ALASKA GEOBOTANY CENTER DATA REPORT

AGC 16-01

ROAD EFFECTS AT AIRPORT STUDY SITE, PRUDHOE BAY, ALASKA, SUMMER 2015

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EDITED BY DONALD A. WALKER, MARTHA K. RAYNOLDS, MARCEL BUCHHORN AND JANA L. PEIRCE

OCTOBER 2016

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Field work, September 2015. Photos by Mikhail Kanevskiy: IMGP5057, IMGP5060, and IMGP5063.

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On the cover:

Vegetation survey along Transect 4. High-centered polygons with thermokarst and flooded ice-wedge-polygon troughs that have developed in a flooded area between the Dalton Highway on the right and the Deadhorse Airport runway on the left. Photo: IMG_0013.

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Edited by
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1 Overview of the 2015 field program

The Airport Study Site

This data report contains methods and data from transects, permanent vegetation plots, and permafrost boreholes sampled in summer-fall 2015 at the Airport Site at Prudhoe Bay, Alaska, for the NSF-funded project, "Cumulative effects of Arctic oil development—planning and designing for sustainability," with additional funding from NASA's LCLUC Program. The study site consists of three transects located near the Deadhorse Airport (Figs. 1.1 and 1.2). This builds on data collected in 2014 at a site near Lake Colleen. A forthcoming data report will contain additional data from both sites collected from fall 2015 to summer 2016.

The main objectives of the 2014 field program were to document the extent and effects of road dust and road-related flooding to the topography, landforms, permafrost, soils and vegetation near the Spine Road—the oldest, most heavily traveled road in the Prudhoe Bay region. We were particularly interested in changes to permafrost and ice wedges. During 2-13 August 2014, we established two transects to examine vegetation and thermokarst features near Lake Colleen: T1 to the northeast of the Spine Road and T2 southwest of the road (Fig. 1.1). A full description of the project goals, methods, data and conclusions from the 2014 field season is in Alaska Geobotany Center Data Report AGC 15-01 (Walker *et al.,* 2015).

Objectives of the 2015 field program were similar to those in 2014, except the focus of the study was three new transects established near the Deadhorse Airport and the northern terminus of the Dalton High-

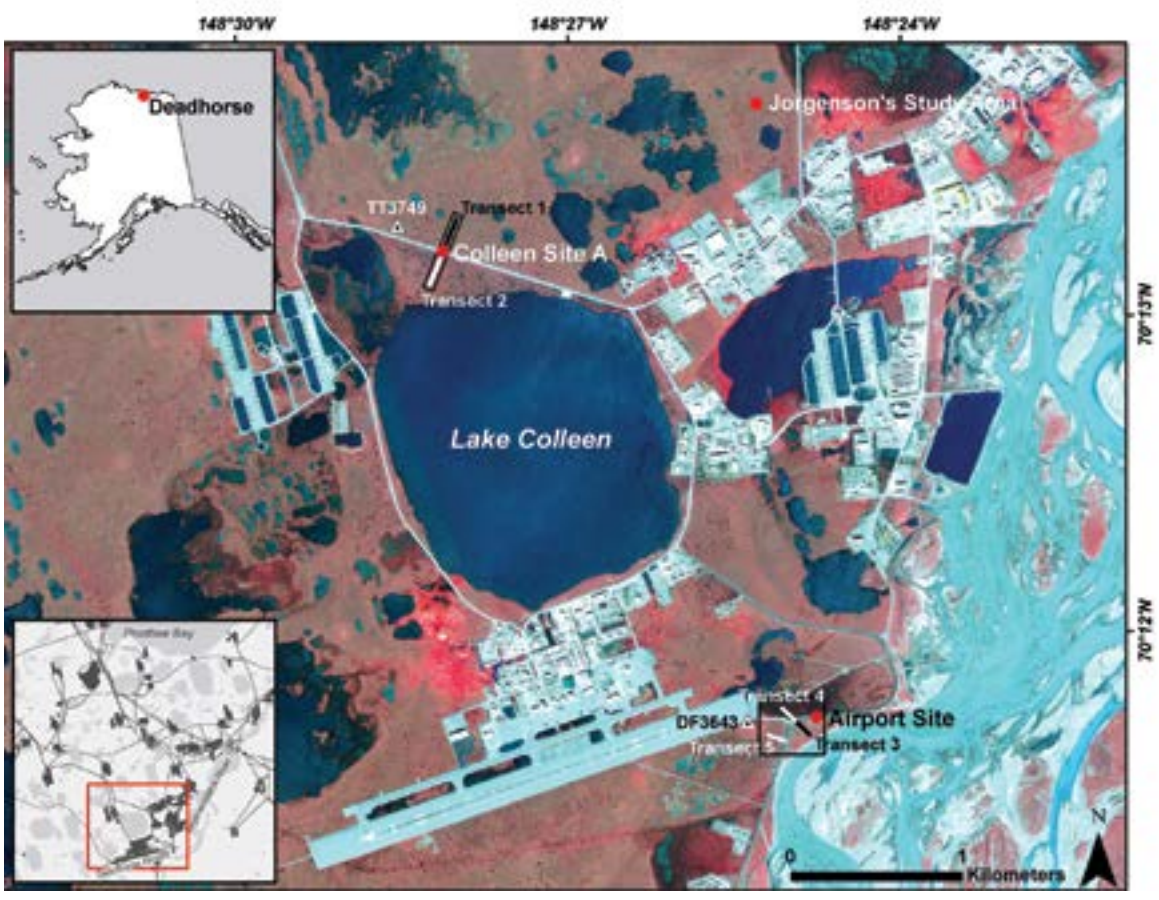


Figure 1.1. *Location of the 2015 field study site near the Deadhorse Airport at Prudhoe Bay, Alaska. The locations of Colleen Site A, site of the 2014 field program, and the Jorgenson Study Site are also identified.*

way at Milepost 414. This site offers some contrasts to Colleen Site A, including extensive dry thermokarst terrain with well-developed high-centered polygons along Transect 3, located southeast of the Dalton Highway between the road and the Sagavanirktok River (Figs. 1.2a and 1.3), and terrain in a heavily disturbed area northwest of the road where Transect 4 was established, that is mostly continuously flooded due to drainage being blocked by the road berm (Figs. 1.2a, 1.4 and cover photo).

Transect 5 (Figs. 1.2b and 1.5) was established to provide better options for permafrost coring on the west side of the road, since deep flooding and gravel deposits from previous flood events prevented coring on Transect 4. Transect 5 also provides an approximate local analog of the conditions that existed prior to road construction. Data were collected on all three transects during 1-10 August and 16-23 September 2015.

Another coring site, Sagavanirktok River Site 1 (SR-1), was established south of the Airport Site along the Sagavanirktok River (Figs. 2.14 and 2.19), where local destruction of the highway caused by flooding from the Sagavanirktok River in spring 2015 created a major disturbance (Figs. 1.8 and 2.17) (Shur *et al.,* 2016).

The terrain and vegetation in the vicinity of the Airport Site have changed considerably since the road was constructed in 1974 (Fig. 1.6). Aerial photos taken between 1949 and 2015 document the conversion from low- to high-centered polygons to the east of the road, and the conversion to somewhat wetter conditions on the west side of the road (Fig. 1.7). The effects of road dust and flooding are described in general terms in Data Report AGC 15-01.

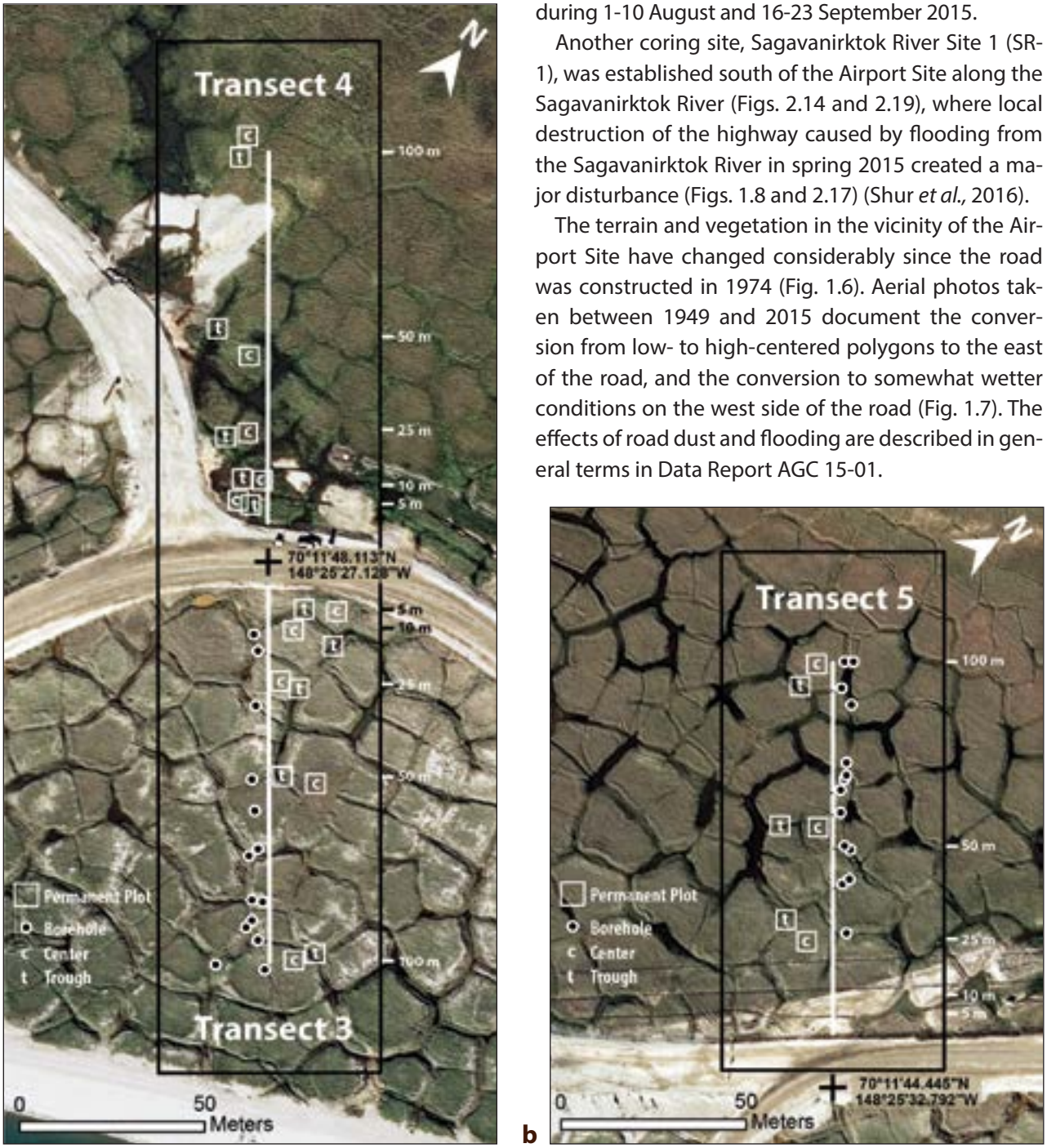


Figure 1.2. *The Airport Site showing the locations of (***a***) Transects 3 and 4, and (***b***) Transect 5. The mostly dry thermokarst terrain with high-centered polygons with >0.5 m of topographic relief along Transect 3 contrasts with the wetter terrain along Transect 4. Transect 5 was established to provide better permafrost coring opportunities west of the road.*

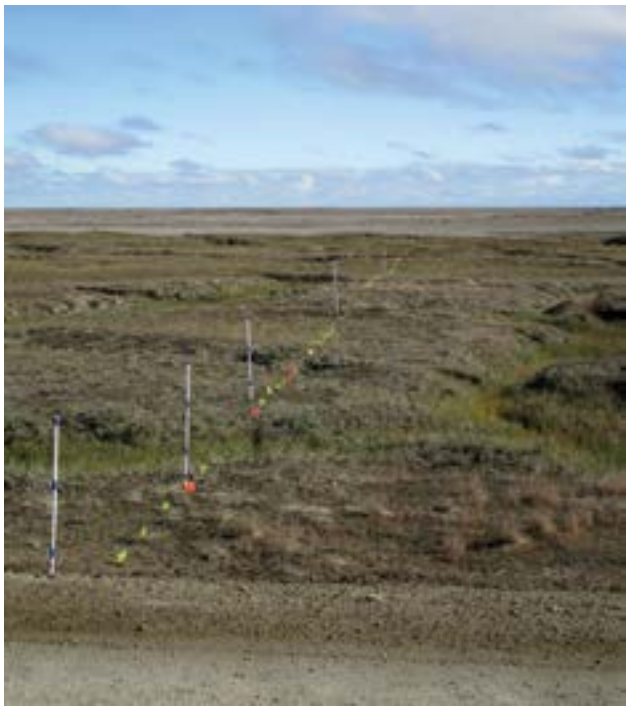


Figure 1.3. *Transect 3, showing generally dry vegetation and high-centered polygons with >0.5 m of topographic relief. Vertical stakes are at 0, 5, 10, 25, 50 and 100 m. IMG_0026.jpg.*

Figure 1.4. *Transect 4, showing wet tundra with considerable flooding due to blockage of drainage by the Dalton Highway. Vertical stakes at same intervals as Transect 3. IMG_0024.jpg.*

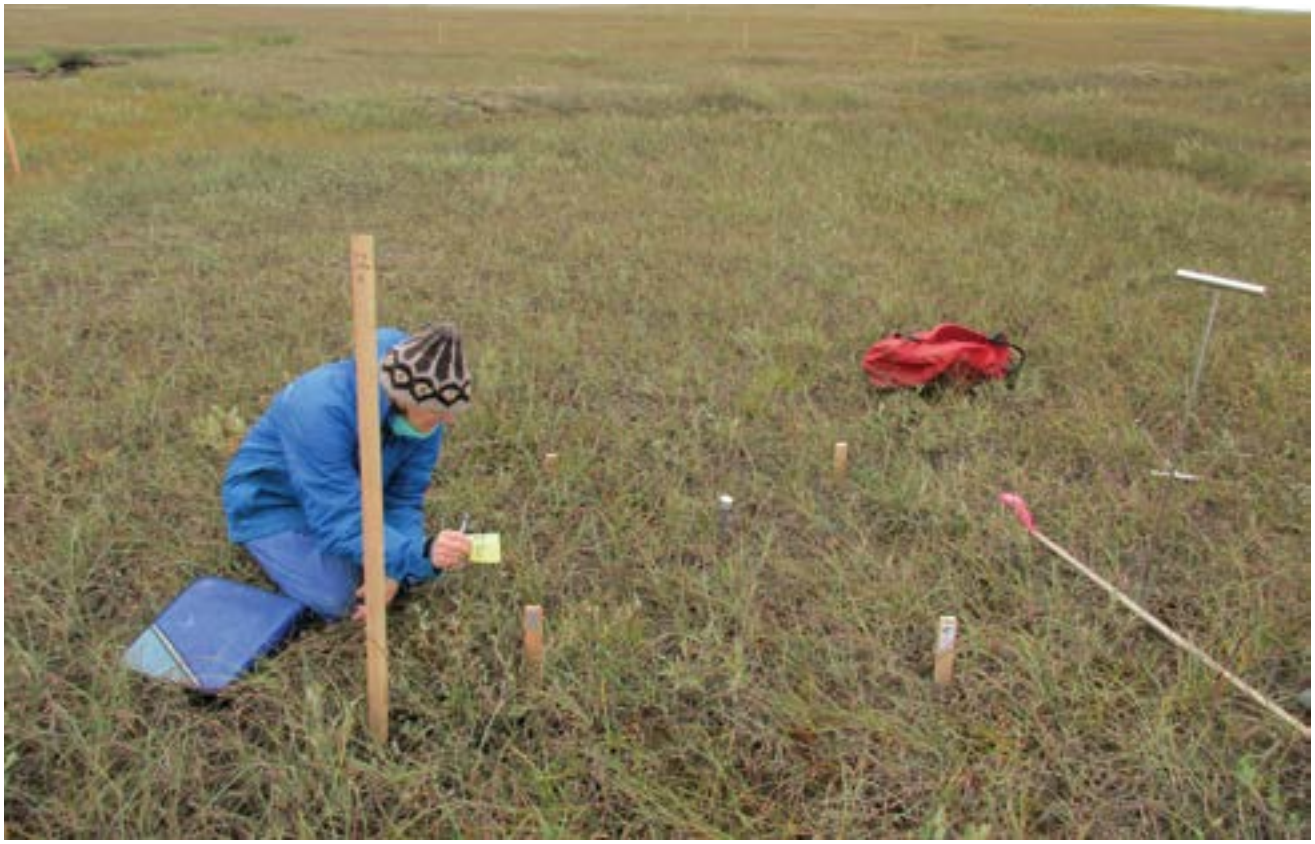


Figure 1.5. *Plot T5-25-C located at 25 m from the start of Transect 5 in the center of a low-centered polygon. These wet low-centered polygons are likely similar to polygons that existed prior to construction of the road. Other plots along the transect are marked with stakes in the background. There is no flagged transect line as there is for Transects 1 to 4. IMG_0298.jpg.*

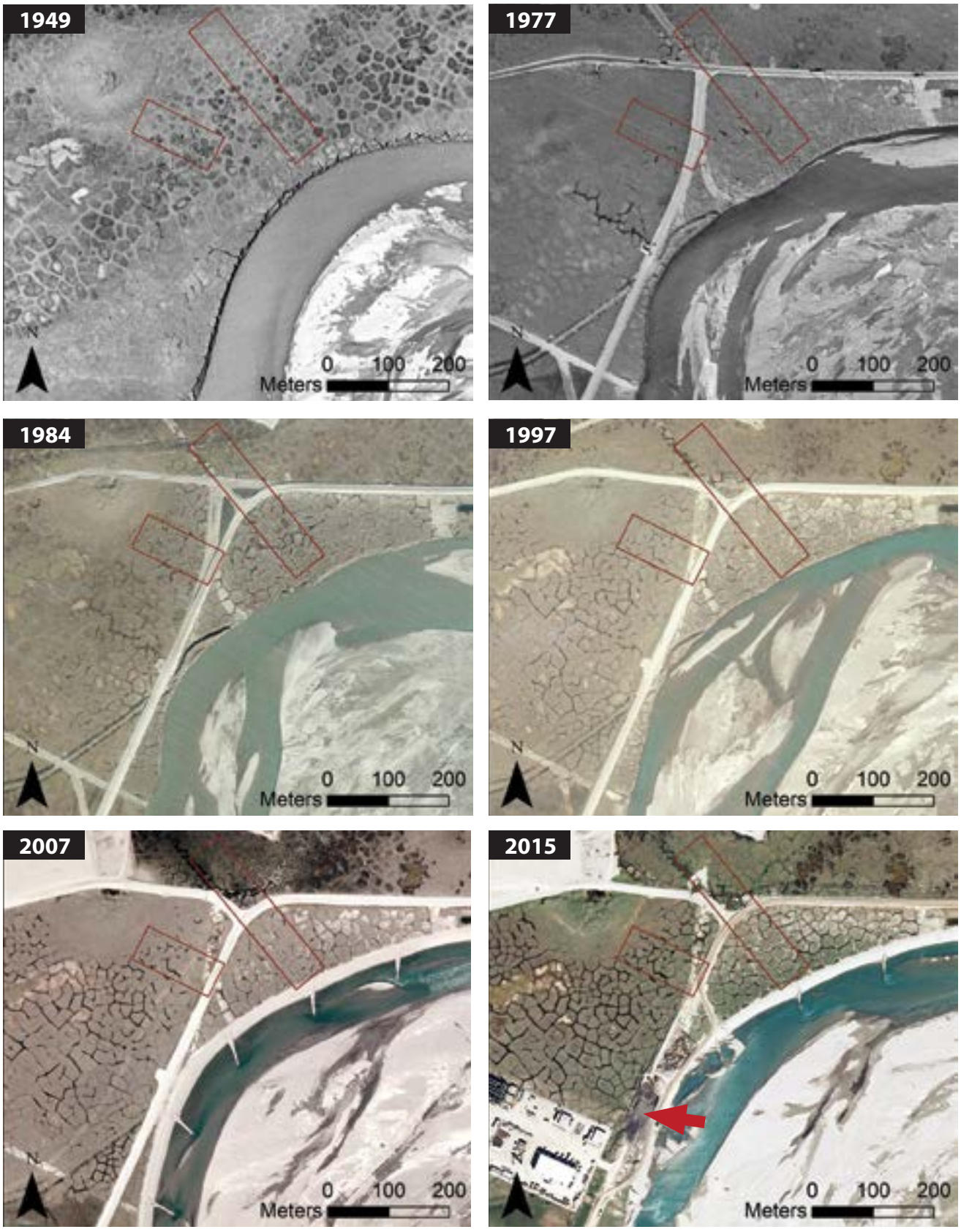


Figure 1.6. *Airport Site area time series, 1949-2015, showing growth in infrastructure. Imagery and original scales: Jul 1, 1949, U.S. Navy, BAR, black & white, 1:20,000; Jul 24, 1977, BP Exploration Alaska (BPXA), black & white, 1:18,000; 1984-2015 (Aug 30, 1984; Jul 20, 1997; Jul 4, 2007; Jul 5, 2015), BPXA, color, 1:18,000. Notes: The Dalton Highway was completed in 1974 so it does not appear on the 1949 image. Red arrow in 2015 photo shows location of highway damaged by flooding in Fig. 1.8 c and d.*

Figure 1.7. *Close-ups of the Airport Site transects 3, 4 and 5 (detailed images in Fig. 1.2) from the 1949 and 2015 aerial photos (Fig. 1.6) show the conversion from low- to high-centered polygons to the southeast (right) side of the road, and the heavy disturbance and conversion to somewhat wetter conditions on the northwest (left) side of the road.*

Figure 1.8. *Flooding in Spring 2015 near the Airport Site.* (**a**) *Flooding near the Deadhorse airstrip (left), looking north. The Airport Site is located at the bend in the Dalton Highway (***arrow 1***). The building (***arrow 2***) is the same building shown in b and c. Photo courtesy of Channel 2 KTUU news. www.breakingnews.com/topic/deadhorse-ak-us/ accessed May 24, 2016.* **(b)** *Flooding immediately south of transects T3 and T4, May 25, 2015, looking south along the Dalton Highway.* (**c**) *Taken as the flood waters were subsiding.* **(d)** *Aerial view of the same area as in c, showing extensive thermokarst resulting from erosion of ice wedges by flood waters. The Airport Site is just to the left of the three white barriers on the road in the upper right, June 11, 2015. Photos b, c and d are courtesy of Alaska Department of Transportation, Maintenance and Operations.*

2 Methods

Chapter 2 provides a record of the methods used in data collection. Many methods are described in more detail in Alaska Geobotany Center Data Report AGC 15-01 (Walker et al.*, 2015). Data tables referenced in this section appear in Chapter 3, starting on page 20. Data tables are also archived in digital format on the ArcSEES website* (www.geobotany.uaf.edu/arcsees*) and at the NSF ACADIS Arctic data repository (*nsidc.org/acadis*).*

Transects

We established three 100-m transects at the Airport Site to quantify differences in microtopography, soil temperatures, thaw depth, soils, vegetation, permafrost and snow in relationship to distance from the road. Transect 3 (T3) is on the southeast side of the Dalton Highway between the road and the Sagavanirktok River (Figs. 1.2a bottom and 1.3). Transects 4 and 5 (T4 and T5) are on the northwest side of the Dalton Highway. T4 is north of the airport runway access road (Figs. 1.2a top and 1.4); T5 is south of the access road (Figs. 1.2b and 1.5). Pin flags were placed at 1-m intervals along Transects 3 and 4, and vertical 150-cm PVC posts were placed at 0, 5, 10, 25, 50 and 100 m. The poles have blue stripes at 50, 100 and 150 cm height to help locate the transects in winter (Fig. 2.1).

At each pin flag, we measured thaw depth with a 1-m steel thaw probe, and we measured water depth and plant canopy height with a meter stick. Leaf-area index (LAI) was measured with an AccuPAR LP-80 PAR/LAI Ceptometer (Fig. 2.6). Thickness of the surface dust layer was measured using a 2-cm diameter soil corer. The vegetation type and microrelief feature were recorded at each meter according to the vegetation classification system of the Geobotanical Atlas of the Prudhoe Bay Region, Alaska (Walker & Webber, 1980). Elevations along the transects were measured using a Topcon RTK (real time kinematic) GPS HiPer Lite+ and robotic Topcon IS3 surveying instrument (see p. 8 for topographic survey methods). Summary data from the transect surveys for T3 and T4 are in Tables 3.1A and B respectively.

No poles or pin flags were placed along T5, but the plots are permanently marked by wooden corner stakes and an aluminum-capped piece of rebar at the center bearing the plot number (Fig. 2.2).

Figure 2.1. *Placing yellow pin flags at 1 m intervals along Transect 3. Orange flags were placed every 5 m, and blue flags at 25 m intervals. Vertical poles were placed at 0, 5, 10, 25, 50 and 100 m from the road. Photo: IMG_0014.*

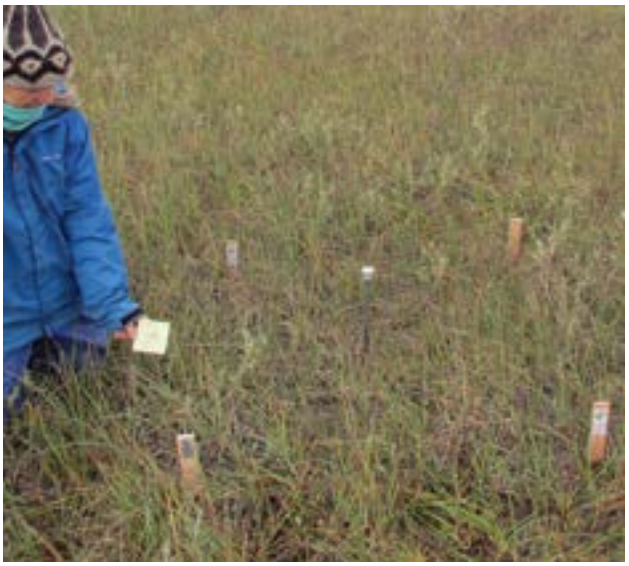


Figure 2.2. *Each permanent plot is marked with wooden corner stakes and a photo point at center with the plot number stamped on an aluminum cap attached to a 46 cm piece of 3/8-inch (1 cm) steel rebar. Photo: IMG_0302.*

Permanent vegetation and soil plots

We established permanent vegetation plots (Figs. 1.5 and 2.3) with photo points in polygon centers and troughs at 5, 10, 25, 50 and 100 m from the road along T3 and T4, and at 25, 50 and 100 m from the road on T5 (Fig. 1.2). Voucher collections of all vascular plants, mosses and lichens were collected from each plot and are stored at the Alaska Geobotany Center.

Species cover was measured using 100 points from a 1 x 1 m^2 point-quadrat (Fig. 2.3, Table 3.3). Cover of all species was estimated using Braun-Blanquet cover abundance scores (Table 3.4). The species at the top of the plant canopy were recorded at 100 grid points within each plot. Leaf Area Index (LAI) was measured using an AccuPAR LP-80 PAR/LAI Ceptometer (Fig. 2.6).

Soil temperature loggers were installed at all permanent plots on T3 and T4. Air temperature loggers were installed along the T3 and T4 flag transects. For details see section on "iButton Temperature loggers."

A soil core was extracted from a spot adjacent to each plot with a Sharpshooter shovel (Fig. 2.4). Samples were obtained from each core using a 190-ml soil can. Laboratory analysis of the samples included soil moisture, bulk density, percent gravel, dry and moist soil color, soil pH and percent organic matter. Samples were taken from both the surface dust horizon, if present, and from the top organic horizon immediately below the dust layer (Tables 3.5 and 3.6). A horizontal section of the core was removed at each sample location to allow the soil can to be inserted vertically, and a serrated knife was used to cut around the edges of the soil can as it was inserted into the soil horizon to ensure the soil was not compressed for bulk density determinations. Each sample was removed from the soil can and placed in a labeled quart-size Ziploc® bag. A brief description and photo of each soil were made in the field noting the locations of the obvious horizons.

To determine gravimetric and volumetric soil moisture and bulk density, the soils were weighed wet in their Ziploc® collection bags, then dried at 105˚C for 48 hours and reweighed. Gravimetric soil moisture was calculated as mass of water divided by the mass of dry soil times 100%, after subtracting the weight of the bag. Volumetric soil moisture was calculated as the volume of water divided by the volume of the soil

Figure 2.3. *Plot T3 050 C (Transect 3, 50 m from road, polygon center) with point quadrat in place. The grid defines the 100 points for sampling. The point quadrat is mounted on legs that are inserted in metal washers nailed into the tundra to allow the frame to be repositioned at the same point for resampling. The central metal disk is the aluminum photo-point marker with the engraved plot number. The grid consists of two layers of monofilament fishing line. The plant species intercepted at each point is recorded. Grid points in the two layers of monofilament line are visually aligned at each point to avoid problems of parallax in accurately locating each point in the plant canopy. Photo: IMG_0059.jpg.*

Figure 2.4. *Soil plug from trough of an ice-wedge polygon 5 m from the road on Transect 3. The back of the Sharpshooter shovel used to extract the soil plugs is shown. Note the gray color at the top of the organic soil horizon underlying the surface layer of moss, indicating leaching of dust into the organic layer. Photo: IMG_216.*

can (190 cm^3) times 100%, noting that 1 cm^3 of water weighs 1 g. The bulk density of the soil was calculated from the dry mass of the soil divided by the volume of the soil can and reported as g/cm^3. Dry and moist soil colors were determined in the lab using a Munsell color chart (Munsell Color 1994).

