>imbricatum</i>	.	2	1
<i>Sphagnum teres</i>	.	2	+
<i>Eriophorum vaginatum</i>	1	.	.
<i>Sphagnum girgensohnii</i>	1	.	.
<i>Carex bigelowii</i>	1	.	.
<i>Aulacomnium turgidum</i>	1	.	.
<i>Peltigera apthosa</i>	1	.	.
<i>Cladonia pleurota</i>	+	.	.
<i>Cladonia gracilis</i>	+	.	.
<i>Cladonia squamosa</i>	+	.	.
<i>Dicranum angustum</i>	+	.	.
<i>Dicranum elongatum</i>	+	.	.
<i>Dactylina arctica</i>	+	.	.
<i>Flavocetraria cucullata</i>	+	.	.
<i>Sphenolobus minutus</i>	+	.	.
<i>Vaccinium uliginosum</i>	r	.	.
<i>Polemonium acutiflorum</i>	.	1	.
<i>Valeriana capitata</i>	.	1	.
<i>Sanonia uncinata</i>	.	1	.
<i>Stellaria laeta</i>	.	1	.
<i>Plagiomnium ellipticum</i>	.	+	.
<i>Peltigera</i> cf. <i>Horizontalis</i>	.	+	.
<i>Tomentypnum nitens</i>	.	+	.
<i>Pedicularis lanata</i>	.	r	.
<i>Calliargon stramineum</i>	.	.	3
<i>Eriophorum scheuchzeri</i>	.	.	2
<i>Arctagrostis latifolia</i> ssp. <i>latifolia</i>	.	.	1
<i>Anemone richardsonii</i>	.	.	+
Richness	25	21	11

Table 6 continued.

site	veg type	SR#	moss	lichen	equilium	forb	dead shrub stem	live shrub stem	evergm. shrub stem	dead evergm. leaf	live granitoid	dead granitoid	dead granitoid	evergm. reproduction	dead reproduction	TOTAL	filter	total evergm. shrub	total dead shrub	total granitoid	total vascular	total shrub	
Oumalik2	MAT	A-11	5.79	3.17	0	7.46	1.13	0.38	10.2	10.41	0.86	5.79	20.37	0	0.3	65.86	2.03	21.77	8.97	26.16	56.9	30.74	
Oumalik2	MAT	B-3	33.28	1.48	0	0.07	22.24	3.62	2.32	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	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	11.72	0.02	0.19	89.07	3.61	25.81	25.22	13.23	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	69.97	5.02	16.54	10.22	18.46	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	42.55	0	0	120	25.31	17.73	50.25	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	69.05	0	0	163	7.27	33.4	102.38	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	13.01	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	60.92	0	0	129.2	25.78	10.11	74.03	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	12.33	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	27.58	0	0	108.3	30.29	22.73	37.41	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	10.03	39.54	29.51	
Ivotuk1	MAT	A-9	17.96	6.66	0	0.19	13.04	4.18	1.28	18.61	14.89	1.7	8.28	21.13	0	0	107.3	35.2	18.5	29.41	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	22.92	0	0	73.45	20.81	13.91	35.52	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	16.19	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	18.85	0	0	69.62	17.53	2.02	28.28	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	16.22	0	0	70.08	29.57	8.16	23.93	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	12.88	0	0	100.2	18.46	28.56	19.41	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	18.19	0	0	65.15	22.98	6.3	34.57	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	62.08	0	0	124.5	26.07	12.34	78.94	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	132.5	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	10.08	0	0	83.52	7.88	5.06	16.26	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	102.4	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	19.96	0	0	33.72	0	0	30.05	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
17-Jul	BARROW	A2	1.28	5-Jul	OUMALIK1	K05	1.92
17-Jul	BARROW	A4	0.05	5-Jul	OUMALIK1	K07	1.35
17-Jul	BARROW	A7	1.45	5-Jul	OUMALIK1	K08	0.51
17-Jul	BARROW	B6	0.73	5-Jul	OUMALIK1	J10	0.19
17-Jul	BARROW	B8	1.42	5-Jul	OUMALIK1	J08	1.07
17-Jul	BARROW	B10	1.11	5-Jul	OUMALIK1	J02	0.35
17-Jul	BARROW	C1	0.24	5-Jul	OUMALIK1	I06	0.59
17-Jul	BARROW	C8	1.4	5-Jul	OUMALIK1	I07	0.27
17-Jul	BARROW	C9	0.41	5-Jul	OUMALIK1	I11	0.31
17-Jul	BARROW	D7	0.39	5-Jul	OUMALIK1	H08	1.28
17-Jul	BARROW	D9	0.43	5-Jul	OUMALIK1	H06	0.33
17-Jul	BARROW	D11	0.99	5-Jul	OUMALIK1	H03	0.18
17-Jul	BARROW	E1	1	5-Jul	OUMALIK1	G02	1.48
17-Jul	BARROW	E4	0.79	5-Jul	OUMALIK1	G05	0.71
17-Jul	BARROW	E8	0.63	5-Jul	OUMALIK1	G06	0.42
17-Jul	BARROW	F1	0.18	5-Jul	OUMALIK1	F04	0.55
17-Jul	BARROW	F3	1.01	5-Jul	OUMALIK1	F03	0.42
17-Jul	BARROW	F4	0.88	5-Jul	OUMALIK1	F02	0.56
17-Jul	BARROW	G1	0.75	5-Jul	OUMALIK1	E02	1.87
17-Jul	BARROW	G7	0.49	5-Jul	OUMALIK1	E06	0.08
17-Jul	BARROW	G8	1.28	5-Jul	OUMALIK1	E08	0.79
17-Jul	BARROW	H1	0.62	5-Jul	OUMALIK1	D09	0.42
17-Jul	BARROW	H2	0.45	5-Jul	OUMALIK1	D08	0.36
17-Jul	BARROW	H10	0.46	5-Jul	OUMALIK1	D03	0.4
17-Jul	BARROW	I3	0.41	5-Jul	OUMALIK1	C02	0.31
17-Jul	BARROW	I7	0.74	5-Jul	OUMALIK1	B01	0.06
17-Jul	BARROW	I10	0.64	5-Jul	OUMALIK1	A02	0.22
17-Jul	BARROW	J1	0.3	5-Jul	OUMALIK1	A06	0.07
17-Jul	BARROW	J4	0.85	5-Jul	OUMALIK1	A10	0.68
17-Jul	BARROW	J5	0.98	5-Jul	OUMALIK1	B10	0.62
17-Jul	BARROW	K3	1.18	5-Jul	OUMALIK1	B09	0.21
17-Jul	BARROW	K4	0.38	5-Jul	OUMALIK1	C09	0.39
17-Jul	BARROW	K7	0.94	5-Jul	OUMALIK1	C11	1.12
15-Jul	ATQASUK	A2	0.77	9-Jul	OUMALIK2	A05	4.39
15-Jul	ATQASUK	A5	0.87	9-Jul	OUMALIK2	A10	1.35
15-Jul	ATQASUK	A8	0.86	9-Jul	OUMALIK2	B08	3.13
15-Jul	ATQASUK	B5	0.91	9-Jul	OUMALIK2	B05	2.75
15-Jul	ATQASUK	B6	1.21	9-Jul	OUMALIK2	B03	2.21
15-Jul	ATQASUK	B9	0.77	9-Jul	OUMALIK2	C05	1.49
15-Jul	ATQASUK	C1	1.32	9-Jul	OUMALIK2	C08	1.09
15-Jul	ATQASUK	C3	1.09	9-Jul	OUMALIK2	C11	0.64
15-Jul	ATQASUK	C10	2.07	9-Jul	OUMALIK2	D06	2.79
15-Jul	ATQASUK	D1	0.74	9-Jul	OUMALIK2	D05	1.8

Table 7 continued.

