Pre-ABoVE: Arctic Vegetation Plots, Frost Boil Sites, North Slope, Alaska, 2000-2006

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Documentation Revision Date: 2016-12-08

Data Set Version: V1

Summary

This data set describes the environment, soil, and vegetation on nonsorted circles and earth hummocks at seven study sites along a N-S-transect from the Arctic Ocean to the Arctic Foothills based on data collected from 2000 to 2006. The study sites are located along the Dalton Highway, beginning in Prudhoe Bay, on the North Slope of Alaska. These frost-boil features are important landscape components of the arctic tundra. Data include the baseline plot information for vegetation, soils, and site factors for 117 study plots subjectively located in areas of homogeneous, representative vegetation on frost-heave features surrounding stable tundra. Nine community types were identified in three bioclimate subzones. Vegetation was classified according to the Braun-Blanquet system.

This data set includes 4 data files in *.csv format and 3 companion files in *.pdf format.

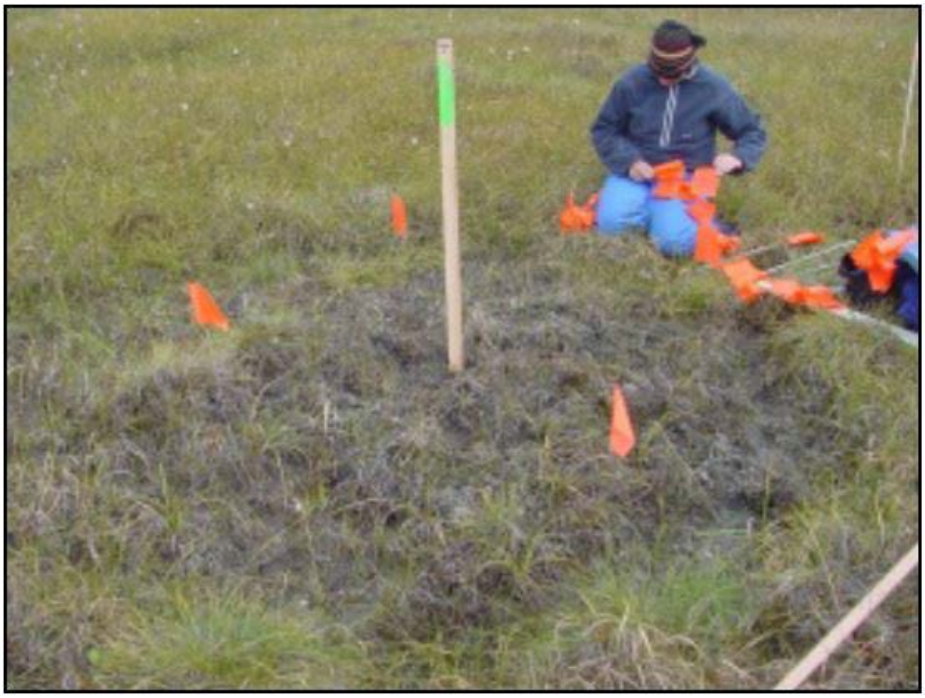

Figure 1. Plot 3 at Franklin Bluffs in northern Alaska

Citation

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Table of Contents

1. Data Set Overview

This data set describes the environment, soil, and vegetation on nonsorted circles and earth hummocks at seven study sites along a N-S-transect from the Arctic Ocean to the Arctic Foothills, Alaska, based on data collected from 2000 to 2006. These frost-boil features are important landscape components of the arctic tundra. Data includes the baseline plot information for vegetation, soils, and site factors for 117 study plots subjectively located in areas of homogeneous, representative vegetation on frost-heave features surrounding stable tundra. Nine community types were identified in three bioclimate subzones. Vegetation was classified according to the Braun-Blanquet system.

The Pre-ABoVE vegetation plot datasets were curated to create the Alaska Arctic Vegetation Archive (AVA-AK; Walker et al. 2016b, Walker 2013) The AVA-AK is a regional database that is part of the larger Arctic Vegetation Archive (Walker 2016a, Walker et al. 2013, Walker and Raynolds 2011). The database contains vegetation plots from homogeneous plant communities with tables of cover or cover-abundance scores for all species, and accompanying environmental site data. Field data were collected using Braun-Blanquet, US National Vegetation Classification protocols, or comparable methods.