To determine percentage soil organic matter, the soils were first put through a 2-mm sieve to remove gravel and undecomposed plant material. These components were weighed and reported as percent of total soil sample. The pH of the < 2 mm component was determined using the saturated paste method. (Kalra 1995). Organic matter content was determined from 5-10 g samples of the < 2 mm soil component. The samples were dried to 105 ˚C, then put in a combustion oven at 550 ˚C for seven hours. Samples were weighed after drying and after combustion. Before weighing, the samples were kept in desiccators to cool to minimize moisture absorption.

Tables 3.2A, B, and C contain environmental data from all the permanent plots on Transects 3, 4, and 5 respectively. Table 3.2D explains the codes used in site descriptions of the plots. Table 3.3 contains the percentage cover of species as determined using the point-intercept method. Tables 3.4A, B, and C contain the complete species list for the plots with Braun-Blanquet cover-abundance scores for Transects 3, 4, and 5 respectively. Tables 3.5 and 3.6 contain the soil data for all plots. Appendix A contains photos taken in August 2015 of the vegetation and soils at all permanent plots in Transects 3, 4, 5.

Topographic surveys

The location and elevation of all boreholes, transects, vegetation plots and other reference points were surveyed using a combination of a GPS real time kinematic (RTK) system and a robotic imaging system. All measurements where connected to the stable National Geodetic Survey (NGS) benchmark point DF3643 (70˚ 11′48.87851″ N, 148˚ 25′53.20441″ W) in order to acquire the exact location and orthoheight of all surveyed points. Since we required two different levels of accuracy, we used two different survey systems for the topographic survey.

The real time kinematic (RTK) system, an advanced technique of GPS measurement that relies on a single reference station delivering real-time location correction, was used for surveying instrument locations where we needed up to centimeter-level accuracy (e.g., boreholes and vegetation plots). For these measurements, we used a Topcon RTK HiPer Lite+ GPS system in combination with a Topcon FC-2500 field controller (a handheld computer) for data acquisition (Fig. 2.5a).

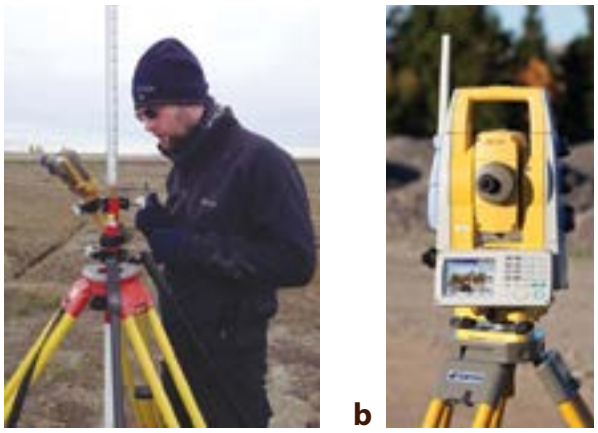


Figure 2.5. (a) *Marcel Buchhorn surveying plot markers using a Topcon RTK GPS HyPer Lite + GPS system.* **(b)** *Topcon IS-3 Imaging Station and Laser Scanner. Photo: Topcon.*

For the creation of elevation profiles of Transects 3 and 4, we needed position data with a higher degree of accuracy, which we achieved using a Topcon IS-3 Imaging Station system in combination with an RC-4 advanced prism tracking and locking system, and the same FC-2500 field controller (Fig. 2.5b). This robotic, fully automatic, total imaging station and laser scanner allowed high-accuracy surveying at millimeter-levels (again with reference to the NGS benchmark point DF3643).

In all, 514 points were surveyed. Fig. 2.8 shows a map of the locations surveyed along Transects 3, 4 and 5. The PDF version of this page can be enlarged to reveal the codes for each location. The coordinates and elevations of all points surveyed at the Airport Site are included in Table 3.7. Coordinates use the World Geodetic System 1984 (WGS84) datum expressed in Decimal Degrees (DD).

iButton temperature loggers

In August 2014, Maxim iButton® temperature loggers were installed at 0, -20 and -40 cm soil depths and above ground at 10, 20, 50 and 100 cm in the air to monitor temperatures at permanent vegetation plots on Colleen Site A Transects 1 and 2 (T1 and T2). In August 2015, these iButtons were retrieved, read and replaced, and additional temperature loggers deployed at the Airport Site. Some changes to the methodology were made to improve their placement along the transects and to better protect the devices from water dam-

age. Experience at Colleen Site A revealed that iButtons are not sufficiently waterproof to survive a full, annual vegetation cycle when used in wet locations. Since the devices do not log data into protected long-term storage, all data from an iButton is lost if the battery is depleted in the field or the device fails due to water exposure at some point during the year.

At the Airport Site, we attached iButtons at 0, 10, 20, 50, 100 and 150 cm above the soil on all T3 and T4 transect poles to record air temperature and the formation and melting of the roadside snowdrift. Additional iButtons were installed at T3 and T4 permanent plots at depths of 0, -20 and -40 cm to record soil temperature at polygon centers and troughs on both sides of the road (Fig. 2.6).

To ensure comparability of 2015-16 temperature data from the Airport and Lake Colleen sites, the same placement scheme was applied on T1 and T2. Overall, we installed 260 iButtons in the 2015 field season: 123 at the Airport Site and 137 at Colleen Site A. The serial numbers and points of installation for all iButtons are in Table 3.8. Temperature data will be included in the final data report for the project.

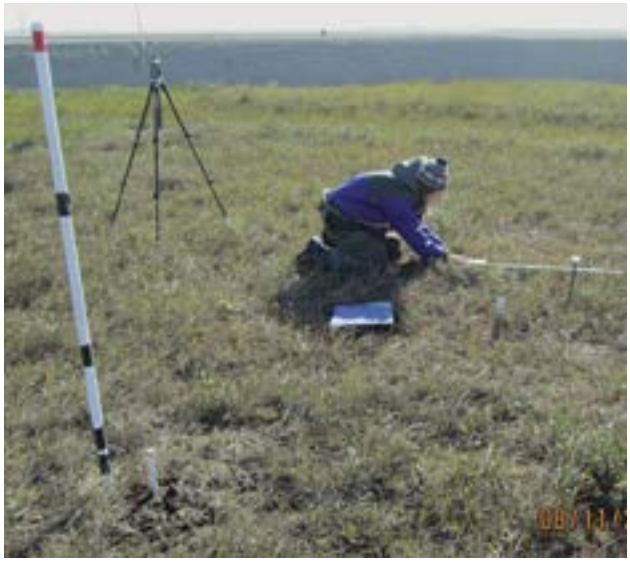


Figure 2.6. *Martha Raynolds measures leaf-area index (LAI) using an AccuPAR LP-80, PAR/LAI Ceptometer, in August 2014. The white horizontal sensor measures photosynthetically active radiation (PAR) that penetrates the plant canopy. The above-canopy PAR sensor is mounted on the tripod in the background. LAI is calculated as the ratio of the below-canopy PAR to the above-canopy PAR. The short white stake next to the pole in the foreground has Maxim iButton® temperature loggers attached at 0, -10, and -20 cm depths. A soil plug was removed from the site of the temperature loggers for collection of soil samples prior to burial of the temperature logger. Photo: IMG_0871.*

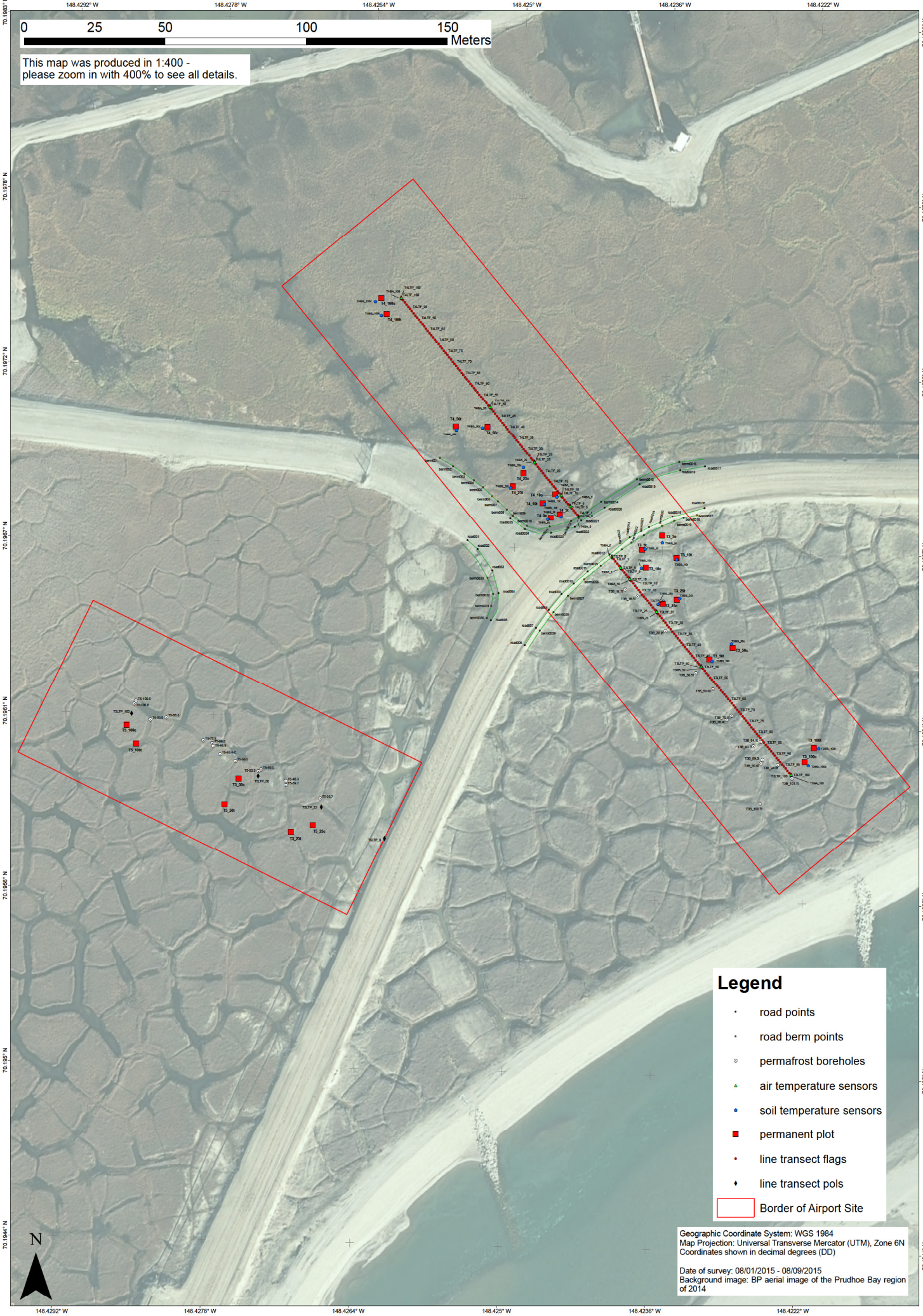
Field Spectroscopy

Field spectroscopy is a technique used to measure the reflectance properties of vegetation, soils, and other surfaces in the natural environment using a field spectroradiometer. These reflectance properties can be used to analyze changes in vegetation structure or composition. Moreover, vegetation indices (mathematically compressions of the spectral information source) like the NDVI (Normalized Difference Vegetation Index) can be derived from field spectroscopy and can be for example used as indicators for vegetation health and greenness. NDVI is one of the most widely used vegetation indices and is an indicator that describes the greenness—the relative density and health of vegetation—for each measured surface point.

Field spectroscopy sampling along the T3 and T4 flag transects and at all permanent plots on those transects was carried out around solar noon with a clear sky on August, 7, 2015 (Fig. 2.7). Along the two 100-m flag transects, we measured surface reflectance every 1 m. At the permanent vegetation plots, we split the 1 x 1-m plot area into nine quadrants and

Figure 2.7. *Marcel Buchhorn measures surface reflectance via field spectroscopy at a permanent vegetation plot in August 2015. Surface reflectance was measured at every 1 m flag and at each permanent plot on the 100-m transects T3 and T4 at the Airport Site.*

Figure 2.8 (next page). *Locations of all points surveyed along Transects 3, 4 and 5, Airport Site, August 2015.*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Legend
road points
road berm points
permafrost boreholes
air temperature sensors
soil temperature sensors
permanent plot
line transect flags
line transect pols
Border of Airport Site
N
Geographic Coordinate System: WGS 1984
Map Projection: Universal Transverse Mercator (UTM), Zone 6N
Coordinates shown in decimal degrees (DD)
Date of survey: 08/01/2015 - 08/09/2015
Background image: BP aerial image of the Prudhoe Bay region of 2014

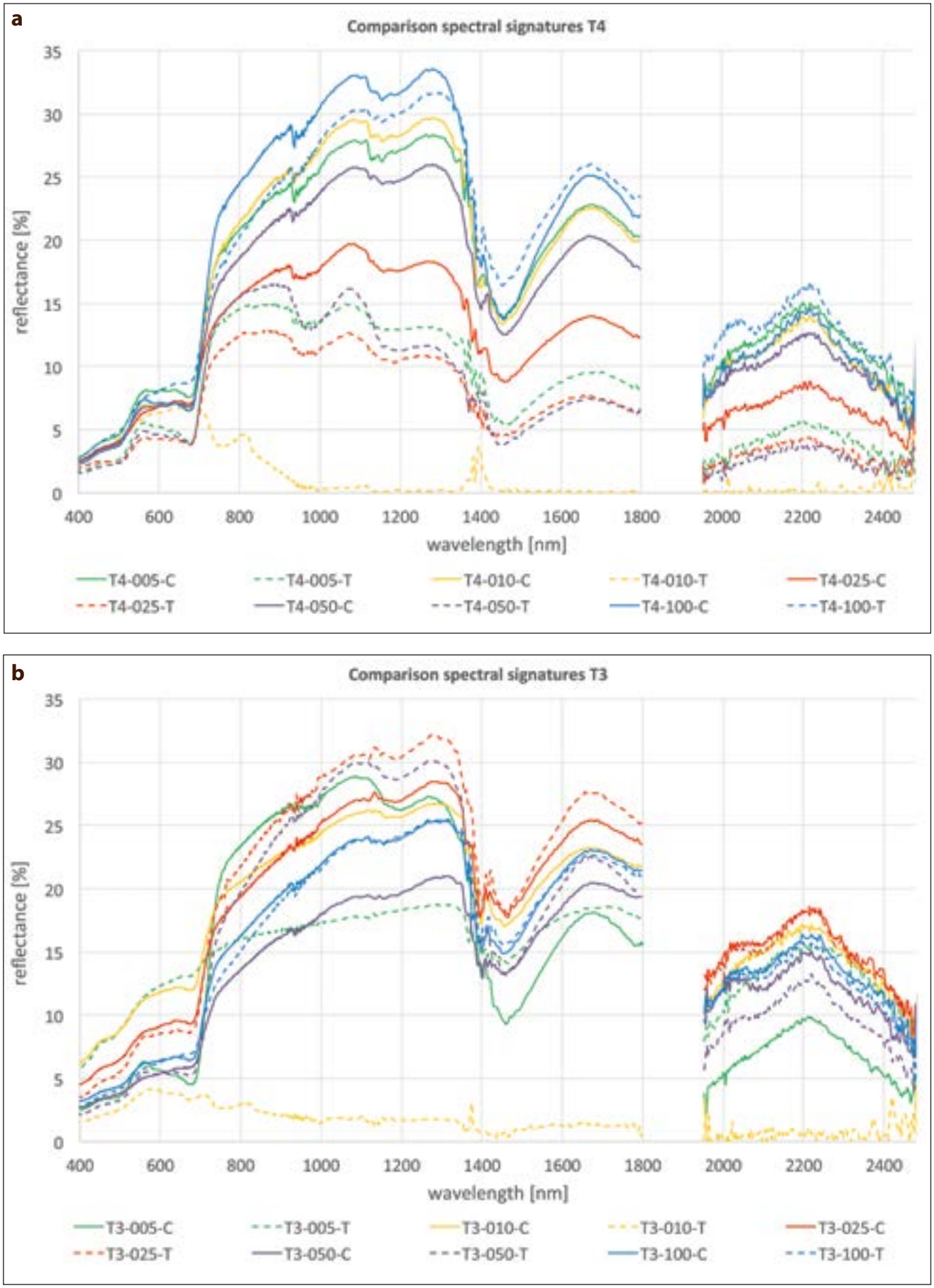

Figure 2.9. *Comparison of the average spectral signatures of permanent plots on T3 (***a***) and T4 (***b***), Airport Site, August 2015.*

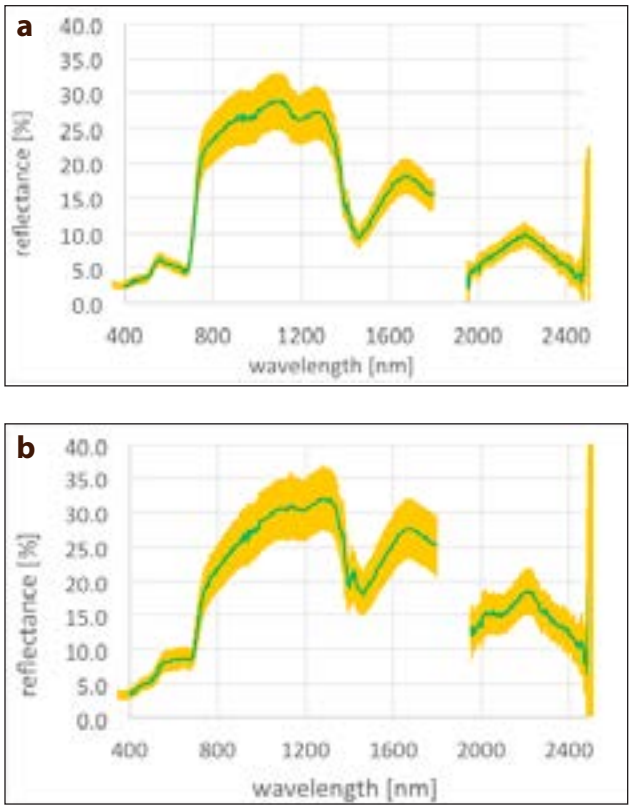

Figure 2.10. *Average spectral signatures of plots T3-005-C (**a**) and T3-025-T (**b**), with standard deviation shown in yellow, Airport Site, August 2015.*

measured these individually. We used a Spectral Evolution PSR+3500 full range spectroradiometer, which measures the reflected surface radiance in the spectral region from 345 to 2507 nm with a bandpass of 6-8 nm. In order to increase the Signal-to-Noise ratio (SNR), an indicator for the data quality, the instrument was set up to average 30 measurements into a single measurement.

The relative reflectance of a measured surface was calculated by creating the ratio of the measured radiance of the surface to the measured radiance of a white reference panel (spectralon panel). In a second processing step, this relative surface reflectance was transferred into absolute surface reflectance by using the reflectance correction factor of the white reference panel. The NDVI was calculated following the equation NDVI = (NIR – RED) / (NIR + RED), where NIR is the near infrared reflectance and RED is the red reflectance of the surface. For NIR, we used the average reflectance in the 725 - 1060 nm region, and for RED, we used the average reflectance in the 580 - 680 nm region.

Fig. 2.9 shows the comparison of the mean spectral surface signatures, a function of the average reflectance over the 400 – 2500 nm wavelength range, for all plots along transects T3 and T4. More detailed spectral surface signatures showing mean and standard deviation for two sample plots are in Fig. 2.10. For a better comparison with the vegetation and environmental variables, the calculated NDVI values along the flag transects and of plots are included in Tables 3.1 and 3.2.

Permafrost cores

In September 2015, we drilled 28 shallow boreholes along 100-m-long transects T3 and T5 (Figs. 1.2 and 2.8) using a motorized SIPRE corer to study soil stratigraphy, different types of ground ice, and dimensions of ice wedges. No boreholes were drilled along Transect 4 because of extensive near-surface gravel from numerous previous roads and redistribution of gravel by floods. Deep water over most of the transect also made coring difficult. Due to severe weather conditions, the number of boreholes was smaller in comparison with the field study of 2014. Only two boreholes were drilled in ice-wedge polygon centers (one for each transect). All other boreholes were drilled in polygon troughs along both transects at different distances from the Dalton Highway (13 boreholes for each transect).

Boreholes in polygon centers

In September 2015, two 2.5-m-deep boreholes in ice-wedge polygon centers were drilled near T3 (T3-59.0-C) and T5 (T5-65.4-C) (Table 3.9). Cores were examined to study cryostratigraphy of the upper permafrost and to determine the ground-ice volume in the surface deposits (Fig. 2.11). At the time of drilling (22-23 September), seasonal thaw depth reached its maximum; the active-layer thickness was 63 cm at T3-59.0-C and 66 cm at T5-65.4-C.

Analysis of cryostructures showed that the thickness of the transient layer, which represents potential seasonal thawing under favorable conditions, was 1 cm at T3-59.0-C and 3 cm at T5-65.4-C. The upper permafrost in sections of these two boreholes was composed of organic-rich mineral soils of presumably eolian and lacustrine origin. Neither 2.5-m-deep borehole reached organic-poor mineral soils (silts, sands, or gravelly sands), which were encountered along Transects 1 and 2 at depths varying from 1.2 to 2.0 m. Gravimetric moisture content of soils was determined for these boreholes (Table 3.10). Photographs of the frozen soils are presented in Fig. 2.12.

Based on the data obtained from boreholes T3-59.0-C and T5-65.4-C with almost identical cryostratigraphy (Fig. 2.11), four cryostratigraphic units were detected:

1. **Unfrozen active layer** (silty peat with layers of organic silt), thickness: 63-66 cm
2. **Frozen transient layer** (organic silt, ice-poor), thickness: 1-3 cm
3. **Frozen organic-rich silt with peat inclusions, ice-rich** (Fig. 2.12a), thickness: ~130 cm
4. **Frozen organic-rich silt, ice-rich** (Fig. 2.12b), thickness: ~55 cm (visible); total thickness unknown

Boreholes in polygon troughs and rims

Drilling in polygon troughs and adjacent rims of polygons was done to establish the current state of

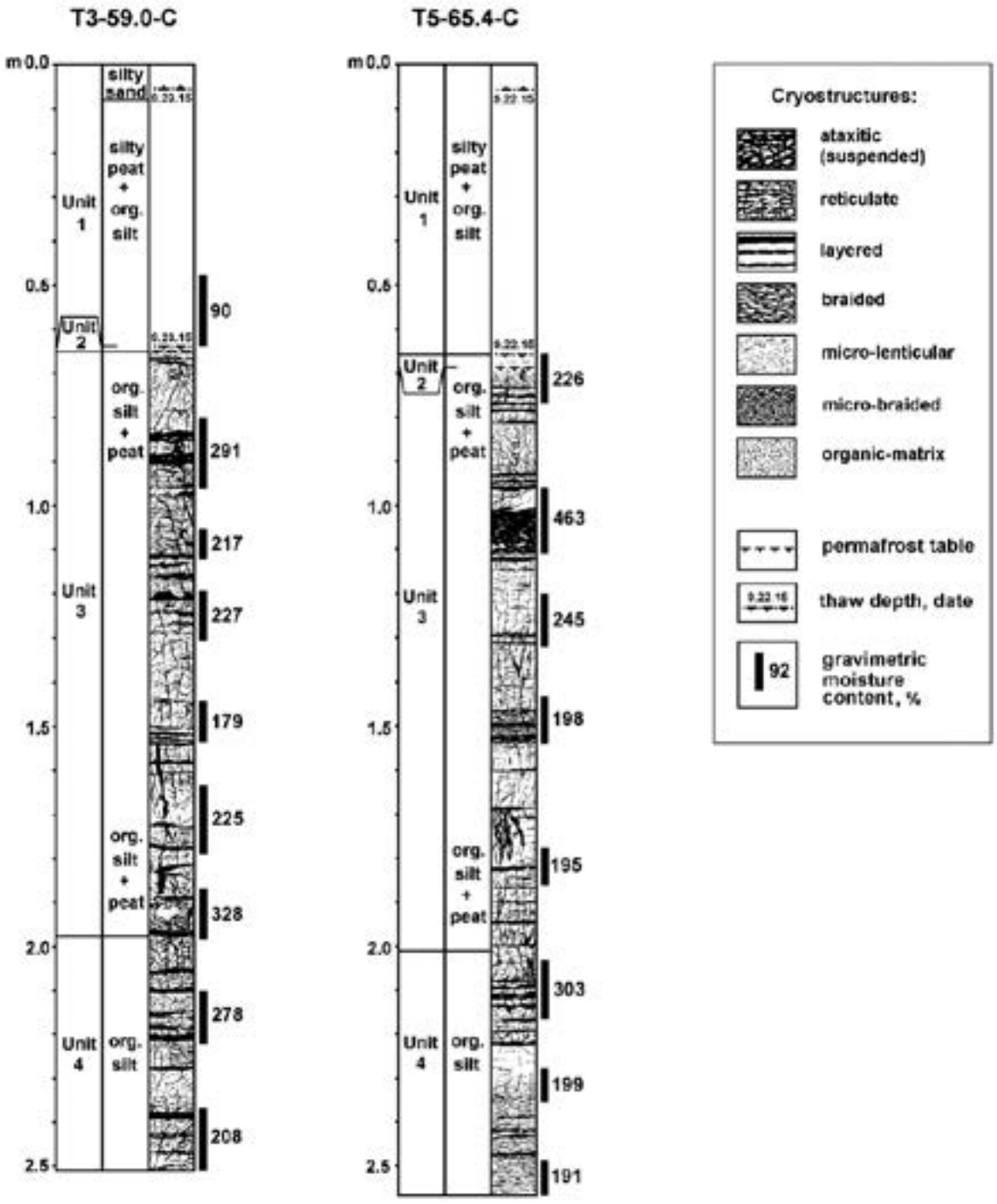

Figure 2.11. *Cryostratigraphy of the upper permafrost, based on boreholes drilled in ice-wedge-polygon centers (ice is black).*

thawing and recovery of the ice wedges. The goal was to estimate the thicknesses of frozen protective soil layers on top of massive ice bodies, including the frozen part of the active layer, transient layer, and intermediate layer.

In September 2015, we drilled 13 boreholes along Transect 3, and 13 boreholes along Transect 5 (Fig. 1.2; Table 3.11). Massive ground ice was encountered in 23 of 26 boreholes, including wedge ice (WI), thermokarst-cave ice (TCI) and composite (ice/soil) wedges (CW) (Table 3.11). Most of boreholes were drilled in the central parts of dry or water-filled ice-wedge troughs. Several boreholes were drilled from the surface of low mounds or "ridges" located within the troughs. At the time of drilling (September 18 to 22), seasonal thaw depth reached its maximum; the active-layer thickness varied from 36 to 69 cm (average values were 55.5 cm for Transect 3 and 54.5 cm for Transect 5).

At the time of drilling, 0.5 to 15-cm-thick protective layer of frozen soil, which includes the transient layer and/or intermediate layer, was observed above the majority of ice wedges. The ice-rich Intermediate layer up to 14 cm thick was encountered in 10 boreholes. Seven ice wedges of 23 experienced thawing at the time of drilling. For Transect 3, average thickness of protective frozen layer was 2.3 cm and average thickness of the Intermediate layer was 2.0 cm. For Transect 5, these thicknesses were 4.2 cm and 2.6 cm correspondingly. The risk of ice-wedge degradation is much higher at Transect 3: along this transect, protective layers (of any thickness) were encountered only in 50% of ice wedges (which means that a half of wedges were degrading by the end of summer), while at Transect 5 more than 90% of wedges had this layer, and most of them were protected by a thin intermediate layer. Gravimetric moisture content (Table 3.12) was determined for frozen soils above massive-ice bodies. Photographs of the frozen soils on top of wedge ice, including the ice-rich intermediate layer (IL), are presented in Fig. 2.13.

Permafrost studies at Site SR-1

Site SR-1 is located on the left bank of the Sagavanirktok River approximately 2 km to the south of the Deadhorse airport (70°10'39.0"N, 148°26'12.1"W) (Fig. 2.14). This area was strongly affected by thermal erosion during the catastrophic flooding in May-June of 2015 (Shur *et al.,* 2016), which has completely changed the landscape between the Dalton Highway and the Sagavanirktok riverbank (Fig. 2.17).