DATE	GRID	POINT	LAI
15-Jul	ATQASUK	D10	1.15
15-Jul	ATQASUK	E5	1.62
15-Jul	ATQASUK	E7	1.03
15-Jul	ATQASUK	E11	1.36
15-Jul	ATQASUK	D2	1.79
15-Jul	ATQASUK	F2	1.36
15-Jul	ATQASUK	F7	1.62
15-Jul	ATQASUK	F10	0.8
15-Jul	ATQASUK	G4	0.66
15-Jul	ATQASUK	G5	1.21
15-Jul	ATQASUK	G10	1.1
15-Jul	ATQASUK	H2	2.36
15-Jul	ATQASUK	H5	0.21
15-Jul	ATQASUK	H10	0.84
15-Jul	ATQASUK	I4	0.95
15-Jul	ATQASUK	I7	1
15-Jul	ATQASUK	I9	0.78
15-Jul	ATQASUK	J1	1.16
15-Jul	ATQASUK	J8	0.99
15-Jul	ATQASUK	J11	1.04
15-Jul	ATQASUK	K1	0.33
15-Jul	ATQASUK	K3	1.7
15-Jul	ATQASUK	K6	0.77

DATE	GRID	POINT	LAI
9-Jul	OUMALIK2	E01	1.23
9-Jul	OUMALIK2	E05	3.09
9-Jul	OUMALIK2	E06	2.05
9-Jul	OUMALIK2	F04	0.72
9-Jul	OUMALIK2	D03	1.47
9-Jul	OUMALIK2	F02	1.63
9-Jul	OUMALIK2	F01	1.33
9-Jul	OUMALIK2	G02	0.68
9-Jul	OUMALIK2	G04	1.51
9-Jul	OUMALIK2	G04	1.41
9-Jul	OUMALIK2	H04	2.15
9-Jul	OUMALIK2	H05	1.86
9-Jul	OUMALIK2	H06	1.14
9-Jul	OUMALIK2	I04	1.24
9-Jul	OUMALIK2	I06	1.21
9-Jul	OUMALIK2	I09	0.89
9-Jul	OUMALIK2	J10	1.09
9-Jul	OUMALIK2	J06	0.83
9-Jul	OUMALIK2	J01	1.4
9-Jul	OUMALIK2	K02	1.63
9-Jul	OUMALIK2	K04	1.44
9-Jul	OUMALIK2	K05	1.28

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

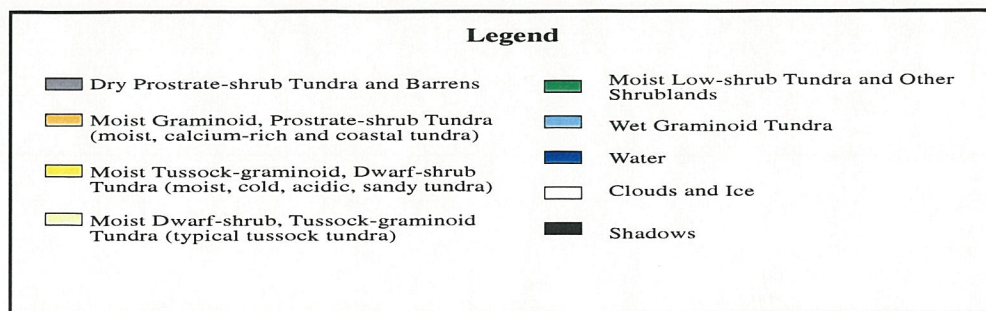
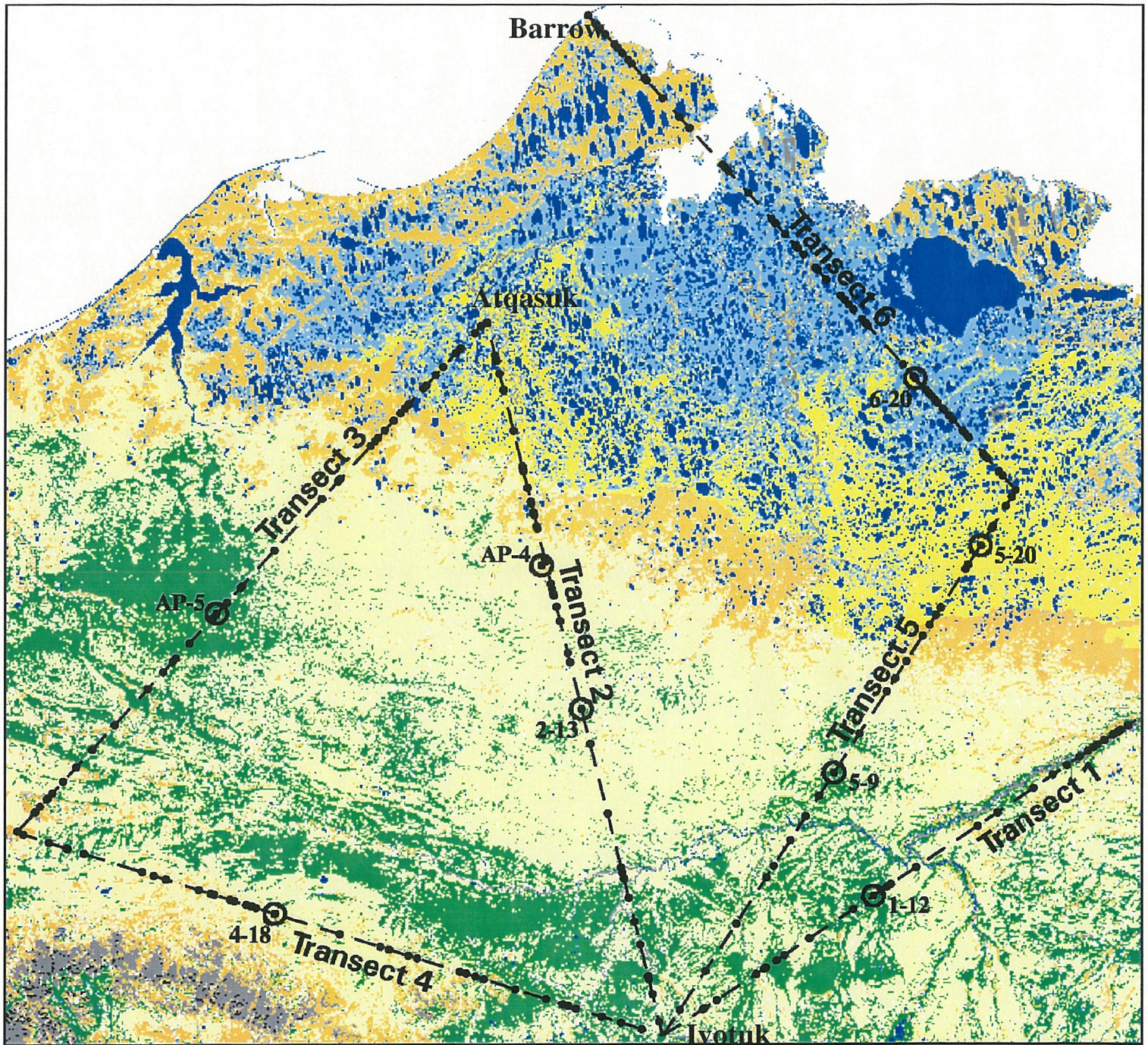


