OBSERVATIONS IN ICE-RICH PERMAFROST SYSTEMS, PRUDHOE BAY ALASKA, 2020-21

DONALD A. WALKER, MIKHAIL KANEVSKIY, AMY L. BREEN, ANJA KADE, RONALD P. DAANEN, BENJAMIN M. JONES, DMITRY J. NICOLSKY, HELENA BERGSTEDT, EMILY WATSON-COOK, JANA L. PEIRCE

EDITED BY D. A. WALKER AND J. L. PEIRCE

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NNAIRPS Ice-Rich Permafrost Systems

UAF UNIVERSITY OF ALASKA FAIRBANKS

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On the cover

Thermokarst landscape with high-centered polygons and flooded troughs in a Natural Ice-Rich Permafrost Observatory (NIRPO) research site in Prudhoe Bay, Alaska. **Inset photos, top:** Benjamin Jones prepares a quadcopter for a remote sensing survey (Photo: M. Kanevskiy); **middle row from left:** Sergei Rybakov and Nicholas Hasson mark locations for installing ground temperature sensors (Photo: D.J. Nicolsky); Anja Kade and Josephine Mahoney make trace gas flux measurements; **bottom from left:** Donald Walker and Amy Breen survey plant species at a terrestrial plot; Emily Watson-Cook samples aquatic vegetation in a thermokarst pond. (Photos: J.L. Peirce except as noted)

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Preface and Acknowledgments

The National Science Foundation's Navigating the New Arctic (NNA) initiative seeks innovations in fundamental convergence research across the social, natural, and engineered environments to inform understanding of Arctic change and its local and global effects. The NNA Track 1 project *Landscape evolution and adapting to change in ice-rich permafrost systems (NNA-IRPS)* is focused on several key questions:

- How are climate change and infrastructure affecting ice-rich permafrost systems (IRPS)?
- What roles do ecosystems play in the development and degradation of IRP?
- How can people and their infrastructure adapt to changes in IRPS?

The *Landscape Evolution* portion of the project is geographically focused in the Prudhoe Bay Oilfield (PBO), Alaska, and is investigating (1) how differences in vegetation, soils, water, and time influence the accumulation and degradation of ground ice in IRP landscapes, and (2) how the loss of ground ice can radically change these landscapes, their components, and the infrastructure built on them. The *Adaptation to Change* component is focused in the village of Point Lay, Alaska, which did not have a field campaign in 2020 or 2021 due to the COVID-19 pandemic.

This data report covers research activities during the 2020 and 2021 field seasons at NNA-IRPS field sites in the PBO. The 2020 field season was abbreviated due to COVID-19 restrictions on travel and access to hotel facilities in Deadhorse, Alaska, the service center for the PBO. Field work was conducted from a field camp situated approximately 14 km south of Deadhorse. The primary goals were to (1) conduct a reconnaissance of a new Natural Ice-Rich Permafrost Observatory (NIRPO), (2) monitor late-season thaw depths, water depths, ice-wedge degradation, landscape change, and vegetation distribution along six previously established transects in the PBO, and (3) provide training and field-site overview for a new graduate student and postdoctoral fellow. Goals, participants, schedule, and observations during the 2020 field season are in this report, including new data from previously established research transects in the PBO and data obtained from a new NIRPO reconnaissance area.

Most of this data report covers the 2021 field season. An overview of the tasks, field team, schedule, and logistics is followed by sections devoted to summaries of (1) remote sensing activities (Daanen and Jones), (2) observations along transects at the NIRPO and other PBO transects (Walker et al.), (3) observations from the NIRPO terrestrial plots (Walker and Breen), (4) thermokarst-pond vegetation and environments (Watson-Cook), (5) trace-gas fluxes (Kade), (6) basal-peat dating (Bergstedt), (7) permafrost borehole temperature stations (Nicolsky and Romanovsky), and (8) studies of permafrost cryostructure (Kanevskiy and Shur). Some preliminary analyses are presented with these summaries. Tables containing several of the datasets are in seven appendices with instructions on where to access the data online in the Arctic Data Center, the primary data and software repository for the Arctic section of the National Science Foundation's Office of Polar Programs.

This project was primarily funded by the National Science Foundation NNA Track 1 award (1928237) and built on a previous award from the NSF ArcSEES program (1263854) with contributions the Bureau of Ocean Energy Management, Bureau of Land Management, and U.S. Geological Survey. The aerial surveys were made with the collaboration of the Alaska Division of Geological and Geophysical Surveys. The research activities of several of members of the expedition were supported in part by other NSF awards to Ben Jones (1806213), Yuri Shur (820883), and Dmitry Nicolsky (1832238, 1927708). Logistic support was provided the Battelle Arctic Research Operations, Fairbanks office, and the Institute of Arctic Biology, University of Alaska Fairbanks.

1 Introduction

1.1 *The study area (D.A. Walker)*

The Prudhoe Bay Oilfield (Figure 1a) was discovered in 1967 and is now part of the largest industrial complex in the North American Arctic. The region, history, and cumulative impacts of development have been described in several publications (Brown 1975, Walker *et al.* 1980, Walker 1985, Truett and Johnson 2000, National Research Council 2003, Raynolds *et al.* 2014).

Key research sites include three 25-km^2 areas (A, B, and C, Figure 1a) where geoecological and historical-change maps were made for cumulative impact studies (Walker *et al.* 1987, National Research Council 2003, Raynolds *et al.* 2014). New research for the NNA Ice-Rich Permafrost Systems project has focused at four field sites in the main NNA-IRPS study area (Figure 1b), described here in the order they were established.

1.1.1 Jorgenson site

The Jorgenson site (JS) (Figure 2) was established in 2011 to better understand the processes of ice-wedge degradation and stabilization (Jorgenson *et al.* 2015, Kanevskiy *et al.* 2017). The site is relatively isolated from road-related dust and flooding and provides a historical comparison with the heavily disturbed Colleen and Airport sites. Changes to the vegetation and landforms at the JS are mainly those associated with climate change, but there are also some low-level impacts, including trails from past seismic operations, vegetation impacts from atmospheric emissions from industrial activities, and low levels of road dust from the PBO road network.

Previous observations (2011–2013) at the JS included measurement of ground elevations, thaw depths, water depths, and snow along a 0–250-m

Figure 1. ***a.*** *The eastern portion of the Prudhoe Bay oilfield (PBO) showing study areas of the NNA-IRPS project, including areas of geoecological change mapping (A, B, and C).* ***b.*** *Detail of the main NNA-IRPS PBO study area, including the Colleen, NIRPO, Jorgenson and Airport sites. Climate and permafrost borehole temperature data were from the Romanovsky Deadhorse station and the Deadhorse Airport. Ice-wedge degradation studies were conducted at the Erosion and Culvert sites.*

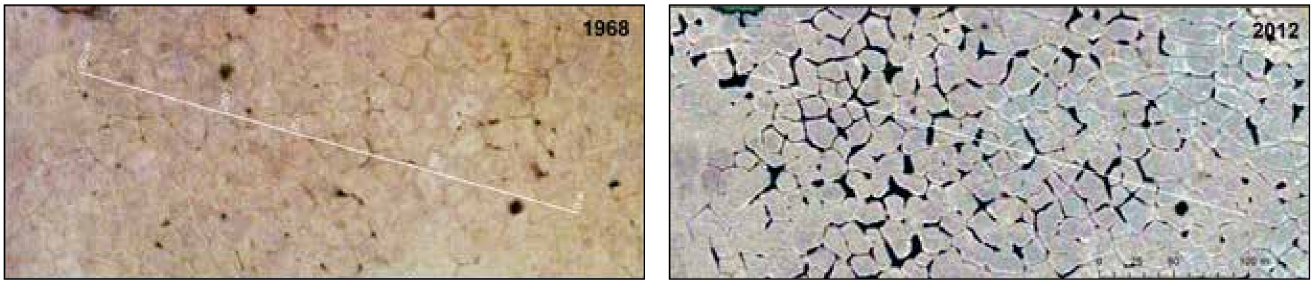


Figure 2. *The Jorgenson site in 1968 and 2012 illustrating the expansion of thermokarst ponds in 44 years. The 350-m transect (white line) has been the focus of intensive landscape and permafrost studies (Jorgenson et al. 2015, Kanevskiy et al. 2017).*

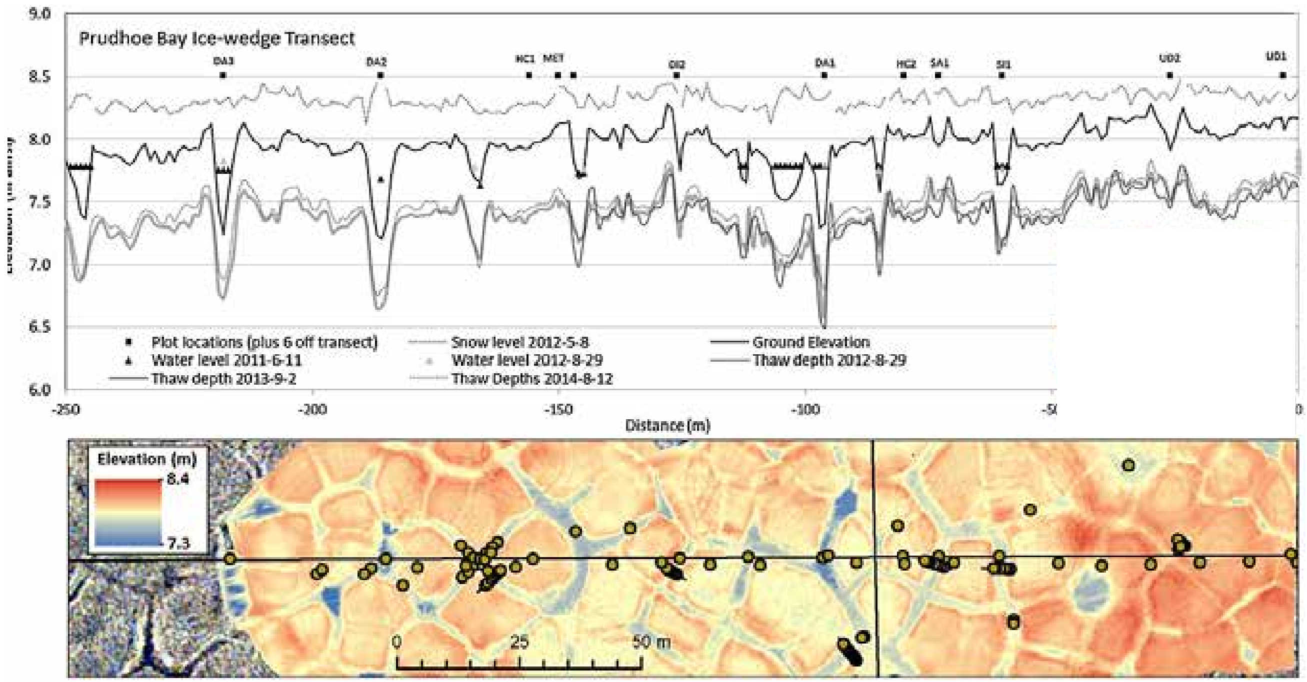


Figure 3. *Cross-sectional profile (top) and digital elevation model (bottom) of the first 250 meters of the Jorgenson transect. Plot locations, microtopography, water levels, snow and thaw depth are shown (from Jorgenson* et al. *2015).*

section of the 350-m JS transect (Figure 3). This section was revisited in 2020 and 2021 for repeat measurements of thaw and water depth, as well as other measurements discussed below.

1.1.2 Colleen Site

The Colleen site (CS) is located along the Spine Road in the eastern portion of the PBO near the north shore of Lake Colleen (Figure 1b). The Spine Road was built in 1969 and is the most heavily traveled road in the oilfield. The modern history of change in ice-wedge polygons and thermokarst at the CS are recorded in nearly annual high-resolution aerial photographs and remote sensing images from 1949–2014 (Appendix 1, Figure A1.1).

In 2014, 200-m transects T1 and T2 were surveyed perpendicular to the northeast and southwest sides of the Spine Road to examine variations in vegetation and environmental factors along gradients of distance from the road (Figure 4).

Vegetation and environmental factors were recorded at pin flags spaced at 1-m intervals from 0 to 100 m and at 5-m intervals from 100 to 200 m. These variables included elevation, patterned-ground feature (polygon center, rim, trough, frost boil), vegetation type, height of the plant canopy, thickness of the moss and dust layers, NDVI, leaf-area index (LAI), water depth, snow depth, and active-layer thickness. Vegetation was compared with types defined during the original vegetation surveys in the 1970s (Walker *et al.* 1980, Walker 1985).

Vegetation plots were established in polygon centers and troughs at 5, 10, 25, 50, 100, and 200 m from the road. Permafrost boreholes were drilled in ice-wedge-polygon troughs and centers at approximately the same distances from the road to examine the cryo-

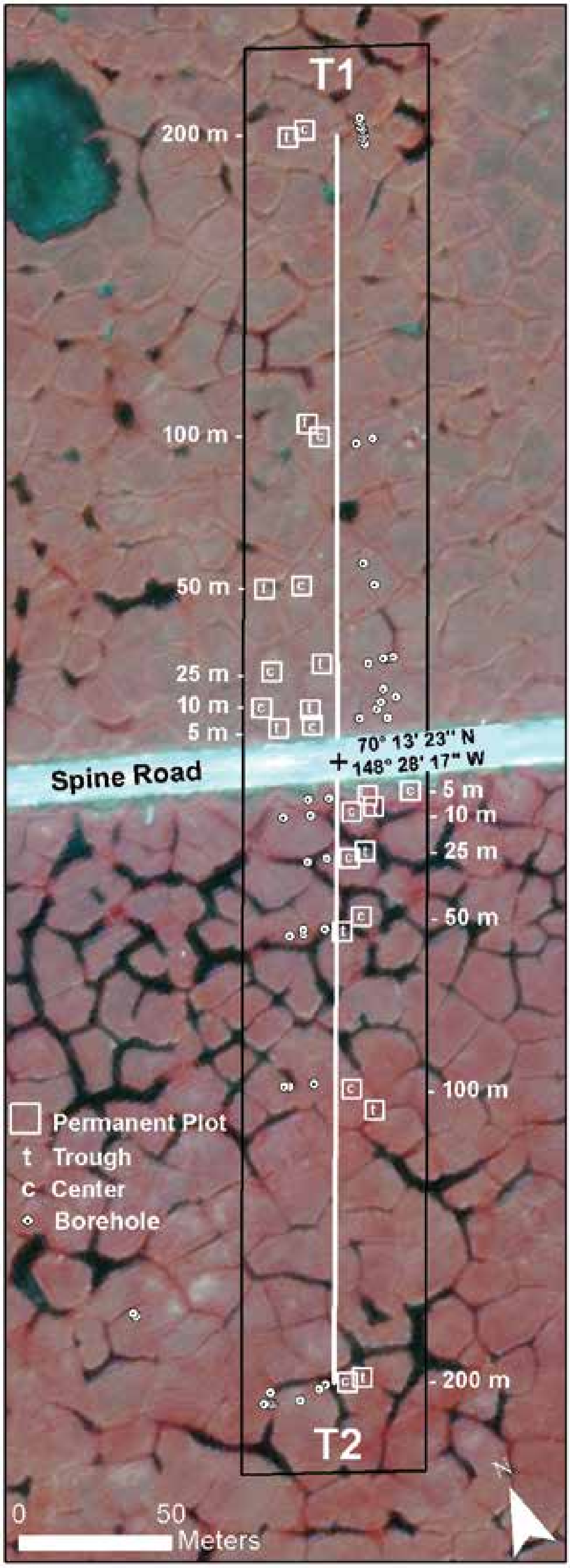


Figure 4. *The Colleen site showing transects T1 and T2, distances from the road, and locations of permanent vegetation plots (squares: c = polygon center, t = polygon trough) and permafrost boreholes (circles).*

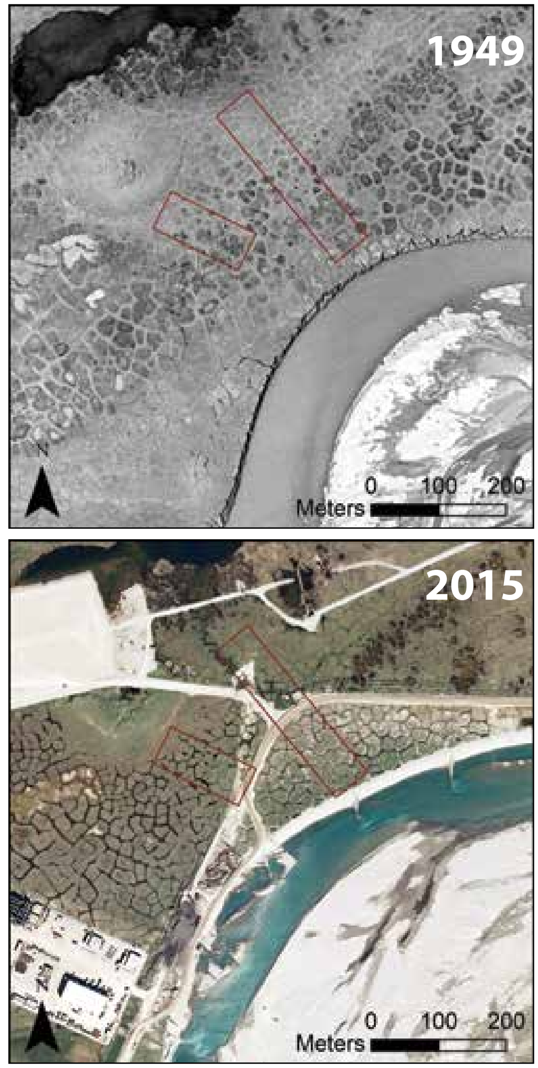


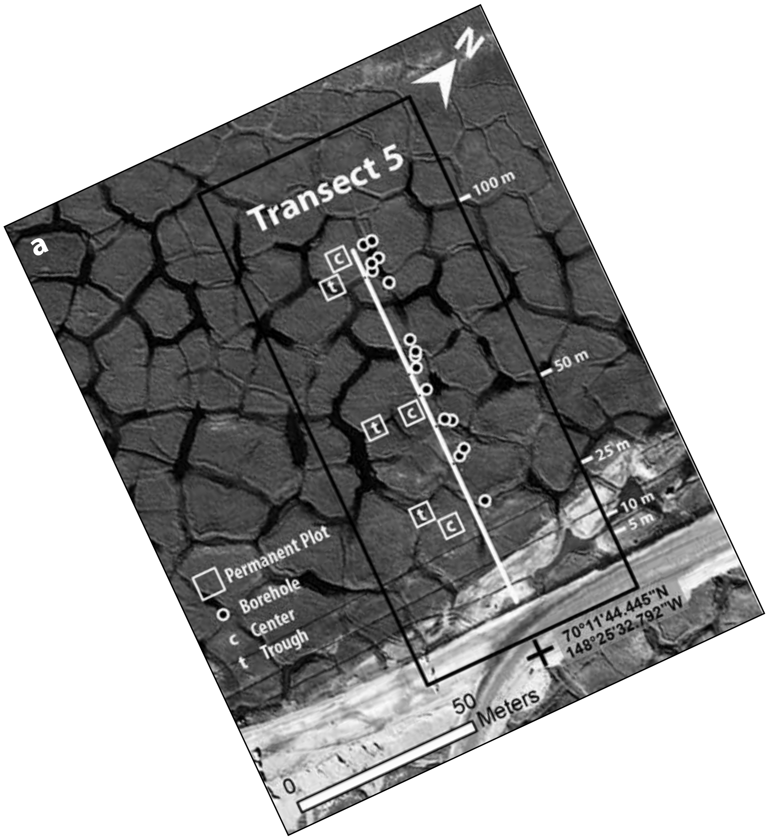
Figure 5. *The Airport site in 1949 and 2015. The areas of Transects 3, 4, and 5 are shown by the red rectangles in both images.*

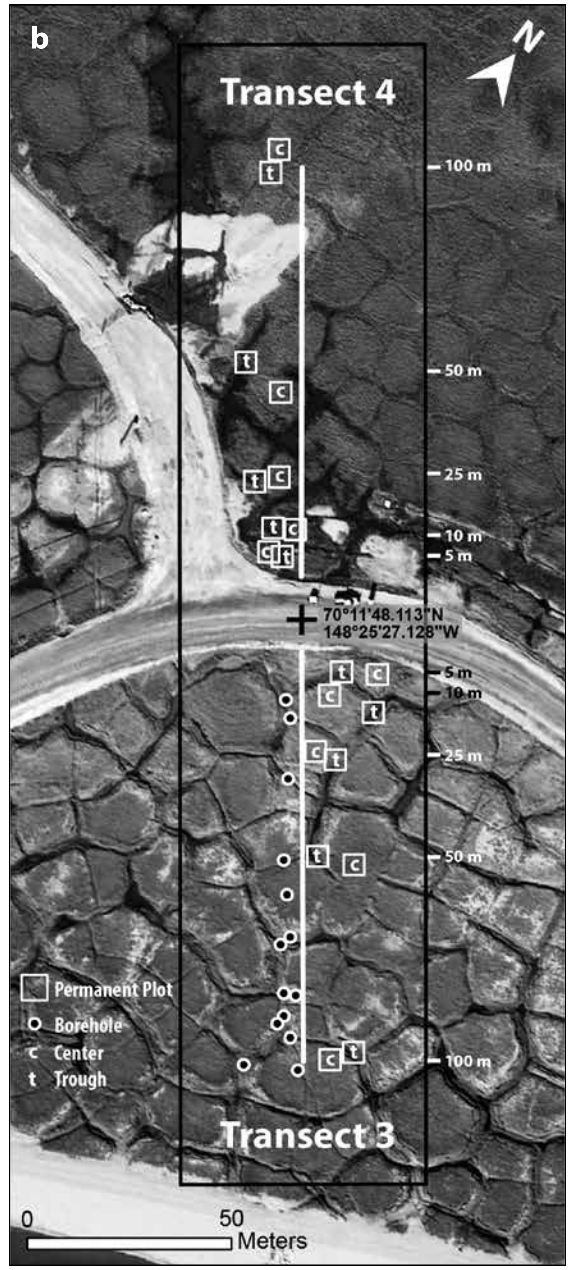
structure of the permafrost and the thicknesses of frozen protective soil layers above ice wedges.

1.1.3 Airport Site (AS)

The Airport site (AS) was established in 2015 along the Dalton Highway just east of the Deadhorse Airport (Figure 1b). In 1949, most of the site was covered by low-centered ice-wedge polygons with varying degrees of wetness in polygon centers (Figure 5, top). By 2015, the highway, numerous gravel pads, abandoned roads, and several floods had altered the drainage patterns and converted most low-centered polygons to high-centered polygons, with extensive thermokarst ponds in the troughs (Figure 5, bottom). The modern history of the AS (1949–2015) is recorded in nearly annual high-resolution aerial photographs and remote sensing images (Appendix 1, Figure A1.2).

Figure 6. *The Airport site.* ***a.*** *Transect T5 and* ***b.*** *Transects T3 and T4 showing distances from the road, and locations of permanent vegetation plots (squares: c = polygon center, t = polygon trough) and permafrost boreholes (circles).*





AS transects T3, T4, and T5 were surveyed in 2015 (Figure 6). Transect T3 is on the southeast side of the highway in an area previously covered by wet low-centered polygons, but which is now heavily impacted by thermokarst and road dust. Dry high-centered polygons with deeply eroded troughs are dominant along T3. Transect T4 is on the northwest side of the highway and has been impacted by gravel displaced by floods and breaches in the road, as well as extensive impacts from older roads. It is continuously flooded and does not drain by late summer.

Gravel deposits from previous flood events prevented drilling deep boreholes with a SIPRE corer near the road at T4, so transect T5 (Figure 6a) was surveyed approximately 100 m south of T4 to provide better options for permafrost coring on the northwest side of the road. T5 is in an area of low-centered polygons with extensive flooding in interconnected thermokarst troughs. Within 25 m of the road, transect T5 is very heavily disturbed by trenching for buried fiber-optic cables. Sampling along the T5 was confined to 25–100 m from the road.

Detailed methods and data from summer and winter observations at CS and AS are in previous data reports (Walker *et al.* 2015, 2016, 2018) and three journal articles (Kanevskiy *et al.* 2017, 2022, Walker et al. 2022). A time series of aerial photos of these sites from 1949 to near present are in Appendix 1.

2 2020 Field Season

2.1 Overview

2.1.1 Goals

- Conduct reconnaissance for a Natural Ice-Rich Permafrost Observatory (NIRPO) near Deadhorse.
- Monitor late-season thaw depths, water-depths, ice-wedge polygon microrelief contrasts, and vegetation distribution along six transects at the Colleen, Airport, and Jorgenson sites.
- Establish and conduct thaw- and water-depth measurements along several new transects in the NIRPO reconnaissance area.
- Examine previous ice-wedge boreholes at the Colleen site to check the status of ice wedges.
- Obtain basal peat samples from drained thaw lake basins in the reconnaissance area for C14 dating.
- Training and field-site overview for a new graduate student and postdoctoral fellow.

2.1.2 Participants

Dr. Donald A. (Skip) Walker (UAF, Institute of Arctic biology; faculty): Project PI, vegetation component

Dr. Mikhail Kanevskiy (UAF, Institute of Northern Engineering; faculty): Permafrost component

Dr. Helena Bergstedt (UAF, INE; postdoctoral fellow): Remote sensing

Emily Watson-Cook (UAF, Dept. of Biology and Wildlife, M.S. student): Vegetation component

2.1.3 Schedule

August 12. Drive to and camp at Coldfoot with stops at Yukon R., Arctic Circle, and Finger Mtn.

August 13. Drive to and camp at Galbraith Lake, with stops at Sukakpak Mtn., frozen debris lobe near Wiseman, and Atigun Pass.

August 14. Drive to Prudhoe Bay, camp at MP 405 on gravel bar of the Sagavanirktok R.

August 15. Jorgenson site (JS): Survey thaw, water depths, and vegetation transitions along 250 m transect.

August 16. Airport site (AS): Survey thaw and water depths at transects T3, T4, and T5. Obtain cores to examine ice wedge status.

August 17. NIRPO reconnaissance area: Survey drained thaw lake moisture gradient, thaw and water depths, and vegetation. Collect basal peat samples.

August 18. Colleen site (CS): Survey thaw and water depths at transects T1 and T2. Obtain cores to examine degradation and stabilization of ice wedges. Extend transect T1 to 600 m. Survey possible thermokarst-pond site. Establish new vegetation plots as training for M.S. student.

August 19. Drive to and camp at Middle Fork of Koyukuk River 3 bridge. Take cores of Sukakpak mounds.

August 20. Drive to Fairbanks and unload trucks.

2.2 2020 NIRPO site reconnaissance (D.A. Walker)

Roadside areas at CS and AS have changed from their pre-oilfield status due to a combination of a warmer climate, altered drainage patterns, road dust, and other roadside disturbances that have resulted in ice-wedge degradation. Although the JS is relatively isolated from infrastructure compared to the CS and AS, drainage and vegetation patterns are affected by proximity to intensive development to the south and a pipeline access road adjacent to the site on the east. Another more remote area was needed to answer the question of what has happened in areas of the oilfield that are less affected by infrastructure. The site also needed to include a variety of different-aged surfaces where landscape evolution could be examined.

A potential Natural Ice-Rich Permafrost Observatory (NIRPO) was selected as distant as possible from major infrastructure but within the same landscape types as the Colleen and Airport sites. The center of the area was approximately 1.5 km NW of the JS, 1.7 km NNE of the CS and approximately 1.4 km from other infrastructures (Figure 7).

We later learned that most of this area is north of an oilfield boundary that stretches between the East and West Security Gates of the PBO and has restricted access. In 2021, a new NIRPO research site was surveyed south of the oilfield boundary in an area approximately 1 km west of the Jorgenson site (see Chapter 3, 2021 Field Season, Figure 14a).

Figure 7. *2020 NIRPO reconnaissance area showing transects NIRPO-1, BM-1, BP-1 and BP-2 (yellow lines).*

Figure 8. *100-m transect at NIRPO-1. The site has flat ice-wedge polygons with moist sedge, dwarf shrub, and moss tundra in polygon centers, and water and aquatic communities in the troughs. Yellow pin flags mark 10-m intervals along the transect. (Photo: H. Bergstedt, P1060178)*

2.3 Field methods and observations

2.3.1 NIRPO reconnaissance area transects

A 100-m transect was established at NIRPO-1 (Figure 7) for measuring thaw and water depths and other factors being monitored at transects in the JS, CS, and AS. The NIRPO-1 transect area has flat-centered ice-wedge polygons with moist tundra in the ice-wedge-polygon centers and extensive ponds and aquatic plant communities in the polygon troughs (Figure 8). 2020 thaw- and water-depth data from the NIRPO-1 transect are in Appendix 2, Table A2.4.

A large partially-drained lake basin in the southwestern part of the NIRPO area (Figures 7 and 9a) has a moisture gradient with moist tundra along the eastern margin of the basin, grading into wet sedge tundra over much of the basin to a complex wetland with numerous lakes with aquatic plant communities in the center of the basin. Three temporary sites (BM-1, BP-1, and BP-2) were established along a moisture gradient on the eastern side of the basin. Some areas, such as that at transect BP-1 have weakly developed ice-wedge polygons. Thaw depths were measured at 1-m intervals along 40-m transects at BM-1, BP-1, and BP-2 (Figure 9a) (Appendix 2, Table A2.5).

2.3.2 Basal peat samples (H. Bergstedt)

Basal peat samples were collected from the bottom of the peat layer at BM-1, BP-1, BP-2, and two other nearby drained lake basins (BP-3 and BP-4) (Figure 9b).

Figure 9. *Transect BP-1 in the large partially drained thaw-lake basin.* ***a.*** *The vegetation is dominated by wet sedge (*Eriophorum angustifolium *and* Carex aquatilis*) tundra. Small ridges are associated with weakly developed ice-wedge polygons.* ***b.*** *Basal peat sample from BP-1. (Photos: H. Bergstedt, P1060169, P1060144)*

Samples were processed in the lab to remove contaminants and extract organic material suitable for C14 dating to determine when the peat started to form. Results are in Appendix 2, Table A2.1. Dating was done at the National Ocean Sciences Accelerator Mass Spectrometry (NOSAMS) facility through NSF Award 1806213.

2.3.3 Permafrost boreholes (M. Kanevskiy)

A total of 12 shallow permafrost boreholes were drilled in mid-August 2020, including nine in previously drilled ice wedges at the CS on transect T1 and three boreholes along a new 15-m transect at the AS. The frozen cores were described and photographed in the field and samples were collected for evaluation of ground-ice content in the INE UAF Laboratory. See Appendix 7, Table A7.1 for borehole locations.

2.3.3.1 Colleen Site (CS) boreholes

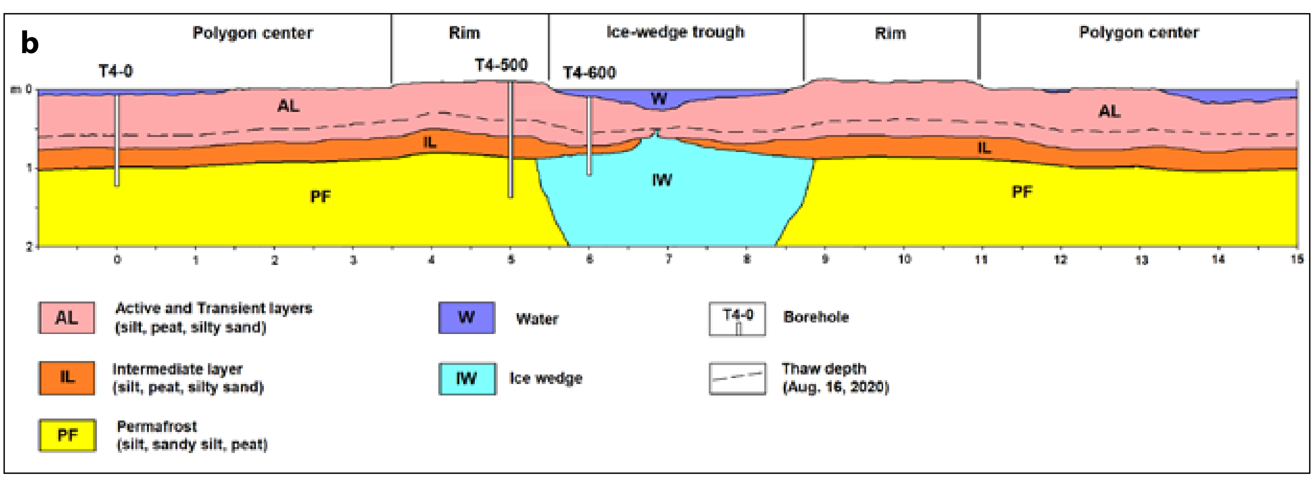
Nine boreholes were drilled at the same locations where ice wedges had been degrading or stabilizing during field studies in August 2014. Additionally, the status of ice wedges was estimated at several locations without drilling either because they looked stable (T1-50T-1 and -8), or had deep water (T1-200T-1, -2 and -3). Comparison of 2014 and 2020 data show that five ice wedges have not experienced significant changes or have experienced some minor stabilization (T1-50T-1, -2, -5, -8, and -9), and two ice wedges have experienced significant degradation (T1-100T-1 and T1-200T), detected by deeper ice-wedge troughs with water depths 32 and 36 cm respectively. These ice wedges were either degrading or very vulnerable in both 2014 and 2020, but in 2014 the troughs were dry. Another five ice wedges have experienced stabilization since 2014 (T1-5T-1, T1-10T-1 and -2, T1-25T-1, T1-50T-7). Of these, two that are located near the Spine Road and were actively degrading in 2014 (T1-5T-1 and T1-10T-1) have experienced significant stabilization detected by thicker intermediate and transient layers, possibly related to additional accumulation of road dust. Results are in Appendix 2, Table A2.3.

Data from redrilling boreholes show that degradation and stabilization of ice wedges may occur within the same area simultaneously. Similar results were obtained from the adjacent JS, where 21 sites were redrilled in July 2019 at the same locations where ice wedges had been either degrading or stabilizing during studies in 2011 and 2012 (Appendix 2, Table A2.3).

2.3.3.2 Airport site (AS) boreholes

Three new boreholes were drilled along a 15-m transect spanning an ice wedge near T4 (Figure 10). Cryostratigraphy, moisture and ground ice content are in Appendix 2, Table A2.2.

Figure 10. *T4 boreholes, Prudhoe Bay, Airport Site (AS), vicinity of the T4 transect, August 16, 2020.* ***a.*** *Site of boreholes. The stake (right side of photo) marks the beginning of this transect in a polygon center (borehole T4-0) and the permafrost probe marks the location of borehole on the elevated polygon rim (T4-500). (Photo: M. Kanevskiy IMG 3439).* ***b.*** *Cryostratigraphic 15-m-long cross-section across the polygon based on the 3 boreholes, showing estimated positions of thaw depth (18 August 2020), active-layer, intermediate layer, permafrost and extent of the ice wedge. (Image: M. Kanevskiy)*



2.3.4 Thaw and water depths (D.A. Walker)

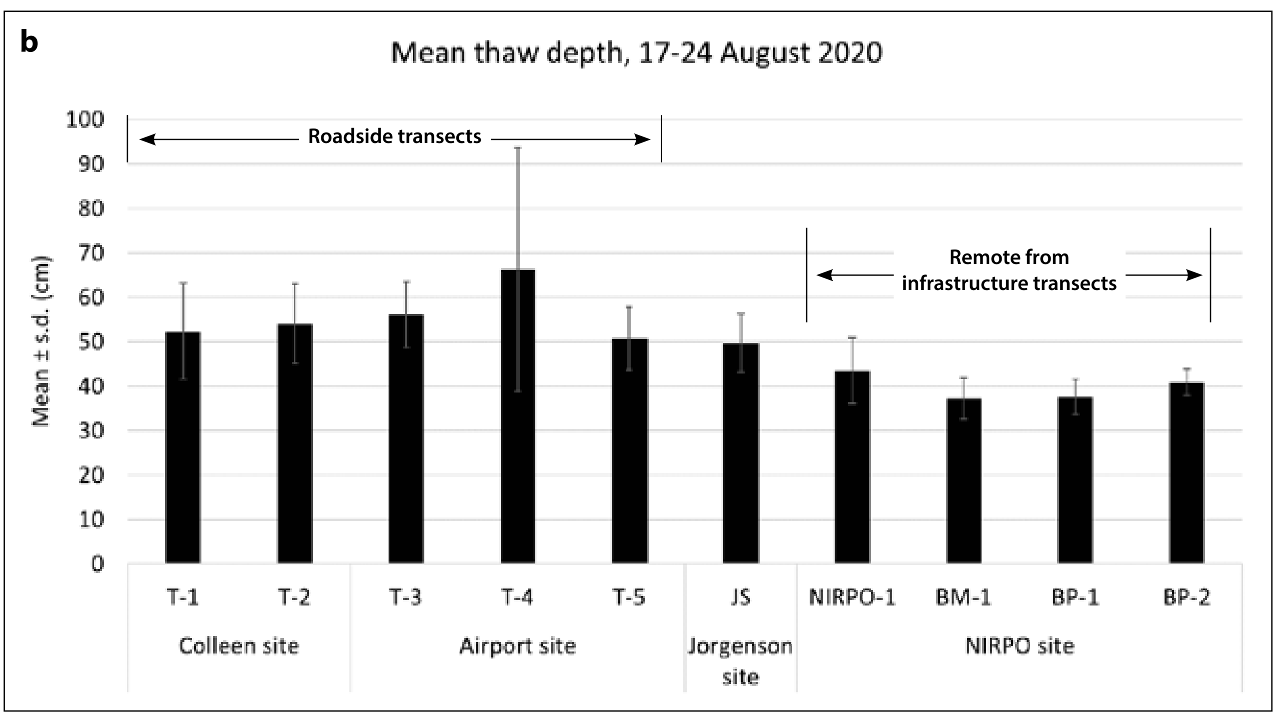
Measurements of thaw and water depth were taken at 1-m intervals along a 100-m measuring tape using calibrated aluminum thaw probes pushed to the permafrost table (Figure 11a). Data are recorded along with notes on the polygon feature or microrelief at each location where measurements were made for the 100-m NIRPO-1 transect (Appendix 2, Tables A2.4) and the three 40-m transects (BM-1, BP-1, and BP-2) in the 2020 NIRPO reconnaissance area (Appendix 2, Tables A2.5). Along the JS transect, thaw and water depth were measured at every meter from 0–250 m (Appendix 2, Tables A2.6), the main sampling area where measurements have been repeated for past studies. At CS and AS transects T1 to T5, measurements were taken at previously placed pin flags spaced at 1-m intervals (Appendix 2, Tables A2.7 to A2.8).

2.3.5 Vegetation type distribution along the Jorgenson transect

Prior to oilfield development the JS and CS had similar landscapes with mainly wet low-centered ice-wedge polygons dominated by wet tundra in the polygon centers and troughs, moist tundra on the polygon rims, and scattered thermokarst pits containing water and aquatic plant communities. We were interested in the current distribution of vegetation along the CS and JS transects to compare with patterns observed on aerial photographs taken in 1949.

In 2020, the percentages of cover for moist tundra, wet tundra, and water/aquatic tundra were estimated along the Jorgenson transect for comparison with the previously measured distribution of vegetation along the roadside transects at the Colleen site. For each vegetation type, the sum of the lengths of the

Figure 11. *Thaw-depth measurements.* ***a.*** *Measuring thaw along 40-m transect at BP-1. (Photo: H. Bergstedt, P1060163).* ***b.*** *Thaw depths (means ± standard deviations) for the transects sampled 15–17 August 2020.*



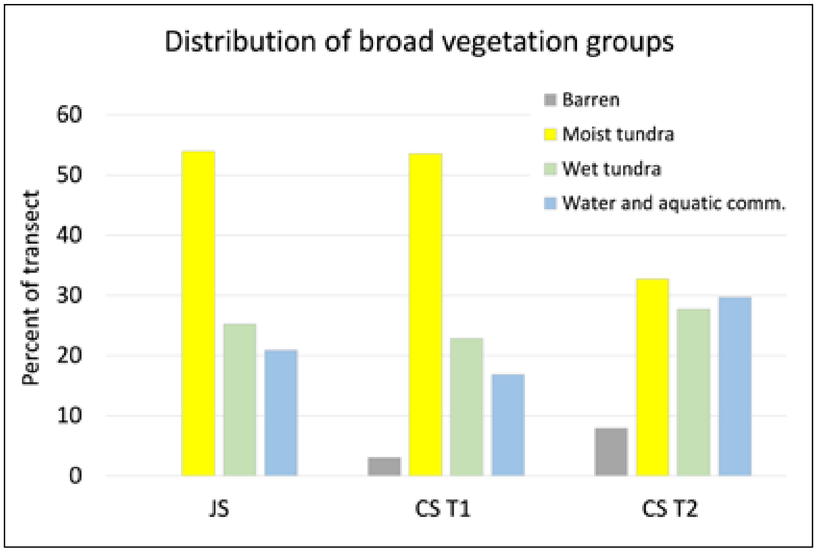


Figure 12. *Comparison of the distribution of barren, moist, wet, and aquatic vegetation types along the Jorgenson transect in 2020 and the Colleen site transects T1 and T2 in 2014.*

transect covered by the type were divided by the total length of the transect to determine the percentage cover by type.

The measurements indicate that the JS and CS T1 transects still have similar vegetation but that moist tundra now dominates because of the conversion of most low-centered polygons to polygons with either flat-, high-, or transitional polygon centers. There are also many new thermokarst ponds with water and aquatic communities. Transect CS T2 is on the flooded side of the road at the Colleen site and has much more water/aquatic tundra and wet tundra and much less moist tundra than JS or CS T1 (Figure 12).

2.4 *New plots and potential study sites*

2.4.1 Extension of Colleen transect T1

Transect T1 was extended to 600 m to get further from the dust effects of the original 200 m transect. Dust effects (reduced cover of lichens) were evident even at this distance, but the transect could not be extended further because of a major terrain transition at a drained thaw lake basin. Two new plots were established in moist polygon centers at approximately 435 m from the road.

2.4.2 A potential thermokarst-pond study site

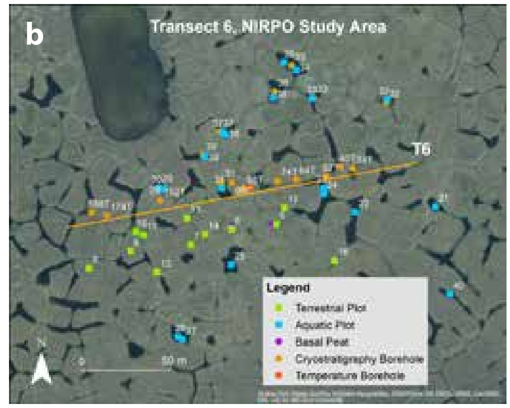
Thermokarst ponds were not sampled during the vegetation surveys of the 1970s (Walker 1985). Further studies are needed to examine the variety of plant communities and successional processes in the deeper thaw ponds. A new thaw-pond component of the NNA-IRPS research will be developed as the focus of Emily Watson-Cook's M.S. thesis. We visited several ponds in 2020 that appeared to be good sites for future studies. A good example is Bear Pelt Pond located along the extension of transect T1 (Figure 13).

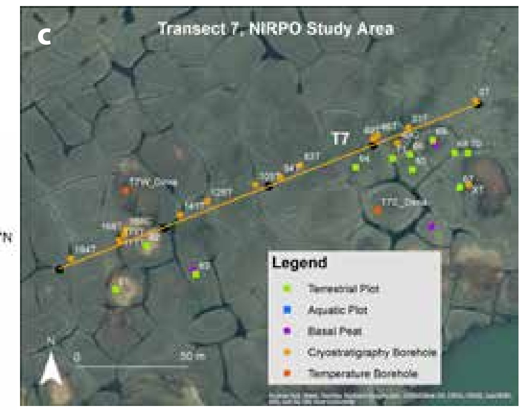
Figure 13. *Bear Pelt Pond.* ***a.*** *Overview of the moderately large ice-wedge thermokarst pond.* ***b.*** *An emergent* Hippuris vulgaris *community in Bear Pelt Pond. (Photos: E. Watson-Cook, IMG 1231, IMG 1230)*

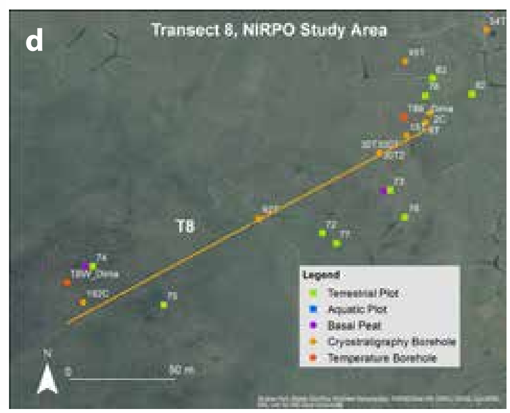
3 2021 Field Season

3.1 Overview

Field work was conducted 13 July–3 August and 21 August–6 September 2021. The focus was the collection of baseline topographic surveys, aerial imagery, vegetation, and permafrost data from the Natural Ice-Rich Permafrost Observatory (NIRPO) site and the nearby Jorgenson research site (Figure 14).







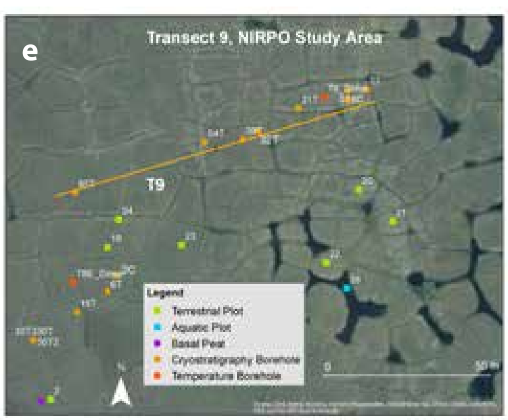


Figure 14. ***a.*** *Overview of the Colleen, Jorgenson, and NIRPO sites.* ***b–e.*** *Transects T6–T9 and* ***f.*** *Jorgenson transect with the locations of air temperature sensors, basal peat samples, terrestrial plots, aquatic plots, and permafrost boreholes sampled in summer 2021. See Figure 4 for an overview of Colleen transects T1 and T2.*

3.1.1 Field-team members

3.1.1.1 Vegetation team

Dr. Helena Bergstedt (UAF, Institute of Northern Engineering; postdoc): soils, basal peat samples.

Dr. Amy Breen (UAF, International Arctic Research Center; faculty): Vegetation surveys

Dr. Anja Kade (UAF, Dept. of Biology and Wildlife; faculty): Trace-gas fluxes

Josephine Mahoney (UAF, Institute of Arctic Biology; undergraduate): Trace-gas fluxes, pond vegetation

Zoe Meade (UAF, IAB; research assistant): Pond vegetation

Jana Peirce (UAF, IAB; project coordinator): Logistics and photographer

Zachary Spath (UAF, IAB; research assistant): Research assistant, vegetation surveys

Dr. Skip Walker (UAF, IAB; faculty): Project lead and vegetation surveys

Emily Watson Cook (UAF, IAB, Dept. of Biology and Wildlife; M.S. student): Pond vegetation

3.1.1.2 Remote sensing team

Dr. Ronnie Daanen, Barrett Salisbury (Alaska Department of Natural Resources, Division of Geological and Geodetic Surveys): Ground topographic control and LiDAR acquisition

Dr. Ben Jones (UAF, INE; faculty): Ground surveys and drone aerial imagery

3.1.1.3 Permafrost team

Dr. Mikhail Kanevskiy (UAF, INE; faculty): Permafrost characterization

Dr. Dmitry Nicolsky (UAF, Geophysical Institute; faculty): Permafrost temperature boreholes

Nicholas Hasson (UAF, INE; PhD student): Permafrost temperature boreholes

Sergei Rybakov (UAF, GI; PhD student): Permafrost temperature boreholes

3.1.2 Schedule

3.1.2.1 Mid-summer field work

Vegetation team (13 July–4 August)

- New NIRPO transects 6, 7, 8, and 9 established and marked with pin flags, aerial survey markers, and vertical snow poles.
- 35 terrestrial vegetation plots established along NIRPO transects; 17 of 35 plot surveys completed including plant species, soils, and environmental factors (Breen, Walker).
- 40 aquatic plots established at Jorgenson and NIRPO sites; 13 of 40 plot surveys completed (Watson-Cook, Meade).
- Flux measurements at 27 terrestrial plot and 6 aquatic plots completed (Kade & Mahoney).
- 10 basal peat samples collected for C14 analysis (Bergstedt, Peirce).

Remote sensing (15–20 July)

- Aerial LiDAR survey (Daanen, Salisbury).
- Ground elevation survey of transects and plots (Daanen).

3.1.2.2 Late-summer field work

Vegetation team (21 August–4 September)

- Measured thaw depth, water depth, vegetation height, vegetation type and microrelief at JS, CS (T1, T2), AS (T3, T4, T5) and NIRPO (T6, T7, T8, T9) transects (Kanevskiy, Mahoney, Peirce, Spath, Walker, Watson-Cook).

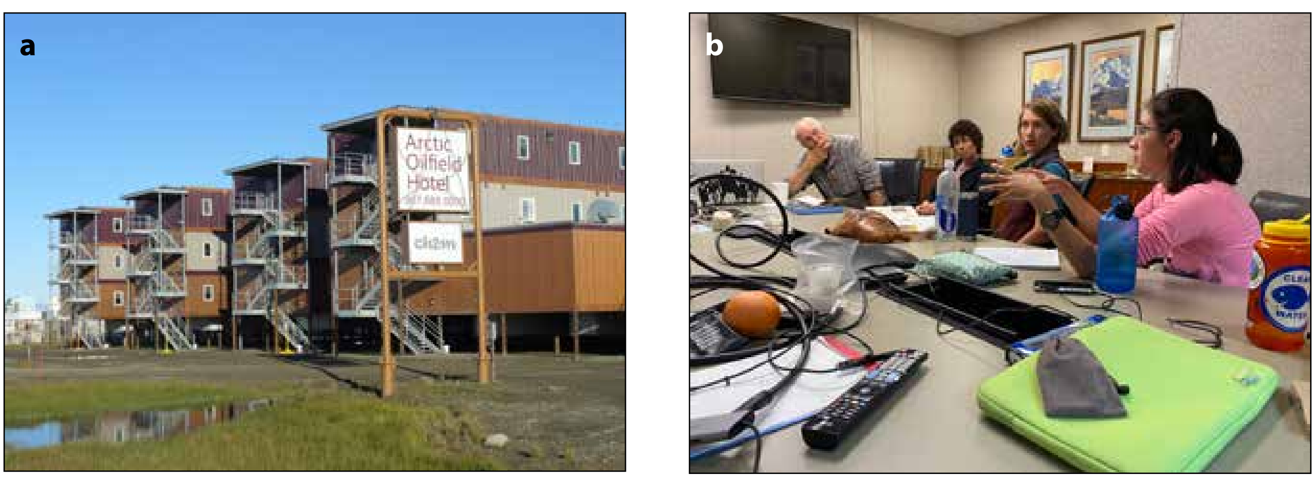


Figure 15. ***a.*** *Arctic Oilfield Hotel (AOH).* ***b.*** *Morning meeting in the AOH conference room.* ***Left to right:*** *Skip Walker, Amy Breen, Emily Watson-Cook, Josephine Mahoney. (Photo: J.L. Peirce, IMG 4651)*

- Biomass samples collected and vegetation types, thaw and water depths recorded at NIRPO terrestrial plots (Mahoney, Peirce, Spath, Walker).
- 18 terrestrial plots surveyed (Walker, Breen).
- 16 Aquatic plots surveyed (Watson-Cook, Mahoney).

Permafrost and remote sensing teams (21 August–6 September):

- Characterized permafrost in polygon centers, troughs and ponds along transects at Jorgenson and NIRPO (Kanevskiy).
- Permafrost temperature thermistors and loggers in installed in polygon centers along NIRPO and Colleen transects (Nicolsky, Hasson, Rybakov).
- Aerial drone and ground DGPS surveys of plots and transects completed (Jones).

3.1.3 Logistic support

Battelle ARO provided expedition support, including safety training, two trucks, and lodging in Wiseman, Coldfoot, and Deadhorse. The Arctic Oilfield Hotel in Deadhorse provided a conference room for our daily morning meetings and evening sample preparation, and freezer space for our samples (Figure 15).

3.1.4 NIRPO base camp

A base camp was established to provide equipment storage, overnight shelter, and a field toilet at the NIRPO site (Figure 16a). The camp was accessible on foot via a 25-minute walk (1.2 km) from the nearest gravel pad. A Quicksilver R-44 helicopter (Figure 16b) stationed at the Teshekpuk Lake Observatory transported camp and field supplies from the Deadhorse Airport to the site in three trips, including two sling loads.

3.2 Remote sensing

3.2.1 LiDAR imagery (R.P. Daanen)

LiDAR data provide topographic information for ground, water, and snow surfaces necessary for NNA-IRPS hydrological, permafrost, and vegetation studies. Ground control points were surveyed for the IRPS study areas 17–19 July 2021 using a Trimble R10-2 Real Time Kinematic Differential Global Positioning System (RTK-DGPS). A base station was placed on the NIRPO pingo for good sky view. The base station was operated on the same location collecting three epics of 4-hr static data. These data were used to find the best position in the Online Position User Service from NOAA. The fixed position was used to correct all RTK-DGPS observations.

High- and low-resolution LiDAR imagery were collected with a DGPS-operated Riegl VUX1-LR LiDAR system with an integrated Global Navigation Satellite System (GNSS) receiver and Northrop Grumman inertial measurement unit (IMU) system. The integration was designed by Phoenix LiDAR systems. This survey was flown with a pulse rate of 800,000 pulses/second, at a scan rate of 180–200 scans/second. This survey was flown with an average elevation of 100 m above ground level and a ground speed of approximately 45 m/s with a Pollux Aviation R44 helicopter configuration. The scan angle was set from 80–280 degrees, centered normal to the bottom of the aircraft.