An ice wedge approximately 1 m wide exposed in the riverbank at Site SR-1 was described on August 8, 2015 (Figs. 2.18 and 2.20). This ice wedge formed in ice- and organic-rich silts with peat inclusions. On September 19, one borehole was drilled within the

Figure 2.12. *Frozen cores obtained from boreholes drilled in ice-wedge-polygon centers.* **(a)** *Borehole T3-59.0-C, ice-rich organic silt with peat Inclusions, 62-97 cm.* **(b)** *Borehole T5-65.4-C, ice-rich organic silt, 233-257 cm.*

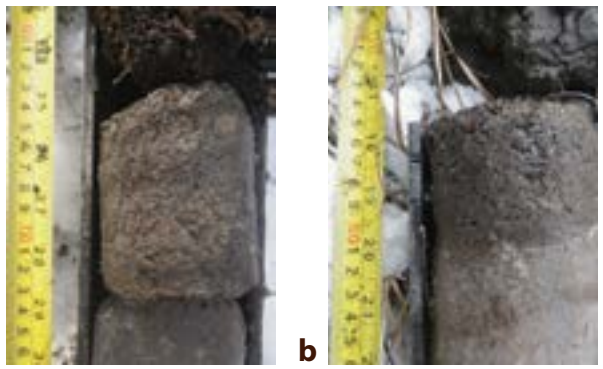

Figure 2.13. *Photos of the intermediate layer (IL) above ice wedges in boreholes drilled on T3 and T5.* **(a)** *Borehole T3-100.7-T, 59-76 cm (IL - 62-72 cm).* **(b)** *Borehole T5-88.3-T, 38-57 cm (IL - 46-51 cm).*

polygon adjacent to this exposure (Fig. 2.19). Based on the data obtained from this 2.3-m-deep borehole (Fig. 2.16, Table 3.13), five cryostratigraphic units were Identified:

1. Unfrozen active layer (peat with layers of organic silt), thickness: 55 cm

2. Frozen transient layer (organic-rich silt with peat Inclusions, relatively ice-poor), thickness: 13 cm

3. Frozen silt with peat Inclusions, ice-rich (Fig. 2.15a), thickness: 85 cm

4. Frozen organic-poor silt, ice-rich (Fig. 2.15b), thickness: 64 cm

5. Frozen silty sand with coarse inclusions (Fig. 2.15b), thickness: 9 cm (visible); total thickness unknown (we could not drill deeper than 2.26 m because of gravel)

Figure 2.14. *Location of Site SR-1 Image: Google Earth.*

Figure 2.15 *Frozen core obtained from borehole SR-1.* **(a)** *Ice-rich silt with peat Inclusions, 123-154 cm.* **(b)** *Ice-rich organic-poor silt, 192-217 cm; ice-rich silty sand with coarse inclusions 217-226 cm.*

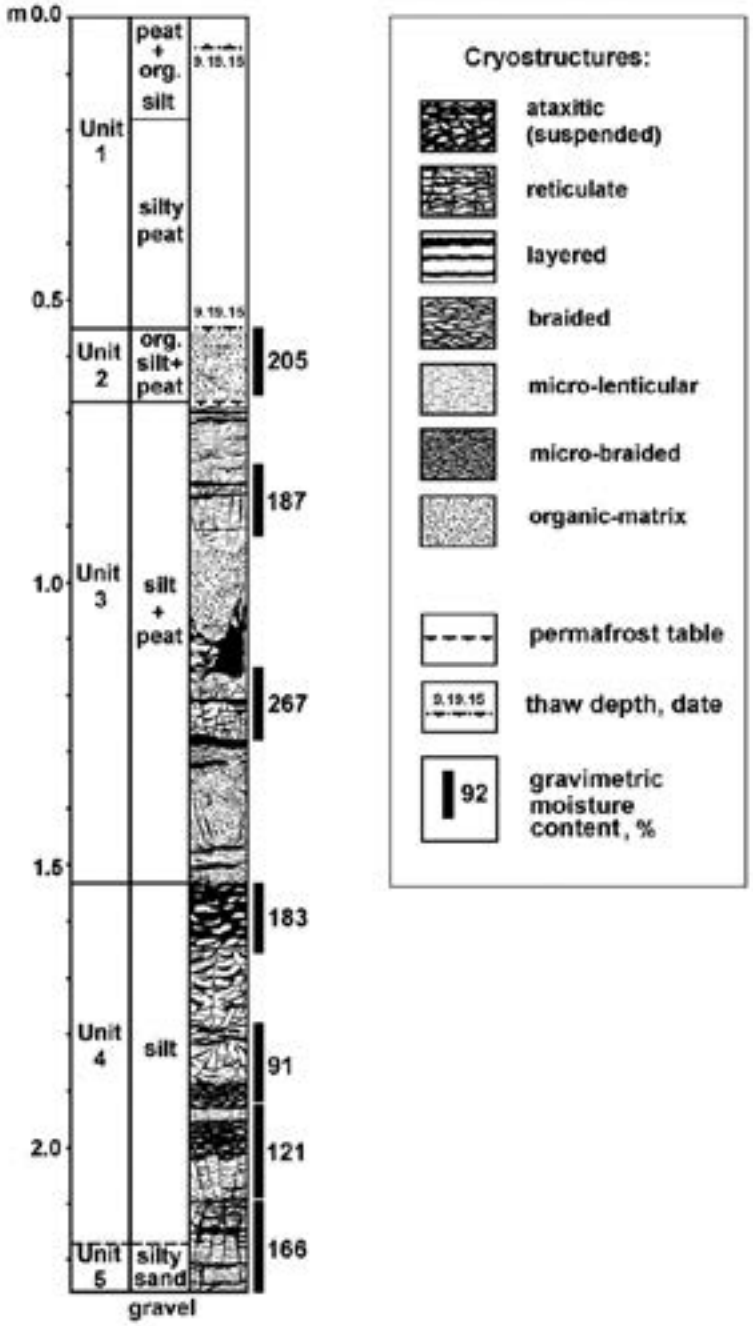

Figure 2.16. *Cryostratigraphy of the upper permafrost, Site SR-1, based on borehole drilled in ice-wedge-polygon center (ice is black).*

Figure 2.17. *Left bank of the Sagavanirktok River near Site SR-1 before and after the erosional event caused by catastrophic flooding in May-June of 2015.*

Figure 2.18. *Ice wedge exposed at Site SR-1, August 8, 2015. This exposure is also shown in the drawing in Fig. 2.20.*

Figure 2.19. *Borehole drilled at Site SR-1 in ice-wedge polygon center near the exposed ice wedge, September 19, 2015.*

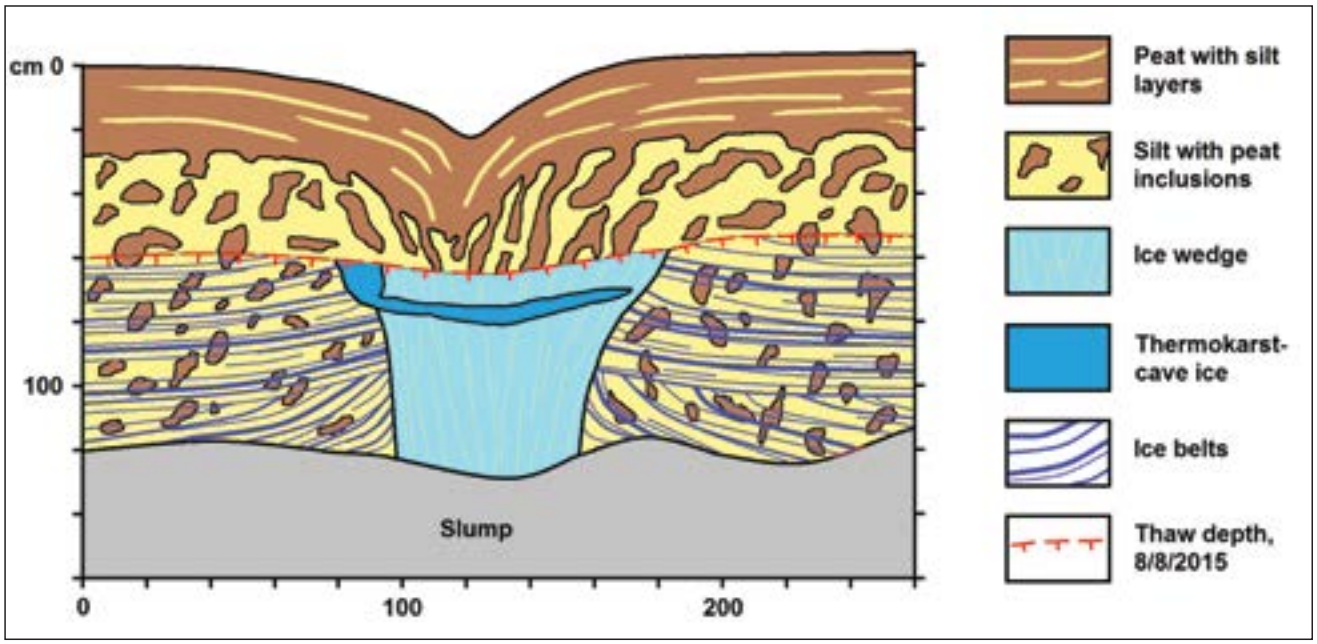

Figure 2.20. *Cryostratigraphic profile across ice wedge exposed at Site SR-1, August 8, 2015.*

3 Data

Chapter 3 provides copies of the data tables available from the study. Data are also archived in digital format on the ArcSEES project website (www.geobotany.uaf.edu/arcsees) *and at the NSF ACADIS Arctic data repository (*nsidc.org/acadis*).*

Table 3.1A. *Summary of data from* **Transect 3,** *Airport Site, August 2015.* **m:** *Distance from the road in meters.* **LAI:** *Leaf Area Index measured using an AcuPAR Model 80 instrument (1 measurement/point).* **Vegetation type:** *Based on Walker & Webber (1980), Table 6. A suffix of 'd' indicates disturbed vegetation types. See notes following table for description of additional vegetation types added by DA Walker for this study.* **Microrelief type:** *Frost boil (F), flat-centered polygon (FC), low-centered polygon (LC), high-centered polygon (HC), high-center polygon with rim (HCr), thermokarst pit (P), low-centered polygon rim (R), roadside berm (RB) and trough (T).* **Vegetation height:** *Average height of dominant layer above the ground or water.* **Dust depth:** *Measured from a soil plug.* **Thaw depth:** *Measured using a 1-m steel probe.* **Latitude/Longitude/Elevation:** *Measured using topographic survey instruments described on p. 8.*

m	LAI	NDVI	Vegetation type between flags	Micro-relief type between flags	Vegetation height at flag (cm)	Water depth (cm)	Surface dust depth (cm)	Dust-penetrated peat (cm)	Thaw depth at flag (cm)	Latitude (WGS84 DD)	Longitude (WGS84 DD)	Elevation (m)
Transect 3												
0	0.37	0.24	B16[1]	HC[1]	27	0	10	4	80	70.196643	-148.424064	14.54
1	0.20	0.06	B16	HC	0	0	8	5	78	70.196636	-148.424046	14.45
2	0.20	0.12	B16	HC	9	0	14	6	76	70.196630	-148.424030	14.43
3	0.18	0.07	B16	HC	0	0	8	0	74	70.196623	-148.424012	14.43
4	0.18	0.06	B16	HC	0	0	6	0	71	70.196616	-148.423995	14.48
5	0.21	0.04	B16	HC	2	0	6	2	67	70.196610	-148.423980	14.47
6	0.28	0.18	B16	R	1	0	7	0	68	70.196602	-148.423961	14.48
7	0.55	0.36	B16	R	5	0	5	9	62	70.196596	-148.423944	14.27
8	1.46	0.58	M10d[2]	T	25	1	6	6	55	70.196589	-148.423927	14.10
9	1.37	0.48	M10d	T	27	0	14	2	54	70.196582	-148.423911	14.17
10	0.30	0.20	B16	R	3	0	4	4	66	70.196575	-148.423892	14.54
11	0.26	0.29	B16	HC	0	0	3	3	57	70.196568	-148.423875	14.56
12	0.18	0.38	B16	HC	0	0	5	3	59	70.196562	-148.423857	14.61
13	0.19	0.06	B16	HC	1	0	4	4	50	70.196555	-148.423840	14.52
14	0.23	0.24	B16	HC	1	0	3	2	65	70.196548	-148.423824	14.48
15	0.46	0.10	B16	HC	1	0	3	1	62	70.196541	-148.423806	14.45
16	0.18	0.36	B16	T	0	0	2	2	63	70.196534	-148.423790	14.35
17	0.20	0.13	B16	T	1	0	1	5	56	70.196527	-148.423773	14.21
18	0.50	0.45	B17[3]	R	1	0	1	4	64	70.196520	-148.423754	14.58
19	0.16	0.19	B17	R	2	0	1	4	65	70.196514	-148.423737	14.64
20	0.32	0.55	B17	HC	0	0	1	4	59	70.196507	-148.423720	14.58
21	0.24	0.30	B17	HC	5	0	1	5	58	70.196500	-148.423703	14.58
22	0.23	0.33	B17	HC	2	0	1	4	59	70.196493	-148.423686	14.58
23	0.75	0.42	B17	HC	4	0	1	6	60	70.196486	-148.423668	14.58
24	0.2	0.34	B17	HC	5	0	0	6	60	70.196480	-148.423651	14.61
25	0.23	0.26	B17	HC	3	0	1	4	60	70.196473	-148.423634	14.64
26	0.18	0.44	B17	R	0	0	1	3	53	70.196466	-148.423616	14.62
27	0.19	0.56	B17	HC	3	0	1	3	54	70.196459	-148.423599	14.84
28	0.12	0.28	B17	HC	3	0	1	1	55	70.196452	-148.423582	14.82
29	0.11	0.23	B17	HC	2	0	2	3	55	70.196445	-148.423565	14.89

Table 3.1A (cont). *Summary of data from* ***Transect 3,*** *Airport Site, August 2015.*

m	LAI	NDVI	Vegetation type between flags	Micro-relief type between flags	Vegetation height at flag (cm)	Water depth (cm)	Surface dust depth (cm)	Dust-penetrated peat (cm)	Thaw depth at flag (cm)	Latitude (WGS84 DD)	Longitude (WGS84 DD)	Elevation (m)
Transect 3												
30	0.11	0.31	B17	HC	2	0	2	2	55	70.196439	-148.423547	14.84
31	0.09	0.14	B17	HC	0	0	1	1	58	70.196432	-148.423531	14.78
32	0.20	0.57	B17	HC	0	0	1	2	63	70.196425	-148.423514	14.69
33	0.09	0.08	B17	HC	0	0	2	3	73	70.196419	-148.423497	14.59
34	0.72	0.44	?[4]	T	20	0	2	2	42	70.196412	-148.423481	14.26
35	0.12	0.19	B16	HC	1	0	1	1	62	70.196404	-148.423462	14.77
36	0.16	0.16	B16	HC	15	0	1	1	58	70.196398	-148.423445	14.87
37	0.20	0.09	B16	HC	15	0	1	2	57	70.196391	-148.423428	14.92
38	0.21	0.22	B16	HC	0	0	1	1	56	70.196384	-148.423411	14.90
39	0.11	0.10	B16	HC	2	0	1	3	61	70.196377	-148.423393	14.91
40	0.38	0.55	B16	HC	0	0	0	2	61	70.196370	-148.423376	14.79
41	0.27	0.13	B17	HC	3	0	0	3	60	70.196364	-148.423359	14.90
42	0.18	0.29	B17	HC	2	0	0	3	56	70.196357	-148.423342	14.85
43	0.18	0.59	B17	HC	2	0	0	2	55	70.196350	-148.423324	14.86
44	0.18	0.36	B17	HC	3	0	0	1	56	70.196343	-148.423307	14.82
45	0.2	0.17	B17	HC	1	0	0	1	66	70.196336	-148.423290	14.81
46	0.23	0.46	B17	HC	0	0	0	1	51	70.196330	-148.423272	14.55
47	0.27	0.28	B17	R	0	0	0	1	83	70.196323	-148.423256	14.69
48	1.25	0.52	B17	R	22	0	0	4	52	70.196316	-148.423238	14.15
49	0.6	0.52	M10d	T	22	0	0	5	59	70.196309	-148.423222	14.12
50	0.39	0.48	M10d	T	10	0	0	3	58	70.196302	-148.423202	14.29
51	0.17	0.28	B17	R	3	0	0	4	69	70.196296	-148.423185	14.56
52	0.16	0.44	B17	R	5	0	0	4	56	70.196289	-148.423169	14.34
53	0.63	0.45	M2d[5]	HC	7	0	0	5	55	70.196282	-148.423151	14.31
54	0.42	0.38	M2d	HC	7	0	0	6	56	70.196275	-148.423134	14.31
55	0.3	0.40	M2d	HC	5	0	0	7	58	70.196268	-148.423116	14.35
56	0.27	0.41	M2d	HC	7	0	0	4	60	70.196262	-148.423099	14.38
57	0.4	0.45	M2d	HC	2	0	0	4	60	70.196255	-148.423081	14.40
58	0.77	0.46	M2d	HC	8	0	0	3	59	70.196248	-148.423064	14.37
59	0.48	0.42	M2d	HC	10	0	0	6	58	70.196241	-148.423047	14.37
60	0.55	0.46	M2d	HCr	5	0	0	5	52	70.196234	-148.423029	14.50
61	0.27	0.47	U17[6]	R	2	0	0	4	60	70.196228	-148.423012	14.48
62	0.42	0.53	U17	R	2	0	0	4	59	70.196221	-148.422994	14.52
63	0.42	0.62	U17	R	12	0	0	2	56	70.196214	-148.422977	14.59
64	0.19	0.59	U17	R	3	0	0	2	57	70.196208	-148.422959	14.65
65	0.34	0.61	U17	R	3	0	0	3	52	70.196201	-148.422943	14.67
66	0.23	0.53	B17	R	1	0	0.5	1	50	70.196194	-148.422925	14.69
67	0.13	0.25	B17	R	3	0	0	1	60	70.196187	-148.422907	14.72
68	0.17	0.16	B17	R	0	0	0.5	2	75	70.196181	-148.422891	14.49
69	0.58	0.45	M10d	T	20	0	0	2	54	70.196174	-148.422874	14.09
70	0.82	0.46	M10d	T	15	0	0	3	55	70.196166	-148.422856	14.04
71	0.62	0.51	M10d	T	4	0	0	1	53	70.196160	-148.422837	14.18
72	0.28	0.56	B17	R	1	0	0	1	72	70.196154	-148.422821	14.73
73	0.13	0.36	B17	R	0	0	0.5	0	59	70.196147	-148.422803	14.75
74	0.27	0.58	B17	R	2	0	0	2	59	70.196140	-148.422786	14.57
75	0.21	0.46	U17	HCr	5	0	0	2	63	70.196133	-148.422769	14.52
76	0.44	0.50	U17	HCr	3	0	0	2	60	70.196126	-148.422752	14.45

Table 3.1A (cont). *Summary of data from* ***Transect 3,*** *Airport Site, August 2015.*

m	LAI	NDVI	Vegetation type between flags	Micro-relief type between flags	Vegetation height at flag (cm)	Water depth (cm)	Surface dust depth (cm)	Dust-penetrated peat (cm)	Thaw depth at flag (cm)	Latitude (WGS84 DD)	Longitude (WGS84 DD)	Elevation (m)
Transect 3												
77	0.38	0.42	U17	HCr	6	0	0	1	59	70.196119	-148.422735	14.44
78	0.41	0.40	U17	HCr	8	0	0	2	59	70.196113	-148.422718	14.47
79	0.64	0.45	U17	HCr	10	0	0	1	60	70.196106	-148.422700	14.51
80	0.49	0.40	U17	HCr	4	0	0	2	58	70.196099	-148.422683	14.48
81	0.33	0.42	U17	HCr	2	0	0	2	60	70.196092	-148.422666	14.53
82	0.26	0.67	U17	HCr	1	0	0	1	57	70.196085	-148.422648	14.67
83	0.24	0.68	B17	R	1	0	0	1	72	70.196079	-148.422631	14.69
84	0.49	0.48	B17	R	7	0	0	1	62	70.196072	-148.422614	14.36
85	0.45	0.24	U17	T	4	0	0	1	61	70.196065	-148.422597	14.26
86	0.34	0.34	M10d	T	1	0	0	3	62	70.196058	-148.422579	14.17
87	0.17	0.54	B17	HCr	0	0	0	2	70	70.196051	-148.422561	14.46
88	0.33	0.59	B17	HCr	0	0	0	2	59	70.196045	-148.422544	14.48
89	0.19	0.53	U17	HCr	2	0	0	3	56	70.196038	-148.422527	14.51
90	0.32	0.49	U17	HCr	6	0	0	2	60	70.196031	-148.422509	14.52
91	0.16	0.51	U17	HCr	3	0	0	2	59	70.196024	-148.422493	14.47
92	0.23	0.53	U17	HCr	5	0	0	2	62	70.196017	-148.422475	14.45
93	0.19	0.52	U17	HCr	3	0	0	4	61	70.196011	-148.422458	14.42
94	0.13	0.56	U17	HCr	2	0	0	3	70	70.196004	-148.422440	14.37
95	0.44	0.56	U17	T	2	0	0	2	68	70.195997	-148.422423	14.50
96	0.38	0.60	B17	R	17	0	0	3	63	70.195990	-148.422405	14.58
97	0.14	0.58	U17	R	7	0	0	3	60	70.195984	-148.422388	14.49
98	0.10	0.57	U17	R	4	0	0	3	65	70.195977	-148.422371	14.38
99	0.07	0.50	U17	R	5	0	0	5	61	70.195970	-148.422354	14.22
100	0.04	0.42	U17	HCr	1	0	0	4	65	70.195964	-148.422337	14.17

Notes: **Vegetation type:** [1]B16 – Dry *Puccinellia angustata*, *Puccinnellia andersonii*, *Salix ovalifolia*, *S. lanata* barren; [2]M10d – Disturbed versions of type M10 (wet *Carex aquatilis, Dupontia fisheri, Eriophorum angustifolium*, saline graminoid tundra); [3]B17 – Dry *Dryas integrifolia, Saxifraga oppositifolia, Chrysanthemum integrifolium, Carex capillaris, Thamnolia* spp. prostrate-dwarf shrub, sedge, forb tundra; [4]no code – Dry *Salix lanata, S. ovalifolia*, dwarf-shrub tundra; [5]M2d – Disturbed versions of M2 (Wet *Carex aquatalis, Bryoerythrophyllum recurvirostrum* tundra); [6]U17 – Moist version of B17. **Microrelief type:** [1]All are high-centered polygons; some are flat on top (HC), some have rims (HCr).

Table 3.1B. *Summary of data from* ***Transect 4****, Airport Site, August 2015.* **m:** *Distance from the road in meters.* **LAI:** *Leaf Area Index measured using an AcuPAR Model 80 instrument (1 measurement/point).* **Vegetation type:** *Based on Walker & Webber (1980), Table 6. A suffix of 'd' indicates disturbed vegetation types.* **Microrelief type:** *Frost boil (F), flat-centered polygon (FC), low-centered polygon (LC), high-centered polygon (HC), high-center polygon with rim (HCr), thermokarst pit (P), low-centered polygon rim (R), roadside berm (RB) and trough (T).* **Vegetation height:** *Average height of dominant layer above the ground or water.* **Dust depth:** *Measured from a soil plug.* **Thaw depth:** *Measured using a 1-m steel probe.* **Latitude/Longitude/Elevation:** *Measured using topographic survey instruments described on p. 8.*

m	LAI	NDVI	Vegetation type between flags	Micro-relief type between flags	Vegetation height at flag (cm)	Water depth (cm)	Surface dust depth (cm)	Dust-penetrated peat (cm)	Thaw depth at flag (cm)	Latitude (WGS84 DD)	Longitude (WGS84 DD)	Elevation (m)
Transect 4												
0	0.13	0.10	E1d	RB	0	0	12	12	ROCKY	70.196769	-148.424384	14.80
1	1.34	0.57	E1d	RB	43	0	10	10	93	70.196776	-148.424399	14.92
2	2.19	0.57	U4d[1]	R	45	0	10	13	69	70.196782	-148.424416	14.98
3	1.90	0.54	U4d	R	35	0	10	12	60	70.196789	-148.424433	14.88
4	1.89	0.52	M2d[2]	FC	40	0	TOO WET	TOO WET	62	70.196795	-148.424450	14.84
5	1.53	0.48	M2d	FC	36	0	TOO WET	TOO WET	59	70.196803	-148.424468	14.80
6	0.53	0.27	M2d	FC	0	0	TOO WET	TOO WET	74	70.196809	-148.424486	14.81
7	0.19	0.42	E1	T	0	11	TOO WET	TOO WET	75	70.196816	-148.424504	14.66
8	0.35	-0.34	E1	T	0	6	TOO WET	TOO WET	72	70.196822	-148.424521	14.72
9	1.67	0.54	M2d	FC	40	1	TOO WET	TOO WET	61	70.196829	-148.424538	14.76
10	0.64	0.50	M2d	FC	35	0	TOO WET	TOO WET	59	70.196837	-148.424554	14.78
11	1.79	0.51	M2d	FC	37	0	TOO WET	TOO WET	60	70.196843	-148.424572	14.81
12	1.66	0.60	M2d	FC	35	0	TOO WET	TOO WET	64	70.196850	-148.424589	14.82
13	1.19	0.56	M2d	FC	38	3	TOO WET	TOO WET	76	70.196857	-148.424607	14.79
14	2.78	0.68	M2d	FC	30	20	TOO WET	TOO WET	83	70.196863	-148.424624	14.66
15	2.40	0.68	E1	T	37	0	TOO WET	TOO WET	94	70.196870	-148.424642	14.80
16	1.10	0.49	M2d	FC	37	0	TOO WET	TOO WET	103	70.196877	-148.424659	14.83
17	1.16	0.47	M2d	FC	32	0	TOO WET	TOO WET	109	70.196884	-148.424675	14.81
18	0.69	0.41	M2d	FC	30	4	TOO WET	TOO WET	109	70.196891	-148.424692	14.76
19	0.53	0.30	M2d	FC	30	28	TOO WET	TOO WET	114	70.196897	-148.424710	14.68
20	0.24	0.21	E1	T	12	37	TOO WET	TOO WET	113	70.196905	-148.424727	14.50
21	0.50	0.12	E1	T	23	39	TOO WET	TOO WET	122	70.196911	-148.424745	14.40
22	0.66	-0.07	E1	T	32	24	TOO WET	TOO WET	98	70.196918	-148.424762	14.56
23	0.84	0.57	E1	T	26	9	TOO WET	TOO WET	111	70.196925	-148.424779	14.71
24	0.65	0.41	M2d	FC	32	11	TOO WET	TOO WET	109	70.196931	-148.424795	14.68
25	0.72	0.45	M2d	FC	35	17	TOO WET	TOO WET	110	70.196938	-148.424812	14.64
26	0.57	0.41	E1	T	25	20	TOO WET	TOO WET	111	70.196946	-148.424829	14.54
27	0.42	0.41	E1	T	35	20	TOO WET	TOO WET	104	70.196952	-148.424844	14.54
28	0.52	0.55	E1	T	28	32	TOO WET	TOO WET	99	70.196960	-148.424860	14.52
29	0.11	0.30	E1	T	23	46	TOO WET	TOO WET	111	70.196966	-148.424881	14.34
30	0.21	0.14	E1	T	30	33	TOO WET	TOO WET	102	70.196973	-148.424898	14.47
31	0.47	0.24	E1	T	35	19	TOO WET	TOO WET	101	70.196979	-148.424916	14.58
32	0.40	0.46	E1	T	33	15	TOO WET	TOO WET	87	70.196986	-148.424932	14.66
33	0.77	0.56	E1	T	28	14	TOO WET	TOO WET	82	70.196993	-148.424949	14.66
34	0.57	0.57	E1	T	29	15	TOO WET	TOO WET	75	70.197000	-148.424967	14.63
35	0.14	-0.53	E1	T	0	35	TOO WET	TOO WET	69	70.197007	-148.424984	14.40
36	0.00	-0.68	W	T	0	48	TOO WET	TOO WET	67	70.197014	-148.425001	14.28
37	0.00	-0.76	W	T	0	61	TOO WET	TOO WET	76	70.197021	-148.425016	14.16
38	0.08	-0.75	W	T	0	78	TOO WET	TOO WET	57	70.197027	-148.425035	13.99
39	0.55	0.49	E1	FC	29	25	TOO WET	TOO WET	70	70.197034	-148.425054	14.45
40	0.75	0.59	E1	FC	30	24	TOO WET	TOO WET	58	70.197041	-148.425071	14.54
41	0.22	0.53	E1	FC	43	3	TOO WET	TOO WET	62	70.197048	-148.425087	14.72