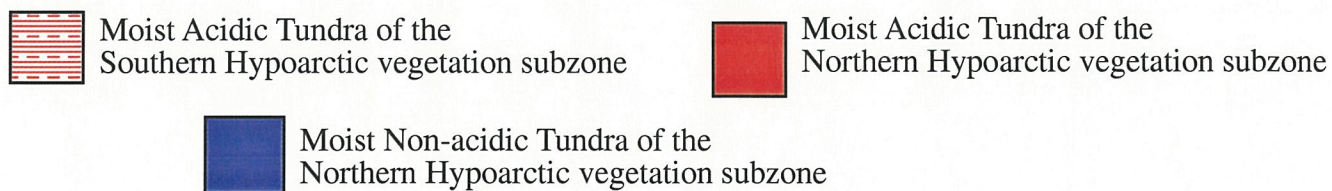
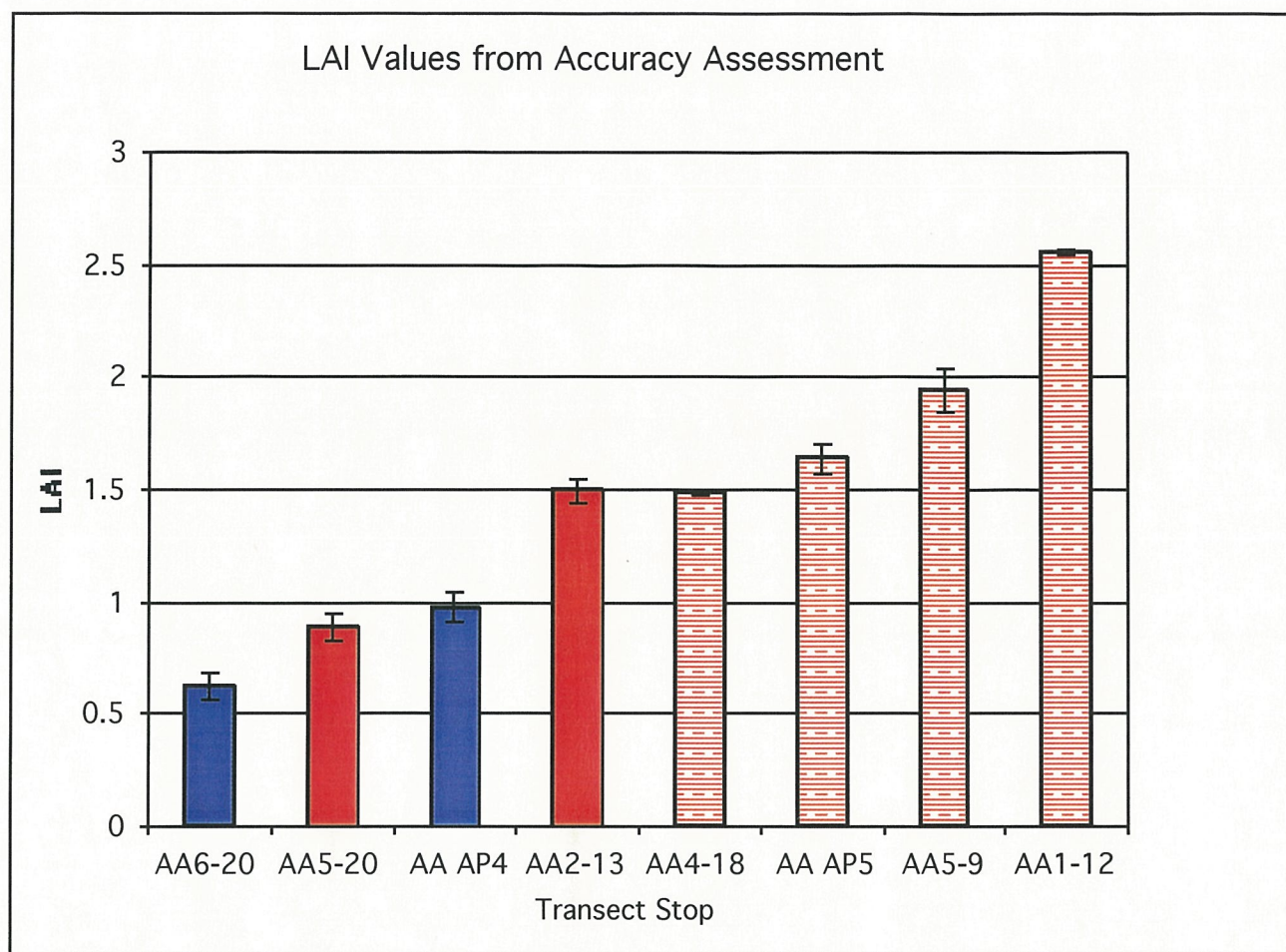
Table 8. LAI measurements for Accuracy Assessment ground stops, 11-18 July 1999.

transect point	LAI	transect point	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 point	LAI	transect point	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 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 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 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	AA 4-18	0.71		
AA1-12	0.26	AA1-12	3.24	AA 4-18	0.49	AA 4-18	0.97	AA 4-18	0.97		
AA1-12	3.25	AA1-12	0.95	AA 4-18	0.48	AA 4-18	1.86	AA 4-18	1.86		
AA1-12	1.3	AA1-12	0.39	AA 4-18	0.2	AA 4-18	0.37	AA 4-18	0.37		
AA1-12	0.81	AA1-12	4.99	AA 4-18	1.09	AA 4-18	0.24	AA 4-18	0.24		
AA1-12	3.22	AA1-12	1.02	AA 4-18	0.28	AA 4-18	2.46	AA 4-18	2.46		
AA1-12	2.34	AA1-12	6.56	AA 4-18	1.38	AA 4-18	3.18	AA 4-18	3.18		
AA1-12	0.99	AA1-12	0.4	AA 4-18	2.94	AA 4-18	2.12	AA 4-18	2.12		
AA1-12	1.25	AA1-12	2.01	AA 4-18	0.11	AA 4-18	0.59	AA 4-18	0.59		
AA1-12	5.22	AA1-12	5.18	AA 4-18	0.61	AA 4-18	0.12	AA 4-18	0.12		
AA1-12	4.21	AA1-12	2.34	AA 4-18	0.96	AA 4-18	1.38	AA 4-18	1.38		
AA1-12	1.66	AA1-12	1.46	AA 4-18	0.1	AA 4-18	1.59	AA 4-18	1.59		
AA1-12	2.76	AA1-12	0.42	AA 4-18	0.58	AA 4-18	1.24	AA 4-18	1.24		
AA1-12	1.66	AA1-12	3.43	AA 4-18	0.58	AA 4-18		AA 4-18			
AA1-12	1.1										

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



<u>Transect</u>	<u>Microsite</u>
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 interfluvium