The NIRPO intensive study areas, including the Colleen, NIRPO, Jorgenson, and Airport sites were surveyed at high resolution (approximately 110 pts/m^2) (Figure 17, horizontal flights lines). A larger area was surveyed at relatively course resolution (13–19

Figure 16. ***a.*** *NIRPO base camp (from left): Helena Bergstedt, Amy Breen, Skip Walker. (Photo: A.L. Breen, IMG E6967).* ***b.*** *Quicksilver helicopter, pilot Eryk de la Montaña and Skip Walker preparing sling load. (Photo: J.L. Peirce IMG 4119).*

pts/m²), including the northern portion of the Dalton Highway and much of the eastern portion of the Prudhoe Bay oilfield, including areas A, B, and C in Figure 1a (Figure 17, diagonal flights lines). The resulting data provide detailed views of the relative height of the ground surface at several scales (Figure 18). Elevations of ground control points will be archived at the Arctic Data Center NNA-IRPS portal (arcticdata.io/catalog/portals/nna-irps) and LiDAR data and imagery will be archived with the State of Alaska DGGS.

3.2.2 UAV and Ground-based DGPS Surveys (B.M. Jones)

3.2.2.1 Differential GPS (DGPS) Survey

Data collection. Data were collected 25–26 August 2021 at the CS, JS, and NIRPO sites and on 27 August at the AS using a Leica Viva GS10 Base Station (Figure 19a) and GS15 Rover. Real-Time Kinematic corrections and the base station and rover data were post-processed using the NGS Online Positioning User Service (OPUS). At the NIRPO site, the base station was established on top of the NIRPO pingo. A red survey marker cap was placed in the ground at the AS where the base station was established on the south side of the small access road west of the Sagavanirktok River.

Base station post-processing. Data from the NIRPO area were collected on 26 August 2021 every 5 seconds for nearly 7 hours. At the AS, data were collected on 27 August 2021 every 5 seconds for 3 hours. The post-processed locations of the base station based on the OPUS solutions were used to correct the initial location of the base station using the Leica Infinity software version 3.2.1.3319, which post-processed the location of all RTK rover points. The ITRF2014 solution was used to correct the latitude, longitude, and ellipsoid heights of the base

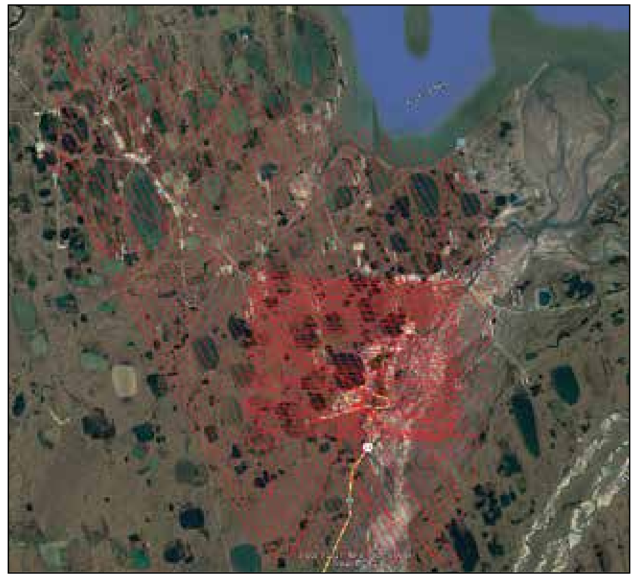


Figure 17. *LiDAR flight lines for the NNA-IRPS studies. Diagonal flight lines were surveyed at relatively course resolution (13–18 pts/m²). The core area (horizontal flight lines) was surveyed at 110 pts/m². (Image: B. Salisbury. Base image courtesy of Google Maps Maxar Technologies.)*

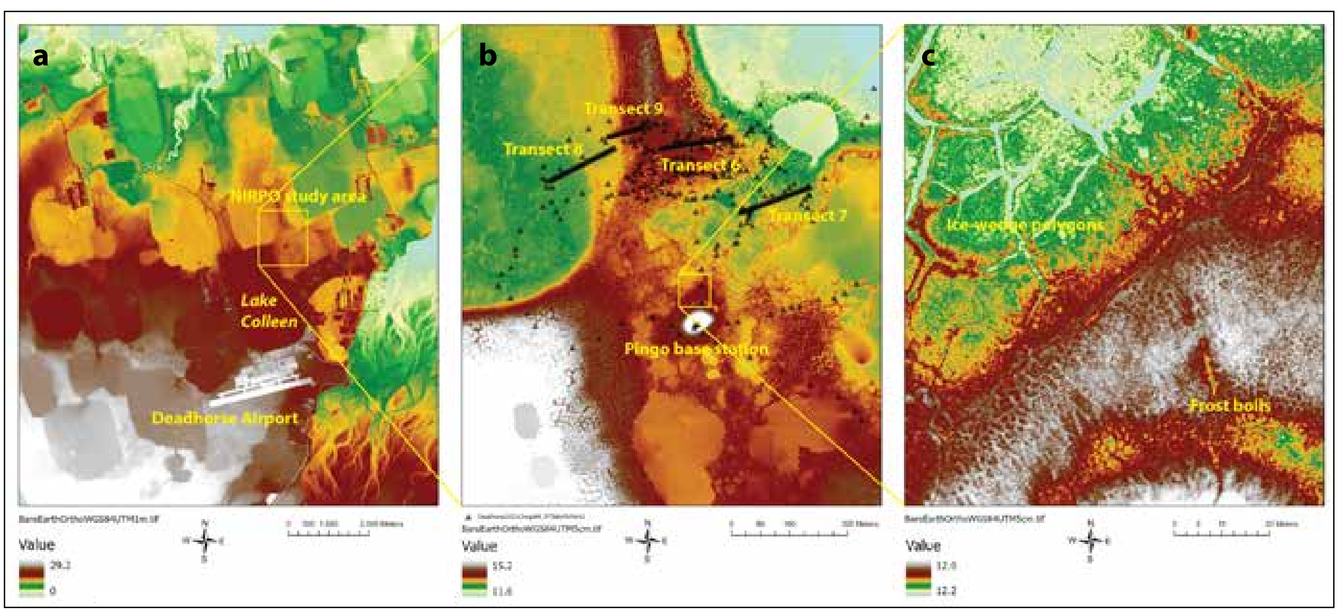


Figure 18. *LiDAR imagery for NNA-IRPS study areas.* ***a.*** *The Deadhorse region showing the location of the NIRPO study area, Lake Colleen, and the Deadhorse Airport.* ***b.*** *Detail of the NIRPO study area with locations of ground-control points (black triangles), transects T6–T9 and the survey base station on the NIRPO pingo.* ***c.*** *An area of polygonal terrain to the north of the pingo showing two different scales of patterned ground. (Base imagery: R.P. Daanen)*

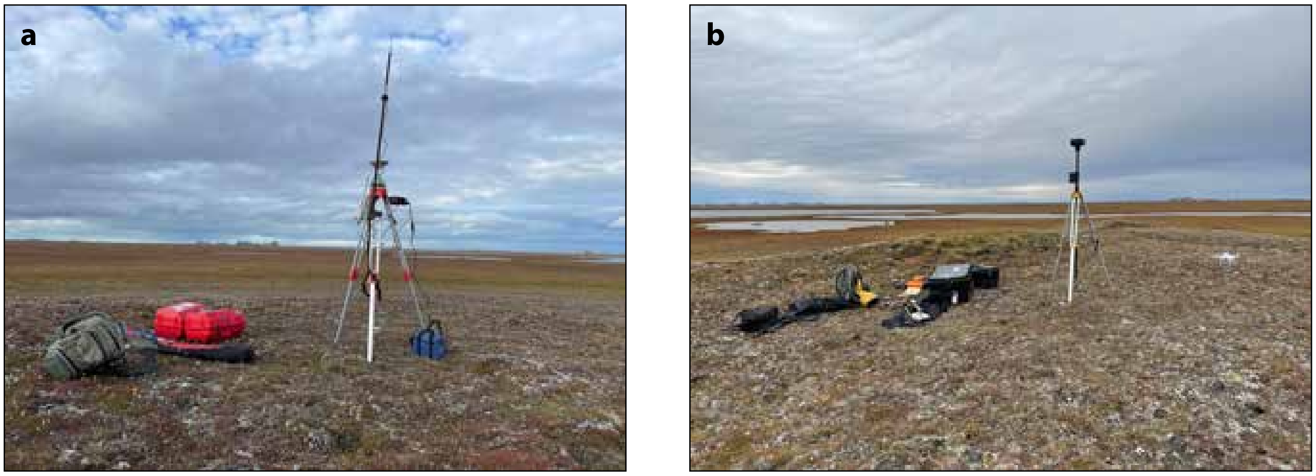


Figure 19. *UAV base station on the NIRPO pingo.* ***a.*** *Leica Viva GS10 Base Station for surveying ground points.* ***b.*** *DJI D-RTK 2 Mobile Station and DJI P4RTK quadcopter for the UAV surveys. (Photos: B.M. Jones)*

station and rover points. ITRF2014 and WGS84 agree at the centimeter level, yielding conventional 0-transformation parameters. Orthometric heights were derived using the Geiod12b transformation.

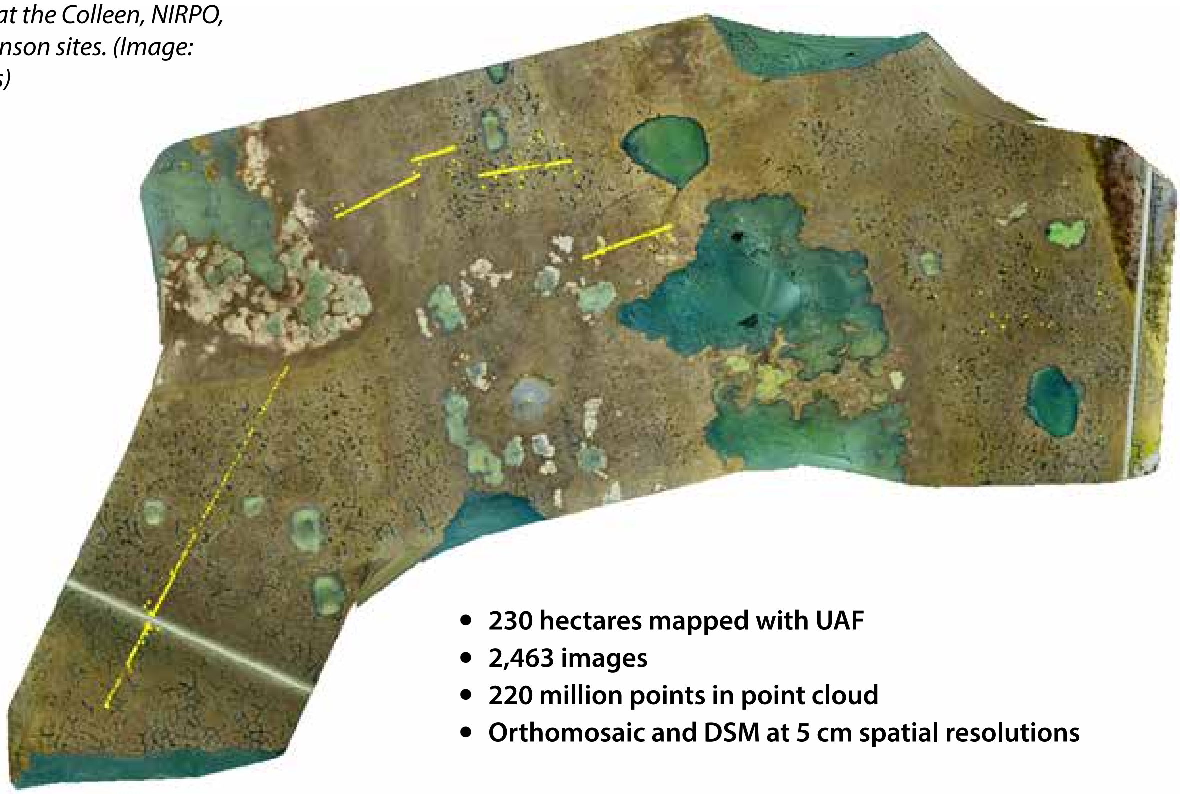
Data. 1,488 DGPS points. The table and shapefile include information on the point description (Point ID), date of data collection, latitude, longitude, WGS84 ellipsoid height, and orthometric height (geoid 12b). Data will be archived at the Arctic Data Center NNA-IRPS portal (arcticdata.io/catalog/portals/nna-irps).

3.2.2.2 UAV Survey

Permission for UAV operation. FAA through a certificate of waiver or authorization – FAA Form 7711-1 2021-P107-WSA-20670.

UAV base station. The UAV (drone) base station was established at the same pingo location as the Leica Base Station (Figure 19b) and the post-processed location of that point based on the OPUS solution was input into the mission prior to the flights taking place. All images were tagged relative to this post-processed

Figure 20. *Drone-derived image of transects at the Colleen, NIRPO, and Jorgenson sites. (Image: B.M. Jones)*



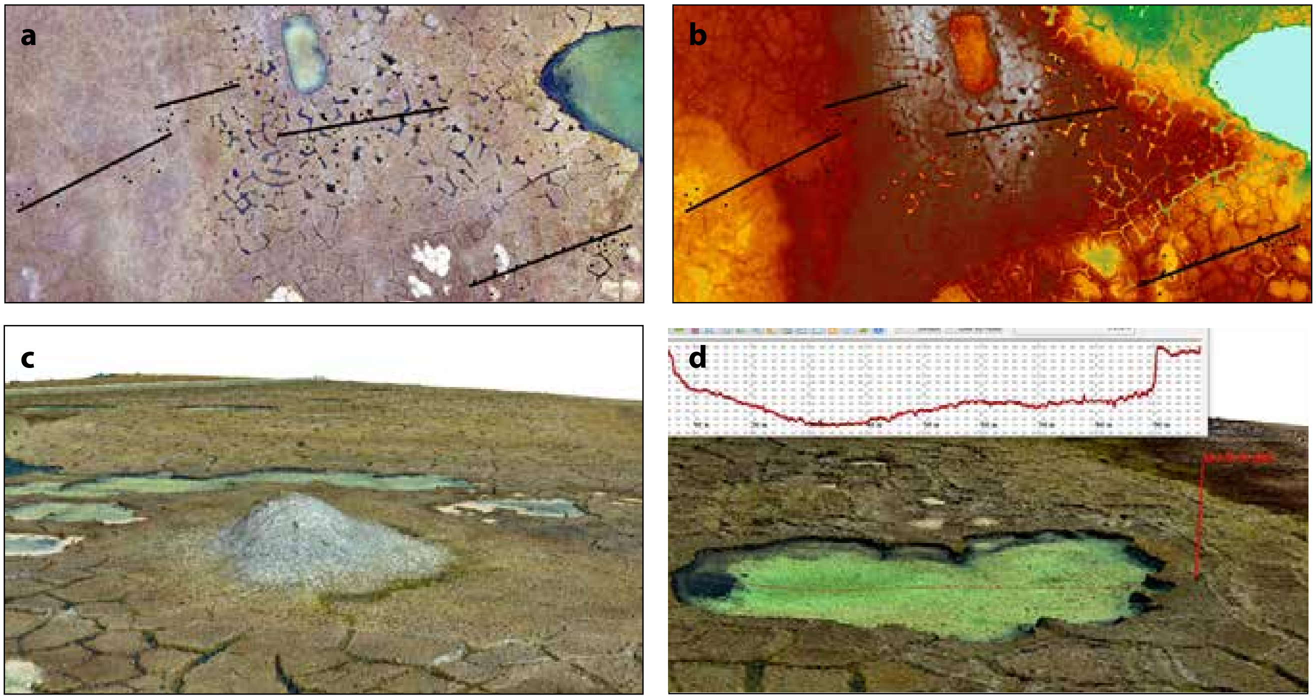


Figure 21. *Examples of derived products from the UAV surveys.* ***a.*** *Orthophoto mosaic of the NIRPO site.* ***b.*** *Digital surface model of the NIRPO site.* ***c.*** *3-D view of orthophoto mosaic and digital surface mode of the NIRPO pingo.* ***d.*** *Topographic survey across a small marl-bottomed pond. (Images: B.M. Jones)*

DGPS base station position. This eliminated the need for further post-processing of the drone images.

UAV flight. The survey acquired 2,463 images on 29 August using a DJI P4RTK quadcopter and a DJI D-RTK 2 Mobile Station. The survey area included the CS, JS, and NIRPO sites. The drone was flown at 100 m agl and flight speeds varied from 7–8 m/s. The frontlap and sidelap of the mission were set at 80% and 70% respectively.

Image processing. 2,431 images were processed in the software Pix4D Mapper to produce a colorized point cloud (220,183,349 points), an orthophoto mosaic, and a digital surface model of the NNA-IRPS study area at spatial resolutions of 5 cm (Figure 20). The data were processed as WGS84 UTM Zone 6 North in Ellipsoid Heights. The mean horizontal error in Pix4d processing was estimated at 10 cm. During the flight mission, the vertical error of the drone relative to base station was +/- 3cm.

Products. Examples of the resulting data include a colored orthomosaic image and surface elevation model of the NIRPO site (Figure 21a, b), a 3-D orthomosaic image overlaid on the 3-D surface model of the NIRPO pingo (Figure 21c), and a topographic survey across a small marl-bottom pond that illustrates the possibility of surveying bottom elevations in shallow ponds and lakes with clear water (Figure 21d).

3.3 NIRPO transects (D.A. Walker)

3.3.1 NIRPO transect locations and methods

Three 200-m transects (T6, T7, T8) and one 100-m transect (T9) were established at the NIRPO site on surfaces at different stages of ice-wedge evolution/geomorphology. Yellow pin flags were place at 1-m intervals and orange pin flags at 5-m intervals (Figure 22). White 1.2-m tall PVC poles marked with the

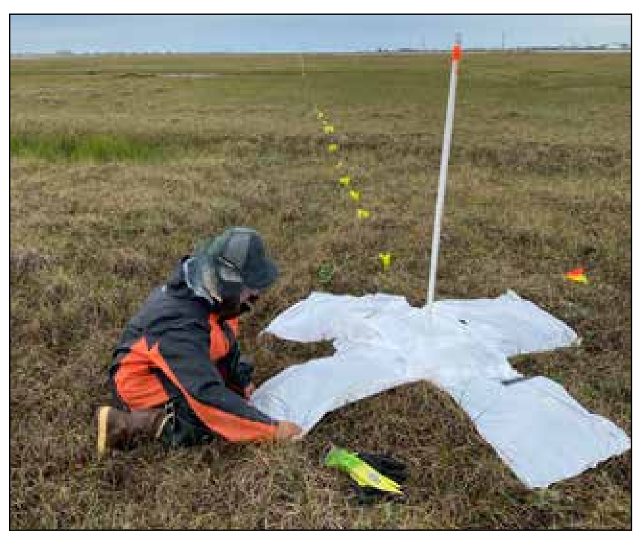


Figure 22. *East end of NIRPO transect T8. See text for explanation of ground markings along the transect. (Photo: J.L. Peirce, IMG 4283).*

transect number and distance from the start were set onto rebar at 0-, 50-, 100-, 150-, and 200-meters. Orange surveyors' tape was wrapped at the top of each pole to make it easier to locate during winter surveys. The end points of each transect were marked with six white 13-gallon trash bags in an X (Figure 22) and 10-inch (25-cm) paper plates were placed at the base of the poles at 50-m intervals along the transect to ensure transects would be visible on aerial imagery.

Transect T6 (200 m) is situated on a relatively old surface elevated above the drained thaw-lake basins that surround it. The surface forms are mainly well-developed transitional and high-centered polygons with many thermokarst ponds in the polygon troughs (Figure 23).

Transect T7 (200 m) is in a drained lake basin that has low-centered polygons and thermokarst features on the east end of the transect and disjunct polygons and shallow marl-bottomed ponds on the west end (Figure 24).

Transect T8 (200 m) is in a young drained lake basin with disjunct polygon features on the east end and younger flat featureless terrain on the west end (Figure 25).

Transect T9 (100 m) crosses the boundary of a large drained thaw-lake basin. The east end is on a low bluff of the lake basin with well drained high-centered polygons (Figure 26a). The west end of the transect has weakly developed low-centered ice-wedge polygons with infrequent thermokarst (Figure 26b).

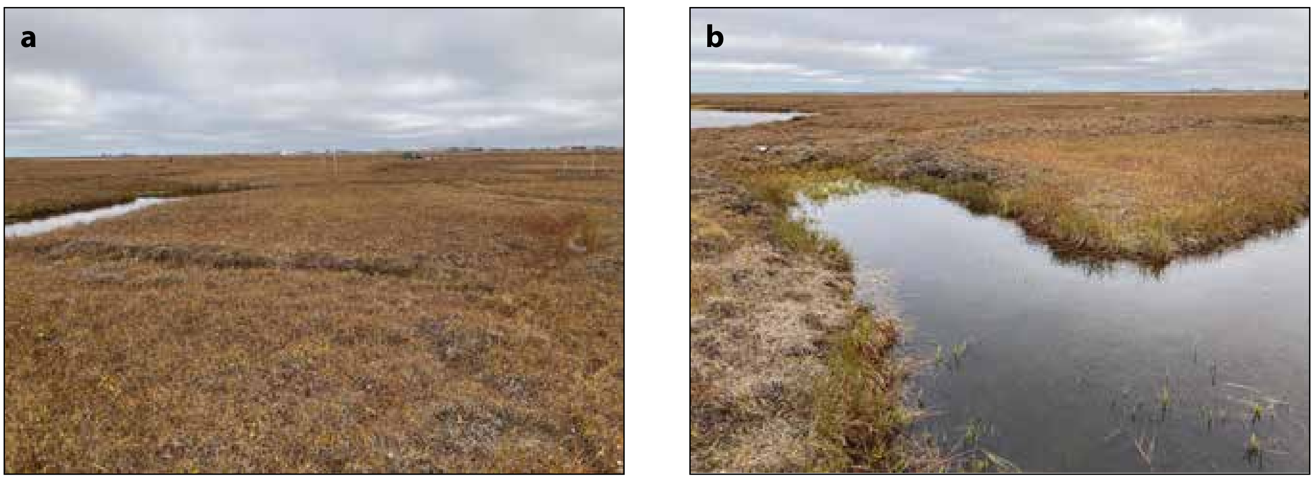


Figure 23. *Transect T6 on the oldest (primary or residual) surface with no evidence of thaw lakes.* ***a.*** *Flat-centered polygon with partially eroded polygon rims and a thermokarst pond in a polygon trough.* ***b.*** *Transitional polygon with partial rim and thermokarst pond at intersection of polygon troughs. (Photos: D.A. Walker, IMG 0301, IMG 0299)*

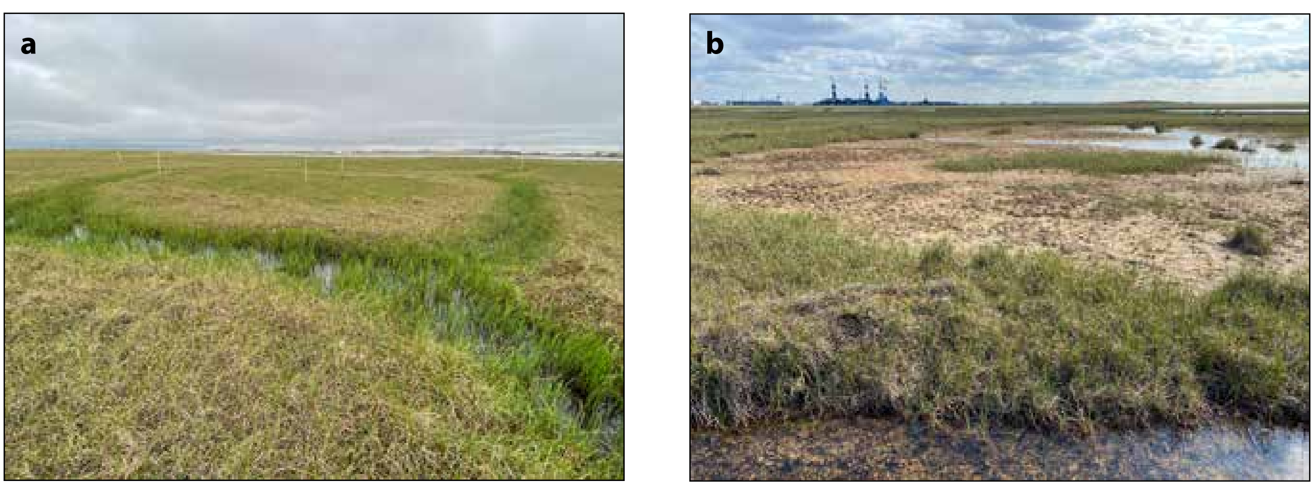


Figure 24. *Transect T7 in an older drained lake basin with mixed terrain.* ***a.*** *East end of T7 with well-developed low-centered polygons and thermokarst in polygon troughs.* ***b.*** *West end of T7 with younger landscape, including shallow ponds with marl deposits and disjunct polygon features. (Photos: J.L. Peirce, IMG 4914, IMG 4235).*

3.3.2 2021 transect surveys: Vegetation height, water depth, and thaw depth

Thaw depths, water depths, vegetation heights and vegetation types were recorded along the CS (T1, T2), AS (T3–T5), NIRPO (T6–T9), and JS transects during 23–26 August 2021. Measurements were made at 1-m intervals along all transects. Thaw and water depths were measured with a 0.95-cm (3/8 inch) x 1.2-m steel probe. Vegetation height was measured with a meter stick. In aquatic sites, vegetation height was measured from the bottom of the pond. Vegetation was classified using vegetation types modified from Walker (1980, 1985) in Appendix 4, Table 4.7. Data are in Appendix 3, Tables A3.1 (CS), A3.2 (AS), A3.3–A3.4 (NIRPO site), and A3.5 (JS).

The roadside transect T4 (flooded) had the deepest mean thaw (66 ± 19 cm) and water depth (21 ± 18 cm). The shallowest mean thaw depth was along Transect T9 (38 ± 5 cm). The Jorgenson transect had intermediate mean thaw depths (54± 6 cm). The roadside transects (T1–T4) had relatively deep and more variable thaw compared to the NIRPO transects (T6–T9) (Figure 27).

3.4 NIRPO terrestrial vegetation plots (D.A. Walker, A.L. Breen, O. Hobgood)

3.4.1 Terrestrial plot surveys

Vegetation in the NIRPO study area was surveyed in 35 permanent 1-m x 1-m plots. The locations of

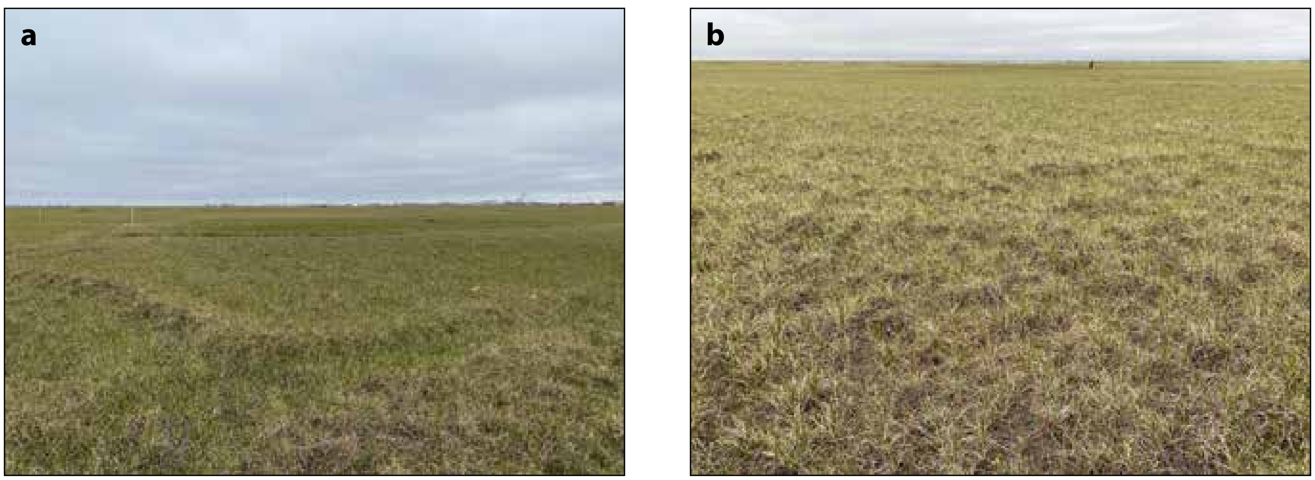


Figure 25. *Transect T8 with young surfaces in drained lake basin.* ***a.*** *East end of T8 in somewhat older portion of the drained-lake basin with disjunct polygon rims.* ***b.*** *West end of T8 with somewhat younger surface and few disjunct polygon rims or other polygonal features. (Photos: J.L. Peirce, IMG 4761, IMG 4966)*

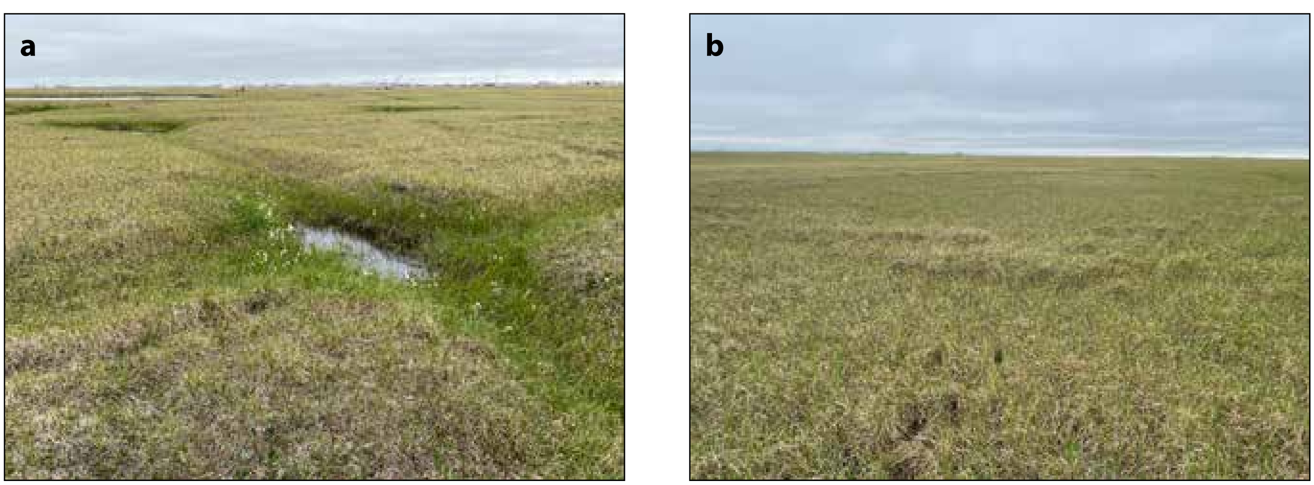


Figure 26. *Transect T9 along margin of drained lake basin.* ***a.*** *East end of T9 with flat-centered and transitional polygons on an older surface outside the lake basin (similar to Transect 6 (Figure 23b).* ***b.*** *Somewhat older portion of the drained lake basin with disjunct polygon rims (similar to east end of T8 (Figure 25a). (Photos: J.L. Peirce, IMG 4771, IMG 4964)*

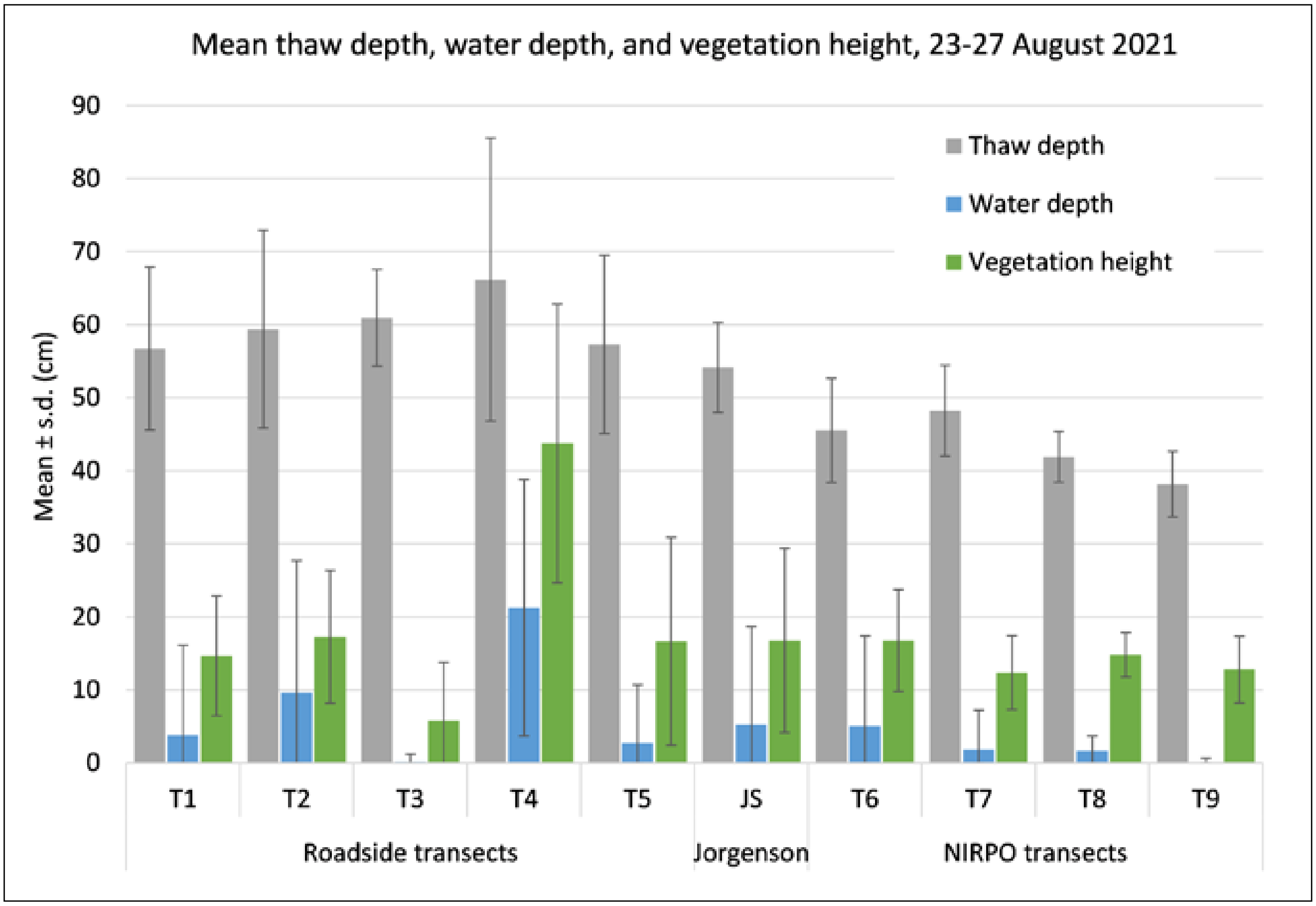


Figure 27. *Mean thaw depths, water depths, and vegetation heights (± s.d.) for transects sampled 23–27 August 2021. The roadside transects (T1–T5) had deeper thaw than less disturbed transects (Jorgenson and T6–T9). Measurements along with vegetation height and polygonal features at each meter along the transects are in Appendix 3, Tables A3.1 to A3.5.*

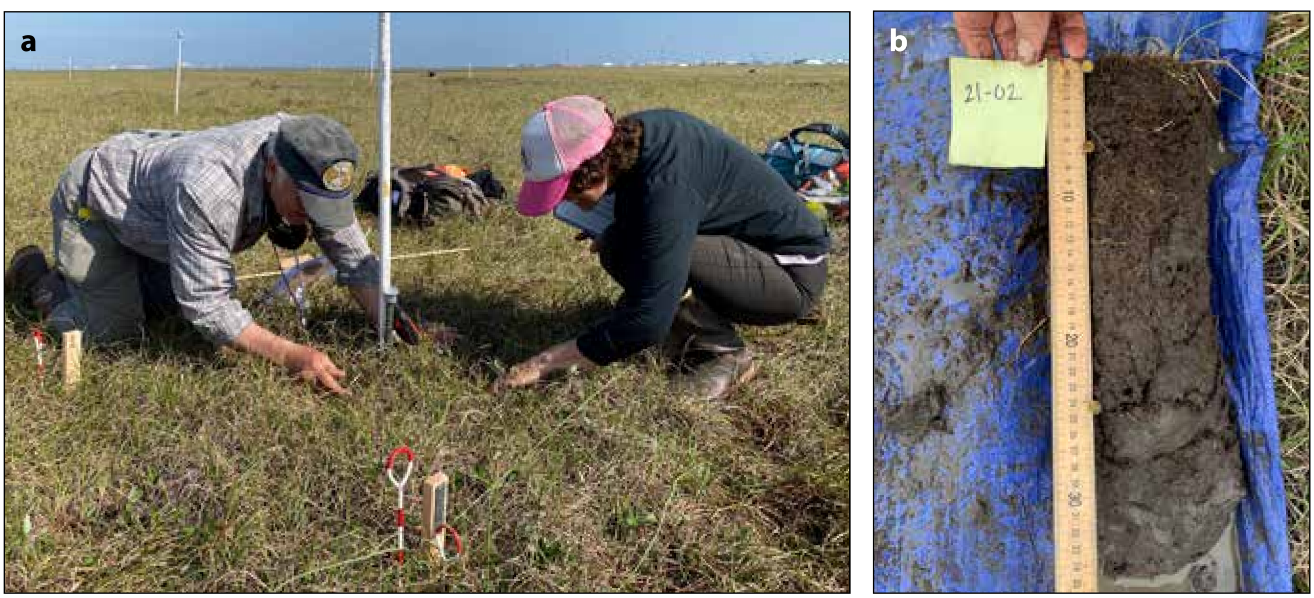


Figure 28. *Terrestrial vegetation plot.* ***a.*** *Skip Walker and Amy Breen recording species cover abundance using Braun-Blanquet (Westhoff and van der Maarel 1978) protocols. The four corners of the 1-m x 1-m plot are marked with pre-labeled wooden stakes. The short rebar stake with aluminum cap is in the center of plot and has the plot number stamped on the cap for vertical photographs of the plot. The 1.5-m post is for locating the plot in winter. (Photo: J.L. Peirce, IMG 4495).* ***b.*** *Soil plug after removal from soil pit for description. Nails mark horizon boundaries. (Photo: A.L. Breen, IMG 7019).*

the plots are shown along transects T6–T9 in Figure 14b–e (green squares) and their latitude, longitude and elevation fixed in a DGPS survey (Appendix 4, Table A4.1). The corners of the plots were marked with the plot numbers (21-01 to 21-35). The center of each plot was marked with a 3/8-inch x 30 cm rebar pole with an aluminum cap stamped with the plot number (Figure 28a). A white 1.5-m vertical PVC pole with the plot number and blue surveyors' tape at the top of the pole was placed next to the rebar pole for locating the terrestrial plots in winter. A 25-cm-diameter white paper plate was anchored in the plot center with the center pole to make the plot visible for summer aerial surveys. Photos of the plots are in Appendix 4, Tables A4.2 (vegetation), A4.3 (soils), and A4.4 (landscapes).

Species composition and environmental factors were surveyed in each plot following the protocols developed for the Colleen and Airport sites (Walker *et al.* 2015, 2016). Data are in Appendix 4. The plot surveys included environmental site factors and plant growth form data (Table A4.10; see Tables A4.5–A4.7 for codes used for categorical and scalar variables, habitat types, and vegetation types). A list of plant species includes field names, accepted names, taxon codes, and plant growth form (Table A4.8). A summary table includes transect location, vegetation type, microrelief, habitat type, and field name of the plant community for each plot (Table A4.9). Plant species cover abundance by plot is in Table A4.11.

Soil plugs were removed from a site adjacent to each terrestrial vegetation plot (Figure 28b). The major soil horizons were briefly described, and soil samples were collected from the top organic horizon and the mineral horizon using a 180 cm^3 soil can. Soil analyses were done in the UAF Forest Soils Lab including soil color, gravimetric soil moisture, volumetric soil moisture, bulk density, particle size, organic matter, and pH (Table A4.12). Figure 29 summarizes some trends related to soil moisture and organic matter.

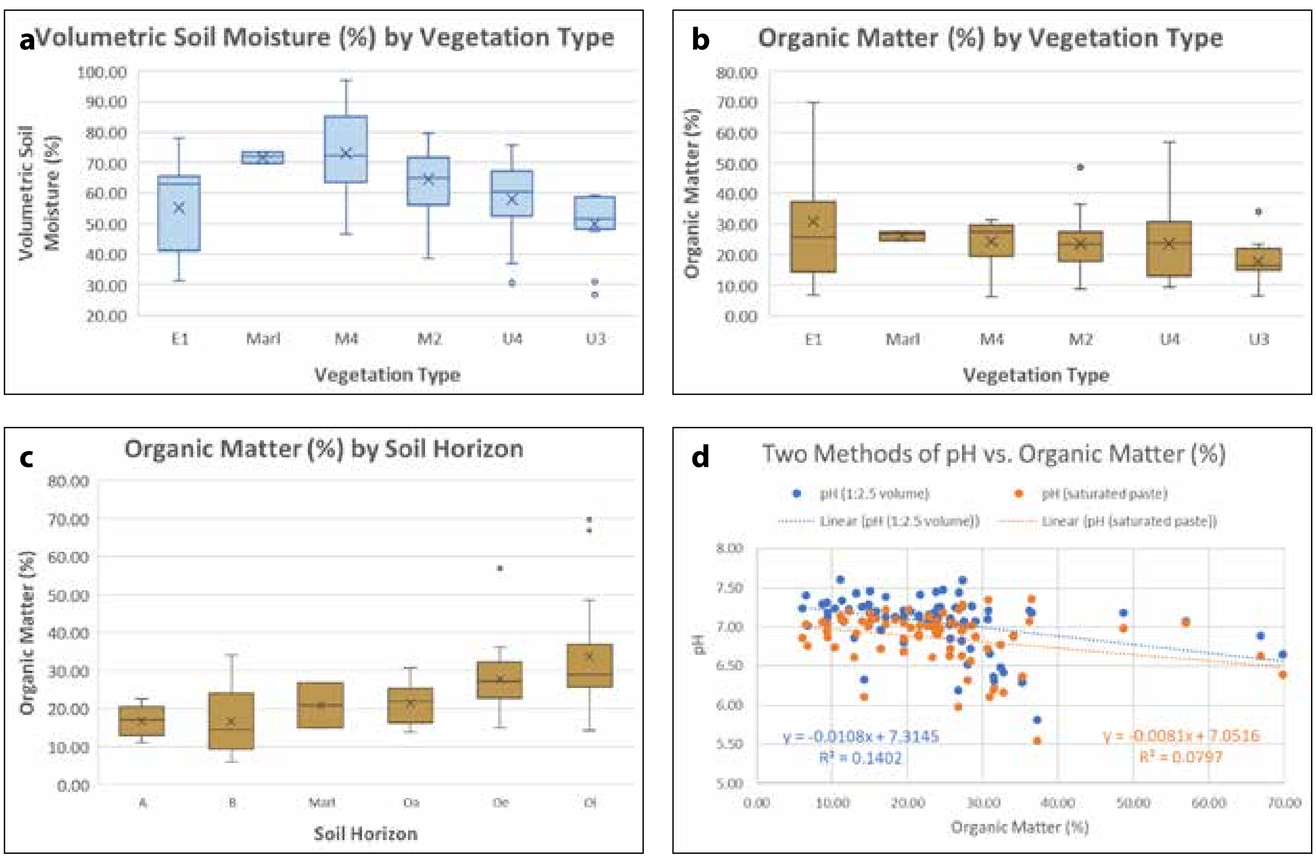


Figure 29. *Summaries of selected NIRPO terrestrial-plot soil variables.* ***a.*** *Volumetric soil moisture by vegetation type.* ***b.*** *Percent organic matter by vegetation type.* ***c.*** *Percent organic matter by soil horizon.* ***d.*** *Soil pH vs. organic matter using the saturated paste method and a 1:2.5 soil:water ratio. The box and whisker diagrams display the distribution of data points. Box limits indicate the range of the central 50% of the data, with the central line marking the median value and the X marking the mean values. "Whiskers" extend from each box to capture the range of the remaining data, with dots placed past the line edges to indicate outliers.*

Figure 30. *Biomass harvest. **a.** Cutting out a 50-cm x 20-cm slice of tundra using a metal frame to guide the cut and a serrated bread knife. **b.** Zip-top gallon freezer bag containing one half of the tundra slice. (Photos: J.L. Peirce, IMG 5608, IMG 5602)*

3.4.1.1 Terrestrial-plot aboveground biomass

The terrestrial plots were harvested for aboveground biomass during 26–31 August 2021. A 50-cm x 20-cm metal sampling frame was nailed to the tundra near each plot in tundra that matched as closely as possible the composition and structure of the tundra in the terrestrial plot. The tundra within the frame was removed by first cutting around the inner margin of the frame with a serrated bread knife (Figure 30a) and then cutting horizontally 2–3 cm beneath the surface to detach a slice of tundra. The tundra slice was then divided in half, and each half placed in quart-size ziptop bag labeled with the plot number and date of harvest (Figure 30b).

The samples were frozen for transport to UAF where they were thawed and the live aboveground plant parts were clipped with scissors and sorted into growth forms: evergreen shrubs, deciduous shrubs (leaves and woody stems), graminoids (live and dead), horsetails, forbs, mosses, lichens, and litter. The biomass data are in Table A4.13. A summary of the data by plant growth form, vegetation type, and surface form is shown in Figure 31.

3.4.1.2 Terrestrial-plot soil temperature loggers

To measure the insulative effect of the vegetation and peat layers, 60 temperature loggers (Maxim iButtons® DS1922L Thermochon 8K, resolution $\pm$ 0.5° C)

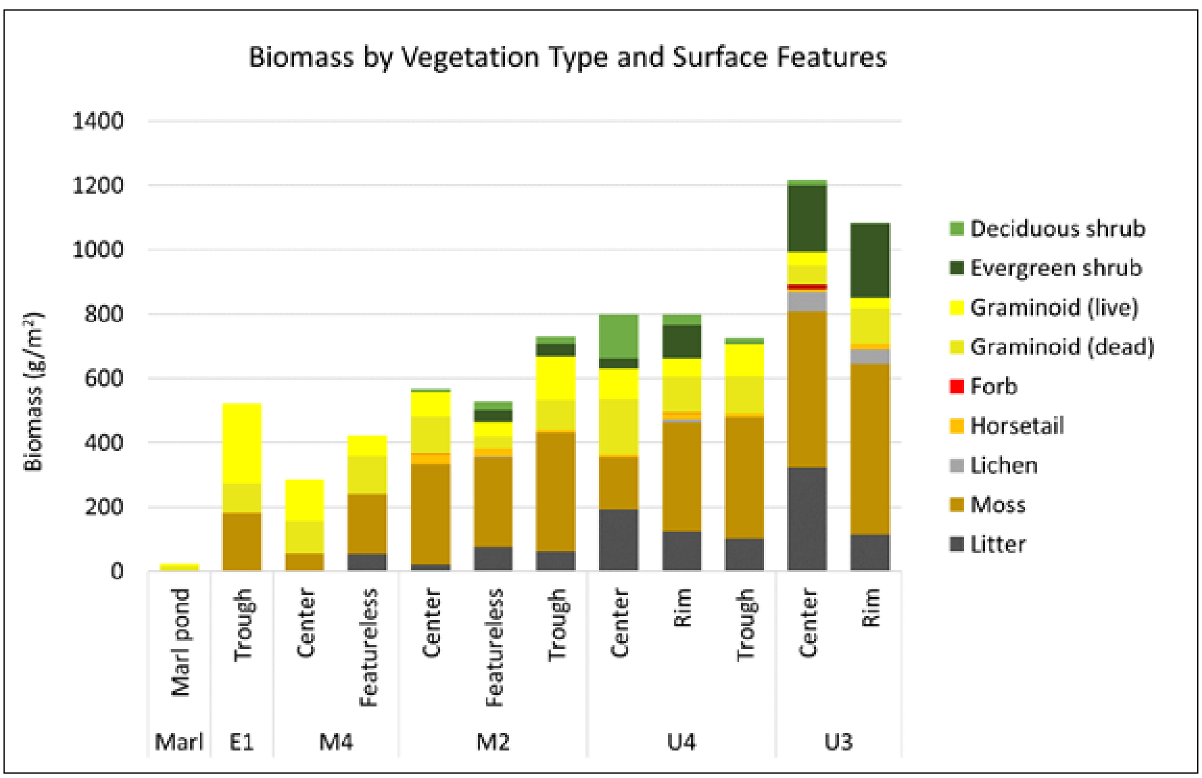


Figure 31. *Aboveground biomass by plant growth forms for NIRPO vegetation types and surface form features.*

Figure 32. *Temperature logger placement in terrestrial plots.* ***a.*** *Sealed logger placed in small zip-top bag labeled with the plot number.* ***b.*** *Orange ribbon attached to the bag.* ***c.*** *Soil pit after insertion of the loggers just beneath the surface and at the base of the organic layer, with orange ribbons displayed above ground. (Photos: J.L. Peirce, IMG 4510, IMG 4632, IMG 4823).*

were programmed to log the temperature every four hours. Two temperature loggers were installed adjacent to each terrestrial plot: one was inserted just beneath the soil surface and a second at the base of the organic soil horizon in the hole where the soil plug was temporarily removed. Loggers were waterproofed by coating with spray plastic (Plasti-dip), tied in a finger from a nitrile rubber glove, and sealed in a small zip-top bag marked with the iButton ID number (Figure 32a). An orange ribbon tied to each bag was displayed above the ground surface to aid in later retrieval (Figure 32b, c). All loggers were installed by 18:00 26 July 2021. Serial numbers, field numbers, and location information for all temperature loggers installed at terrestrial plots are in Table A4.14.

3.5 Aquatic vegetation plots (E. Watson-Cook)

3.5.1 Plot locations and sampling protocols

Thirty-nine aquatic vegetation plots were surveyed, including 19 at the JS and 20 at the NIRPO site near transect T6 (Figure 33a and Appendix 5, Table A5.1). Locations are also shown in maps of transects T6, T9 and the JS (Figure 14, blue squares). Plots are on older primary (residual) surfaces with abundant thermokarst ponds. Ten ponds contained paired plots, where one is located in a vegetated area of the pond and one in a sparsely vegetated area (Figure 33b). Data are in Appendix 5, including photos of plots (Table A5.6) and soil samples (Table A5.7).

The list of plant species includes acrocarpous and pleurocarpous mosses, forbs, and a non-tussock sedge (Table A5.2). Species nomenclature followed the Pan Arctic Species List (Raynolds *et al.* 2013). Percent species cover abundance (Table A5.3) was estimated within each 1-m^2 plot using a square quadrat as a visual aid (Figure 33c, d). Total absolute percent cover often exceeded 100% in dense stands due to overlapping canopy layers. Voucher collections were made of all species found within a plot, and a representative sample of each species will be deposited in the UAF Herbarium.

Environmental site factors and plant growth form cover values were surveyed following protocols developed for the CS and AS (Walker *et al.* 2015, 2016), and are summarized in Table A5.4, including water chemistry characteristics and measurements of water depth, thaw depth, and pond sediment thickness. Pond dimensions were measured with a 100-m tape stretched across the pond at its maximum width and perpendicular to the maximum width.

3.5.2 Temperature measurements

Water and sediment temperatures were determined using temperature loggers (Maxim iButtons®, models DS1921G and DS1922L) placed at three depths. Loggers were waterproofed using the same methods as for terrestrial plots. After being placed in small zip-top bags labeled with the plot number and relative location within the plot, two loggers were attached with duct tape and wire to a PVC pole marked with the height of the sediment surface and the top of the submerged vegetation layer. A third logger was taped beneath a small square of foam insulation to measure the temperature at the water surface while protected from solar radiation (Figure 34a). The PVC pole was pushed through the foam and a large enough hole created to allow the foam to float freely once the PVC was installed adjacent to the plot in the bottom of the pond using 3/8-inch rebar (Figure 34b, c).