Table 3.1B (cont). *Summary of data from **Transect 4,** Airport Site, August 2015.*

m	LAI	NDVI	Vegetation type between flags	Micro-relief type between flags	Vegetation height at flag (cm)	Water depth (cm)	Surface dust depth (cm)	Dust-penetrated peat (cm)	Thaw depth at flag (cm)	Latitude (WGS84 DD)	Longitude (WGS84 DD)	Elevation (m)
Transect 4												
42	0.22	0.50	E1	FC	35	11	TOO WET	TOO WET	52	70.197054	-148.425103	14.70
43	0.37	0.62	E1	FC	36	8	TOO WET	TOO WET	58	70.197061	-148.425121	14.70
44	0.81	0.59	E1	FC	37	6	TOO WET	TOO WET	56	70.197068	-148.425137	14.72
45	0.64	0.59	E1	FC	40	9	TOO WET	TOO WET	59	70.197075	-148.425156	14.69
46	0.55	0.63	E1	FC	40	15	TOO WET	TOO WET	55	70.197082	-148.425173	14.60
47	0.95	0.62	E1	FC	30	15	TOO WET	TOO WET	63	70.197089	-148.425191	14.63
48	0.55	0.52	E1	FC	25	55	TOO WET	TOO WET	41	70.197096	-148.425206	14.20
49	0.31	0.49	W	T	28	25	TOO WET	TOO WET	61	70.197103	-148.425223	14.47
50	0.68	0.60	E1	T	33	14	TOO WET	TOO WET	62	70.197110	-148.425241	14.63
51	0.48	0.45	E1	FC	34	12	TOO WET	TOO WET	57	70.197116	-148.425257	14.68
52	0.81	0.58	M2d	FC	30	0	TOO WET	TOO WET	56	70.197123	-148.425275	14.80
53	0.57	0.52	M2d	FC	27	0	TOO WET	TOO WET	51	70.197130	-148.425292	14.82
54	0.89	0.47	M2d	FC	30	1	TOO WET	TOO WET	47	70.197137	-148.425309	14.77
55	0.65	0.47	M2d	FC	30	0	TOO WET	TOO WET	50	70.197144	-148.425326	14.79
56	0.57	0.52	M2d	FC	30	0	TOO WET	TOO WET	44	70.197150	-148.425343	14.81
57	0.79	0.50	M2d	FC	30	0	TOO WET	TOO WET	46	70.197157	-148.425361	14.82
58	1.07	0.54	M2d	FC	28	1	TOO WET	TOO WET	47	70.197164	-148.425379	14.82
59	0.81	0.59	M2d	FC	35	0	TOO WET	TOO WET	45	70.197171	-148.425394	14.81
60	1.32	0.60	M2d	FC	33	0	TOO WET	TOO WET	44	70.197178	-148.425412	14.80
61	0.96	0.53	M2d	FC	30	0	TOO WET	TOO WET	45	70.197185	-148.425428	14.80
62	1.47	0.59	M2d	FC	32	0	TOO WET	TOO WET	45	70.197192	-148.425446	14.82
63	1.31	0.50	M2d	FC	37	0	TOO WET	TOO WET	47	70.197198	-148.425464	14.84
64	1.28	0.57	M2d	R	42	0	0	6	47	70.197205	-148.425480	14.79
65	1.75	0.60	M2d	R	28	7	TOO WET	TOO WET	43	70.197212	-148.425498	14.72
66	1.95	0.57	E1	T	46	0	TOO WET	TOO WET	35	70.197219	-148.425514	14.78
67	1.69	0.57	U4d	R	40	0	TOO WET	TOO WET	44	70.197226	-148.425532	14.81
68	1.55	0.62	M2d	FC	42	0	TOO WET	TOO WET	49	70.197233	-148.425549	14.80
69	1.70	0.63	M2d	FC	43	0	TOO WET	TOO WET	45	70.197240	-148.425566	14.80
70	1.66	0.63	M2d	R	35	0	TOO WET	TOO WET	47	70.197246	-148.425583	14.80
71	2.60	0.63	M2d	FC	27	11	TOO WET	TOO WET	42	70.197253	-148.425599	14.69
72	1.53	0.58	E1	FC	28	10	TOO WET	TOO WET	42	70.197260	-148.425616	14.69
73	1.21	0.55	E1	FC	27	9	TOO WET	TOO WET	42	70.197267	-148.425634	14.74
74	1.52	0.60	E1	FC	35	5	TOO WET	TOO WET	50	70.197274	-148.425651	14.76
75	2.16	0.66	U4d	R	42	0	TOO WET	TOO WET	54	70.197281	-148.425669	14.88
76	1.42	0.60	M2d	FC	38	0	TOO WET	TOO WET	46	70.197287	-148.425685	14.87
77	0.91	0.52	M2d	FC	40	0	TOO WET	TOO WET	48	70.197294	-148.425703	14.86
78	1.18	0.51	M2d	FC	40	0	TOO WET	TOO WET	45	70.197301	-148.425719	14.82
79	1.05	0.49	M2d	FC	34	0	TOO WET	TOO WET	48	70.197308	-148.425737	14.78
80	0	-0.01	M2d	FC	0	0	TOO WET	TOO WET	66	70.197314	-148.425755	14.90
81	0	-0.02	gravel[3]	FC	0	0	TOO WET	TOO WET	72	70.197321	-148.425772	14.97
82	0	-0.02	gravel	FC	0	0	TOO WET	TOO WET	75	70.197328	-148.425790	15.01
83	0	-0.03	gravel	FC	0	0	TOO WET	TOO WET	74	70.197335	-148.425806	15.02
84	0	-0.02	gravel	FC	0	0	TOO WET	TOO WET	75	70.197342	-148.425823	15.00
85	0	-0.02	gravel	FC	0	0	TOO WET	TOO WET	75	70.197348	-148.425840	15.02
86	0	0.01	gravel	FC	0	0	TOO WET	TOO WET	62	70.197355	-148.425858	14.92
87	1.12	0.46	M2d	FC	37	1	TOO WET	TOO WET	43	70.197362	-148.425874	14.78
88	1.03	0.52	M2d	FC	43	0	TOO WET	TOO WET	46	70.197369	-148.425891	14.83

Table 3.1B (cont). *Summary of data from* ***Transect 4,*** *Airport Site, August 2015.*

m	LAI	NDVI	Vegetation type between flags	Micro-relief type between flags	Vegetation height at flag (cm)	Water depth (cm)	Surface dust depth (cm)	Dust-penetrated peat (cm)	Thaw depth at flag (cm)	Latitude (WGS84 DD)	Longitude (WGS84 DD)	Elevation (m)
Transect 4												
89	1.27	0.57	M2d	FC	30	0	TOO WET	TOO WET	49	70.197376	-148.425909	14.82
90	0.84	0.58	M2d	FC	40	0	TOO WET	TOO WET	47	70.197383	-148.425926	14.81
91	1.19	0.60	M2d	FC	45	0	TOO WET	TOO WET	49	70.197390	-148.425942	14.88
92	1.36	0.67	U4d	R	38	0	1	2	43	70.197396	-148.425959	14.86
93	1.00	0.60	E1	T	27	3	TOO WET	TOO WET	43	70.197404	-148.425976	14.77
94	1.01	0.66	E1	T	38	0	TOO WET	TOO WET	42	70.197410	-148.425994	14.80
95	1.21	0.56	M2d	FC	38	0	TOO WET	TOO WET	39	70.197417	-148.426011	14.82
96	1.29	0.61	M2d	FC	40	0	TOO WET	TOO WET	39	70.197424	-148.426027	14.83
97	1.33	0.55	M2d	FC	40	0	TOO WET	TOO WET	37	70.197431	-148.426045	14.84
98	0.97	0.53	M2d	FC	38	0	TOO WET	TOO WET	38	70.197438	-148.426061	14.84
99	0.75	0.55	M2d	FC	40	0	TOO WET	TOO WET	40	70.197445	-148.426079	14.85
100	0.95	0.53	M2d	FC	40	0	TOO WET	TOO WET	41	70.197451	-148.426097	14.84

Notes: **Vegetation type:** [1]*Salix lanata* band next to road; [2]M2d is now *Carex aquatilis* with some *Eriophorum angustifolium, Carex saxatilis*, and deep litter; [3]Gravel from flood deposit in spring 2015. By the end of 2016 growing season, M2d and U4d were mostly a continuous stand of *Carex aquatilus* with minor variations in the mosses. Difficult to tell what was originally present over most of the transect. Gravel tongue at 80-86 m is about 20 cm thick and covers original low-centered polygons.

Table 3.2A. *Environmental characteristics and lifeform cover values for permanent plots on* ***Transect 3****, Airport Site, August 2015.* ***Site information:*** *Codes for site descriptors are listed in Table 3.2D.* **LAI:** *Leaf Area Index measured using an AcuPAR Model 80 instrument (1 measurement/point).* **Vegetation type:** *Based on Walker & Webber (1980), Table 6. A suffix of 'd' indicates disturbed vegetation types. See notes following Table 3.1A for description of additional vegetation types added by DA Walker for this study.*

Transect	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**
Distance from road (m)	**5**	**5**	**10**	**10**	**25**	**25**	**50**	**50**	**100**	**100**
Polygon Center (C) or Trough (T)	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**
Date	8/3/15	8/3/15	8/3/15	8/3/15	8/3/15	8/3/15	8/3/15	8/3/15	8/3/15	8/3/15
Observers	DAW, MKR	DAW, MKR	DAW, MKR	DAW, MKR	DAW, MKR	DAW, MKR	DAW, MKR	DAW, MKR	DAW, MKR	DAW, MKR
Geography										
Latitude (WGS84 DD)	70.196715	70.196668	70.196612	70.196645	70.196499	70.196513	70.196364	70.196326	70.196006	70.196052
Longitude (WGS84 DD)	-148.423597	-148.423784	-148.423744	-148.423458	-148.423577	-148.423446	-148.422913	-148.423128	-148.422212	-148.422128
Slope (degrees)	0	0	0	0	0	0	0	0	0	0
Aspect	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Elevation (m)	14.66	14.03	14.46	13.30	14.57	14.04	14.30	13.91	14.20	13.77
Photos										
Plot photo number (taken from roadside)	83, 84	85, 86	90-92	93-95	96-99	100-102	103-106	107-109	110-112	113,115, 116
Soil photo number	214, 215	216	218	219	220	221	222	229	230	231
Site information										
Landform	7	7	7	7	7	7	7	7	7	7
Surficial geology (parent material)	8	8	8	8	8	8	8	8	8	8
Surficial geomorphology	6	6	6	6	6	6	6	6	6	6
Microsite	5	6	5	6	5	6	5	6	5	6
Site moisture	4	9	4	10	4	8	6	8	5	8
Soil moisture	3	10	3	10	4	7	6	7	5	7
Glacial geology	0	0	0	0	0	0	0	0	0	0
Topographic position	4	4	4	4	4	4	4	4	4	4
Estimated snow duration	3	3	3	3	3	3	3	4	4	4
Disturbance degree	5	4	5	4	4	3	3	1	1	1
Disturbance type	8,9	8,9,2	8,9	8,9	8,9	8	8	2	8,4	4
Physical stability	1	3	1	3	1	3	1	3	1	3
Exposure	2	1	2	1	3	1	3	2	3	2
Soil samples taken	2	2	2	2	2	2	3	2	2	2
Cover (% live/%standing dead)										
Low shrubs	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Erect dwarf shrubs	0/1	0/0	20/3	0/0	10/1	0/0	0/0	0/0	5/0	0/0
Prostrate dwarf shrubs	0/0	0/0	25/2	0/0	8/2	0/0	15/0	0/0	10/1	0/0

Table 3.2A (cont.). *Environmental characteristics and lifeform cover values for permanent plots on* ***Transect 3****, Airport Site, August 2015.*

Transect	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**
Distance from road (m)	**5**	**5**	**10**	**10**	**25**	**25**	**50**	**50**	**100**	**100**
Polygon Center (C) or Trough (T)	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**
Evergeen shrubs	0/0	0/0	0/0	0/0	5/5	0/0	0/0	0/0	5/1	0/0
Deciduous shrubs	0/1	0/0	45/5	0/0	10/1	0/0	15/0	0/0	10/0	0/0
Erect forbs	0/0	0/0	+/0	0/0	1/0	0/0	+/0	0/0	1/0	0/0
Mat & cushion forbs	0/0	0/0	0/0	0/0	15/0	0/0	0/0	0/0	5/0	0/0
Non-tussock graminoids	10/10	75/5	1/0	0/0	12/3	60/35	40/10	65/35	20/5	40/10
Tussock graminoids	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Foliose lichen	0	0	0	0	0	0	0	0	0	0
Fruticose lichen	0	0	0	0	+	0	0	0	0	0
Crustose lichen	0	0	0	0	0	0	0	0	5	0
Pleurocarpous bryophytes	0	0	+	0	1	0	3	1	2	90
Acrocarpous bryo./ Liverworts	0/0	0/0	+/+	0/0	7/1	0/0	2/1	0/0	5/+	0/0
Horsetails/Algae	0/0	0/0	0/0	0/0	+/0	0/0	+/0	0/0	+/0	2/0
Cover (%)										
Rocks	25	0	15	0	3	0	0	0	0	0
Bare soil	55	0	35	0	15	5	0	+	2	0
Water (%/depth in cm)	0/0	95/3.5	0/0	100/70	0/0	0/0	0/0	0/0	0/0	0/0
Litter	0	5	15	0	5	5	7	5	3	8
Other characteristics										
Low shrub height (cm)	0	0	0	0	0	0	0	0	0	0
Dwarf shrub height (cm)	20	0	16	0	15	0	15	0	15	0
Herbaceous height (cm above water or soil)	10	30	5	0	7	23	5	25	10	23
Live moss height (cm)	0	0	1	0	1	0	1	1	1	3
Dead moss depth (cm)	0	0	0	0	5	0	2	0	0	3
Dust thickness (cm)	7	13	6	11	7	9	2	5	3	3
Organic (cm)	46	40	30	20	30	32	34	32	33	35
Microrelief (cm)	2	5	5	0	5	20	7	5	6	7
Mean thaw depth (cm)	74	58	67	45	57	56	51	54	61	49
NDVI	0.65	0.13	0.30	-0.26	0.40	0.48	0.47	0.63	0.49	0.47
LAI (mean of 4 readings)	0.04	1.57	.0	0.09	0.07	0.53	0.31	1.04	0.08	0.54
Vegetation type	B16	M10d	B16	W1	B17	M10d	M2d	M10d	U17	M10d

Table 3.2B. *Environmental characteristics and lifeform cover values for permanent plots on* ***Transect 4****, Airport Site, August 2015.* ***Site information:*** *Codes for site descriptors are listed in Table 3.2D.* **LAI:** *Leaf Area Index measured using an AcuPAR Model 80 instrument (1 measurement/point).* **Vegetation type:** *Based on Walker & Webber (1980), Table 6. A suffix of 'd' indicates disturbed vegetation types.*

Transect	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**
Distance from road (m)	**5**	**5**	**10**	**10**	**25**	**25**	**50**	**50**	**100**	**100**
Polygon Center (C) or Trough (T)	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**
Date	8/4/15	8/4/15	8/4/15	8/4/15	8/4/15	8/4/15	8/4/15	8/4/15	8/4/15	8/4/15
Observers	DAW,MKR	DAW,MKR	DAW,MKR	DAW,MKR	DAW,MKR	DAW,MKR	DAW,MKR	DAW,MKR	DAW,MKR	DAW,MKR
Geography										
Latitude (WGS84 DD)	70.196764	70.196776	70.196839	70.196810	70.196903	70.196861	70.197047	70.197047	70.197449	70.197399
Longitude (WGS84 DD)	-148.4246471	-148.424562	-148.424610	-148.424725	-148.424911	-148.425010	-148.425259	-148.425555	-148.426283	-148.426230
Slope (degrees)	1	0	0	0	0	0	0	0	0	0
Aspect	W	NA	NA	NA	NA	NA	NA	NA	NA	NA
Elevation (m)	14.73	14.49	14.74	14.24	14.69	14.38	14.71	14.50	14.79	14.64
Photos										
Plot photo number (taken from roadside)	232	233	234	235	236	237	238	239	167,240,241	242
Soil photo number	214, 215	216	218	219	220	221	222	229	230	231
Site information										
Landform	7	7	7	7	7	7	7	7	7	7
Surficial geology (parent material)	8	8	8	8	8	8	8	8	8	8
Surficial geomorphology	20	20	20	20	20	20	20	20	20	20
Microsite	5	6	5	6	5	6	5	6	5	6
Site moisture	8	9	8	10	9	9	9	9	8	9
Soil moisture	8	9	8	10	9	9	9	9	9	9
Glacial geology	0	0	0	0	0	0	0	0	0	0
Topographic position	4	4	4	4	4	4	4	4	4	4
Estimated snow duration	3	3	3	3	3	3	4	4	4	4
Disturbance degree	5	5	4	4	5	5	5	4	0	1
Disturbance type	8,9	8,9	8,9	9	9,8	9,8	9	9	0	2
Physical stability	2	1	1	1	1	1	1	1	1	1
Exposure	2	2	2	2	2	2	3	3	3	3
Soil samples taken	2	2	2	2	1	2	1	2	2	2
Cover (% live/%standing dead)										
Low shrubs	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Erect dwarf shrubs	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0.1/0	0/0
Prostrate dwarf shrubs	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0

Table 3.2B (cont.). *Environmental characteristics and lifeform cover values for permanent plots on* ***Transect 4****, Airport Site, August 2015.*

Transect	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**
Distance from road (m)	**5**	**5**	**10**	**10**	**25**	**25**	**50**	**50**	**100**	**100**
Polygon Center (C) or Trough (T)	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**
Evergeen shrubs	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Deciduous shrubs	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0.1/0	0/0
Erect forbs	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Mat & cushion forbs	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Non-tussock graminoids	60/20	35/0	60/20	0/0	30/10	30/0	45/35	25/1	45/40	60/30
Tussock graminoids	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Foliose lichen	0	0	0	0	0	0	0	0	0	0
Fruticose lichen	0	0	0	0	0	0	0	0	0	0
Crustose lichen	0	0	0	0	0	0	0	0	0	0
Pleurocarpous bryophytes	+	0	5	0	0	0	15	0	25	0
Acrocarpous bryo./ Liverworts	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	25/0	0/0
Horsetails/Algae	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Cover (%)										
Rocks	0	0	0	0	0	0	0	0	0	0
Bare soil	2	0	+	0	0	0		0	0	0
Water (%/depth in cm)	5/1	100/24	0/0	100/44	35/7	100/31	3/3	100/28	0/0	3/2
Litter	20	50[1]	20	0	20	20[1]	15	100[1]	5	10
Other characteristics										
Low shrub height (cm)	0	0	0	0	0	0	0	0	0	0
Dwarf shrub height (cm)	0	0	0	0	0	0	0	0	20	0
Herbaceous height (cm above water or soil)	40	30	40	0	30	30	25	25	30	30
Live moss height (cm)	1	0	1	0	0	0	1	0	3	0
Dead moss depth (cm)	1	0	3	0	0	0	3	0	7	0
Dust thickness (cm)	0	26	6	Too wet	Too wet	6	3	0	0	0
Organic (cm)	17	35	32	30	100	23	27	50	25	30
Microrelief (cm)	30	2	10	20	2	40	2	10	5	2
Mean thaw depth (cm)	64	61	57	63	101	42	61	41	41	38
NDVI	0.48	0.49	0.55	-0.52	0.41	0.48	0.50	0.54	0.59	0.48
LAI (mean of 4 readings)	0.96	0.54	1.12	0.00	0.49	0.21	0.49	0.33	1.12	0.66
Vegetation type	M2d	E1	M2d	E1	M2d	E1	M2d	E1	M2d	E1

Notes: **Cover: Litter:** [1]Under water.

Table 3.2C. *Environmental characteristics and lifeform cover values for permanent plots on* ***Transect 5****, Airport Site, August 2015.* ***Site information:*** *Codes for site descriptors are listed in Table 3.2D.*

Transect	**T5**	**T5**	**T5**	**T5**	**T5**	**T5**	**T5**
Distance from road (m)	**25**	**25**	**50**	**50**	**50**	**100**	**100**
Polygon Center (C) or Trough (T)	**C**	**T**	**C**	**T(A)**	**T(B)**	**C**	**T**
Date	8/9/15	8/9/15	8/9/15	8/9/15	8/9/15	8/9/15	8/9/15
Observers	DAW,MKR	DAW,MKR	DAW,MKR	DAW,MKR	DAW,MKR	DAW,MKR	DAW,MKR
Geography							
Latitude (WGS84 DD)	70.195770	70.195747	70.195911	70.195829	70.195829	70.196074	70.196016
Longitude (WGS84 DD)	-148.426809	-148.427013	-148.427514	-148.427642	-148.427642	-148.428575	-148.428483
Slope (degrees)	1	0	0	0	0	0	0
Aspect	W	NA	NA	NA	NA	NA	NA
Elevation (m)	14.52	14.34	14.46	14.29	14.29	14.63	14.22
Photos							
Plot photo number (taken from roadside)	297,298	299,300	301,302	304,305	304,305	307-310	312-314
Soil photo number	316	317	303	306	306	311	315
Site information							
Landform	7	7	7	7	7	7	7
Surficial geology (parent material)	8	8	8	8	8	8	8
Surficial geomorphology	20	20	20	20	20	20	20
Microsite	5	6	5	6	6	5	6
Site moisture	6	7.5	6	7	8	6	8
Soil moisture	7	8	7	7	7	7	8
Glacial geology	0	0	0	0	0	0	0
Topographic position	4	4	4	4	4	4	4
Estimated snow duration	3	3	3	3	3	4	4
Disturbance degree	3	3	2	1	1	2	1
Disturbance type	1,8,7	8	8,1	8	8	7,8	8
Physical stability	1	1	1	1	1	1	1
Exposure	2	1	2	2	2	3	2
Soil samples taken	2	2	2	2		2	2
Cover (% live/%standing dead)							
Low shrubs	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Erect dwarf shrubs	5/0	2/0	5/0	3/0	0.1/0	5/0	0/0
Prostrate dwarf shrubs	10/0	0.1/0	10/0	5/0	0/0	12/3	0/0
Evergeen shrubs	0/0	0/0	0/0	3/0	0/0	4/3	0/0
Deciduous shrubs	15/0	2/0	15/0	5/0	0/0	13/0	0/0
Erect forbs	0.1/0	0/0	0.1/0	0/0	0/0	0.1/0	0/0
Mat & cushion forbs	0/0	0/0	0.1/0	0/0	0/0	0.1/0	0/0
Non-tussock graminoids	40/15	45/30	35/20	45/20	10/3	25/10	50/30
Tussock graminoids	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Foliose lichen	0	0	0	0	0	0	0
Fruticose lichen	0	0	0	0	0	0	0
Crustose lichen	0	0	0	0	0	0	0
Pleurocarpous bryophytes	5	10	3	5	80	15	40
Acrocarpous bryo./ Liverworts	20/1	0/0	5/0	10/1	5/0	15/0	20/0
Horsetails/Algae	5/0	1/0	3/0	1/0	0.1/0	0.1/0	0.1/0
Cover (%)							
Rocks	0	0	0	0	0	0	0
Bare soil	5	0	5	0	0	0	0
Water (%/depth in cm)	0	0	0	0	0	0	5/5

Table 3.2C (cont.). *Environmental characteristics and lifeform cover values for permanent plots on* ***Transect 5*** *(T5), Airport Site, August 2015.*

Transect	**T5**	**T5**	**T5**	**T5**	**T5**	**T5**	**T5**
Distance from road (m)	**25**	**25**	**50**	**50**	**50**	**100**	**100**
Polygon Center (C) or Trough (T)	**C**	**T**	**C**	**T(A)**	**T(B)**	**C**	**T**
Litter	5	15	20	10	10	15	25
Other characteristics							
Low shrub height (cm)	0	0	0	0	0	0	0
Dwarf shrub height (cm)	20	24	25	17	0	12	0
Herbaceous height (cm above water or soil)	15	25	23	22	20	17	30
Live moss height (cm)	1	1	1	1	3	1	3
Dead moss depth (cm)	0	0	0	2	7	2	2
Dust thickness (cm)[1]	3/12	5/10	3/8	4/4	7/7	0/3	0/0
Organic (cm)	>29	>25	>67	>30	>29	28[2]	>28
Microrelief (cm)	3	10	3	15	5	3	15
Mean thaw depth (cm)	60	52	67	57	45	57	47

Notes: **Other characteristics: Dust thickness:** [1]Thickness of surface dust layer (cm)/thickness of dust penetrating the peat (cm). **Other characteristics: Organic:** [2]Only plot with C horizon

Table 3.2D. *Codes used for site description of plots in Tables 3.2A, B and C.*

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 Alluvial plain/abandoned
19 Island
20 Plain - residual surface
21 Disturbed, gravel

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 Loess
14 Fine sand
15 _____
16 _____

Surficial Geomorphology

1 Frost scars
2 Wetland hummocks
3 Turf hummocks
4 Gelifluction features
5 Strangmoor or aligned hummocks
6 High- or flat-centered polygons
7 Mixed high- and low-centered polygons
8 Sorted and non-sorted stripes
9 Palsas
10 Thermokarst pits
11 Featureless or with <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 Hill hummock
19 Wetland
20 Low-centered polygon
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 Ring
13 Thermokarst pit
14 _____
15 _____

Site Moisture (modified from Komárková 1983)

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

Soil Moisture (from Komárková 1983)

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

Glacial Geology

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

Topographic Position

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

Soil Units (U.S. Soil Survey Staff 1975 and Everett 1980)

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 (Aquiturbol)
9 Pergelic Cryaquept, acid (Ochriturbel)
10 Pergelic Cryaquept, nonacid
11 Pergelic Cryochrept
12 Pergelic Cryumbrept
13 Ruptic-Lithic Cryumbrept
14 Pergelic Cryaquoll
15 Histic Pergelic Cryaquoll
16 Pergelic Cryoboroll (Mollitrubel)
17 _____
18 _____
19 _____

Estimated Snow Duration

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

Animal and Human Disturbance (degree)

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

Animal and Human Disturbance (type)

1 Ptarmigan scat
2 Caribou tracks
3 Caribout scat
4 Goose tracks, scat, grazing
5 Squirrel mounds
6 Vole tracks & scat
7 Vehicle tracks
8 Road/pad dust
9 Road/pad gravel

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

Exposure Scale

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

Table 3.3. *Percent plant cover on permanent plots by species, based on 100 points within a 1-m² quadrat (first hit only recorded for each point), Airport Site, August 2015.*

Transect		T3	T3	T3	T3	T3	T3	T3	T3	T3	T3	T4	T4	T4	T4	T4	T4	T4	T4	T4	T4
Distance from road (m)		5	5	10	10	25	25	50	50	100	100	5	5	10	10	25	25	50	50	100	100
Polygon Center (C) or Trough (T)		C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T
Vascular species																					
Bistorta vivipara	live vascular						1			2											
Carex fuliginosa ssp. *misandra*	live vascular					1															
Carex fuliginosa ssp. *misandra* (dead)	dead vascular					2															
Carex saxatilis ssp. *laxa*	live vascular											1								4	
Carex saxatilis ssp. *laxa* (dead)	dead vascular													2						1	
Carex aquatilis	live vascular		40				24	1	18		15	45	56	35		31	43	47	41	25	46
Carex aquatilis (dead)	dead vascular		7				35	3	24		21	27	2	28		21	2	32	3	55	26
Carex krausei	live vascular					4				18											
Carex krausei (dead)	dead vascular			1		10				10											
Carex membranacea	live vascular									1											
Carex rotundata	live vascular									2											
Dryas integrifolia ssp. *integrifolia*	live vascular					8				9											
Dryas integrifolia ssp. *integrifolia* (dead)	dead vascular					3				2											
Equisetum variegatum ssp. *variegatum*	live vascular										2										
Eriophorum angustifolium	live vascular		31	1		2	18	40	32	3	19	10		26		6		3	1	2	
Eriophorum angustifolium (dead)	dead vascular		4	1		1	14	44	16	4	16	2		3						1	
Hulteniella integrifolia	live vascular					4				8											
Oxytropis deflexa	live vascular									3											
Puccinellia angustata	live vascular	4																			
Puccinellia angustata (dead)	dead vascular	2																			
Puccinellia andersonii	live vascular	9																			
Puccinellia andersonii (dead)	dead vascular	7																			
Salix ovalifolia var. ovalifolia	live vascular			20		1		5													
Salix richardsonii	live vascular			7		3				3											
Salix richardsonii (dead)	dead vascular	3																			
Salix reticulata	live vascular									1											
Saxifraga oppositifolia ssp. *oppositifolia*	live vascular					11															
Saxifraga oppositifolia ssp. *oppositifolia* (dead)	dead vascular					1															
Stellaria sp.	dead vascular							1													
Nonvascular species																					
Calliergon giganteum	nonvascular										12										

Table 3.3 (cont.). *Percent plant cover on permanent plots by species, based on 100 points within a 1-m² quadrat (first hit only recorded for each point), Airport Site, August 2015.*

Transect		**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T3**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**	**T4**
Distance from road (m)		**5**	**5**	**10**	**10**	**25**	**25**	**50**	**50**	**100**	**100**	**5**	**5**	**10**	**10**	**25**	**25**	**50**	**50**	**100**	**100**
Polygon Center (C) or Trough (T)		**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**T**
Cinclidium latifolium	nonvascular																			5	
Drepanocladus species	nonvascular			1						1										1	
Limprichtia revolvens	nonvascular										7										
Meesia triquetra	nonvascular													2						2	
Pohlia cruda	nonvascular			1																	
Scorpidium scorpioides	nonvascular																	2			
Black crustose lichen	nonvascular					3				15											
Unkown moss (colonizing mat)	nonvascular					13		1		3											
White crustose lichen	nonvascular									2											
Non-vegetated cover																					
Bare ground	soil	57	4	39		14	1					6									
Gravel	soil	18		4		1															
Litter	organic litter		2	25		18	7	5	10	13	8	7		4		10		13		4	27
Water	water		12		100							2	42		100	32	55	3	55		1
SUM		**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 3.4A. *Braun-Blanquet categorical species cover abundance values for permanent plots on* ***Transect 3****, Airport Site, August 2015.* ***Vascular species:*** *Six letter species codes use the first three letters of the genus and first three letters of the species name.* ***Cover:*** *Rare (R), common but < 1% (+), 1-5% (1), 6-25% (2), 26-50% (3), 51-75% (4), 76-100% (5), outside plot (*).*