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

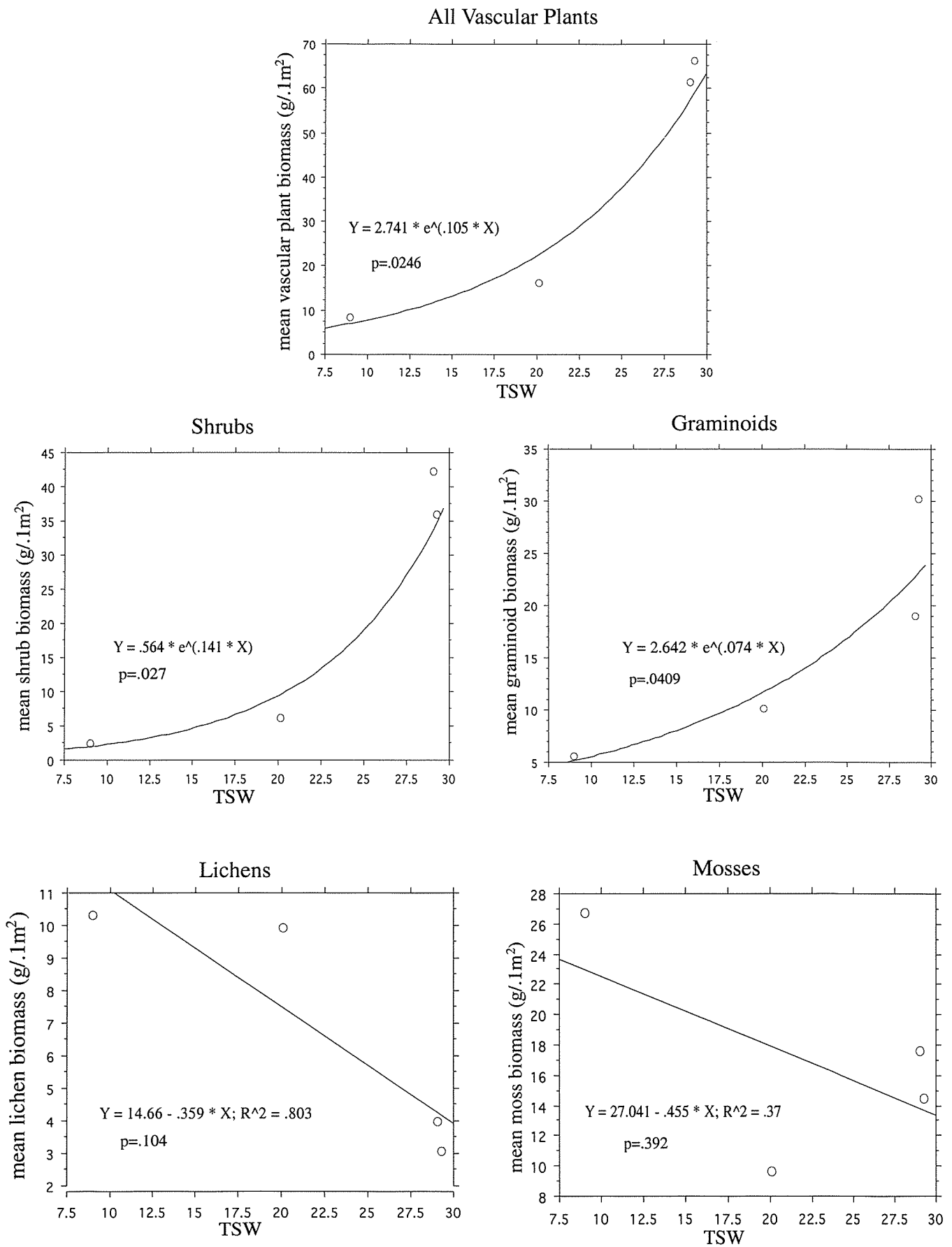


Figure 13. Changes in plant functional type dominance with increasing Total Summer Warmth.

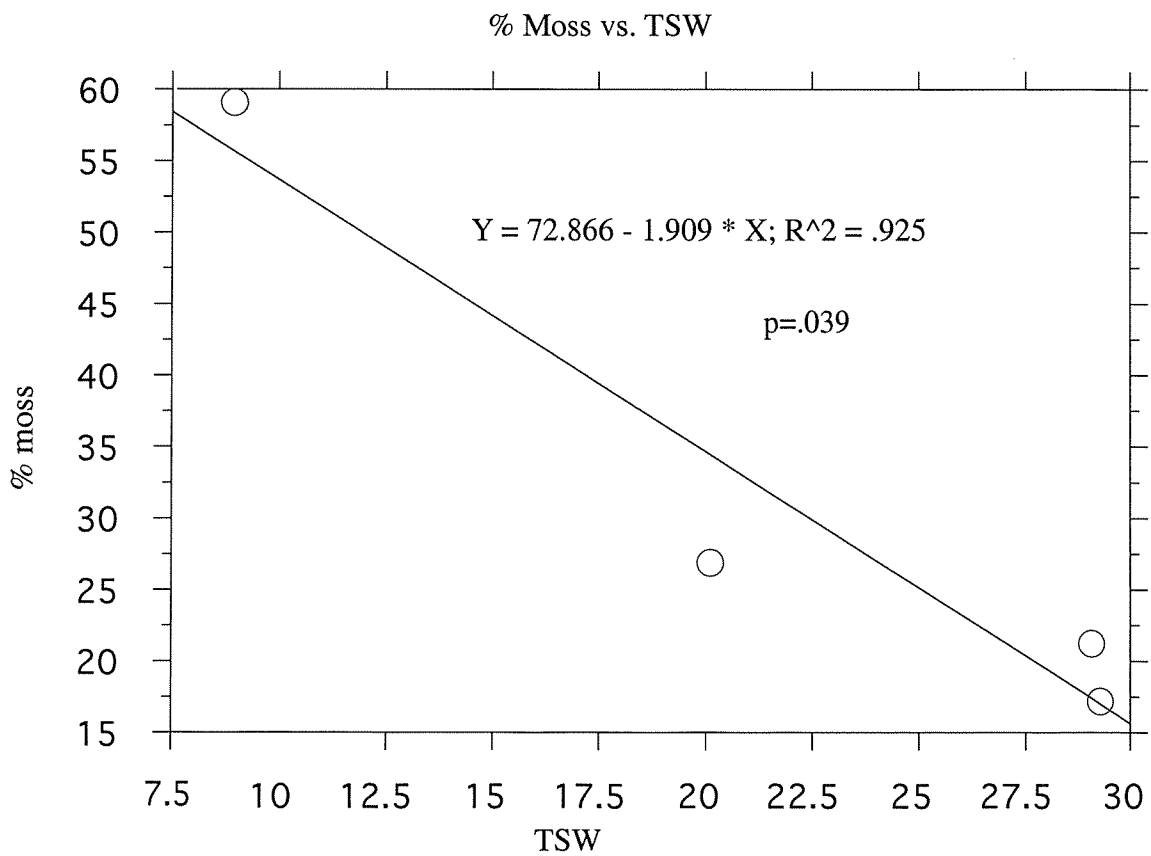
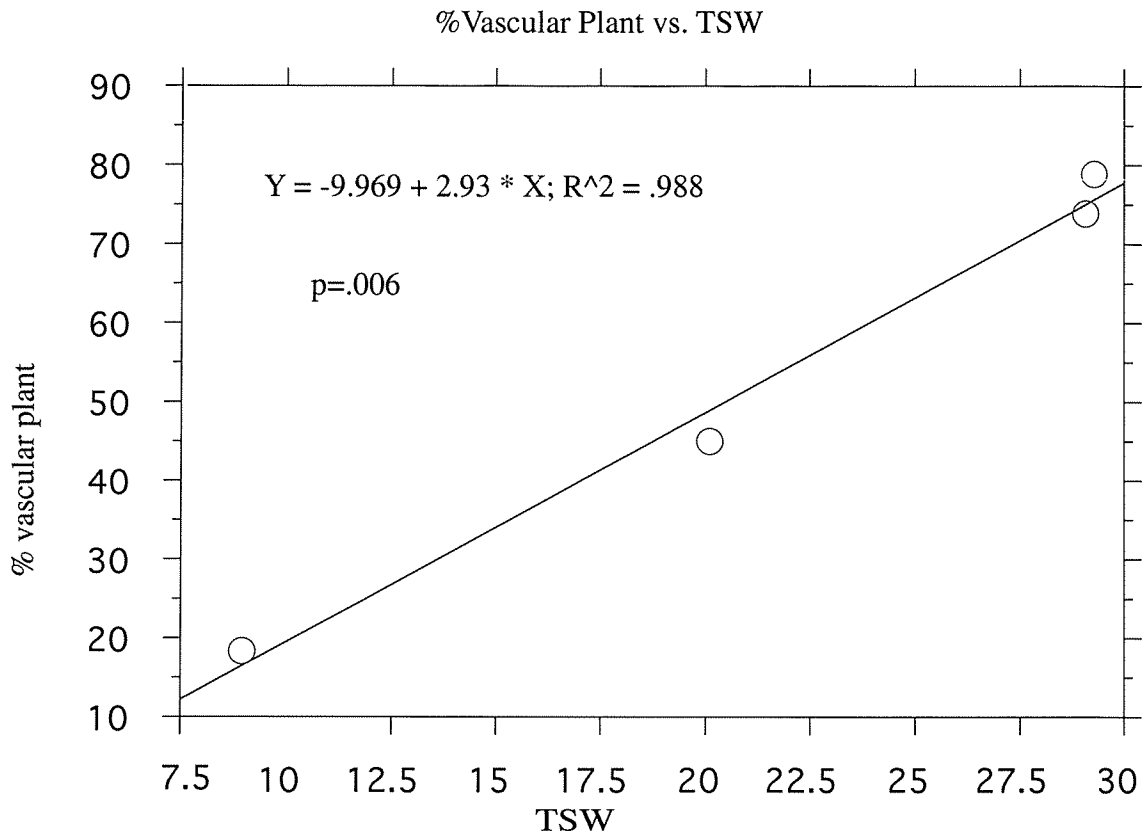