Project: Arctic-Boreal Vulnerability Experiment (ABoVE)

The Arctic-Boreal Vulnerability Experiment (ABoVE) is a NASA Terrestrial Ecology Program field campaign based in Alaska and western Canada between 2016 and 2021. Climate change in the Arctic and Boreal region is unfolding faster than anywhere else on Earth. ABoVE seeks a better understanding of the vulnerability and resilience of ecosystems and society to this changing environment.

Acknowledgements:

These data were obtained from the Alaska Arctic Geoecological Atlas (http://agc.portal.gina.alaska.edu), which provides access to existing Arctic vegetation plot and map data in support of the ABoVE campaign.

2. Data Characteristics

Spatial Coverage: Frost Boil research sites between the Arctic Ocean and Arctic Foothills, Dalton Highway, Alaska

ABoVE Grid Location: Ah1v0.Bh2v3

Spatial Resolution: Point resolution

Temporal Coverage: 20000816 - 20060730

Temporal Resolution: Each plot was sampled once

Study Area (All latitude and longitude given in decimal degrees)

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Frost Boil Sites, Alaska	-148.994	-147.991	70.381	69.147

Data File Information

The data set includes four data files in *.csv format -- *Frost_Boils_Soil_data*, *Frost_Boils_Species_Data*, *Frost_Boils_Spectral_Biomass_Data*, and *Frost_Boils_Environmental_Data* -- and three companion files in *.pdf format: *Frost_Boils_Env_Legend, frostboils_barredaj_2006_report.pdf,* and *frostboils_kade_2005_plotphotos.pdf*.

Table 1. Data and companion files

Data File Name	Description
Frost_Boils_Soil_Data.csv	Soil characterization data for Frost Boil research plots
Frost_Boils_Spectral_Biomass_Data.csv	NDVI and above ground biomass data for Frost Boil research plots
Frost_Boils_Environmental_Data.csv	Comprehensive set of environmental characterization data for Frost Boil research plots including the descriptive site factors.
Frost_Boils_Species_Data.csv	Species cover data for Frost Boil research plots
Companion Files	**Description**
Frost_Boils_Env_Legend.pdf	List of coded and scalar variables and their descriptions (*Frost_Boils_Environmental_Data.csv*)
Frost_Boils_barredaj2006_Report.pdf	Summary report of all the data collected, methods of collection, maps/plots etc. for the study plots. Barreda et al. 2006.
Frost_Boils_Plot_Photos.pdf	Plot photos

Data Descriptions: The column names, their units, and descriptions for each of the *.csv data files are listed below.

Table 2. Frost_Boils_Soil_Data.csv

Column Name	Units	Description
RELEVE_NUMBER		Releve number
BULK_DENSITY	g/cm^3	Bulk density of the soil sample
MOISTURE_GRAVIMETRIC	%	Gravimetric water content in the soil sample
MOISTURE_VOLUME	%	Volumetric water content in the soil sample
SAND	%	Percentage of sand in the soil sample
SILT	%	Percentage of silt in the soil sample
CLAY	%	Percentage of clay in the soil sample
PH_PASTE		PH of the soil sample
TOTAL_C	%	Percentage of carbon in the soil sample
TOTAL_N	%	Percentage of nitrogen in the soil sample
C/N		Carbon to nitrogen ratio
K	MEQ/100 G	Extractable K in the soil sample
CA	MEQ/100 G	Extractable Ca in the soil sample
MG	MEQ/100 G	Extractable Mg in the soil sample
NA	MEQ/100 G	Extractable Na in the soil sample
DEPTH_LIVE_MOSS	cm	Depth of live moss in the soil sample
DEPTH_O_HORIZON	cm	Depth of O horizon in soil profile
DEPTH_A_HORIZON	cm	Depth of A horizon in soil profile

Table 3. Frost_Boils_Spectral_Biomass_Data.csv

Column Name	Units	Description
PLOT		Plot identifier
NDVI		Normalized Difference Vegetation Index
DECIDUOUS_STEM	g/m^2	Amount of deciduous stem

DECIDUOUS_LEAF_LIVE	g/m^2	Amount of live deciduous leaf
DECIDUOUS_LEAF_DEAD	g/m^2	Amount of dead deciduous leaf
DECIDUOUS_FLOWER_FRUIT	g/m^2	Amount of deciduous flower fruit
EVERGREEN_STEM	g/m^2	Amount of evergreen stem
EVERGREEN_LEAF_LIVE	g/m^2	Amount of live evergreen leaf
EVERYGREEN_LEAF_DEAD	g/m^2	Amount of dead evergreen leaf
EVERGREEN_FLOWER_FRUIT	g/m^2	Amount of evergreen flower fruit
GRAMINOID_LIVE	g/m^2	Amount of live graminoid
GRAMINOID_DEAD	g/m^2	Amount of dead graminoid
FORB	g/m^2	Amount of forb
HORSETAIL	g/m^2	Amount of horsetail
LICHEN	g/m^2	Amount of lichen
MOSS	g/m^2	Amount of moss
ALGAE	g/m^2	Amount of algae
TOTAL_ABOVEGROUND_PHYTOMASS	g/m^2	Total amount of aboveground phytomass