Transect		T3	T3	T3	T3	T3	T3	T3	T3	T3	T3
Distance from road (m)		5	5	10	10	25	25	50	50	100	100
Polygon Center (C) or Trough (T)		C	T	C	T	C	T	C	T	C	T
Vascular species											
PUCANG	*Puccinellia angustata*	2		*							
PUCAND	*Puccinellia andersonii*	2									
SALLAN	*Salix richardsonii*	1	*R	2		2		*		1	
SALOVA	*Salix ovalifolia* var. *ovalifolia*	*+		3		+		2			
DESCAE	*Deschampsia sukatschewii* ssp. *orientalis*	*+									
COCOFF	*Cochlearia officinalis*	*R									
ERIANG	*Eriophorum angustifolium*		2	+		1	3	3	2	1	2
CARAQU	*Carex aquatilis*		4			+	4	2	4		3
POLVIV	*Bistorta vivipara*			+		+		+		+	
CARCAP	*Carex capillaris*			+		1					
BRABAR	*Braya glabella* ssp. *glabella*			*							
SAXOPP	*Saxifraga oppositifolia* ssp. *oppositifolia*					2		*		1	
CHRINT	*Hulteniella integrifolia*					2		+		1	
DRYINT	*Dryas integrifolia* ssp. *integrifolia*					2		+		2	
CARMIS	*Carex fuliginosa* ssp. *misandra*					1				+	
CARATR	*Carex atrofusca*					1		*			
EQUVAR	*Equisetum variegatum* ssp. *variegatum*					+		+		+	1
PEDCAP	*Pedicularis capitata*					+					
CARSCI	*Carex scirpoidea*					*				2	
CARKRA	*Carex krausei*							*		1	
EUTEDW	*Eutrema edwardsii*							*			
PEDSUD	*Pedicularis albolabiata*							*			
STELONG	*Stellaria longipes*							1			
OXYDEF	*Oxytropis deflexa* ssp. *dezhnevii*									+	
SALRET	*Salix reticulata*									1	
Mosses											
MEETRI	*Meesia triquetra*								+		
BRYCYC	*Bryum cyclophyllum*										+
BRYPSE	*Bryum pseudotriquetrum*			+				+		+	
BRYREC	*Bryoerythrophyllum recurvirostre*					+		1			
CALRIC	*Calliergon richardsonii*							+	+		2

Table 3.4A (cont.). *Braun-Blanquet categorical species cover abundance values for permanent plots on* ***Transect 3****, Airport Site, August 2015.*

Transect		T3	T3	T3	T3	T3	T3	T3	T3	T3	T3
Distance from road (m)		5	5	10	10	25	25	50	50	100	100
Polygon Center (C) or Trough (T)		C	T	C	T	C	T	C	T	C	T
CAMSTE	*Campylium stellatum*							+		1	
CATNIG	*Catoscopium nigritum*					2					
DISCAP	*Distichium capillaceum*			+		1		1		1	
DITFLE	*Ditrichum flexicaule*					+				+	
DRESEN	*Drepanocladus sendtneri*			+		+			1	+	4
ENCALP	*Encalypta alpina*					+		+		+	
ENCLON	*Encalypta longicolla*									+	
ORTSTR	*Orthothecium strictum*					+		+		+	
POHCRU	*Pohlia cruda*	R		+							
PSETUR	*Pseudocalliergon turgescens*							+			
Lichens											
BLACK CRUST	Black crustose lichen									2	
SOLORINA sp.	*Solorina* species					*					
THAMN	*Thamnolia vermicularis*					*					
WHITE CRUST	White crustose lichen									1	

Table 3.4B. *Braun-Blanquet categorical species cover abundance values for permanent plots on* ***Transect 4****, Airport Site, August 2015.* ***Vascular species:*** *Six letter species codes use the first three letters of the genus and first three letters of the species name.* ***Cover:*** *Rare (R), common but < 1% (+), 1-5% (1), 6-25% (2), 26-50% (3), 51-75% (4), 76-100% (5), outside plot (*).*

Transect		T4	T4	T4	T4	T4	T4	T4	T4	T4	T4
Distance from road (m)		5	5	10	10	25	25	50	50	100	100
Polygon Center (C) or Trough (T)		C	T	C	T	C	T	C	T	C	T
Vascular species											
SALLAN	*Salix richardsonii*									R	
ERIANG	*Eriophorum angustifolium*	1	+	1		1		1		+	+
CARAQU	*Carex aquatilis*	5	3	5		3	3	5	3	5	5
CARSAX	*Carex saxatilis* ssp. *laxa*	1		+				*		1	
UTRMIN	*Utricularia minor*			R							
ERIRUS	*Eriophorum russeolum* ssp. *leiocarpum*					+					
Mosses											
MEETRI	*Meesia triquetra*	+		1				1		1	
BRYPSE	*Bryum pseudotriquetrum*	+									

Table 3.4B (cont.). *Braun-Blanquet categorical species cover abundance values for permanent plots on* ***Transect 4****, Airport Site, August 2015.*

Transect		T4	T4	T4	T4	T4	T4	T4	T4	T4	T4
Distance from road (m)		5	5	10	10	25	25	50	50	100	100
Polygon Center (C) or Trough (T)		C	T	C	T	C	T	C	T	C	T
CALRIC	*Calliergon richardsonii*			+						3	
CINLAT	*Cinclidium latifolium*									3	
DRESEN	*Drepanocladus sendtneri*									1	
SCOSCO	*Scorpidium scorpioides*							2			

Table 3.4C. *Braun-Blanquet categorical species cover abundance values for permanent plots on* ***Transect 5****, Airport Site, August 2015.* ***Vascular species****: Six letter species codes use the first three letters of the genus and first three letters of the species name.* ***Cover:*** *Rare (R), common but < 1% (+), 1-5% (1), 6-25% (2), 26-50% (3), 51-75% (4), 76-100% (5), outside plot (*).*

Transect		T5	T5	T5	T5	T5	T5	T5
Distance from road (m)		25	25	50	50	50	100	100
Polygon Center (C) or Trough (T)		C	T	C	T-A	T-B	C	T
Vascular species								
SALLAN	*Salix richardsonii*	1	+	1	1	+	2	
SALOVA	*Salix ovalifolia* var. *ovalifolia*	2	*	1	1		+	
ERIANG	*Eriophorum angustifolium*	4	3	3	3	1	3	2
CARAQU	*Carex aquatilis*	+	3	1	1	+	+	4
POLVIV	*Bistorta vivipara*	+		+			+	
CHRINT	*Hulteniella integrifolia*			*				
DRYINT	*Dryas integrifolia* ssp. *integrifolia*				1		2	
CARATR	*Carex atrofusca*	1						
EQUVAR	*Equisetum variegatum* ssp. *variegatum*	1	+		1	+	+	
CARKRA	*Carex krausei.*	+					1	
SALRET	*Salix reticulata*		+		+			
CARSAX	*Carex saxatilis* ssp. *laxa*	+		*				
SALARC	*Salix arctica*	1		+	+		1	
JUNBIG	*Juncus biglumis*			+				
KOBSIM	*Kobresia simpliciuscula* ssp. *subholarctica*			*			*	
CARROT	*Carex rotundata*			*				
Mosses								
MEETRI	*Meesia triquetra*	+	+			1		3
SCOREV	*Limprichtia revolvens*	1	1			4		

Table 3.4C (cont.). *Braun-Blanquet categorical species cover abundance values for permanent plots on* ***Transect 5****, Airport Site, August 2015.*

Transect		**T5**	**T5**	**T5**	**T5**	**T5**	**T5**	**T5**
Distance from road (m)		**25**	**25**	**50**	**50**	**50**	**100**	**100**
Polygon Center (C) or Trough (T)		**C**	**T**	**C**	**T-A**	**T-B**	**C**	**T**
BRYCYC	*Bryum cyclophyllum*				1	1		
BRYPSE	*Bryum pseudotriquetrum*	+						
BRYREC	*Bryoerythrophyllum recurvirostre*	+		1				2
CALRIC	*Calliergon richardsonii*		1	+				3
CATNIG	*Catoscopium nigritum*	2		1	1		2	
CINLAT	*Cinclidium latifolium*	+			+	2		
DISCAP	*Distichium capillaceum*	1		1	1	1	1	
DITFLE	*Ditrichum flexicaule*							
DRESEN	*Drepanocladus sendtneri*	2		+		+	2	
ENCALP	*Encalypta alpina*	+		+	+			
ENCLON	*Encalypta longicolla*				+			
SCOSCO	*Scorpidium scorpioides*							1
TOMNIT	*Tomentypnum nitens*						+	
Liverworts								
ANEPIN	*Aneura pinguis*	+			+		+	

Table 3.5. *Soil characteristics of samples taken from permanent plots at the Airport Site, August 2015.* ***Relevé number:*** *Plots are numbered as follows: Transect number (T3, T4 or T5) – distance from road (m) – C (polygon center) or T (polygon trough).* ***Layer:*** *Dust layer (1), organic layer (2).* ***Soil color:*** *all dry colors were determined in the lab, moist colors were determined in the field (*) or lab (+).*

	Location			Soil color						Soil moisture			Soil pH	Gravel, plant material, OM		
				Dry			Moist									
Sample no.	Relevé number	Layer	Depth of sample (cm), horizon	Hue	Value	Chroma	Hue	Value	Chroma	Gravimetric (%)	Volumetric (%)	Bulk density (g/cm³)	Paste	Gravel (% dry wt.)	Undecomposed organics (% dry wt.)	Organic matter (% dry wt.)
1	T3-5-C	1	0-7 cm, C	2.5 Y	7	1	10 YR	3	1+	17.32	22.28	1.29	6.85	37.1	0.0	2.97
2		2	7-12 cm, Oe	10 YR	5	2	7.5 YR	3	1+	53.74	39.61	0.74	7.04	0.0	0.0	8.19
3	T3-5-T	1	0-5 cm, Oi	10 YR	7	2	7.5 YR	3	2+	152.80	71.11	0.47	7.20	18.7	1.9	10.11
4		2	7-12 cm, Oi	2.5 Y	7	1	10 YR	3	2+	49.61	48.78	0.98	7.18	33.7	0.5	5.75
5	T3-10-C	1	0-5 cm, C	10 YR	5	2	10 YR	3	2+	25.07	25.94	1.03	7.24	36.0	0.1	4.37
6		2	6-11 cm, Oe	10 YR	5	2	7.5 YR	2.5	1+	65.69	40.28	0.61	7.02	0.0	0.0	10.02
7	T3-10-T	1	0-5 cm, Oi	2.5 Y	7	1	7.5 YR	3	1+	114.54	57.89	0.51	6.76	7.2	0.3	13.54
8		2	7-12 cm, B	2.5 Y	6	2	10 YR	3	2+	116.77	73.22	0.63	6.88	0.1	0.0	11.72
9	T3-25-C	1	0-5 cm, Oi	2.5 Y	6	2	10 YR	3	2+	54.04	27.61	0.51	7.07	15.5	0.2	9.29
10		2	5-10 cm, Oe	10 YR	5	2	10 YR	4	1+	71.49	48.44	0.68	7.24	0.0	0.0	10.84
11	T3-25-T	1	0-5 cm, Oi	2.5 Y	6	1	10 YR	3	1+	98.24	57.83	0.59	6.74	10.8	0.9	11.65
12		2	5-10 cm, C	2.5 Y	5	2	10 YR	3	2*	133.11	63.50	0.48	6.95	0.0	0.0	14.63
13	T3-50-C	1	2-7 cm, Oe	10 YR	8	2	7.5 YR	3.5	2*	123.29	63.61	0.52	7.35	0.0	0.0	11.31
14		2	11-16 cm, O	2.5 Y	4	2	10 YR	6	2*	105.34	59.56	0.57	6.98	23.3	1.7	12.84
15		2	18-23 cm, B	2.5 Y	5	1	10 YR	3	2*	83.45	50.61	0.61	7.18	0.0	0.4	15.40
16	T3-50-T	1	0-5 cm, Oi	2.5 Y	5	1	7.5 YR	3	2*	165.12	58.22	0.35	6.51	0.0	2.3	17.81
17		2	5-10 cm, Oe	10 YR	5	2	7.5 YR	3	1*	93.35	55.94	0.60	6.98	0.0	0.5	11.87
18	T1-100-C	1	0-5 cm, Oe	2.5 Y	6	3	10 YR	3.5	2*	75.58	48.44	0.64	7.29	0.0	0.0	11.35
19		2	5-10 cm, O	2.5 Y	5	1	10 YR	5	2*	43.67	37.67	0.86	7.16	0.0	0.0	8.12
20	T1-100-T	1	0-5 cm, Oi	2.5 Y	6	2	10 YR	4	4*	106.35	36.56	0.34	6.91	0.0	1.4	13.26
21		2	5-10 cm, Oe	10 YR	4	3	10 YR	2	1*	115.31	60.39	0.52	6.97	0.0	0.0	13.02
22	T4-5-C	1	0-5 cm, Oi	2.5 Y	7	1	10 YR	3	2*	51.90	44.33	0.85	7.06	13.3	0.5	7.42
23		2	5-10 cm, Oe	2.5 Y	6	1	10 YR	3.5	1*	71.41	63.78	0.89	7.11	17.2	0.5	6.07
24	T4-5-T	1	0-5 cm, Oi	2.5 Y	7	1	2.5 YR	3	2+	47.24	43.56	0.92	7.06	22.5	0.1	4.46
25		2	5-10 cm, Oe	2.5 Y	6	1	10 YR	3	1+	122.56	61.06	0.50	6.95	7.7	0.0	10.45
26	T4-10-C	1	0-5 cm, Oi	2.5 Y	6	1	10 YR	2	2*	40.69	42.33	1.04	7.09	21.4	0.3	4.58
27		2	5-10 cm, Oi	2.5 Y	6	2	10 YR	2	2*	15.20	22.78	1.50	7.23	47.2	0.3	2.22
28	T4-10-T	1	0-5 cm, Oi	2.5 Y	5	2	10 YR	2	2*	72.23	56.61	0.78	7.05	14.1	0.0	7.74
29		2	15-20 cm, Oe	10 YR	5	2	10 YR	2	1*	121.94	60.00	0.49	7.02	0.0	0.0	11.84
30	T4-25-C	1	0-5 cm, C	10 YR	6	2	10 YR	4	2+	7.36	11.83	1.61	7.48	66.8	0.0	1.13

Table 3.5 (cont.). *Soil characteristics of samples taken from permanent plots at the Airport Site, August 2015.*

Sample no.	Location			Soil color						Soil moisture			Soil pH	Gravel, plant material, OM		
				Dry			Moist									
	Relevé number	Layer	Depth of sample (cm), horizon	Hue	Value	Chroma	Hue	Value	Chroma	Gravimetric (%)	Volumetric (%)	Bulk density (g/cm³)	Paste	Gravel (% dry wt.)	Undecomposed organics (% dry wt.)	Organic matter (% dry wt.)
31	T4-25-T	1	0-5 cm, Oi	2.5 Y	7	2	2.5 YR	4	2+	139.25	37.11	0.27	7.20	7.3	1.5	11.73
32		2	6-11 cm, C	2.5 Y	7	1	2.5 YR	4	2+	40.80	42.83	1.05	7.06	21.7	0.0	4.98
33	T4-50-C	1	3-8 cm, Oi	2.5 Y	6	1	10 YR	3	1*	38.73	44.00	1.14	6.81	64.6	0.3	9.25
34	T4-50-T	1	10-15 cm, Oi	10 YR	3	3	10 YR	3	2*	384.64	62.33	0.16	6.48	3.4	4.4	33.10
35		2	20-25 cm, C	2.5 Y	5	2	10 YR	3	2*	87.86	59.78	0.68	7.01	30.9	0.0	11.60
36	T4-100-C	1	0-5 cm, Oi	2.5 Y	5	2	10 YR	3.5	2*	59.43	42.06	0.71	6.90	74.4	1.2	20.37
37		2	10-15 cm, Oe	10 YR	4	2	10 YR	2	2*	219.20	65.72	0.30	6.95	0.0	0.2	23.62
38	T4-100-T	1	0-5 cm, Oi	10 YR	4	1	10 YR	3	2*	177.35	49.33	0.28	6.86	12.7	3.2	18.56
39		2	13-18 cm, Oe	10 YR	5	2	10 YR	2	2*	197.04	68.06	0.35	6.98	3.5	0.2	22.17
40	T5-25-C	1	0-5 cm, Oe	2.5 Y	6	2	2.5 YR	3	2+	64.08	45.67	0.71	7.19	9.6	0.1	7.53
41		2	6-11 cm, Oe	10 YR	4	1	10 YR	3	2+	85.28	51.72	0.61	7.08	0.0	0.0	9.78
42	T5-25-T	1	3-8 cm, Oi	2.5 Y	7	1	10 YR	3	2+	72.33	57.17	0.79	7.14	28.7	0.8	7.49
43		2	9-14 cm, Oe	2.5 Y	5	1	7.5 YR	2.5	1+	99.85	61.28	0.61	7.00	10.4	0.1	12.23
44	T5-50-C	1	0-5 cm, Oi	10 YR	5	1	10 YR	3	2*	103.24	62.50	0.61	7.20	0.0	0.2	11.61
45		2	5-10 cm, Oe	10 YR	5	1	10 YR	2.5	2*	95.86	58.78	0.61	7.13	0.0	0.4	10.76
46	T5-50-T(B)	1	0-5 cm, Oi	10 YR	5	1	7.5 YR	3	2*	185.10	55.50	0.30	7.21	0.0	0.9	13.01
47		2	6-11 cm, Oe	10 YR	4	1	10 YR	3	2*	143.56	60.11	0.42	7.08	0.3	0.5	16.09
48	T5-100-C	1	2-7 cm, Oe	10 YR	4	1	10 YR	3	2*	119.23	50.06	0.42	6.96	0.0	0.5	16.90
49		2	8-13 cm, Oe	10 YR	4	1	10 YR	3	2*	100.14	53.39	0.53	7.05	0.0	0.0	14.49
50	T5-100-T	1	6-11 cm, Oi	7 YR	5	2	10 YR	3	1*	285.99	56.83	0.20	7.05	0.0	2.8	24.65
51		2	12-17 cm, Oi	10 YR	5	1	10 YR	3	1*	222.89	63.61	0.29	7.02	0.0	0.8	21.54

Table 3.6. *Soil descriptions from permanent plots at the Airport Site, August 2015.* ***Relevé number:*** *Plots are numbered as follows: Transect number (T3, T4 or T5) – distance from road (m) – C (polygon center) or T (polygon trough).* ***Horizon:*** *U.S. Soil Survey Staff 1975.*

Relevé number	Depth (cm)	Horizon	Color (moist)	Structure	Gravel (%)	Consistency	Texture	Boundaries	Notes
Transect 3									
T3-005-C	0-7	C		weak/fine/granular	< 10	slightly sticky	loamy sand	abrupt	Pure dust and sand, collected in polygon basin
T3-005-C	7-15	Oe		massive/platey	0	slightly sticky	sandy loam	continuous	Platey structure; Organic, sandy hemic peat
T3-005-C	15-46+	Oe		massive/platey	0	slightly sticky	silt loam		Silty hemic peat
T3-005-T	0-7	Oi		none	10-25	not sticky		abrupt	Loose mat of dead sedges leaves and roots
T3-005-T	7-22	Oi		massive	<10	slightly sticky	silt loam	continuous	Silty
T3-005-T	22-40+	B		weak/fine/granular	0	slightly sticky	silt loam		
T3-010-C	0-6	C		weak/fine/granular	10-25	slightly sticky	silt loam	abrupt	Gravelly silty loam
T3-010-C	6-30	Oe		moderate/fine/platey	< 10	slightly sticky	silt loam	continuous	Fine sandy peat loam
T3-010-C	30+	Oe		weak	0	not sticky	sand		Sandy peat lens
T3-010-T	0-7	Oi		none	<10	not sticky	silt loam	abrupt	Silty loose mat of sedge roots and leaves
T3-010-T	7-22+	B		weak/fine/granular	0	slightly sticky	silt loam		Silty, loamy organic rich; Many fine roots
T3-025-C	0-5	Oi		none	10-25	not sticky		continuous	Dead moss, dust, gravel
T3-025-C	5-23	Oe		weak/fine/platey	0	slightly sticky	silt loam	continuous	Silty, hemic peat
T3-025-C	23-30+	Oe		weak/fine/platey	0	not sticky	sandy loam	abrupt	Sandy, silty peat
T3-025-T	0-4	Oi		none	0	not sticky		abrupt/wavy	Loose mat of dead sedges leaves and roots
T3-025-T	4-9	C	10 yr 3/2	massive	0	slightly sticky	silt loam	abrupt	Dust layer, peat, roots
T3-025-T	9-22	B	10yr 2/75/2	weak/fine/granular	0	not sticky	silt loam	abrupt	Many fine roots, large orange mottles
T3-025-T	22-32	B	10 yr 2.5/2	weak/fine/granular	0	not sticky	silt loam	abrupt	Many fine roots
T3-050-C	0-2	Oe	7.5yr 3.5/2	none	0	not sticky	silt loam		Loose dead moss, silty
T3-050-C	2-18	O marl	10 yr 6/2	massive	0	slightly sticky	silt loam		Marl from old pond bottom; Orange mottles (10 YR 5/8) 2-11 cm, few to no mottles 11-18 cm
T3-050-C	18-34+	B	10 yr 3/2	moderate/medium/ platey	0	not sticky	silt loam		Organic rich
T3-050-T	0-5	Oi	7.5 yr 3/2	none	0	not sticky		abrupt/smooth	Dead sedge leaves and roots; Dust/silt

Table 3.6 (cont.). *Soil descriptions from permanent plots at the Airport Site, August 2015.*

Relevé number	Depth (cm)	Horizon	Color (moist)	Structure	Gravel (%)	Consistency	Texture	Boundaries	Notes
T3-050-T	5-13	Oe	7.5 yr 3/1	weak/fine/granular	0	slightly sticky	silt loam	abrupt/smooth	Many fine sedge roots
T3-050-T	13-19	Sb	7.5 yr 3/2	weak/fine/granular	0	not sticky	sandy loam	abrupt/smooth	Organic rich fine sand, many roots; Medium orange mottles (7.5 YR 4/6)
T3-050-T	19-29	Oe	7.5 yr 3/1	moderate/medium/ platey	0	not sticky	sandy loam	abrupt/smooth	
T3-050-T	29-32+	B	7.5 yr 2.5/1	moderate/medium/ granular	0	slightly sticky	silt loam		Organic-rich silt
T3-100-C	0-3	Oe	10 yr 3.5/2	moderate/fine/granular	0	slightly sticky	silt loam	abrupt/smooth	Many fine roots
T3-100-C	3-4	O marl	10 yr 5/2	weak/fine/granular	0	slightly sticky	silt loam	abrupt/smooth	Marl
T3-100-C	4-9	Oe	10 yr 3.5/2	weak/fine/granular	0	not sticky	sandy loam	continuous/ smooth	
T3-100-C	9-23	Oe	10 yr 3/2	moderate/medium/ platey	0	not sticky	silt loam	abrupt/wavy	Structure: breaking into weak, fine, granular
T3-100-C	23-33+	B	10 yr 3/2	moderate/coarse/ platey	0	slightly sticky	silt loam		
T3-100-T	0-3	Oi	10 yr 4/4	massive	0	not sticky		abrupt/smooth	Loose mat of dead moss
T3-100-T	3-10	Oe	10 yr 2/1	massive	0	slightly sticky	silt loam	continuous/ smooth	Silty, hemic, silt rich
T3-100-T	10-27	Oe	10 yr 2.5/2	weak/medium/ granular	0	slightly sticky	loam	abrupt/smooth	
T3-100-T	27-35+	Oa	10 yr 2/2	moderate/medium/ granular	<10	slightly sticky	silt loam		Sapric
Transect 4									
T4-005-C	0-5	Oi	10 yr 3/2		10-25	not sticky/not plastic	sandy loam	continuous/ smooth	Loose silty organic, gravel
T4-005-C	5-12	Oe	10yr 3.5/1	massive	10-25	not sticky/not plastic	sandy loam	continuous/ smooth	Sand, silt, gravel, organic
T4-005-C	12-30	Oe	10 yr 3/2	massive	0	not sticky/not plastic	silt loam		
T4-005-T	0-5	Oi			10-25	not sticky	sandy loam	abrupt/smooth	Gravel, silt, dead sedge leaves and roots
T4-005-T	5-24	Oe		massive	<10	slightly sticky	sandy loam	abrupt/smooth	Organic hemic silt, sand (dust to 26 cm)
T4-005-T	24-33	Oe		massive	<10	slightly sticky	sandy loam		Organic sedge roots, sedge bases
T4-010-C	0-18	Oi	10yr 2/2	massive	25-50	not sticky	sandy loam	abrupt/smooth	Organic sedge roots mixed with gravel, sand, silt up to 5 cm
T4-010-C	18-32	C	10 yr 3/1	single grain	50-75	not sticky	sandy loam		Gravelly sandy loam with abundant sedge roots
T4-010-T	0-15	Oi	10 yr 2/2	massive	<10	not sticky/not plastic	silt loam		Loose mat with dead sedges, fine roots

Table 3.6 (cont.). *Soil descriptions from permanent plots at the Airport Site, August 2015.*

Relevé number	Depth (cm)	Horizon	Color (moist)	Structure	Gravel (%)	Consistency	Texture	Boundaries	Notes
T4-010-T	15-30	Oe	10 yr 2/1	massive	<10	not sticky/not plastic	sandy loam		10% mineral, mostly decomposed sedge leaves and fine roots
T4-025-C	0-50	C		single grain	> 75	not sticky/not plastic	sand		Gravel layer 50 cm maybe from old road or flood
T4-025-C	50-100	Ob							Not able to reach peat layer
T4-025-T	0-6	Oi			0		silt loam	abrupt	Mostly sedge leaves and bases, fine roots, silt; Water depth 35 cm, thaw 42 cm
T4-025-T	6-23	C		massive	10-25	slightly sticky/sl. plastic	silt loam		Gravelly silt
T4-050-C	0-3	Oi	10 yr 2/1	single grain	< 10		silt loam	abrupt/smooth	Dead sedge leaves and bases
T4-050-C	3-6	Oi	10 yr 3/1	single grain	50-75		sand	abrupt/smooth	Silty, gravelly sedge roots
T4-050-C	6-11	Oi	11yr 1/2	massive	50-75		sand	abrupt/smooth	Sandy, gravelly, fine sedge roots
T4-050-C	11-27	Oe	10 yr 31	massive	<10		silt loam		Hemic peat
T4-050-T	0-20	Oi	10 yr 3/2		10-25	not sticky/sl. plastic	sandy loam	abrupt/smooth	Dead sedge leaves and fine roots, gravel, almost no mineral
T4-050-T	20-50	C	10 yr 3/2		10-25	not sticky/sl. plastic	silt loam		Gravelly sand with sedge roots
T4-100-C	0-10	Oi	10 yr 3.5/2	massive	10-25	not sticky/not plastic	sand	abrupt/smooth	Gravelly sedge peat, many fine roots, dead sedge leaves and roots
T4-100-C	10-25	Oe	10 yr 2/2	massive	<10	not sticky/not plastic	sandy loam		Less gravel at bottom
T4-100-T	0-13	Oi	10 yr 3/2	massive	10-25	not sticky/not plastic	sandy loam	abrupt/smooth	Loose mat of sedge roots and rhizomes; No moss, no dust, 45 cm thaw
T4-100-T	13-30	Oe	10 yr 2/2	massive	<10	not sticky/sl. plastic	sandy loam		Mainly fine roots; Weak, small mottles (10 YR 4/6)
Transect 5									
T5-025-C	0-4	Oe	brownish gray	moderate/medium/ platey	0	slightly sticky/sl. plastic	loam	abrupt/smooth	Dust layer with organic
T5-025-C	4-11	Oe	grayish brown	moderate/medium/ platey	0	slightly sticky/ not plastic	silt loam	continuous/ smooth	Dusty organic
T5-025-C	11-24	Oe	v.dk. brown	moderate/medium/ platey	0	not sticky/not plastic	sandy loam	abrupt/wavy	
T5-025-C	24-29+				0	not sticky/not plastic	sand		

Table 3.6 (cont.). *Soil descriptions from permanent plots at the Airport Site, August 2015.*