Figure 14. Interactions between moss and vascular plant abundance.

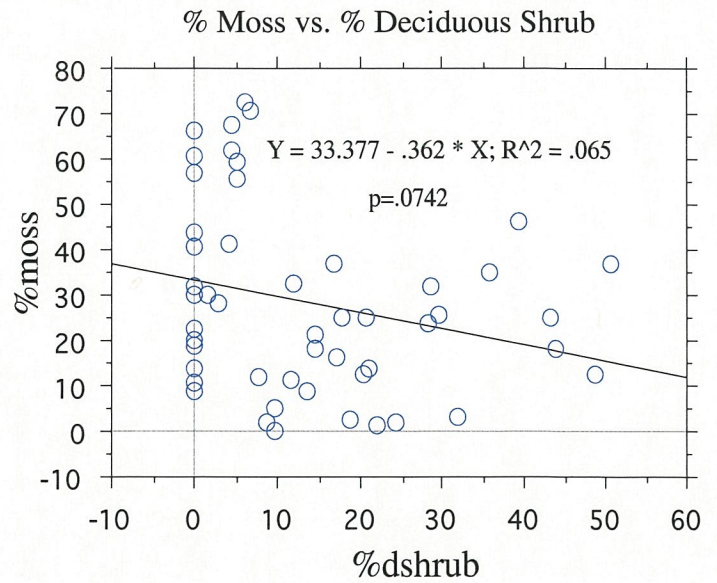
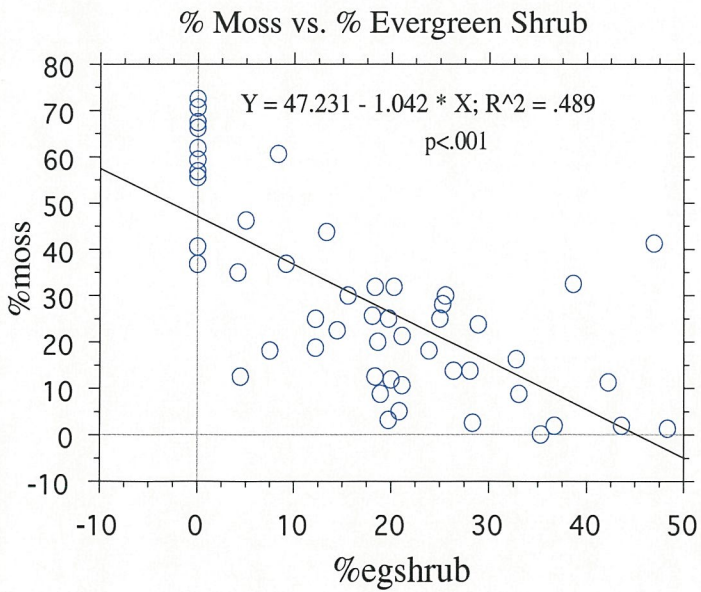
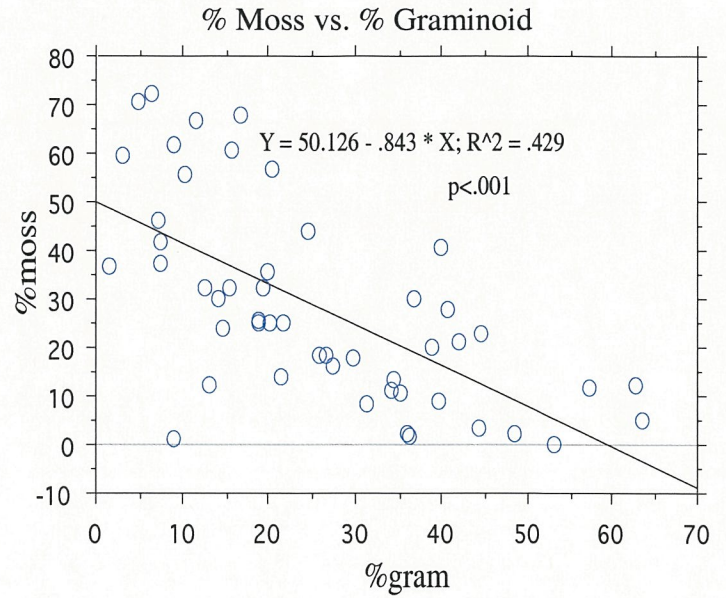
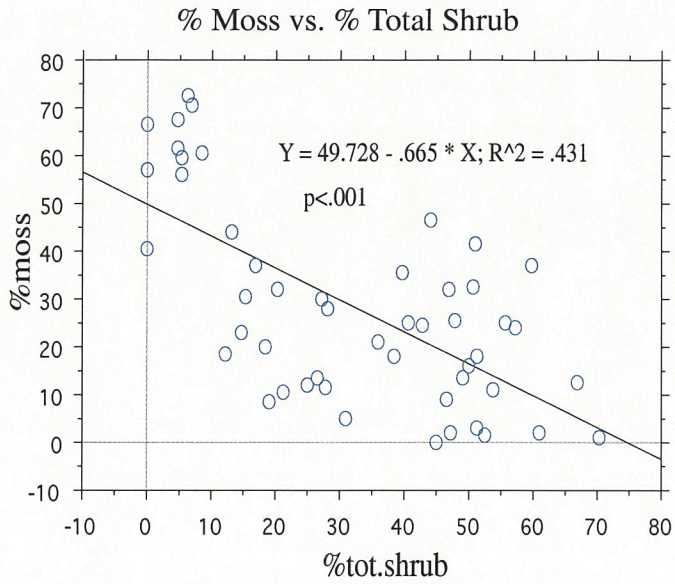


Figure 15. Trends in LAI with increasing TSW.