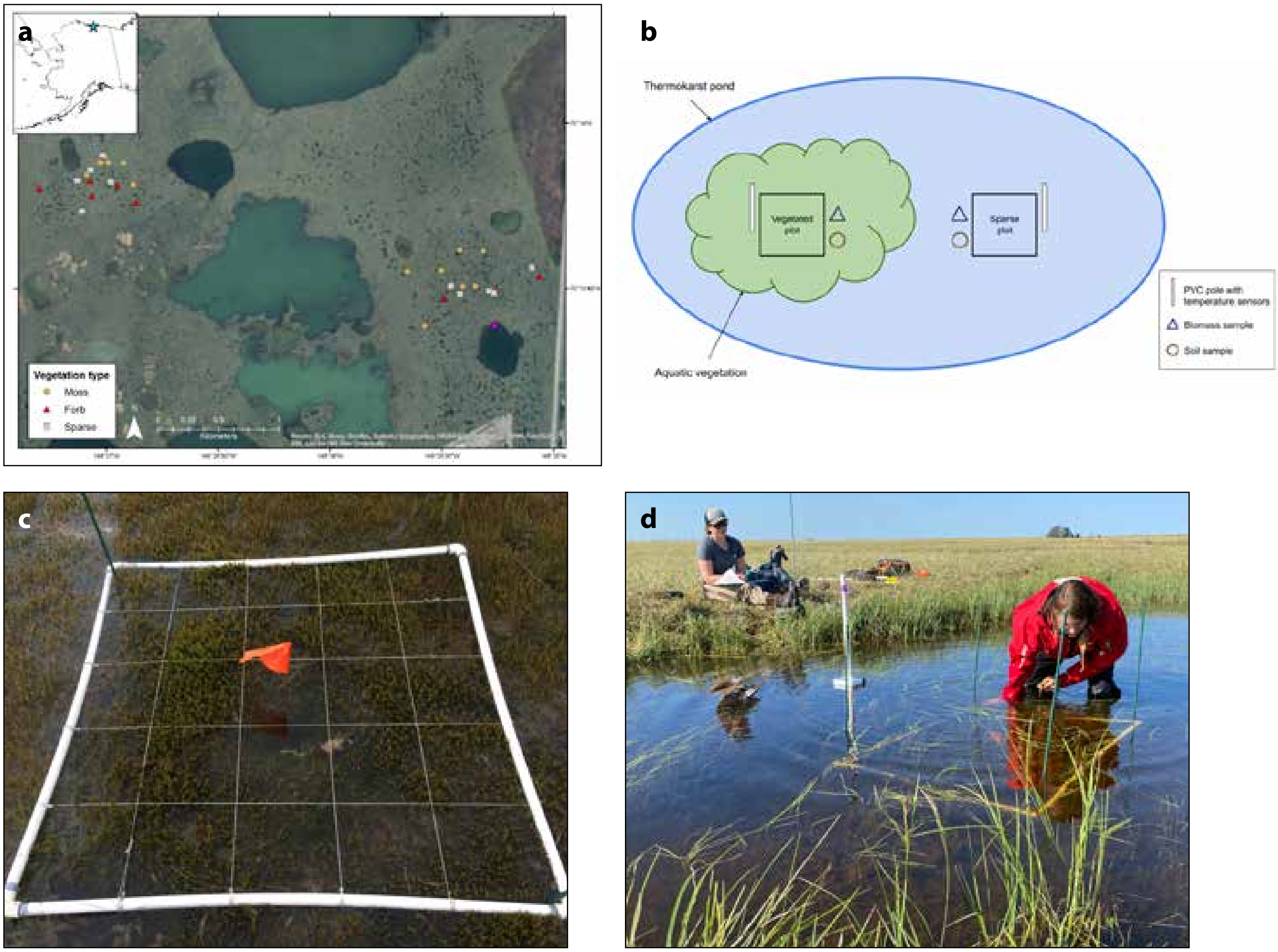


Figure 33. *Aquatic vegetation plots.* ***a.*** *Locations of plots at the JS and NIRPO sites.* ***b.*** *Layout of a vegetated and sparse plot within a thermokarst pond. (Image: E. Watson-Cook).* ***c.*** *1-m x 1-m plot and square quadrat, which was used as a visual aid in percent cover estimation. (Photo: E. Watson-Cook, IMG 3537).* ***d.*** *Emily Watson-Cook and Zoe Meade sampling plant-community composition and site factors in a* Sparganium hyperboreum *aquatic plant community within a 1-m x 1-m plot. (Photo: J.L. Peirce, IMG 4593)*

In cases where the top of the submerged vegetation was at the pond surface, one of the three sensors was omitted. At sparse plots co-located near vegetated plots in some ponds (Figure 33b), loggers were placed at the water surface and at the sediment surface. A third logger was placed at the same height above the sediment as the logger located at the top of the submerged vegetation layer in the adjacent vegetated plot to allow for direct comparison of temperatures in vegetated and sparsely vegetated areas. At the NIRPO site, 15 poles with temperature loggers were installed at vegetated plots and five at sparse plots. At JS, 14 poles were installed at vegetated plots and five at sparse plots.

To compare temperatures in small ponds with those in a larger body of water, an additional set of loggers was installed in a lake just south of the JS (Figure 33a, purple point). Air temperature was also measured. At the JS, a logger was located on the PVC pole at plot 21A-03 at a height of 35 cm above the water surface (115 cm above the sediment). At NIRPO, one was located on the pole marking the east end of transect T6 at a height of 1 m. These sensors were attached to the PVC pole using wire and tape. A small plastic cup, slit to allow air flow, was placed around the logger to limit the effects of direct sunlight.

A total of 120 temperature loggers (60 at each site) were set to record measurements every 60 minutes. These data were downloaded, trimmed to the same time period beginning at 18:00 on 19 July 2021 and ending at 8:00 on 23 August, a period of 34 days and 14 hours. An additional 20 high-resolution DS1922L iButtons® (10 at each site) were set to log the temperature

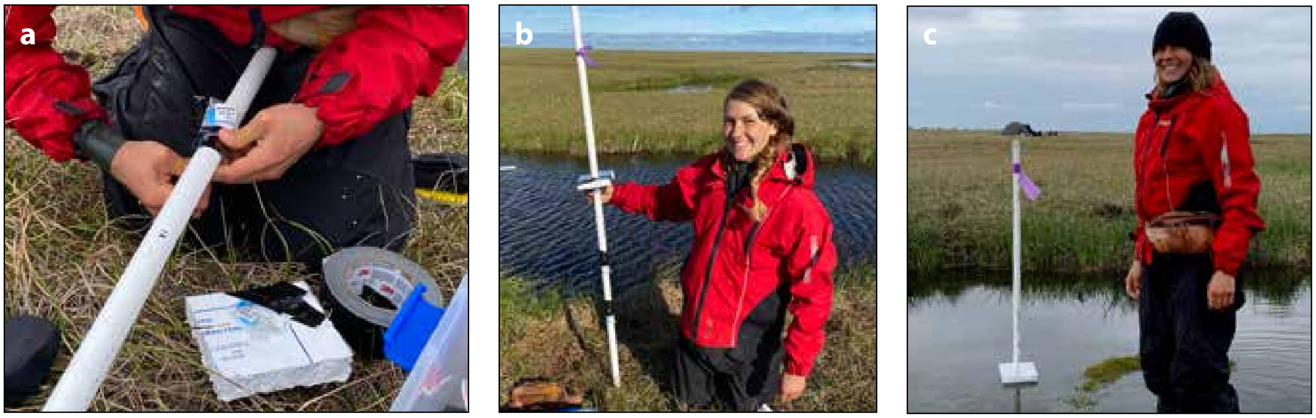


Figure 34. *In aquatic plots, two waterproofed sensors were attached with duct tape and wire to a PVC pole to record temperature at the sediment surface and top of the submerged vegetation layer every hour. A third was taped to the underside of a square of foam insulation to measure temperature at the water surface. (Photos: J.L. Peirce, IMG 4335, IMG 4405, IMG 4797).*

every 240 min. and are still in the field. Information on iButtons® installed at aquatic plots is in Table A5.5.

3.5.3 Biomass sampling

Biomass samples were collected to quantify aboveground biomass within thermokarst ponds. Samples were taken outside each plot, within the same homogeneous area of vegetation as the plot. Samples were collected in late August near the end of the growing season. A coring device was modeled after a previously described aquatic biomass sampler (Madsen *et al.* 2007). The dimensions were altered and a steel stovepipe added to the end to provide a sharp coring edge (Figure 35a). The cylindrical biomass and soil cores had a diameter of 15.24 cm (6 in), and a circular cross section area of approximately 182 cm^2).

To extract samples, the corer was inserted into the vegetation layer, as well as a small amount of the sediment layer since the additional material helped to hold the sample in the corer. Rotating the corer while pushing it downward allowed the device to effectively cut through dense vegetation. The corer was sealed with PVC cement, except for the end of one handle where an air-tight cap was placed over this handle once the corer was inserted into the sediment (Figure 35b). This allowed the intact sample to be removed with vacuum suction and to be released from the device once the cap was removed (Figure 35b).

Once the core was removed, a knife was used to cut through vegetation at the sediment surface in order to obtain a sample of aboveground biomass. The samples were thoroughly washed in both the field and lab to remove any trapped mineral sediment, and they were kept cool before sorting and drying. Biomass samples were sorted into the following plant functional types (PFTs): moss, forb, graminoid, and shrub. Material too fragmented or decomposed to identify as a particular PFT was considered litter. The samples were dried at 65 °C until a constant mass was obtained (approximately one week). Biomass and soils data are included in Emily Watson-Cook's M.S. thesis (2022, unpublished).

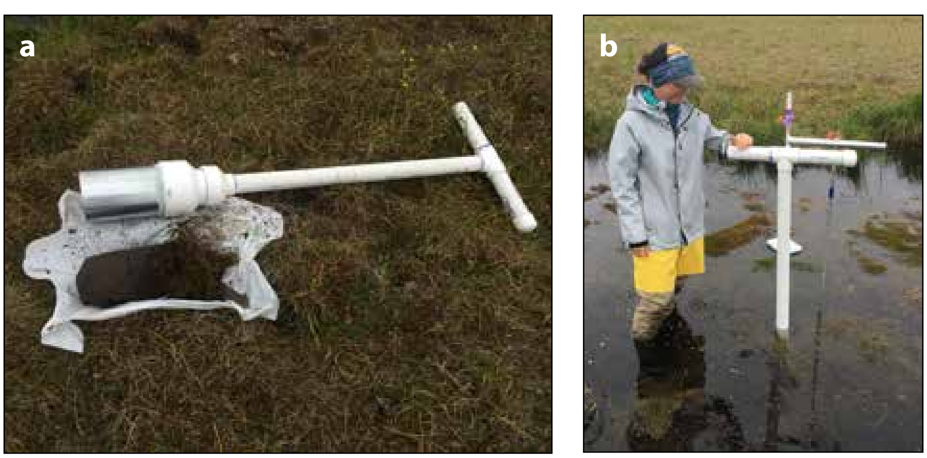


Figure 35. ***a.*** *Coring device used to collect biomass and soil samples and an intact core sample removed from the coring device post-extraction.* ***b.*** *The corer inserted into pond sediment with the cap sealing the open handle. (Photos: E. Watson-Cook, IMG 3631, IMG 3630)*

3.5.4 Soil sampling and analyses

Soil samples were collected adjacent to each plot using the coring device described above. The device was inserted in the soil to the top permafrost layer. The thickness of the litter layer, organic horizon, and mineral horizon were measured with a meter stick. Wet and dry soil colors were determined using Munsell soil color charts (Munsell Color 1975). Samples were collected in a 180-cm^3 soil can to determine volumetric soil moisture and bulk density of the organic and mineral horizons. Additional soil was collected to ensure adequate material for all the analyses.

Following collection, samples were kept frozen until they were analyzed in the UAF Forest Soils Laboratory. Samples were dried at 65 ^{0}C until they reached a constant mass (approximately three weeks) to determine gravimetric and volumetric soil moisture and bulk density (Peters 1965, Gardner 1986). The samples were ground using a mortar and pestle. The gravel fraction and coarse organic matter were removed using a 2-mm sieve. Soil pH was determined using the saturated paste method (McLean 1982) and an Oakton 810 Series pH meter. Soils were ashed at 550 °C for seven hours to determine percent soil organic matter (SOM). The Bouyoucos hydrometer method (Bouyoucos 1936) was used to determine the percentage of sand, silt, and clay for each sample.

Table 1. *Sampling strategy for measuring trace-gas fluxes, NIRPO site, Prudhoe Bay, Alaska, July 2021.*

Transect	Landform	Surface form element	Vegetation type	Number of samples
T6	Residual surface	Polygon flat center	U3	3
T6	Residual surface	Polygon flat center	U4	3
T6	Residual surface	Polygon trough	U4	3
T6	Residual surface	Polygon trough	M2	3
T6	Residual surface	Pond, moss mat	?	3
T6	Residual surface	Pond, bare	?	3
T7	Older drained lake basin	Low-centered polygon rim	U4	3
T7	Older drained lake basin	Low-centered polygon center	M2	3
T7	Older drained lake basin	Low-centered polygon trough	M4	3
T8	Younger drained lake basin	Featureless	M2	3
T8	Younger drained lake basin	Featureless	M4	3

3.6 *Trace-gas flux study (A. Kade)*

Trace-gas fluxes were measured during 16-24 July 2021 at 27 terrestrial and six aquatic plots co-located with the terrestrial and aquatic plots selected for surveys. Three representative plots were selected for each

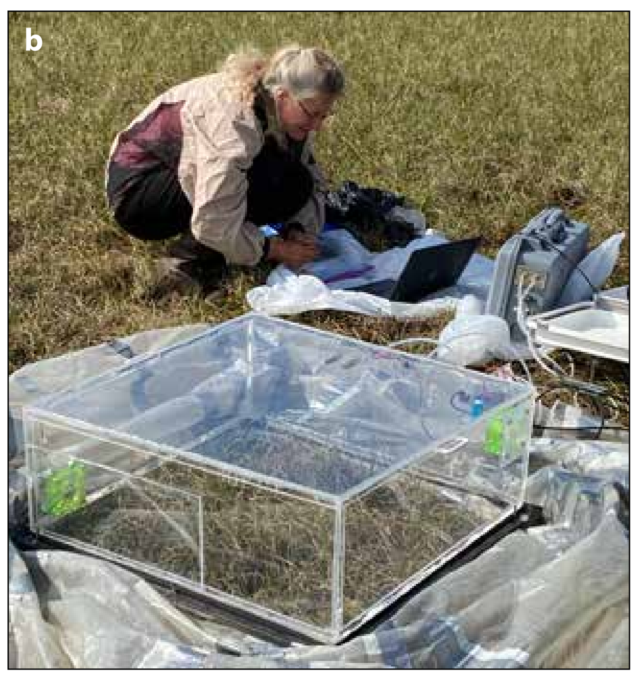


Figure 36. *Trace-gas flux measurements.* ***a.*** *Anja Kade and Josephine Mahoney preparing to make flux measurements using a 0.7-m x 0.7-m chamber.* ***b.*** *Anja Kade recording trace-gas flux and respiration in a wet-tundra plant community. (Photos: J.L. Peirce, IMG 4212, IMG 4197)*

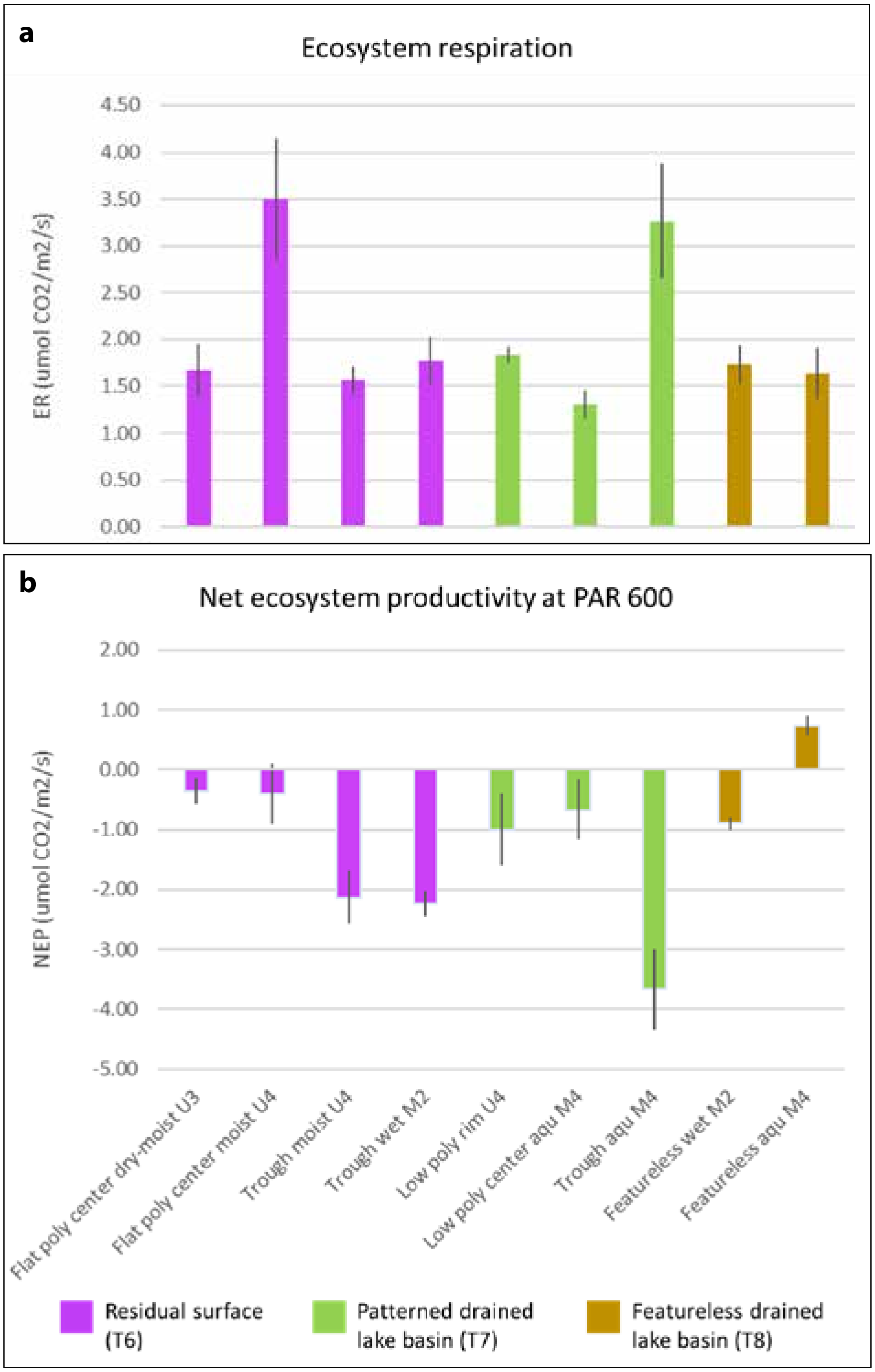


Figure 37. ***a.*** *Mean ecosystem respiration and* ***b.*** *net ecosystem productivity at PAR 600. Preliminary analysis of peak-season* CO_2 *fluxes indicate that net ecosystem exchange (NEE) was generally greater in troughs than polygon centers or rims, with the highest* CO_2 *uptake occurring in the very wet M4 troughs.*

vegetation type on various patterned-ground features, such as polygon centers, rims, and troughs (Table 1).

Chamber-based methods were used to measure ecosystem respiration (ER) and the light response of net ecosystem exchange (NEE) and gross ecosystem exchange (GEE) at each study plot. Mid-day carbon dioxide, humidity, and methane concentrations were measured by connecting a clear Plexiglas chamber (0.7x0.7x0.25 m) to an LI-7810 portable infrared gas analyzer in closed-path configuration (Li-Cor Inc., Lincoln, Nebraska) and fitting the chamber to a portable rectangular base with an airtight polyethylene skirt (Figure 36). Two small fans mixed the air within the chamber. The LI-7810 recorded internal trace-gas concentrations, while temperature, barometric pressure and photosynthetic active radiation (PAR) were logged simultaneously to a Campbell CR-6 data logger each second over a 40-second period.

At each plot, two to three measurements were taken under full sunlight and three levels of successive

Figure 38. *Helena Bergstedt and Skip Walker examine a soil plug from a terrestrial vegetation plot for C14 dating. Ten basal peat samples were collected in July 2021 for possible dating. (Photo: J.L. Peirce, IMG 4452)*

shading, ending in complete darkness. Shading was provided with layers of fiberglass window screening (approximately 1.5 mm mesh). Each successive layer of shading reduced the ambient light intensity by approximately 50%. To obtain complete darkness for ER measurements, the chamber was covered with an opaque tarp. The chamber was ventilated between measurements.

For each data set, only periods with stable PAR values were used to calculate net CO_2 flux. From these data, a light-response curve was constructed for each plot by interpolating between measured light intensities. Net CO_2 flux was calculated as NEE = (r*V/A)*(dC/dt), where r was air density (mol/m^3), V is the chamber volume (m^3), dC/dt was the rate of change in CO_2 concentration (mmol/mol/s), and A was the surface area of the chamber (m^2). In the preliminary analysis of CO_2 fluxes, NEE values were reported at 600 mmol photons/m^2/s, because this light level occurred consistently in the field. GEE was calculated as the difference between NEE and ER. Negative GEE and NEE values indicate carbon uptake by the vegetation, according to the micrometeorological sign convention.

Preliminary analysis of peak-season CO_2 fluxes indicate that NEE was generally greater in troughs than polygon centers or rims, with the highest CO_2 uptake occurring in the very wet M4 troughs (Figure 37). For example, when comparing results within the same vegetation type, such as moist tundra U4 or wet tundra M4, troughs took up significantly more CO_2 than polygon centers or rims. Presumably, nutrient dynamics in the troughs are more favorable. The CO_2 flux data showed no consistent pattern when considering the chronosequence from old residual surfaces to more recently drained lake basins. Data from the pond plots were erratic without clear trends, possibly due to methodological errors. A new method for aquatic plots will be developed for the July 2022 campaign. Flux data will be archived at the Arctic Data Center project portal (arcticdata.io/catalog/portals/nna-irps).

3.7 Basal peat collection (H. Bergstedt)

On July 19 2021, ten basal peat samples were collected near terrestrial vegetation plots along transects T6–T9 to complement samples collected in 2020 for accelerator mass spectrometry (AMS) C14 dating. Sample sites were chosen at the NIRPO site near plots representing characteristic vegetation types. Each soil plug was described (Figure 38), including thaw depth, water depth, organic thickness, dominant texture, dominant mineral, state of the organic horizon (hemic, fibric, sapric), and depth where the samples were taken (Appendix 6, Table A6.1). After description the soil plug was replaced in the pit. Basal peat samples were frozen for later processing to remove contaminants and extract organic material suitable for C14 dating. Results will be archived in the Arctic Data Center NNA-IRPS project portal.

3.8 Permafrost cryostratigraphy boreholes (M. Kanevskiy)

A total of 66 permafrost boreholes were drilled during 21 August to 7 September 2021 to examine the status of permafrost and the protective layer above ice wedges. New boreholes were drilled at the NIRPO site in six polygon centers and 35 troughs and rims at T6, T7, T8, and T9. At the JS and NIRPO sites, boreholes at 12 thermokarst ponds where aquatic vegetation plots were established were drilled (eight at NIRPO T6 and four at the JS).

At the AS, eight permafrost boreholes were redrilled at transects T3 and T5. A summary of borehole data is in Appendix 7, including borehole locations (Table A7.1); cryostratigraphy, moisture and ground ice content (Table A7.2); and thicknesses of frozen protective layers above ice wedges including comparisons with 2015 AS and 2019 JS data (Table A7.3).

3.9 Permafrost temperature boreholes (D.J. Nicolsky)

Eight permafrost temperature monitoring sites were established on NIRPO transects T6, T7, T8, and T9, and near the road on either side of the Spine Road at the CS. Shallow 1-in diameter boreholes (1.5–2.5 m deep) were drilled at each site, and Hobo Onset temperature sensors were then placed at four depths: at the ground surface, 0.5 m and 1.0 m below the ground surface, and at the bottom of the borehole (1.5–2.5 m below the surface).

Sensors record the temperature every four hours, starting three days after installation on 26 August 2022. Figure 39 shows typical setups for installations in wet and moist sites. Temperatures at the bottom of the borehole varied between -2.5 and -4 ^{0}C at installation.

3.9.1 Temperature-borehole site descriptions

- ***T6:*** Transect T6. High-center polygon, dry end of the moist tundra, vegetation type U3. Maximum depth 2.49 m, temperature at bottom -4 ^{0}C. Coordinates: -148.450731, 70.231876.
- ***T7W:*** West end of transect T7. Marl site, aquatic tundra, standing water most of the year, vegetation type M4. Maximum depth 2.29 m, temperature at bottom -3.9 ^{0}C. Coordinates: -148.446651, 70.230452.
- ***T7E:*** Transect 7 east end. Low-center polygon, wet tundra, no standing water at end of season, vegetation type M2. Maximum depth 2.1 m, temperature at the bottom -3 ^{0}C. Coordinates: -148.443620, 70.230450.
- ***T8W:*** West end of transect T8. No visible troughs or polygons, aquatic tundra, vegetation type M4. Maximum depth 1.5 m (gravel at 1.2 m), temperature at bottom -2.7 ^{0}C. Coordinates: -148.461380, 70.230996.
- ***T8E:*** East end of transect T8. Flat-center polygon, wet tundra, vegetation type M2. Maximum depth 2.06 m, temperature at the bottom -3.6 ^{0}C. Coordinates: -148.457094 70.231716.
- ***T9:*** Transect T9. High-center polygon, moist tundra, vegetation type U4. Maximum depth 2.45 m, temperature at the bottom -4.4 ^{0}C. Coordinates: -148.455061, 70.232227.
- ***CS LD*** (Less Dust): Roadside site, Colleen transect T1, northeast (dusty) side of the road. Maximum depth 2.34 m, temperature at bottom -3.3 ^{0}C. Coordinates: -148.471324, 70.223152.
- ***CS MD*** (More Dust): Roadside site, Colleen transect T2, southwest (dusted and flooded) side of the road. Maximum depth 2.29 m, temperature at bottom -2.8 ^{0}C. Coordinates: -148.471669, 70.222962.

Figure 39. *Typical setups of loggers.* **a.** *A station in a flood prone wet/ aquatic-tundra location where the logger is elevated on a tripod.* **b.** *Station located in moist-tundra site, where the logger case is located on the ground. (Photos: N. Hasson)*

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APPENDICES Data Tables and Photos

LIST OF APPENDICES

APPENDIX 1 Time series of Aerial Images for Colleen and Airport Sites (1949-2015)

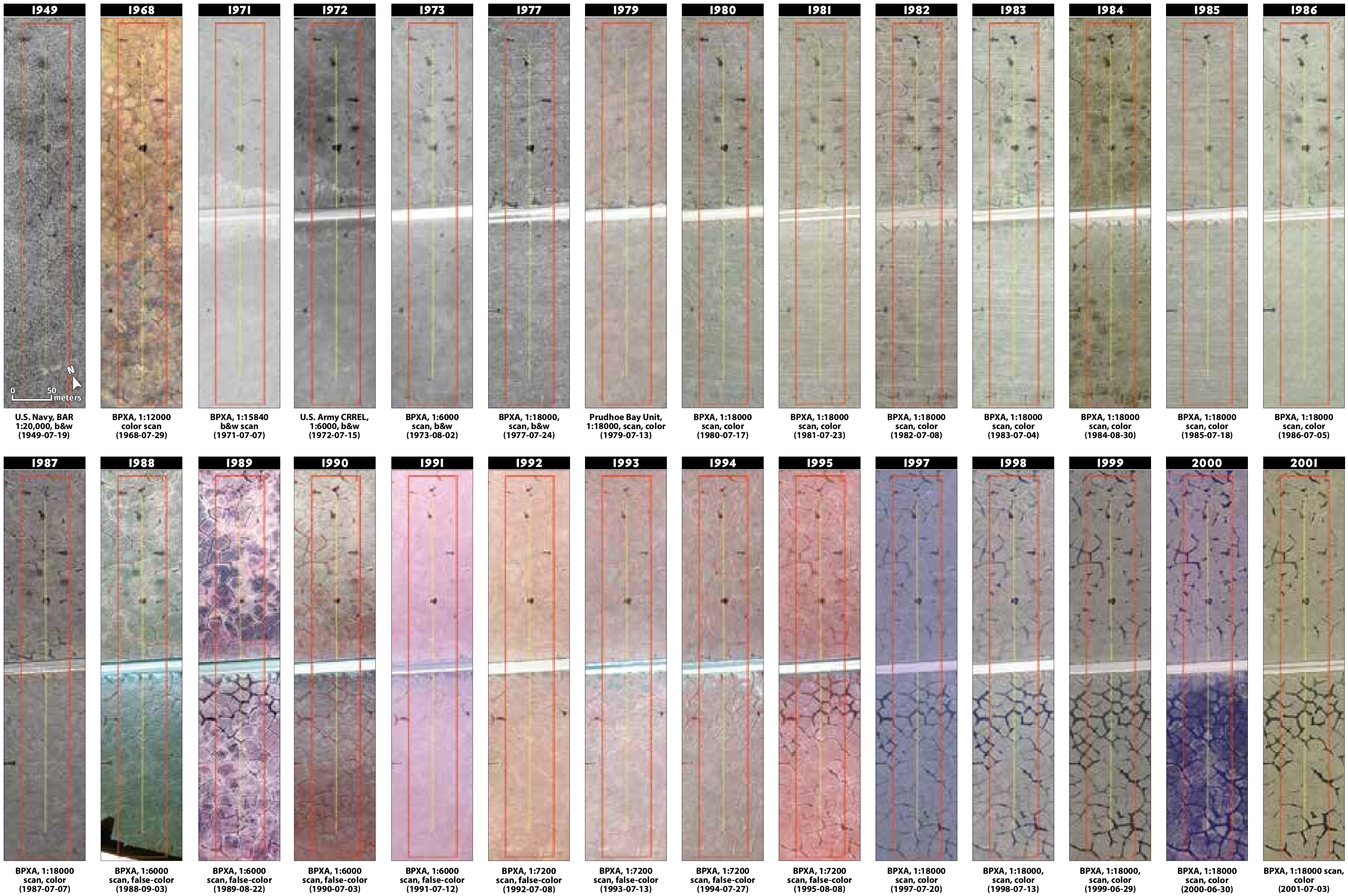


Figure A1.1. *Time series of aerial images of the Colleen Site: 1949–2001. Aerial photos: Quantum Spatial, courtesy BP Exploration (Alaska), Inc.*

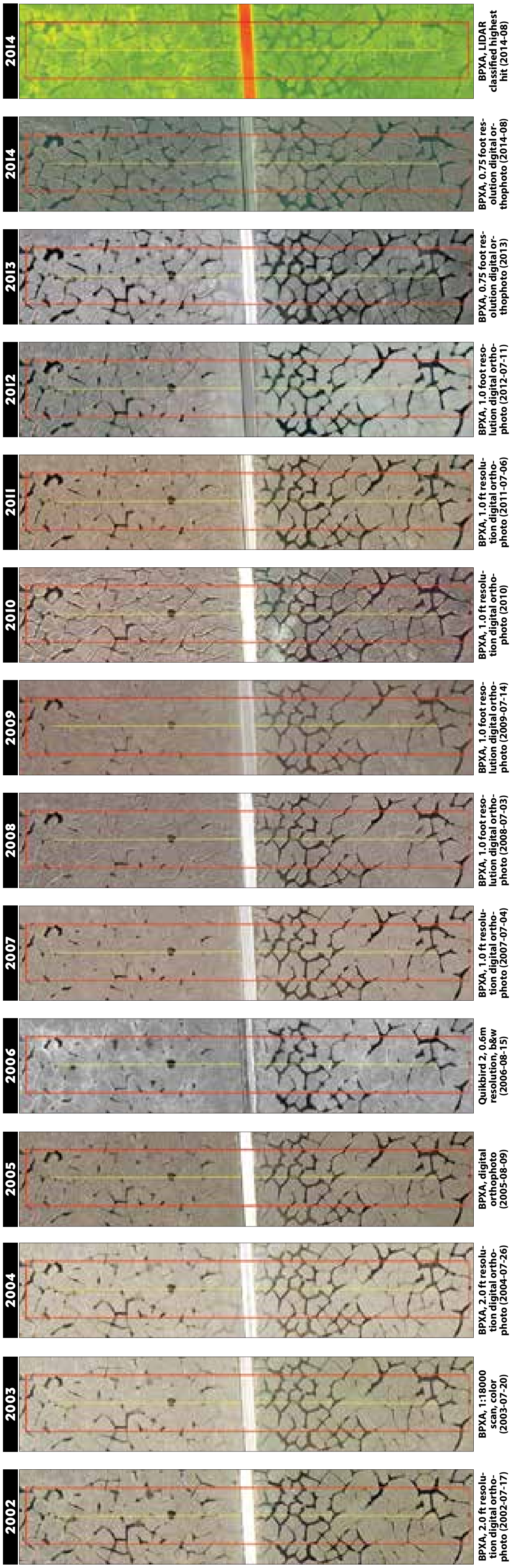


Figure A1.1 *(continued)*

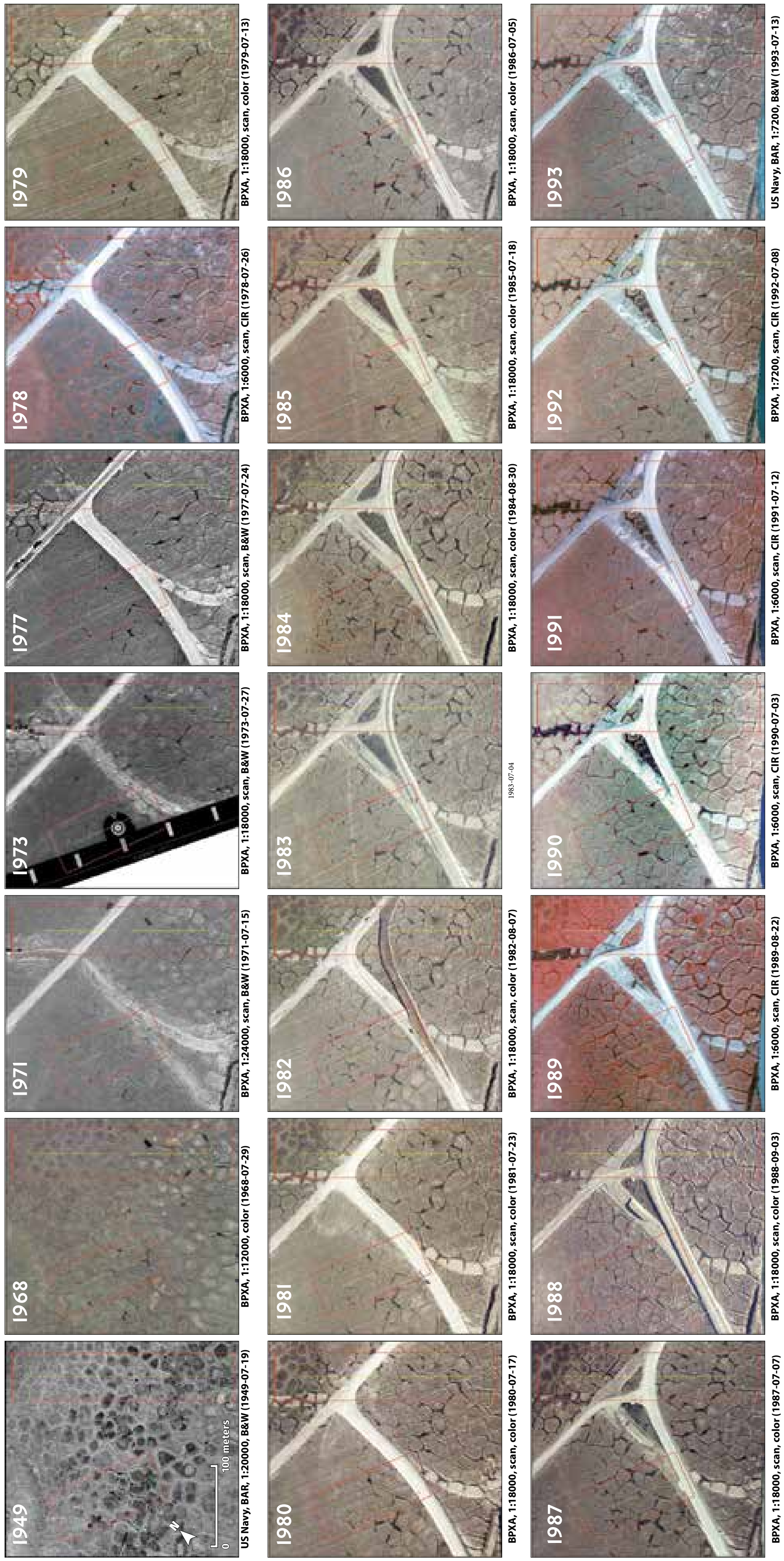


Figure A1.2. *Time series of aerial images of the Airport Site: 1949–1993. Aerial photos: Quantum Spatial, courtesy BP Exploration (Alaska), Inc.*

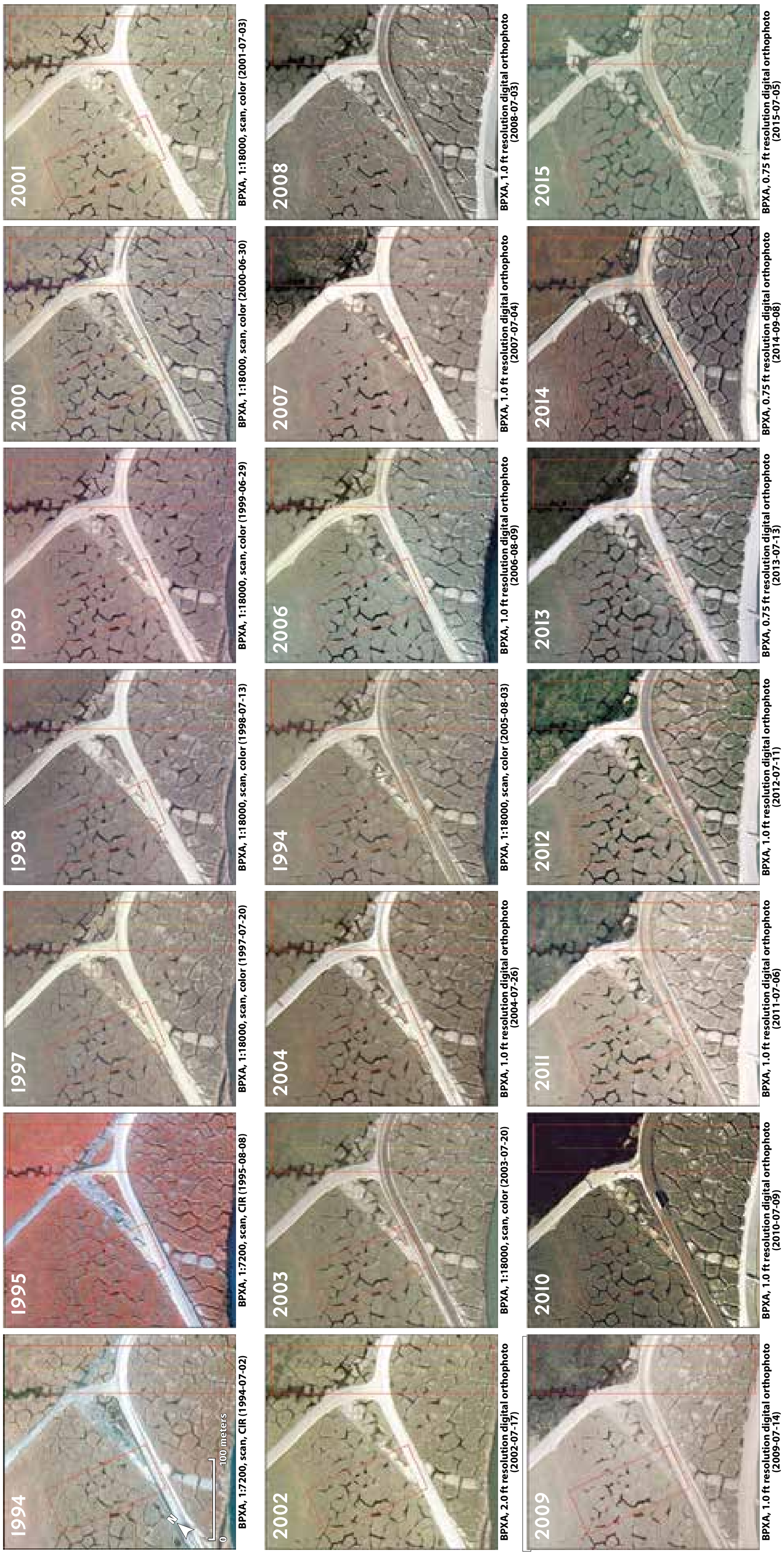


Figure A1.2 *(continued)*

APPENDIX 2 2020 Field Data

Table A2.1. *C14 dating by accelerator mass spectrometry (AMS) of basal peat samples collected from bottom of the peat layer at BM-1, BPI-1,BP-1, BP-3, and BP-4, NIRPO 2020 reconnaissance area, Prudhoe Bay, Alaska, August 17, 2020.* ***NOSAMS batch****: Batch number at the National Ocean Sciences Accelerator Mass Spectrometry (NOSAM) facility where dating was done.*

Sample basin ID	NOSAMS batch	Sample depth (cm)	Material category	Latitude (WGS84 DD)	Longitude (WGS84 DD)	Feature event	Age uncalibrated (years)	Error (+/- years)	Lower bound (BP) (years)	Upper bound (BP) (years)	Description
BP-NIRPO-W-grass	2	13	grass	70.240	-148.460	basal peat	145	15	8	278	moss and grass, rootles, no obvious aquatics
BP-NIRPO-W-moss	2	13	moss	70.240	-148.460	basal peat	300	15	305	429	mostly rootles, some grass, some
BP-NIRPO-W-grass	2	17	grass	70.240	-148.460	basal peat	250	15	156	309	mostly rootles, some grass, some
BP-NIRPO-W-moss	2	17	moss	70.240	-148.460	basal peat	445	15	494	516	moss and grass, rootles, no obvious aquatics
BP1-grass, 24-26, 24-26	2	24	grass	70.236	-148.462	basal peat	620	15	555	649	moss and grass with lots of rootles no obvious aquatics
BP1-moss, 24-26, 24-26	2	24	moss	70.236	-148.462	basal peat	890	15	735	897	moss and grass with lots of rootles no obvious aquatics
BP2, 23-25	2	23	moss	70.234	-148.467	basal peat	690	15	572	671	mostly moss, some grass and rootlets, no obvious aquatics
BP3, 14-15	2	14	grass stems	70.237	-148.454	basal peat	>Modern				detrital grass with very little moss, no obvious aquatics
BP4, 44-45	2	44	moss	70.236	-148.446	basal peat	1,640	15	1418	1546	moss and grass with lots of rootles no obvious aquatics

Table A2.2. *Cryostratigraphy, moisture and ground-ice content of soil sampled from permafrost boreholes, Airport and Colleen Sites, Prudhoe Bay, Alaska, August 16-18, 2020.* ***Polgyon feature:*** *Center (C), rim (R), trough (T).* ***Cryostratigraphic unit:*** *Code descriptions are listed below the table.*

Borehole ID	Polygon feature	Sample depth (cm)	Cryostrati-graphic unit (see notes)	Soil texture	Gravimetric moisture content, GMC (% wt)	Volumetric moisture content, VMC (% vol)	Excess ice content, EIC (% vol)
T4-0	C	59-68	ALF-TL	sandy silt	81	67.5	13.1
	R	69-83	IL	silt with peat inclusions	335	89.5	71.5
	T	88-96	IL	silt with peat inclusions	159	80.3	38.5
	T	103-112	SP	silt with peat inclusions	115	74.6	23.7
T4-500	T	50-56	TL	silty sand with peat inclusions	80	67.2	5.48
	T	69-75	IL-PD	silt with peat inclusions	151	79.4	33.2
	T	90-95	IL-PD	silt with peat inclusions	152	77.2	10.5
	T	105-116	SP	silt, sandy silt, sandy peat	189	82.9	42.3
	T	122-131	SP	silt, sandy silt, sandy peat	156	79.9	33.7
	T	139-148	SP	silt, sandy silt, sandy peat	180	80.0	20.9
T4-600	T	59-67	IL-PD	peat, sandy silt	152	77.1	0.63
T1-5T-1/20	T	59-67	ALF-TL	silty sand	68	63.5	0.62
	T	73-81	IL-PD	silty sand with peat inclusions	183	80.2	24.0
T1-10T-1/20	T	54-63	TL	silty sand with peat inclusions	95	70.9	5.32
T1-10T-2/20	T	53-61	IL-PD	sandy silt with peat inclusions	145	76.3	0.6
T1-25T-1/20	T	40-49	ALF-TL	organic-rich silty sand	130	74.3	0.28
T1-50T-2/20	T	37-42	ALF-TL	mostly organic	193	81.1	16.3
T1-50T-5/20	T	45-49	ALF-TL	mostly organic	126	73.7	13.9
T1-50T-7/20	T	41-45	ALF-TL	mostly organic	166	78.7	2.2
T1-50T-9/20	T	58-63	ALF-TL	peat, mineral	123	73.2	3.82

Notes: **Cryostratigraphic unit**: AL – active layer; ALF – frozen active layer (ice-poor; often with dry friable soil horizons closer to the base of the AL); TL – transient layer (relatively ice-poor, mainly with reticulate and/or braided cryostructures); ALF-TL – undifferentiated AL-TL (no distinctive boundary between AL and TL); IL – intermediate layer, usually ice rich (thick belts, mainly ataxitic cryostructure); IL-PD – intermediate layer, poorly developed (relatively ice-poor, no well-developed belts); QSP – quasi-syngenetic permafrost (buried ILs, usually ice-rich); SP – syngenetic permafrost (thin belts, micro-cryostructures).

Table A2.3. *Comparison of borehole drilling results in 2011-2012 with 2019 at the Jorgenson Site and 2014 with 2020 at the Colleen Site (Transect 1), Prudhoe Bay, Alaska.* ***Microrelief:*** *Polygon trough (T), pond (P).* ***Thaw depth:*** *Active layer thickness (ALT).* ***Permafrost table:*** *Top of the intermediate layer based on analysis of cryostructure.* ***Depth to massive ice:*** *wedge ice (WI), thermokarst-cave ice (TCI). Frozen protective Layer (PL1) includes frozen active layer (ALF) + transient layer (TL) + intermediate layer (IL, PL3).* ***Change in ice wedge status:*** *Undisturbed wedge (UD), initial degradation (D1), advanced degradation (D2), initial stabilization (SI1, SI2), advanced stabilization (SA1, SA2).* ***Results****: Intermediate layer, poorly developed (IL-PD).*

Borehole ID	Date	Micro-relief	Borehole depth (cm)	Water depth (cm)	Thaw depth (ALT) (cm)	Perma-frost table (cm)	Inter-mediate layer (PL3) (cm)	Depth to massive ice (cm)	Frozen protective layer (PL2) (cm)	Change in ice wedge status	Notes
COLLEEN SITE, TRANSECT 1 REDRILLING, 2014 & 2020											
Undisturbed wedges (UD), 2014											
T1-10T-2	8/7/2014	T	95	0	56	56	5	61 (WI)	5	UD	
T1-10T-2/20	8/18/2020	T	63	5	53	56	6	62 (WI)	9	SI2	IL-PD. Some degradation and then stabilization
T1-50T-1	8/7/2014	T	118	0	56	65	5	73 (WI)	18	UD	
T1-50T-1/20	8/18/2020	T	-	0	57	-	-	-	-	-	Did not drill. Looks stable, not big changes
Degradation initial (D1), 2014											
T1-5T-1	8/7/2014	T	98	0	51	60	0	60 (WI)	9	D1	
T1-5T-1/20	8/18/2020	T	87	0	58	72	13	85 (WI)	27	SI1	
T1-10T-1	8/7/2014	T	90	1	58	58	0	58 (WI)	0	D1	
T1-10T-1/20	8/18/2020	T	80	5	48	61	2	63	15	SI2	IL-PD. Some degradation and then stabilization
T1-100T-1	8/7/2014	T	75	0	44	45	0	45 (WI)	1	D1	
T1-100T-1/20	8/18/2020	T	63	32	50	50	0	50 (WI)	0	D2	
Degradation advanced (D2), 2014											
T1-25T-1	8/6/2014	T	75	15	45	47	0	47 (WI)	2	D2	
T1-25T-1/20	8/18/2020	T	62	15	40	49	0	49 (WI)	9	D2 or SI2	Probably some stabilization, still vulnerable
T1-50T-7	8/14/2014	T	81	30	43	43	0	43 (WI)	0	D2	
T1-50T-7/20	8/18/2020	T	53	39	41	45	0	45 (WI)	4	D2 or SI2	Probably some stabilization, still vulnerable
T1-50-8	8/14/2014	T	51	49	41	44	0	44 (WI)	3	D2	
T1-50-8/20	8/18/2020	T	–	50	41	–	–	–	–	-	Did not drill.
T1-50T-9	8/14/2014	T	88	31	51	56	0	56 (WI)	5	D2	
T1-50T-9/20	8/18/2020	T	70	30	58	63	0	63 (WI)	5	D2 or SI2	Probably some stabilization, still vulnerable
Stabilization initial (SI1), 2014											
T1-50T-2	8/13/2014	T	86	0	28	36	0	36 (WI)	8	SI1	
T1-50T-2/20	8/18/2020	T	62	0	37	42	12	54 (TCI+WI)	17?	No big changes	42-54 soil/ice boundary. Probably some stabilization
T1-50T-5	8/13/2014	T	81	0	35	46	0	46 (WI)	11	SI1	
T1-50T-5/20	8/18/2020	T	58	0	45	49	0	49 (WI)	4	No big changes	
T1-200T-1	8/8/2014	T	298	0	35	42	0	42 (WI+TCI)	7	SI1	
T1-200T-2	8/9/2014	T	158	0	27	34	0	34 (WI+TCI)	7	SI1	
T1-200T-3	8/9/2014	T	155	0	30	37	0	37 (TCI+WI)	7	SI1	
T1-200T/20	8/18/2020	T	–	36	33	–	–	–	–	D2	Didn't drill, deep water, significant degradation
Stabilization initial (SI2), 2014											7 boreholes evaluated in 2014-2016. None redrilled.
2014 Mean (n=9)		T	85	8.6	46	50	0.6		5		
2020 Mean (n=9)		T	66	14	48	54	3.7		10		

Table A2.3 (*continued*)

Borehole ID	Date	Micro-relief	Borehole depth (cm)	Water depth (cm)	Thaw depth (ALT) (cm)	Perma-frost table (cm)	Inter-mediate layer (PL3) (cm)	Depth to massive ice (cm)	Frozen protective layer (PL2) (cm)	Change in ice wedge status	Notes
JORGENSON SITE, POND REDRILLING, 2011-12 & 2019											
DA1	6/12/2011	P	72	55	9	49	1	50	41		
DA1-B	6/12/2011	P	49	54	19	49	0	49	30		
DA1/19 (21A-14)	7/11/2019	P	90	65	33	54?	4?	58	25		Stabilization since 2011
DA2	6/12/2011	P	105	48	3	48	0	48	45		Massive ice – TCI (no WI)
DA2/19 (21A-08)	7/11/2019	P	117	42	40	88?	10?	98	58		WI, no TCI. Significant stabilization since 2011
DA3	6/12/2011	P	89	56	11	50	1	51	40		
DA3/19 (21A-06)	7/11/2019	P	93	49	34	66?	?	66	32		Stabilization since 2011
SI3	6/11/2011	P	65	0	13	45	0	45	32		
SI3/19 (21A-10)	7/11/2019	P	85	65	35	50	0	50	15		Deep pond; some degradation since 2011
SI5	7/24/2012	P	83	0.5	[51]	53	2	55	[4]		Deeper pond; some degradation, probably some
SI5/19 (21-A11)	7/13/2019	P	82	20	42	57?	3	60	18		stabilization
2011-2012 mean (DA1-B excl., n=5)		P	83	32			0.8	50			All cores obtained in June/July, so TL and IL not precise
2019 mean (DA1-B excl., n=5)		P	93	48	37		3.4	66			Depths to massive ice increased significantly
2011-2012 mean (DA2, DA1-B excl., n=4)		P	77	28			1.0	50			
2019 mean (DA2, DA1-B excl., n=4)		P	88	50	36		1.8	59			

Table A2.4. *Water depth, thaw depth, and polygon features measured at 1-meter intervals along the NIRPO-1 transect in the NIRPO 2020 reconnaissance area, Prudhoe Bay, Alaska, 17 August 2020. Measurements were taken using a small-diameter calibrated metal thaw probes and wooden meter sticks.* ***Microrelief:*** *Polygon feature (trough, center, rim), or other note.*

Distance (m)	Water depth (cm)	Thaw depth (cm)	Microrelief
0	0	49	center
1	0	50	center
2	0	49	center
3	0	48	center
4	0	50	center
5	0	48	center
6	0	48	center
7	0	41	center
8	0	49	center
9	0	40	center
10	0	54	center
11	19	50	trough
12	39	51	trough
13	46	53	trough
14	60	34	trough
15	51	51	trough
16	37	57	trough
17	18	57	trough
18	0	51	center
19	0	46	center
20	0	46	center
21	0	44	center
22	0	49	center
23	0	44	center
24	0	49	center
25	0	45	center
26	0	44	center
27	0	34	inter hummock
28	0	40	center
29	0	35	rim
30	0	44	rim
31	0	44	rim
32	15	44	trough
33	25	48	trough
34	39	38	trough
35	38	31	trough
36	16	52	trough
37	17	41	trough
38	0	40	rim
39	0	41	rim
40	0	51	rim
41	0	43	rim
42	0	45	center
43	0	41	center
44	0	42	center
45	0	39	center
46	0	39	center
47	0	44	center
48	0	42	center
49	0	46	center
50	0	44	center
51	0	45	center
52	0	49	center
53	0	46	center
54	0	47	center
55	0	44	center
56	0	43	center
57	0	30	trough
58	0	26	trough
59	0	35	trough
60	0	34	trough
61	0	35	trough
62	0	35	trough
63	0	25	trough
64	2	31	trough
65	0	48	trough
66	3	50	wet
67	0	60	rim
68	0	67	rim
69	0	45	center
70	0	36	center
71	0	37	center
72	0	38	center
73	0	39	center
74	0	40	center
75	0	41	center
76	0	40	center
77	0	40	center
78	0	36	center
79	0	34	center
80	0	41	center
81	0	34	trough
82	0	45	center
83	0	44	center
84	0	35	center
85	0	37	center
86	0	43	center
87	0	40	center
88	0	40	center
89	0	42	center
90	0	43	center
91	0	45	center
92	0	55	center
93	17	45	trough
94	30	41	trough
95	23	51	trough
96	2	58	trough
97	0	59	rim
98	0	35	center
99	0	31	center
100	0	39	center
Mean (cm)	**4.9**	**43.4**	
Std deviation	**12.5**	**7.4**	
Std error	**1.24**	**0.74**	

Table A2.5. *Water depth, thaw depth, and polygon features measured at 1-meter intervals along three transects (BM-1, BP-1, and BP-2) in the NIRPO 2020 Reconnaissance Area, Prudhoe Bay, Alaska, 17 August 2020. Measurements were taken using a small-diameter calibrated metal thaw probes and wooden meter sticks. Field notes may include microrelief (e.g. polygon trough, center, rim), vegetation type codes, and presence of water or gravel.* ***Field Notes****: See Appendix 4, Tables A4.7 for vegetation type codes. Most other notes describe polygon feature.*

