NGEE Arctic Plant Traits: Soil Cores, Kougarok Road Mile Marker 64, Seward Peninsula, Alaska, 2016

NGEE Arctic Record_id: NGA047

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Summary:

Soil cores were collected from twelve vegetation biomass plots at the Kougarok hillslope in late July of 2016. The sampled plots were located across six ecotypes present at this site (n=2 replicates per ecotype). Soil cores were separated into depth intervals in the field and frozen for transport to Oak Ridge National Laboratory. Laboratory sample processing of these soils generated data on soil texture, pH, gravimetric water content, bulk density, bulk soil %C and %N. Water extracts were performed on subsamples for determination of extractable total nitrogen, inorganic nitrogen, organic nitrogen, phosphorus, and dissolved organic carbon.

Please use this citation to reference the data.

Verity Salmon, Colleen Iversen, Joanne Childs, Holly Vander Stel. 2019. NGEE Arctic Plant Traits: Soil Cores, Kougarok Road Mile Marker 64, Seward Peninsula, Alaska, 2016. Next Generation Ecosystem Experiments Arctic Data Collection, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee, USA. Dataset accessed on [insert_date] at https://doi.org/10.5440/1346200.

Data Characteristics

This dataset is comprised of one comma-separated (*.csv) file containing depth-specific soil properties and one user guidance document (*.pdf)

Missing data was filled in with “NA.”

Data Dictionary

Data Files:

NGEEArctic_Kougarok2016_SoilCoreData_v1.csv

Column name	Units/format	Description
Region *		Values: Seward Peninsula
Locale *		Values: Kougarok
Ecotype		Values: Tussock tundra, Tussock tundra willow birch tundra, Willow birch tundra, Alder shrubland, Non-acidic mountain complex, Dwarf shrub lichen tundra

PlotID		Values represent a unique identifier for the Kougarok site biomass plot where soil cores were collected. Plot IDs represent concatenation of the following codes denoting different ecotypes along with a number to distinguish between replicate plots. AS= Alder shrubland vegetation plot (replicates numbered 1-5) DSLT=Dwarf shrub lichen tundra vegetation plot (replicates numbered 1-5) TT= Tussock tundra vegetation plot (replicates numbered 1-5) TTWBT= Tussock tundra, willow birch tundra vegetation plot (replicates numbered 1-5) WBT= Willow birch tundra vegetation plot (replicates numbered 1-5) NAMC= Non-acidic mountain complex vegetation plot (replicates numbered 1-5)
CoreRep		Values: A or B. Two replicate cores were collected within each of the Kougarok biomass plots sampled.
CoreDiameter_cm	Soil core diameter, cm	Diameter of soil core measured in cm
DepthTop_cm	Soil depth top, cm	Depth of the most shallow portion of the soil sample, zero refers to the soil surface and larger values are deeper in the profile
DepthBottom_cm	Soil depth bottom, cm	Depth of the deepest portion of the soil sample, zero refers to the soil surface and larger values are deeper in the profile
Horizon_TextureBased	Soil horizon based on texture	Values: Organic or mineral. Classified based on appearance and texture in the field
Sand_percent	Soil sand, percent	Percent of soil classified as sand
Clay_percent	Soil clay, percent	Percent of soil classified as clay
Silt_percent	Soil silt, percent	Percent of soil classified as silt
pH	Soil , pH	pH of root free soil
GWC	GWV, percent	Gravimetric water content
BulkDensity_gpercm3	Soil bulk density, gpercm3	Soil bulk density
BulkSoilN_percent	Soil %N	Percent N of bulk soil on a mass basis
BulkSoilC_percent	Soil %C	Percent C of bulk soil on a mass basis
TN_mgNpergdrysoil	Extractable total N, mg N per g dry soil	Water extractable total nitrogen
DOC_mgCpergdrysoil	Extractable dissolved organic carbon, mg C per g dry soil	Water extractable dissolved organic carbon

DIN_mgNpergdrysoil	Extractable dissolved inorganic N, mg N per g dry soil	Water extractable dissolved inorganic nitrogen (ammonium plus nitrate)
P_ugPpergdrysoil	Extractable P, ug P per g dry soil	Water extractable phosphorus
DON_mgNpergdrysoil	Extractable dissolved organic nitrogen, mg N per g dry soil	Water extractable dissolved organic nitrogen, calculated as DIN-DOC
Notes		notes on sample processing

* Values for these location fields have been standardized for NGEE Arctic and are required fields for all data dictionaries.