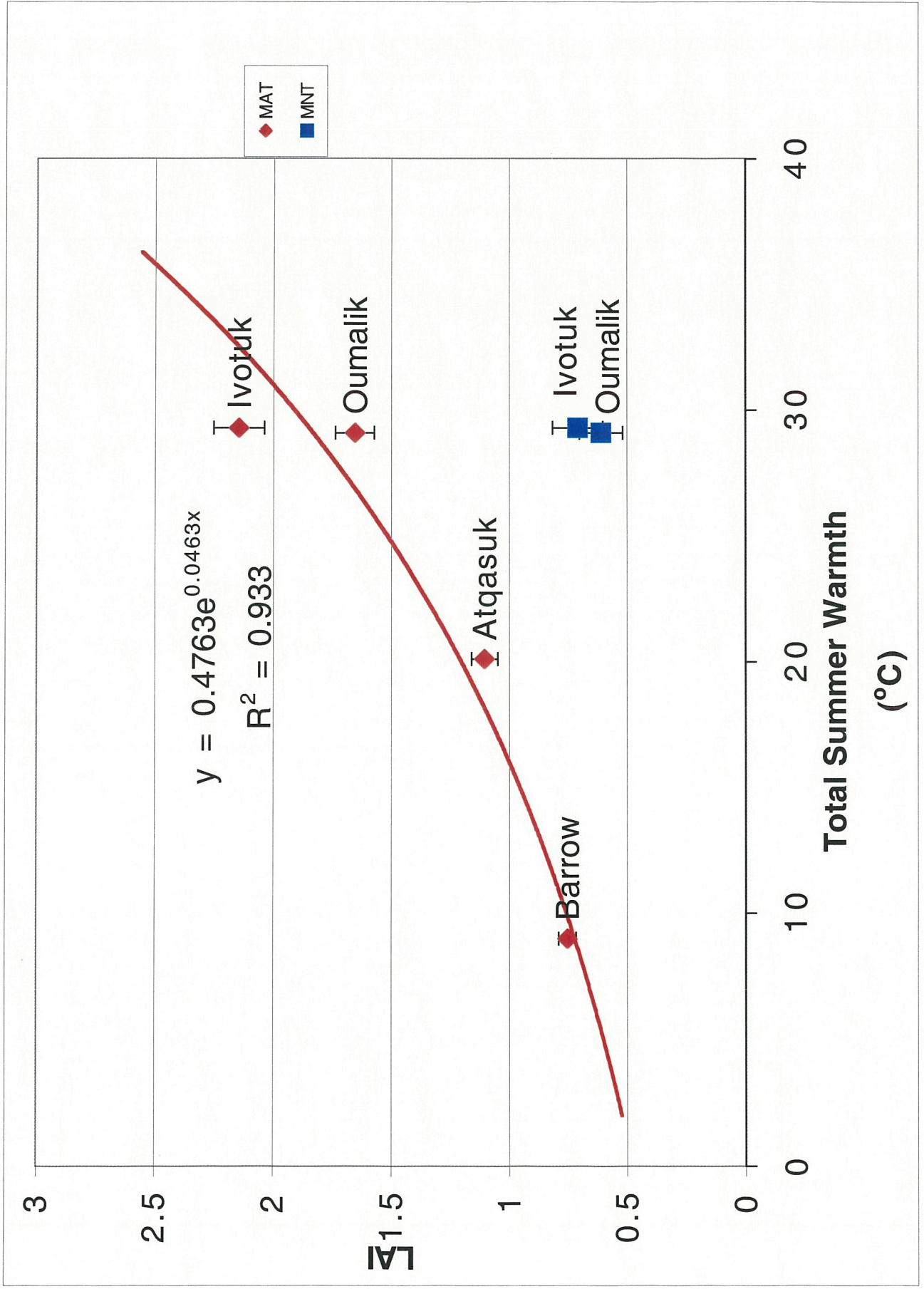
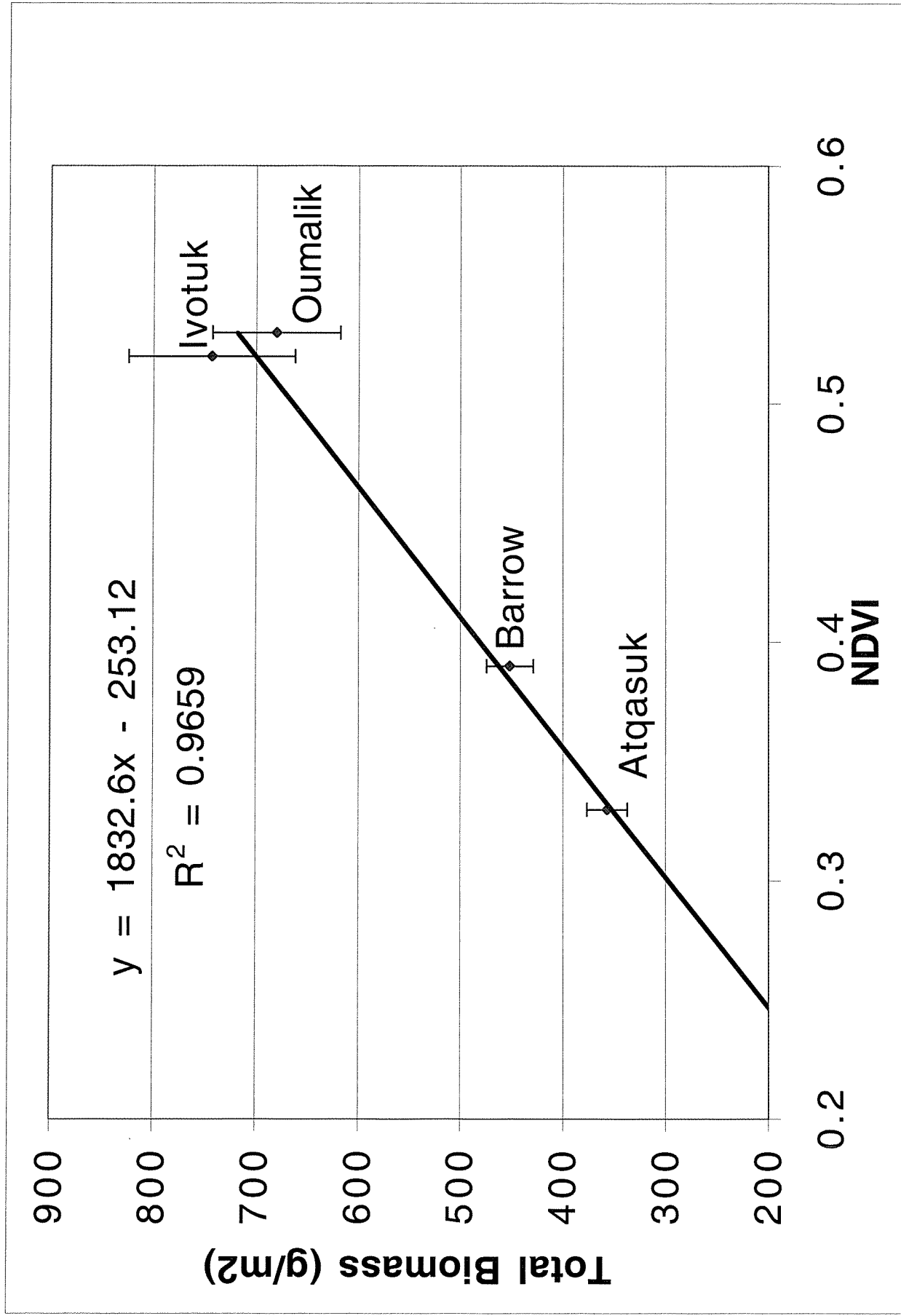


Figure 16. Relationship between NDVI and mean biomass for grid locations.