Relevé number	Depth (cm)	Horizon	Color (moist)	Structure	Gravel (%)	Consistency	Texture	Boundaries	Notes
T5-025-T	0-3	Oi	10 yr 4/6 guess	massive	0	not sticky/not plastic	loam	abrupt/smooth	Loose mat of dead mosses
T5-025-T	3-7	Oi	grayish brown	weak/medium/platey	<10	not sticky/not plastic	silt loam	abrupt/smooth	Hemic with dust
T5-025-T	7-25+	Oe	v.dk. gray-brown	weak/medium/platey	0	not sticky/sl. plastic	loam		Many fine roots
T5-050-C	0-4	Oi	10 yr 3/2	massive	0	slightly sticky/sl. plastic	silt loam	abrupt/smooth	Moss and dust
T5-050-C	4-11	Oe1	10 yr 2.5/2	moderate/medium/ platey	0	not sticky/sl. plastic	loam	continuous/ smooth	Dusty organic
T5-050-C	10-30+	Oe2	10 yr 2/2	moderate/medium/ platey	0	not sticky/not plastic	sandy loam		Sand, many fine roots
T5-050-T(B)	0-7	Oi	7.5 yr 3/2	massive	0	not sticky/not plastic	silt loam	abrupt/smooth	Loose mat of moss and dusty sedge leaves; Just soil from directly over crack described.
T5-050-T(B)	7-12	Oe1	10 yr 3/2	massive	0	not sticky/sl. plastic	loam	continuous/ wavy	More dust rich than below
T5-050-T(B)	12-29	Oe2	10 yr 3/1	massive	0	not sticky/sl. plastic	loam		
T5-050-T(B)	29+	Oe3	10 yr 3/1						
T5-100-C	0-2	Oi	10 yr 4/4	massive	0	not sticky/not plastic	loam	abrupt/smooth	Loose mat of dead mosses
T5-100-C	2-28	Oe	10 yr 3/2	moderate/medium/ platey	0	not sticky/sl. plastic	loam	abrupt/wavy	
T5-100-C	28+	C	10yr 3/5/1	moderate/medium/ platey	0	slightly sticky/ plastic	loam		
T5-100-T	0-15	Oi	10 yr 3/1	massive	0	not sticky/not plastic	loam	continuous/ smooth	Loose mat
T5-100-T	15-28+	B	10 ry 3/2	weak/medium/platey	0	not sticky/sl. plastic	loam		Organic rich, many fine roots, some marl

Table 3.7. *Coordinates of all points surveyed along* ***Transects 3, 4 and 5****, Airport Site, August 2015.*

Type	Code	Lat (DD)	Long (DD)	Elevation (m)
Benchmark Point				
DF3643	benchmark pt	70.196912	-148.431478	17.67
General				
Road berm	berm1	70.196945	-148.425698	14.95
Road berm	berm2	70.196920	-148.425573	14.93
Road berm	berm3	70.196897	-148.425464	14.87
Road berm	berm4	70.196877	-148.425375	14.82
Road berm	berm5	70.196856	-148.425288	14.86
Road berm	berm6	70.196828	-148.425200	15.00
Road berm	berm7	70.196813	-148.425144	15.06
Road berm	berm8	70.196788	-148.425060	15.13
Road berm	berm9	70.196768	-148.425001	15.30
Road berm	berm10	70.196736	-148.424865	15.09
Road berm	berm11	70.196736	-148.424653	14.97
Road berm	berm12	70.196754	-148.424455	14.76
Road berm	berm13	70.196769	-148.424384	14.80
Road berm	berm14	70.196819	-148.424177	14.74
Road berm	berm15	70.196892	-148.423845	15.08
Road berm	berm16	70.196950	-148.423453	14.91
Road berm	berm17	70.196784	-148.423276	14.57
Road berm	berm18	70.196773	-148.423399	14.67
Road berm	berm19	70.196762	-148.423485	14.52
Road berm	berm20	70.196745	-148.423599	14.64
Road berm	berm21	70.196715	-148.423768	14.39
Road berm	berm22	70.196691	-148.423883	14.59
Road berm	berm23	70.196668	-148.423973	14.59
Road berm	berm24	70.196644	-148.424063	14.58
Road berm	berm25	70.196614	-148.424167	14.62
Road berm	berm26	70.196571	-148.424318	14.64
Road berm	berm27	70.196517	-148.424467	14.34
Road berm	berm28	70.196464	-148.424599	14.46
Road berm	berm29	70.196404	-148.424724	14.50
Road berm	berm30	70.196441	-148.425222	14.82
Road berm	berm31	70.196479	-148.425184	14.79
Road berm	berm32	70.196518	-148.425169	14.80
Road berm	berm33	70.196568	-148.425225	14.49

Type	Code	Lat (DD)	Long (DD)	Elevation (m)
Road	roadpoint1	70.196686	-148.425421	15.21
Road	roadpoint2	70.196659	-148.425324	15.51
Road	roadpoint3	70.196592	-148.425182	15.68
Road	roadpoint4	70.196521	-148.425119	15.77
Road	roadpoint5	70.196434	-148.425184	15.73
Road	roadpoint6	70.196358	-148.424861	15.42
Road	roadpoint7	70.196413	-148.424760	15.41
Road	roadpoint8	70.196471	-148.424643	15.44
Road	roadpoint9	70.196523	-148.424528	15.36
Road	roadpoint10	70.196557	-148.424415	15.29
Road	roadpoint11	70.196596	-148.424287	15.22
Road	roadpoint12	70.196652	-148.424086	15.23
Road	roadpoint13	70.196707	-148.423901	15.31
Road	roadpoint14	70.196741	-148.423721	15.30
Road	roadpoint15	70.196777	-148.423503	15.40
Road	roadpoint16	70.196807	-148.423205	15.47
Road	roadpoint17	70.196938	-148.423210	16.21
Road	roadpoint18	70.196924	-148.423441	16.08
Road	roadpoint19	70.196877	-148.423820	16.11
Road	roadpoint20	70.196801	-148.424143	16.00
Road	roadpoint21	70.196757	-148.424359	15.69
Road	roadpoint22	70.196736	-148.424418	15.82
Road	roadpoint23	70.196716	-148.424640	15.75
Road	roadpoint24	70.196726	-148.424884	15.72
Road	roadpoint25	70.196759	-148.425025	15.82
Cable box (middle)	cablebox1	70.196649	-148.425422	15.13
Cable box (middle)	cablebox2	70.197011	-148.424269	15.18
Road profile	roadprofile1	70.196768	-148.424382	14.84
Road profile	roadprofile2	70.196766	-148.424378	14.99
Road profile	roadprofile3	70.196763	-148.424371	15.23
Road profile	roadprofile4	70.196760	-148.424367	15.47
Road profile	roadprofile5	70.196757	-148.424359	15.65
Road profile	roadprofile6	70.196753	-148.424350	15.80
Road profile	roadprofile7	70.196749	-148.424341	15.92
Road profile	roadprofile8	70.196746	-148.424335	16.06
Road profile	roadprofile9	70.196741	-148.424324	16.11

Table 3.7 (cont.). *Coordinates of all points surveyed along* ***Transects 3, 4 and 5****, Airport Site, August 2015.*

Type	Code	Lat (DD)	Long (DD)	Elevation (m)
Road profile	roadprofile10	70.196734	-148.424308	16.12
Road profile	roadprofile11	70.196725	-148.424284	16.10
Road profile	roadprofile12	70.196713	-148.424236	16.00
Road profile	roadprofile13	70.196699	-148.424202	15.83
Road profile	roadprofile14	70.196683	-148.424162	15.63
Road profile	roadprofile15	70.196667	-148.424125	15.47
Road profile	roadprofile16	70.196657	-148.424099	15.31
Road profile	roadprofile17	70.196652	-148.424083	15.18
Road profile	roadprofile18	70.196649	-148.424076	14.93
Road profile	roadprofile19	70.196643	-148.424062	14.52
Transect 3				
Line transect poles	T3LTP_0m	70.196643	-148.424064	14.54
Line transect poles	T3LTP_5m	70.196610	-148.423980	14.47
Line transect poles	T3LTP_10m	70.196575	-148.423892	14.54
Line transect poles	T3LTP_25m	70.196473	-148.423634	14.64
Line transect poles	T3LTP_50m	70.196302	-148.423202	14.29
Line transect poles	T3LTP_100m	70.195964	-148.422337	14.17
Line transect flags	T3LTF_0	70.196643	-148.424064	14.54
Line transect flags	T3LTF_1	70.196636	-148.424046	14.45
Line transect flags	T3LTF_2	70.196630	-148.424030	14.43
Line transect flags	T3LTF_3	70.196623	-148.424012	14.43
Line transect flags	T3LTF_4	70.196616	-148.423995	14.48
Line transect flags	T3LTF_5	70.196610	-148.423980	14.47
Line transect flags	T3LTF_6	70.196602	-148.423961	14.48
Line transect flags	T3LTF_7	70.196596	-148.423944	14.27
Line transect flags	T3LTF_8	70.196589	-148.423927	14.10
Line transect flags	T3LTF_9	70.196582	-148.423911	14.17
Line transect flags	T3LTF_10	70.196575	-148.423892	14.54
Line transect flags	T3LTF_11	70.196568	-148.423875	14.56
Line transect flags	T3LTF_12	70.196562	-148.423857	14.61
Line transect flags	T3LTF_13	70.196555	-148.423840	14.52
Line transect flags	T3LTF_14	70.196548	-148.423824	14.48
Line transect flags	T3LTF_15	70.196541	-148.423806	14.45
Line transect flags	T3LTF_16	70.196534	-148.423790	14.35
Line transect flags	T3LTF_17	70.196527	-148.423773	14.21
Line transect flags	T3LTF_18	70.196520	-148.423754	14.58
Line transect flags	T3LTF_19	70.196514	-148.423737	14.64
Line transect flags	T3LTF_20	70.196507	-148.423720	14.58
Line transect flags	T3LTF_21	70.196500	-148.423703	14.58
Line transect flags	T3LTF_22	70.196493	-148.423686	14.58
Line transect flags	T3LTF_23	70.196486	-148.423668	14.58
Line transect flags	T3LTF_24	70.196480	-148.423651	14.61
Line transect flags	T3LTF_25	70.196473	-148.423634	14.64
Line transect flags	T3LTF_26	70.196466	-148.423616	14.62
Line transect flags	T3LTF_27	70.196459	-148.423599	14.84
Line transect flags	T3LTF_28	70.196452	-148.423582	14.82
Line transect flags	T3LTF_29	70.196445	-148.423565	14.89
Line transect flags	T3LTF_30	70.196439	-148.423547	14.84
Line transect flags	T3LTF_31	70.196432	-148.423531	14.78
Line transect flags	T3LTF_32	70.196425	-148.423514	14.69
Line transect flags	T3LTF_33	70.196419	-148.423497	14.59
Line transect flags	T3LTF_34	70.196412	-148.423481	14.26
Line transect flags	T3LTF_35	70.196404	-148.423462	14.77
Line transect flags	T3LTF_36	70.196398	-148.423445	14.87
Line transect flags	T3LTF_37	70.196391	-148.423428	14.92
Line transect flags	T3LTF_38	70.196384	-148.423411	14.90
Line transect flags	T3LTF_39	70.196377	-148.423393	14.91
Line transect flags	T3LTF_40	70.196370	-148.423376	14.79
Line transect flags	T3LTF_41	70.196364	-148.423359	14.90
Line transect flags	T3LTF_42	70.196357	-148.423342	14.85
Line transect flags	T3LTF_43	70.196350	-148.423324	14.86
Line transect flags	T3LTF_44	70.196343	-148.423307	14.82
Line transect flags	T3LTF_45	70.196336	-148.423290	14.81
Line transect flags	T3LTF_46	70.196330	-148.423272	14.55
Line transect flags	T3LTF_47	70.196323	-148.423256	14.69
Line transect flags	T3LTF_48	70.196316	-148.423238	14.15
Line transect flags	T3LTF_49	70.196309	-148.423222	14.12
Line transect flags	T3LTF_50	70.196302	-148.423202	14.29
Line transect flags	T3LTF_51	70.196296	-148.423185	14.56
Line transect flags	T3LTF_52	70.196289	-148.423169	14.34

Table 3.7 (cont.). *Coordinates of all points surveyed along* ***Transects 3, 4 and 5****, Airport Site, August 2015.*

Type	Code	Lat (DD)	Long (DD)	Elevation (m)
Line transect flags	T3LTF_53	70.196282	-148.423151	14.31
Line transect flags	T3LTF_54	70.196275	-148.423134	14.31
Line transect flags	T3LTF_55	70.196268	-148.423116	14.35
Line transect flags	T3LTF_56	70.196262	-148.423099	14.38
Line transect flags	T3LTF_57	70.196255	-148.423081	14.40
Line transect flags	T3LTF_58	70.196248	-148.423064	14.37
Line transect flags	T3LTF_59	70.196241	-148.423047	14.37
Line transect flags	T3LTF_60	70.196234	-148.423029	14.50
Line transect flags	T3LTF_61	70.196228	-148.423012	14.48
Line transect flags	T3LTF_62	70.196221	-148.422994	14.52
Line transect flags	T3LTF_63	70.196214	-148.422977	14.59
Line transect flags	T3LTF_64	70.196208	-148.422959	14.65
Line transect flags	T3LTF_65	70.196201	-148.422943	14.67
Line transect flags	T3LTF_66	70.196194	-148.422925	14.69
Line transect flags	T3LTF_67	70.196187	-148.422907	14.72
Line transect flags	T3LTF_68	70.196181	-148.422891	14.49
Line transect flags	T3LTF_69	70.196174	-148.422874	14.09
Line transect flags	T3LTF_70	70.196166	-148.422856	14.04
Line transect flags	T3LTF_71	70.196160	-148.422837	14.18
Line transect flags	T3LTF_72	70.196154	-148.422821	14.73
Line transect flags	T3LTF_73	70.196147	-148.422803	14.75
Line transect flags	T3LTF_74	70.196140	-148.422786	14.57
Line transect flags	T3LTF_75	70.196133	-148.422769	14.52
Line transect flags	T3LTF_76	70.196126	-148.422752	14.45
Line transect flags	T3LTF_77	70.196119	-148.422735	14.44
Line transect flags	T3LTF_78	70.196113	-148.422718	14.47
Line transect flags	T3LTF_79	70.196106	-148.422700	14.51
Line transect flags	T3LTF_80	70.196099	-148.422683	14.48
Line transect flags	T3LTF_81	70.196092	-148.422666	14.53
Line transect flags	T3LTF_82	70.196085	-148.422648	14.67
Line transect flags	T3LTF_83	70.196079	-148.422631	14.69
Line transect flags	T3LTF_84	70.196072	-148.422614	14.36
Line transect flags	T3LTF_85	70.196065	-148.422597	14.26
Line transect flags	T3LTF_86	70.196058	-148.422579	14.17
Line transect flags	T3LTF_87	70.196051	-148.422561	14.46
Line transect flags	T3LTF_88	70.196045	-148.422544	14.48
Line transect flags	T3LTF_89	70.196038	-148.422527	14.51
Line transect flags	T3LTF_90	70.196031	-148.422509	14.52
Line transect flags	T3LTF_91	70.196024	-148.422493	14.47
Line transect flags	T3LTF_92	70.196017	-148.422475	14.45
Line transect flags	T3LTF_93	70.196011	-148.422458	14.42
Line transect flags	T3LTF_94	70.196004	-148.422440	14.37
Line transect flags	T3LTF_95	70.195997	-148.422423	14.50
Line transect flags	T3LTF_96	70.195990	-148.422405	14.58
Line transect flags	T3LTF_97	70.195984	-148.422388	14.49
Line transect flags	T3LTF_98	70.195977	-148.422371	14.38
Line transect flags	T3LTF_99	70.195970	-148.422354	14.22
Line transect flags	T3LTF_100	70.195964	-148.422337	14.17
Veg. plots photo points	T3_5c	70.196715	-148.423597	14.66
Veg. plots photo points	T3_5t	70.196668	-148.423784	14.03
Veg. plots photo points	T3_10c	70.196612	-148.423744	14.46
Veg. plots photo points	T3_10t	70.196645	-148.423458	13.30
Veg. plots photo points	T3_25c	70.196499	-148.423577	14.57
Veg. plots photo points	T3_25t	70.196513	-148.423446	14.04
Veg. plots photo points	T3_50c	70.196364	-148.422913	14.30
Veg. plots photo points	T3_50t	70.196326	-148.423128	13.91
Veg. plots photo points	T3_100c	70.196006	-148.422212	14.20
Veg. plots photo points	T3_100t	70.196052	-148.422128	13.77
Veg. plots washer	T3_5c_w1	70.196716	-148.423615	14.65
Veg. plots washer	T3_5c_w2	70.196708	-148.423601	14.63
Veg. plots washer	T3_5c_w3	70.196713	-148.423578	14.67
Veg. plots washer	T3_5c_w4	70.196721	-148.423593	14.67
Veg. plots washer	T3_5t_w1	70.196669	-148.423803	14.12
Veg. plots washer	T3_5t_w2	70.196662	-148.423788	14.03
Veg. plots washer	T3_5t_w3	70.196667	-148.423766	14.07
Veg. plots washer	T3_5t_w4	70.196675	-148.423781	14.08
Veg. plots washer	T3_10c_w1	70.196611	-148.423725	14.47
Veg. plots washer	T3_10c_w2	70.196618	-148.423741	14.52
Veg. plots washer	T3_10c_w3	70.196613	-148.423763	14.49
Veg. plots washer	T3_10c_w4	70.196606	-148.423747	14.42

Table 3.7 (cont.). *Coordinates of all points surveyed along* ***Transects 3, 4 and 5****, Airport Site, August 2015.*

Type	Code	Lat (DD)	Long (DD)	Elevation (m)
Veg. plots washer	T3_25c_w1	70.196500	-148.423596	14.59
Veg. plots washer	T3_25c_w2	70.196492	-148.423582	14.55
Veg. plots washer	T3_25c_w3	70.196497	-148.423559	14.61
Veg. plots washer	T3_25c_w4	70.196505	-148.423574	14.58
Veg. plots washer	T3_25t_w1	70.196515	-148.423464	14.11
Veg. plots washer	T3_25t_w2	70.196506	-148.423452	13.93
Veg. plots washer	T3_25t_w3	70.196510	-148.423427	13.93
Veg. plots washer	T3_25t_w4	70.196519	-148.423440	14.18
Veg. plots washer	T3_50c_w1	70.196364	-148.422931	14.33
Veg. plots washer	T3_50c_w2	70.196358	-148.422910	14.38
Veg. plots washer	T3_50c_w3	70.196365	-148.422893	14.34
Veg. plots washer	T3_50c_w4	70.196371	-148.422914	14.32
Veg. plots washer	T3_50t_w1	70.196333	-148.423126	14.01
Veg. plots washer	T3_50t_w2	70.196327	-148.423147	13.92
Veg. plots washer	T3_50t_w3	70.196320	-148.423129	13.87
Veg. plots washer	T3_50t_w4	70.196326	-148.423108	13.90
Veg. plots washer	T3_100c_w1	70.196000	-148.422213	14.22
Veg. plots washer	T3_100c_w2	70.196006	-148.422192	14.24
Veg. plots washer	T3_100c_w3	70.196013	-148.422208	14.26
Veg. plots washer	T3_100c_w4	70.196008	-148.422229	14.23
Veg. plots washer	T3_100t_w1	70.196045	-148.422132	13.81
Veg. plots washer	T3_100t_w2	70.196049	-148.422108	13.80
Veg. plots washer	T3_100t_w3	70.196057	-148.422121	13.73
Veg. plots washer	T3_100t_w4	70.196053	-148.422145	13.73
iButton air temperature	T3iBA_0	70.196643	-148.424064	14.54
iButton air temperature	T3iBA_5	70.196610	-148.423980	14.47
iButton air temperature	T3iBA_10	70.196575	-148.423892	14.54
iButton air temperature	T3iBA_25	70.196473	-148.423634	14.64
iButton air temperature	T3iBA_50	70.196302	-148.423202	14.29
iButton air temperature	T3iBA_100	70.195964	-148.422337	14.17
iButton soil temperature	T3iBS_5c	70.196693	-148.423595	14.65
iButton soil temperature	T3iBS_5t	70.196671	-148.423755	13.98
iButton soil temperature	T3iBS_10c	70.196610	-148.423785	14.50
iButton soil temperature	T3iBS_10t	70.196640	-148.423456	13.39
iButton soil temperature	T3iBS_25c	70.196497	-148.423621	14.64
iButton soil temperature	T3iBS_25t	70.196517	-148.423419	14.12
iButton soil temperature	T3iBS_50c	70.196376	-148.422924	14.34
iButton soil temperature	T3iBS_50t	70.196321	-148.423104	14.02
iButton soil temperature	T3iBS_100c	70.195995	-148.422177	14.33
iButton soil temperature	T3iBS_100t	70.196050	-148.422085	13.80
Boreholes	T3B_16.5t	70.196520	-148.423815	14.33
Boreholes	T3B_32.2t	70.196412	-148.423546	14.39
Boreholes	T3B_50.5t	70.196282	-148.423252	14.56
Boreholes	T3B_70.3t	70.196148	-148.422909	14.30
Boreholes	T3B_84.1t	70.196066	-148.422628	14.31
Boreholes	T3B_83.7t	70.196051	-148.422695	14.09
Boreholes	T3B_89.3t	70.196010	-148.422609	14.25
Boreholes	T3B_90.0t	70.195998	-148.422623	14.40
Boreholes	T3B_94.2t	70.195995	-148.422464	14.47
Boreholes	T3B_101.1t	70.195953	-148.422329	14.16
Boreholes	T3B_100.7t	70.195871	-148.422623	14.22
Boreholes	T3B_11.7t	70.196542	-148.423934	14.21
Boreholes	T3B_70.4t	70.196134	-148.422953	14.27
Boreholes	T3B_59.0c	70.196229	-148.423088	14.40
Transect 4				
Line transect poles	T4LTP_0m	70.196769	-148.424384	14.80
Line transect poles	T4LTP_5m	70.196803	-148.424468	14.80
Line transect poles	T4LTP_10m	70.196837	-148.424554	14.78
Line transect poles	T4LTP_25m	70.196938	-148.424812	14.64
Line transect poles	T4LTP_50m	70.197110	-148.425241	14.63
Line transect poles	T4LTP_100m	70.197451	-148.426097	14.84
Line transect flags	T4LTF_0	70.196769	-148.424384	14.80
Line transect flags	T4LTF_1	70.196776	-148.424399	14.92
Line transect flags	T4LTF_2	70.196782	-148.424416	14.98
Line transect flags	T4LTF_3	70.196789	-148.424433	14.88
Line transect flags	T4LTF_4	70.196795	-148.424450	14.84
Line transect flags	T4LTF_5	70.196803	-148.424468	14.80
Line transect flags	T4LTF_6	70.196809	-148.424486	14.81
Line transect flags	T4LTF_7	70.196816	-148.424504	14.66
Line transect flags	T4LTF_8	70.196822	-148.424521	14.72

Table 3.7 (cont.). *Coordinates of all points surveyed along* ***Transects 3, 4 and 5****, Airport Site, August 2015.*

Type	Code	Lat (DD)	Long (DD)	Elevation (m)
Line transect flags	T4LTF_9	70.196829	-148.424538	14.76
Line transect flags	T4LTF_10	70.196837	-148.424554	14.78
Line transect flags	T4LTF_11	70.196843	-148.424572	14.81
Line transect flags	T4LTF_12	70.196850	-148.424589	14.82
Line transect flags	T4LTF_13	70.196857	-148.424607	14.79
Line transect flags	T4LTF_14	70.196863	-148.424624	14.66
Line transect flags	T4LTF_15	70.196870	-148.424642	14.80
Line transect flags	T4LTF_16	70.196877	-148.424659	14.83
Line transect flags	T4LTF_17	70.196884	-148.424675	14.81
Line transect flags	T4LTF_18	70.196891	-148.424692	14.76
Line transect flags	T4LTF_19	70.196897	-148.424710	14.68
Line transect flags	T4LTF_20	70.196905	-148.424727	14.50
Line transect flags	T4LTF_21	70.196911	-148.424745	14.40
Line transect flags	T4LTF_22	70.196918	-148.424762	14.56
Line transect flags	T4LTF_23	70.196925	-148.424779	14.71
Line transect flags	T4LTF_24	70.196931	-148.424795	14.68
Line transect flags	T4LTF_25	70.196938	-148.424812	14.64
Line transect flags	T4LTF_26	70.196946	-148.424829	14.54
Line transect flags	T4LTF_27	70.196952	-148.424844	14.54
Line transect flags	T4LTF_28	70.196960	-148.424860	14.52
Line transect flags	T4LTF_29	70.196966	-148.424881	14.34
Line transect flags	T4LTF_30	70.196973	-148.424898	14.47
Line transect flags	T4LTF_31	70.196979	-148.424916	14.58
Line transect flags	T4LTF_32	70.196986	-148.424932	14.66
Line transect flags	T4LTF_33	70.196993	-148.424949	14.66
Line transect flags	T4LTF_34	70.197000	-148.424967	14.63
Line transect flags	T4LTF_35	70.197007	-148.424984	14.40
Line transect flags	T4LTF_36	70.197014	-148.425001	14.28
Line transect flags	T4LTF_37	70.197021	-148.425016	14.16
Line transect flags	T4LTF_38	70.197027	-148.425035	13.99
Line transect flags	T4LTF_39	70.197034	-148.425054	14.45
Line transect flags	T4LTF_40	70.197041	-148.425071	14.54
Line transect flags	T4LTF_41	70.197048	-148.425087	14.72
Line transect flags	T4LTF_42	70.197054	-148.425103	14.70
Line transect flags	T4LTF_43	70.197061	-148.425121	14.70
Line transect flags	T4LTF_44	70.197068	-148.425137	14.72
Line transect flags	T4LTF_45	70.197075	-148.425156	14.69
Line transect flags	T4LTF_46	70.197082	-148.425173	14.60
Line transect flags	T4LTF_47	70.197089	-148.425191	14.63
Line transect flags	T4LTF_48	70.197096	-148.425206	14.20
Line transect flags	T4LTF_49	70.197103	-148.425223	14.47
Line transect flags	T4LTF_50	70.197110	-148.425241	14.63
Line transect flags	T4LTF_51	70.197116	-148.425257	14.68
Line transect flags	T4LTF_52	70.197123	-148.425275	14.80
Line transect flags	T4LTF_53	70.197130	-148.425292	14.82
Line transect flags	T4LTF_54	70.197137	-148.425309	14.77
Line transect flags	T4LTF_55	70.197144	-148.425326	14.79
Line transect flags	T4LTF_56	70.197150	-148.425343	14.81
Line transect flags	T4LTF_57	70.197157	-148.425361	14.82
Line transect flags	T4LTF_58	70.197164	-148.425379	14.82
Line transect flags	T4LTF_59	70.197171	-148.425394	14.81
Line transect flags	T4LTF_60	70.197178	-148.425412	14.80
Line transect flags	T4LTF_61	70.197185	-148.425428	14.80
Line transect flags	T4LTF_62	70.197192	-148.425446	14.82
Line transect flags	T4LTF_63	70.197198	-148.425464	14.84
Line transect flags	T4LTF_64	70.197205	-148.425480	14.79
Line transect flags	T4LTF_65	70.197212	-148.425498	14.72
Line transect flags	T4LTF_66	70.197219	-148.425514	14.78
Line transect flags	T4LTF_67	70.197226	-148.425532	14.81
Line transect flags	T4LTF_68	70.197233	-148.425549	14.80
Line transect flags	T4LTF_69	70.197240	-148.425566	14.80
Line transect flags	T4LTF_70	70.197246	-148.425583	14.80
Line transect flags	T4LTF_71	70.197253	-148.425599	14.69
Line transect flags	T4LTF_72	70.197260	-148.425616	14.69
Line transect flags	T4LTF_73	70.197267	-148.425634	14.74
Line transect flags	T4LTF_74	70.197274	-148.425651	14.76
Line transect flags	T4LTF_75	70.197281	-148.425669	14.88
Line transect flags	T4LTF_76	70.197287	-148.425685	14.87
Line transect flags	T4LTF_77	70.197294	-148.425703	14.86
Line transect flags	T4LTF_78	70.197301	-148.425719	14.82

Table 3.7 (cont.). *Coordinates of all points surveyed along* ***Transects 3, 4 and 5****, Airport Site, August 2015.*