	Basin margin 1 (BM-1)			Basal peat 1 (BP-1)			Basal peat 2 (BP-2)		
Distance (m)	**Water depth (cm)**	**Thaw depth (cm)**	**Field notes**	**Water depth (cm)**	**Thaw depth (cm)**	**Field notes**	**Water depth (cm)**	**Thaw depth (cm)**	**Field Notes**
0	0	35	U4	0	40	-	4	36	-
1	0	34	U4	1	42	-	0	44	-
2	0	35	U4	0	40	-	0	44	-
3	0	35	U4	0	39	-	0	43	-
4	0	31	U4	0	40	-	0	43	-
5	0	31	U4	0	34	rim	0	40	-
6	0	38	U4	4	32	trough	0	39	rim
7	0	34	U4	0	44	-	0	35	rim
8	0	43	rim	0	36	-	0	36	trough, M2
9	0	37	trough	0	36	-	0	37	-
10	0	41	rim	0	38	-	0	40	-
11	0	33	U4	0	40	-	0	41	-
12	0	35	U4	0	39	-	0	41	-
13	0	42	M2	0	40	-	0	45	-
14	0	46	M2	0	40	-	0	44	-
15	0	45	M2	0	43	-	0	44	-
16	0	47	M2	0	39	-	0	44	-
17	0	44	M2	0	43	-	0	41	-
18	0	48	M2	1	41	-	0	40	-
19	0	44	M2	1	39	-	0	41	-
20	0	41	M9	0	36	-	0	39	-
21	0	33	rim	0	38	rim	0	40	-
22	0	34	rim	7	32	trough	0	42	-
23	0	30	U4, trough	1	29	-	0	41	-
24	0	34	rim	0	36	rim	0	40	-
25	0	35	rim	0	39	-	0	45	-
26	0	33	rim	0	38	-	0	45	-
27	0	35	rim	0	39	-	0	45	-
28	0	37	rim	0	38	-	0	44	-
29	0	37	rim	0	39	-	0	45	-
30	0	37	rim	0	44	-	0	40	-
31	0	36	rim	3	37	-	0	35	rim, U4
32	0	41	rim	0	40	-	0	35	trough, M2
33	7	29	trough	0	36	-	0	40	-
34	0	39	rim	0	36	-	0	39	-
35	0	34	margin rim	0	40	rim	0	40	-
36	0	38	U4	0	29	trough	0	41	-
37	0	37	U4	0	29	rim; lots of moss	0	43	-
38	0	39	U4	0	29	lots of moss (tomnit)	0	40	-
39	0	35	U4	0	35	edge of basin	0	40	-
40	0	36	U4	0	40	basin	0	40	-
Mean (cm)	**0.2**	**37.3**		**0.4**	**37.7**		**0.10**	**40.90**	
Std deviation	**1.1**	**4.7**		**1.3**	**4.0**		**0.62**	**2.93**	
Std error	**0.17**	**0.74**		**0.21**	**0.62**		**0.10**	**0.46**	

Table A2.6. *Water depth, thaw depth, and polygon features measured at 1-meter intervals along a 250-m transect at the Jorgenson site, Prudhoe Bay, Alaska, 15 August 2020. Measurements were taken using a small-diameter calibrated metal thaw probes and wooden meter sticks.* ***Microrelief****: Polygon feature (trough, center, rim).*

Distance (m)	Water depth (cm)	Thaw depth (cm)	Micro-relief
0	0	46	-
1	0	45	-
2	0	56	-
3	0	40	-
4	0	50	-
5	0	43	-
6	0	44	-
7	0	46	-
8	0	48	-
9	0	47	-
10	0	50	-
11	0	46	-
12	0	49	-
13	0	50	-
14	0	40	-
15	0	54	-
16	0	50	-
17	0	54	-
18	0	49	-
19	0	40	-
20	0	48	-
21	0	36	-
22	0	34	-
23	0	48	-
24	0	60	-
25	22	38	trough
26	25	38	trough
27	26	38	trough
28	7	52	-
29	0	45	-
30	0	49	-
31	0	52	-
32	0	50	-
33	0	52	-
34	0	40	-
35	0	35	-
36	0	35	-
37	0	35	-
38	0	49	-
39	0	38	-
40	0	40	-
41	0	41	-
42	0	49	-
43	0	34	-
44	0	45	-
45	0	37	-
46	0	42	-
47	0	50	-
48	0	50	-
49	0	55	-
50	0	58	-
51	0	54	-
52	0	57	-
53	0	55	-
54	0	55	-
55	0	52	-
56	0	52	-
57	0	42	-
58	0	59	-
59	25	35	trough
60	26	39	trough
61	24	33	trough
62	0	56	-
63	0	44	-
64	0	54	-
65	0	53	-
66	0	52	-
67	0	52	-
68	0	56	-
69	0	53	-
70	0	55	-
71	0	57	-
72	37	38	trough
73	45	42	trough
74	39	45	-
75	0	71	-
76	0	48	-
77	0	55	-
78	0	52	-
79	0	47	-
80	0	49	-
81	0	43	-
82	0	44	-
83	0	38	-
84	0	51	-
85	20	40	trough
86	0	59	-
87	0	46	-
88	0	48	-
89	0	50	-
90	0	55	-
91	0	58	-
92	0	50	-
93	0	50	-
94	0	50	-
95	25	50	trough
96	51	54	trough
97	58	45	trough
98	19	70	trough
99	5	55	-
100	0	63	-
101	18	45	trough
102	22	47	trough
103	23	50	trough
104	29	43	trough
105	29	43	trough
106	23	45	trough
107	10	50	trough
108	0	55	-
109	0	45	
110	0	40	-
111	0	56	-
112	19	52	trough
113	12	48	trough
114	0	46	-
115	0	51	-
116	0	54	-
117	0	54	-
118	0	58	-
119	0	56	-
120	0	58	-
121	0	55	-
122	0	49.0	-
123	0	45	-
124	0	47.0	-
125	0	51.0	trough
126	0	50	-
127	0	49	-
128	0	51	-
129	0	42	-
130	0	50	-
131	0	54	-
132	0	56	-
133	0	55	-
134	0	51	-
135	0	60	-
136	0	49	-
137	0	55	-
138	0	34	trough
139	0	54	
140	0	46	-
141	0	47	-
142	0	51	-
143	0	62	-
144	17	61	trough
145	51	53	trough
146	63	51	trough
147	55	54	trough
148	25	60	trough
149	0	61	-
150	0	54	-
151	0	53	-
152	0	51	-
153	0	54	-
154	0	52	-
155	0	54	-
156	0	54	-
157	0	54	-
158	0	58	-
159	0	55	-
160	0	57	-
161	0	54	-
162	0	48	-
163	0	55	-
164	0	62	-

Table A2.6 (*continued*)**.** *Jorgenson site 250-m transect.*

Distance (m)	Water depth (cm)	Thaw depth (cm)	Micro-relief
165	10	50	trough
166	0	50	
167	4	50	trough
168	7	49	trough
169	9	51	trough
170	10	44	trough
171	0	60	trough
172	0	46	-
173	0	52	-
174	0	53	-
175	0	50	-
176	0	52	-
177	0	49	-
178	0	52	-
179	0	50	-
180	0	53	-
181	0	53	-
182	0	55	-
183	0	52	-
184	0	70	-
185	36	53	trough
186	49	51	trough
187	40	54	trough
188	16	53	trough
189	0	50	-
190	0	42	-
191	0	48	-
192	0	52	-
193	0	56	-
194	0	56	-
195	0	58	-
196	0	51	-
197	0	51	-
198	0	53	-
199	0	53	-
200	0	54	-
201	0	47	-
202	0	46	-
203	0	46	-
204	0	50	-
205	0	52	-
206	0	50	-
207	0	53	-
208	0	52	-
209	0	55	-
210	0	54	-
211	0	46	-
212	0	42	-
213	0	41	-
214	0	46	-
215	0	50	-
216	8	48	trough
217	21	59	trough
218	51	40	trough
219	31	53	trough

Distance (m)	Water depth (cm)	Thaw depth (cm)	Micro-relief
220	0	61	-
221	0	47	-
222	0	42	-
223	0	41	-
224	0	46	-
225	0	46	-
226	0	49	-
227	0	51	-
228	0	49	-
229	0	52	-
230	0	44	-
231	0	40	-
232	0	48	-
233	0	41	-
234	0	53	-
235	0	51	-
236	0	52	-
237	0	53	-
238	0	54	-
239	0	52	-
240	0	53	-
241	0	55	-
242	0	49	-
243	0	45	-
244	0	49	-
245	25	55	trough
246	58	45	trough
247	56	49	trough
248	28	57	trough
249	23	41	trough
250	10	33	trough
Mean (cm)	**5.4**	**49.7**	
Std deviation	**12.9**	**6.6**	
Std error	**0.82**	**0.42**	

Table A2.7. *Water depth and thaw depth measured at 1-meter intervals along transects T1 and T2 at the Colleen site, Prudhoe Bay, Alaska, 15 August 2020.*

Distance from road (m)	Transect 1 (T1)		Transect 2 (T2)	
	Water depth (cm)	Thaw depth (cm)	Water depth (cm)	Thaw depth (cm)
0	0	60	-	-
1	0	45	0	65
2	0	105	0	69
3	0	77	0	64
4	0	60	0	65
5	0	60	0	66
6	0	61	0	68
7	0	61	9	51
8	0	59	0	60
9	0	69	0	53
10	0	68	0	59
11	0	64	0	57
12	0	65	0	58
13	0	64	0	53
14	0	65	0	56
15	0	64	13	66
16	0	65	39	71
17	0	65	71	58
18	0	64	76	55
19	0	64	61	61
20	0	65	37	62
21	0	61	7	67
22	0	55	0	53
23	0	60	0	53
24	0	59	0	57
25	2	63	0	57
26	27	48	0	57
27	25	49	0	58
28	25	40	0	56
29	25	30	0	56
30	1	63	0	54
31	0	45	0	47
32	0	63	0	51
33	0	58	0	51
34	0	58	0	53
35	0	45	3	57
36	0	47	25	57
37	1	44	39	50
38	17	42	26	56
39	22	47	24	56
40	1	55	25	53
41	0	55	28	49
42	0	47	25	54
43	0	46	36	45
44	0	49	39	41
45	0	49	45	44
46	0	59	50	33
47	0	44	45	36
48	0	45	40	38
49	0	45	16	56
50	0	49	0	45
51	0	45	0	42
52	0	54	0	54
53	0	53	0	55
54	0	55	0	57
55	0	55	0	53
56	0	57	0	55
57	0	53	0	48
58	0	50	0	53
59	0	44	0	54
60	0	55	0	56
61	0	50	0	53
62	0	55	0	44
63	0	59	0	45
64	0	59	0	45
65	0	58	0	42
66	0	50	0	41
67	0	49	0	50
68	0	46	0	63
69	0	42	7	51
70	0	40	9	49
71	9	57	4	56
72	44	60	0	54
73	49	60	0	55
74	54	66	0	50
75	60	59	0	45
76	59	44	0	42
77	4	5	0	47
78	0	50	0	45
79	0	35	0	47
80	0	49	0	41
81	0	49	0	42
82	0	53	0	46
83	0	47	0	64
84	0	47	10	86
85	0	44	45	55
86	0	44	64	38
87	0	43	55	43
88	0	43	42	55
89	0	42	36	58
90	0	51	24	71
91	0	55	18	72
92	0	46	9	67
93	19	46	21	71
94	37	32	0	67
95	26	42	0	47
96	25	40	0	50
97	0	61	0	55
98	0	60	0	52
99	0	50	0	51
100	0	45	0	53
105	0	64	0	63
110	0	44	0	68
115	0	47	0	47
120	0	48	0	65
125	0	65	0	78
130	0	51	0	53
135	0	54	16	50
140	0	54	0	48
145	0	43	0	47
150	0	51	0	54
155	0	45	0	57
160	0	50	0	56
165	27	43	0	58
170	0	35	26	59
175	0	50	0	48
180	9	50	0	41
185	0	49	0	53
190	0	48	0	51
195	0	43	0	50
200	10	47	0	48
Mean (cm)	**4.8**	**52.3**	**9.7**	**54.1**
Std deviation	**12.6**	**10.8**	**17.8**	**8.9**
Std error	**1.14**	**0.98**	**1.66**	**0.82**

Table A2.8. *Water depth and thaw depth measured at 1-meter intervals along three transects (T3, T4 and T5) at the Airport Site, Prudhoe Bay, Alaska, 16 August 2020. Measurements were taken using a small-diameter calibrated metal thaw probes and wooden meter sticks.*

Distance from road (m)	Transect 3 (T3)		Transect 4 (T4)		Transect 5 (T5)	
	Water depth (cm)	Thaw depth (cm)	Water depth (cm)	Thaw depth (cm)	Water depth (cm)	Thaw depth (cm)
0	-	-	34	>106	-	-
1	-	-	14	94	-	-
2	-	-	1	74	-	-
3	-	-	10	59	-	-
4	0	65	19	57	-	-
5	0	57	21	59	-	-
6	0	59	21	67	-	-
7	0	50	20	81	-	-
8	0	45	27	63	-	-
9	0	44	23	56	-	-
10	0	61	18	60	-	-
11	0	49	19	61	-	-
12	0	49	20	61	-	-
13	0	58	29	64	-	-
14	0	55	40	71	-	-
15	0	55	29	81	-	-
16	0	63	18	96	-	-
17	0	53	18	105	-	-
18	0	57	25	104	-	-
19	0	57	26	>130	-	-
20	0	59	50	>50	0	71
21	0	64	59	>113	12	55
22	0	58	40	>116	18	50
23	0	57	25	120	21	47
24	0	57	25	111	31	36
25	0	58	30	117	0	61
26	0	49	39	113	0	53
27	0	49	40	110	0	54
28	0	48	61	>104	0	53
29	0	51	71	-	0	64
30	0	49	65	-	0	60
31	0	51	54	101	0	64
32	0	56	45	96	0	65
33	0	69	47	71	0	50
34	0	38	42	82	0	45
35	0	49	60	73	0	40
36	0	52	85	64	0	49
37	0	57	90	69	0	52
38	0	49	94	51	0	49
39	0	54	49	67	20	40
40	0	57	45	57	0	51
41	0	50	39	46	0	59
42	0	47	39	51	0	55
43	0	48	23	63	0	59
44	0	51	35	54	0	59
45	0	60	37	59	0	62
46	0	43	48	50	0	63
47	0	81	44	60	0	60
48	0	55	70	52	0	55
49	1	56	52	70	0	49
50	0	66	40	60	0	46
51	0	61	32	53	0	44
52	0	53	23	59	0	41
53	0	50	16	59	0	45
54	0	56	20	49	0	45
55	0	59	17	48	0	45
56	0	61	15	50	0	45
57	0	60	17	48	0	47
58	0	60	17	47	0	42
59	0	58	14	54	0	46
60	0	63	18	46	0	49
61	0	56	17	46	0	49
62	0	53	14	46	0	52
63	0	56	7	52	0	59
64	0	51	14	42	0	59
65	0	44	17	38	0	60
66	0	42	13	45	0	59
67	0	51	5	55	0	53
68	0	77	5	53	0	42
69	1	51	17	38	0	53
70	5	52	13	45	35	42
71	0	44	16	44	41	48
72	0	79	22	39	31	50
73	0	48	20	48	0	55
74	0	55	22	42	0	50
75	0	61	10	54	0	51

Table A2.8 (*continued*). *Airport site, transects T3, T4 and T5.*

Distance from road (m)	Transect 3 (T3)		Transect 4 (T4)		Transect 5 (T5)	
	Water depth (cm)	Thaw depth (cm)	Water depth (cm)	Thaw depth (cm)	Water depth (cm)	Thaw depth (cm)
76	0	59	12	44	0	54
77	0	55	10	46	0	49
78	0	56	10	49	0	51
79	0	56	19	47	0	53
80	0	59	20	57	0	51
81	0	55	13	72	0	52
82	0	52	12	73	0	52
83	0	69	13	76	0	50
84	0	64	12	77	16	47
85	0	60	13	72	24	42
86	0	59	17	61	0	51
87	0	65	20	45	0	49
88	0	53	17	47	0	47
89	0	51	20	44	0	49
90	0	59	20	44	0	45
91	0	55	11	51	0	44
92	0	61	11	45	0	45
93	0	59	20	39	13	30
94	0	65	17	43	0	49
95	0	65	20	38	0	43
96	0	54	14	43	0	49
97	0	54	16	41	0	53
98	0	61	14	44	0	48
99	0	60	18	39	0	51
100	0	67	14	41	0	49
Mean (cm)	**0.1**	**56.1**	**27.3**	**60.8**	**3.2**	**50.7**
Std deviation	**0.5**	**7.4**	**18.8**	**20.1**	**8.9**	**7.0**
Std error	**0.05**	**0.75**	**1.87**	**2.09**	**0.99**	**0.78**

APPENDIX 3 2021 Transect Data

Table A3.1. *Water depth, thaw depth, and environmental variables at 1-meter intervals along transects T1 and T2 at the Colleen site, Prudhoe Bay, Alaska, 24 August 2021.* ***Vegetation height*** *was measured above the ground or water surface.* ***Vegetation type and Microrelief:*** *See Appendix 4, Tables A4.7 and A4.5 respectively for code descriptions.*

Distance from road (m)	Transect 1 (T1)					Transect 2 (T2)				
	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief
0	0	110	20	B	RB	0	125	0	B	RB
1	0	110	10	CARAQU, SALOVA	RB	0	118	1	PUCPHR	RB
2	0	100	12	Trench berm	RB	0	103	1	B	RB
3	0	72	10	U4d	RB	0	90	12	CARAQU	RB
4	0	60	14	U4d	FC	0	82	10	CARAQU	HC
5	0	61	15	U4d	R	0	74	15	M2d	HC
6	0	63	13	U4d	LC	0	75	13	M2d	HC
7	0	66	10	U4d	R	8	60	16	M2d	T
8	0	58	13	M2d	T	0	68	18	M2d	HC
9	0	67	12	U4d	R	0	63	20	M2d	HC
10	0	68	15	U4d	R	0	67	18	M2d	HC
11	0	67	15	U4d	R	0	65	14	M2d	HC
12	0	73	14	U4d	R	0	58	20	M2d	HC
13	0	68	12	M2d	LC	0	59	15	M2d	HC
14	0	68	12	M2d	LC	0	64	25	E1D	HC
15	0	68	10	M2d	LC	18	70	34	E1d	T
16	0	69	14	M2d	LC	50	70	0	E1d	T
17	0	69	10	M2d	LC	75	53	20	HIPVUL	T
18	0	69	10	M2d	LC	50	70	10	W	T
19	0	67	13	M2d	LC	30	68	37	E1d	T
20	0	67	15	M2d	LC	5	63	22	HIPVUL	T
21	0	66	13	U4d	LC	8	67	25	E1d	T
22	0	61	10	U4d	LC	0	62	15	M2d	HC
23	0	65	12	U4d	R	0	62	15	M2d	HC
24	0	68	15	U4d	R	0	60	13	M2d	HC
25	0	62	30	E1d	T	0	63	15	M2d	HC
26	0	52	16	E1d	T	0	60	10	M2d	HC
27	0	59	35	E1d	T	0	61	12	M2d	HC
28	0	50	28	E1d	T	0	63	15	M2d	HC
29	0	47	30	E1d	T	0	63	14	M2d	HC
30	0	47	17	E1d	T	0	61	15	M2d	HC
31	0	47	22	M2d	R	0	61	12	M2d	HC
32	0	65	16	U4d	R	0	39	15	M2d	HC
33	0	62	16	U4d	R	0	61	14	M2d	HC
34	0	61	14	U4d	R	0	62	17	M2d	HC
35	0	61	5	U4d	R	10	64	35	E1d	T
36	0	46	18	U4d	T	38	50	47	E1d	T
37	0	46	16	E1d	T	28	59	20	CALGIG	T
38	0	47	30	E1d	T	24	57	40	E1d	T
39	0	32	0	E1d	T	18	56	34	E1d	T
40	0	54	23	E1d	T	20	53	34	E1d	T
41	0	54	20	U4d	R	16	57	35	E1d	T
42	0	51	13	U3d	R	6	52	33	E1d	T
43	0	51	10	M2d	LC	3	49	50	E1d	T
44	0	50	15	M2d	LC	45	48	15	CALGIG	T
45	0	52	15	M2d	LC	48	40	10	HIPVUL	T
46	0	57	14	U4d	R	44	42	15	HIPVUL	T
47	0	48	10	M2d	T	45	36	23	CALGIG	T
48	0	47	17	M2d	T	35	50	15	HIPVUL	T
49	0	49	16	M2d	T	20	63	36	E1d	T
50	0	52	15	M2d	T	0	54	30	E1d	T

Table A3.1 (*continued*). *Colleen site, transects T1 and T2.*

Distance from road (m)	Transect 1 (T1)					Transect 2 (T2)				
	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief
51	0	50	16	U4d	T	0	51	18	U4d	R
52	0	57	13	U4d	R	0	57	15	U4d	R
53	0	55	14	M2d	LC	0	62	16	U4d	R
54	0	57	12	M2d	LC	0	59	20	U4d	R
55	0	58	15	M2d	LC	0	58	15	U4d	R
56	0	60	10	M2d	LC	0	58	15	U4d	R
57	0	59	14	U4d	R	0	51	14	M2d	R
58	0	54	7	U4d	T	0	56	12	M2d	T
59	0	46	14	M2d	T	0	59	12	M2d	T
60	0	56	8	U3d	R	0	58	20	M2d	HC
61	0	54	10	M2d	LC	0	58	15	M2d	HC
62	0	54	13	M2d	LC	0	55	12	M2d	HC
63	0	60	13	U4d	LC	0	53	14	U4d	HC
64	0	60	10	M2d	LC	0	50	15	U4d	HC
65	0	59	12	M2d	LC	0	46	12	U4d	HC
66	0	53	9	M2d	LC	0	46	14	U4d	HC
67	0	51	11	M2d	LC	0	55	12	U4d	HC
68	0	50	11	M2d	LC	0	66	20	U4d	T
69	0	49	12	U4d	R	10	53	30	E1d	P
70	0	48	15	U4d	R	11	55	25	E1d	P
71	12	55	40	E1d	P	5	60	13	HIPVUL	P
72	40	60	0	E1d	P	0	61	14	U4d	HC
73	49	59	0	W1	P	0	56	20	U4d	P
74	70	66	0	W1	P	0	52	17	U4d	HC
75	53	67	15	W1	P	0	54	15	U4d	HC
76	60	57	0	W1	P	0	49	14	U4d	HC
77	38	56	0	E1d	P	0	48	15	U4d	HC
78	0	59	16	M2d	FC	0	48	10	U4d	HC
79	0	45	14	U4d	FC	0	50	10	U4d	HC
80	0	51	15	U4d	FC	0	50	11	U4d	HC
81	0	52	16	U4d	FC	0	47	10	U4d	HC
82	0	55	10	U4d	FC	0	56	9	U4d	HC
83	0	48	13	U4d	FC	3	72	0	B	P
84	0	51	13	U4d	FC	15	90	2	RANHYP	P
85	0	47	12	U4d	FB	54	55	29	CALGIG	P
86	0	43	12	U3d	R	58	48	30	CALIGIG	P
87	0	42	12	U3d	FC	80	20	20	CALIGIG	P
88	0	44	12	U3d	FC	62	38	40	CALIGIG	P
89	0	48	5	U3d	FC	50	48	25	CALIGIG	P
90	0	54	10	U3d	R	37	63	22	CALGIG-RANHYP	P
91	0	59	2	U3d	R	34	60	24	HIPVUL-RANHYP	P
92	0	60	12	U3d	R	8	77	15	RAN-HYP-HIPVUL-CAL-GIG	P
93	9	57	35	E1d	T	22	79	15	Eid	P
94	17	49	30	E1d	T	0	74	11	M2d	T
95	25	46	35	E1d	T	0	52	5	U4d	HC
96	30	40	35	E1d	T	0	53	15	U4d	HC
97	16	47	45	U4d	R	0	60	14	U4d	HC
98	0	62	12	E1	T	0	59	12	U4d	HC
99	0	55	14	U4d	LC	0	68	13	U4d	HC
100	0	49	13	U4d	LC	0	56	14	U4d	HC
105	0	60	16	U3d	R	0	64	15	B	F
110	0	52	11	U4d	R	0	68	10	B	F
115	0	53	12	U4d	R	21	44	15	M4d	T

Table A3.1 (*continued*)**.** *Colleen site, transects T1 and T2.*

Distance from road (m)	Transect 1 (T1)					Transect 2 (T2)				
	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief
120	0	50	4	U3d	R	0	69	17	M2d	FB
125	0	66	2	U3d	R	0	77	24	M2d	FB
130	0	52	14	M2d	LC	0	55	13	M2d	HC
135	0	57	17	M2d	LC	23	53	20	SCOSCO	P
140	1	56	22	M2d	T	0	53	11	U4d	HC
145	0	46	10	U4d	R	0	51	20	M2d	HC
150	0	56	10	U4d	R	0	56	13	M2d	HC
155	0	48	15	U4d	R	0	55	18	U4d	HC
160	0	53	20	M2d	T	0	58	14	M2d	HC
165	27	54	42	E1d	T	0	60	12	M3d	HC
170	0	40	12	U4d	LC	30	58	0	B	T
175	0	58	12	M2d	FC	0	53	18	U4d	HC
180	0	55	20	E1d	P	0	46	14	U4d	HC
185	6	53	15	M2d	LC	0	55	13	E1d	T
190	0	52	13	M2d	LC	0	57	15	U4d	HC
195	0	48	15	U4d	R	2	55	20	E1d	T
200	7	53	24	E1d	T	0	50	18	U4d	HC
Mean (cm)	3.8	56.7	14.7			9.7	59.4	17.3		
Std deviation	12.3	11.2	8.2			18.0	13.5	9.1		
Std error	0.10	.09	.07			0.15	0.11	0.08		

Table A3.2. *Water depth, thaw depth, and environmental variables at 1-meter intervals along transects T3 and T5 (24 August 2021) and transect T4 (27 August 2021), at the Airport site, Prudhoe Bay, Alaska.* ***Vegetation height*** *was measured above the ground or water surface.* ***Vegetation type and Microrelief:*** *See Appendix 4, Tables A4.7 and A4.5 respectively for code descriptions.*

Distance from road (m)	Transect 3 (T3) Water depth (cm)	T3 Thaw depth (cm)	T3 Vegetation height (cm)	T3 Vegetation type	T3 Microrelief	Transect 4 (T4) Water depth (cm)	T4 Thaw depth (cm)	T4 Vegetation height (cm)	T4 Vegetation type, 2015	T4 Microrelief, 2015	Transect 5 (T5) Water depth (cm)	T5 Thaw depth (cm)	T5 Vegetation height (cm)	T5 Vegetation type	T5 Microrelief
0	Road berm	Road berm	Road berm	gravel	RB	9	100	37	E1d	RB	0	n.d.	0	Bare	RB
1	Road berm	Road berm	Road berm	gravel	RB	7	100	25	E1d	RB	0	n.d.	0	Bare	RB
2	Road berm	Road berm	Road berm	gravel	RB	0	73	18	U4d	R	0	75	0	Bare	RB
3	Road berm	Road berm	Road berm	gravel	RB	4	67	36	U4d	R	0	n.d.	0	Bare	RB
4	Road berm	Road berm	Road berm	gravel	RB	10	64	39	M2d	FC	0	n.d.	0	Bare	RB
5	0	65	0	Bare	R	16	62	35	M2d	FC	0	n.d.	0	Bare	Trench
6	0	69	1	Bare	R	17	68	50	M2d	FC	0	n.d.	0	Bare	Trench
7	0	51	18	Bare	R	22	60	49	E1	T	0	n.d.	0	Bare	Trench
8	9	55	25	E1d	T	23	62	53	E1	T	0	n.d.	0	Bare	Trench
9	0	54	28	E1d	T	28	58	50	M2d	FC	0	118	0	Bare	Trench
10	0	66	1	B16	R	13	61	45	M2d	FC	0	110	0	Bare	Trench
11	0	64	0	Bare	HC	14	63	34	M2d	FC	0	100	0	Bare	Trench
12	0	58	0	Bare	R	12	66	45	M2d	FC	0	73	0	Bare	Trench
13	0	60	1	SALOVA/ SALRIC	HC	20	72	52	M2d	FC	0	74	15	Bare/CARA-QU	Trench
14	0	63	1	Bare	HC	35	>100	30	M2d	FC	0	66	15	Bare/CARA-QU	Trench
15	0	63	1	SALOVA	HC	17	108	54	E1	T	0	73	0	Bare	Trench
16	0	62	1	SALOVA	T, edge	12	>100	44	M2d	FC	0	71	0	Bare	Trench
17	0	53	0	Bare	T	13	83	49	M2d	FC	0	63	0	Bare	Trench
18	0	65	0	B17	R	17	>100	54	M2d	FC	0	63	0	Bare	Trench
19	0	65	4	B17	R	19	100	40	M2d	FC	0	70	16	ERIANG	Trench
20	0	63	2	B17	HC	38	>100	43	E1	T	0	72	16	ERIANG	T
21	0	62	5	B17	HC	60	>100	0	E1	T	14	55	45	E1d	T
22	0	61	1	B17	HC	30	>100	58	E1	T	15	58	45	E1d	T
23	0	60	3	B17	HC	27	>100	64	E1	T	20	48	45	E1d	T
24	0	61	4	B17	HC	25	>100	52	M2d	FC	26	43	45	E1d	T
25	0	60	4	B17	HC	30	>100	54	M2d	FC	22	41	45	E1d	T
26	0	54	1	B17	HC	38	>100	53	E1	T	0	65	25	U4d	R
27	0	58	1	B17	R	30	>100	50	E1	T	0	60	15	U4d	R
28	0	55	1	B17	HC, incipient T	55	>100	70	E1	T	16	41	28	E1d	T
29	0	60	2	B17	HC	56	>100	75	E1	T	0	60	18	U4d	R
30	0	59	1	B17	HC	49	>100	66	E1	T	0	61	15	U4d	R
31	0	49	1	Bare	HC	35	>100	59	E1	T	0	61	14	U4d	R
32	0	63	0	Bare	HC	28	>100	66	E1	T	0	66	15	U4d	R
33	0	71	0	Bare	HC	32	65	55	E1	T	0	55	12	U4d	R
34	0	40	35	Willows	T	35	83	64	E1	T	0	50	12	U4d	R
35	0	63	1	Bare	HC	57	66	78	E1	T	0	48	15	M2d	LC

Table A3.2 *(continued). Airport site, transects T3, T4 and T5.*

Distance from road (m)	Transect 3 (T3)					Transect 4 (T4)					Transect 5 (T5)				
	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Microrelief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type, 2015	Microrelief, 2015	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Microrelief
36	0	54	2	FESBRA	HC	68	72	0	W	T	0	52	15	U4d	R
37	0	60	1	Lichens THASUB	HC	79	66	0	W	T	0	54	16	U4d	R
38	0	54	0	Bare	HC	86	56	0	W	T	0	53	25	U4d	R
39	0	60	0	Bare	HC	50	80	70	E1	FC	7	54	33	E1d	T
40	0	59	0	Bare	HC collapsing into T	39	52	66	E1	FC	0	54	20	M2d	T
41	0	58	2	B17	HC	26	59	55	E1	FC	0	62	12	U4d	R
42	0	55	1	B17	HC	34	53	68	E1	FC	0	57	10	U4d	R
43	0	54	2	B17	HC	23	59	46	E1	FC	0	61	5	U4d	R
44	0	58	1	B17	HC	29	64	69	E1	FC	0	63	5	B3d	FB
45	0	68	1	B17	HC	36	52	59	E1	FC	0	64	12	M2d	FB
46	0	58	0	B17	HC collapsed, SAXOPP	37	60	52	E1	FC	0	64	20	M2d	LC
47	0	85	0	Bare	R	32	55	58	E1	FC	0	58	19	M2d	LC
48	0	55	30	E1d	T	70	48	0	E1	FC	0	56	17	M2d	LC
49	0	61	25	E1d	T	48	65	69	W	T	0	53	19	U4d	R
50	0	70	25	M2d	T, collapsed R	31	65	55	E1	T	0	50	17	M2d	R
51	0	70	15	B17	R	24	60	45	E1	FC	0	51	18	M2d	T
52	0	57	3	B17	R	14	64	48	M2d	FC	0	46	20	M2d	T
53	0	57	8	M2d	HC	10	58	52	M2d	FC	0	51	15	M2d	LC
54	0	59	0	M2d	HC	14	57	44	M2d	FC	0	52	15	M2d	LC
55	0	60	10	M2d	HC	13	53	47	M2d	FC	0	48	16	M2d	LC
56	0	62	10	M2d	HC	13	54	41	M2d	FC	0	49	20	M2d	LC
57	0	62	12	M2d	HC	8	56	47	M2d	FC	0	51	18	M2d	LC
58	0	62	5	M2d	HC	13	54	40	M2d	FC	0	48	12	M2d	LC
59	0	61	4	M2d	HC	12	55	40	M2d	FC	0	50	17	U4d	R
60	0	66	0	M2d	R	8	57	40	M2d	FC	0	50	12	U4d	R
61	0	61	4	B17	R	10	52	94	M2d	FC	0	52	14	U4d	R
62	0	59	7	B17	R	6	54	35	M2d	FC	0	56	20	U4d	FC
63	0	59	8	B17	R	2	52	46	M2d	FC	0	60	15	B3d	FB
64	0	57	2	B17	R	6	56	37	M2d	R	0	62	10	B3d	FB
65	0	52	2	Bare	R	10	46	40	M2d	R	31	60	11	U4d	FC
66	0	48	0	B17	R	9	53	42	E1	T	42	61	12	U4d	FC
67	0	63	1	B17	R	5	53	38	U4d	R	35	54	12	U4d	FC
68	0	68	4	B17	T, collapsed R	4	56	37	M2d	FC	0	51	12	U4d	FC
69	0	54	25	E1d	T	7	51	49	M2d	FC	0	62	12	U4d	R
70	5	53	30	E1d	T	10	50	29	M2d	R	0	45	60	E1d	T

Table A3.2 *(continued). Airport site, transects T3, T4 and T5.*

Distance from road (m)	Transect 3 (T3)					Transect 4 (T4)					Transect 5 (T5)				
	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Microrelief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type, 2015	Microrelief, 2015	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Microrelief
71	0	53	24	M2d	T, collapsed R	14	41	44	M2d	FC	0	46	65	E1d	T
72	0	86	8	B17	R	21	35	47	E1	FC	0	55	60	E1d	T
73	0	57	0	Bare	R	16	38	50	E1	FC	0	58	50	U4d	FC
74	0	59	3	B17	HC	21	43	49	E1	FC	0	55	14	U4d	FC
75	0	63	4	B17	HC	4	55	50	U4d	R	0	55	10	U4d	FC
76	0	60	3	B17	HC	5	52	35	M2d	FC	0	55	15	U4d	FC
77	0	60	7	B17	HC	7	50	51	M2d	FC	0	55	15	U4d	FC
78	0	60	2	B17	HC	8	52	47	M2d	FC	0	54	15	U4d	FC
79	0	59	7	B17	HC	10	54	53	M2d	FC	0	55	15	M2d	FC
80	0	60	4	B17	HC	17	58	45	M2d	FC	0	55	15	M2d	FC
81	0	60	4	B17	HC	12	70	0	gravel	FC	0	56	10	U4d	FC
82	0	60	5	B17	HC	10	74	0	gravel	FC	0	56	15	U4d	FC
83	0	75	6	B17	R	10	80	0	gravel	FC	15	56	15	U4d	FC
84	0	63	7	B17	T, collapsed R	11	77	0	gravel	FC	22	48	50	E1d	T
85	0	63	12	U17	T	8	77	0	gravel	FC	0	44	56	E1d	T
86	0	64	14	M10d	T	13	63	0	gravel	FC	0	61	20	U4d	FC
87	0	73	0	Bare	HC	12	55	54	M2d	FC	0	50	12	U4d	FC
88	0	59	3	B17	HC	12	52	39	M2d	FC	0	50	12	U4d	FC
89	0	56	2	B17	HC	15	47	52	M2d	FC	0	52	13	U4d	FC
90	0	61	6	U17	HCr	15	49	57	M2d	FC	0	49	10	U4d	FC
91	0	60	2	B17	HCr	4	56	43	M2d	FC	0	48	13	U4d	FC
92	0	61	4	B17	HCr	9	48	37	U4d	R	0	52	15	U4d	FC
93	0	66	1	B17	HCr	14	45	49	E1	T	12	40	26	E1d	T
94	0	68	5	B17	HCr	13	46	44	E1	T	0	54	20	U4d	FC
95	0	72	2	B17	R	9	50	48	M2d	FC	0	47	13	U4d	FC
96	0	63	10	U17	R	10	45	39	M2d	FC	0	52	15	U4d	FC
97	0	60	8	U17	R	4	48	45	M2d	FC	0	54	16	U4d	FC
98	0	63	7	U17	R	9	47	48	M2d	FC	0	51	15	M2d	FC
99	0	64	2	U17	R	5	51	42	M2d	FC	0	55	10	U4d	FC
100	0	70	10	U17	HCr	9	48	48	M2d	FC	0	57	10	U4d	FC
Mean (cm)	0.1	60.9	5.8			21.2	66.2	43.8			2.7	57.3	16.7		
Std deviation	1.1	6.6	8.0			17.6	19.4	19.1			8.0	12.2	14.3		
Std error	0.01	0.07	0.08			0.18	0.19	0.19			0.08	0.13	0.14		

Table A3.3. *Water depth, thaw depth, and environmental variables at 1-meter intervals along transects T6, T7, and T8 at the NIRPO site, Prudhoe Bay, Alaska, 23 August 2021.* ***Vegetation height*** *was measured above the ground or water surface.* ***Vegetation type and Microrelief:*** *See Appendix 4, Tables A4.7 and A4.5 respectively for code descriptions.*

Distance from road (m)	Transect 6 (T6)					Transect 7 (T7)					Transect 8 (T8)				
	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief
0	5			E1	T	0	42	12	U4	R	NA	NA	NA	U4	R
1	7	48	30	E1	T	0	42	13	U4	R	0	31	12	M2	T
2	7	45	30	E1	T	0	40	7	M2	T	0	31	8	U3	R
3	0	51	16	U3	R	0	46	14	U4	R	0	40	10	U4	LC
4	0	42	10	U3	R	0	45	10	U4	R	0	42	11	U4	LC
5	0	41	18	U4	R	0	37	14	U4	R	0	38	12	U4	LC
6	0	43	12	U3	R	0	33	5	U4	R	0	45	14	U4	LC
7	0	40	15	U4	R	0	36	14	U4	R	4	43	20	M2	LC
8	0	43	7	U3	FC	0	42	7	U4	R	0	43	9	M2	LC
9	0	35	8	U4	FC	0	39	10	U4	R	0	44	12	M2	LC
10	0	33	11	U4	FC	0	42	11	U4	R	0	47	11	M2	LC
11	0	30	11	U2	FC	0	45	13	U4	R	0	45	18	M4	T
12	0	35	15	U4	FC	0	42	9	U4	R	0	54	17	U4	R
13	0	40	11	U4	FC	0	45	12	U4	R	0	34	14	M2	F
14	0	45	11	U4	FC	0	43	11	U4	R	0	41	12	M2	F
15	0	46	13	U3	FC	0	44	12	U4	R	0	40	15	M2	F
16	0	37	15	U4	R	0	39	8	U4	R	0	41	9	M2	P
17	0	48	14	U4	R	0	41	15	U4	R	0	42	10	M2	F
18	0	60	20	U4	R	0	45	10	M2	T	0	44	12	M2	F
19	21	57	35	E1	T	0	47	14	U4	R	0	45	13	M2	F
20	31	49	15	E1	T	0	55	10	U4	R	2	45	15	M2	F
21	0	37	23	E1	T	0	48	15	U4	R	3	47	15	M2	F
22	0	45	21	U4	FC	0	37	10	U4	R	1	47	11	M2	F
23	0	53	21	U4	FC	0	41	13	U4	R	3	45	14	M2	F
24	0	45	20	U4	FC	0	31	5	U4	R	2	44	16	M2	F
25	0	48	21	U4	FC	0	34	4	U4	R	2	45	15	M2	F
26	0	47	22	U4	FC	0	39	5	U4	R	1	46	15	M2	F
27	0	50	9	U4	FC	0	42	3	U4	R	1	43	13	M2	F
28	0	50	17	U4	FC	0	59	4	U4	R	0	46	16	U4	R
29	0	45	18	U2	FC	0	66	16	U4	R	0	41	15	U4	R
30	0	39	22	U2	FC	9	71	21	E1	T	0	41	16	M2	F
31	0	40	15	U4	R	11	55	25	E1	T	0	40	18	M2	F
32	0	40	21	U4	R	20	44	36	E1	T	1	44	12	M2	F
33	0	44	10	U3	R	0	37	10	U4	R	0	44	15	M2	F
34	0	60	30	U4	R	0	49	20	U4	LC	2	41	17	M2	F
35	24	55	15	E1	P	0	48	10	M2	LC	2	41	21	M2	F
36	52	48	14	W	P	3	51	15	M4	LC	4	44	13	M2	F

Table A3.3 *(continued). NIRPO site, transects T6, T7, and T8.*

Distance from road (m)	Transect 6 (T6) Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Transect 7 (T7) Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Transect 8 (T8) Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief
37	48	50	14	W	P	5	50	15	M4	LC	4	45	16	M2	F
38	38	50	10	W	P	5	53	17	M4	LC	4	45	15	M2	F
39	0	65	17	E1	P	8	52	10	M4	LC	4	47	20	M2	F
40	0	62	13	U3	R	9	50	16	M4	LC	4	46	12	M2	F
41	0	43	7	U3	R	6	50	11	M4	LC	4	46	14	M2	F
42	0	40	15	U3	R	6	50	15	M4	LC	1	45	15	M4	F
43	0	44	18	U3	R	0	53	8	M2	LC	3	42	23	M4	F
44	0	45	10	U3	R	0	48	12	U4	LC	3	46	18	M2	F
45	0	50	18	U3	R	0	47	12	U4	R	5	42	18	M4	F
46	0	50	13	U3	R	5	40	13	M2	T	3	45	19	M4	F
47	0	43	14	U3	R		57	14	U4	R	5	44	18	M4	F
48	0	42	20	U3	R		49	16	M2	LC	3	46	16	M4	F
49	0	47	16	U3	R		55	11	M2	LC	5	44	17	M4	F
50	0	44	17	U3	R	4	46	14	M2	LC	7	42	16	M4	F
51	0	45	18	U3	R	1	52	16	M4	LC	5	46	17	M4	F
52	0	44	22	U2	R	5	52	16	M4	LC	3	43	16	M4	F
53	12	63	30	E1	P	5	52	17	M4	LC	3	45	17	M4	F
54	27	61	0	W	P	3	51	12	M4	LC	2	50	15	M4	F
55	33	56	19	CALGIG	P	0	53	12	M2	H	7	45	17	M4	F
56	32	61	16	CALGIG	P	9	45	15	M4	T	6	45	19	M4	F
57	36	54	2	SCOSCO	P	10	45	18	M4	T	7	47	15	M4	F
58	37	57	18	CALGIG,HIPVUL	P	6	45	20	M4	T	8	48	16	M4	F
59	36	62	11	CALGIG	P	1	48	10	M2	T	7	46	16	M4	F
60	43	55	0	W	P	1	45	12	M2	T	3	44	15	M4	F
61	42	56	0	W	P	0	46	11	M2	LC	4	41	16	M4	F
62	42	52	0	W	P	0	45	10	M2	LC	1	41	15	M2	F
63	36	52	10	HIPFUL	P	1	44	12	M2	LC	3	40	15	M4	F
64	29	53	40	E1	P	3	44	16	M2	LC	0	40	16	M4	F
65	22	49	0	W	P	0	45	10	U4	R	3	37	18	M2	F
66	13	48	13	E1	P	0	42	11	U4	R	1	43	19	M2	F
67	0	39	12	U4	R	0	50	7	U4	R	4	43	17	M4	F
68	0	35	15	U3	R	2	44	8	M2	T	4	45	19	M4	F
69	0	46	20	U3	R	0	52	12	M2	F	3	43	18	M2	F
70	0	54	11	U3	R	1	48	15	M2	F	4	47	16	M4	F
71	0	50	18	U4	R	5	48	13	M4	F	4	46	16	M4	F
72	0	45	23	U4	R	3	52	16	M4	F	2	45	19	M4	F
73	0	43	3	U2	R	5	52	16	M4	F	4	40	15	M4	F

Table A3.3 *(continued). NIRPO site, transects T6, T7, and T8.*

Distance from road (m)	Transect 6 (T6)					Transect 7 (T7)					Transect 8 (T8)				
	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief
74	0	48	17	U3	R	5	52	19	M4	F	1	46	14	M2	F
75	0	35	21	U4	T	6	48	20	M4	F	0	50	16	M2	H
76	0	52	20	U3	R	5	49	19	M4	F	1	46	14	M4	F
77	0	40	3	U3	R	4	48	13	M4	F	2	43	15	M2	F
78	0	52	17	U2	R	0	48	18	M2	F	1	44	15	M2	F
79	0	44	12	U2	LC	4	48	17	M4	F	5	37	19	M4	T
80	0	38	13	U2	LC	4	49	16	M2	LC	1	43	16	M2	F
81	0	40	22	U4	R	0	48	15	M2	LC	0	43	16	M2	F
82	0	40	21	U2	R	0	42	17	M2	LC	0	45	16	M2	F
83	0	49	20	U3	R	1	51	11	M2	LC	0	44	19	M2	F
84	0	47	24	U3	R	1	50	10	M2	LC	0	44	18	M2	F
85	0	43	18	U4	R	0	50	10	M2	LC	0	43	19	M2	F
86	0	49	20	U4	R	0	48	12	M2	LC	0	41	19	M2	F
87	0	44	3	U3	B	0	48	11	M2	LC	0	41	15	M2	F
88	0	52	17	U3	R	0	47	14	M2	LC	0	44	13	M2	F
89	0	47	16	U2	R	0	47	15	M2	LC	0	40	13	M2	F
90	0	41	20	U3	R	0	42	13	M2	LC	0	38	15	U4	F
91	0	43	22	U4	R	0	41	11	M2	LC	0	37	12	U4	F
92	0	33	22	U4	T	0	38	13	U4	R	0	35	5	U4	F
93	0	33	15	U4	T	0	47	8	U4	R	0	31	10	U3	B
94	0	46	21	U4	T	0	40	12	M2	LC	0	36	8	U10	B
95	0	49	16	U3	FC	0	45	10	M2	LC	0	34	8	U10	B
96	0	44	16	U3	FC	0	47	12	U4	H	0	37	9	U10	B
97	0	44	14	U3	FC	0	45	9	M2	LC	0	32	10	U10	B
98	0	44	22	U4	FC	0	44	10	M2	LC	0	32	8	U4	F
99	0	45	19	U3	FC	0	40	13	M2	LC	0	33	16	U4	F
100	0	24	NA	U4	T	0	42	12	U4	H	0	35	15	U4	F
101	0	34	26	U2	T	0	46	10	M2	T	0	37	12	U4	F
102	0	37	24	U4	FC	0	40	14	M2	R	0	39	9	M2	F
103	0	41	22	U4	FC	0	41	12	U4	F	0	42	11	M2	F
104	0	28	18	M2	T	0	37	9	U4	F	0	43	12	M2	F
105	0	32	3	M2	T	0	45	8	U4	F	0	43	15	M2	F
106	0	39	26	M2	T	0	35	13	M2	T	0	44	16	M2	F
107	0	55	30	U3	R	0	48	7	U4	R	0	41	12	M2	F
108	0	59	40	U3	R	0	50	10	M2	F	0	39	15	M2	F
109	21	41	15	E1	P	0	59	12	M2	F	0	40	17	M2	F
110	33	51	5	W	P	0	60	10	M2	F	0	38	16	M2	F

Table A3.3 *(continued). NIRPO site, transects T6, T7, and T8.*

Distance from road (m)	Transect 6 (T6)					Transect 7 (T7)					Transect 8 (T8)				
	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief
111	44	49	5	W	P	0	57	9	M2	F	0	39	19	M2	F
112	45	46	5	W	P	2	52	12	M2	F	0	40	11	M2	F
113	21	49	15	W	P	0	56	10	M2	H	0	40	15	M2	F
114	0	44	25	U4	FC	0	54	11	M2	F	0	42	14	M2	F
115	0	47	21	U3	HC	0	57	12	M2	F	0	40	10	M2	F
116	0	46	21	U3	HC	1	57	7	M4	F	0	43	16	M2	F
117	0	48	23	U3	HC	4	56	15	M4	F	1	41	18	M2	F
118	0	53	18	U4	HC	4	54	12	M4	F	1	43	16	M2	F
119	0	55	14	U4	R	0	54	10	M2	F	3	39	20	M2	F
120	0	50	22	E1	P	0	52	7	U4	H	0	45	18	M2	F
121	0	47	25	M2	T	0	54	11	U4	F	2	41	17	M2	F
122	0	49	26	U3	R	0	53	14	M2	F	2	40	15	M2	F
123	0	42	22	U4	R	0	51	10	U4	R	0	42	16	M2	F
124	0	43	16	U4	R	0	48	7	U4	R	1	41	16	M2	F
125	0	48	18	U4	F	0	52	13	U4	R	1	40	14	M2	F
126	0	52	12	U3	F	0	39	11	U4	R	0	41	20	M2	F
127	0	42	7	U4	FC	0	48	7	U4	R	0	40	17	M2	F
128	0	41	11	U4	FC	0	48	14	U4	R	1	41	18	M2	F
129	0	42	10	U4	FC	0	54	13	M2	F	1	41	13	M2	F
130	0	39	15	U4	FC	0	50	12	U4	R	1	42	15	M4	F
131	0	41	18	U4	FC	0	49	15	M2	F	2	41	13	M2	F
132	0	43	17	U2	FC	0	51	14	M2	F	1	43	14	M2	F
133	0	41	18	U4	FC	0	49	11	M2	F	1	43	16	M2	F
134	0	42	13	U4	FC	0	47	11	M2	F	1	40	13	M2	F
135	0	46	11	U3	R	0	47	15	M2	F	0	35	15	U4	B
136	0	35	18	U4	T	0	48	16	M2	F	1	41	16	M2	F
137	0	34	22	U4	T	0	50	12	M2	F	1	42	17	M2	F
138	0	42	17	U4	R	0	48	13	M2	F	0	46	18	M2	F
139	0	40	18	U4	FC	0	49	12	U4	R	1	42	17	M2	F
140	0	38	16	U4	FC	0	47	14	U4	R	2	42	16	M4	F
141	0	38	17	U4	FC	0	51	8	U4	R	3	43	12	M4	F
142	0	40	15	U4	R	0	48	11	U4	R	2	42	10	M4	F
143	0	38	12	U4	R	0	51	16	U4	R	3	42	9	M4	F
144	0	28	9	U4	T	23	53	0	U4	R	0	44	18	U2	F
145	0	45	15	U4	FC	39	51	0	U4	R	3	40	13	M4	F
146	0	40	13	U4	FC	34	53	0	U4	R	6	40	19	M4	F
147	0	47	16	U4	FC	27	61	40	U4	R	4	42	17	M4	F

Table A3.3 *(continued). NIRPO site, transects T6, T7, and T8.*

Distance from road (m)	Transect 6 (T6) Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Transect 7 (T7) Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Transect 8 (T8) Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief
148	0	45	15	U4	FC	25	54	35	W	P	3	41	12	M4	F
149	0	47	21	U4	FC	18	52	30	E1	P	6	42	13	M4	F
150	0	43	10	U4	R	0	54	18	M2	T	9	40	13	M4	F
151	0	42	16	U4	T	0	50	14	U4	R	5	40	14	M4	F
152	0	41	21	U4	R	0	57	10	M2	F	4	41	18	M4	F
153	0	58	20	U4	R	0	55	11	E1	F	4	40	17	M4	F
154	0	45	12	U4	FC	0	56	0	E1	F	5	42	11	M4	F
155	0	47	13	U4	FC	0	58	0	E1	F	5	38	19	M4	F
156	0	44	15	U4	FC	0	52	11	E1	F	5	41	12	M4	F
157	0	41	18	U4	FC	0	53	10	E1	F	1	42	15	M4	F
158	0	40	16	U4	FC	0	50	10	E1	F	2	43	17	M4	F
159	0	33	13	U4	FC	0	54	10	E1	F	2	43	16	M4	F
160	0	43	16	U4	FC	0	53	12	E1	F	2	43	19	M4	F
161	0	55	19	U4	FC	0	55	11	E1	F	4	41	12	M4	F
162	15	51	20	E1	P	0	51	12	E1	F	1	43	15	M4	F
163	33	51	0	W	P	0	50	5	E1	F	4	41	17	M4	F
164	34	48	13	CALGIG	P	0	50	9	E1	F	2	42	18	M4	F
165	36	42	10	CALGIG	P	0	52	10	E1	F	0	43	15	M4	F
166	0	50	28	E1	T	0	50	14	M4	F	0	41	18	M2	F
167	0	51	20	U3	FC	0	55	12	M4	F	0	40	17	M4	F
168	0	42	21	U4	FC	0	50	10	M4	F	1	43	12	M4	F
169	0	35	13	U4	FC	0	48	13	M4	F	2	40	13	M4	F
170	0	38	16	U4	FC	0	36	16	M4	F	1	41	10	M4	F
171	0	40	22	U4	FC	1	55	15	M4	F	0	43	9	M4	F
172	0	39	24	U4	FC	11	48	16	M4	T	0	41	12	M4	F
173	0	38	14	U4	FC	0	58	13	M4	F	0	42	15	M4	F
174	0	34	14	U4	FC	0	50	14	M4	F	0	44	16	M4	F
175	0	49	15	U3	R	0	57	15	M4	F	0	44	18	M4	F
176	0	45	13	U3	R	0	51	15	M4	F	1	40	17	M2	F
177	0	36	7	U4	T	0	51	15	M4	F	1	42	17	M2	F
178	0	47	22	U3	R	0	54	16	M4	F	1	39	18	M4	F
179	0	44	17	U4	R	0	53	15	M4	F	0	45	18	M4	F
180	0	50	18	U4	R	0	57	14	M4	F	0	44	11	M4	F
181	0	50	28	U4	R	0	52	15	M4	F	3	42	13	M4	F
182	0	45	25	M2	T	0	52	13	M4	F	2	41	12	M4	F
183	0	48	22	U4	R	0	56	15	M4	F	4	40	13	M4	F
184	0	49	23	U4	R	0	52	14	M4	F	1	43	9	M4	F