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

- 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
13
14
15

- Soil Units
1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryohemist, euic
4 Pergelic Cryosaprist, euic
5 Lithic Pergelic Cryosaprist
6 Pergelic Cryofibril, 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

- 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

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

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 Inactive dune
14
15
16

- 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

- 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

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

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

- 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

- 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

- 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: Near crest of dune

Relevé 6:20
 GPS 70 20.027 153 50.673 120 ft elev
 photo 3D-7,6
 Transect #3

Note: See field book for species data!

Study Site: Transect #3 **1999 Accuracy Assessment: Site Description**

Relevé No: AP-5 Point ID #: AP-5 Date: July 16, 1999 Recording personnel: S. Walker
 Study area description: Fragaria N. ... cor pt ... Solanum ...
 GPS Coordinates N: 69° 35.76 Slope(deg): 20 Elevation: 450 ft
 W: 159° 21.05 Aspect: _____

Record numbers for all microsites.

- Landforms**
- Hills (including kames and moraines)
 - Talus slope
 - Colluvial basin
 - Glaciofluvial and other fluvial terraces
 - Marine terrace
 - Floodplains
 - Drained lakes and flat lake margins
 - Abandoned point bars and sloughs
 - Estuary
 - Lake or pond
 - Stream
 - Sea bluff
 - Lake bluff
 - Stream bluff
 - Sand dunes
 - Beach
 - Disturbed
 - _____
 - _____
 - _____
 - _____
 - _____

- Microsites**
- Frost-scar element
 - Inter-frost scar element
 - Strang or hummock
 - Flark, interstrang, or interhummock area
 - Polygon center
 - Polygon trough
 - Polygon rim
 - Stripe element
 - Inter-stripe element
 - Point bar (raised element)
 - Slough (wet element)
 - _____
 - _____
 - _____
 - _____

- Soil Units**
- Pergelic Cryorthent, acid
 - Pergelic Cryopsamment
 - Pergelic Cryohemist, euic
 - Pergelic Cryosaprist, euic
 - Lithic Pergelic Cryosaprist
 - Pergelic Cryofibrist, euic
 - Histic Pergelic Cryaquept, acid
 - Histic Pergelic Cryaquept, nonacid
 - Pergelic Cryaquept, acid ?
 - Pergelic Cryaquept, nonacid
 - Pergelic Cryochrept
 - Pergelic Cryumbrept
 - Ruptic-Lithic Cryumbrept
 - Pergelic Cryaquoil
 - Histic Pergelic Cryaquoil
 - Pergelic Cryoboroll
 - _____
 - _____
 - _____
 - _____

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

- Exposure Scale**
- Protected from winds
 - Moderate exposure to winds
 - Exposed to winds
 - Very exposed to winds

- Surficial Geology (Parent Material)**
- Glacial tills
 - Glaciofluvial deposits
 - Active alluvial sands
 - Active alluvial gravels
 - Stabilized alluvium (sands & gravels)
 - Undifferentiated hill slope colluvium
 - Basin colluvium and organic deposits
 - Drained lake or lacustrine organic deposits
 - Lake or pond organic, sand, or silt
 - Undifferentiated sands
 - Undifferentiated clay
 - Roads and gravel pads
 - _____
 - _____
 - _____
 - _____

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

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

- Surficial Geomorphology**
- Frost scars
 - Wetland hummocks
 - Turf hummocks
 - Gelifluction features
 - Strangmoor or aligned hummocks
 - High- or flat-centered polygons
 - Mixed high- and low-centered polygons
 - Sorted and non-sorted stripes
 - Palsas
 - Thermokarst pits
 - Featureless or with less 20% frost scars
 - Well-developed hillslope water tracks and small streams > 50 cm deep
 - Poorly developed hillslope water tracks, < 50 cm deep
 - Gently rolling or irregular microrelief
 - Stoney surface
 - Lakes and ponds
 - Disturbed
 - _____
 - _____
 - _____
 - _____
 - _____

- Glacial Geology**
- Till
 - Outwash
 - Bedrock
 - _____
 - _____
 - _____
 - _____

- Animal and Human Disturbance**
- No sign present
 - Some sign present; no disturbance
 - Minor disturbance or extensive sign grazing
 - Major disturbance; multiple dens or noticeable trampling
 - Very major disturbance; very extensive tunneling or large pit

- Topographic Position**
- Hill crest or shoulder
 - Side slope
 - Footslope or toeslope
 - Flat
 - Drainage channel
 - Depression
 - Lake or pond

- Stability**
- Stable
 - Subject to occasional disturbance
 - Subject to prolonged but slow disturbance such as solifluction
 - Annually disturbed
 - Disturbed more than once annually

Other notes: Site record ...

Location Ketik R. Date 7/16/99

Project / Client Releve AP-S Transect #3

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

99-

Site data is on data form

Releve AP-S Photos 11-25-10, 9, 8

Moist Saligia Carrion, Eriuaq, Open low structure
on broad interfluvium

- Saligia 2 + Camste + * Pelaph +
- Salpia 2 - Tomnet 2
- Corbig 2 + Aulpal 1
- Petofri 1 + Aultus 2
- Eriuaq 2 * Polka (Carrion) +
- Polaca + Hylspl 1
- Valeap 1 Dicranum +
- Suuaq + Pti Crista cauda +
- Pyrgia + Polstri +
- Vucant +

Ladde +	tussock ht 30	low shrubs	50%	Rock 0
Sallant	veg ht 40	dwarf shrubs	40%	sed 0
Betnan +	shrub ht 40	medium shrubs	0+	Hyd 0
Eriuaq 3		dwarf shrubs	50	FS 0
Salaxi +		forbs	1	Red 10
		grasslands	40	
		lichen +		
		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: Raised 10-m high hill at coastal plain/foot hill transition w/ MNT
GPS Coordinates N: 69° 47.28 Slope(deg): 5° Elevation: 400 ft
W: 156° 49.16 Aspect: W

Record numbers for all microsites.

- Landforms**
- Hills (including kames and moraines)
 - Talus slope
 - Colluvial basin
 - Glaciofluvial and other fluvial terraces
 - Marine terrace
 - Floodplains
 - Drained lakes and flat lake margins
 - Abandoned point bars and sloughs
 - Estuary
 - Lake or pond
 - Stream
 - Sea bluff
 - Lake bluff
 - Stream bluff
 - Sand dunes
 - Beach
 - Disturbed
 - _____
 - _____
 - _____
 - _____

- Microsites**
- Frost-scar element
 - Inter-frost scar element
 - Strang or hummock
 - Flark, interstrang, or interhummock area
 - Polygon center
 - Polygon trough
 - Polygon rim
 - Stripe element
 - Inter-stripe element
 - Point bar (raised element)
 - Slough (wet element)
 - _____
 - _____
 - _____
 - _____

- Soil Units**
- Pergelic Cryorthent, acid
 - Pergelic Cryopsamment
 - Pergelic Cryohemist, euic
 - Pergelic Cryosaprist, euic
 - Lithic Pergelic Cryosaprist
 - Pergelic Cryofibrist, euic
 - Histic Pergelic Cryaquept, acid
 - Histic Pergelic Cryaquept, nonacid
 - Pergelic Cryaquept, acid
 - Pergelic Cryaquept, nonacid
 - Pergelic Cryochrept
 - Pergelic Cryumbrept
 - Ruptic-Lithic Cryumbrept
 - Pergelic Cryaquoll
 - Histic Pergelic Cryaquoll
 - Pergelic Cryoboroll
 - _____
 - _____
 - _____
 - _____

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

- Exposure Scale**
- Protected from winds
 - Moderate exposure to winds
 - Exposed to winds
 - Very exposed to winds