Table 4. Frost_Boils_Environmental_Data.csv

NOTE: Coded and scalar variables are followed by a description column (e.g. MICROSITE & MICROSITE_DESC). See legend companion file for complete list of coded and scalar variables and their descriptions.

Column Name	Units	Description
FIELD_RELEVE_NUMBER		Field plot number
ERECT_DWARF_SHRUB_COVER	%	Percentage of erect dwarf shrub cover in the plot
PROSTRATE_DWARF_SHRUB_COVER	%	Percentage of prostrate dwarf shrub cover in the plot
EVERGREEN_SHRUB_COVER	%	Percentage of evergreen shrub cover in the plot
DECIDUOUS_SHRUB_COVER	%	Percentage of deciduous shrub cover in the plot
ERECT_FORB_COVER	%	Percentage of erect forb cover in the plot
MATTED_FORB_COVER	%	Percentage of matted forb cover in the plot
NON.TUSSOCK_GRAMINOID_COVER	%	Percentage of non-tussock graminoid cover in the plot
TUSSOCK_GRAMINOID_COVER	%	Percentage of tussock graminoid cover in the plot
FOLIOSE_LICHEN_COVER	%	Percentage of foliose lichen cover in the plot
FRUTICOSE_LICHEN_COVER	%	Percentage of fruticose lichen cover in the plot
CRUSTOSE_LICHEN_COVER	%	Percentage of crustose lichen cover in the plot
PLEUROCARPOUS_MOSS_COVER	%	Percentage of pleurocarpous moss cover in the plot
ACROCARPOUS_MOSS_COVER	%	Percentage of acrocarpous moss cover in the plot
LIVERWORT_COVER	%	Percentage of liverwort cover in the plot
HORSETAIL_COVER	%	Percentage of horsetail cover in the plot
ALGAE_COVER	%	Percentage of algae cover in the plot
TYPE_OF_FROST_BOIL		Frost boil type
CHARACTERISTIC_SPECIES_ABBREVIATED		Primary species in the plot
DATE	YYYYMMDD	Date of plot observation

PLOT_SIZE	m^2	Plot size
ELEVATION	m	Elevation of the plot
ROCK_COVER	%	Percentage of rock cover in the plot
BARE_SOIL_COVER	%	Percentage of bare soil cover in the plot
SALT_CRUST_COVER	%	Percentage of salt crust cover in the plot
STANDING_WATER_COVER	%	Percentage of standing water cover in the plot
DEAD_VEGETATION	%	Percentage of dead vegetation cover in the plot
TOTAL_VEGETATION_COVER	%	Percentage of total vegetation cover in the plot
VEGETATION_HEIGHT	cm	Vegetation height within the plot
MICRORELIEF_HEIGHT	cm	Microrelief height of the plots
MICROSITE		Microsite code
MICROSITE_DESC		Description of microsite within the plots
SITE_MOISTURE		Site moisture of the plots
SITE_MOISTURE_DESC		Description of the site moisture of the plots
SOIL_MOISTURE		Site moisture of the plots
SOIL_MOISTURE_DESC		Description of the site moisture of the plots
GLACIAL_GEOLOGY		Glacial geology of the plots
GLACIAL_GEOLOGY_DESC		Description of glacial geology of the plots
TOPOGRAPHY		Topographic position of the plots
TOPOGRAPHY_DESC		Description of the topographic position of the plots
SNOW_DURATION		Estimated snow duration within the plots
SNOW_DURATION_DESC		Description of estimated snow duration within the plots
DISTURBANCE_DEGREE		Degree of disturbance within the plots
DISTURBANCE_DEGREE_DESC		Description of the degree of disturbance within the plots
STABILITY		Stability of the plots
STABILITY_DESC		Description of stability of the plots
EXPOSURE		Exposure of the plots
EXPOSURE_DESC		Description of the exposure of the plots
LOCATION		Location of the plot
SAND	%	Percentage of sand content of the plot soil
CLAY	%	Percentage of clay content of the plot soil
SILT	%	Percentage of silt content of the plot soil
SOIL_PH		pH of the soil in the plot
MEAN_MOSS_LAYER_HEIGHT	cm	Average height of moss layer
SOILS.DEPTH_OF_ORGANIC_HORIZON	cm	Depth of organic horizon
SOILS.DEPTH_OF_A_HORIZON	cm	Depth of A horizon
LATITUDE	decimal degrees	Plot latitude
LONGITUDE	decimal degrees	Plot longitude
FROST_SCAR_COVER	%	Percentage of frost scar cover in the plots
MEAN_THAW_DEPTH	cm	Average depth to permafrost of the plots
LANDFORM		Landform of the plots
LANDFORM_DESC		Description of landform of the plots