Table A3.3 *(continued). NIRPO site, transects T6, T7, and T8.*

Distance from road (m)	Transect 6 (T6)					Transect 7 (T7)					Transect 8 (T8)				
	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief	Water depth (cm)	Thaw depth (cm)	Vegetation height (cm)	Vegetation type	Micro-relief
185	0	44	17	M2	T	0	53	10	M4	F	3	42	13	M4	F
186	0	46	12	U4	R	0	48	13	M2	F	2	44	13	M4	F
187	0	46	17	U4	R	0	50	14	M2	F	1	42	15	M4	F
188	0	45	22	M2	FC	0	44	10	M2	F	1	44	9	M4	F
189	0	51	22	M2	FC	0	53	7	M2	F	2	38	16	M4	F
190	0	53	18	M2	FC	0	44	9	M2	F	1	37	15	M4	F
191	0	57	21	M2	FC	0	44	10	U4	R	0	42	15	M4	F
192	0	54	22	M2	FC	0	39	12	U4	R	1	43	17	M4	F
193	0	52	19	M2	FC	0	43	5	U4	R	3	43	18	M4	F
194	0	50	17	M2	FC	0	45	10	U4	R	0	46	10	M4	F
195	0	46	23	M2	FC	0	44	12	M2	T	4	42	12	M4	F
196	0	43	24	U4	R	0	40	14	M2	T	2	44	13	M4	F
197	0	45	23	U4	FC	0	44	14	U4	R	3	42	16	M4	F
198	0	64	28	U4	FC	0	42	11	U4	R	2	42	15	M4	F
199	29	51	10	E1	P	0	43	10	U4	R	5	41	16	M4	F
200	36	50	35	W	P	0	30	11	U4	R	4	31	15	M4	F
Mean (cm)	5.1	45.5	16.8			1.9	48.2	12.3			1.7	41.9	14.8		
Std deviation	12.3	7.1	6.9			5.4	6.2	5.1			2.0	3.5	3.0		
Std error	0.10	0.06	0.06			0.03	0.03	0.03			0.01	0.02	0.02		

Table A3.4. *Water depth, thaw depth, and environmental variables at 1-meter intervals along transect T9 at the NIRPO site, Prudhoe Bay, Alaska, 23 August 2021.* ***Vegetation height*** *was measured above the ground or water surface.* ***Vegetation type and Microrelief:*** *See Appendix 4, Tables A4.7 and A4.5 respectively for code descriptions.*

Distance from road (m)	Transect 9 (T9) Water depth (cm)	Thaw depth (cm)	Vegetation ht. (cm)	Vegetation type	Microrelief
0	NA	NA	NA	M2	T
1	0	29	13	U4	T
2	0	28	7	U4	T
3	0	28	14	U4	T
4	0	37	10	U3	R
5	0	38	14	U3	R
6	0	37	5	U3	R
7	0	38	14	U3	R
8	0	39	7	U3	R
9	0	45	10	U$	R
10	0	53	11	U4	R
11	0	40	13	E1	T
12	0	48	9	U4	T
13	0	41	12	U4	FC
14	0	40	11	U4	FC
15	0	39	12	U4	FC
16	0	42	8	U4	FC
17	0	36	15	U3	R
18	0	39	10	U3	R
19	0	36	14	U4	FC
20	0	38	10	U4	FC
21	0	38	15	U4	FC
22	0	38	10	U4	FC
23	0	39	13	U4	FC
24	0	35	5	U3	R
25	0	35	4	U3	R
26	0	42	5	U3	R
27	0	42	3	U4	FC
28	0	38	4	U4	FC
29	0	40	16	U4	FC
30	0	39	21	U4	FC
31	0	40	25	U3	FC
32	0	44	36	U4	R
33	0	38	10	M2	T
34	0	40	20	U3	R
35	0	40	10	U4	FC
36	0	34	15	U4	FC

Distance from road (m)	Transect 9 (T9) Water depth (cm)	Thaw depth (cm)	Vegetation ht. (cm)	Vegetation type	Microrelief
37	0	36	15	U4	FC
38	0	33	17	U4	FC
39	0	38	10	U3	R
40	0	29	16	M2	T
41	0	36	11	U3	R
42	0	33	15	U4	FC
43	0	35	8	U4	T
44	0	35	12	M2	T
45	0	40	12	U4	FC
46	0	34	13	U4	T
47	0	42	14	U4	FC
48	0	38	16	U4	FC
49	0	40	11	U4	FC
50	0	31	14	U4	FC
51	0	42	16	U4	FC
52	0	39	16	U4	FC
53	0	37	17	U4	FC
54	0	34	12	U3	FC
55	0	35	12	U3	R
56	0	34	13	U4	T
57	0	33	18	U3	R
58	0	34	20	U4	FC
59	0	32	10	U4	FC
60	0	32	12	U4	FC
61	0	33	11	U4	FC
62	0	29	10	M2	T
63	0	37	12	U4	FC
64	0	34	16	U4	FC
65	0	37	10	U4	FC
66	0	37	11	U4	FC
67	0	36	7	U4	FC
68	0	35	8	U4	FC
69	0	43	12	U4	FC
70	0	41	15	U4	FC
71	0	42	13	U4	FC
72	0	38	16	U4	FC
73	0	40	16	U4	FC

Distance from road (m)	Transect 9 (T9) Water depth (cm)	Thaw depth (cm)	Vegetation ht. (cm)	Vegetation type	Microrelief
74	0	42	19	U4	FC
75	0	35	20	U4	R
76	0	32	19	M2	T
77	0	35	13	M2	T
78	0	37	18	M2	T
79	0	39	17	U4	R
80	0	35	16	U4	R
81	0	38	15	U4	LC
82	0	42	17	U4	LC
83	0	38	11	U4	LC
84	0	39	10	U4	LC
85	0	42	10	M2	LC
86	0	40	12	M2	LC
87	0	36	11	M2	T
88	0	41	14	M2	LC
89	0	46	15	M2	LC
90	0	46	13	M2	LC
91	2	44	11	M2	LC
92	1	47	13	M2	LC
93	0	48	8	M2	LC
94	0	44	12	M2	LC
95	0	41	10	U4	LC
96	5	39	12	M2	T
97	0	39	9	U4	R
98	1	41	10	M2	LC
99	0	43	13	M2	LC
100	0	41	12	M2	LC
Mean (cm)	0.1	38.1	12.8		
Std dev	0.5	4.6	4.5		
Std error	0.01	0.05	0.05		

Table A3.5. *Water depth, thaw depth, and environmental variables at 1-meter intervals along a 250-m transect at the Jorgenson site, Prudhoe Bay, Alaska, 23 August 2021.* ***Vegetation height*** *was measured above the ground or water surface.* ***Vegetation type and Microrelief:*** *See Appendix 4, Tables A4.7 and A4.5 respectively for code descriptions.*

Distance from road (m)	Jorgenson Transect (JS) Water depth (cm)	Thaw depth (cm)	Vegetation ht. (cm)	Vegetation type	Microrelief
0	0	55	17	U4	FC
1	0	45	15	U4	FC
2	0	50	17	U4	FC
3	0	43	18	U4	T
4	0	48	10	U4	FC
5	0	50	9	U4	FC
6	0	50	15	U4	FC
7	0	52	12	U4	FC
8	0	47	11	U4	FC
9	0	50	15	U4	FC
10	0	49	13	U4	FC
11	0	48	11	U4	FC
12	0	50	10	U4	FC
13	0	47	17	U4	FC
14	0	54	11	U4	FC
15	0	45	18	M2	FC
16	0	55	15	M2	FC
17	0	54	16	M2	FC
18	0	48	16	M2	FC
19	0	48	14	M2	FC
20	0	50	18	M2	FC
21	0	49	17	U4	FC
22	0	48	14	U4	FC
23	0	57	2	U3	FC
24	0	64	23	U4	FC
25	19	51	0	E1	P
26	28	43	8	CALGIG	P
27	28	46	40	E1	P
28	16	49	40	E1	P
29	0	52	12	U3	FC
30	0	53	16	U3	FC
31	0	53	9	U3	FC
32	0	52	12	U4	FC
33	0	46	11	U4	FC
34	0	49	15	U4	FC
35	0	43	12	U4	FC
36	0	44	13	U4	FC

Distance from road (m)	Jorgenson Transect (JS) Water depth (cm)	Thaw depth (cm)	Vegetation ht. (cm)	Vegetation type	Microrelief
37	0	42	13	U4	FC
38	0	47	12	U4	FC
39	0	41	12	U4	T
40	0	48	10	U4	T
41	0	52	17	U4	R
42	0	48	15	U4	R
43	0	39	19	U4	T
44	0	52	9	U4	R
45	0	42	14	U4	FC
46	0	46	11	U4	FC
47	0	50	12	U4	FC
48	0	54	9	M2	FC
49	0	53	12	M2	FC
50	0	60	2	U4	FC
51	0	58	17	M2	FC
52	0	60	9	M2	FC
53	0	60	16	M2	FC
54	0	59	16	M2	FC
55	0	59	15	M2	FC
56	0	58	10	U4	FC
57	0	52	18	U4	FC
58	0	64	15	U4	R
59	19	45	40	E1	T
60	26	42	42	E1	T
61	27	36	45	E1	T
62	0	63	15	U4	FC
63	0	53	15	U4	FC
64	0	45	11	U4	FC
65	0	57	10	M2	FC
66	0	56	10	M2	FC
67	0	58	10	U4	FC
68	0	60	1	U4	FC
69	0	59	8	U4	FC
70	0	59	7	U4	FC
71	0	63	15	U4	R
72	60	42	55	E1	T
73	60	41	70	E1	T

Distance from road (m)	Jorgenson Transect (JS) Water depth (cm)	Thaw depth (cm)	Vegetation ht. (cm)	Vegetation type	Microrelief
74	38	47	55	E1	T
75	0	71	18	U4	R
76	0	56	15	U4	FC
77	0	56	8	U4	FC
78	0	52	15	U4	FC
79	0	52	12	U4	FC
80	0	52	15	M2	FC
81	0	52	11	U4	FC
82	0	52	15	U4	FC
83	0	49	11	U4	FC
84	0	52	20	U4	T
85	20	44	35	E1	T
86	0	65	12	U4	R
87	0	56	12	U4	FC
88	0	57	12	U4	FC
89	0	57	13	M2	FC
90	0	60	7	U4	FC
91	0	59	12	U4	FC
92	0	57	9	U4	FC
93	0	55	15	U4	FC
94	0	54	17	M2	FC
95	9	69	20	E1	T
96	50	64	NA	HIPVUL	T
97	54	49	NA	HIPVUL	T
98	19	71	38	E1	T
99	0	69	25	M2	T
100	0	67	19	M2	T
101	10	59	30	E1	T
102	13	47	40	E1	T
103	25	51	50	E1, SCOSCO	T
104	24	53	18	SCOSCO	T
105	26	47	20	SCOSCO	T
106	22	46	40	E1, SCOSCO	T
107	0	53	12	M2	R
108	0	58	12	U4	FC
109	0	50	12	M2	FC
110	0	50	14	U4	FC

Table A3.5 *(continued). Jorgenson site 250-m transect.*

Distance from road (m)	Jorgenson Transect (JS)				
	Water depth (cm)	Thaw depth (cm)	Vegetation ht. (cm)	Vegetation type	Microrelief
111	0	61	10	M2	FC
112	24	50	40	E1	T
113	13	48	28	E1	T
114	0	54	15	U4	R
115	0	53	12	M2	LC
116	0	56	12	M2	LC
117	0	58	12	M2	LC
118	0	59	10	U4	LC
119	0	58	12	U4	LC
120	0	60	8	U4	LC
121	0	59	10	U4	R
122	0	56	8	U4	R
123	0	48	12	U4	R
124	0	51	12	U4	R
125	0	52	18	U4	R
126	0	50	15	U4	T
127	0	51	12	U4	R
128	0	60	2	U3	R
129	0	45	12	U4	R
130	0	54	12	U4	R
131	0	54	9	U4	R
132	0	57	10	M2	LC
133	0	56	17	M2	LC
134	0	55	12	M2	LC
135	0	60	12	U4	R
136	0	52	15	U4	R
137	0	50	23	U4	R
138	0	50	18	U4	T
139	0	55	17	U4	R
140	0	51	15	U4	FC
141	0	54	12	U4	FC
142	0	54	12	U4	FC
143	0	58	15	U4	FC
144	0	81	15	U4	FC
145	55	49	65	E1	T
146	63	52	75	E1	T
147	59	51	0	W	T
148	5	79	35	E1	T
149	0	62	15	U4	FC
150	0	56	15	U4	FC
151	0	56	4	U3	FC
152	0	57	10	U4	FC
153	0	57	12	U4	FC
154	0	59	12	U4	FC
155	0	56	11	U4	FC
156	0	57	13	U4	FC
157	0	57	12	U4	FC
158	0	61	10	U4	FC
159	0	60	15	U4	FC
160	0	60	10	U4	FC
161	0	59	13	U4	FC
162	0	57	10	U4	FC
163	0	60	13	U4	FC
164	0	68	15	U4	FC
165	7	58	39	E1	T
166	5	58	30	E1	T
167	8	55	29	E1	T
168	10	56	40	E1	T
169	12	55	36	E1	T
170	12	48	40	E1	T
171	0	63	12	U4	FC
172	0	54	10	U4	FC
173	0	56	12	U4	FC
174	0	56	10	U4	FC
175	0	55	12	U4	FC
176	0	55	7	U4	FC
177	0	54	9	U4	FC
178	0	54	7	U4	FC
179	0	54	12	U4	FC
180	0	56	10	M2	FC
181	0	57	12	U4	FC
182	0	59	12	U4	FC
183	0	60	12	M2	FC
184	0	62	20	M2	T
185	36	55	50	E1	P
186	51	54	15	SCOSCO	P
187	47	51	15	SCOSCO	P
188	19	56	45	E1	P
189	0	57	12	M2	R
190	0	53	12	U4	R
191	0	55	12	U4	LC
192	0	56	12	U4	LC
193	0	61	7	M2	LC
194	0	61	10	M2	LC
195	0	60	12	M2	LC
196	0	55	14	U4	LC
197	0	56	12	U4	R
198	0	56	10	U4	R
199	0	56	15	U4	R
200	0	58	15	U4	R
201	0	52	14	U4	R
202	0	57	8	U4	FC
203	0	50	10	U4	R
204	0	54	10	U4	R
205	0	56	13	U4	R
206	0	53	10	U4	R
207	0	55	15	U4	R
208	0	55	15	M2	R
209	0	58	12	M2	FC
210	0	60	12	U4	FC
211	0	51	12	U4	FC
212	0	48	12	U4	R
213	0	47	12	U4	R
214	0	57	10	U3	R
215	0	55	16	U4	R
216	8	56	15	E1	T
217	20	63	15	E1	T
218	40	53	50	HIPVUL	T
219	33	54	15	E1	T
220	0	68	10	U4	R
221	0	54	7	U4	R

Table A3.5 *(continued). Jorgenson site 250-m transect.*

Distance from road (m)	Jorgenson Transect (JS) Water depth (cm)	Thaw depth (cm)	Vegetation ht. (cm)	Vegetation type	Micro-relief
222	0	51	5	U4	R
223	0	48	13	U4	FC
224	0	52	5	U4	FC
225	0	50	8	U4	FC
226	0	52	8	U4	FC
227	0	54	7	M2	FC
228	0	51	8	M2	FC
229	0	54	6	U4	FC
230	0	49	12	M2	T
231	0	53	18	M2	T
232	0	54	10	M2	T
233	5	47	16	M2	T
234	0	55	12	M2	FC
235	0	55	15	M2	FC
236	0	57	10	M2	FC
237	0	58	11	M2	FC
238	0	51	12	M2	FC
239	0	60	12	M2	FC
240	0	56	15	M2	FC
241	0	56	12	M2	FC
242	0	54	10	M2	FC
243	0	55	10	M2	FC
244	0	55	12	M2	R
245	17	60	44	E1	T
246	57	53	64	E1	T
247	57	54	70	E1	T
248	38	56	63	E1	T
249	23	51	35	E1	T
250	9	46	12	E1	T
Mean (cm)	5.3	54.1	16.8		
Std dev	13.4	6.2	12.6		
Std error	0.05	0.02	0.05		

APPENDIX 4 2021 NIRPO Terrestrial Plot Data and Photos

Table A4.1. *NIRPO terrestrial vegetation plots.* ***Observers:*** *Donald A. Walker, Amy L. Breen.* ***Latitude, Longitude, Orthometric*** *and* ***Ellipsoid Height*** *based on DGPS survey, 25 August 2021.*

Plot ID	Date sampled	Plot photo no.	Soil photo no.	Tran-sect	Latitude (WGS84 DD)	Longitude (WGS84 DD)	Orthometric height (m)	Ellipsoidal height (m)
21-01	2021-07-22	7016-7018	7013-7015	T8	70.231197	-148.458217	12.1791	8.0035
21-02	2021-07-22	7020-7023	7019	T8	70.231383	-148.457347	12.1879	8.0119
21-03	2021-07-22	7025-7028	7024	T8	70.231053	-148.461164	11.9466	7.7714
21-04	2021-07-22	7030-7032	7029	T8	70.230886	-148.460253	11.9839	7.8092
21-05	2021-07-19	6934-6936	6956	T6	70.231692	-148.450386	12.7407	8.5652
21-06	2021-07-19	6937-3939	6958	T6	70.231667	-148.451058	12.9845	8.8089
21-07	2021-07-19	6940-6943	6963	T6	70.231586	-148.451672	12.8488	8.6733
21-08	2021-07-19	6944-6946	6965	T6	70.231553	-148.452586	12.7015	8.526
21-09	2021-07-19	6950-6955	6966	T6	70.231467	-148.453208	12.6875	8.5118
21-10	2021-07-19	6947-6949	6968	T6	70.231653	-148.452497	12.8252	8.6494
21-11	2021-07-21	6975-6978	6969	T6	70.231636	-148.452381	12.4959	8.3202
21-12	2021-07-21	6979-6981	6970	T6	70.231447	-148.452181	12.5203	8.345
21-13	2021-07-21	6982-6985	6986	T6	70.231722	-148.451733	12.6	8.4242
21-14	2021-07-21	6990-6992	6993	T6	70.231639	-148.451456	12.5761	8.4005
21-15	2021-07-21	6994-6996	6997	T6	70.231775	-148.450261	12.3839	8.2082
21-16	2021-07-21	6999-7001	7002	T6	70.231506	-148.449506	12.2445	8.0694
21-17	2021-07-22	7006-7008	7005	T8	70.231267	-148.457156	12.3475	8.1717
21-18	2021-07-22	7009-7012	7013	T8	70.231153	-148.458039	12.2549	8.0794
21-19	2021-07-23	7037-7040	7035-7036	T9	70.231794	-148.456894	12.2276	8.0507
21-20	2021-07-23	7044-7046	7043	T9	70.23195	-148.454883	12.926	8.749
21-21	2021-07-23	7049-7051	7052	T9	70.231864	-148.454611	12.9039	8.7271
21-22	2021-07-23	7054-7058	7059	T9	70.231753	-148.455144	12.5909	8.4142
21-23	2021-07-23	7061-7063	7060	T9	70.2318	-148.4563	12.2986	8.1217
21-24	2021-07-24	7068-7071	7072	T9	70.231869	-148.456803	12.4553	8.2782
21-25	2021-07-24	7080-7084	7085	T7	70.230069	-148.446767	12.0616	7.8896
21-26	2021-07-24	7086-7089	7090-7102	T7	70.230244	-148.446403	12.034	7.8616
21-27	2021-07-24	7104-7107	7103	T7	70.230131	-148.445822	12.1562	7.984
21-28	2021-07-24	7109-7112	7115	T7	70.230556	-148.443939	12.0756	7.9027
21-29	2021-07-24	7120-7122	7123	T7	70.230547	-148.443275	12.1631	7.9903
21-30	2021-07-25	7126-7128	7129	T7	70.230608	-148.4433	12.2942	8.1212
21-31	2021-07-25	7148-7151	7164	T7	70.230475	-148.442717	12.0191	7.8465
21-32	2021-07-25	7152-7155	7156	T7	70.230614	-148.442778	12.0664	7.8935
21-33	2021-07-26	7166-7169	7170	T7	70.230664	-148.443033	12.079	7.9059
21-34	2021-07-26	7178-7180	7181	T7	70.230614	-148.442622	12.2966	8.1237
21-35	2021-07-26	7182-7185	7186	T7	70.230592	-148.443503	12.0024	7.8294

Table A4.2. *Photographs of 2021 NIRPO terrestrial plot vegetation. (Photos: A.L. Breen)*


21-01 (IMG 7015.jpg)


21-02 (IMG 7120.jpg)


21-3 (IMG 7025.jpg)


21-4 (IMG 7030.jpg)


21-5 (IMG 6934.jpg)


21-6 (IMG 6937.jpg)


21-7 (IMG 6940.jpg)


21-8 (IMG 6944.jpg)


21-9 (IMG 6950.jpg)


21-10 (IMG 6947.jpg)


21-11 (IMG 6975.jpg)


21-12 (IMG 6979.jpg)


21-13 (IMG 6982.jpg)


21-14 (IMG 6990.jpg)


21-15 (IMG 6994.jpg)

Table A4.2 *(continued)*

21-16 (IMG 6999.jpg)

21-17 (IMG 7006.jpg)

21-18 (IMG 7009.jpg)

21-19 (IMG 7037.jpg)

21-20 (IMG 7044.jpg)

21-21 (IMG 7049.jpg)

21-22 (IMG 7054.jpg)

21-23 (IMG 7061.jpg)

21-24 (IMG 7068.jpg)

21-25 (IMG 7080.jpg)

21-26 (IMG 7086.jpg)

21-27 (IMG 7104.jpg)

21-28 (IMG 7109.jpg)

21-29 (IMG 7120.jpg)

21-30 (IMG 7127.jpg)

Table A4.2 *(continued)*

21-31 (IMG 7148.jpg)

21-32 (IMG 7152.jpg)

21-33 (IMG 7166.jpg)

21-34 (IMG 7178.jpg)

21-35 (IMG 7182.jpg)

Table A4.3. *Photographs of 2021 NIRPO terrestrial plot soils. (Photos: A.L. Breen)*

21-01 (IMG 7014.jpg)

21-02 (IMG 7019.jpg)

21-3 (IMG 7024.jpg)

21-4 (IMG 7029.jpg)

21-5 (IMG 6956.jpg)

21-6 (IMG 6958.jpg)

21-7 (IMG 6963.jpg)

21-8 (IMG 6965.jpg)

21-9 (IMG 6966.jpg)

21-10 (IMG 6968.jpg)

Table A4.3 *(continued)*

21-11 (IMG 6969.jpg)

21-12 (IMG 6970.jpg)

21-13 (IMG 6986.jpg)

21-14 (IMG 6993.jpg)

21-15 (IMG 6997.jpg)

21-16 (IMG 7002.jpg)

21-17 (IMG 7005.jpg)

21-18 (IMG 7013.jpg)

21-19 (IMG 7036.jpg)

21-20 (IMG 7043.jpg)

Table A4.3 *(continued)*

21-21 (IMG 7052.jpg)

21-22 (IMG 7059.jpg)

21-23 (IMG 7060.jpg)

21-24 (IMG 7072.jpg)

21-25 (IMG 7085.jpg)

21-26 (IMG 7090.jpg)

21-27 (IMG 7103.jpg)

21-28 (IMG 7114.jpg)

21-29 (IMG 7123.jpg)

21-30 (IMG 7129.jpg)

Table A4.3 *(continued)*

21-31 (IMG 7164.jpg)

21-32 (IMG 7156.jpg)

21-33 (IMG 7170.jpg)

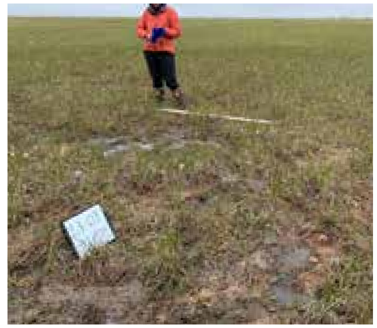
21-34 (IMG 7181.jpg)

21-35 (IMG 7187.jpg)

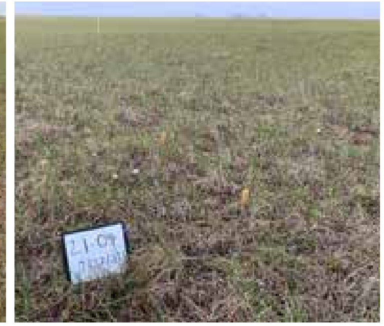
Table A4.4. Photographs of 2021 NIRPO terrestrial plot landscapes. (Photos: A.L. Breen)

21-01 (IMG 7018.jpg)

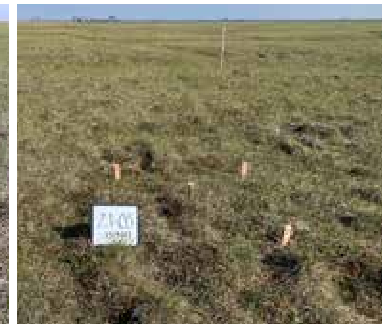
21-02 (IMG 7023.jpg)



21-3 (IMG 7028.jpg)

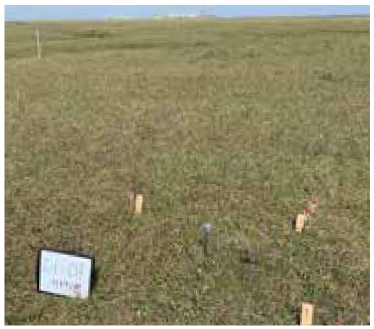


21-4 (IMG 7032.jpg)



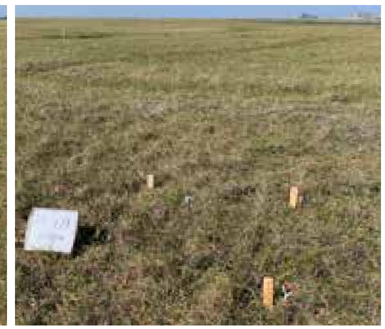
21-5 (IMG 6936.jpg)

21-6 (IMG 6938.jpg)



21-7 (IMG 6942.jpg)

21-8 (IMG 6946.jpg)

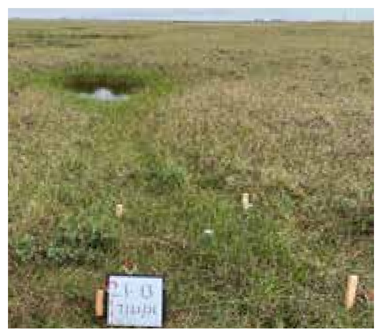


21-9 (IMG 6952.jpg)

21-10 (IMG 6949.jpg)

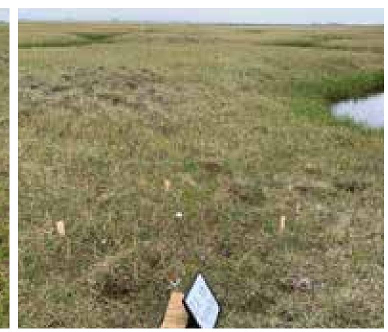
21-11 (IMG 6978.jpg)

21-12 (IMG 6981.jpg)



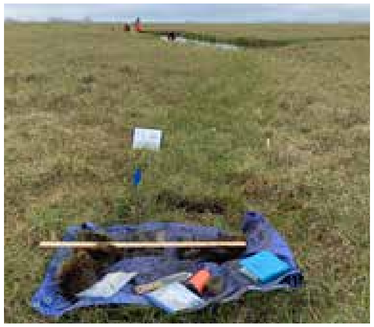
21-13 (IMG 6985.jpg)

21-14 (IMG 6992.jpg)



21-15 (IMG 6996.jpg)

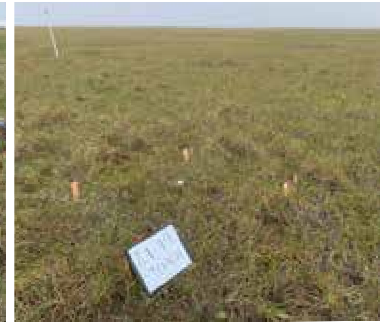
Table A4.4 *(continued)*



21-16 (IMG 7003.jpg)

21-17 (IMG 7008.jpg)

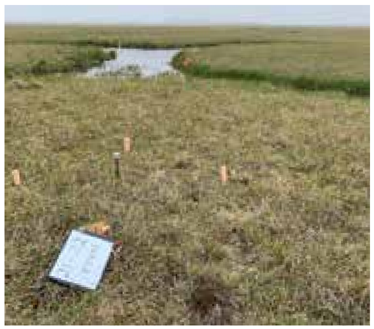
21-18 (IMG 7011.jpg)



21-19 (IMG 7039.jpg)

21-20 (IMG 7046.jpg)

21-21 (IMG 7051.jpg)



21-22 (IMG 7058.jpg)

21-23 (IMG 7063.jpg)

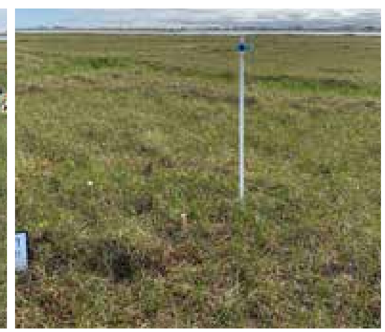
21-24 (IMG 7070.jpg)

21-25 (IMG 7083.jpg)

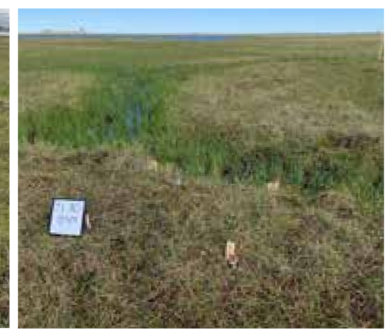
21-26 (IMG 7089.jpg)

21-27 (IMG 7107.jpg)

21-28 (IMG 7112.jpg)



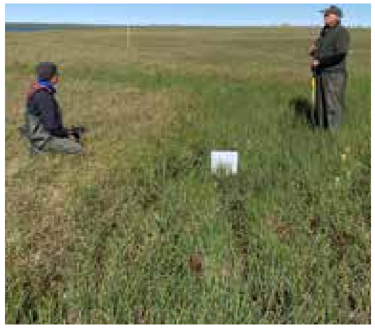
21-29 (IMG 7122.jpg)



21-30 (IMG 7126.jpg)

Table A4.4 *(continued)*

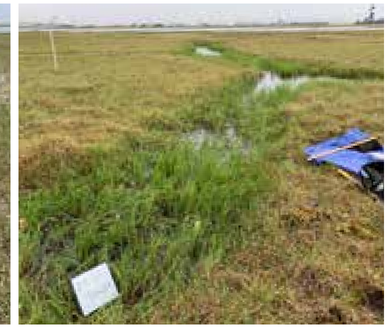
21-31 (IMG 7150.jpg)



21-32 (IMG 7154.jpg)

21-33 (IMG 7168.jpg)

21-34 (IMG 7180.jpg)



21-35 (IMG 7185.jpg)

Table A4.5. *Codes for categorical and scalar site variables used in the description of environmental characteristics.*

Code	Categorical site variables
Surficial Geology (Parent Material)	
1	**Unconsolidated marine deposits**
1.1	Marine sands and gravels
1.2	Marine silts and clays
2	**Unconsolidated eolian deposits (deposited by wind)**
2.1	Eolian sands
2.2	Eolian silts (loess)
3	**Eluvial deposits (deposited by in situ weathering and gravity)**
3.1	Frost shattered bedrock
4	**Colluvial deposits (slope deposits, derived from a combination of gravity and alluvial processes)**
4.1	Hillslope colluvium
4.2	Talus
4.3	Solifluction deposits
4.4	Basin colluvium
5	**Lacustrine deposits (lake deposits)**
5.1	5 Organic lacustrine deposits
5.2	5 Mineral lacustrine deposits
6	**Alluvial deposits (deposited by rivers and streams)**
6.1	Alluvial sands and gravels
6.2	Alluvial silts
7	**Glacial deposits**
7.1	Glacial till
7.2	Glacio-marine sediments
7.3	Glacio-fluvial sediments
8	**Bedrock**
8.1	Sedimentary rocks and metamorphosed sedimentary rocks
8.1.2	Sedimentary and metamorphic rocks derived from course grained sediments of mixed mineralogy: conglomerates and breccias
8.1.3	Sedimentary and metamorphic rocks derived from quartz-rich sediments: sandstones, quartzites, cherts
8.1.4	Sedimentary and metamorphic rocks derived from fine grained silts and clays: siltstones, claystones, mudstones, shales
8.1.5	Sedimentary and metamorphic rocks derived from carbonate sediments: limestone, dolomite, marlstone, marble
8.2	Igneous and metamorphosed igneous rocks
8.2.1	Felsic igneous rocks (rich in Si, Al): obsidian pumice, rhyolite, granite, pegmatite, gneiss
8.2.2	Mafic igneous rocks (rich in Fe, Mg): basaltic glass, scoria, basalt, diabase, gabbro
8.2.3	Ultramafic igneous rocks (extremely rich in Fe, Mg and often other metaliferous minerals Co, Ni, Ch), peridotite, dunite, serpentine, olivine, hornblende, pyroxene
Landforms	
1	**Hills and mountains**
2	**Plateaus**
3	**Plains**
3.1	Coastal plain
3.1.1	Flat thaw-lake plain
3.1.1.1	Thaw lake
3.1.1.2	Drained thaw-lake basin
3.1.1.3	Primary (residual) surface unaffected by thaw-lake processes
3.1.2	Hilly coastal plain
Topographic Position	
1	**Flat elevated plain** (includes plateaus, elevated river terraces)
2	**Hill crest**
3	**Shoulder**
4	**Backslope**
5	**Foot slope** (includes toeslopes)
6	**Flat plain**
7	**Riparian zone** (includes active floodplains, drainage channels, water tracks, avalanche tracks)

Code	Categorical site variables
8	**Lake or pond**
Surficial Geomorphology	
1	**Lowland features**
1.1	Lake and pond
1.2	Drained lake basin
1.2	Thermokarst pits or ponds
1.3	Flat featureless wetland, < 20% frost scars or hummocks
1.4	Strangmoor or aligned hummocks or disjunct polygon rims
1.5	Wetland hummocks
1.6	Lowland frost boils, non-sorted polygons, often with rings
1.7	Lowland ice-wedge polygons
1.7.1	Low-centered polygons
1.7.2	High-centered, flat-centered, or transitional polygons
1.7.3	Mixed high- and low-centered polygons
1.8	Palsas
1.9	Pingos
2	**Upland features** (interfluves)
2.1	Featureless upland or slope, < 20% frost scars or hummocks
2.2	Turf hummocks (mainly snowbeds)
2.3	Upland frost scars, sometimes forming earth mounds
2.4	Gelifluction features (including solifluction terraces)
2.5	Sorted and non-sorted stripes or hummocks
2.6	Gently rolling or irregular microrelief
2.7	Stoney hill slope or crest
3	**Riparian, water-track, or stream features**
3.1	Stream or river active floodplain
3.2	Stream or river inactive or stabilized floodplain
3.3	Stream or river terrace or bluff
3.4	Well-developed hillslope water tracks, small streams > 50 cm deep
3.5	Poorly developed hillslope water tracks, channels < 50 cm deep
Animal and Human Disturbance (type)	
0	**No sign**
1	**Ptarmigan scat**
2	**Caribou tracks**
3	**Caribou scat**
4	**Goose tracks, scat, feathers, and/or grazing**
5	**Squirrel mounds**
6	**Vole tracks & scat**
7	**Vehicle tracks**
8	**Wind erosion**
9	**Swan grazing**
10	**Owl pellets**
Microrelief	
1	**Frost-scar element**
2	**Inter-frost scar element**
3	**Strang, disjunct polygon rims (S)**
4	**Flat featureless or interhummock area (F)**
5	**Polygon center (C)**
5.1	Low-centered-polygon basin (LC)
5.2	High-centered, flat-centered, or transitional polygon center (HC)
6	**Polygon trough (T)**
7	**Low-centered-polygon rim (R)**
8	**Stripe element**
9	**Inter-stripe element**
10	**Point bar** (raised element)
11	**Slough** (wet element)
12	**Non-sorted polygon ring of tussocks**
13	**Lake or pond (P)**

Continued on next page

Table A4.5 *(continued)*

Code	Categorical site variables
Microrelief (continued)	
14	**Bird mound (B)**
15	**Hummock (H)**
16	**Reticulate pattern (RP)**

Code	Scalar site variables
Estimated relative surface age (applies only to NIRPO site)	
1	**Youngest** (flat with few disjunct polygon rims or hummocks)
2	**Young** (flat with disjunct polygon rims or hummocks)
3	**Intermediate** (low-centered ice-wedge polygons with no or little thermokarst in polygon troughs)
4	**Old** (low-centered ice-wedge polygons with thermokarst in polygon troughs
5	**Oldest** (high-, flat-, or transitional ice-wedge polygons with extensive thermokarst in polygon troughs)
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** - slightly moist site, flat to gently sloping
6	**Mesic** - moderate moisture; flat or shallow depressions
7	**Mesic to subhygric** - considerable late season moisture; saturated soils, 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

Code	Scalar site variables
7	**Wet** - considerable moisture; water drops can be squeezed from soil
8	**Very wet** - much moisture can be squeezed out of soil
9	**Saturated** - very much moisture; water drips out of soil
10	**Very saturated** - extreme moisture; soil is more liquid than solid
Estimated Snow Duration	
1	**Snow free all year**
2	**Snow free most of winter; some snow cover persists after storm but is blown free soon afterward**
3	**Snow free prior to melt out but with snow**
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**
Site Stability	
1	**Stable**
2	**Subject to occasional disturbance** (e.g. ice-wedge thermokarst in polygon troughs)
3	**Subject to prolonged but slow disturbance such as solifluction**
4	**Annually disturbed** (e.g. annual flooding, grazing by geese in polygon troughs)
5	**Disturbed more than once annually**
Exposure to wind	
1	**Protected from winds**
2	**Somewhat protected from winds**
3	**Moderate exposure to winds**
4	**Exposed to winds**
5	**Very exposed to winds**

Table A4.6. *Habitat type codes and categorical descriptors, after Mucina* et al. *2014.*

Code	Habitat type description
1	***ARCTIC ZONAL TUNDRA***
1.01	Polar desert vegetation, subzone A
1.01.1	Polar deserts of the Arctic zone of the Arctic Ocean archipelagos – North America
1.02	Dry and mesic dwarf-shrub and graminoid zonal vegetation on non-acidic base-rich soils
1.02.1	Dry zonal habitats of graminoid tundra and dwarf-shrub heath vegetation of Scotland, Scandinavia, Iceland and the Arctic Ocean islands on base-rich soils, subzones B and C
1.02.2	Mesic zonal habitats of graminoid tundra and dwarf-shrub heath vegetation of Arctic, Western Russia and Siberia on base-rich soils, subzones B, C & D
1.02.3	Graminoid tundra and dwarf-shrub heath vegetation of Greenland and the Arctic North America, subzones B, C & D, (includes for now early-melting base-rich *Cassiope-Tomentypnum* snowbeds)
1.03	Dry to mesic dwarf-shrub heath on acidic substrates, subzones D and E
1.03.1	Wind-swept dry habitats with prostrate-dwarf-shrub tundra acidic soils, subzones D and E
1.03.2	Zonal habitats with erect-dwarf-shrub tundra acidic soils, subzones D and E (includes for now early-melting acidic *Cassiope-Hylocomium* snowbeds)
1.03.3	Low-shrub tundra, acidic soils, warmest parts of subzone E
1.03.4	Amphiberingian chionophytic heath communities
1.03.5	Achionophytic heath communities (a vicariant alliance to the *Loiseleurio-Arctostaphyllion* that occurs in Northern Europe, Greenland as well as the Eastern part of North America)
2	***BOREAL MARITIME TUNDRA***
2.01	Mesic tall-herb vegetation, boreal maritime tundra
2.01.1	Mesic tall-herb vegetation, boreal maritime tundra
3	***INTRAZONAL VEGETATION OF THE ARCTIC ZONE***
3.01	Cryoxerophytic steppe and associated shrub on base-rich and (sub)saline substrates in continental Greenland and North America
3.01.1	Cryoxerophytic steppe and associated shrub on base-rich soils
3.01.2	Mesic forb-rich, turfy low Arctic (sub)saline steppe vegetation on base-rich soils
3.02	Arctic rush swards on acidic substrates in arctic region
3.02.1	Wind-swept, chionophobous habitats on acidic soils dominated by rushes
3.03	Grass- & rush-rich, zoogenic habitats, subzones A, B & C
3.03.1	Zoogenic, disturbed habitats, subzones, all sub- zones
4	***EXTRAZONAL BOREAL VEGETATION OCCURRING IN THE ARCTIC ZONE***
4.01	Boreal coniferous forest enclaves within the tundra zone
4.02	Subalpine and subarctic herb-rich alder and willow scrub and krummholz
4.02.1	Moist to dry alder (*Alnus viridis*) communities and alder savannas
4.02.2	Willow shrublands along streams, rivers, and water tracks on hill slopes
4.02.3	Herb-rich willow scrub and krummholz, subzones D and E
5	***AZONAL ARCTIC HABITATS***
5.01	SALT MARSHES, SAND DUNES, SEA CLIFFS
5.01.1	Wet saline coastal marshes
5.01.1.1	Coastal salt-marshes
5.01.2	Tall-grass swards, sand dunes
5.01.2.1	Tall-grass swards, sand dunes (*Leymus arenarius*), and for now other undescribed saline coastal embryonic communities
5.02	***Talus, screes, and boulder fields*** *(see also habitat codes 5.08.1 to 5.08.4 for epilithic moss- and lichen-dominated communities)*
5.02.1	Rock-crevices, ledges, faces of rocky cliffs & walls
5.02.1.1	Siliceous rock crevices, ledges, faces and walls
5.02.2	Scree habitats and course alluvium
5.02.2.1	Base-rich and neutral screes and moraines
5.02.2.2	Herb-rich snow-beds, stabilized course calcareous soils
5.02.2.3	Herb-rich vegetation, damp coarse gravels, siliceous substrates of Iceland
5.02.2.4	Ruderal riparian floodplain and terrace vegetation (*Epilobium latifolium*)
5.03	***Snowbeds and wet cold frost-active soils***
5.03.1	Late-melting snowbeds and wet cold frost active soils
5.03.1.1	Prostrate dwarf-shrub snowbeds on acidic siliceous substrates
5.03.1.2	Wet late-melting snowbeds and frost boils, cold acidic fine-grained soils
5.03.1.3	Amphiberingian late-melting snowbed communities
5.03.1.4	Early melting snowbed communities of the Alasko-Yukonian phytogeographical sector
5.04	***Springs***
5.04.1	Cold oligotrophic springs in the boreal and arctic zones of northern Europe
5.05	***Fresh water bodies***
5.05.1	Aquatic rooted floating or submerged macrophyte vegetation of meso-eutrophic water
5.05.1.1	Aquatic forb marshes
5.05.2	Pond and lake margins with aquatic grasses
5.05.2.1	Aquatic grass marshes

Table A4.6 *(continued)*

Code	Habitat type description
5.06	***Mires (wetlands)***
5.06.1	Fens, base-rich wetlands
5.06.1.1	Sedge fens on calcareous mineral substrates
5.06.1.2	Sedge-brown-moss fens on peats and peaty mineral soils
5.06.1.3	Moist to wet coastal sedge-grass tundra calcareous slightly saline soils (*Carex stans-Saxifraga cernua, Dupontia fisheri*)
5.06.1.4	Poor fens, slightly acidic organic soils (sedge-dwarf-shrub-*Sphagnum*)
5.06.1.5	Wet acidic sedge forb mires of Aleutian Islands
5.06.1.6	Moist to wet grassy meadows (*Calamagrostis canadensis, Polemonium acutiflorum, Potentilla palustris*)
5.06.2	Bogs, wetlands on acidic ombrotrophic soils
5.06.2.1	Tussock tundra (*Eriophorum vaginatum*)
5.06.2.2	Dwarf-shrub and peat-moss raised bog vegetation in the boreal and Arctic zones
5.07	***Riparian shrublands and gallery forests***
5.07.1	Riparian habitats, willow (*Salix*) shrublands and poplar (*Populus*) forests
5.07.1.1	Floodplains, springs, aufeis deposits and warm south facing slopes with balsam poplar (*Populus balsamifera*)
5.08	***Bryophyte and lichen vegetation***
5.08.1	Bryophyte communities on sunny exposed siliceous rocks, boulders and screes
5.08.2	Bryophyte communities on exposed limestone rocks and screes
5.08.3	Ombryophilous lichen communities of siliceous rock surfaces
5.08.4	Mainly crustose lichen communities on moderately to highly nutrient-rich limestone substrates
5.08.5	Bryophyte and lichen vegetation on dry acid to subneutral, silty-sand and gravelly soils
5.08.6	Bryophyte and lichen vegetation on subneutral and
5.09	***Anthropogenic and ruderal vegetation***
5.09.1	Human-disturbed habitats in the subarctic and Arctic zones of Russia, Siberia and North America
5.09.1.1	Ruderal vegetation of natural disturbances (e.g., lake bluff erosion)

Table A4.7. *Vegetation type codes and categorical descriptors based on site moisture, dominant plant species, growth forms, and physiognomy for Prudhoe Bay, Alaska (Modified from Walker 1980, 1985; Watson-Cook 2022).*

Code	Vegetation type description
DRY TUNDRA (B)	
B1	Dry *Dryas integrifolia, Carex rupestris, Oxytropis nigrescens, Lecanora epibryon* dwarf shrub, crustose lichen tundra
B2	Dry *Dryas integrifolia, Saxifraga oppositifolia, Lecanora epibryon* dwarf-shrub, crustose-lichen tundra
B3	Dry *Saxifraga oppositifolia, Juncus biglumis* forb, biological soil crust barren
B16	Dry *Puccinellia angustata, P. andersonii, Salix ovalifolia, S. lanata* graminoid, dwarf-shrub barren (dry saline disturbed areas near roads)
B17	Dry *Dryas integrifolia, Saxifraga oppositifolia, Hulteniella integrifolia, Carex capillaris* prostrate-shrub, herb tundra (dry dust-disturbed tundra)
MOIST TUNDRA (U)	
U2	Moist *Eriophorum vaginatum, Dryas integrifolia, Tomentypnum nitens, Thamnolia subuliformis* tussock-graminoid, prostrate dwarf-shrub, moss, lichen tundra
U3	Moist *Eriophorum angustifolium, Dryas integrifolia, Tomentypnum nitens, Thamnolia subuliformis* graminoid, prostrate dwarf-shrub, moss, lichen tundra
U3d	Disturbed version of type U3
U4	Moist *Eriophorum angustifolium, Dryas integrifolia, Tomentypnum nitens* graminoid, dwarf-shrub, moss tundra
U4d	Disturbed version of type U4
U10	Moist *Festuca baffinensis, Papaver macounii, Ranunculus pedatifidus* forb, grass tundra
U17	Moist version of B17 (*Carex scirpidea, Dryas integrifolia, Oxytropis borealis, Chrysanthemum integrifolium)*
WET TUNDRA (M)	
M2	Wet *Carex aquatilis, Drepanocladus brevifolius* sedge, moss tundra
M2d	Disturbed version of type M2
M4	Wet *Carex aquatilis, Scorpidium scropioides* sedge, moss tundra
M4/E1	Transitional wet to aquatic *Carex aquatilis, Scorpidium scorpioides* graminoid, moss tundra
M10	Wet *Carex aquatilis, Eriophorum angustifolium, Dupontia fisheri* graminoid tundra (coastal wet saline graminoid tundra)
M10d	Disturbed version of type M10
AQUATIC VEGETATION (E, W)	
E1	Aquatic *Carex aquatilis* sedge marsh (CARAQU)
E1d	Disturbed version of type E1
E2	Aquatic *Arctophila fulva* grass marsh
E3	Aquatic *Scorpidium scorpioides* moss tundra (SCOSCO)
E5	Aquatic *Calliergon richardsonii* moss tundra (CALGIG)
E6	Aquatic *Hippurus vulgaris* forb, moss tundra (HIPVUL)
W	Unvegetated water

Table A4.8. *Plant species list for 2021 NIRPO terrestrial vegetation plots, July 2021.* ***Field name:*** *Taxon used in the field.* ***Accepted name:*** *Accepted taxon name following the nomenclature of the Panarctic Species List (PASL; v. 2019).* ***Growth form:*** *Plant growth form (PASL; v. 2019).* ***Taxon code:*** *6-letter code based on field name.*

Field name	Accepted name	Taxon code	Plant growth form
Abietinella abietina	*Abietinella abietina* (Hedw.) Fleisch.	ABIABI	Pleurocarpous moss
Aneura pinguis	*Aneura pinguis* (L.) Dumort.	ANEPIN	Thalloid liverwort
Arctagrostis latifolia	*Arctagrostis latifolia* (R. Br.) Griseb.	ARCLAT	Grass
Aulacomnium palustre	*Aulacomnium palustre* (Hedw.) Schwaegr.	AULPAL	Pleurocarpous moss
Blepharostoma trichophyllum	*Blepharostoma trichophyllum* (Linn.) Dumortier	BLETRI	Leafy liverwort
Brachythecium sp.	*Brachythecium* sp.	BRACSP	Pleurocarpous moss
Bryum pseudotriquetrum	*Bryum pseudotriquetrum* (Hedw.) P.G. Gaertn., B. Mey. & Scherb.	BRYPSE	Acrocarpous moss
Bryum sp.	*Bryum* sp.	BRYUSP	Acrocarpous moss
Calliergon richardsonii	*Calliergon richardsonii* (Mitt.) Kindb.	CALGIG	Pleurocarpous moss
Calliergon richardsonii	*Calliergon richardsonii* (Mitt.) Kindb.	CALRIC	Pleurocarpous moss
Calliergon sp.	*Calliergon* sp.	CALISP	Pleurocarpous moss
Campylium sp.	*Campylium* sp.	CAMPSP	Pleurocarpous moss
Campylium stellatum	*Campylium stellatum* (Hedw.) C. Jens.	CAMSTE	Pleurocarpous moss
Cardamine digitata	*Cardamine digitata* Richardson	CARDIG	Low erect forb
Carex aquatilis	*Carex aquatilis* Wahlenb.	CARAQU	Wet to moist nontussock sedge
Carex atrofusca	*Carex atrofusca* Schkuhr	CARATR	Wet to moist nontussock sedge
Carex bigelowii	*Carex bigelowii* Torr.	CARBIG	Wet to moist nontussock sedge
Carex marina	*Carex marina Dewey*	CARHEL	Wet to moist nontussock sedge
Carex membranacea	*Carex membranacea* Hook.	CARMEM	Wet to moist nontussock sedge
Carex rotundata	*Carex rotundata* Wahlenb.	CARROT	Wet to moist nontussock sedge
Carex saxatilis ssp. *laxa*	*Carex saxatilis* L.	CARSAX	Wet to moist nontussock sedge
Carex scirpoidea	*Carex scirpoidea* Michx.	CARSCI	Wet to moist nontussock sedge
Carex sp.	*Carex* sp.	CARESP	Sedge
Cassiope tetragona	*Cassiope tetragona* (L.) D. Don	CASTET	Evergreen or summer green dwarf shrub
Catoscopium nigritum	*Catoscopium nigritum* (Hedw.) Brid.	CATNIG	Acrocarpous moss
Cetraria islandica	*Cetraria islandica* (L.) Ach.	CETISL	Fruticose lichen
Cetraria laevigata	*Cetraria laevigata* Rass.	CETLAE	Fruticose lichen
Cinclidium arcticum	*Cinclidium arcticum* Schimp.	CINARC	Acrocarpous moss
Cinclidium latifolium	*Cinclidium latifolium* Lindb.	CINLAT	Acrocarpous moss
Cinclidium sp.	*Cinclidium* sp.	CINCSP	Acrocarpous moss
Cinclidium stygium	*Cinclidium stygium* Swartz	CINSTY	Acrocarpous moss
Cirriphyllum cirrosum	*Cirriphyllum cirrosum* (Schwaegr.) Grout	CIRCIR	Pleurocarpous moss
Cladonia pyxidata	*Cladonia pyxidata* (L.) Hoffm.	CLAPYX	Fruticose lichen
Dactylina arctica	*Dactylina arctica* (Richardson) Nyl.	DACARC	Fruticose lichen
Dactylina madreporiformis	*Allocetraria madreporiformis* (Ach.) Karnefelt & Thell	DACMAD	Fruticose lichen
Dicranum elongatum	*Dicranum elongatum* Schleich. ex Schwaegr.	DICELO	Acrocarpous moss
Distichium capillaceum	*Distichium capillaceum* (Hedw.) Bruch & Schimp.	DISCAP	Acrocarpous moss
Distichium inclinatum	*Distichium inclinatum* (Hedw.) B.S.G.	DISINC	Acrocarpous moss
Ditrichum flexicaule	*Ditrichum flexicaule* (Schwaegr.) Hampe	DITFLE	Acrocarpous moss
Drepanocladus brevifolius	*Drepanocladus brevifolius* (Lindb.) Warnst.	DREBRE	Pleurocarpous moss
Drepanocladus sp.	*Drepanocladus* sp.	DREPSP	Pleurocarpous moss
Dryas integrifolia	*Dryas integrifolia* Vahl	DRYINT	Evergreen or summer green dwarf shrub
Dupontia fisheri	*Dupontia fisheri* R. Br.	DUPFIS	Grass
Encalypta rhabdocarpa	*Encalypta rhaptocarpa* Schwaegr.	ENCRHA	Acrocarpous moss
Encalypta sp.	*Encalypta* sp.	ENCASP	Acrocarpous moss
Equisetum scirpoides	*Equisetum scirpoides* Michx.	EQUSCI	Horsetail
Equisetum variegatum	*Equisetum variegatum* Schleich. ex Weber & Mohr	EQUVAR	Horsetail
Eriophorum angustifolium s. l.	*Eriophorum angustifolium* s.l. Honck.	ERIANG	Wet to moist nontussock sedge
Eriophorum scheuchzeri	*Eriophorum scheuchzeri* Hoppe	ERISCH	Wet to moist nontussock sedge
Eutrema edwardsii	*Eutrema edwardsii* R. Br.	EUTEDW	Low erect forb
Fissidens sp.	*Fissidens* sp.	FISSSP	Acrocarpous moss
Flavocetraria cucullata	*Flavocetraria cucullata* (Bell.) Karnefelt & Thell	FLACUC	Fruticose lichen
Flavocetraria nivalis	*Flavocetraria nivalis* (L.) Karnefelt & Thell	FLANIV	Fruticose lichen
Hamatocaulis vernicosus	*Hamatocaulis vernicosus* (Mitt.) Hedenas	HAMVER	Pleurocarpous moss
Hierochloe pauciflora	*Hierochloe pauciflora* R. Br.	HIEPAU	Grass
Hypnum procerrimum	*Hypnum procerrimum* Molendo	HYPPRO	Pleurocarpous moss
Hypnum species	*Hypnum* sp.	HYPNSP	Pleurocarpous moss