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

- Surficial Geology (Parent Material)**
- Glacial tills
 - Glaciofluvial deposits
 - Active alluvial sands
 - Active alluvial gravels
 - Stabilized alluvium (sands & gravels)
 - Undifferentiated hill slope colluvium
 - Basin colluvium and organic deposits
 - Drained lake or lacustrine organic deposits
 - Lake or pond organic, sand, or silt
 - Undifferentiated sands
 - Undifferentiated clay
 - Roads and gravel pads
 - Silt loess
 - _____
 - _____
 - _____

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

- Animal and Human Disturbance**
- No sign present
 - Some sign present; no disturbance
 - Minor disturbance or extensive sign Corv. b
 - Moderate disturbance; small dens or light grazing
 - Major disturbance; multiple dens or noticeable trampling
 - Very major disturbance; very extensive tunneling or large pit

- Surficial Geomorphology**
- Frost scars
 - Wetland hummocks
 - Turf hummocks
 - Gelifluction features
 - Strangmoor or aligned hummocks
 - High- or flat-centered polygons
 - Mixed high- and low-centered polygons
 - Sorted and non-sorted stripes
 - Palsas
 - Thermokarst pits
 - Featureless or with less 20% frost scars
 - Well-developed hillslope water tracks and small streams > 50 cm deep
 - Poorly developed hillslope water tracks, < 50 cm deep
 - Gently rolling or irregular microrelief
 - Stoney surface
 - Lakes and ponds
 - Disturbed
 - _____
 - _____
 - _____
 - _____

- Glacial Geology**
- Till
 - Outwash
 - Bedrock
 - Unglaciated
 - _____
 - _____
 - _____

- Topographic Position**
- Hill crest or shoulder
 - Side slope
 - Footslope or toeslope
 - Flat
 - Drainage channel
 - Depression
 - Lake or pond

- Stability**
- Stable
 - Subject to occasional disturbance
 - Subject to prolonged but slow disturbance such as solifluction
 - Annually disturbed
 - Disturbed more than once annually

Other notes: _____

Study Site:

1999 Accuracy Assessment: Site Description

Relevé No.: 5-9 Point ID #: 5-9 Date: July Recording personnel: S. Walk
Study area description: Alver Savanna south of Maple Creek
GPS Coordinates N: 69° 13.761 W: 154° 29.312 Slope(deg): 8° Elevation: 600 ft
Aspect: SE

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

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
13
14
15

Soil Units

- 1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryohemist, euic
4 Pergelic Cryosaprist, euic
5 Lithic Pergelic Cryosaprist
6 Pergelic Cryofibrst, 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

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 subhygic - considerable moisture; depressions
8 Subhygic - very considerable moisture; saturated but with < 5% standing water < 10 cm deep
9 Hygic - 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

Exposure Scale

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

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

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

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

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

Glacial Geology

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

Animal and Human Disturbance

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

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

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:

Blank lines for other notes.

Study Site:

1999 Accuracy Assessment: Site Description

Relevé No.: A-18 Point ID #: A-18 Date: July 13, 1999 Recording personnel: S. Walker
Study area description: Gentle N facing slope with tussock tundra near Liberator Ridge (7.5 km SW)
GPS Coordinates N: 68° 46' W: 158° 42' Slope(deg): 5° Aspect: NW Elevation: ~1200 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

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
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 subhygic - considerable moisture; depressions
8 Subhygic - very considerable moisture; saturated but with < 5% standing water < 10 cm deep
9 Hygic - 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 Possible with all
5 Association Tors on
6 ridges
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: Finally large Tors on w/ lots of shrubs 50% shrubs

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

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

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 (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
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 Stony surface
16 Lakes and ponds
17 Disturbed
18
19
20
21

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 (classified as 3.1) in broad hill 500m of Colville Rive
GPS Coordinates N: 69° 23.48 W: 156° 27.28 Slope(deg): 20 Aspect: NW Elevation: 600m?

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

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

Soil Units

- 1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryohemist, euic
4 Pergelic Cryosaprist, euic
5 Lithic Pergelic Cryosaprist
6 Pergelic Cryofibrst, 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

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

Exposure Scale

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

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

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

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

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

Glacial Geology

- 1 Till
2 Outwash
3 Bedrock
4 Unconsolidated
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

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: Good example of tussock tundra (classified as 3.1) in broad hill 500m of Colville Rive

Study Site:

1999 Accuracy Assessment Releve Data

Releve No. Q9-2-13 Date: July 15, 1999 Observer: S. Walker
 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 Eri.vag 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 cm Low Shrubs: 30/1/ <20cm Dwarf Shrubs: 29/1/ Evergreen Shrubs: 15/1/ Deciduous Shrubs: 35/1/ Forbs: +/1/ Graminoids: 45/1/ Lichens: +/1/ Bryophytes: 20/1/	Non-Living Cover (%) A/B/C Rocks: 0/1/ Bare Soil: 0/1/ Water: 0/1/ Frost Scars: 5/1/ Total Dead: 10/1/ Ht. Of Veg. Canopy (cm): 35/1/
	Ht. of tussocks, 10-15 cm	Ht of Tussocks 25 cm Ht of shrubs 35 cm

Species Cover Estimates

Vascular plants		Bryophytes		Lichens	
Species	Cover	Species	Cover	Species	Cover
<i>Eri.vag</i>	3/1	* <i>Aul.tur</i>	1/1	* <i>Plasca</i>	+/1
<i>Betnan</i>	3/1	✖ <i>Sph.war</i>	12/1	+ <i>Pelaph</i>	+/1
<i>Sai.pla</i>	3/1	+ <i>Sphang</i>	2/1	* <i>Dacroc</i>	+/1
<i>Loddec</i>	2/1	* <i>Hylspl</i>	1/1	<i>Thasub</i>	+/1
<i>Vac.vulb</i>	1/1	# <i>Sphgir</i>	2/1	<i>Claama</i>	+/1
<i>Vacvit</i>	1/1	* <i>Dic.ang</i>	+/1	<i>Clagreen</i>	+/1
<i>Armlas</i>	r/1	* <i>Bram.Sphag</i>	+/1		/1
<i>Carbig</i>	+/1	<i>Alve.Dicranum</i>	+/1		/1
<i>Empher</i>	+/1		/1		/1
<i>Polbis</i>	+/1		/1		/1
<i>Polgr: lon</i>	+/1		/1		/1
<i>Polgr: lon</i> (frost scars)	/1		/1		/1
<i>Arclat</i>	+/1		/1		/1
<i>Castet</i>	+/1		/1		/1
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	/1		/1		/1
	/1		/1		/1

30-35 cm

Study Site: 1-12

1-12

1999 Accuracy Assessment: Site Description

Relevé No.: 1 Point ID #: 1 Date: 7/12/99 Recording personnel: S. Walker 3/4 mi W of Dola Nagarwal R in EW valley
Study area description: Shrubby tssk tndr on S. facing slope
GPS Coordinates N: 68° 53.106 W: 154° 11.108 Slope(deg): 5° 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

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 Feature class slope
13
14
15

Soil Units

- 1 Pergelic Cryorthent, acid
2 Pergelic Cryopsamment
3 Pergelic Cryohemist, euic
4 Pergelic Cryosaprist, euic
5 Lithic Pergelic Cryosaprist
6 Pergelic Cryofibril, 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

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 Unassociated
14
15
16

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 subhygic - considerable moisture; depressions
8 Subhygic - very considerable moisture; saturated but with < 5% standing water < 10 cm deep
9 Hygic - 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

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

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

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

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

Glacial Geology

- 1 Till
2 Outwash
3 Bedrock
4 Unassociated, 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

Stability

- 1 Stable snow 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
characteristic of boreal S facing slopes
near Dola Nagarwal River