SURFICIAL_GEOLOGY		Surficial geology of the plots
SURFICIAL_GEOLOGY_DESC		Description of surficial geology of the plots
SURFICIAL_GEOMORPHOLOGY		Surficial geomorphology of the plots
SURFICIAL_GEOMORPHOLOGY_DESC		Description of surficial geomorphology of the plots
SOIL_UNITS		Soil units in the plot
DISTURBANCE_TYPE		Disturbance type in the plots
SLOPE	degrees	Slope of the plots
ASPECT	degrees	Aspect of the plots
PLANT_COMMUNITY_NAME		Primary vegetation types
LATITUDE_WGS_84	decimal degrees	Latitude of the plots in WGS 84
LONGITUDE_WGS_84	decimal degrees	Longitude of the plots in WGS 84
SOIL_TEXTURE		Soil texture of the plots
ALL_FORB_COVER	%	Percentage of forb cover in the plots
TOTAL_GRAMINOID_COVER	%	Percentage of graminoid cover in the plots
FOLIOSE_AND_FRUTICOSE_LICHEN_COVER	%	Percentage of foliose and fruticose lichen cover in the plots
BRYOPHYTES_COVER	%	Percentage of bryophytes cover in the plots
MOSS_AND_LIVERWORT_COVER	%	Percentage of moss and liverwort cover in the plots
MEAN_CANOPY_COVER	%	Percentage of canopy cover in the plots

Table 5. Frost_Boils_Species_Data.csv

Column Numbers	Column Name	Units	Description
1	PASL_TAXON_SCIENTIFIC_NAME_NO_AUTHORS		Current taxonomy according to the Panarctic Species List (PASL)
2	PASL_TAXON_SCIENTIFIC_NAME_WITH_AUTHORS		Current taxonomy according to the Panarctic Species List (PASL) including authors names
3	DATASET_TAXON		Data set taxonomy
4 to 118	DATASET_PLOT_NUMBER		Column headings are all 117 plot numbers. The data values are Species Cover Classes (Braun-Blanquet cover-abundance scale): where r (rare), + (common, but less than 1 percent cover), 1 (1-5 percent), 2 (6 to 25 percent), 3 (25 to 50 percent), 4 (51 to 75 percent), 5 (76 to 100 percent).

3. Application and Derivation

Derived regional maps of these data will be used in regional models of fluxes of trace gases, water, and energy from tundra surfaces. In addition, a circumpolar vegetation classification resulting from these data sets would be highly desirable to extend the results to the entire arctic region.

4. Quality Assessment

No specific quality assessment information provided.

5. Data Acquisition, Materials, and Methods

The vegetation associated with cryoturbated frost-heave features on the North Slope, Alaska was described by Kade et al. (2005) as part of the "Biocomplexity associated with biogeochemical cycles in arctic frost-boil ecosystems" project (NSF grant #0PP-0120736) from 2002 to 2006. The study sites spanned a latitudinal gradient from the Arctic Ocean (bioclimate subzone C) and Coastal Plain (bioclimate subzone D) to the Arctic Foothills (bioclimate subzone E) of Alaska. Bioclimate subzones and plot locations are depicted in Figure 2.