Table A4.8 *(continued)*

Field name	Accepted name	Taxon code	Plant growth form
Juncus triglumis	*Juncus triglumis* L.	JUNTRI	Rush
Lecanora epibryon	*Lecanora epibryon* (Ach.) Ach.	LECEPI	Crustose lichen
Lophozia sp.	*Lophozia* sp.	LOPHSP	Leafy liverwort
Masonhalea richardsonii	*Masonhalea richardsonii* (Hook.) Karnefelt	MASRIC	Foliose lichen
Meesia triquetra	*Meesia triquetra* (H. Richter) Aongstr.	MEETRI	Acrocarpous moss
Meesia uliginosa	*Meesia uliginosa* Hedw.	MEEULI	Acrocarpous moss
Minuartia arctica	*Minuartia arctica* (Steven ex Ser.) Graebn.	MINARC	Cushion, mat, or rosette forb
Mnium sp.	*Mnium* sp.	MNIUSP	Acrocarpous moss
Nostoc commune	*Nostoc commune* Vaucher ex Bornet & Flahault	NOSCOM	Alga and cyanobacteria
Nostoc sp.	*Nostoc* sp.	NOSTSP	Alga
Orthothecium chryseum	*Orthothecium chryseum* (Schwaegr.) B.S.G.	ORTCHR	Pleurocarpous moss
Papaver macounii	*Papaver macounii* Greene	PAPMAC	Low erect forb
Pedicularis albolabiata	*Pedicularis albolabiata* (Hultén) Kozhevn.	PEDALB	Low erect forb
Pedicularis capitata	*Pedicularis capitata* Adams	PEDCAP	Low erect forb
Pedicularis lanata	*Pedicularis lanata* Willd. ex Cham. & Schltdl.	PEDLAN	Low erect forb
Peltigera aphthosa	*Peltigera aphthosa* (L.) Willd.	PELAPH	Foliose lichen
Peltigera species	*Peltigera* sp.	PELTSP	Foliose lichen
Philonotis fontana	*Philonotis fontana* (Hedw.) Brid.	PHIFON	Acrocarpous moss
Polygonum viviparum	*Bistorta vivipara* (L.) Delarbre	POLVIV	Low erect forb
Pyrola secunda	*Orthilia secunda* (L.) House	PYRSEC	Low erect forb
Salix arctica	*Salix arctica* Pall.	SALARC	Deciduous dwarf shrub
Salix lanata s. l.	*Salix lanata* L.	SALLAN	Deciduous dwarf shrub
Salix ovalifolia	*Salix ovalifolia* Trautv.	SALOVA	Deciduous dwarf shrub
Salix reticulata	*Salix reticulata* L.	SALRET	Deciduous dwarf shrub
Sanionia uncinata	*Sanionia uncinata* (Hedw.) Loeske	SANUNC	Pleurocarpous moss
Saxifraga hirculus	*Saxifraga hirculus* L.	SAXHIR	Cushion, mat and rosette forb
Saxifraga oppositifolia	*Saxifraga oppositifolia* L.	SAXOPP	Cushion, mat and rosette forb
Scorpidium scorpioides	*Scorpidium scorpioides* (Hedw.) Limpr.	SCOSCO	Pleurocarpous moss
Senecio atropurpureus ssp. frigidus	*Tephroseris frigida* (Richardson) Holub	SENATRFRI	Low erect forb
Solorina sp.	*Solorina* sp.	SOLOSP	Foliose lichen
Stereocaulon alpinum	*Stereocaulon alpinum* Laur.	STEALP	Fruticose lichen
Stereocaulon species	*Stereocaulon* sp.	STERSP	Fruticose lichen
Thamnolia subuliformis s. l.	*Thamnolia subuliformis* s.l. (Sw.) Schaer.	THASUB	Fruticose lichen
Tomentypnum nitens	*Tomentypnum nitens* (Hedw.) Loeske	TOMNIT	Pleurocarpous moss
Unknown bryophytes	Unknown bryophyte (including mosses and liverworts)	UNKBRY	Bryophyte
Unknown crustose lichen	Unknown crustose lichen	UNKCRU	Crustose lichen
Unknown dicot	Unknown/unidentified forb	UNKDIC	Forb
Unknown graminoid	Unknown graminoid	UNKGRAM	Graminoid

Table A4.9. *Summary of plant community and habitat information for 2021 NIRPO terrestrial vegetation plots, Prudhoe Bay, July-August 2021.* ***Vegetation type:*** *Modified from Walker 1980, 1985; Watson-Cook 2022. See Table A4.7.* ***Habitat type****: After Mucina* et al. *2014. See Table A4.6.* ***Microrelief****: See Table A4.7 for code definitions.*

Plot ID	Trans-ect	Vegeta-tion type	Habitat type	Micro-relief	Field name (description) of plant community
21-01	T8	M2	5.06.1.2	F	Wet *Eriophorum angustifolium, Carex aquatilis, Drepanocladus brevifolius* graminoid, moss tundra
21-02	T8	M2	5.06.1.2	F	Wet *Carex aquatilis, Drepanocladus brevifolius* graminoid, moss tundra
21-03	T8	M4	5.06.1.2	F	Wet *Eriophorum angustifolium, Scorpidium scorpioides* graminoid, moss tundra
21-04	T8	M4	5.06.1.2	F	Wet *Eriophorum angustifolium, Scorpidium scorpioides* graminoid, moss tundra
21-05	T6	U3	1.02.2	HC	Moist *Eriophorum triste, Dryas integrifolium, Tomentypnum nitens, Thamnolia subuliformis* graminoid, prostrate dwarf-shrub, moss, lichen tundra
21-06	T6	U3	1.02.2	HC	Moist *Eriophorum triste, Dryas integrifolium, Tomentypnum nitens, Thamnolia subuliformis* graminoid, prostrate dwarf-shrub, moss, lichen tundra
21-07	T6	U4	1.02.2	HC	Moist *Eriophorum triste, Dryas integrifolium, Tomentypnum nitens*, graminoid, prostrate dwarf-shrub, moss tundra
21-08	T6	U4	1.02.2	HC	Moist *Eriophorum triste, Salix lanata, Drepanocladus brevifolius,* graminoid, dwarf-shrub, moss tundra
21-09	T6	U4	1.02.2	HC	Moist *Eriophorum triste, Salix lanata, Tomentypnum nitens,* graminoid, dwarf-shrub, moss tundra
21-10	T6	U3	NA	HC	Moist *Eriophorum triste, Dryas integrifolium, Tomentypnum nitens, Thamnolia subuliformis* graminoid, prostrate dwarf-shrub, moss, lichen tundra
21-11	T6	M2	5.06.1.2	T	Wet *Eriophorum angustifolium, Salix arctica, Drepanocladus brevifolius* sedge, moss tundra
21-12	T6	U4	1.02.2	T	Moist *Eriophorum triste, Salix lanata, Hamatocaulis vernicosus* graminoid, dwarf-shrub, moss tundra
21-13	T6	U4	5.06.1.2	T	Moist *Eriophorum angustifolium, Carex membranacea, Salix arctica, Drepanocladus brevifolius* sedge, moss tundra
21-14	T6	M2	5.06.1.2	T	Wet *Eriophorum angustifolium, Dupontia fisheri, Drepanocladus brevifolius* graminoid, moss tundra
21-15	T6	U4	1.02.2	T	Moist *Eriophorum triste, Salix arctica, Tomentypnum nitens* graminoid, dwarf-shrub, moss tundra
21-16	T6	M2	5.06.1.2	T	Wet *Eriophorum angustifolium, Salix arctica, Drepanocladus brevifolius* graminoid, moss tundra
21-17	T8	U4	1.02.2	S	Moist *Carex aquatilis, Eriophorum triste, Salix arctica, Tomentypnum nitens* graminoid, dwarf-shrub, moss tundra
21-18	T8	U4	1.02.2	S	Moist *Carex aquatilis, Eriophorum triste, Dryas integrifolia, Drepanocladus brevifolius* graminoid, dwarf-shrub, moss tundra
21-19	T9	M2	5.06.1.2	HC	Wet *Eriophorum angustifolium, Drepanocladus brevifolius* graminoid, moss tundra
21-20	T9	U3	1.02.2	HC	Moist *Carex membranacea, Dryas integrifolia, Tomentypnum nitens, Thamnolia subuliformis* graminoid, prostrate dwarf-shrub, moss, lichen tundra
21-21	T9	U3	1.02.2	HC	Moist *Dryas integrifolia, Carex membranacea, Tomentypnum nitens, Thamnolia subuliformis* prostrate dwarf-shrub, graminoid, moss, lichen tundra
21-22	T9	U3	1.02.2	HC	Moist *Eriophorum triste, Dryas integrifolia, Tomentypnum nitens, Thamnolia subuliformis* graminoid, prostrate dwarf-shrub, moss, lichen tundra
21-23	T9	M2	5.06.1.2	HC	Wet *Eriophorum angustifolium, Drepanocladus brevifolius* graminoid, moss tundra
21-24	T9	U3	1.02.2	S	Moist *Eriophorum triste, Dryas integrifolia, Tomentypnum nitens, Thamnolia subuliformis* graminoid, prostrate dwarf-shrub, moss, lichen tundra
21-25	T7	M4-MARL	5.06.1.1	P	Aquatic *Carex aquatilis* marl tundra
21-26	T7	M4-MARL	5.06.1.1	P	Aquatic *Carex aquatilis* marl tundra
21-27	T7	M2	5.06.1.2	LC	Wet *Eriophorum angustifolium, Drepanocladus brevifolius* graminoid, moss tundra
21-28	T7	M4	5.06.1.2	T	Aquatic *Eriophorum angustifolium, Carex aquatilis, Scorpidium scropioides* graminoid, moss tundra
21-29	T7	M2	5.06.1.2	LC	Wet *Eriophorum angustifolium, Carex aquatilis, Drepanocladus brevifolius* graminoid, moss tundra
21-30	T7	U4	1.02.2	LC	Moist *Eriophorum triste, Salix reticulata, Dryas integrifolia, Tomentypnum nitens* graminoid, prostrate dwarf-shrub, moss tundra
21-31	T7	M4/E1	5.06.1.2	T	Aquatic *Carex aquatilis, Calliergon giganteum* graminoid, moss tundra
21-32	T7	M4	5.06.1.2	T	Aquatic *Carex aquatilis, Drepanocladus* sp. graminoid, moss tundra
21-33	T7	M4	5.06.1.2	LC	Aquatic *Carex aquatilis, Eriophorum angustifolium, Drepanocladus brevifolius, Scorpidium scorpioides* graminoid, moss tundra
21-34	T7	U4	1.02.2	LC	Moist *Eriophorum triste, Salix reticulata, Dryas integrifolia, Tomentypnum nitens* graminoid, prostrate dwarf-shrub, moss tundra
21-35	T7	M4/E1	5.06.1.2	T	Aquatic *Carex aquatilis, Calliergon giganteum* graminoid, moss tundra

Table A4.10. *Environmental site factor and plant growth-form data for 2021 NIRPO terrestrial vegetation plots, Prudhoe Bay, July-August 2021.* ***Site factors:*** *See Table A4.5 for definitions of categorical and scalar variables.* ***Habitat type****: After Mucina* et al. *2014. See Table A4.6.* ***Vegetation type:*** *Modified from Walker 1980, 1985; Watson-Cook 2022. See Table A4.7.*

Plot ID	21-01	21-02	21-03	21-04	21-05	21-06	21-07	21-08	21-09	21-10	21-11	21-12
SITE FACTORS: CATEGORICAL VARIABLES (SEE TABLE A4.5)												
Surficial geology / parent material	5.1, 5.2	5.1, 5.2	5.1, 5.2	5.1, 5.2	5.1, 5.2	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1
Landform	3.1.1.2	3.1.1.2	3.1.1.2	3.1.1.2	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3
Topographic position	6	6	6	6	6	6	6	6	6	6	6	6
Surficial geomorphology	1.4	1.4	1.3	1.3	1.7.2	1.7.2	1.7.2	1.7.2	1.7.2	1.7.2	1.7.2	1.7.2
Microrelief	4	4	4	4	5.2	5.2	5.2	5.2	5.2	5.2	6	6
Disturbance type	4	4, 1	0	0	4, 1	1	0	0	1	0	0	1
SITE FACTORS: SCALAR VARIABLES (SEE TABLE A4.5)												
Estimated relative surface age (scalar, 1–5)	2	2	1	1	5	5	5	5	5	5	5	5
Site moisture (scalar, 1–10)	8	8	9	9	5	5	6	6	6	5	8	6
Soil moisture (scalar, 1–10)	9	9	9	9	5	5	6	6	6	5	9	7
Estimated snow duration (scalar, 1–10)	4	4	4	4	4	4	4	4	4	4	5	5
Animal and human disturbance degree (scalar, 0–5)	1	1	0	0	1	1	0	0	1	0	0	1
Site stability (scalar, 1–5)	1	1	1	1	2	2	2	2	2	2	4	4
Exposure to wind (scalar, 1-5)	3	3	3	3	3	3	3	3	3	3	2	2
SITE FACTORS: CONTINUOUS VARIABLES												
Slope (degrees)	0	0	0	0	0	0	0	0	0	0	0	0
Aspect (cardinal)	0	0	0	0	0	0	0	0	0	0	0	0
Microrelief height (cm)	7	5	2	2	10	5	5	5	5	7	3	7
Thaw depth (cm, mean of 5 measurements), July 19-26, 2021	33.4	38.2	37.8	34	31.7	32.3	26.5	30.75	34.5	29	36.2	29
Thaw depth (cm, mean of 5 measurements), Aug. 26-31, 2021	42.6	50.2	43.8	43.4	45.4	48	40.2	42.4	48.2	43.8	44.2	42
Water depth (cm, mean of 5 measurements), July 19-26, 2021	1	0	1	1	0	0	0	0	0	0	0	0
Water depth (cm, mean of 5 measurements), Aug. 26–31, 2021	0.8	0.6	4.8	3.8	0	0	0	0	0	0	2.4	0
Herbaceous layer height, including erect dwarf shrubs <10 CM (cm)	10	10	20	20	10	5	10	8	12	12	15	13
Live moss thickness (cm)	2	2	1	1	4	2	2	3	2	3	4	2
Total organic (+ a horizon) thickness (cm)	24	25	25	21	3	3+7 (A horizon)	8	20	16	17	26	22
COVER OF PLANT GROWTH FORMS AND OTHER VARIABLES (% COVER)												
Erect dwarf shrubs (15-40 cm tall) (live + attached dead)	0.1	0	0	0	0	0	1	15	2	0	0	0
Prostrate dwarf shrubs (<15 cm tall) (live + attached dead)	0.1	0.1	0	0	19	23	18	3	8	35	4	9
Evergreen shrubs (live + attached dead)	0.1	0	0	0	16	21	15	1	6	30	1	1
Deciduous shrubs (live + attached dead)	2	0.1	0	0	3	2	4	17	5	5	3	7
Erect forbs (live + attached dead)	0.1	0.1	0	0	0.1	1	0	0.1	0	0.1	0.1	0
Mat and cushion forbs (live + attached dead)	0	0	0	0	0	0.1	0	0	0	0	0	0
Non-tussock graminoids (live + attached dead)	50	55	55	61	20	11	60	80	26	17	75	81
Tussock graminoids (live + attached dead)	0	0	0	0	20	0	0	0	0	0	0	0
Horsetails (live + attached dead)	1	2	0.1	0.1	0	0.1	0	0	0.1	0	0.1	0.1
Foliose lichens	0.1	0.1	0	0	0.1	0	0	0	0	0	0	0
Fruticose lichens	0	0	0	0	0	8	0	0	0	6	0	0
Crustose lichens	0	0	0	0	10	0.1	0	0	0	0.1	0	0
Pleurocarpous bryophytes + leafy liverworts	32	55	10	20	0	52	32	31	14	30	42	16
Acrocarpous bryophytes	4	5	0	0	65	5	0.1	1	1	5	1	3
Total bryophytes (mosses + leafy liverworts)	36	60	10	20	75	57	32	32	15	35	43	19
Biological soil crusts	0	0	0	0	0	0	0	0	0	0	0	0
Algae	0.1	0	0	0	0	0	0	0	0	0	0	0
Rocks	0	0	0	0	0	0	0	0	0	0	0	0
Bare soil or marl	10	5	60	30	0	0	0	0	0	10	0	0
Litter	5	5	2	10	5	5	10	5	5	10	2	20
VEGETATION CATEGORICAL DESCRIPTORS												
Habitat type (See Table A4.6)	5.06.1.2	5.06.1.2	5.06.1.2	5.06.1.2	1.02.2	1.02.2	1.02.2	1.02.2	1.02.2	NA	5.06.1.2	1.02.2
Vegetation type (See Table A4.7)	M2	M2	M4	M4	U3	U3	U4	U4	U4	U3	M2	U4

Table A10 *(continued). Terrestrial vegetation plots 21-13 to 21-24.*

Plot ID	21-13	21-14	21-15	21-16	21-17	21-18	21-19	21-20	21-21	21-22	21-23	21-24
SITE FACTORS: CATEGORICAL VARIABLES (SEE TABLE A4.5)												
Surficial geology / parent material	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1	2.2, 5.1
Landform	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.3	3.1.1.2	3.1.1.2
Topographic position	6	6	6	6	6	6	6	6	6	6	6	6
Surficial geomorphology	1.7.2	1.7.2	1.7.2	1.7.2	1.4	1.4	1.7.2	1.7.2	1.7.2	1.7.2	1.7.2	1.7.1
Microrelief	6	6	6	6	3	3	5.2	5.2	5.2	5.2	5.2	3
Disturbance type	0	0	1	4	4	1, 4	0	1, 3	1	1	4	1
SITE FACTORS: SCALAR VARIABLES (SEE TABLE A4.5)												
Estimated relative surface age (scalar, 1–5)	5	5	5	5	2	2	3	5	5	5	3	3
Site moisture (scalar, 1–10)	7	8	6	7	6	6	8	5	5	5	8	5
Soil moisture (scalar, 1–10)	8	9	7	9	6	7	8	5	5	5	8	6
Estimated snow duration (scalar, 1–10)	5	5	5	5	4	4	4	4	4	4	4	4
Animal and human disturbance degree (scalar, 0–5)	0	0	1	1	1	1	0	1	2	1	2	1
Site stability (scalar, 1–5)	4	4	4	4	2	2	2	2	2	2	2	2
Exposure to wind (scalar, 1-5)	2	2	2	2	3	3	3	3	3	3	3	3
SITE FACTORS: CONTINUOUS VARIABLES												
Slope (degrees)	0	0	0	0	0	0	0	0	0	0	0	0
Aspect (cardinal)	0	0	0	0	0	0	0	0	0	0	0	0
Microrelief height (cm)	3	5	5	7	7	5	4	3	3	3	4	5
Thaw depth (cm, mean of 5 measurements), July 19-26, 2021	39.2	37.6	23	40	29.4	30.6	40.3	32.8	34.2	25.4	38.4	33.4
Thaw depth (cm, mean of 5 measurements), Aug. 26-31, 2021	48.4	41	37.8	45.8	46.6	40.4	47.6	41	43	33.2	46	42
Water depth (cm, mean of 5 measurements), July 19-26, 2021	0	0	0	0	0	0	0	0	0	0	0	0
Water depth (cm, mean of 5 measurements), Aug. 26–31, 2021	0.6	9.8	0	2.6	0	0	0.8	0	0	0	0	0
Herbaceous layer height, including erect dwarf shrubs <10 CM (cm)	20	25	10	15	10	10	10	5	5	10	10	8
Live moss thickness (cm)	1	7	3	6	4	2	1	2	2	5	2	3
Total organic (+ a horizon) thickness (cm)	20	19	20	23	23	20	19	1+23 (A horizon)	2+22 (A horizon)	5+18 (A horizon)	20	26
COVER OF PLANT GROWTH FORMS AND OTHER VARIABLES												
Erect dwarf shrubs (15-40 cm tall) (live + attached dead)	0.1	0	0	0	0	1	0	0	0	0	1	0
Prostrate dwarf shrubs (<15 cm tall) (live + attached dead)	7	1	11	2	5	16	1	61	62	31	1	6
Evergreen shrubs (live + attached dead)	0.1	0	5	4	3	10	0	60	60	25	1	5
Deciduous shrubs (live + attached dead)	7	1	6	2	2	7	1	1	2	1	1	1
Erect forbs (live + attached dead)	0.1	0	1	1	0	1	0.1	2	3	1	0	1
Mat and cushion forbs (live + attached dead)	0	0	0	0	0	0.1	0	0.1	0.1	0	0	0.1
Non-tussock graminoids (live + attached dead)	80	88	80	71	75	45	60	15	30	62	51	66
Tussock graminoids (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0
Horsetails (live + attached dead)	0.1	0.1	0.1	0.1	0.1	0.1	2	1	0.1	0.1	2	0.1
Foliose lichens	0	0	0	0	0	0	0	0	0	1	0	0.1
Fruticose lichens	0	0	0	0	0.1	0	0	15	11	5	0	5
Crustose lichens	0	0	0	0	0	0	0	1	1	0	0	0.1
Pleurocarpous bryophytes + leafy liverworts	15	45	57	37	13	20	15	15	50	75	50	45
Acrocarpous bryophytes	7	0	5	3	14	21	8	3	6	6	1	2
Total bryophytes (mosses + leafy liverworts)	22	45	62	40	27	41	23	18	56	81	51	47
Biological soil crusts	0	0	0	0	0	0	0	0	0	0	0	0
Algae	0	0	0	0	0	0	0	0	0	0	0	0
Rocks	0	0	0	0	0	0	0	0	0	0	0	0
Bare soil or marl	0	0	0	0	0	0	30	0	0	0	3	0
Litter	5	7	5	5	10	10	5	2	2	7	2	10
VEGETATION CATEGORICAL DESCRIPTORS												
Habitat type (See Table A4.6)	5.06.1.2	5.06.1.2	1.02.2	5.06.1.2	1.02.2	1.02.2	5.06.1.2	1.02.2	1.02.2	1.02.2	5.06.1.2	1.02.2
Vegetation type (See Table A4.7)	U4	M2	U4	M2	U4	U4	M2	U3	U3	U3	M2	U3

Table A4.10 *(continued). Terrestrial vegetation plots 21-25 to 21-35.*

Plot ID	21-25	21-26	21-27	21-28	21-29	21-30	21-31	21-32	21-33	21-34	21-35
SITE FACTORS: CATEGORICAL VARIABLES (SEE TABLE A4.5)											
Surficial geology / parent material	5.2	5.2	5.1, 5.2	5.1, 5.2	5.1, 5.2	5.1, 5.2	5.1, 5.2	5.1, 5.2	5.1, 5.2	5.1, 5.2	5.1, 5.2
Landform	3.1.1.2	3.1.1.2	3.1.1.2	3.1.1.2	3.1.1.2	3.1.1.2	3.1.1.2	3.1.1.2	3.1.1.2	3.1.1.2	3.1.1.2
Topographic position	8	8	6	6	6	6	6	6	6	6	6
Surficial geomorphology	1.1	1.1	1.7.1	1.7.1	1.7.1	1.7.1	1.7.1	1.7.1	1.7.1	1.7.1	1.7.1
Microrelief	13	13	5.1	6	5.1	7	6	6	5.1	7	6
Disturbance type	4	4	4	4	4	1	4	4	4	4, 1	4
SITE FACTORS: SCALAR VARIABLES (SEE TABLE A4.5)											
Estimated relative surface age (scalar, 1–5)	3	3	3	4	4	4	4	4	4	4	4
Site moisture (scalar, 1–10)	9	9	8	9	8	6	9	8	9	6	9
Soil moisture (scalar, 1–10)	10	10	9	9	9	7	10	9	9	7	9
Estimated snow duration (scalar, 1–10)	4	4	4	4	4	4	5	4	5	5	5
Animal and human disturbance degree (scalar, 0–5)	1	1	1	1	1	1	2	2	1	2	2
Site stability (scalar, 1–5)	4	4	2	4	2	4	4	4	2	4	4
Exposure to wind (scalar, 1-5)	3	3	3	2	3	3	3	2	3	3	2
SITE FACTORS: CONTINUOUS VARIABLES											
Slope (degrees)	0	0	0	0	0	0	0	0	0	0	0
Aspect (cardinal)	0	0	0	0	0	0	0	0	0	0	0
Microrelief height (cm)	2	2	3	2	3	15	1	4	4	4	1
Thaw depth (cm, mean of 5 measurements), July 19-26, 2021	42.4	44.6	45.2	39.2	43.8	36.2	35.8	36	49.6	40.5	36.6
Thaw depth (cm, mean of 5 measurements), Aug. 26-31, 2021	51	53.2	54.6	47.6	52	50.8	48	45.6	59.2	52	48
Water depth (cm, mean of 5 measurements), July 19-26, 2021	0	0	0	1.5	0.5	0	13.6	1.6	3	0	17.4
Water depth (cm, mean of 5 measurements), Aug. 26–31, 2021	0	0	0	4.2	0	0	15.2	6.4	6.6	0	13.4
Herbaceous layer height, including erect dwarf shrubs <10 CM (cm)	5	5	10	15	20	10	30	20	20	10	30
Live moss thickness (cm)	0	0	1	2	2	4	5	4	3	1	5
Total organic (+ a horizon) thickness (cm)	32	30	25	30	41	44	32	39	38	40	30
COVER OF PLANT GROWTH FORMS AND OTHER VARIABLES											
Erect dwarf shrubs (15-40 cm tall) (live + attached dead)	0	0	0	0	0	1	0	0	0	0.1	0
Prostrate dwarf shrubs (<15 cm tall) (live + attached dead)	0	0	0	0	0	31	0	0	0.1	31	0
Evergreen shrubs (live + attached dead)	0	0	0	0	0	20	0	0	0	20	0
Deciduous shrubs (live + attached dead)	0	0	0	0	0	11	0	0	0.1	11	0
Erect forbs (live + attached dead)	0	0	1	0	1	1	0	0	0.1	0.1	0
Mat and cushion forbs (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0
Non-tussock graminoids (live + attached dead)	8	10	86	45	80	35	45	60	75	35	62
Tussock graminoids (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0
Horsetails (live + attached dead)	0	0	0.1	0.1	2	1	0	0.1	0.1	0.1	0
Foliose lichens	0	0	0	0	0	0	0	0	0	0	0
Fruticose lichens	0	0	0	0	0	0	0	0	0	0	0
Crustose lichens	0	0	0	0	0	0.1	0	0	0	0.1	0
Pleurocarpous bryophytes + leafy liverworts	0	0.1	8	11	40	47	70	55	62	26	25
Acrocarpous bryophytes	0	0	2	5	10	10	10	20	4	40	0
Total bryophytes (mosses + leafy liverworts)	0	0	10	16	50	57	80	75	66	66	25
Biological soil crusts	0	0	0	0	0	0	0	0	0	0	0
Algae	0	0	0	0	0	0	0	0	0	0.1	0
Rocks	0	0	0	0	0	0	0	0	0	0	0
Bare soil or marl	100	100	20	20	1	0	0	10	10	0	0
Litter	1	2	5	2	5	10	90	20	20	5	85
VEGETATION CATEGORICAL DESCRIPTORS											
Habitat type (See Table A4.6)	5.06.1.1	5.06.1.1	5.06.1.2	5.06.1.2	5.06.1.2	1.02.2	5.06.1.2	5.06.1.2	5.06.1.2	1.02.2	5.06.1.2
Vegetation type (See Table A4.7)	M4-MARL	M4-MARL	M2	M4	M2	U4	M4/E1	M4	M4	U4	M4/E1

Table A4.11a. *Percent species cover abundance for 2021 NIRPO terrestrial vegetation plots 21-1 to 21-18, July 2021. Values are Braun-Blanquet cover-abundance scores: r = rare; + = <1% cover; 1 = 1–5% cover; 2 = 6–25% cover; 3 = 26–50% cover; 4 = 51–75% cover; 5 = 76–100% cover.*

Taxon	21-01	21-02	21-03	21-04	21-05	21-06	21-07	21-08	21-09	21-10	21-11	21-12	21-13	21-14	21-15	21-16	21-17	21-18
Abietinella abietina	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0
Aneura pinguis	+	0	0	0	0	0	0	r	0	0	+	0	0	0	0	+	0	0
Arctagrostis latifolia	0	0	0	0	+	1	0	0	0	+	0	0	0	+	+	+	0	0
Aulacomnium palustre	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blepharostoma trichophyllum	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0
Brachythecium species	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0
Bryum pseudotriquetrum	0	0	0	0	0	0	0	0	0	0	+	+	0	0	1	0	0	+
Bryum sp.	0	0	0	0	0	0	0	0	+	0	0	0	0	0	r	0	0	0
Calliergon giganteum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calliergon richardsonii	1	1	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	1
Calliergon sp.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Campylium sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Campylium stellatum	0	0	0	0	0	0	0	0	+	0	1	1	0	1	0	+	0	0
Cardamine digitata	0	0	0	0	r	r	0	0	0	+	0	0	0	0	+	0	0	0
Carex aquatilis	2	3	+	1	0	0	0	0	1	0	+	0	1	0	0	0	3	3
Carex atrofusca	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carex bigelowii	0	0	0	0	+	1	0	0	2	+		1	0	0	2	0	0	0
Carex marina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carex membranacea	+	0	0	0	+	0	+	3	+	1	0	0	2	1	0	1	0	0
Carex rotundata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carex saxatilis ssp. *laxa*	0	0	1	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carex scirpoidea	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0
Carex sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r
Cassiope tetragona	0	0	0	0	+	1	0	0	0	0	0	0	0	0	+	0	0	0
Catoscopium nigritum	+	1	0	0	r	0	0	+	0	r	0	r	1	0	1	0	1	1
Cetraria islandica	0	0	0	0	+	+	0	0	0	+	0	0	0	0	0	0	0	0
Cetraria laevigata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cinclidium arcticum	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cinclidium latifolium	+	1	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	1
Cinclidium sp.	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0
Cinclidium stygium	0	+	0	0	0	0	0	0	0	0	0	1	+	+	+	+	0	+
Cirriphyllum cirrosum	0	0	0	0	0	0	0	0	+	0	0	0	0	0	r	+	+	1
Cladonia pyxidata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dactylina arctica	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	+	0
Dactylina madreporiformis	0	0	0	0	0	r	0	0	0	0	0	0	0	0	0	0	0	0
Dicranum elongatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distichium capillaceum	0	+	0	0	+	+	+	+	+	+	2	1	1	0	1	1	1	1
Distichium inclinatum	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0
Ditrichum flexicaule	0	0	0	0	2	1	+	1	+	1	+	0	0	0	0	+	2	2
Drepanocladus brevifolius	3	3	0	0	0	0	0	3	1	0	1	2	1	3	1	2	0	2

Table A4.11a *(continued). Terrestrial vegetation plots 21-01 to 21-18.*

Taxon	21-01	21-02	21-03	21-04	21-05	21-06	21-07	21-08	21-09	21-10	21-11	21-12	21-13	21-14	21-15	21-16	21-17	21-18
Drepanocladus sp.	3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Dryas integrifolia	r	0	0	0	2	2	2	1	1	3	1	1	+	0	1	+	1	2
Dupontia fisheri	0	0	0	0	0	0	0	0	0	0	+	0	0	1	0	+	0	0
Encalypta rhabdocarpa	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0
Encalypta sp.	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0
Equisetum scirpoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Equisetum variegatum	1	1	+	0	+	+	+	+	+	0	+	+	+	+	+	+	1	1
Eriophorum angustifolium s. l.	3	2	3	4	2	1	4	3	2	3	4	5	4	4	4	4	1	2
Eriophorum scheuchzeri	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eutrema edwardsii	0	0	0	0	r	r	0	0	0	0	0	0	0	0	0	0	0	0
Fissidens species	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r
Flavocetraria cucullata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flavocetraria nivalis	0	0	0	0	0	r	0	0	0	0	0	0	0	0	0	0	0	0
Hamatocaulis vernicosus	0	0	0	0	0	0	0	0	0	0	2	+	+	1	0	2	0	0
Hierochloe pauciflora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0
Hypnum procerrimum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypnum species	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0
Juncus triglumis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lecanora epibryon	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0
Lophozia sp.	0	0	0	0	0	0	0	+	0	0	0	r	0	0	0	+	0	0
Masonhalea richardsonii	0	0	0	0	0	+	0	0	0	0	0	0	0	0		0	0	0
Meesia triquetra	1	1	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
Meesia uliginosa	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
Minuartia arctica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mnium sp.	0	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0
Nostoc commune	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nostoc sp.	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orthothecium chryseum	0	0	0	0	+	0	1	0	1	+	+	+	0	0	1	+	1	1
Papaver macounii	0	0	0	0	0	+	0	0	0	+	0	0	0	0	0	0	0	0
Pedicularis albolabiata	+	+	0	0	0	0	0	r	0	0	0	0	+	0	0	+	0	0
Pedicularis capitata	0	0	0	0	0	+	0	0	0	0	+	0	0	0	0	0	0	0
Pedicularis lanata	0	0	0	0	+	+	0	0	0	0	0	0	0	0	0	0	0	0
Peltigera aphthosa	0	0	0	0	0	r	0	0	0	0	0	0	0	0	0	0	0	0
Peltigera species	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Philonotis fontana	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0
Polygonum viviparum	+	0	0	0	0	0	0	0	0	0	+	0	+	0	+	+	0	+
Pyrola secunda	0	0	0	0	0	0	0	0	0	r	0	0	0	0	0	0	0	0
Salix arctica	+	+	0	0	1	1	1	1	1	1	1	1	1	+	1	1	1	1
Salix lanata s. l.	+	0	0	0	0	0	1	2	1	+	0	0	+	0	0	0	0	1
Salix ovalifolia	0	0	0	0	0	0	0	+	0	0	0	0	+	+	0	0	0	0

Table A4.11a *(continued). Terrestrial vegetation plots 21-01 to 21-18.*

Taxon	21-01	21-02	21-03	21-04	21-05	21-06	21-07	21-08	21-09	21-10	21-11	21-12	21-13	21-14	21-15	21-16	21-17	21-18
Salix reticulata	0	0	0	0	+	0	1	+	1	1	0	1	+	0	+	+	1	1
Sanionia uncinata	0	0	0	0	1	+	r	0	0	+	0	0	0	0	0	0	+	0
Saxifraga hirculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r	0	0
Saxifraga oppositifolia	0	0	0	0	r	+	0	0	0	0	0	0	0	0	0	0	0	r
Scorpidium scorpioides	+	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Senecio atropurpureus ssp. *frigidus*	0	0	0	0	+	+	0	0	0	0	0	0	0	0	+	0	0	0
Solorina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stereocaulon alpinum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stereocaulon species	0	0	0	0	0	r	0	0	0	0	0	0	0	0	0	0	0	0
Thamnolia subuliformis s. l.	0	0	0	0	2	2	0	0	0	1	0	0	0	0	0	0	0	0
Tomentypnum nitens	0	0	0	0	4	3	3	1	2	3	1	1	0	0	3	+	2	1
Unknown bryophytes	0	0	0	0	+	0	0	+	1	+	0	1	0	0	0	0	0	0
Unknown crustose lichen	0	0	0	0	0	0	0	0	0	r	0	0	0	0	0	0	0	0
Unknown dicot	0	0	0	0	0	0	0	0	0	0	r	0	0	0	0	0	0	0
Unknown graminoid	0	0	0	0	r	0	0	0	0	0	0	0	0	0	0	0	0	r

Table A4.11b. *Percent species cover abundance for 2021 NIRPO terrestrial vegetation plots 21-19 to 21-35, July 2021. Values are Braun-Blanquet cover-abundance scores: r = rare; + = <1% cover; 1 = 1–5% cover; 2 = 6–25% cover; 3 = 26–50% cover; 4 = 51–75% cover; 5 = 76–100% cover.*

Taxon	21-19	21-20	21-21	21-22	21-23	21-24	21-25	21-26	21-27	21-28	21-29	21-30	21-31	21-32	21-33	21-34	21-35
Abietinella abietina	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
Aneura pinguis	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	+	0
Arctagrostis latifolia	0	1	+	+	0	+	0	0	0	0	0	0	0	0	0	0	0
Aulacomnium palustre	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0
Blepharostoma trichophyllum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brachythecium species	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bryum pseudotriquetrum	0	0	0	0	0	+	0	0	1	0	+	+	0	0	0	5	0
Bryum sp.	0	0	0	0	+	+	0	0	+	0	0	0	0	+	+	0	0
Calliergon giganteum	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	2
Calliergon richardsonii	0	0	0	0	+	0	0	0	0	0	+	0	0	0	0	0	0
Calliergon sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0
Campylium sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Campylium stellatum	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Cardamine digitata	0	r	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carex aquatilis	2	0	0	0	2	1	8	2	1	3	3	5	3	4	3	2	4
Carex atrofusca	+	0	0	0	+	0	0	0	1	0	0	0	0	0	0	0	0
Carex bigelowii	0	0	0	2	0	0	0	0	0	0	0	5	0	0	0	0	0
Carex marina	0	0	0	0	0	0	0	0	0	0	+	0	0	0	+	0	0
Carex membranacea	0	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Carex rotundata	+	0	0	0	0	0	0	0	+	1	0	0	0	0	+	0	+

Table A4.11b *(continued). Terrestrial vegetation plots 21-19 to 21-35.*

Taxon	21-19	21-20	21-21	21-22	21-23	21-24	21-25	21-26	21-27	21-28	21-29	21-30	21-31	21-32	21-33	21-34	21-35
Carex saxatilis ssp. *laxa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carex scirpoidea	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carex sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassiope tetragona	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Catoscopium nigritum	1	0	0	+	+	+	0	0	+	1	0	0	0	0	0	2	0
Cetraria islandica	0	+	1	+	0	+	0	0	0	0	0	+	0	0	0	0	0
Cetraria laevigata	0	r	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cinclidium arcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cinclidium latifolium	1	0	0	0	0	0	0	0	1	1	5	0	0	0	1	+	0
Cinclidium sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Cinclidium stygium	0	0	0	0	+	0	0	0	0	1	1	0	0	0	0	0	0
Cirriphyllum cirrosum	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
Cladonia pyxidata	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dactylina arctica	0	1	1	+	0	1	0	0	0	0	0	0	0	0	0	0	0
Dactylina madreporiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dicranum elongatum	0	+	+	0	0	0	0	0	0	0	0	0	0	0	0	5	0
Distichium capillaceum	+	0	0	0	+	+	0	0	0	0	0	0	0	0	0	2	0
Distichium inclinatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ditrichum flexicaule	0	1	5	5	0	5	0	0	0	0	0	2	0	0	0	0	0
Drepanocladus brevifolius	2	1	0	0	3	5	0	0	5	1	3	5	0	3	3	2	0
Drepanocladus sp.	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	5
Dryas integrifolia	0	60	60	2	+	5	0	0	0	0	0	2	0	0	0	2	0
Dupontia fisheri	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0
Encalypta rhabdocarpa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Encalypta sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Equisetum scirpoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Equisetum variegatum	1	+	+	+	1	+	0	0	+	+	1	1	0	+	+	+	0
Eriophorum angustifolium s. l.	3	5	2	3	3	4	+	0	5	2	3	2	0	0	3	2	0
Eriophorum scheuchzeri	0	0	0	0	0	0	0	0	0	+	+	0	0	0	0	0	0
Eutrema edwardsii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissidens species	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flavocetraria cucullata	0	r	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
Flavocetraria nivalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hamatocaulis vernicosus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hierochloe pauciflora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypnum procerrimum	0	1	+	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Hypnum species	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Juncus triglumis	0	0	0	0	0	0	0	0	+	0	r	0	0	0	+	0	0
Lecanora epibryon	0	+	1	0	0	+	0	0	0	0	0	0	0	0	0	0	0
Lophozia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A4.11b *(continued). Terrestrial vegetation plots 21-19 to 21-35.*

Taxon	21-19	21-20	21-21	21-22	21-23	21-24	21-25	21-26	21-27	21-28	21-29	21-30	21-31	21-32	21-33	21-34	21-35
Masonhalea richardsonii	0	1	+	+	0	0	0	0	0	0	0	0	0	0	0	0	0
Meesia triquetra	1	0	0	0	+	0	0	0	0	0	1	0	2	2	1	0	0
Meesia uliginosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
Minuartia arctica	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mnium sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nostoc commune	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0
Nostoc sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orthothecium chryseum	+	0	0	+	0	+	0	0	0	0	0	1	0	0	0	+	0
Papaver macounii	0	+	+	+	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedicularis albolabiata	+	0	0	0	+	0	0	0	+	0	+	0	0	0	+	0	0
Pedicularis capitata	0	+	+	+	0	+	0	0	0	0	0	+	0	0	0	0	0
Pedicularis lanata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peltigera aphthosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peltigera species	0	0	0	r	0	0	0	0	0	0	0	0	0	0	0	0	0
Philonotis fontana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polygonum viviparum	0	0	0	+	+	0	0	0	0	0	0	+	0	0	0	+	0
Pyrola secunda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salix arctica	+	0	1	+	+	0	0	0	0	0	0	1	0	0	+	+	0
Salix lanata s. l.	0	0	0	+	1	0	0	0	0	0	0	+	0	0	0	+	0
Salix ovalifolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salix reticulata	r	1	0	0	+	1	0	0	0	0	0	2	0	0	0	2	0
Sanionia uncinata	0	1	+	+	0	+	0	0	0	0	0	+	0	0	0	0	0
Saxifraga hirculus	0	0	0	0	0	0	0	0	+	0	r	0	0	0	0	0	0
Saxifraga oppositifolia	0	+	+	0	0	0	0	0	0	0	0	+	0	0	0	0	0
Scorpidium scorpioides	5	0	0	0	0	0	0	r	0	2	0	0	5	0	2	0	0
Senecio atropurpureus ssp. *frigidus*	0	1	1	+	0	0	0	0	0	0	0	0	0	0	0	0	0
Solorina sp.	0	0	0	r	0	r	0	0	0	0	0	0	0	0	0	0	0
Stereocaulon alpinum	0	1	+	+	0	0	0	0	0	0	0	0	0	0	0	0	0
Stereocaulon species	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thamnolia subuliformis s. l.	0	2	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Tomentypnum nitens	0	2	3	4	0	3	0	0	0	0	0	3	0	0	0	2	0
Unknown bryophytes	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Unknown crustose lichen	0	1	1	0	0	r	0	0	0	0	0	0	0	0	0	+	0
Unknown dicot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unknown graminoid	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A4.12. *Soil characteristics of 2021 NIRPO terrestrial vegetation plots, Prudhoe Bay, July 2021.* ***Horizon****: Soil layer.* ***Depth:*** *Distance below soil surface.* ***Gravel****: Percentage of particles >2mm.* ***Sand, Silt, and Clay****: Hydrometer method (Klute 1986).* ***Texture:*** *A USDA textural triangle.* ***Organic Matter****: Mass loss on ignition.* ***Bulk density****: Mass of the oven-dried sample divided by the volume of the can it was sampled in (180cm³).* ***Gravimetric soil moisture****: Mass of water lost by oven drying divided by the mass of the dried sample.* ***Volumetric soil moisture****: Mass of water lost by oven drying divided by the volume of the soil can (180cm³).* ***pH (saturated paste)****: Moistened as much as possible without pooling.* ***pH (1:2.5)****: soil-to-water ratio.* ***Soil color****: Color of the soil using Munsell 1975 Soil Color Charts.*

	Horizon		Soil color		Soil moisture		Soil texture and organic matter							Soil pH	
Plot ID	Horizon	Depth (cm)	Wet hue value/chroma	Dry hue value/chroma	Gravimetric soil moisture (%)	Volumetric soil moisture (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Texture	Organic matter (%)	Bulk density (g/cm³)	Saturated paste method	1:2.5 volume method
21-01	Oe1 + Oe2	11-16	10YR 2/2	10YR 3/2	256	72	0.00	56	42	2	Sandy loam	32.3	0.28	6.8	6.5
21-01	B	24-29	10YR 3/2	10YR 3/2	79	56	0.00	56	42	2	Sandy loam	25.7	0.70	7.1	6.9
21-02	Oi	1-6	7.5YR 3/2.5	10YR 4.5/2	511	64	0.00	58	38	4	Sandy loam	36.5	0.12	7.4	7.2
21-02	Oe	12-17	10YR 3/2	10YR 4/2	186	71	0.00	58	38	4	Sandy loam	20.2	0.38	7.2	7.2
21-02	B	25-30	10YR 3/2	10YR 3/2	53	58	0.00	58	38	4	Sandy loam	11.6	1.10	7.1	7.1
21-03	Oi	3-8	10YR 3/2	10YR 3/2	201	70	0.00	42	54	4	Silt loam	26.3	0.35	7.0	7.3
21-03	B	25-30	10YR 3/2	10YR 3/2	271	97	0.00	42	52	4	Silt loam	28.6	0.36	7.0	7.3
21-04	Oi	11-16	10YR 2/1	10YR 3/2	230	74	0.00	32	64	4	Silt loam	29.1	0.32	6.9	7.1
21-04	B	21-26	10YR 2/1	10YR 3/2	112	69	0.00	32	64	4	Silt loam	24.0	0.62	7.0	7.1
21-05	B	3-8	10YR 2/2	10YR 4/2	94	59	0.00	44	52	4	Silt loam	15.9	0.63	7.1	7.2
21-06	A	3-8	10YR 2/1	10YR 3/2	137	52	0.00	30	66	4	Silt loam	22.7	0.38	7.0	7.1
21-06	B	NA	10YR 2/1	10YR 4/2	78	51	0.00	30	66	4	Silt loam	19.5	0.65	7.1	7.1
21-07	Oa	3-8	10YR 2/2	10YR 4/2	222	66	0.00	44	50	6	Silt loam	30.7	0.30	7.4	7.2
21-07	B	NA	10YR 3/1	10YR 5/2	61	50	0.00	44	50	6	Silt loam	12.3	0.81	7.2	7.2
21-08	Oe	3-8	10YR 2/2	10YR 4/2	210	67	0.00	48	46	6	Sandy loam	27.5	0.32	7.0	7.1
21-08	B	8-13	10YR 4/1	10YR 5/2	32	40	0.00	48	46	6	Sandy loam	10.3	1.25	6.7	7.2
21-09	Oe	2-7	10YR 2/2	10YR 4/2	164	57	0.00	44	50	6	Silt loam	27.2	0.35	7.0	7.3
21-09	Oa	6-11	10YR 2/1	10YR 3/2	150	68	0.00	44	50	6	Silt loam	23.6	0.45	7.0	7.2
21-09	B	16-21	10YR 3/1	10YR 5/2	28	31	0.00	44	50	6	Silt loam	9.3	1.07	6.9	7.3
21-10	Oa2	6-11	10YR 2/1	10YR 4/2	124	52	0.00	52	42	6	Sandy loam	23.5	0.42	7.1	7.2
21-10	B	17-22	10YR 3/1	10YR 5/1	26	31	0.01	52	42	6	Sandy loam	6.5	1.17	7.0	7.4
21-11	Oi2	3-8	10YR 2/2	10YR 5/2	492	56	0.00	n.d.	n.d.	n.d.	n.d.	48.6	0.11	7.0	7.2
21-12	Oe	4-9	10YR 2/1	10YR 4/2	385	60	0.00	n.d.	n.d.	n.d.	n.d.	57.0	0.16	7.1	7.1
21-12	Oa	11-16	10YR 3/1	10YR 5/2	133	58	0.00	n.d.	n.d.	n.d.	n.d.	20.4	0.44	7.0	7.2
21-13	Oe	3-8	10YR 3/2	10YR 4/2	153	63	0.00	44	52	4	Silt loam	24.1	0.41	6.9	7.1
21-13	B	20-25	10YR 3/1	10YR 4/1	70	53	0.00	44	52	4	Silt loam	11.3	0.75	7.1	7.3
21-14	Oe	10-15	10YR 2/2	10YR 4/2	191	72	0.00	30	64	6	Silt loam	23.7	0.37	7.0	7.0
21-14	B	19-24	10YR 3/2	10YR 4/2	73	56	0.01	30	64	6	Silt loam	16.5	0.76	6.7	7.0
21-15	Oe	5-10	10YR 2/2	10YR 4.5/2	155	52	0.00	30	64	6	Silt loam	n.d.	0.33	7.3	7.3
21-15	Oa	14-19	10YR 3/2	10YR 5/2	77	53	0.00	30	64	6	Silt loam	14.0	0.69	7.1	7.3
21-15	B	25-30	10YR 3/1	10YR 4/1	81	54	0.02	30	64	6	Silt loam	19.5	0.67	6.7	6.8
21-16	Oe	6-11	10YR 2/2	10YR 4/2	313	79	0.00	44	48	8	Loam	36.2	0.25	7.1	7.2
21-16	Oa	11-16	10YR 2/2	10YR 5/2	146	68	0.00	44	48	8	Loam	17.1	0.47	7.2	7.4
21-16	B	23-28	10YR 3/1	10YR 5/2	44	52	0.02	44	48	8	Loam	8.8	1.20	7.1	7.3
21-17	Oe	5-10	10YR 2/2	10YR 4.5/2	168	76	0.00	54	38	8	Sandy loam	22.9	0.45	7.1	7.2
21-17	B	23-28	10YR 3/2	10YR 4/1	31	37	0.09	54	38	8	Sandy loam	9.4	1.20	7.0	7.2

Table A4.12 *(continued)*

	Horizon		Soil color		Soil moisture		Soil texture and organic matter							Soil pH	
Plot ID	Horizon	Depth (cm)	Wet hue value/chroma	Dry hue value/chroma	Gravimetric soil moisture (%)	Volumetric soil moisture (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Texture	Organic matter (%)	Bulk density (g/cm^3)	Saturated paste method	1:2.5 volume method
21-18	Oe2	5-10	10YR 2/2	10YR 3/3	204	69	0.00	54	42	4	Sandy loam	27.2	0.34	6.6	6.8
21-18	B	20-25	10YR 3/2	10YR 4/1	50	46	0.03	54	42	4	Sandy loam	12.9	0.91	6.6	6.9
21-19	Oe	4-9	10YR 2/2	10YR 3/2	171	80	0.00	34	64	2	Silt loam	21.5	0.47	6.9	7.2
21-19	B	19-24	10YR 3/2	10YR 4/1	125	76	0.00	34	64	2	Silt loam	24.0	0.61	7.1	7.3
21-20	A1	4-9	10YR 2/2	10YR 3/3	97	59	0.00	NA	NA	NA	NA	17.1	0.61	7.0	7.1
21-20	A2	24-29	10YR 2/2	10YR 3/2	92	51	0.00	NA	NA	NA	NA	18.3	0.55	7.1	7.1
21-21	A	5-10	10YR 3/2	10YR 4/2	30	27	0.00	NA	NA	NA	NA	14.8	0.90	7.0	7.3
21-22	A	10-15	10YR 2.5/2	10YR 5/2	104	59	0.00	NA	NA	NA	NA	11.1	0.57	7.1	7.6
21-23	Oe2	13-18	10YR 2/2	10YR 3/2	182	69	0.00	32	62	6	Silt loam	21.7	0.38	7.0	7.4
21-23	B	20-25	10YR 3/2	10YR 5/2	95	59	0.00	32	62	6	Silt loam	24.3	0.62	7.0	7.3
21-24	Marl	6-11	10YR 3/2	10YR 5/2	116	47	0.00	34	64	2	Silt loam	15.0	0.41	7.2	7.5
21-24	Oe	15-20	10YR 2/2	10YR 4/1	83	58	0.00	34	64	2	Silt loam	15.0	0.70	7.1	7.2
21-24	B	26-31	10YR 2/2	10YR 3/2	117	52	0.00	34	64	2	Silt loam	34.1	0.44	6.9	6.9
21-25	Oi?	10-15	10YR 4/2	10YR 3/2	191	73	0.00	NA	NA	NA	NA	27.3	0.38	7.3	7.6
21-26	Marl	0-5	10YR 5/2	10YR 4.5/1	226	72	0.00	NA	NA	NA	NA	26.8	0.32	7.2	7.4
21-26	Oi	6-11	10YR 2/2	10YR 3/2	187	70	0.00	NA	NA	NA	NA	24.7	0.37	7.2	7.5
21-27	Oe	10-15	10YR 3/2	10YR 3/2	198	75	0.00	56	40	4	Sandy loam	28.0	0.38	6.3	6.5
21-27	B	29-34	10YR 3.5/1	10YR 4/1	41	39	0.00	56	40	4	Sandy loam	9.4	0.93	6.9	7.1
21-28	Oi2	10-15	10YR 2/2	10YR 3/2	218	59	0.00	NA	NA	NA	NA	30.9	0.27	6.1	6.7
21-29	Oe1	10-15	10YR 3/3	10YR 4/2	147	63	0.00	48	50	2	Silt loam	23.7	0.43	6.9	7.5
21-29	Oe2	35-40	10YR 2/2	10YR 3/2	129	66	0.01	48	50	2	Silt loam	23.3	0.51	6.6	7.1
21-29	B	43-48	10YR 3/2	10YR 3/2	100	63	0.07	48	50	2	Silt loam	19.5	0.63	6.9	7.2
21-30	Oe2	15-20	10YR 3/2	10YR 3/2	163	63	0.00	46	52	2	Silt loam	32.8	0.38	6.2	6.4
21-30	Oe3	25-30	10YR 3/2	10YR 3/2	149	62	0.00	46	52	2	Silt loam	28.4	0.42	6.6	6.7
21-30	B	44-48	10YR 3/2	10YR 3/2	127	68	0.05	46	52	2	Silt loam	23.8	0.53	6.9	7.0
21-31.1	Oi1	5-10	10YR 2/1	10YR 3/3	824	31	0.00	NA	NA	NA	NA	66.9	0.04	6.6	6.9
21-31.1	Oi2	10-16	10YR 2/2	10YR 3/3	204	66	0.00	NA	NA	NA	NA	25.6	0.32	6.6	7.0
21-31.1	Oi3	16-21	10YR 3/2	10YR 4/2	232	78	0.00	NA	NA	NA	NA	25.7	0.34	6.7	7.1
21-31.2	Oi2	2-6	10YR 2/1	10YR 3/3	199	43	0.00	50	46	4	Sandy loam	30.6	0.22	6.7	7.1
21-31.2	Oi3	8-13	10YR 2/1	10YR 3/2	145	63	0.00	50	46	4	Sandy loam	21.5	0.43	6.9	7.1
21-31.2	B	31-36	10YR 3/1	10YR 4/1	46	43	0.06	50	46	4	Sandy loam	13.2	0.95	6.9	7.4
21-32	Oi1	0-5	10YR 2/2	10YR 3/4	863	41	0.00	NA	NA	NA	NA	69.8	0.05	6.4	6.7
21-32	Oi2	10-15	10YR 3/2	10YR 4/1	105	64	0.00	NA	NA	NA	NA	14.3	0.61	6.1	6.3
21-32	Oi3	30-35	10YR 2.5/2	10YR 3/2	256	74	0.00	NA	NA	NA	NA	37.2	0.29	5.6	5.8