Type	Code	Lat (DD)	Long (DD)	Elevation (m)
Line transect flags	T4LTF_79	70.197308	-148.425737	14.78
Line transect flags	T4LTF_80	70.197314	-148.425755	14.90
Line transect flags	T4LTF_81	70.197321	-148.425772	14.97
Line transect flags	T4LTF_82	70.197328	-148.425790	15.01
Line transect flags	T4LTF_83	70.197335	-148.425806	15.02
Line transect flags	T4LTF_84	70.197342	-148.425823	15.00
Line transect flags	T4LTF_85	70.197348	-148.425840	15.02
Line transect flags	T4LTF_86	70.197355	-148.425858	14.92
Line transect flags	T4LTF_87	70.197362	-148.425874	14.78
Line transect flags	T4LTF_88	70.197369	-148.425891	14.83
Line transect flags	T4LTF_89	70.197376	-148.425909	14.82
Line transect flags	T4LTF_90	70.197383	-148.425926	14.81
Line transect flags	T4LTF_91	70.197390	-148.425942	14.88
Line transect flags	T4LTF_92	70.197396	-148.425959	14.86
Line transect flags	T4LTF_93	70.197404	-148.425976	14.77
Line transect flags	T4LTF_94	70.197410	-148.425994	14.80
Line transect flags	T4LTF_95	70.197417	-148.426011	14.82
Line transect flags	T4LTF_96	70.197424	-148.426027	14.83
Line transect flags	T4LTF_97	70.197431	-148.426045	14.84
Line transect flags	T4LTF_98	70.197438	-148.426061	14.84
Line transect flags	T4LTF_99	70.197445	-148.426079	14.85
Line transect flags	T4LTF_100	70.197451	-148.426097	14.84
Veg. plots photo points	T4_5c	70.196764	-148.424647	14.73
Veg. plots photo points	T4_5t	70.196776	-148.424562	14.49
Veg. plots photo points	T4_10c	70.196839	-148.424610	14.74
Veg. plots photo points	T4_10t	70.196810	-148.424725	14.24
Veg. plots photo points	T4_25c	70.196903	-148.424911	14.69
Veg. plots photo points	T4_25t	70.196861	-148.425010	14.38
Veg. plots photo points	T4_50c	70.197047	-148.425259	14.71
Veg. plots photo points	T4_50t	70.197047	-148.425555	14.50
Veg. plots photo points	T4_100c	70.197449	-148.426283	14.79
Veg. plots photo points	T4_100t	70.197399	-148.426230	14.64
Veg. plots washer	T4_5c_w1	70.196762	-148.424630	14.83
Veg. plots washer	T4_5c_w2	70.196758	-148.424655	14.79
Veg. plots washer	T4_5c_w3	70.196766	-148.424664	14.73
Veg. plots washer	T4_5c_w4	70.196770	-148.424640	14.76
Veg. plots washer	T4_5t_w1	70.196783	-148.424560	14.44
Veg. plots washer	T4_5t_w2	70.196777	-148.424581	14.43
Veg. plots washer	T4_5t_w3	70.196769	-148.424569	14.52
Veg. plots washer	T4_5t_w4	70.196774	-148.424545	14.54
Veg. plots washer	T4_10c_w1	70.196841	-148.424629	14.70
Veg. plots washer	T4_10c_w2	70.196833	-148.424615	14.76
Veg. plots washer	T4_10c_w3	70.196838	-148.424591	14.80
Veg. plots washer	T4_10c_w4	70.196846	-148.424606	14.74
Veg. plots washer	T4_10t_w1	70.196814	-148.424741	14.48
Veg. plots washer	T4_10t_w2	70.196815	-148.424712	14.52
Veg. plots washer	T4_25c_w1	70.196910	-148.424913	14.72
Veg. plots washer	T4_25c_w2	70.196903	-148.424930	14.76
Veg. plots washer	T4_25c_w3	70.196897	-148.424909	14.73
Veg. plots washer	T4_25c_w4	70.196905	-148.424892	14.73
Veg. plots washer	T4_25t_w1	70.196867	-148.425012	14.54
Veg. plots washer	T4_25t_w2	70.196863	-148.425031	14.53
Veg. plots washer	T4_25t_w3	70.196855	-148.425017	14.25
Veg. plots washer	T4_25t_w4	70.196861	-148.424993	14.43
Veg. plots washer	T4_50c_w1	70.197047	-148.425280	14.73
Veg. plots washer	T4_50c_w2	70.197041	-148.425260	14.74
Veg. plots washer	T4_50c_w3	70.197047	-148.425241	14.75
Veg. plots washer	T4_50c_w4	70.197054	-148.425260	14.70
Veg. plots washer	T4_50t_w1	70.197053	-148.425553	14.59
Veg. plots washer	T4_50t_w2	70.197047	-148.425579	14.49
Veg. plots washer	T4_50t_w3	70.197040	-148.425560	14.50
Veg. plots washer	T4_50t_w4	70.197046	-148.425536	14.52
Veg. plots washer	T4_100c_w1	70.197442	-148.426286	14.78
Veg. plots washer	T4_100c_w2	70.197447	-148.426264	14.83
Veg. plots washer	T4_100c_w3	70.197455	-148.426278	14.78
Veg. plots washer	T4_100c_w4	70.197450	-148.426302	14.78
Veg. plots washer	T4_100t_w1	70.197392	-148.426234	14.67
Veg. plots washer	T4_100t_w2	70.197397	-148.426212	14.63
Veg. plots washer	T4_100t_w3	70.197405	-148.426227	14.71
Veg. plots washer	T4_100t_w4	70.197400	-148.426250	14.69

Table 3.7 (cont.). *Coordinates of all points surveyed along* ***Transects 3, 4 and 5****, Airport Site, August 2015.*

Type	Code	Lat (DD)	Long (DD)	Elevation (m)
iButton air temperature	T4iBA_0	70.196769	-148.424384	14.80
iButton air temperature	T4iBA_5	70.196803	-148.424468	14.80
iButton air temperature	T4iBA_10	70.196837	-148.424554	14.78
iButton air temperature	T4iBA_25	70.196938	-148.424812	14.64
iButton air temperature	T4iBA_50	70.197110	-148.425241	14.63
iButton air temperature	T4iBA_100	70.197451	-148.426097	14.84
iButton soil temperature	T4iBS_5c	70.196758	-148.424676	14.79
iButton soil temperature	T4iBS_5t	70.196767	-148.424552	14.52
iButton soil temperature	T4iBS_10c	70.196832	-148.424594	14.72
iButton soil temperature	T4iBS_10t	70.196808	-148.424713	14.22
iButton soil temperature	T4iBS_25c	70.196922	-148.424915	14.75
iButton soil temperature	T4iBS_25t	70.196856	-148.425030	14.35
iButton soil temperature	T4iBS_50c	70.197043	-148.425306	14.77
iButton soil temperature	T4iBS_50t	70.197035	-148.425549	14.38
iButton soil temperature	T4iBS_100c	70.197438	-148.426339	14.79
iButton soil temperature	T4iBS_100t	70.197395	-148.426279	14.70
Transact 5				
Line transect poles	T5LTP_0m	70.195733	-148.426136	15.19
Line transect poles	T5LTP_25m	70.195827	-148.426734	14.30
Line transect poles	T5LTP_50m	70.195921	-148.427333	14.59
Line transect poles	T5LTP_100m	70.196110	-148.428531	14.66
Veg. plots photo points	T5_25c	70.195770	-148.426809	14.52
Veg. plots photo points	T5_25t	70.195747	-148.427013	14.34
Veg. plots photo points	T5_50c	70.195911	-148.427514	14.46
Veg. plots photo points	T5_50t	70.195829	-148.427642	14.29
Veg. plots photo points	T5_100c	70.196074	-148.428575	14.63
Veg. plots photo points	T5_100t	70.196016	-148.428483	14.22
Veg. plots washer	T5_25t_w1	70.195740	-148.427007	14.46
Veg. plots washer	T5_25t_w2	70.195745	-148.427030	14.46
Veg. plots washer	T5_25t_w3	70.195752	-148.427015	14.45
Boreholes	T5B_26.7t	70.195855	-148.426747	14.56
Boreholes	T5B_40.3t	70.195907	-148.427072	14.64
Boreholes	T5B_39.7t	70.195895	-148.427071	14.68
Boreholes	T5B_50.5t	70.195936	-148.427329	14.52
Boreholes	T5B_59.5t	70.195966	-148.427550	14.55
Boreholes	T5B_72.9t	70.196030	-148.427853	14.54
Boreholes	T5B_69.6t	70.196022	-148.427769	14.50
Boreholes	T5B_68.9t	70.196013	-148.427760	14.46
Boreholes	T5B_88.3t	70.196100	-148.428206	14.46
Boreholes	T5B_93.0t	70.196092	-148.428355	14.48
Boreholes	T5B_100.5t	70.196151	-148.428492	14.46
Boreholes	T5B_100.6t	70.196141	-148.428509	14.52
Boreholes	T5B_50.0t	70.195942	-148.427307	14.54
Boreholes	T5B_65.4c	70.195987	-148.427694	14.60

Table 3.8. *Maxim iButton® temperature loggers serial numbers and depths, August 2015.*

Relevé no.	Logger ID#	Code for Position	AGC ID	Location	Depth	Absolute Height
Transect 3						
T3-000	2E00000035F29821	T3LTP_0m	007	air	0 cm	14.54
T3-000	0A00000036173321	T3LTP_0m	113	air	10 cm	14.64
T3-000	EB00000039E1E421	T3LTP_0m	278	air	20 cm	14.74
T3-000	D300000039F5F421	T3LTP_0m	262	air	50 cm	15.04
T3-000	1300000039D73B21	T3LTP_0m	139	air	100 cm	15.54
T3-000	950000003A377321	T3LTP_0m	249	air	150 cm	16.04
T3-005	F300000035F21921	T3LTP_5m	005	air	0 cm	14.47
T3-005	7500000035FA4021	T3LTP_5m	060	air	10 cm	14.57
T3-005	EF000000361CAC21	T3LTP_5m	101	air	20 cm	14.67
T3-005	A50000003A200421	T3LTP_5m	145	air	50 cm	14.97
T3-005	0B0000003A258D21	T3LTP_5m	176	air	100 cm	15.47
T3-010	1F0000003A004521	T3LTP_10m	182	air	0 cm	14.54
T3-010	C60000003A082A21	T3LTP_10m	253	air	10 cm	14.64
T3-010	BB0000003A541521	T3LTP_10m	198	air	20 cm	14.74
T3-010	000000003A129A21	T3LTP_10m	211	air	50 cm	15.04
T3-010	0200000039DCC521	T3LTP_10m	136	air	100 cm	15.54
T3-025	B100000039EDDD21	T3LTP_25m	227	air	0 cm	14.64
T3-025	E40000003A40CE21	T3LTP_25m	252	air	10 cm	14.74
T3-025	FC0000003A257A21	T3LTP_25m	222	air	20 cm	14.84
T3-025	D00000003A3A3721	T3LTP_25m	217	air	50 cm	15.14
T3-025	300000003A1DAC21	T3LTP_25m	213	air	100 cm	15.64
T3-050	DD0000003A121B21	T3LTP_50m	203	air	0 cm	14.29
T3-050	96000000360E3D21	T3LTP_50m	102	air	10 cm	14.39
T3-050	640000003A2EE921	T3LTP_50m	186	air	20 cm	14.49
T3-050	5C00000039DE4421	T3LTP_50m	256	air	50 cm	14.79
T3-050	F20000003A149821	T3LTP_50m	178	air	100 cm	15.29
T3-100	4700000035FAE221	T3LTP_100m	013	air	0 cm	14.17
T3-100	A90000003A263821	T3LTP_100m	197	air	10 cm	14.27
T3-100	830000003A53A721	T3LTP_100m	133	air	20 cm	14.37
T3-100	D90000003A2F0A21	T3LTP_100m	201	air	50 cm	14.67
T3-100	3C00000039FB4921	T3LTP_100m	159	air	100 cm	15.17
T3-005-C	DB00000035F99F21	T3iBS_5c	040	soil	0 cm (soil surface)	14.65
T3-005-C	6B00000039DD6E21	T3iBS_5c	151	soil	-20 cm	14.45
T3-005-C	AD0000003A227A21	T3iBS_5c	237	soil	-40 cm	14.25
T3-005-T	0D00000036061321	T3iBS_5t	078	soil	0 cm (soil surface)	13.98
T3-005-T	C40000003A23D121	T3iBS_5t	202	soil	-20 cm	13.78
T3-005-T	E80000003A2D0C21	T3iBS_5t	255	soil	-40 cm	13.58
T3-010-C	9100000036118321	T3iBS_10c	105	soil	0 cm (soil surface)	14.50
T3-010-C	53000000360F7121	T3iBS_10c	110	soil	-20 cm	14.30
T3-010-C	320000003A5CB021	T3iBS_10c	194	soil	-40 cm	14.10
T3-010-T	0300000036003C21	T3iBS_10t	009	soil	+20 cm (water)	13.59
T3-010-T	2A0000003604B821	T3iBS_10t	077	soil	0 cm (soil surface)	13.39
T3-010-T	080000003A2FE121	T3iBS_10t	166	soil	-20 cm	13.19
T3-025-C	9F00000035F77521	T3iBS_25c	010	soil	0 cm (soil surface)	14.64
T3-025-C	7900000035FD6521	T3iBS_25c	021	soil	-20 cm	14.44
T3-025-C	6A0000003A52A821	T3iBS_25c	276	soil	-40 cm	14.24
T3-025-T	8400000035FDCD21	T3iBS_25t	047	soil	0 cm (soil surface)	14.12
T3-025-T	FC00000035FF5021	T3iBS_25t	059	soil	-20 cm	13.92

Table 3.8 (cont.). *Maxim iButton® temperature loggers serial numbers and depths, August 2015.*

Relevé no.	Logger ID#	Code for Position	AGC ID	Location	Depth	Absolute Height
T3-025-T	480000003A0EA121	T3iBS_25t	223	soil	-40 cm	13.72
T3-050-C	2A00000035F5F121	T3iBS_50c	014	soil	0 cm (soil surface)	14.34
T3-050-C	3400000036054021	T3iBS_50c	022	soil	-20 cm	14.14
T3-050-C	0900000036017A21	T3iBS_50c	072	soil	-40 cm	13.94
T3-050-T	0500000036011021	T3iBS_50t	028	soil	0 cm (soil surface)	14.02
T3-050-T	9C00000035F38721	T3iBS_50t	038	soil	-20 cm	13.82
T3-050-T	4D00000035F42321	T3iBS_50t	063	soil	-40 cm	13.62
T3-100-C	8800000035FAE821	T3iBS_100c	025	soil	0 cm (soil surface)	14.33
T3-100-C	9500000035FEFB21	T3iBS_100c	086	soil	-20 cm	14.13
T3-100-C	290000003A336821	T3iBS_100c	270	soil	-40 cm	13.93
T3-100-T	C800000035F99121	T3iBS_100t	056	soil	0 cm (soil surface)	13.80
T3-100-T	2C0000003601F021	T3iBS_100t	058	soil	-20 cm	13.60
T3-100-T	0100000039FB1721	T3iBS_100t	137	soil	-40 cm	13.40
Transect 4						
T4-000	6200000039F33221	T4LTP_0m	183	air	0 cm	14.80
T4-000	520000003A493F21	T4LTP_0m	231	air	10 cm	14.90
T4-000	EC00000039FB2721	T4LTP_0m	131	air	20 cm	15.00
T4-000	300000003A1E8721	T4LTP_0m	134	air	50 cm	15.30
T4-000	C50000003A0CD821	T4LTP_0m	226	air	100 cm	15.80
T4-000	730000003A190C21	T4LTP_0m	228	air	150 cm	16.30
T4-005	D50000003A2D5221	T4LTP_5m	165	air	0 cm	14.80
T4-005	6D00000035FDDB21	T4LTP_5m	035	air	10 cm	14.90
T4-005	F100000035F20A21	T4LTP_5m	084	air	20 cm	15.00
T4-005	DC0000003A4C9F21	T4LTP_5m	232	air	50 cm	15.30
T4-005	9E0000003A12DF21	T4LTP_5m	236	air	100 cm	15.80
T4-005	780000003A23AE21	T4LTP_5m	188	air	150 cm	16.30
T4-010	570000003A5B2721	T4LTP_10m	254	air	0 cm	14.78
T4-010	4A0000003A2D9221	T4LTP_10m	184	air	10 cm	14.88
T4-010	AC00000035FDA821	T4LTP_10m	080	air	20 cm	14.98
T4-010	980000003A569821	T4LTP_10m	155	air	50 cm	15.28
T4-010	9C00000039F8EF21	T4LTP_10m	158	air	100 cm	15.78
T4-025	B50000003A322721	T4LTP_25m	157	air	0 cm	14.64
T4-025	010000003A04C021	T4LTP_25m	271	air	10 cm	14.74
T4-025	3C0000003A517C21	T4LTP_25m	257	air	20 cm	14.84
T4-025	680000003A2BFE21	T4LTP_25m	242	air	50 cm	15.14
T4-025	120000003A3C8421	T4LTP_25m	189	air	100 cm	15.64
T4-050	990000003A44A621	T4LTP_50m	208	air	0 cm	14.63
T4-050	990000003A00D421	T4LTP_50m	179	air	10 cm	14.73
T4-050	F500000039E33721	T4LTP_50m	214	air	20 cm	14.83
T4-050	D40000003A1E7E21	T4LTP_50m	230	air	50 cm	15.13
T4-050	4700000039E75521	T4LTP_50m	234	air	100 cm	15.63
T4-100	C900000035FD7021	T4LTP_100m	088	air	0 cm	14.84
T4-100	D40000003A36BD21	T4LTP_100m	156	air	10 cm	14.94
T4-100	110000003A387621	T4LTP_100m	180	air	20 cm	15.04
T4-100	F500000039F6C321	T4LTP_100m	148	air	50 cm	15.34
T4-100	250000003A1D9721	T4LTP_100m	195	air	100 cm	15.84
T4-005-C	140000003A0F1821	T4iBS_5c	135	soil	0 cm (soil surface)	14.79
T4-005-C	1300000039EC5A21	T4iBS_5c	193	soil	-20 cm	14.59
T4-005-C	4B00000035FCDE21	T4iBS_5c	083	soil	-40 cm	14.39

Table 3.8 (cont.). *Maxim iButton® temperature loggers serial numbers and depths, August 2015.*

Relevé no.	Logger ID#	Code for Position	AGC ID	Location	Depth	Absolute Height
T4-005-T	A30000003A4EB221	T4iBS_5t	177	soil	0 cm (soil surface)	14.52
T4-005-T	F900000035FB9721	T4iBS_5t	053	soil	-20 cm	14.32
T4-005-T	9100000035F27121	T4iBS_5t	069	soil	-40 cm	14.12
T4-010-C	D800000035F2EA21	T4iBS_10c	081	soil	0 cm (soil surface)	14.72
T4-010-C	DD00000035F8B321	T4iBS_10c	082	soil	-20 cm	14.52
T4-010-C	5B0000003A5C0221	T4iBS_10c	169	soil	-40 cm	14.32
T4-010-T	3D00000035FA5E21	T4iBS_10t	079	soil	0 cm (soil surface)	14.22
T4-010-T	4600000035F4F921	T4iBS_10t	018	soil	-20 cm	14.02
T4-010-T	E70000003A579E21	T4iBS_10t	210	soil	-40 cm	13.82
T4-025-C	C6000000360DDC21	T4iBS_25c	103	soil	+5 cm (soil surface)	14.80
T4-025-C	040000003A0E9921	T4iBS_25c	205	soil	-15 cm	14.60
T4-025-C	DA0000003A0BF321	T4iBS_25c	215	soil	-35 cm	14.40
T4-025-T	F400000035F2A921	T4iBS_25t	052	soil	+5 cm (water)	14.40
T4-025-T	1100000036131521	T4iBS_25t	127	soil	-15 cm	14.20
T4-025-T	D80000003A2DBD21	T4iBS_25t	187	soil	-35 cm	14.00
T4-050-C	3300000035F4B921	T4iBS_50c	050	soil	0 cm (soil surface)	14.77
T4-050-C	3400000035F25F21	T4iBS_50c	076	soil	-20 cm	14.57
T4-050-C	A40000003A084221	T4iBS_50c	196	soil	-40 cm	14.37
T4-050-T	9A0000003603E221	T4iBS_50t	075	soil	0 cm (soil surface)	14.38
T4-050-T	410000003A3CD821	T4iBS_50t	171	soil	-20 cm	14.18
T4-050-T	DC0000003A197D21	T4iBS_50t	269	soil	-40 cm	13.98
T4-100-C	A200000035FCC821	T4iBS_100c	020	soil	0 cm (soil surface)	14.79
T4-100-C	4C00000035FC6E21	T4iBS_100c	042	soil	-20 cm	14.59
T4-100-C	8000000035F71121	T4iBS_100c	091	soil	-40 cm	14.39
T4-100-T	6200000039EB7321	T4iBS_100t	268	soil	0 cm (soil surface)	14.70
T4-100-T	E200000035F54B21	T4iBS_100t	001	soil	-20 cm	14.50
T4-100-T	2A00000036126721	T4iBS_100t	129	soil	-40 cm	14.30

Table 3.9. *Boreholes in ice-wedge polygonal centers, Airport Site, September 2015.* ***Borehole location****: Transect number – distance from road (m) – polygon center (C).* ***Permafrost table:*** Base of the frozen transient layer which coincides with top of the intermediate layer or massive-ice body (based on analysis of cryostructures).

Borehole location	Date	Distance from transect (m)	Borehole depth (cm)	Thaw depth (cm)	Permafrost table[1] (cm)
T3-59.0-C	9/23/2015	2.2	251	63	64
T5-65.4-C	9/22/2015	0.9	257	66	69

Notes: [1]Base of the frozen transient layer which coincides with top of the intermediate layer (based on analysis of cryostructures).

Table 3.10. *Gravimetric moisture content (GMC) of soil samples from boreholes drilled in ice-wedge polygonal centers, Airport Site, September 2015.* ***Borehole location****: Transect number – distance from road (m) – polygon center (C).*

Borehole location	Depth (cm)	Tare (g)	Wet weight + tare (g)	Dry weight + tare (g)	Water (g)	GMC (%)
T3-59.0-C	48-63	89.1	407.3	256.2	151.1	90.4
T3-59.0-C	80-96	87.0	718.0	248.4	469.6	291.0
T3-59.0-C	106-112	87.1	307.3	156.6	150.7	216.8
T3-59.0-C	119-131	88.0	588.3	240.9	347.4	227.2
T3-59.0-C	144-153	86.8	511.9	239.4	272.5	178.6
T3-59.0-C	163-179	87.0	740.5	288.4	452.1	224.5
T3-59.0-C	187-198	88.7	495.5	183.8	311.7	327.8
T3-59.0-C	210-222	87.0	546.0	208.3	337.7	278.4
T3-59.0-C	237-251	87.3	699.9	286.3	413.6	207.8
T5-65.4-C	66-77	86.8	552.3	229.6	322.7	226.0
T5-65.4-C	96-111	87.0	628.3	183.2	445.1	462.7
T5-65.4-C	120-132	87.3	542.4	219.2	323.2	245.0
T5-65.4-C	143-154	87.0	515.1	230.9	284.2	197.5
T5-65.4-C	178-186	88.7	541.7	242.1	299.6	195.3
T5-65.4-C	203-217	88.0	672.0	232.8	439.2	303.3
T5-65.4-C	228-235	89.0	400.7	193.1	207.6	199.4
T5-65.4-C	249-257	86.9	481.8	222.4	259.4	191.4

Table 3.11. *Thicknesses of frozen protective layers above massive-ice bodies in boreholes drilled in ice-wedge troughs, Airport Site, September 2015.* ***Borehole location:*** *Transect number – distance from road (m) – polygon trough (T).* ***Permafrost table:*** Base of the frozen transient layer which coincides with top of the intermediate layer or massive-ice body (based on analysis of cryostructures). ***Depth to massive ice:*** Wedge ice (WI), thermokarst-cave ice (TCI), composite wedge (CW). ***Frozen protective layer:*** Thickness of frozen soil layer on top of massive ice bodies on the day or drilling (includes the frozen part of the active layer, transient layer and intermediate layer).

Borehole location	Date	Borehole depth (cm)	Location	Water depth (cm)	Thaw depth (cm)	Perma-frost table (cm)	Depth to massive ice (cm)	Frozen protective layer	Inter-mediate layer (cm)
Transect 3									
T3-11.7-T	9/22/15	81	Trough	23	53	53	67 WI+TCI	14	14
T3-16.5-T	9/18/15	92	Trough	-	60	60	60 WI	0	0
T3-32.2-T	9/18/15	79	Trough	-	51	51.5	51.5 WI	0.5	0
T3-50.5-T	9/18/15	75	Trough	-	43	43	43 WI	0	0
T3-70.3-T	9/18/15	92	Trough	-	62	62	62 WI	0	0
T3-70.4-T	9/22/15	90	Trough	27	47	47	47 WI	0	0
T3-83.7-T	9/18/15	109	Mound in the trough	-	65	66	66 WI+CW	1	0
T3-84.1-T	9/18/15	92	Trough	-	62	63	63 WI	1	0
T3-89.3-T	9/18/15	143	Ridge in the trough	-	(66)	-	(113 CW?)	-	-
T3-90.0-T	9/18/15	88	Trough	-	48	48.5	48.5 WI	0.5	0
T3-94.2-T	9/19/15	79	Trough	-	48	48	48 WI	0	0
T3-100.7-T	9/19/15	135	Ridge in the trough	-	62	62	72 TCI	10	10
T3-101.1-T	9/19/15	90	Trough	-	55	55	55 WI	0	0
Average, all boreholes					**54.7 (n=12)**	**54.9 (n=12)**	**56.9 (n=12)**	**2.3 (n=12)**	**2.0 (n=12)**
Transect 5									
T5-26.7-T	9/20/15	63	Trough	10	53	53	55 WI	2	2
T5-39.7-T	9/20/15	92	Trough	8	61	61.5	61.5 WI	0.5	0
T5-40.3-T	9/20/15	104	Mound in the trough	-	77	78	78 WI	1	0
T5-50.0-T	9/22/15	118	Trough	27	48	48	51 TCI	3	3
(T5-50.5)-T	9/20/15	150	Mound in the trough	-	69	73	(134 WI)	-	-
T5-59.5-T	9/20/15	61	Trough	11	48	48	50 WI	2	2
T5-68.9-T	9/21/15	57	Trough	15	36	36	42 WI+TCI	6	6
T5-69.6-T	9/21/15	110	Ridge in the trough	-	71	75	77 WI	6	2
T5-72.9-T	9/20/15	93	Trough	-	51	51	57 TCI	6	6
T5-88.3-T	9/21/15	66	Trough	10	46	46	51 WI	5	5
T5-93.0-T	9/21/15	50	Trough	27	45	45	45 WI	0	0
(T5-100.5-T)	9/21/15	113	Ridge in the trough	-	67	77	(90 CW?)	-	-
T5-100.6-T	9/21/15	62	Trough	17	36	48	51 WI	15	3
Average, all boreholes					**54.5 (n=13)**	**56.9 (n=13)**	**56.2 (n=11)**	**4.2 (n=11)**	**2.6 (n=11)**

Table 3.12. *Gravimetric moisture content (GMC) of soil samples from boreholes drilled in ice-wedge troughs, Airport Site, September 2015.* ***Borehole location:*** *Transect number – distance from road (m) – polygon trough (T).*

Borehole location	Depth (cm)	Tare (g)	Wet weight + tare (g)	Dry weight + tare (g)	Water (g)	GMC (%)
Transect 3						
T3-89.3-T	72-80	88.0	473.0	219.1	253.9	193.7
T3-89.3-T	98-110	89.0	543.6	216.7	326.9	256.0
T3-89.3-T	126-143	86.7	690.2	218.4	471.8	358.2
T3-100.7-T	62-72	86.8	420.2	165.5	254.7	323.6
T3-100.7-T	89-106	87.0	836.4	413.0	423.4	129.9
T3-11.7-T	53-67	87.0	665.2	220.0	445.2	334.7
Transect 5						
T5-26.7-T	53-55	87.9	163.5	111.4	52.1	221.7
T5-50.5-T	82-103	87.0	971.1	437.7	533.4	152.1
T5-50.5-T	121-134	87.9	623.4	268.2	355.2	197.0
T5-59.5-T	48-50	87.9	166.4	112.2	54.2	223.0
T5-72.9-T	51-57	87.0	377.1	194.8	182.3	169.1
T5-72.9-T	72-78	87.0	231.1	99.6	131.5	1043.7
T5-69.6-T	71-75	86.9	238.8	147.2	91.6	151.9
T5-69.6-T	75-77	87.0	188.8	126.5	62.3	157.7
T5-68.9-T	36-42	86.7	322.6	175.5	147.1	165.7
T5-88.3-T	46-51	87.9	286.4	149.5	136.9	222.2
T5-100.5-T	67-82	87.1	796.5	392.7	403.8	132.1
T5-100.5-T	82-101	87.9	861.8	321.7	540.1	231.0
T5-100.5-T	101-113	88.7	540.6	259.4	281.2	164.7
T5-100.6-T	36-48	87.3	665.2	353.1	312.1	117.4
T5-100.6-T	48-51	89.0	191.5	125.1	66.4	183.9
T5-50.0-T	48-51	86.7	220.7	139.7	81.0	152.8
T5-50.0-T	86-95	86.8	457.4	198.5	258.9	231.8

Table 3.13. *Gravimetric moisture content (GMC) of soil samples from boreholes drilled in ice-wedge polygonal center, Sagavanirktok River Site SR-1, September 2015.*

Depth (cm)	Tare (g)	Wet weight + tare (g)	Dry weight + tare (g)	Water (g)	GMC (%)
55-67	88.0	574.7	247.8	326.9	204.6
79-92	87.0	628.4	275.6	352.8	187.1
115-128	87.9	596.1	226.3	369.8	267.2
153-166	86.8	446.4	213.7	232.7	183.4
178-192	87.3	854.5	489.6	364.9	90.7
192-209	88.6	881.5	447.3	434.2	121.0
209-226	87.0	824.9	364.1	460.8	166.3

4 Conclusions

History of the Airport Site

Prior to construction of the Deadhorse Airport in 1969 and the Dalton Highway in 1974, the areas of our three transects at the Airport Site—T3, T4, and T5—were situated in a rather uniform network of well-developed low-centered ice-wedge polygons (Fig. 1.6, 1949). An exception was a narrow band of high-centered polygons along the west bluff of the Sagavanirktok River. By 1977, numerous roads, including the Dalton Highway, had been constructed. Portions of some of these were later abandoned as new intersections and connections with the airport were built. The abandoned sections quickly developed extensive thermokarst. From 1949 to 1977, the west bluff of Sagavanirktok River was strongly affected by thermal erosion (total riverbank retreat approximately 40m), which threatened the integrity of the Dalton Highway; by 2007 this segment of the riverbank was protected from erosion (Fig. 1.6, 2007).