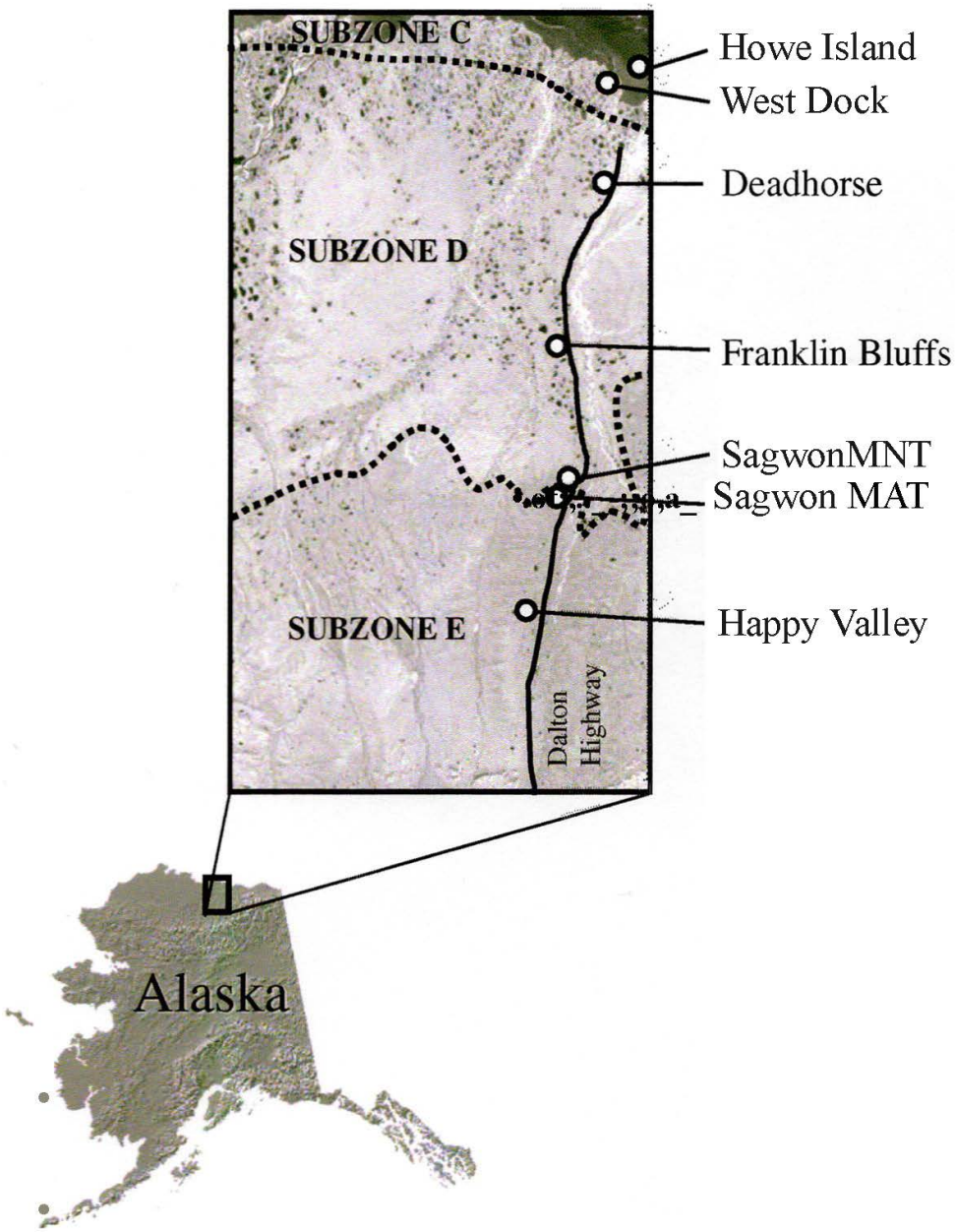

Figure 2. Location of the three climatic subzones and the seven study sites examined by Kade et al. (2005)

Seven study sites were established along a N-S-transect, with a total of 117 relevé plots on frost-heave features and surrounding stable tundra. Nine community types were identified in three bioclimatic subzones: dry nonacidic nonsorted circles (10 plots), dry nonacidic dwarf-shrub tundra (5 plots) and coastal nonacidic willow-sedge tundra (5 plots) in the bioclimate subzone C; moist nonacidic nonsorted circles (42 plots), moist nonacidic dwarf shrub-sedge tundra (20 plots) and wet nonacidic sedge tundra (5 plots) in bioclimate subzone D; and moist acidic lichen- and shrub-rich nonsorted circles and earth hummocks (15 plots), moist acidic tussock tundra (10 plots) and wet acidic nonsorted circles (5 plots) in bioclimate subzone E.

The study plots were chosen subjectively in areas of homogeneous, representative vegetation, permanently marked and geo-referenced. For each plant community, the minimum sampling area was determined. At each study plot, the site variables were recorded and a soil sample of the upper 10 cm of the mineral horizon was collected. The raw environmental data were published in a data report (Barreda et al. 2006). The vegetation data were analyzed using the Braun-Blanquet approach, and the plant community types, including three new associations, were published in Kade et al. (2005).