Table A4.12 *(continued)*

	Horizon		Soil color		Soil moisture		Soil texture and organic matter							Soil pH	
Plot ID	Horizon	Depth (cm)	Wet hue value/chroma	Dry hue value/chroma	Gravimetric soil moisture (%)	Volumetric soil moisture (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Texture	Organic matter (%)	Bulk density (g/cm^3)	Saturated paste method	1:2.5 volume method
21-33.2	Oi3	10-15	10YR 2/2	10YR 3/2	206	81	0.00	66	30	4	Sandy loam	31.4	0.39	6.2	6.4
21-33.2	B	38-43	10YR 4/1	10YR 4.5/1	35	47	0.04	66	30	4	Sandy loam	6.0	1.34	6.9	7.2
21-34	Oe1	10-15	10YR 2/2	10YR 4/2	236	66	0.00	34	64	2	Sandy loam	35.3	0.28	6.4	6.3
21-34	B	38-43	10YR 3/1	10YR 3/2	195	70	0.00	34	64	2	Sandy loam	31.5	0.36	6.2	6.3
21-35	Oi2	10-15	10YR 2/2	10YR 3/2	146	64	0.00	74	24	2	Loamy sand	26.7	0.44	6.0	6.2
21-35	B	30-35	10YR 3/2	10YR 4/1	30	40	0.06	74	24	2	Loamy sand	6.8	1.32	6.8	7.0

Table A4.13. *Aboveground biomass of 2021 NIRPO terrestrial vegetation plots, Prudhoe Bay, 26-31 August 2021. Data are dry weights in g/m² from a representative 50 x 20 cm sample of the plant communities at each plot sorted by growth form and lifeform.*

Plot ID	Vegetation type	Surface feature	Transect	Deciduous shrub (g/m²)	Evergreen shrub (g/m²)	Graminoid (live) (g/m²)	Graminoid (dead) (g/m²)	Forb (g/m²)	Horsetail (g/m²)	Spike moss (g/m²)	Alga (g/m²)	Lichen (g/m²)	Moss (g/m²)	Litter (g/m²)	Total (g/m²)
21-01	M2	Featureless	T8	33.8	69.9	44.3	41.3	0	32	0	0	5.8	295.8	134.7	**657.6**
21-02	M2	Featureless	T8	16.6	10.1	41.7	35.5	0	18	0	0	0	259.8	17.9	**399.6**
21-03	M4	Featureless	T8	0	0	30.2	75.6	0	0	0	0	0	28.5	25	**159.3**
21-04	M4	Featureless	T8	0	0	97.6	161.3	0	0	0	0	0	342.4	86.9	**688.2**
21-05	U3	Center	T6	29	160	53.9	52.4	0	7.4	0	0	64.8	265.3	291.1	**923.9**
21-06	U3	Center	T6	9.3	183.8	36.1	20.9	6.5	8.3	0	0	55	594.2	105.2	**1019.3**
21-07	U4	Center	T6	86.4	8	197.7	230.6	0	8.1	0	0	0	249.8	216	**996.6**
21-08	U4	Center	T6	311.2	24.8	58	157.6	0	10	0	0	0	130.6	183.2	**875.4**
21-09	U4	Center	T6	153.2	99.5	25.2	213.5	1.1	14.3	0	0	0	211.2	369.2	**1087.2**
21-10	U3	Center	T6	7.2	279.5	67.2	50.9	0.3	1.1	0	0	53.1	739.3	498.6	**1697.2**
21-11	M2	Trough	T6	32.9	77.7	123.7	79.6	0	0	0	0	0	118.6	82.8	**515.3**
21-12	U4	Trough	T6	26.5	0	139.4	165.7	0	6.7	0	0	0	129	149	**616.3**
21-13	U4	Trough	T6	0	1.3	68.3	83	0	17.2	0	0	0	64.4	80.6	**314.8**
21-14	M2	Trough	T6	15.6	0	106.5	92.9	0	8.4	0	0	0	613.6	51.3	**888.3**
21-15	U4	Trough	T6	32.5	0	90.8	99.5	0	15.7	0	0	0	934.9	76.5	**1249.9**
21-16	M2	Trough	T6	16.9	43.2	174.2	103.9	2.1	8.7	0	0	2.9	376.9	55.6	**784.4**
21-17	U4	Rim	T8	29.7	149.7	31.4	122.7	2.7	23.9	0	0	37.6	411.4	186.6	**995.7**
21-18	U4	Rim	T8	55.1	120.7	34.9	103.4	0	18.8	0	0	0	188	120.9	**641.8**
21-19	M2	Center	T9	0	0	61.6	124.4	0	39	0	0	0	269.7	24.9	**519.6**
21-20	U3	Center	T9	2.3	273.4	29.6	52.2	63.7	22.4	6.8	0	77.7	355.2	415.5	**1298.8**
21-21	U3	Center	T9	5.5	176.4	30.8	58.1	7.8	0	0	0	72.1	628.3	272.6	**1251.6**
21-22	U3	Center	T9	50.4	166.9	29.7	130.2	2.4	6.9	0	0	37.6	350.8	342.2	**1117.1**
21-23	M2	Center	T9	30.3	4.1	84.3	123.7	2.5	55.1	0	0	0	563.4	30.3	**893.7**
21-24	U3	Rim	T9	1.4	230.2	33.4	109.6	0	19.3	0	0	43.9	531.4	114.3	**1083.5**
21-25	M4?	Marl pond	T7	0	0	4	13.7	0	0	0	0	0	0	0	**17.7**
21-26	M4?	Marl pond	T7	0	0	12.2	20.1	0	0	0	0	0	0	0	**32.3**
21-27	M2	Center	T7	0	0	82.4	126.4	0	1.6	0	0	0	1.1	0	**211.5**
21-28	U4	Center	T7	0	0	95.1	83.1	0	1.5	0	0	0	60.8	0	**240.5**
21-29	M2	Center	T7	0	0	85.1	93.4	1.9	32	0	0	0	413.2	22.9	**648.5**
21-30	U4	Rim	T7	28.3	53.4	106.8	148.1	3.2	19.6	0	0	0	538.3	127.7	**1025.4**
21-31	E1	Trough	T7	0	0	271.4	65.5	0	0	0	0	0	142.4	0	**479.3**
21-32	E1	Trough	T7	0	0	224.4	118.6	0	2.8	0	0	0	218.2	0	**564**
21-33	M4	Center	T7	0	0	130.1	98.2	0	0.6	0	1.8	0	56.8	0	**287.5**
21-34	U4	Rim	T7	23.1	89.3	53	73.3	2.5	15	0	0	0	211.7	66.5	**534.4**
21-35	E1	Trough	T7	0	0	148.4	20	0	0	0	0	0	72.8	81.1	**322.3**

Table A4.14. *Temperature loggers (Thermocron iButton® model DS1922L) installed at 2021 NIRPO terrestrial vegetation plots, Prudhoe Bay, Alaska, July 2021. Sampling started at 0:00 on 17 July 2021, with a sampling rate of 240 min. and capacity of 8192 readings. The last button was installed by 18:00 on 26 July 2021. i****Btn ID:** *Temporary assigned ID number.* ***Depth****: Distance from soil surface.* ***Serial no.****: Permanent factory ID.*

Plot ID	Transect	iBtn ID	Sensor location	Depth (cm)	Serial no.
21-01	T8	T57	organic layer base	-24	15000000751CE641
21-01	T8	T13	soil surface	0	70000000755D3141
21-02	T8	T29	organic layer base	-25	32000000755A3F41
21-02	T8	T08	soil surface	0	29000000755E1941
21-03	T8	T28	organic layer base	-25	7B000000755AA441
21-03	T8	T30	soil surface	0	14000000755E4741
21-04	T8	T36	organic layer base	-21	13000000755A9341
21-04	T8	T07	soil surface	0	DE000000755B9341
21-05	T6	T60[1]	organic layer base	-10	AE000000751C2941
21-05	T6	T58	soil surface	0	E4000000751D3D41
21-06	T6	T22	organic layer base	-10	7B00000075598F41
21-06	T6	T43	soil surface	0	8F000000755AC541
21-07	T6	T51	organic layer base	-12	D7000000755E2741
21-07	T6	T59	soil surface	0	7C000000751A0241
21-08	T6	T47	organic layer base	-20	9C000000755C9D41
21-08	T6	T55	soil surface	0	FF000000755A2641
21-09	T6	T12	organic layer base	-14	6D000000755C5F41
21-09	T6	T23	soil surface	0	B600000075599641
21-10	T6	T27	organic layer base	-19	66000000755BCA41
21-10	T6	T42	soil surface	0	C3000000755DB241
21-11	T6	T52	organic layer base	-17	6E000000755A9F41
21-11	T6	T49	soil surface	0	8B000000755CB541
21-12	T6	T31	organic layer base	-11	A5000000755AB341
21-12	T6	T33	soil surface	0	16000000755C6641
21-13	T6	T45	organic layer base	-20	A2000000755D4C41
21-13	T6	T54	soil surface	0	58000000755A1B41
21-14	T6	T44	organic layer base	-19	2A0000007559C041
21-14	T6	T46	soil surface	0	40000000755ACF41
21-15	T6	T37	organic layer base	-20	73000000755BF141
21-15	T6	T48	soil surface	0	3F000000755BC941
21-16	T6	T41	organic layer base	-23	02000000755CD841
21-16	T6	T50	soil surface	0	18000000755E2D41
21-17	T8	T19	organic layer base	-23	8D000000755BCF41
21-17	T8	T20	soil surface	0	E0000000755C1441

Plot ID	Transect	iBtn ID	Sensor location	Depth (cm)	Serial no.
21-18	T8	T06	organic layer base	-20	74000000755C0E41
21-18	T8	T53	soil surface	0	48000000755B9A41
21-19	T9	T25	organic layer base	-19	DF000000755D4041
21-19	T9	T32	soil surface	0	50000000755D1841
21-20	T9	T24	organic layer base	-19	31000000755AA941
21-20	T9	T14	soil surface	0	83000000755CF941
21-21	T9	T26	organic layer base	-20	96000000755DDB41
21-21	T9	T09	soil surface	0	B1000000755A0D41
21-22	T9	T02[4]	base of A horizon	-23	2B000000755D2141
21-22	T9	T17	soil surface	0	81000000755CEA41
21-23	T9	T18	organic layer base	-20	F9000000755D5C41
21-23	T9	T38	soil surface	0	45000000755A6C41
21-24	T9	T10[5]	organic layer base	-26	1A000000755A5A41
21-24	T9	T11	soil surface	0	10000000755D4A41
21-25	T7	T40	organic layer base	-20	D700000075596841
21-25	T7	T04	soil surface	0	2C000000755BC741
21-26	T7	T39	organic layer base	-20	B5000000755C7D41
21-26	T7	T03	soil surface	0	5E000000755C7841
21-27	T7	T56	organic layer base	-26	BD000000751F0C41
21-27	T7	T21	soil surface	0	55000000755DBB41
21-28	T7	T35	organic layer base	-40	BA000000755AD741
21-28	T7	T01	soil surface	0	B900000075596A41
21-29	T7	NA	no iButtons		
21-30	T7	NA	no iButtons		
21-31b	T7	T15[2]	organic layer base	-20	71000000755CAD41
21-31b	T7	T05	soil surface	0	7D0000007559BA41
21-32	T7	NA	no iButtons		
21-33	T7	NA	no iButtons		
21-34	T7	NA	no iButtons		
21-35	T7	T34	organic layer base	-20	2C000000755C8841
21-35	T7	T16[3]	soil surface	0	79000000755AB741

Notes: 1/ Serial no. is for T60, not T16. Check data. 2/ iButtons on snow pole in the plot. 3/ Serial no. is for T16, not T60. Check data. 4/ Depth not written in the field book; assume base of the A horizon. 5/ Check iButton ID on removal. ID was incompletely recorded in field notebook.

APPENDIX 5 2021 Aquatic Plot Data and Photos

Table A5.1. *2021 aquatic vegetation plots, NIRPO and Jorgenson sites, July-August 2021.* ***Observers:*** *Emily Watson-Cook (EWC), Zoe Meade (ZM), Josephine Mahoney (JM), and Jana L. Peirce (JLP). Latitude, Longitude: Based on DGPS survey, 26 August 2021.*

Plot ID	Date sampled	Observers	Plot photo no.	Soil photo no.	Transect	Latitude (WGS84 DD)	Longitude (WGS84 DD)
21A-01	2021-07-23	EWC, ZM	3579-80, 3938	3715, 16	JS	70.229581	-148.427553
21A-02	2021-07-23	EWC, ZM	3588-89	3717	JS	70.228217	-148.426264
21A-03	2021-07-23	EWC, ZM	3592-93	3719	JS	70.228903	-148.424881
21A-04	2021-07-23	EWC, ZM	3577-78	3714	JS	70.229614	-148.425036
21A-05	2021-07-24	EWC, ZM	3596-97, 3931	3711,12	JS	70.230125	-148.423664
21A-06	2021-07-23	EWC, ZM	3594-95	3721	JS	70.229264	-148.424272
21A-07	2021-07-29	EWC, JM	3740-41	3720	JS	70.229222	-148.424314
21A-08	2021-07-24	EWC, ZM	3600-01	3722	JS	70.229214	-148.423450
21A-09	2021-07-24	EWC, ZM	3598-99	3708	JS	70.230106	-148.421914
21A-10	2021-07-25	EWC, ZM	3613, 3615	3732	JS	70.229222	-148.422481
21A-11	2021-07-24	EWC, ZM	3609-10	3727	JS	70.229078	-148.421514
21A-12	2021-07-29	EWC, JM	3736-37	3728	JS	70.229097	-148.421492
21A-13	2021-07-25	EWC, ZM	3611-12	3730	JS	70.229114	-148.420942
21A-14	2021-07-29	EWC, JM	3734-35	3729	JS	70.229044	-148.421111
21A-15	2021-07-25	EWC, ZM	3616	3706	JS	70.229711	-148.418264
21A-16	2021-07-29	EWC, JM	3742-43	3705	JS	70.229692	-148.418283
21A-17	2021-07-25	EWC, ZM	3620-22	3707	JS	70.229461	-148.417739
21A-18	2021-07-24	EWC, ZM	3602-03	3725	JS	70.229022	-148.423689
21A-19	2021-07-29	EWC, JM	3738-39	3724	JS	70.229019	-148.423644
21A-21	2021-07-20	EWC, ZM, JP	3512, 3771-72	3633	T6	70.231781	-148.447986
21A-22	2021-07-22	EWC, ZM	3543, 3549	3673	T6	70.231753	-148.449194
21A-23	2021-07-22	EWC, ZM	3551-52	3675-76	T6	70.231875	-148.449664
21A-24	2021-07-27	EWC, JM	3702	3677	T6	70.231847	-148.449669
21A-25	2021-07-22	EWC, ZM, JM, JP	3561-62	3626	T6	70.231486	-148.451067
21A-26	2021-07-23	EWC, ZM	3569-70	3679	T6	70.231119	-148.451867
21A-27	2021-07-27	EWC, JM	3681, 3905	3678	T6	70.231106	-148.451794
21A-28	2021-07-23	EWC, ZM	3571, 3573	3680	T6	70.231683	-148.454981
21A-29	2021-07-22	EWC, ZM, JM, JP	3559-60	3658	T6	70.231869	-148.452086
21A-30	2021-07-27	EWC, JM	3682	3659	T6	70.231875	-148.452150
21A-31	2021-07-22	EWC, ZM, JM, JP	3557-58	3655	T6	70.231875	-148.451206
21A-32	2021-07-20	EWC, ZM, JP	3516-17, 3521	3635	T6	70.232325	-148.448708
21A-33	2021-07-20	EWC, ZM, JP	3528-29	3639	T6	70.232331	-148.449839
21A-34	2021-07-20	EWC, ZM, JP	3530-31	3640, 41	T6	70.232475	-148.450083
21A-35	2021-07-27	EWC, JM	3700-01	3644	T6	70.232514	-148.450267
21A-36	2021-07-21	EWC, ZM	3536-37	3648	T6	70.232347	-148.450417
21A-37	2021-07-21	EWC, ZM	3542, 3544	3649	T6	70.232158	-148.451192
21A-38	2021-07-27	EWC, JM	3698-99	3652, 53	T6	70.232147	-148.451153
21A-39	2021-07-22	EWC, ZM	3553-56	3654	T6	70.232036	-148.451458
21A-40	2021-07-20	EWC, ZM, JP	3510-11, 3770	3625	T6	70.231336	-148.447769

Table A5.2. *Plant species list for aquatic vegetation plots, NIRPO and Jorgenson sites, July-August 2021.*

Taxon name	Taxon code	Taxon	Growth form
Calliergon richardsonii (Mitt.) Kindb.	CALRIC	*Calliergon richardsonii*	Pleurocarpous moss
Carex aquatilis Wahlenb.	CARAQU	*Carex aquatilis*	Wet to moist non-tussock sedge
Hamatocaulis lapponicus (Norrlin) Hedenas	HAMLAP	*Hamatocaulis lapponicus*	Pleurocarpous moss
Hamatocaulis vernicosus (Mitt.) Hedenas	HAMVER	*Hamatocaulis vernicosus*	Pleurocarpous moss
Hippuris vulgaris L.	HIPVUL	*Hippuris vulgaris*	Forb
Meesia triquetra (H. Richter) Aongstr.	MESTRI	*Meesia triquetra*	Acrocarpous moss
Pseudocalliergon sp. (Limpricht) Loeske	PSEUSP	*Pseudocalliergon* sp. 06-07	Pleurocarpous moss
Pseudocalliergon sp. (Limpricht) Loeske	PSEUSP	*Pseudocalliergon* sp. 10-03	Pleurocarpous moss
Pseudocalliergon sp. (Limpricht) Loeske	PSEUSP	*Pseudocalliergon* sp. 11-05	Pleurocarpous moss
Pseudocalliergon turgescens (T. Jensen) Loeske	PSETUR	*Pseudocalliergon turgescens*	Pleurocarpous moss
Ranunculus gmelinii DC.	RANGME	*Ranunculus gmelinii*	Forb
Scorpidium cossonii (Schimper) Hedenas	SCOCOS	*Scorpidium cossonii*	Pleurocarpous moss
Scorpidium revolvens (Swartz) Rubers	SCOREV	*Scorpidium revolvens*	Pleurocarpous moss
Scorpidium scorpioides (Hedw.) Limpr.	SCOSCO	*Scorpidium scorpioides*	Pleurocarpous moss
Sparganium hyperboreum Laest. Ex Beurl	SPAHYP	*Sparganium hyperboreum*	Forb
Utricularia vulgaris L.	UTRVUL	*Utricularia vulgaris*	Forb

Table A5.3. *Percent species cover abundance on aquatic vegetation plots 21-01 to 21-19, Jorgenson Site, July 2021. Values are Braun-Blanquet cover-abundance scores: r = rare; + = <1% cover; 1 = 1–5% cover; 2 = 6–25% cover; 3 = 26–50% cover; 4 = 51–75% cover; 5 = 76–100% cover.*

Taxon	21A-01	21A-02	21A-03	21A-04	21A-05	21A-06	21A-07	21A-08	21A-09	21A-10	21A-11	21A-12	21A-13	21A-14	21A-15	21A-16	21A-17	21A-18	21A-19
Calliergon richardsonii	5	2	1	0	5	5	1	r	3	5	1	r	0	0	5	1	r	2	r
Carex aquatilis	0	0	0	0	0	0	0	r	0	0	r	1	0	0	r	0	0	r	1
Hamatocaulis lapponicus	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Hamatocaulis vernicosus	0	0	0	0	0	0	r	0	0	0	0	0	0	0	0	0	0	0	0
Hippuris vulgaris	2	0	5	0	2	1	2	r	0	0	0	0	5	1	0	1	1	0	0
Meesia triquetra	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudocalliergon **sp. 06-07**	0	0	0	0	0	r	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudocalliergon **sp. 10-03**	0	0	0	0	0	0	0	0	0	r	0	0	0	0	0	0	0	0	0
Pseudocalliergon **sp. 11-05**	0	0	0	0	0	0	0	0	0	0	r	0	0	0	0	0	0	0	0
Pseudocalliergon turgescens	0	0	0	0	0	0	r	0	0	r	r	0	0	0	r	r	0	0	0
Ranunculus gmelinii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r	4	0	0
Scorpidium cossonii	0	0	1	0	0	0	0	0	4	3	0	0	0	r	r	0	0	0	0
Scorpidium revolvens	0	0	0	0	0	r	0	0	0	r	0	0	0	0	0	1	0	0	0
Scorpidium scorpioides	0	5	0	5	0	0	0	5	0	0	5	1	1	1	0	0	0	5	1
Sparganium hyperboreum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Utricularia vulgaris	0	0	2	0	0	1	1	r	0	0	r	1	0	r	1	0	4	0	0

Table A5.3 *(continued). Aquatic vegetation plots 21A-21 to 21A-40.*

Taxon	21A-21	21A-22	21A-23	21A-24	21A-25	21A-26	21A-27	21A-28	21A-29	21A-30	21A-31	21A-32	21A-33	21A-34	21A-35	21A-36	21A-37	21A-38	21A-39	21A-40
Calliergon richardsonii	r	0	5	1	2	5	1	r	5	1	0	r	5	5	1	5	5	r	5	r
Carex aquatilis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hamatocaulis lapponicus	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	r	0	0
Hamatocaulis vernicosus	2	0	0	0	r	r	0	0	r	0	0	2	0	0	0	0	0	0	0	0
Hippuris vulgaris	0	4	1	0	5	0	0	5	0	0	0	0	0	2	0	0	0	0	0	3
Meesia triquetra	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudocalliergon **sp. 06-07**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudocalliergon **sp. 10-03**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudocalliergon **sp. 11-05**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudocalliergon turgescens	5	0	0	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Ranunculus gmelinii	0	2	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
Scorpidium cossonii	0	0	r	0	0	0	r	0	1	0	0	0	r	0	r	0	0	0	0	0
Scorpidium revolvens	0	0	0	r	0	0	0	0	0	r	0	0	1	0	0	0	0	0	r	r
Scorpidium scorpioides	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r
Sparganium hyperboreum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Utricularia vulgaris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A5.4. *Environmental site factor and plant growth form cover values for aquatic vegetation plots, Jorgenson and NIRPO sites, Prudhoe Bay, Alaska, July-August 2021.* ***Site factors:*** *See Table A4.5 for definitions of categorical and scalar variables.* ***Habitat type****: After Mucina* et al. *2014. See Table A4.6.*

PLOT ID	21A-01	21A-02	21A-03	21A-04	21A-05	21A-06	21A-07	21A-08	21A-09	21A-10	21A-11	21A-12	21A-13
SITE FACTORS: CATEGORICAL VARIABLES (SEE TABLE A4.5)													
Surficial geology/ parent material	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Landform	10	10	10	10	10	10	10	10	10	10	10	10	10
Topographic position	8	8	8	8	8	8	8	8	8	8	8	8	8
Surficial geomorphology	10	10	10	10	10	10	10	10	10	10	10	10	10
Microsite	13	13	13	13	13	13	13	13	13	13	13	13	13
Disturbance type	0	0	0	0	0	0	0	0	0	0	4	0	0
SITE FACTORS: SCALAR VARIABLES (SEE TABLE A4.5)													
Estimated relative surface age (scalar 1–5)	5	5	5	5	5	5	5	5	5	5	5	5	5
Site moisture (scalar, 1–10)	10	10	10	10	10	10	10	10	10	10	10	10	10
Soil moisture (scalar, 1–10)	9	9	9	10	9	9	9	9	9	9	9	9	9
Estimated snow duration (scalar. 1–10)	5	5	5	5	5	5	5	5	5	5	5	5	5
Animal and human disturbance degree (scalar, 0–5)	0	0	0	0	0	0	0	0	0	0	1	0	0
Site stability (scalar, 1–5))	4	4	4	4	4	4	4	4	4	4	4	4	4
Exposure to wind (scalar)	2	2	2	2	2	2	2	2	2	2	2	2	2
SITE FACTORS: CONTINUOUS VARIABLES													
Slope (degrees)	0	0	0	0	0	0	0	0	0	0	0	0	0
Aspect (cardinal)	0	0	0	0	0	0	0	0	0	0	0	0	0
Microrelief height (cm)	0	0	0	0	0	0	0	0	0	0	0	0	0
Thaw depth (cm, mean of 4 measurements, mid-July 2021)	35.5	29	43.5	36.5	35.0	34.3	41.25	41.75	37.75	37	38.25	40	35.5
Thaw depth (cm, mean of 5 measurements, mid-Aug. 2021)	45.6	38.2	54.4	39	37.6	40.8	50	50.6	48.4	45.6	50.8	47	45.4
Water depth (cm, mean of 5 measurements, mid-July 2021)	35.2	48.2	50	61.8	44.4	53.2	51.6	48	40.6	59.8	36.6	49.8	58.6
Water depth (cm, mean of 5 measurements, mid-Aug 2021)	40.4	48.4	52.8	69.6	49.6	59.4	58.2	55	45.4	65.6	37	57.2	65.2
Water depth (cm, maximum within plot, mid-July 2021)	37	48	55	71	48	57	60	55	41	62	43	54	65
Water depth (cm, maximum within plot, mid-Aug, 2021)	45	54	58	82	58	64	68	61	49	70	43	61	72
Pond width (m, maximum mid-July 2021)	20.3	9.9	14.9	7.2	20.2	12	12	5.9	14.9	17.5	14	14	18.2
Pond width (m, perpendicular to maximum, mid-July 2021)	8.2	6.3	8.2	6.1	7.3	4.7	4.7	3.6	3.3	4.1	5.5	5.5	4.6
Shrub height (cm, mean of 3 measurements)	0	0	0	0	0	0	0	0	0	0	0	6	0
Emergent vegetation height (cm, mean of 3 measurements)	39.67	45.67	0	0	47	0	0	0	0	0	32.3	57.33	58
Submergent vegetation height (cm, mean of 3 measurements)	22.67	43.67	14	13.33	39.67	35.67	7.67	13.67	19	12	17	8	25.33
Herbaceous layer height (cm, mean of 3 measurements)	39.67	0	15.67	0	47	32	9.67	23.67	0	14.3	32.3	4	19.67
Live moss thickness (cm, mean of 3 measurements)	22.67	43.67	6.33	13.33	39.67	26.67	8.33	18.33	19	12	17	7.67	4.33
Dead moss thickness (cm, mean of 3 measurements)	0	0	5	5	0	0	4.67	0	0	0	0	4	0
Total organic (+ a horizon) thickness (cm)	19	16	17	32	24	12	18	22	21	20	24	24	24
VEGETATION CATEGORICAL DESCRIPTORS													
Habitat type (See Table A4.6)	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1
Dominant vegetation type	Moss	Moss	Forb	Moss	Moss	Moss	Bare	Moss	Moss	Moss	Moss	Bare	Forb

Table A5.4 *(continued). Aquatic vegetation plots 21A-01 to 21A-13.*

PLOT ID	21A-01	21A-02	21A-03	21A-04	21A-05	21A-06	21A-07	21A-08	21A-09	21A-10	21A-11	21A-12	21A-13
VEGETATION AND OTHER LANDCOVER VARIABLES (PERCENT COVER)													
Erect dwarf shrubs (15-40 cm tall) (live + attached dead)	0	0	0.1	0	0	0	0	0	0	0	0	0	0
Prostrate dwarf shrubs (<15 cm tall) (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0.1	0
Evergreen shrubs (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0	0
Deciduous shrubs (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0.1	0
Erect forbs (live + attached dead)	12	0	95	0	25	9.1	19	0.2	0	0	0.1	1	90
Mat and cushion forbs (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-tussock graminoids (live + attached dead)	0	0	0	0	0	0	0.1	5.1	0	0	0.1	7	0
Tussock graminoids (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0	0
Horsetails (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0	0
Foliose lichens	0	0	0	0	0	0	0	0	0	0	0	0	0
Fruticose lichen	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustose lichen	0	0	0	0	0	0	0	0	0	0	0	0	0
Pleurocarpous bryophytes + leafy liverworts	95	107	6	80	99	93.3	5.2	84.1	100	82.3	99.1	7.1	40.1
Acrocarpous bryophytes	0	0	0	0	0	0	0	0	0	0	0	0	0
Total bryophytes (mosses and leafy liverworts)	95	107	6	80	99	93.3	5.2	84.1	100	82.3	99.1	7.1	40.1
Biological soil crusts	0	0	0	0	0	0	0	0	0	0	0	0	0
Algae	9	0.1	0.1	75	0.1	15	0.1	0.1	35	25	0.1	0.1	35
Rocks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bare soil	0	0	0	0	0	0	15	0	0	0	0	22	0
Marl	0.1	0.1	0	75	0	0	0.1	0	0	0.1	0.1	0.1	10
Water (mid-July 2021)	100	100	100	100	100	100	100	100	100	100	100	100	100
Litter	100	100	100	100	100	100	90	100	100	100	100	80	100
WATER CHEMISTRY CHARACTERISTICS													
pH (pond bottom)	8.2	8	8.1	7.9	8	7.8	8	8	8.2	8.2	8.1	8.2	8.2
pH (pond surface)	8.3	8.2	8.2	8	8.1	8	8.1	8	8.3	8.2	8.1	8.2	8.2
Conductivity (pond bottom, µs/cm)	250.2	244.1	252.6	394.2	248.6	352.7	373.4	384.4	391.4	372.3	415.6	413.8	401.6
Conductivity (pond surface, µs/cm)	237.5	249.1	255.4	400	251.4	354.2	357	390.5	389.9	379.1	415.5	416.8	407.8
Salinity (pond bottom, ppm)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Salinity (pond surface, ppm)	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Table A5.4 *(continued). Aquatic vegetation plots 21A-14 to 21A-26.*

PLOT ID	21A-14	21A-15	21A-16	21A-17	21A-18	21A-19	21A-21	21A-22	21A-23	21A-24	21A-25	21A-26
SITE FACTORS: CATEGORICAL VARIABLES (SEE TABLE A4.5)												
Surficial geology/ parent material	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Landform	10	10	10	10	10	10	10	10	10	10	10	10
Topographic position	8	8	8	8	8	8	8	8	8	8	8	8
Surficial geomorphology	10	10	10	10	10	10	10	10	10	10	10	10
Microsite	13	13	13	13	13	13	13	13	13	13	13	13
Disturbance type	0	0	0	0	0	0	0	0	0	0	0	0
SITE FACTORS: SCALAR VARIABLES (SEE TABLE A4.5)												
Estimated relative surface age (scalar 1–5)	5	5	5	5	5	5	5	5	5	5	5	5
Site moisture (scalar, 1–10)	10	10	10	10	10	10	10	10	10	10	10	10
Soil moisture (scalar, 1–10)	9	9	9	9	9	9	9	9	9	9	9	9
Estimated snow duration (scalar. 1–10)	5	5	5	5	5	5	5	5	5	5	5	5
Animal and human disturbance degree (scalar, 0–5)	0	0	0	0	0	0	0	0	0	0	0	0
Site stability (scalar, 1–5))	4	4	4	4	4	4	4	4	4	4	4	4
Exposure to wind (scalar)	2	2	2	2	2	2	2	2	2	2	2	2
SITE FACTORS: CONTINUOUS VARIABLES												
Slope (degrees)	0	0	0	0	0	0	0	0	0	0	0	0
Aspect (cardinal)	0	0	0	0	0	0	0	0	0	0	0	0
Microrelief height (cm)	0	0	0	0	0	0	0	0	0	0	0	0
Thaw depth (cm, mean of 4 measurements, mid-July 2021)	41.75	43	47	42.5	37.5	38.3	27.25	48.25	37.75	42.5	39.5	31.75
Thaw depth (cm, mean of 5 measurements, mid-Aug. 2021)	52	54.2	58	54	38.6	45.0	38	58.2	51.8	53.6	51.6	38.8
Water depth (cm, mean of 5 measurements, mid-July 2021)	54.8	45	34.4	45	53.2	49.2	31.8	43	51	52.8	54.2	42.4
Water depth (cm, mean of 5 measurements, mid-Aug 2021)	61	49.2	42.2	45.8	61.8	58	34	48.6	49.4	61	59.8	49.4
Water depth (cm, maximum within plot, mid july 2021)	61	54	46	54	60	57	34	47	57	63	58	45
Water depth (cm, maximum within plot, mid-Aug, 2021)	66	56	53	53	70	62	38	52	52	70	61	58
Pond width (m, maximum mid-July 2021)	18.2	10.1	10.1	11.3	5.6	5.6	12.7	26.7	28.3	28.3	16.2	14.7
Pond width (m, perpendicular to maximum, mid-July 2021)	4.6	6.2	6.2	7.3	4.3	4.3	5.5	3.9	8.5	8.5	7.4	10
Shrub height (cm, mean of 3 measurements)	5	0	0	0	0	5	0	0	0	8	0	0
Emergent vegetation height (cm, mean of 3 measurements)	0	35	0	0	0	0	0	0	0	0	0	43
Submergent vegetation height (cm, mean of 3 measurements)	12.33	28.33	7.33	20	46.67	18	25	14.33	23.33	7.33	8.33	42.4
Herbaceous layer height (cm, mean of 3 measurements)	12	28.67	8	20	57	37.67	0	14.33	23.67	0	11.33	0
Live moss thickness (cm, mean of 3 measurements)	3	34.67	10.67	5	46.67	7.33	25	0	24.67	7.33	4.33	43
Dead moss thickness (cm, mean of 3 measurements)	2.67	0	5.33	0	0	4.67	5	0	0	4	0	0
Total organic (+ a horizon) thickness (cm)	24	9	21	9	17	24	7	17	17	15	12	12
VEGETATION CATEGORICAL DESCRIPTORS												
Habitat type (See Table A4.6)	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1
Dominant vegetation type	Bare	Moss	Bare	Forb	Moss	Bare	Moss	Forb	Moss	Bare	Forb	Moss

Table A5.4 *(continued). Aquatic vegetation plots 21A-14 to 21A-26.*

PLOT ID	21A-14	21A-15	21A-16	21A-17	21A-18	21A-19	21A-21	21A-22	21A-23	21A-24	21A-25	21A-26
VEGETATION AND OTHER LANDCOVER VARIABLES (PERCENT COVER)												
Erect dwarf shrubs (15-40 cm tall) (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0
Prostrate dwarf shrubs (<15 cm tall) (live + attached dead)	0.1	0	0	0	0	0.1	0	0	0	0.1	0.1	0
Evergreen shrubs (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0
Deciduous shrubs (live + attached dead)	0.1	0	0	0	0	0.1	0	0	0	0.1	0.1	0
Erect forbs (live + attached dead)	1.1	1	1.2	124.1	0	0	0	65	3	0	90	0
Mat and cushion forbs (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0
Non-tussock graminoids (live + attached dead)	0.1	0.2	0.1	0	0.2	1.1	0	0	0	2	0	0
Tussock graminoids (live + attached dead)	0	0	0	0	0	0	0	0	0	2	0	0
Horsetails (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0
Foliose lichens	0	0	0	0	0	0	0	0	0	0	0	0
Fruticose lichen	0	0	0	0	0	0	0	0	0	0	0	0
Crustose lichen	0	0	0	0	0	0	0	0	0	0	0	0
Pleurocarpous bryophytes + leafy liverworts	6.2	100.2	8.1	0.1	100	9.1	110.2	0	95.1	27.1	13.1	100.1
Acrocarpous bryophytes	0	0	0	0	0	0	0	0	0	0	0	0
Total bryophytes (mosses and leafy liverworts)	6.2	100.2	8.1	0.1	100	9.1	110.2	0	95.1	27.1	13.1	100.1
Biological soil crusts	0	0	0	0	0	0	0	0	0	0	0	0
Algae	0.1	2	0	0.1	10	0.1	0	85	90	0	50	0.1
Rocks	0	0	0	0	0	0	0	0	0	0	0	0
Bare soil	24	0	4	0	0	20	0	0	0	10	0	0
Marl	0.1	0.1	0.1	0	0	0	0	0	0	0	0	0.1
Litter	70	100	95	100	100	80	0.1	100	100	95	100	100
WATER CHEMISTRY CHARACTERISTICS												
pH (pond bottom)	8.2	8.2	8.3	8.4	8	7.8	8.2	8.6	7.8	8.1	8.1	8
pH (pond surface)	8.2	8.2	8.3	8.4	8	7.8	8.2	8.5	8.1	8.1	8.2	8.3
Conductivity (pond bottom, µs/cm)	404.9	327.9	333.1	233.4	395.7	396.1	257.8	273.5	298.6	300.1	252.8	226.1
Conductivity (pond surface, µs/cm)	410.6	330.7	331.7	233.2	402.7	403.7	260.9	273.5	298.4	298.7	249.7	227.1
Salinity (pond bottom, ppm)	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1
Salinity (pond surface, ppm)	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1

Table A5.4 *(continued). Aquatic vegetation plots 21A-27 to 21A-40.*

PLOT ID	21A-27	21A-28	21A-29	21A-30	21A-31	21A-32	21A-33	21A-34	21A-35	21A-36	21A-37	21A-38	21A-39	21A-40
SITE FACTORS: CATEGORICAL VARIABLES (SEE TABLE A4.5)														
Surficial geology/ parent material	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Landform	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Topographic position	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Surficial geomorphology	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Microsite	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Disturbance type	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SITE FACTORS: SCALAR VARIABLES (SEE TABLE A4.5)														
Estimated relative surface age (scalar 1–5)	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Site moisture (scalar, 1–10)	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Soil moisture (scalar, 1–10)	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Estimated snow duration (scalar. 1–10)	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Animal and human disturbance degree (scalar, 0–5)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site stability (scalar, 1–5))	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Exposure to wind (scalar)	2	2	2	2	2	2	2	2	2	2	2	2	2	2
SITE FACTORS: CONTINUOUS VARIABLES														
Slope (degrees)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aspect (cardinal)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Microrelief height (cm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thaw depth (cm, mean of 4 measurements, mid-July 2021)	47.75	38.25	34.25	47.25	44.5	33.25	31.5	27.25	44	27.25	34.5	42.25	39	40
Thaw depth (cm, mean of 5 measurements, mid-Aug. 2021)	53.2	46.2	46.4	53.8	52.6	42.2	40.6	40	61	38.8	45.2	53.6	45	50
Water depth (cm, mean of 5 measurements, mid-July 2021)	47.4	34	38.8	46	37.2	24.5	16.8	42	46.2	30.4	42.6	45.8	25.2	48
Water depth (cm, mean of 5 measurements, mid-Aug 2021)	50.8	39.8	44	51.8	43.8	30.4	24.6	48.2	50.6	35.6	50.2	50.8	31.8	50.6
Water depth (cm, maximum within plot, mid july 2021)	56	44	43	54	45	29	19	43	51	33	51	57	29	59
Water depth (cm, maximum within plot, mid-Aug, 2021)	59	47	50	62	48	35	28	53	55	46	52	58	34	61
Pond width (m, maximum mid-July 2021)	14.7	15.9	11.8	11.8	11.95	11.1	11.1	20.6	20.6	12.5	11.1	11.1	18.9	12.8
Pond width (m, perpendicular to maximum, mid-July 2021)	10	3	4.8	4.8	9.5	5.4	8	6.5	6.5	9.9	10.1	10.1	4	5.8
Shrub height (cm, mean of 3 measurements)	11.67	0	0	0	0	0	0	0	0	0	0	9	0	0
Emergent vegetation height (cm, mean of 3 measurements)	0	38	0	0	0	0	17	50.67	0	33	0	0	0	0
Submergent vegetation height (cm, mean of 3 measurements)	3.67	30.67	23.33	8.33	18.67	18	16.8	37.33	4.33	30.4	16.67	4.67	15.67	10
Herbaceous layer height (cm, mean of 3 measurements)	0	38	0	0	18.67	0	0	0	0	0	0	0	0	48
Live moss thickness (cm, mean of 3 measurements)	3.67	5	23.33	8.33	0	18	17	37.8	4.33	33	16.67	4.67	15.67	7
Dead moss thickness (cm, mean of 3 measurements)	5.67	5	0	5	0	0	0	37.67	5	0	3.67	3.67	0	3.67
Total organic (+ a horizon) thickness (cm)	13	23	12	15	10	7	15	8	5	11	8	12	10	10
VEGETATION CATEGORICAL DESCRIPTORS														
Habitat type (See Table A4.6)	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1	5.05.1
Dominant vegetation type	Bare	Forb	Moss	Bare	Forb	Moss	Moss	Moss	Bare	Moss	Moss	Bare	Moss	Forb

Table A5.4 *(continued). Aquatic vegetation plots 21A-27 to 21A-40.*

PLOT ID	21A-27	21A-28	21A-29	21A-30	21A-31	21A-32	21A-33	21A-34	21A-35	21A-36	21A-37	21A-38	21A-39	21A-40
VEGETATION AND OTHER LANDCOVER VARIABLES (PERCENT COVER)														
Erect dwarf shrubs (15-40 cm tall) (live + attached dead)	0.1	0	0	0.1	0	0	0	0	0	0	0	0	0	0
Prostrate dwarf shrubs (<15 cm tall) (live + attached dead)	0.1	0	0	0	0	0	0	0	0	0	0	0.1	0	0
Evergreen shrubs (live + attached dead)	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0
Deciduous shrubs (live + attached dead)	0.1	0	0	0	0	0	0	0	0	0	0	0.1	0	0
Erect forbs (live + attached dead)	0	118	0	0	75	0	0	18	0	0	0	0	0	57
Mat and cushion forbs (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-tussock graminoids (live + attached dead)	0	0	0	0.1	0	0	0	0	0	0	0	0.1	0	0
Tussock graminoids (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Horsetails (live + attached dead)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Foliose lichens	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fruticose lichen	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustose lichen	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pleurocarpous bryophytes + leafy liverworts	26.1	0.2	98.2	7.1	0	73	101.1	103	4.1	100	105	20.2	100.1	1.3
Acrocarpous bryophytes	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total bryophytes (mosses and leafy liverworts)	26.1	0.2	98.2	7.1	0	73	101.1	103	4.1	100	105	20.2	100.1	1.3
Biological soil crusts	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Algae	0.1	0.1	95	0	0	22	1	1	0	0.1	90	0.1	3	0.1
Rocks	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0
Bare soil	0	0	0	2	0	0	0	0	20	0	0	5	0	0
Marl	0	0.1	0.1	0.1	0	0.1	5	6	0	0	0	0.1	28	10
Litter	100	100	100	95	100	25	100	100	80	100	100	100	100	80
WATER CHEMISTRY CHARACTERISTICS														
pH (pond bottom)	8	8	8.1	8.1	8	8.1	7.6	8.1	8.2	8.2	7.7	8	7.4	8.3
pH (pond surface)	8	8.3	8.1	8.1	8	8	7.7	8.2	8.2	8.7	7.9	8	7.8	8.1
Conductivity (pond bottom, µs/cm)	232.3	316	317.7	315.9	285.6	271	317.2	231.3	238.9	187.9	294.5	294	389.5	351
Conductivity (pond surface, µs/cm)	231.4	295	317	316.1	283.5	278.2	315.8	231.3	232.3	180.7	294	293.7	346.6	351.1
Salinity (pond bottom, ppm)	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.3	0.2
Salinity (pond surface, ppm)	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2

Table A5.5. *Thermocron iButton® temperature loggers installed at aquatic vegetation plots, NIRPO and Jorgenson sites, July-August 2021.* ***iBtn ID:*** *Temporary assigned ID number.* ***Height****: Distance from sediment surface at pond bottom. Height of sensors at water surface varies with water level.* ***Capacity****: Maximum number of readings, based on data logger model (DS1921G, 2048 readings; DS1922L 8192 8-bit readings).* ***Serial No.:*** *Permanent factory ID.*

Tran-sect	Plot ID	iBtn ID	Sensor location	Height (cm)	Sampling Rate (min.)	Capacity (readings)	Serial no.	Notes
SHORT-TERM IBUTTON DEPLOYMENT (DS1921 SERIES), INSTALLED BY 7/19/21 18:00, REMOVED STARTING AT 8/23/21 08:00								
JS	21A-01	002	above vegetation	20	60	2048	5900000035FF7E21	
JS	21A-01	004	sediment surface	0	60	2048	CE00000035FA8F21	
JS	21A-01	001	water surface	varies	60	2048	E200000035F54B21	
JS	21A-02	006	above vegetation	42	60	2048	4800000036028621	
JS	21A-02	009	sediment surface	0	60	2048	0300000036003C21	
JS	21A-02	005	water surface	varies	60	2048	F300000035F21921	
JS	21A-03	014	above vegetation	12	60	2048	2A00000035F5F121	
JS	21A-03	198	air	115	60	2048	BB0000003A541521	
JS	21A-03	010	sediment surface	0	60	2048	9F00000035F77521	
JS	21A-03	019	water surface	varies	60	2048	4700000036004821	
JS	21A-04	024	above vegetation	19	60	2048	EE00000036057121	
JS	21A-04	022	sediment surface	0	60	2048	3400000036054021	
JS	21A-04	020	water surface	varies	60	2048	A200000035FCC821	
JS	21A-05	021	above vegetation	23	60	2048	7900000035FD6521	
JS	21A-05	025	sediment surface	0	60	2048	8800000035FAE821	
JS	21A-05	023	water surface	varies	60	2048	DD00000035F24921	
JS	21A-06	028	above vegetation	17	60	2048	0500000036011021	
JS	21A-06	029	sediment surface	0	60	2048	DE00000035FF6A21	
JS	21A-06	027	water surface	varies	60	2048	EA00000035F9AB21	
JS	21A-07	032	above vegetation	17	60	2048	D700000036007421	
JS	21A-07	034	sediment surface	0	60	2048	E200000035FBD521	
JS	21A-07	030	water surface	varies	60	2048	9C0000003601E521	
JS	21A-08	037	above vegetation	17	60	2048	F700000035F57021	
JS	21A-08	038	sediment surface	0	60	2048	9C00000035F38721	
JS	21A-08	035	water surface	varies	60	2048	6D00000035FDDB21	
JS	21A-09	047	above vegetation	20	60	2048	8400000035FDCD21	
JS	21A-09	048	sediment surface	0	60	2048	4C00000035F69421	
JS	21A-09	046	water surface	varies	60	2048	AD00000035FF1F21	
JS	21A-10	041	above vegetation	23	60	2048	960000003601BA21	
JS	21A-10	042	sediment surface	0	60	2048	4C00000035FC6E21	
JS	21A-10	039	water surface	varies	60	2048	3A00000035F22621	
JS	21A-11	052	above vegetation	18	60	2048	F400000035F2A921	
JS	21A-11	053	sediment surface	0	60	2048	F900000035FB9721	
JS	21A-11	050	water surface	varies	60	2048	3300000035F4B921	
JS	21A-12	058	above vegetation	18	60	2048	2C0000003601F021	
JS	21A-12	059	sediment surface	0	60	2048	FC00000035FF5021	
JS	21A-12	057	water surface	varies	60	2048	FA00000035F7AD21	
JS	21A-13	064	above vegetation	21	60	2048	3100000035F5B321	
JS	21A-13	065	sediment surface	0	60	2048	6500000035FD9721	
JS	21A-13	060	water surface	varies	60	2048	7500000035FA4021	
JS	21A-14	067	above vegetation	21	60	2048	1400000035F27621	
JS	21A-14	069	sediment surface	0	60	2048	9100000035F27121	
JS	21A-14	066	water surface	varies	60	2048	4600000036069B21	
JS	21A-15	072	above vegetation	27	60	2048	0900000036017A21	
JS	21A-15	074	sediment surface	0	60	2048	E500000035F19F21	
JS	21A-15	070	water surface	varies	60	2048	F000000035FF3A21	
JS	21A-16	076	above vegetation	27	60	2048	3400000035F25F21	
JS	21A-16	077	sediment surface	0	60	2048	2A0000003604B821	
JS	21A-16	075	water surface	varies	60	2048	9A0000003603E221	
JS	21A-17	080	above vegetation	13	60	2048	AC00000035FDA821	
JS	21A-17	082	sediment surface	0	60	2048	DD00000035F8B321	
JS	21A-17	079	water surface	varies	60	2048	3D00000035FA5E21	
JS	21A-18	085	above vegetation	46	60	2048	4000000035F1B121	
JS	21A-18	086	sediment surface	0	60	2048	9500000035FEFB21	

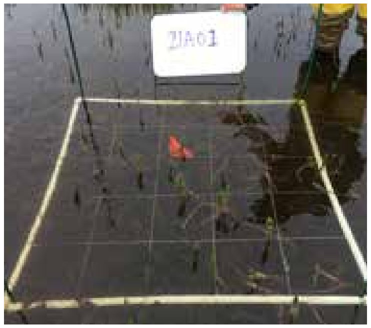
Table A5.5 *(continued)*

Tran-sect	Plot ID	iBtn ID	Sensor location	Height (cm)	Sampling Rate (min.)	Capacity (readings)	Serial no.	Notes
JS	21A-18	083	water surface	varies	60	2048	4B00000035FCDE21	
JS	21A-19	091	above vegetation	46	60	2048	8000000035F71121	
JS	21A-19	095	sediment surface	0	60	2048	2200000035FF4721	
JS	21A-19	090	water surface	varies	60	2048	AD0000003603E321	
JS	21A-20	101	sediment surface	0	60	2048	EF000000361CAC21	
JS	21A-20	096	water surface	varies	60	2048	E70000003603EE21	In lake; no plot
T6	T6 0m	199	air	100	60	2048	4E00000039DFD621	At transect end
T6	21A-21	105	above vegetation	22	60	2048	9100000036118320	
T6	21A-21	108	sediment surface	0	60	2048	1D000000361BB721	
T6	21A-21	103	water surface	varies	60	2048	C6000000360DDC21	
T6	21A-22	111	above vegetation	10	60	2048	D7000000361B1E21	
T6	21A-22	112	sediment surface	0	60	2048	520000003608BB21	
T6	21A-22	110	water surface	varies	60	2048	53000000360F7121	
T6	21A-23	119	above vegetation	25	60	2048	7100000036127720	
T6	21A-23	120	sediment surface	0	60	2048	BA000000360C4C21	
T6	21A-23	117	water surface	varies	60	2048	D500000036182621	
T6	21A-24	125	above vegetation	25	60	2048	910000003613B121	
T6	21A-24	126	sediment surface	0	60	2048	2B00000036098821	
T6	21A-24	122	water surface	varies	60	2048	1E0000003613E921	
T6	21A-25	129	above vegetation	10	60	2048	2A00000036126721	
T6	21A-25	130	sediment surface	0	60	2048	350000003A187221	
T6	21A-25	127	water surface	varies	60	2048	1100000036131520	
T6	21A-26	135	above vegetation	51	60	2048	140000003A0F1821	
T6	21A-26	136	sediment surface	0	60	2048	0200000039DCC521	
T6	21A-26	134	water surface	varies	60	2048	300000003A1E8721	
T6	21A-27	141	above vegetation	51	60	2048	1B0000003A148E21	
T6	21A-27	142	sediment surface	0	60	2048	CE00000039DF7221	
T6	21A-27	138	water surface	varies	60	2048	8C00000039E54B21	
T6	21A-28	145	above vegetation	16	60	2048	A50000003A200421	
T6	21A-28	146	sediment surface	0	60	2048	EA0000003A59EF21	
T6	21A-28	144	water surface	varies	60	2048	CA0000003A59C621	
T6	21A-29	149	above vegetation	24	60	2048	AE0000003A40C321	
T6	21A-29	152	sediment surface	0	60	2048	480000003A254921	
T6	21A-29	147	water surface	varies	60	2048	1D00000039E4EB21	
T6	21A-30	155	above vegetation	24	60	2048	980000003A569821	
T6	21A-30	157	sediment surface	0	60	2048	B50000003A322721	
T6	21A-30	153	water surface	varies	60	2048	5100000039DC9921	
T6	21A-31	160	above vegetation	9	60	2048	F30000003A493721	
T6	21A-31	161	sediment surface	0	60	2048	550000003A227121	
T6	21A-31	158	water surface	varies	60	2048	9C00000039F8EF21	
T6	21A-32	165	above vegetation	14	60	2048	D50000003A2D5221	
T6	21A-32	166	sediment surface	0	60	2048	080000003A2FE121	
T6	21A-32	163	water surface	varies	60	2048	160000003A1F8221	
T6	21A-33	168	above vegetation	14	60	2048	270000003A377521	
T6	21A-33	169	sediment surface	0	60	2048	5B0000003A5C0221	
T6	21A-33	167	water surface	varies	60	2048	E70000003A378321	
T6	21A-34	172	above vegetation	32	60	2048	190000003A1D4C21	
T6	21A-34	173	sediment surface	0	60	2048	7E0000003A377621	
T6	21A-34	170	water surface	varies	60	2048	0B0000003A141621	
T6	21A-35	175	above vegetation	32	60	2048	AC0000003A04A221	
T6	21A-35	176	sediment surface	0	60	2048	0B0000003A258D21	
T6	21A-35	174	water surface	varies	60	2048	310000003A0CB921	
T6	21A-36	NA	no iButton	NA	NA	NA	NA	Vegetation at water surface
T6	21A-36	180	sediment surface	0	60	2048	110000003A387621	
T6	21A-36	177	water surface	varies	60	2048	A30000003A4EB221	