The Dalton Highway strongly affected the natural drainage patterns. During the 30 years between 1977 and 2007, the area east of the road in the vicinity of Transect T3 gradually became well drained with high-centered polygons (ice wedges here have been deeply degraded due to thermokarst and thermal erosion along ice-wedge troughs), while the west side of the road in the vicinity of Transect T4 became flooded by water trapped between the Dalton Highway, the north end of the Deadhorse Airport runway, and two access roads to the Deadhorse runway. Road dust from the Dalton Highway and continued deepening of the ice-wedge troughs strongly affected the vegetation over most of Transect 3, whereas the area along Transect T4 was strongly affected by flooding. The area in the vicinity of Transect T5 remained relatively unaffected for several years, but started developing extensive thermokarst pits and flooded troughs after 1984, probably due to a combination of an extended period of warmer summers as noted in other studies (Jorgenson *et al.* 2006, Raynolds *et al.* 2014), and further major expansion of the Deadhorse runway and nearby construction pads. By 2007, many of the troughs in the vicinity of T5 had become interconnected with continuous channels of water in the polygon troughs.

Comparison with Lake Colleen Site A

The three transects at the Airport Site offer several interesting parallels and contrasts to the transects at Lake Colleen Site A. Both sites are in areas that have been impacted by infrastructure since near the beginning of the oilfield exploration in 1968. And both have also experienced the effects of continued climate warming during the same period. Colleen Site A exhibits extensive flooding and thermokarst on the southwest side of the Spine Road compared to a relatively flood-free area on the northeast side of the road.

The flooding on the south side has recently accelerated because the ice-wedge polygon troughs have become interconnected to the lake waters of Lake Colleen. The flooding has also enhanced primary productivity of the sedges, which has numerous ecosystem effects, including enhanced production of leaf litter that appears to insulate the ice-wedges from further thawing. The northeast side of the road is affected by heavy road dust, snowdrifts, other road effects, and thermokarst that is mainly caused by regionally warming air temperatures. The ice wedges on this side of the road appear to be more susceptible to further melting.

The Airport site also exhibits strong contrasts between the two sides of the road. The southeast side along Transect 3 is relatively well drained, and the ice wedges have undergone severe erosion because of proximity to the Sagavanirktok River and the relatively steep hydrologic gradient, which converted the previous well-developed low-centered polygons to well-developed high-centered polygons with over 90 cm of microtopography contrast in some sections of the transect. The northwest side of the road at the Airport Site is similar to the southwest side of the road at Lake Colleen Site A, but the flooding is not connected to a nearby lake and is more stagnant and less erosive. The high productivity of the sedge vegetation along Transect 4 may have a more protective effect to the ice wedges in this environment.

Consequences of the Spring 2015 Sagavanirktok River flood

In 2015, a major spring flood of the Sagavanirktok River affected the Airport Site. Starting in mid-March 2015 and continuing through early June 2015, unprecedented aufeis formation and floodwaters up to 30 inches deep inundated the highway between miles 390 and 414 of the highway. The northernmost 80 miles of the road were closed for extended periods in April and May, forcing Alaska's Governor to declare a disaster emergency two times (April 7 and May 22). Some of the most serious flooding and damage to the road occurred immediately south of our Airport Site, where the road was intentionally breached to prevent flood waters from damaging the Deadhorse Airport runway and to allow the water to drain into the Sagavanirktok River (red arrow in Fig. 1.6, 2015). When this happened the flowing water quickly eroded the ice wedges down to the alluvial gravels, creating a chaotic landscape of tilted polygon centers, and eroded ice-wedge troughs (Shur *et al*. 2016).

Although unsuspected at the time of our 2015 field season, the areas of Transects 3, 4 and 5 probably were also affected by the lingering effects from the flooding. For example, a large area of Transect 4 has surface gravels that appear to have been dispersed from a break in an access road between the Dalton Highway and the Deadhorse runway. Aerial photos taken during the flood also show that the polygons on the east side of the road along Transect 3 were extensively flooded. In the 2015 aerial photographs (Fig. 1.6) some areas on the west side of the road show considerable new flooding of ice-wedge polygon troughs that occurred between 2007 and 2015, while other areas appear to be better drained.

Need for continued monitoring

The proximity of our Airport Site to the flood-damaged areas presents an opportunity to examine the causes of this unprecedented event and the consequences to the ecosystem and infrastructure. Field data from the Airport Site and the time series of aerial photographs and remotely-sensed images provide an excellent record to examine the changes at the site from 1949 to the present. The data in this report and the earlier one from Colleen Site A (Walker *et al*. 2015) and some additional data from 2016 will form the basis of our final analysis and publications related to the cumulative effects of infrastructure and climate change on the permafrost environment and ecosystems in the Prudhoe Bay region.

It also would be highly desirable to conduct annual monitoring of active-layer depths, water depths, and changes to the ice wedges for several more years to better understand the long-term effects of the unusual 2015 flood in combination with the effects of climate change and the consequences of changes to the ecosystems caused by infrastructure.

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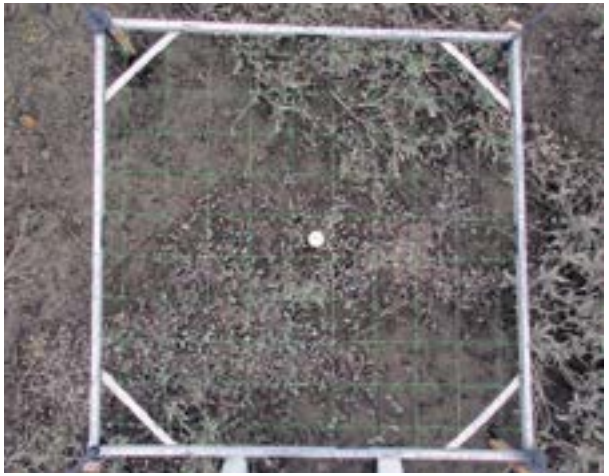
APPENDIX A Photos of permanent plot vegetation and soils

Transect 3: 5 meters from road

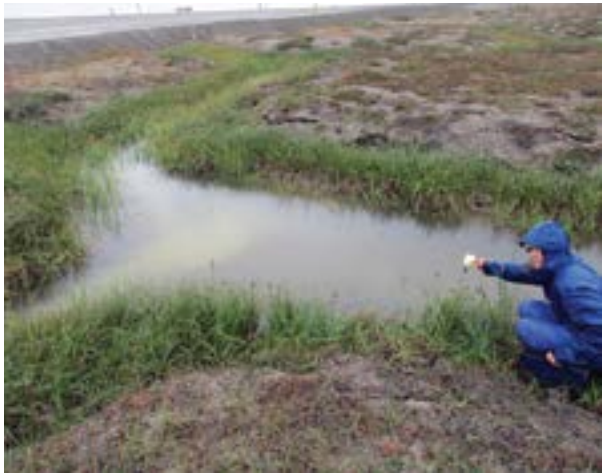
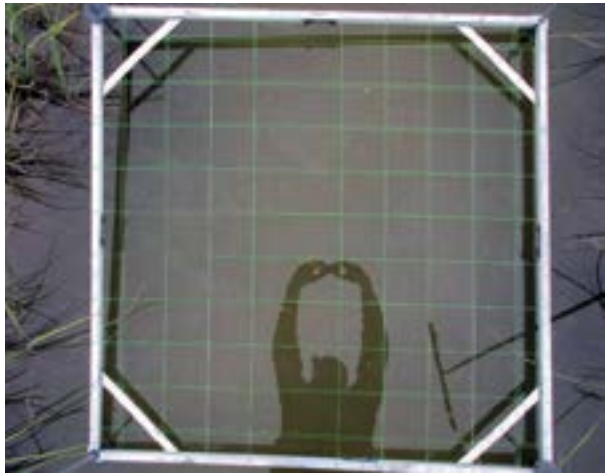
Transect 3, 5 m, polygon center (T3-005-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

Transect 3, 5 m, polygon trough (T3-005-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

Transect 3: 10 meters from road

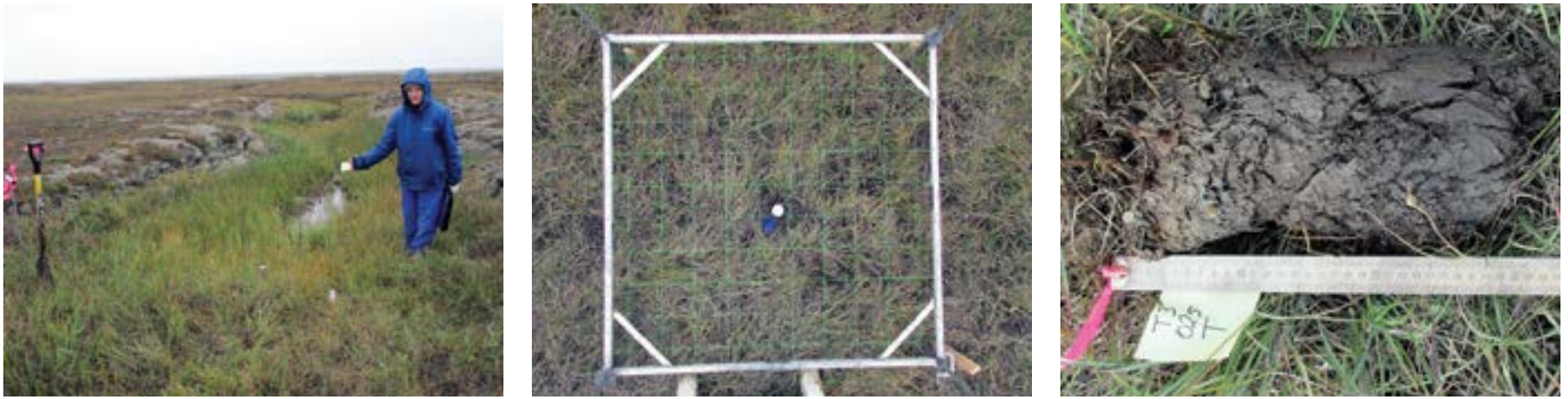

Transect 3, 10 m, polygon center (T3-010-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*


Transect 3, 10 m, polygon trough (T3-010-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

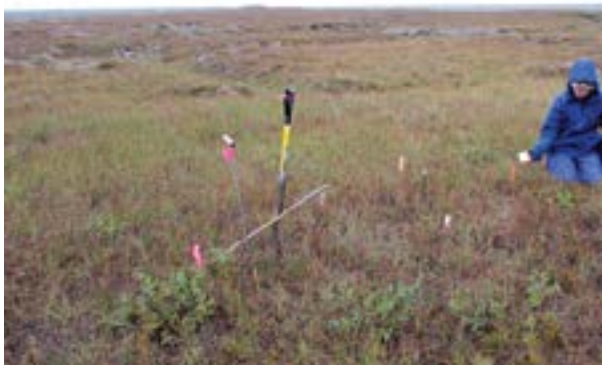
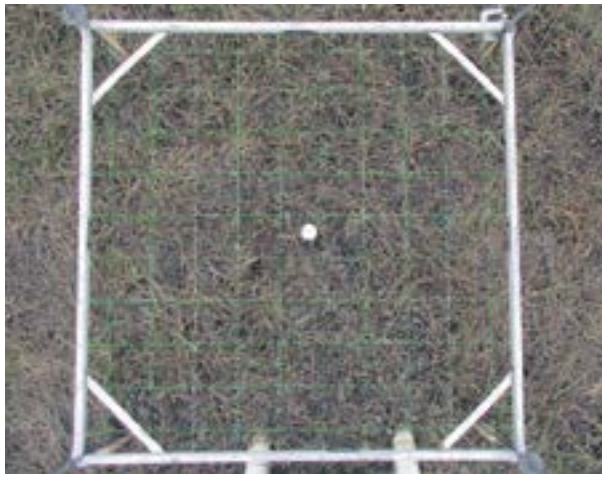
Transect 3: 25 meters from road

Transect 3, 25 m, polygon center (T3-025-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*



Transect 3, 25 m, polygon trough (T3-025-T. *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

Transect 3: 50 meters from road

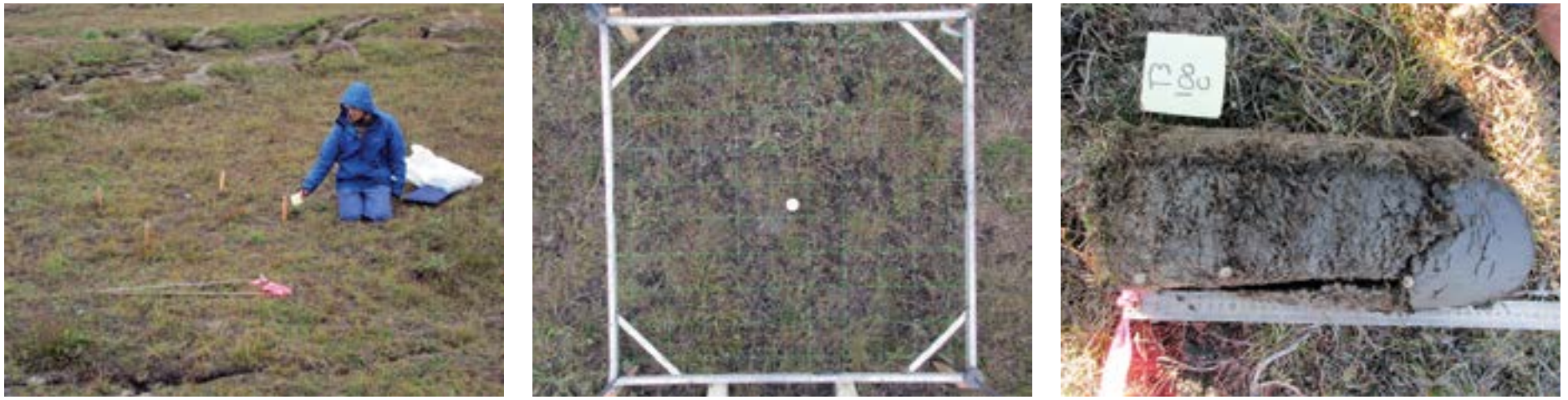




Transect 3, 50 m, polygon center (T3-050-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*



Transect 3, 50 m, polygon trough (T3-050-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

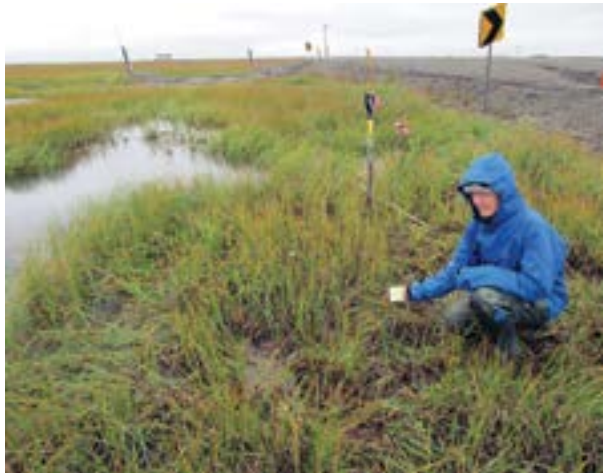
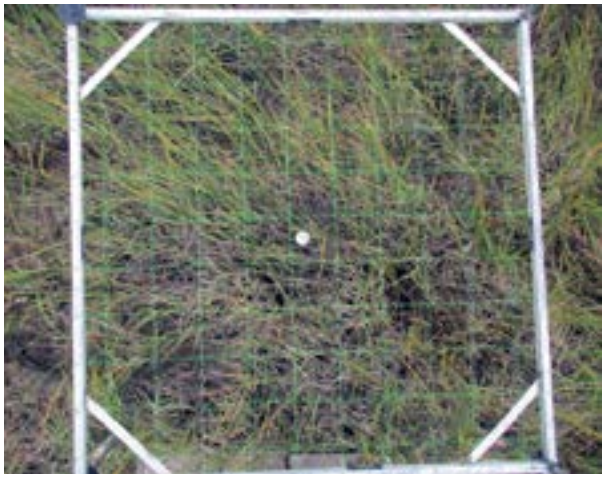
Transect 3: 100 meters from road



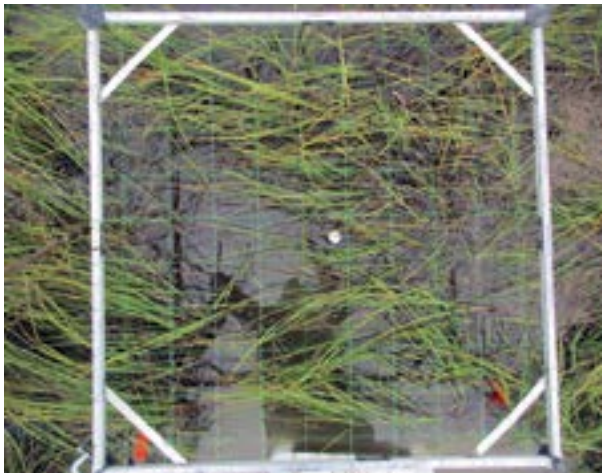
Transect 3, 100 m, polygon center (T3-100-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

Transect 3, 100 m, polygon trough (T3-100-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

Transect 4: 5 meters from road


Transect 4, 5 m, polygon center (T4-005-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

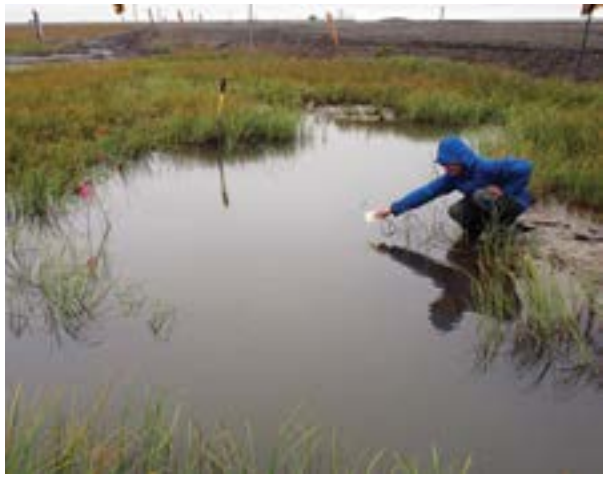
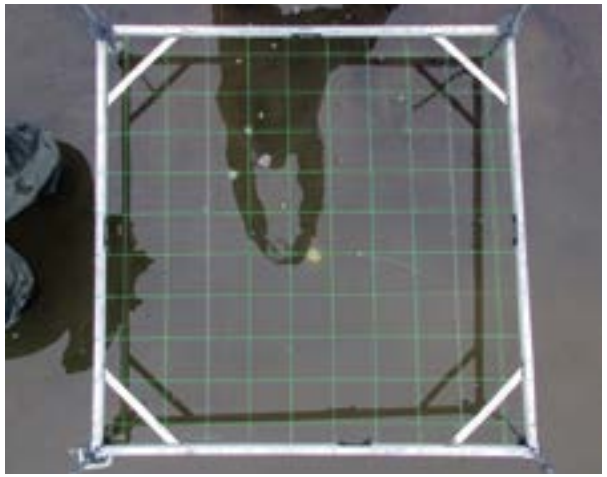




Transect 4, 5 m, polygon trough (T4-005-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

Transect 4: 10 meters from road

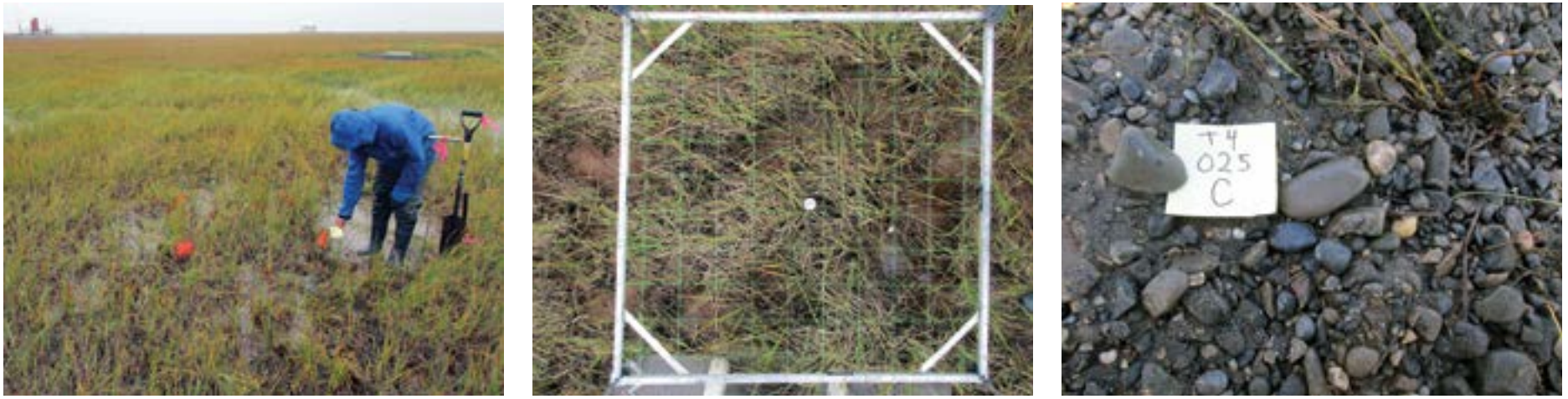


Transect 4, 10 m, polygon center (T4-010-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

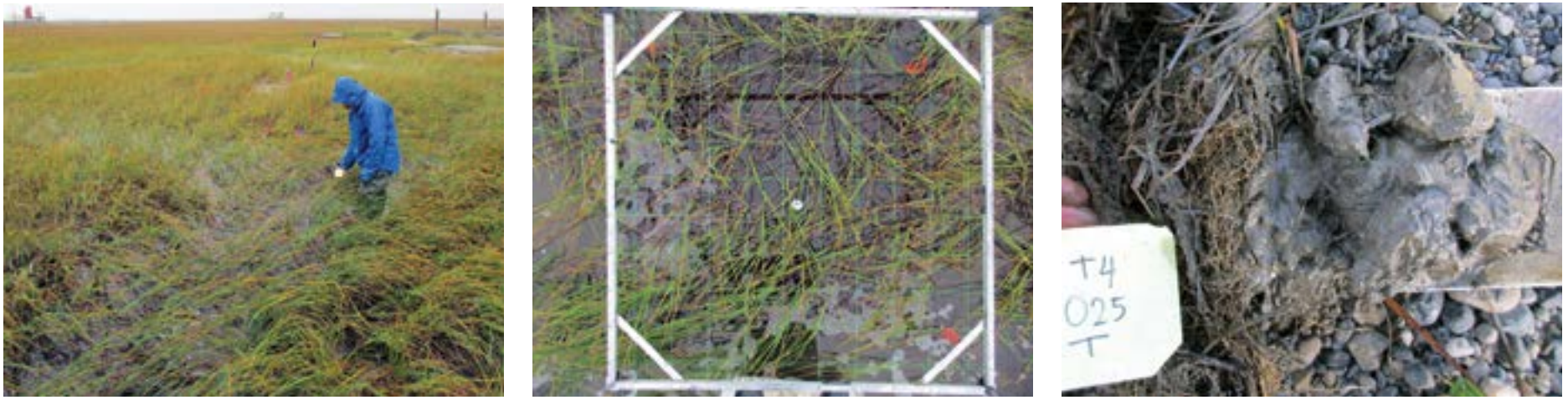




Transect 4, 10 m, polygon trough (T4-010-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

Transect 4: 25 meters from road

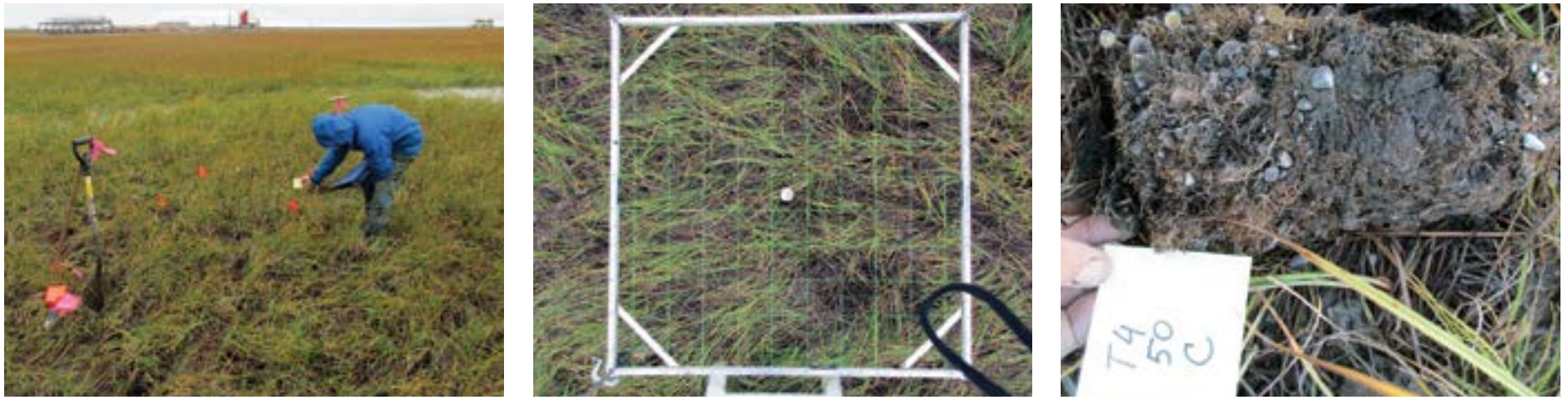


Transect 4, 25 m, polygon center (T4-025-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, no soil sample (gravel).*

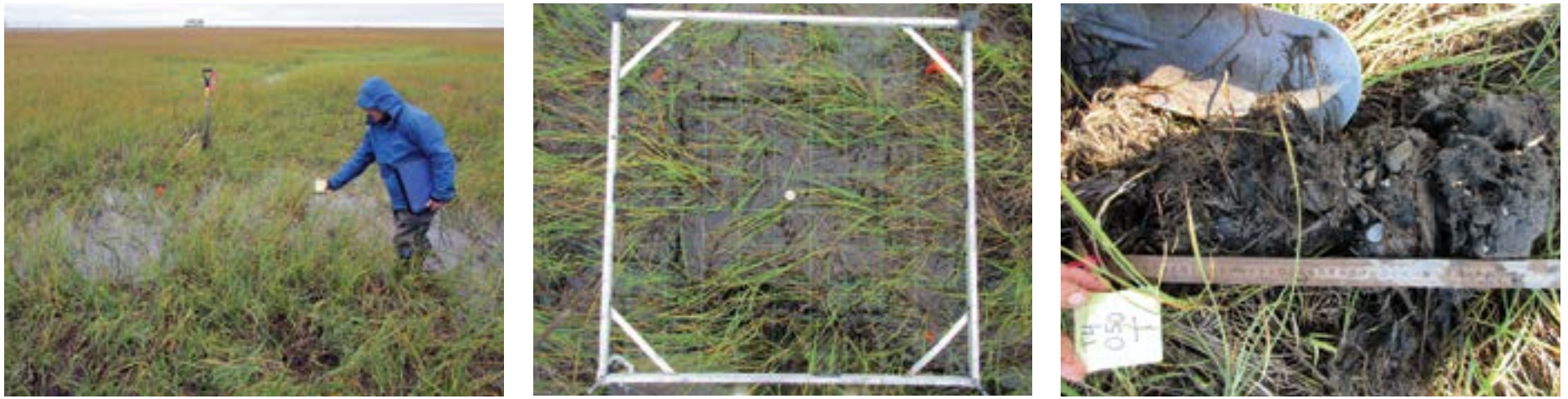


Transect 4, 25 m, polygon trough (T4-025-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, no soil sample (too wet).*

Transect 4: 50 meters from road



Transect 4, 50 m, polygon center (T4-050-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

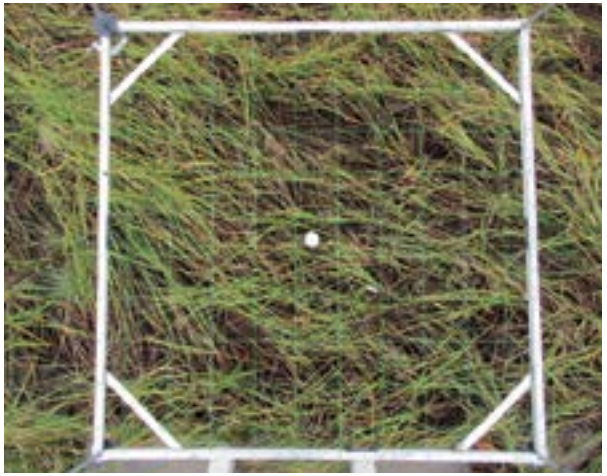


Transect 4, 50 m, polygon trough (T4-050-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

Transect 4: 100 meters from road



Transect 4, 100 m, polygon center (T4-100-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*


Transect 4, 100 m, polygon trough (T4-100-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, soil plug.*

Transect 5: 25 meters from road

Transect 5, 25 m, polygon center (T2-025-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, close up of plot, soil plug.*

Transect 5, 25 m, polygon trough (T2-025-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, close up of plot, soil plug.*

Transect 5: 50 meters from road

Transect 5, 50 m, polygon center (T5-050-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, close up of plot, soil plug.*

Transect 5, 50 m, polygon trough (T5-050-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, close up of plot, soil plug.*

Transect 5: 100 meters from road

Transect 5, 100 m, polygon center (T5-100-C). *(l-r) site location with 1-m plot marked with wooden corner stakes, plot with 1-m grid, close up of plot, soil plug.*

Transect 5, 100 m, polygon trough (T5-100-T). *(l-r) site location with 1-m plot marked with wooden corner stakes, close up of plot, soil plug.*

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