Species Data

Vegetation sampling was conducted during the summer periods of 2000 through 2003 using the centralized replicate sampling procedure (Mueller-

Dombois and Ellenberg 1974). The minimum sampling area of the releves was 1 m per plot. Cover abundance as well as the cover of plant functional types and the average vegetation height were estimated.

Species cover data are published in Kade et al. 2005. Species cover classes are coded according to the old Braun-Blanquet cover-abundance scale: r (rare), + (common, but less than 1 percent), 1 (1 to 5 percent), 2 (6 to 25 percent), 3 (26 to 50 percent), 4 (51 to 75 percent), and 5 (76 to 100 percent). Taxa are listed in alphabetical order. Both the dataset author determinations and the current nomenclature according to the Panarctic Species List (PASL) are listed.

In ten instances, taxa were lumped into a single taxon in the PASL:
1) Cetraria islandica (Cetraria islandica and Cetraria islandica s. crispiformis),
2) Cladonia gracilis s. lat. (Cladonia gracilis and Cladonia gracilis s. elongata),
3) Dicranum spadiceum (Dicranum spadiceum and Dicranum angustum),
4) Pedicularis albolabiata (Pedicularis neoalaskanum and Pedicularis sudetica and Pedicularis sudetica s. albolobiata),
5) Polytrichastrum alpinum (Polytrichastrum alpinum v. alpinum and Polytrichastrum alpinum v. fragile),
6) Pseudolophozia sudetica (Lophozia sudetica v. anomala and Lophozia sudetica v. sudetica),
7) Sphenolobus minutus (Sphenolobus minutus and Anastrophyllum minutum),
8) Stellaria longipes (Stellaria longipes s. longipes and Stellaria longipes s. l.),
9) Tortella tortuosa (Tortella tortuosa and Tortella arctica),
10) Tritomaria quinquedentata (Tritomaria quinquedentata and Lophozia collaris).

Environmental Data

The source of these data is the Biocomplexity of Patterned Ground Data Report (Barreda et al., 2006). The plot numbers in the source data are the author's. The main plot numbers in the Turboveg database are accession numbers and will differ. The author's plot numbers are retained in the FIELD_RELEVE_NUMBER field in the Turboveg database.

At each releve, the following site information was recorded: percent bare soil, percent salt crust cover, cover of standing water, site moisture, glacial history, topography, site stability, and elevation. The maximum snow depths in mid-April 2002 to 2004 and maximum thaw depths in late August 2002 to 2004 were measured using a metal probe.

Spectral and Biomass Data

Hyperspectral data were collected between July 19-30, 2006 using a handheld spectral device. Data were collected preferentially during clear sky conditions and close to midday (10AM-3PM). Collection and processing of the data is detailed in Walker (2011).

Above-ground biomass clippings were also taken at each sample location. These samples were sorted by plant functional type, dried at 50 °C, and the dry weight was measured and recorded for each sample. Vascular plants were clipped at the top of the moss layer or at the bottom of the green shoot. Mosses were clipped at the base of the green moss.

Soils Data

The soils data for the Frost Boils permanent vegetation plots are modified from the data report in Barreda et al. (2006).

At each releve site, the depth of the organic horizon was measured and soil samples of the upper 10 cm of the mineral horizon were collected. Calculation of bulk density and volumetric soil moisture was accomplished by drying field samples at 105º C for 72 hours and determining percentage weight loss. All other analyses were completed on air-dried samples. Particle size was determined using the hydrometer method. Soil pH values were measured using the saturated paste method with a glass electrode pH meter. Total carbon and nitrogen were determined by dry combustion (Robertson et al. 1999). The availability of cations (K^+, Na^+, Ca^{2+}, Mg^{2+}) was determined with Mehlich-3 extractions (Mehlich 1984).

This data set was provided by the GINA repository at http://geobotanical.portal.gina.alaska.edu/catalogs/9629-alaska-arctic-vegetation-archive-frost-boil-ve; access date 7 November 2016.

6. Data Access

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

Pre-ABoVE: Arctic Vegetation Plots, Frost Boil Sites, North Slope, Alaska, 2000-2006

Contact for Data Center Access Information:

- E-mail: uso@daac.ornl.gov
- Telephone: +1 (865) 241-3952

7. References

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