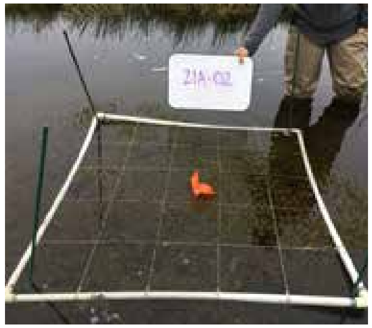
Table A5.5 *(continued)*

Tran-sect	Plot ID	iBtn ID	Sensor location	Height (cm)	Sampling Rate (min.)	Capacity (readings)	Serial no.	Notes
T6	21A-37	182	above vegetation	19	60	2048	1F0000003A004521	
T6	21A-37	184	sediment surface	0	60	2048	4A0000003A2D9221	
T6	21A-37	181	water surface	varies	60	2048	120000003A367E21	
T6	21A-38	186	above vegetation	19	60	2048	640000003A2EE921	
T6	21A-38	187	sediment surface	0	60	2048	D80000003A2DBD21	
T6	21A-38	185	water surface	varies	60	2048	0C0000003A3C6521	
T6	21A-39	190	above vegetation	25	60	2048	FA0000003A1C1C21	
T6	21A-39	192	sediment surface	0	60	2048	F10000003A0D5621	
T6	21A-39	188	water surface	varies	60	2048	780000003A23AE21	
T6	21A-40	195	above vegetation	8	60	2048	250000003A1D9721	
T6	21A-40	194	water surface	varies	60	2048	320000003A5CB021	
T6	21A-40	196	sediment surface	0	60	2048	A40000003A084221	
LONG-TERM IBUTTON DEPLOYMENT (DS1922 SERIES), INSTALLED BY 7/30/21 18:00								
JS	21A-02	L13	sediment surface	0	240	8192	43000000755D1641	
JS	21A-03	L17	sediment surface	0	240	8192	E6000000755A7741	
JS	21A-04	L15	sediment surface	0	240	8192	70000000755E1A41	
JS	21A-09	L14	sediment surface	0	240	8192	5A000000755A0841	
JS	21A-13	L16	sediment surface	0	240	8192	03000000755D4441	
JS	21A-14	L20	sediment surface	0	240	8192	F1000000755C0941	
JS	21A-15	L12	sediment surface	0	240	8192	64000000755D8F41	
JS	21A-16	L19	sediment surface	0	240	8192	C1000000755BF741	
JS	21A-18	L11	sediment surface	0	240	8192	C8000000755C7141	
JS	21A-19	L18	sediment surface	0	240	8192	C0000000755A6B41	
T6	21A-21	L03	sediment surface	0	240	8192	3C000000755D0941	
T6	21A-22	L06	sediment surface	0	240	8192	E8000000755D4141	
T6	21A-23	L04	sediment surface	0	240	8192	51000000755D9D41	
T6	21A-24	L10	sediment surface	0	240	8192	11000000755B9941	
T6	21A-26	L02	sediment surface	0	240	8192	2D000000755C0D41	
T6	21A-27	L09	sediment surface	0	240	8192	1B000000755C8941	
T6	21A-28	L07	sediment surface	0	240	8192	6E0000007559B441	
T6	21A-34	L01	sediment surface	0	240	8192	B9000000755B5841	
T6	21A-35	L08	sediment surface	0	240	8192	06000000755DE741	
T6	21A-37	L05	sediment surface	0	240	8192	62000000755DBA41	

Table A5.6. *Photographs of aquatic vegetation plots, NIRPO and Jorgenson sites, Prudhoe Bay, July 2021. (Photos: E. Watson-Cook)*



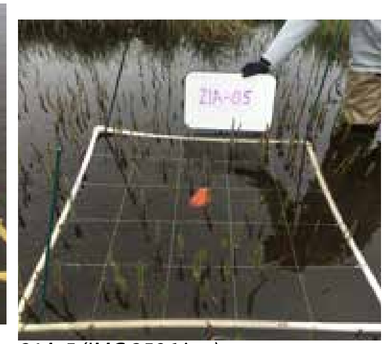
21A-1 (IMG 3579.jpg)



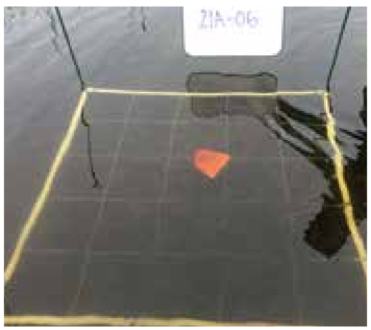
21A-2 (IMG 3588.jpg)

21A-3 (IMG 3592.jpg)

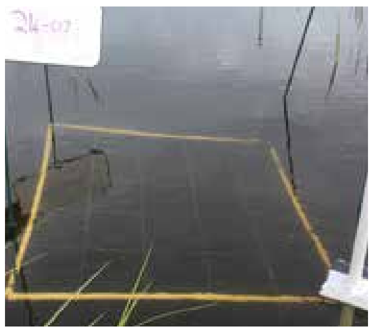
21A-4 (IMG 3577.jpg)



21A-5 (IMG 3596.jpg)

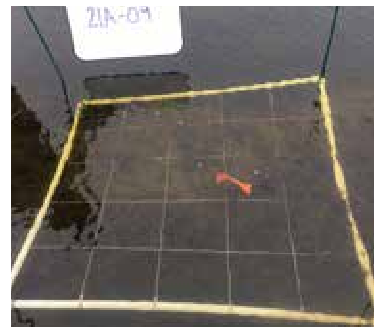


21A-6 (IMG 3594.jpg)



21A-7 (IMG 3740.jpg)

21A-8 (IMG 3600.jpg)

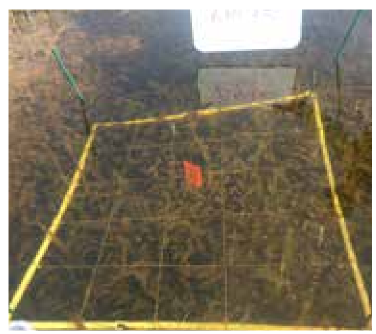


21A-9 (IMG 3598.jpg)

21A-10 (IMG 3613.jpg)

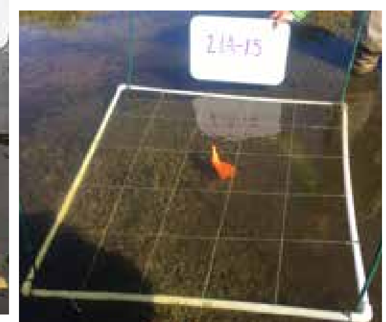
21A-11 (IMG 3610.jpg)

21A-12 (IMG 3736.jpg)



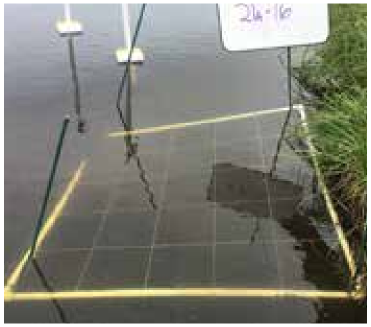
21A-13 (IMG 3611.jpg)

21A-14 (IMG 3734.jpg)

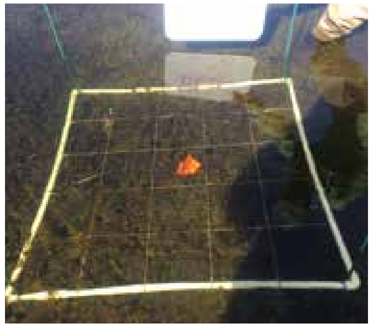


21A-15 (IMG 3616.jpg)

Table A5.6 *(continued)*



21A-16 (IMG 3742.jpg)

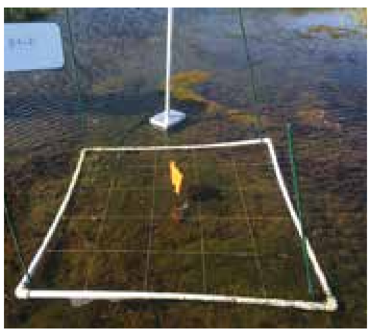


21A-17 (IMG 3621.jpg)

21A-18 (IMG 3603.jpg)

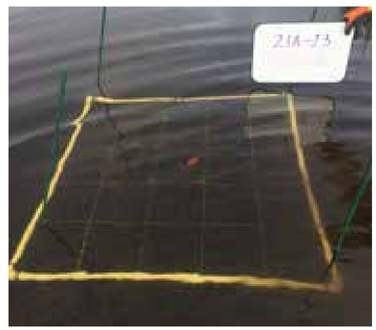
21A-19 (IMG 3738.jpg)

21A-20 Lake (no plot)

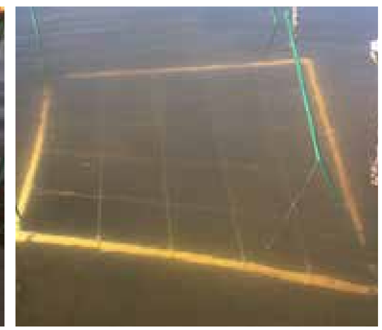


21A-21 (IMG 3512.jpg)

21A-22 (IMG 3549.jpg)



21A-23 (IMG 3551.jpg)



21A-24 (IMG 3702.jpg)

21A-25 (IMG 3562.jpg)

21A-26 (IMG 3569.jpg)

21A-27 (IMG 3681.jpg)

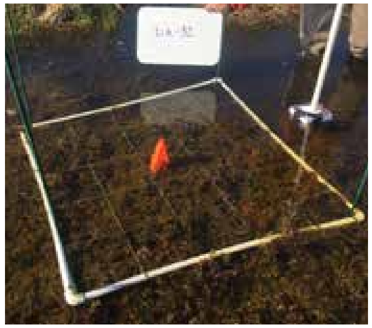
21A-28 (IMG 3573.jpg)

21A-29 (IMG 3560.jpg)

21A-30 (IMG 3682.jpg)

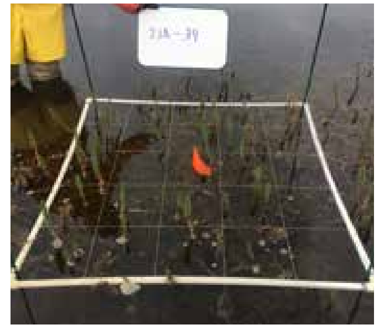
Table A5.6 *(continued)*

21A-31 (IMG 3557.jpg)



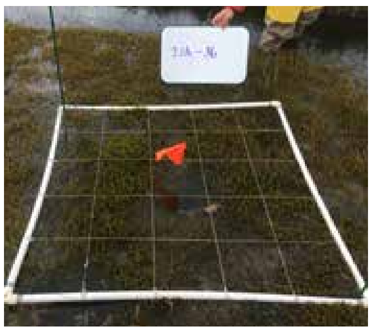
21A-32 (IMG 3516.jpg)

21A-33 (IMG 3528.jpg)



21A-34 (IMG 3530.jpg)

21A-35 (IMG 3700.jpg)



21A-36 (IMG 3536.jpg)

21A-37 (IMG 3542.jpg)

21A-38 (IMG 3698.jpg)

21A-39 (IMG 3553.jpg)

21A-40 (IMG 3510.jpg)

Table A5.7. *Photographs of aquatic plot soils, NIRPO and Jorgenson Sites, Prudhoe Bay, July 2021. (Photos: E. Watson-Cook)*

21A-1 (IMG 3716.jpg)

21A-2 (IMG 3717.jpg)

21A-3 (IMG 3719.jpg)

21A-4 (IMG 3714.jpg)

21A-5 (IMG 3711.jpg)

21A-6 (IMG 3721.jpg)

21A-7 (IMG 3720.jpg)

21A-8 (IMG 3722.jpg)


21A-9 (IMG 3708.jpg)

21A-10 (IMG 3732.jpg)

Table A5.7 *(continued)*

21A-11 (IMG 3727.jpg)

21A-12 (IMG 3728.jpg)

21A-13 (IMG 3730.jpg)

21A-14 (IMG 3729.jpg)

21A-15 (IMG 3706.jpg)

21A-16 (IMG 3705.jpg)

21A-17 (IMG 3707.jpg)

21A-18 (IMG 3725.jpg)

21A-19 (IMG 3724.jpg)

21A-20 (IMG 3733.jpg)

Table A5.7 *(continued)*

21A-21 (IMG 3633.jpg)

21A-22 (IMG 3673.jpg)

21A-23 (IMG 3675.jpg)

21A-24 (IMG 3677.jpg)

21A-25 (IMG 3626.jpg)

21A-26 (IMG 3679.jpg)

21A-27 (IMG 3678.jpg)

21A-28 (IMG 3680.jpg)

21A-29 (IMG 3658.jpg)

21A-30 (IMG 3659.jpg)

Table A5.7 *(continued)*

21A-31 (IMG 3655.jpg)

21A-32 (IMG 3635.jpg)

21A-33 (IMG 3639..jpg)

21A-34 (IMG 3641.jpg)

21A-35 (IMG 3644.jpg)

21A-36 (IMG 3648.jpg)

21A-37 (IMG 3649.jpg)

21A-38 (IMG 3653.jpg)

21A-39 (IMG 3654.jpg)

21A-40 (IMG 3625.jpg)

APPENDIX 6 Basal Peat Sampling

Table A6.1. *Basal peat samples collected at terrestrial vegetation plots at the NIRPO site for AMS C-14 dating, Prudhoe Bay, Alaska, 19 July 2021.*

Sample ID	Trans-ect	Photo no. (Credit: H. Bergstedt)	Latitude (WGS84 DD)	Longitude (WGS84 DD)	Thaw depth (cm)	Total depth (cm)	Cumulative organic (cm)	Surface organic thickness (cm)	Dominant mineral	Dominant texture	State of organic horizon	Water depth (cm)	Water above/be-low	Sample depth	Notes
21-02 FL M2 RC	T8	21.59.31.jpg	70.231378	-148.457424	24	25	24	18	sandy silt	organic	hemic/fibric	17	below	23-24	fibric part is 18-25 cm
21-03 FL M4 RC	T8	NA	70.231056	-148.461261	33	33	25	21	silt	organic	hemic/fibric	33	above, 4 cm	24-25	Pit immediately filled with water
21-04 FL M4	T8	21.34.33.jpg	70.230895	-148.460234	32	32	22	24	silt	organic	hemic (a lot of silt in organic horizon)	32	below (rapid-ly rising)	21-22	
21-05 C U3	T6	01.11.18.jpg	70.231693	-148.450438	33	34	Unclear (1st 8 cm fibric to hemic then almost mineral soil)	10	sandy silty clay	mineral	very sapric/ hemic (nicely aged soil; stones)	0	no	2 samples: 1) 8 cm; 2) 28 cm (buried organic layer?)	buried organic horizon (cryo-turbation). No drained lake history
21-06 C U3 RC	T6	01.11.18.jpg	70.231685	-148.451058	30	33	10	13	silt	mineral	sapric	0	no	No sample	organic boundary no longer visible
31-08 C U4 RC	T6	02.02.46.jpg	70.231547	-148.45261	27	27	13	19	silty clay	organic	sapric	0	no	13-14	sapric layer well-developed, decomposed
21-19 C M2 RC	T9	22.16.02.jpg	70.231796	-148.456901	36	35	32	21	silt	organic with a lot of mineral in organic horizon	sapric/ hemic	10	below	31-32	
21-27 C M2 RC	T7	23.44.26.jpg	70.230145	-148.445852	39	37	25	20	sandy silt	organic	sapric/ hemic (1st 5 cm fibric)	14	below	24-25	
21-33 C M4 RC	T7	00.00.26.jpg	70.230647	-148.442998	43	39	32	22	sandy silt	organic	sapric (a lot of mineral deposits in organic)	20	below	32-33	
21-X (rogue) C RC	T7	NA	70.23032	-148.443046	35	37	29	16	sandy silt	organic	sapric/ hemic	1	below	28-29	some rocks in mineral layer (site is south of T7 closer to lake than tran-sect plots)

APPENDIX 7 2021 Permafrost Borehole Data

Table A7.1. *Permafrost borehole locations including redrilling of boreholes from previous studies, Prudhoe Bay, Alaska, 2011-2021.* ***Transect/plot location****: Distance from start of transect in meters or name of nearest plot.* ***Distance from transect/plot****: Distance in meters and direction from transect line or plot center indicated by cardinal direction (N, E, S, W), right (R), or left (L).*

Borehole ID	Year drilled	Transect ID	Latitude (WGS84 DD)	Latitude (WGS84 DD)	Location accuracy	Transect/ plot location (m)	Distance from transect/ plot (m)	Site description and notes
NIRPO SITE								
T6-34T	2021	T6	70.231972	-148.449233	Approx.	34	3.9 R	Pond ~1.5 wide trough, ~0.3 deep (from the water level), no distinctive elevated rims
T6-40T	2021	T6	70.231981	-148.449417	Approx.	40.4	4.3 R	Dry trough, ~2.5-3.0 wide, ~0.3-0.4 deep, between 2 deep ponds (~3 m apart)
T6-52T	2021	T6	70.231933	-148.449631	Approx.	51.9	2.8 R	~1.4 wide pond in ~2.7 wide, ~0.4-0.5 deep trough
T6-64T	2021	T6	70.231919	-148.450089	Approx.	64.4	2.7 R	Wet trough, ~1.5 wide, ~0.3-0.4 deep, ~ 5 cm above water level, poorly developed elevated rims
T6-74T	2021	T6	70.231911	-148.450364	Approx.	74	3.0 R	Wet trough, ~1.7-2.2 wide, ~0.3 deep
T6-98T	2021	T6	70.231872	-148.450883	Approx.	98.4	4.2 R	Wet trough, ~1.2-1.7 wide, ~0.4 deep; at the water level, ~high-centered polygon
T6-99C	2021	T6	70.231903	-148.45105	Approx.	99.4	8.7 R	High-centered polygon, dry, no rims
T6-152T	2021	T6	70.231811	-148.452133	Approx.	151.8	2.4 R	Dry trough, ~1.3 wide, ~0.1-0.2 deep; almost no elevated rims
T6-174T	2021	T6	70.231736	-148.452942	Approx.	174.4	2.5 R	Wet trough, ~1.3-1.4 wide, ~0.3 deep; elevated rims ~0.8-1.0
T6-188T	2021	T6	70.23175	-148.453169	Approx.	188	4.8 R	Wet trough, ~1.6 wide; W rim ~0.4 high, ~1.4 wide, ~0.2 above center; E rim not elevated; low/high-centered polygon
T6-21A-29	2021	T6	70.23188	-148.452155	Approx.	21A-29	1.5 NW	Pond; aquatic moss
T6-21A-31	2021	T6	70.231905	-148.451213	Approx.	21A-31	1.8	Pond
T6-21A-32	2021	T6	70.23231	-148.44873	Approx.	21A-32	1.6 W	Pond
T6-21A-33	2021	T6	70.232334	-148.449821	Approx.	21A-33	1.6 E	Pond; <10 cm of peat; fresh cracks around the pond
T6-21A-35&34	2021	T6	70.232498	-148.450158	Approx.	21A-35/34		Pond; between 21A-34 and 21A-35
T6-21A-36	2021	T6	70.232365	-148.450413	Approx.	21A-36	1.6 N	Pond
T6-21A-37	2021	T6	70.232162	-148.451235	Approx.	21A-37	1.5 N	Pond
T6-21A-39	2021	T6	70.232042	-148.451491	Approx.	21A-39	1.6 W	Pond; aquatic moss
T7-0T	2021	T7	70.230822	-148.442528	Precise	0	2.1 R	Wet trough, ~0.7 m wide, poorly developed elevated rims
T7-33T	2021	T7	70.230714	-148.443322	Precise	33	1.8 R	Pond, ~1.5-1.9 wide trough, elevated rim (western) ~20 high, ~1.5 wide
T7-40C	2021	T7	70.230653	-148.44345	Precise	40	3.0 L	Low/high-centered polygon with some water
T7-46T	2021	T7	70.230683	-148.443686	Precise	46.2	3.5 R	Trough partially filled with water, ~0.8-0.9 m wide, elevated rims ~40 high, ~0.6-0.9 wide,
T7-49T	2021	T7	70.230669	-148.443736	Precise	49	2.6 R	Dry trough, double rims ~0.15 high and 0.4-0.5 wide (elevated near the ice-wedge crossing)
T7-83T	2021	T7	70.230564	-148.444589	Precise	83	3.2 R	Pond, ~0.8-1.2 m wide trough, poorly developed rims ~0.2-0.3 high
T7-94T	2021	T7	70.230517	-148.444828	Precise	94	2.1 R	Pond, ~0.5-0.6 m wide trough, double rims ~0.3 high and 0.7-0.9 wide
T7-105T	2021	T7	70.230486	-148.445122	Precise	105	3.0 R	Wet trough, ~1.2 m wide, elevated rims ~0.8 wide, ~0.2-0.3 m above water, ~0.1-0.15 above polygon center
T7-128T	2021	T7	70.230422	-148.445689	Precise	128	4.1 R	Dry part of trough, ~1.7 m wide; no samples
T7-141T	2021	T7	70.230367	-148.446011	Precise	141.1	2.7 R	Pond, ~1.7 m wide trough, poorly developed elevated rims ~0.3-0.4 above the water, DA
T7-166C	2021	T7	70.230308	-148.44665	Precise	166	5.5 R	~2 m from the trough; marl site, wet
T7-168T	2021	T7	70.230286	-148.446667	Precise	168	3.6 R	~0.5 m wide trough, no rims
T7-171T	2021	T7	70.230264	-148.446722	Precise	170.7	2.3 R	~1-1.5 m wide trough, no rims
T7-194T	2021	T7	70.230194	-148.447294	Precise	194	2.7 R	Pond ~1.5 m wide trough, poorly developed elevated rims ~0.3-0.4 above the water; DA
T7-XT	2021	T7	70.230486	-148.442611	Precise	Plot 21-31	4.4 E	Pond, ~1.0-2.2 m wide trough, low elevated rims; located 4.4 m E of 21-31

Table A7.1 *(continued)*

Borehole ID	Year drilled	Transect ID	Latitude (WGS84 DD)	Latitude (WGS84 DD)	Location accuracy	Transect/ plot location (m)	Distance from transect/ plot (m)	Site description and notes
T8-2C	2021	T8	70.231719	-148.456833	Approx.	2.5	6.5 R	Low-centered polygon
T8-6T	2021	T8	70.231675	-148.456894	Approx.	6	2.1 R	Wet trough, ~0.6 m wide, ~0.2 deep, low elevated rims ~0.6-0.8 wide; low-centered polygon
T8-15T	2021	T8	70.231619	-148.457139	Approx.	15	4.3 R	Wet trough, ~0.8 m wide, ~0.2 deep, elevated rims ~0.5-0.8 wide; low-centered polygon; stringbog
T8-30T	2021	T8	70.231544	-148.457489	Approx.	29.8	2.6 R	Trough partially filled with water, ~0.6 wide, elevated rims ~0.1-0.15 above water; E rim ~0.6 wide, W rim ~0.8 wide; ~Low-centered polygon
T8-30T-2	2021	T8	n.d.	n.d.	-	-	-	E rim, ~0.55 m from T8-30T, ~0.1 above the water (almost on top)
T8-30T-3	2021	T8	n.d.	n.d.	-	-	-	W rim, ~0.4 m from T8-30T, ~0.05 above the water (slope of the rim)
T8-92T	2021	T8	70.231261	-148.459031	Approx.	92	3.2 R	Dry trough, ~0.4 wide, ~0.1 deep, poorly developed rims; poorly developed polygons near the bird mound
T8-192C	2021	T8	70.230897	-148.461289	Approx.	192	6.1 R	Wet marl area, no distinctive polygons, random mounds, ridges
T9-0T	2021	T9	70.232222	-148.454819	Approx.	0	2.5 R	Wet trough, ~0.8-0.9 m wide, ~0.3 m deep, no elevated rims
T9-5T	2021	T9	70.232217	-148.454972	Approx.	5.4	2.9 R	Dry trough, ~0.2 m wide, ~0.2 m deep
T9-8C	2021	T9	70.232192	-148.454972	Approx.	8	4.5 R	Center of a small polygon
T9-21T	2021	T9	70.232169	-148.455367	Approx.	21	2.9 R	Wet trough, deep, narrow, ~0.4 deep, <0.5 wide
T9-32T	2021	T9	70.232108	-148.455689	Approx.	31.8	3.4 R	Dry trough, ~1.4 m wide, ~0.1-0.2 m deep, no elevated rims
T9-39T	2021	T9	70.232086	-148.455811	Approx.	38.8	2.8 R	Dry trough, ~0.8-1.0 m wide, ~0.2-0.3 m deep, poorly developed elevated rims, small flat/high-centered polygons
T9-54T	2021	T9	70.232078	-148.456117	Approx.	53.7	2.8 R	Dry trough, ~0.6 m wide, ~0.1 m deep
T9-95T	2021	T9	70.231942	-148.457153	Approx.	95.2	2.6 R	Wet trough, ~0.6 m wide, ~0.2 m deep; elevated rims ~0.7-1.0 wide, ~0.1-0.2 above the wet polygon center
Jorgenson site								
JS-21A-01	2021	JS	70.229583	-148.427575	Approx.	21A-01	1.5 NW	Pond
JS-21A-02	2021	JS	70.228207	-148.426331	Approx.	21A-02	1.6 S	Pond
JS-21A-03	2021	JS	70.228879	-148.424806	Approx.	21A-03	1.6 E	Pond
DA3 / 21A-06	2011, 2019	JS	70.229302	-148.42422	Approx.	21A-06	~3	Pond
DA2 / 21A-08	2011, 2019	JS	70.22923	-148.423403	Approx.	21A-08	~3	Pond
SI3 / 21A-10	2011, 2019	JS	70.22919	-148.42237	Approx.	21A-10	~4	Pond
SI5 / 21A-11	2012, 2019	JS	70.229065	-148.4215	Approx.	21A-11	~4.5	Pond
DA1, DA1-B / 21A-14	2011, 2019	JS	70.22903	-148.42111	Approx.	21A-14	~1	Pond
JS-21A-15	2021	JS	70.229719	-148.418237	Approx.	21A-15	1.5 E	Pond
Colleen site								
T1-5T-1	2014, 2020	T1	70.223133	-148.4710251	Precise	T1-5-T	Near	
T1-10T-1	2014, 2020	T1	70.2231487	-148.470794	Precise	T1-10-T	Near	
T1-10T-2	2014, 2020	T1	70.2231802	-148.4707269	Precise	T1-10-T	Near	
T1-25T-1	2014, 2020	T1	70.223257	-148.4705657	Precise	T1-25-T	Near	
T1-50T-2	2014, 2020	T1	70.2234443	-148.4702107	Precise	T1-50-T	Near	
T1-50T-5	2014, 2020	T1	70.2234547	-148.4702169	Precise	T1-50-T	Near	
T1-50T-7	2014, 2020	T1	70.22357	-148.4702785	Precise	T1-50-T	Near	
T1-50T-9	2014, 2020	T1	70.2233616	-148.4704774	Precise	T1-50-T	Near	
T1-100T-1	2014, 2020	T1	70.2238768	-148.4699907	Precise	T1-100-T	Near	

Table A7.1 *(continued)*

Borehole ID	Year drilled	Transect ID	Latitude (WGS84 DD)	Latitude (WGS84 DD)	Location accuracy	Transect/ plot location (m)	Distance from transect/ plot (m)	Site description and notes
AIRPORT SITE								
T3-11.7	2015, 2021	T3	70.196542	-148.423934	Precise	11.7	3.7 R	
T3-16.5	2015, 2021	T3	70.19652	-148.423815	Precise	16.5	1.9 R	2021 location: 0.4 m W
T3-32.2	2015, 2021	T3	70.196412	-148.423546	Precise	32.2	2.0 R	2021 location: 0.4 m W
T3-50.5	2015, 2021	T3	70.196282	-148.423252	Precise	50.5	3.1 R	2021 location: 0.4 m E
T3-70.3	2015, 2021	T3	70.196148	-148.422909	Precise	70.3	3.0 R	2021 location: 0.4 m W
T3-70.4	2015, 2021	T3	70.196134	-148.422953	Precise	70.4	5.3 R	2021 location: 0.4 m W
T3-84.1	2015, 2021	T3	70.196066	-148.422628	Precise	84.1	0.9 R	2021 location: 0.4 m S
T3-83.7	2015, 2021	T3	70.196051	-148.422695	Precise	83.7	3.0 R	
T3-90.0	2015, 2021	T3	70.195998	-148.422623	Precise	90.0	4.7 R	
T3-94.2	2015, 2021	T3	70.195995	-148.422464	Precise	94.2	1.4 R	2021 location: 0.4 m W
T3-100.7	2015, 2021	T3	70.195871	-148.422623	Precise	100.7	15.0 R	
T3-101.1	2015, 2021	T3	70.195953	-148.422329	Precise	101.1	0.6 R	2021 location: 0.4 m NW
T4-0	2020	T4	70.197301	-148.423008	Approx.	T4-0	0	Start of 15m transect; 37 m N of Hwy; 100 m E of T4 transect line; Low-centered polygon; water depth 5 cm
T4-500	2020	T4	n.d.	n.d.	Approx.	T4-0	5	
T4-600	2020	T4	n.d.	n.d.	Approx.	T4-0	6	Water depth 8 cm
T4-1500	2020	T4	70.19717	-148.423187	Approx.	T4-0	15	End of 15m transect; no borehole
T5-26.7	2015, 2021	T5	70.195855	-148.426747	Precise	26.7	2.6 R	2021 location: 0.4 m N
T5-39.7	2015, 2021	T5	70.195895	-148.427071	Precise	39.7	1.5 R	2021 location: 0.4 m S
T5-40.3	2015, 2021	T5	70.195907	-148.427072	Precise	40.3	2.7 R	
T5-50.0	2015, 2021	T5	70.195942	-148.427307	Precise	50	2.5 R	
T5-50.5	2015, 2021	T5	70.195936	-148.427329	Precise	50.5	1.6 R	
T5-59.5	2015, 2021	T5	70.195966	-148.42755	Precise	59.5	1.1 R	2021 location: 0.4 m S
T5-68.9	2015, 2021	T5	70.196013	-148.42776	Precise	68.9	2.5 R	
T5-69.6	2015, 2021	T5	70.196022	-148.427769	Precise	69.6	3.2 R	
T5-72.9	2015, 2021	T5	70.19603	-148.427853	Precise	72.9	2.7 R	
T5-88.3	2015, 2021	T5	70.1961	-148.428206	Precise	88.3	4.2 R	
T5-93.0	2015, 2021	T5	70.196092	-148.428355	Precise	93	1.0 R	2021 location: 0.4 m NW
T5-94.5	2016, 2021	T5	n.d.	n.d.		94.5	2.8 R	
T5-100.5	2015, 2021	T5	70.196151	-148.428492	Precise	100.5	4.8 R	
T5-100.6	2015, 2021	T5	70.196141	-148.428509	Precise	100.6	3.6 R	2021 location: 0.4 m E, several cm above water level

Table A7.2. *Cryostratigraphy, moisture and ground-ice content of soil sampled from permafrost boreholes, NIRPO, Jorgenson and Airport sites, Prudhoe Bay, Alaska, 24 August–5 September 2021.* ***Polgyon feature:*** *Center (C), rim (R), trough (T).* ***Cryostratigraphic unit:*** *Code descriptions are listed below the table.*

Borehole ID	Polygon feature	Sample depth (cm)	Cryostratigraphic unit	Soil texture	Gravimetric moisture content, GMC (% wt)	Volumetric moisture content, VMC (% vol)	Excess ice content, EIC (% vol)	Notes
NIRPO SITE								
T6-98T	T	38-44	TL	organic-rich silt, marl	140	76	16	
	T	54-62	IL	organic-rich silt, marl	106	73	16	
T6-99C	C	50-56	TL	organic-rich silt	112	71	0	high-centered polygon, limnic
	C	68-74	SP	organic-rich silt, ice poor	168	79	0	
	C	88-94	SP	organic-rich silt, ice poor	218	78	0	
	C	111-118	QSP	organic-rich silty sand	191	81	31	94-110 cm horizon is peat
	C	122-130	QSP	organic-rich silty sand	352	90	65	
	C	134-141	QSP	organic-rich silty sand	381	89	66	
T6-21A-31	P	54-61	IL	silty peat, organic-rich silt	169	79	24	
T6-21A-35-34	P	43-49	TL	peat, organic-rich silt	193	81	4	
	P	52-62	IL	organic-rich silt with peat inclusions	252	85	30	
T7-33T	T	44-49	TL	peat, silty sand	199	82	7.1	
T7-40C	C	55-62	TL	peat, silty sand	206	77	1.8	
	C	66-77	IL	silty sand, peat	379	89	44	
	C	105-112	QSP	organic-rich silty sand, peat	314	84	23	105-130 cm horizon is peat
	C	120-130	QSP	organic-rich silty sand, peat	321	88	59	
T7-83T	T	44-52	IL	peat, silty sand	159	78	16	
T7-94T	T	47-52	IL	silty sand with gravel, peat inclusions	181	82	49	
T7-105T	T	46-50	IL	organic-rich silty sand, peat	85	71	44	
	T	58-65	IL	organic-rich silty sand, peat	112	71	5.4	
T7-166C	C	62-70	IL	organic-rich sandy silt, peat	264	85	25	
	C	87-97	QSP	organic-rich sandy silt, peat	303	87	56	70-85 cm horizon is peat
	C	115-123	QSP	organic-rich sandy silt, peat	330	85	31	
	C	130-140	QSP	organic-rich sandy silt, peat	549	92	64	
	C	150-158	QSP	organic-rich sandy silt, peat	393	90	66	
T8-2C	C	57-67	IL?	organic-rich silt	362	86	33	Low-centered polygon
	C	79-88	SP	organic-rich silt	155	77	18	
	C	107-117	SP	silty sand with organic inclusions	103	72	44	
	C	120-126	PSP?	silty sand	52	59	24	EIC is probably too high
	C	136-144	PSP?	silty sand	46	57	28	EIC is probably too high
	C	162-169	SP	silty sand with peat inclusions	166	81	58	EIC is probably too high
	C	178-185	SP	sand, gravel	126	78	54	EIC is probably too high
T8-192C	C	47-53	TL	organic-rich silt	149	77	13	wet marl area
	C	64-74	IL	organic-rich silt with peat inclusions	289	87	36	limnic
	C	84-93	SP	silty sand	125	78	53	EIC is probably too high
	C	105-111	SP	silty sand	57	62	34	EIC is probably too high
	C	123-128	SP	sand, gravel	25	41	17	EIC is probably too high

Table A7.2 *(continued)*

Borehole ID	Polygon feature	Sample depth (cm)	Cryostratigraphic unit	Soil texture	Gravimetric moisture content, GMC (% wt)	Volumetric moisture content, VMC (% vol)	Excess ice content, EIC (% vol)	Notes
T9-8C	C	41-47	TL	organic-rich silt	162	78	0	limnic
	C	60-66	SP	organic-rich silt	264	81	17	limnic, subaquatic SP
	C	78-85	SP	organic-rich silt	493	89	44	
	C	100-109	SP	organic-rich silt	276	86	35	
	C	127-134	SP	organic-rich silt	325	88	40	
	C	142-148	SP	organic-rich silt	176	80	28	silty sand from ~140 cm
T9-32T	T	45-52	TL	organic-rich silt, marl	128	74	0	limnic
JORGENSON SITE								
JS-21A-02	P	48-55	TL	organic-rich silt with peat inclusions	133	74.8	4.8	
AIRPORT SITE (REDRILLING)								
T5-39.7 (2021)	T	59-64	IL?	silty sand, marl	158	77.8	20.0	

Notes: **Cryostratigraphic unit**: AL – active layer; ALF – frozen active layer (ice-poor; often with dry friable soil horizons closer to the base of the AL); TL – transient layer (relatively ice-poor, mainly with reticulate and/or braided cryostructures); ALF-TL – undifferentiated AL-TL (no distinctive boundary between AL and TL); IL – intermediate layer, usually ice rich (thick belts, mainly ataxitic cryostructure); IL-PD – intermediate layer, poorly developed (relatively ice-poor, no well-developed belts); PSP – para-syngenetic permafrost (refrozen talik); QSP – quasi-syngenetic permafrost (buried ILs, usually ice-rich); SP – syngenetic permafrost (thin belts, micro-cryostructures).

Table A7.3. *Thicknesses of frozen protective layers above massive-ice bodies in boreholes, Prudhoe Bay study sites, August-September 2021, including comparisons with 2015 Airport site and 2019 Jorgenson site data.* ***Microrelief****: Polygon center (C), trough (T), and pond (P).* ***Depth to massive ice****: Wedge ice (WI), thermokarst-cave ice (TCI), composite wedge (CW).* ***Thaw depth****: Active-layer thickness (ALT).*

Borehole ID	Date	Transect	Micro-relief	Borehole depth (cm)	Water depth (cm)	Thaw depth (ALT) (cm)	Transient layer (TL) (cm)	Intermediate layer (IL) (PL3) (cm)	Depth to massive ice (cm)	TL+IL (PL2) (cm)	Notes and results
NIRPO SITE, INCLUDING PONDS, 2021											
T6-99C	8/30/2021	T6	C	141	0	50	7	0	N/A	7	
T6-34T	9/1/2021	T6	T	73	21	47	0	0	47	0	
T6-40T	9/1/2021	T6	T	79	0	43	4	0	47	4	
T6-52T	8/31/2021	T6	T	124	20	41	0	0	41	0	Probably WI+TCI on top
T6-64T	8/31/2021	T6	T	73	0	48	5	1	54	6	
T6-74T	8/31/2021	T6	T	77	0	39	11	3	53	14	
T6-98T	8/30/2021	T6	T	81	0	38	16	8	62	24	
T6-152T	8/29/2021	T6	T	81	0	44	7	0	51	7	
T6-174T	8/29/2021	T6	T	75	2	41	6	0	47	6	
T6-188T	8/29/2021	T6	T	120	6	46	4	0	50	4	Soil 81-104; IW from 104; SA
T6-21A-29	8/31/2021	T6	P	95	46	50	6	0	56	6	50-52 – destroyed core
T6-21A-31	8/31/2021	T6	P	99	45	49	5	7	61	12	49-54 – destroyed core
T6-21A-32	9/1/2021	T6	P	77	30	45	6	7	58	13	45-51 – destroyed core
T6-21A-33	9/1/2021	T6	P	89	35	41	0	0	41	0	
T6-21A-35&34	9/1/2021	T6	P	90	55	42	8	13	63	21	
T6-21A-36	8/31/2021	T6	P	79	45	41	6	9	56	15	41-47 – destroyed core
T6-21A-37	8/31/2021	T6	P	97	46	48	0	4	52	4	48-49 – destroyed core
T6-21A-39	8/31/2021	T6	P	82	39	46	6	0	52	6	Destroyed core
Mean (n=8)	**Ponds**	**T6**	**P only**	**88.5**	**42.6**	**45.3**	**4.6**	**5.0**	**54.9**	**9.6**	**1 degrading wedge**
Mean (n=17)	**Troughs + ponds**	**T6**	**T + P**	**87.71**	**22.9**	**44.1**	**5.3**	**3.1**	**52.4**	**8.4**	**3 degrading wedges**
Mean (n=7)	**Water <7 cm**	**T6**	**T dry**	**83.7**	**1.1**	**42.7**	**7.6**	**1.7**	**52.0**	**9.3**	**No degrading wedges**
Mean (n=10)	**Water ≥20 cm**	**T6**	**T + P wet**	**90.5**	**38.2**	**45.0**	**3.7**	**4.0**	**52.7**	**7.7**	**3 degrading wedges**
T7-40C	8/26/2021	T7	C	130	1	53	8	>65?	n.d.	n.d.	
T7-166C	8/24/2021	T7	C	158	0	53	4?	>101?	n.d.	n.d.	
T7-0T	8/26/2021	T7	T	66	0	47	15	0	62	15	
T7-33T	8/26/2021	T7	T	71	23	44	6	0	50	6	
T7-46T	8/26/2021	T7	T	52	9	38	5	0	43	5	
T7-49T	8/25/2021	T7	T	69	0	38	8	9	55	17	
T7-83T	8/25/2021	T7	T	71	25	35	13	4	52	17	
T7-94T	8/25/2021	T7	T	74	11	33	14	5	52	19	
T7-105T	8/25/2021	T7	T	80	0	43	3	19	65	22	
T7-128T	8/24/2021	T7	T	65	0	46	9	0	55	9	
T7-141T	8/24/2021	T7	T	82	12	51	0	0	51	0	
T7-168T	8/24/2021	T7	T	85	1	57	5	0	62	5	
T7-171T	8/24/2021	T7	T	65	10	49	5	0	54	5	
T7-194T	8/24/2021	T7	T	70	14	49	0	0	49	0	
T7-XT	8/26/2021	T7	T	68	17	43	5	0	48	5	
Mean (n=13)	**Troughs**	**T7**	**T only**	**70.6**	**9.4**	**44.1**	**6.8**	**2.8**	**53.7**	**9.6**	**2 degrading wedges**

Table A7.3 *(continued)*

Borehole ID	Date	Transect	Micro-relief	Borehole depth (cm)	Water depth (cm)	Thaw depth (ALT) (cm)	Transient layer (TL) (cm)	Intermediate layer (IL) (PL3) (cm)	Depth to massive ice (cm)	TL+IL (PL2) (cm)	Notes and results
T8-2C	8/28/2021	T8	C	169	3	46	12	20	N/A	32	
T8-192C	8/29/2021	T8	C	128	1	47	6	21	N/A	27	
T8-30T-2	8/28/2021	T8	T	85	0	47	6	0	N/A	N/A	
T8-30T-3	8/28/2021	T8	T	78	0	44	4	0	48	4	
T8-6T	8/27/2021	T8	T	49	1	34	7	1	42	8	
T8-15T	8/28/2021	T8	T	76	0	34	11	0	45	11	
T8-30T	8/28/2021	T8	T	69	6	37	4	0	41	4	
T8-92T	8/28/2021	T8	T	59	0	36	5	0	41	5	
Mean (n=4)	**Troughs (T8-30T-2&3 excl.)**	**T8**	**T only**	**63.3**	**1.8**	**35.3**	**6.8**	**0.3**	**42.3**	**7.0**	**No degrading wedges**
T9-8C	8/27/2021	T9	C	149	0	41	7	0?	N/A	7?	
T9-0T	8/26/2021	T9	T	81	1	37	5	1	43	6	
T9-5T	8/26/2021	T9	T	69	0	37	4	0	41	4	
T9-21T	8/27/2021	T9	T	62	1	24	7	0	31	7	
T9-32T	8/27/2021	T9	T	65	0	43	10	0	53	10	
T9-39T	8/27/2021	T9	T	61	0	34	11	0	45	11	
T9-54T	8/27/2021	T9	T	74	0	36	4	1	41	5	
T9-95T	8/27/2021	T9	T	89	1	39	6	2	47	8	
Mean (n=7)	**Troughs**	**T9**	**T only**	**71.6**	**0.4**	**35.7**	**6.7**	**0.6**	**43.0**	**7.3**	
JORGENSON SITE PONDS, 2019 & 2021											
JS21A-01	9/3/2021	JS	P	81	49	49	7	1	58	8	
JS21A-02	9/3/2021	JS	P	76	49	46	9	0	55	9	
JS21A-03	9/3/2021	JS	P	71	63	46	13	0	59	13	
DA3 / 21A-06	7/11/2019	JS	P	93	49	34		0	66		
DA2 / 21A-08	7/11/2019	JS	P	117	42	40		10	98		
SI3 / 21A-10	7/11/2019	JS	P	85	65	35		0	50		
SI5 / 21A-11	7/11/2019	JS	P	82	20	42		3	60		
DA1 / 21A-14	7/13/2019	JS	P	90	65	33		4	58		
JS21A-15	9/3/2021	JS	P	81	34	54	6	0	60	6	
Mean (n=4)	**2021**	**JS**	**P**	**77.3**	**48.8**	**48.8**	**8.8**	**0.3**	**58.0**	**9.0**	
Mean (n=9)	**2019 + 2021**	**JS**	**P**	**86.2**	**48.4**			**2.0**	**62.7**		
Mean (n=8)	**2019 + 2021 (DA2 excl.)**	**JS**	**P**	**82.4**							**DA2 in slightly different location in 2021: WI not TCI**
AIRPORT SITE, T3 & T5 REDRILLING, 2015 & 2021											***T3-89.3 EXCLUDED***
T3-11.7T	9/22/2015	T3	T	81	23	53	0	14	67	14	IW
T3-11.7T/21	9/4/2021	T3	T	-	19	52	-	-	-	-	No coring, looks stable
T3-16.5T	9/18/2015	T3	T	92	0	60	0	0	60	0	~0.2 cm protective layer above IW
T3-16.5T/21	9/4/2021	T3	T	75	0	58	11	0	69	11	no visible ice
T3-32.2T	9/18/2015	T3	T	79	0	51	0.5	0	51.5	0.5	~0.5 cm protective layer, IW
T3-32.2T/21	9/4/2021	T3	T	78	0	52	4	0	56	4	ice poor soil

Table A7.3 *(continued)*

Borehole ID	Date	Transect	Micro-relief	Borehole depth (cm)	Water depth (cm)	Thaw depth (ALT) (cm)	Transient layer (TL) (cm)	Intermediate layer (IL) (PL3) (cm)	Depth to massive ice (cm)	TL+IL (PL2) (cm)	Notes and results
T3-50.5T	9/18/2015	T3	T	75	0	43	0	0	43	0	~0.2 cm protective layer, IW
T3-50.5T/21	9/4/2021	T3	T	78	0	48	3	0	51	3	
T3-70.3T	9/18/2015	T3	T	92	0	62	0	0	62	0	IW was actively degrading in 2015
T3-70.3T/21	9/4/2021	T3	T	83	0	59	9	0	68	9	WI+TCI
T3-70.4T	9/22/2015	T3	T	90	27	47	0	0	47	0	IW was actively degrading in 2015
T3-70.4T/21	9/4/2021	T3	T	79	26	49	1	4	54	5	WI
T3-83.7T	9/18/2015	T3	Mound in T	109	0	65	1	0	66	1	IW+CW 66-109; "mound"
T3-83.7T/21	9/4/2021	T3	Mound in T	-	0	64	-	-	-	-	No coring, looks stable
T3-84.1	9/18/2015	T3	T	92	0	62	1	0	63	1	~1-1.5 cm protective layer, IW
T3-84.1/21	9/4/2021	T3	T	87	0	64	0	0	64	0	Degrading IW; slightly above water level
T3-90.0	9/18/2015	T3	T	88	0	48	0.5	0	48.5	0.5	~0.5 cm protective layer, IW
T3-90.0	9/4/2021	T3	T	-	0	66	-	-	-	-	No coring, looks stable
T3-94.2	9/19/2015	T3	T	79	0	48	0	0	48	0	~0.2 cm protective layer, IW
T3-94.2/21	9/4/2021	T3	T	62	0	46	0	4	50	4	IW; IL-PD, i~30%
T3-100.7	9/19/2015	T3	Ridge in T	135	0	62	0	10	72	10	TCI 72-89, IW 106-135; elevated "ridge" in the trough
T3-100.7/21	9/4/2021	T3	Ridge in T	-	0	69	-	-	-	-	No coring, looks stable
T3-101.1	9/19/2015	T3	T	90	0	55	0	0	55	0	~0.2 cm protective layer, IW
T3-101.1/21	9/4/2021	T3	T	88	0	62	1	0	63	1	WI
T3-100.7	9/19/2015	T3	Ridge in T	135	0	62	0	10	72	10	TCI 72-89, IW 106-135; elevated "ridge" in the trough
T3-100.7/21	9/4/2021	T3	Ridge in T	-	0	69	-	-	-	-	No coring, looks stable
Mean (n=12)	**2015**	**T3**	**T**	**91.8**	**4.2**	**54.7**	**0.3**	**2.0**	**56.9**	**2.3**	
Mean (n=12)	**2021**	**T3**	**T**		**3.8**	**57.4**					**Water and thaw depths only, 2021**
Mean (n=8)	**2015, redrilled only**	**T3**	**T**	**86.1**	**3.4**	**53.5**	**0.2**	**0.0**	**53.7**	**0.2**	**Only boreholes that were redrilled in 2021**
Mean (n=8)	**2021, redrilled only**	**T3**	**T**	**78.8**	**3.3**	**54.8**	**3.6**	**1.0**	**59.4**	**4.6**	**Only boreholes that were redrilled in 2021**
T5-26.7T	9/20/2015	T5	T	63	10	53	0	2	55	2	IW
T5-26.7T/21	9/5/2021	T5	T	64	2	45	10	3	58	13	Ice poor; thin belt at 48
T5-39.7T	9/20/2015	T5	T	92	8	61	0.5	0	61.5	0.5	~0.5 cm protective layer, IW
T5-39.7T/21	9/5/2021	T5	T	71	5	57	3	6	66	9	
T5-40.3T	9/20/2015	T5	Mound in T	104	0	77	1	0	78	1	IW; "mound"
T5-40.3T/21	9/5/2021	T5	Mound in T	-	0	64	-	-	-	-	No coring, looks stable, mound, ~0.4 m above water
T5-50.0T	9/22/2015	T5	T	118	27	48	0	3	51	3	TCI 51-66, IW 95-118
T5-50.0T/21	9/5/2021	T5	T	-	5	53	-	-	-	-	No coring, looks stable, less water
T5-50.5T	9/20/2015	T5	Mound in T	150	0	69	4	61	134	65	IW; "mound"; ---was excluded
T5-50.5T/21	9/5/2021	T5	Mound in T	-	0	64	-	-	-	-	No coring, looks stable, mound
T5-59.5T	9/20/2015	T5	T	61	11	48	0	2	50	2	IW
T5-59.5T/21	9/5/2021	T5	T	69	0	46	10	0	56	10	ice poor
T5-68.9T	9/21/2015	T5	T	57	15	36	0	6	42	6	IW+TCI?; belt at 36
T5-68.9T/21	9/5/2021	T5	T	-	0	42	-	-	-	-	No coring, looks stable, water level

Table A7.3 *(continued)*

Borehole ID	Date	Transect	Micro-relief	Borehole depth (cm)	Water depth (cm)	Thaw depth (ALT) (cm)	Transient layer (TL) (cm)	Intermediate layer (IL) (PL3) (cm)	Depth to massive ice (cm)	TL+IL (PL2) (cm)	Notes and results
T5-69.6T	9/21/2015	T5	Ridge in T	110	0	71	4	2	77	6	IW; elevated "ridge" in the trough; belt at 75
T5-69.6T/21	9/5/2021	T5	Ridge in T	-	0	66	-	-	-	-	No coring, looks stable, mound
T5-72.9T	9/20/2015	T5	T	93	0	51	0	6	57	6	IW, IL, belt at 51
T5-72.9T/21	9/5/2021	T5	T	-	0	54	-	-	-	-	No coring, looks stable, no water
T5-88.3T	9/21/2015	T5	T	66	10	46	0	5	51	5	IW, ice-rich IL
T5-88.3T/21	9/5/2021	T5	T	-	0	45	-	-	-	-	No coring, looks stable, no water
T5-93.0T	9/21/2015	T5	T	50	27	45	0	0	45	0	IW was actively degrading in 2015
T5-93.0T/21	9/5/2021	T5	T	72	20	46	8	0	54	8	Ice poor TL
T5-94.5	3/28/2016	T5	T	55	73	47	0	0	47	0	Winter coring; IW prob. actively degrading in 2015-16
T5-94.5/21	9/5/2021	T5	T	-	44	56	-	-	-	-	No coring; stabilization??? (less water)
T5-100.5T	9/21/2015	T5	Ridge in T	113	0	67	10	13	[90 CW?]	23	"Ridge" in trough; CW? from 90 (vert. c/s) excluded
T5-100.5T/21	9/5/2021	T5	Ridge in T	-	0	55	-	-	-	-	No coring, looks stable
T5-100.6T	9/21/2015	T5	T	62	17	36	12	3	51	15	IW, distinctive IL 3 cm
T5-100.6T/21	9/5/2021	T5	T	80	0	47	17	0	64	17	No distinctive IL
Mean (n=11)	**2015**	**T5**	**T**	**79.6**	**11.4**	**52.0**	**1.6**	**2.6**	**56.2**	**4.2**	**T5-50.5, T5-100.5, and T5-94.5 excluded**
Mean (n=11)	**2021**	**T5**	**T**		**2.9**	**51.4**					**Water and thaw depths only, 2021**
Mean (n=5)	**2015, redrilled only**	**T5**	**T**	**65.6**	**14.6**	**48.6**	**2.5**	**1.4**	**52.5**	**3.9**	
Mean (n=5)	**2021, redrilled only**	**T5**	**T**	**71.2**	**5.4**	**48.2**	**9.6**	**1.8**	**59.6**	**11.4**	**Less water than in 2015**

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