Footnotes:
Files versions will be updated should new data become available.

Example Data Records:

Region,Locale,Ecotype,PlotID,CoreRep,CoreDiameter_cm,DepthTop_cm,DepthBottom_cm,Horizon_TextureBased,Sand_percent,Clay_percent,Silt_percent,pH,GWC,BulkDensity_gpercm3,BulkSoilN_percent,BulkSoilC_percent,TN_mgNpergdrysoil,DOC_mgCpergdrysoil,DIN_mgNpergdrysoil,P_ugPpergdrysoil,DON_mgNpergdrysoil,Notes
Seward Peninsula,Kougarok,Alder shrubland,AS-1,A,7.62,0,9.5,organic,NA,NA,NA,4.9,77.23,0.128,1.166,24.508,0.11,1.42,0.01,3.48,0.1,
Seward Peninsula,Kougarok,Alder shrubland,AS-1,A,7.62,9.5,10,mineral,45.4,40.2,14.4,4.89,71.71,0.412,1.286,28.349,0.06,0.73,0.01,0,0.06,Texture analysis on combined mineral sample from AS-1/Core A/9.5-10cm with AS-1/CoreB/9-10cm
Seward Peninsula,Kougarok,Alder shrubland,AS-1,B,7.62,0,9,organic,NA,NA,NA,4.85,42.22,0.349,0.488,12.292,0.03,0.76,0.01,0,0.03,

Data Acquisition Materials and Methods

Soil core collection

Cores were collected on July 25 through July 27th, 2016 at the Kougarok hillslope site on the Seward Peninsula. Two cores were collected within each of the twelve biomass plots sampled and were designated core replicates A and B. A battery-powered drill and a modified diameter hole saw was used to extract soil cores. In most plots the hole saw had a 3” diameter but in the very rocky soil at the NAMC plots we used the 2 7/8" diameter hole saw collect cores. All cores were collected down to the depth of permafrost or rock. The depth of each hole was measured after core collection. In the NAMC plots, cores were collected in vegetated areas rather than in unvegetated soil. In TTWBT and TT plots where tussock forming sedges alter microtopography,

cores were collected in tussocks. Immediately following collection, the total length of the core was checked and the depth of the organic layer was recorded. The core was then sectioned into 10-cm depth increments using either clippers (for organic soil) or a knife (mineral soil). If the organic-mineral transition occurred within a 10-cm depth increment, the sample was separated into smaller depth intervals. All samples were then designated part of the organic or mineral horizon. All soil samples were transported back to Nome in coolers and frozen for shipment to ORNL.

Core Processing

In the laboratory, soil samples were split vertically in half. One half was used for a determination of soil texture, gravimetric water content, bulk density, bulk soil %C and %N, and water extractable total nitrogen, inorganic nitrogen, phosphorus, and organic nitrogen. The remaining half of the soil core was used for determination of fine root biomass (data forthcoming), rock volume and weight, and pH of root-free soil. Details on these analyses are listed below and relevant sample processing comments can be found in the datasheet's "Notes" column.

Soil Texture

Analysis of soil texture was performed only on soils from the mineral horizons. Percentage sand, silt and clay were determined by the Buoycous hydrometer method (Gee and Or, 2002). Approximately 40 grams of dry, ground soil was mixed in a dry solid: solution ratio of 1:6 (w/w) with 50 g/L hexametaphosphate solution. Mixtures were soaked overnight and then blended for 5 minutes. Soil slurries were placed in the 1 L cylinder and filled to volume with DI water and mixed well with a plunger. Isoamyl alcohol was added to frothy samples. A hydrometer was placed in the cylinder and read at 30 seconds, 1 minute, 3 minutes, 10 minutes, 30 minutes, 60 minutes, 90 minutes, 120 minutes and 1440 minutes. Readings were temperature corrected and used to calculate particle diameter according to Stoke's Law. Sand was defined as particles greater than 53 μm, silt was defined as particles 2-53 μm, and clay was defined as particles smaller than 2 μm.

Soil pH

Soil pH was measured on root free soil during the process of removing live, fine roots for determination of fine root biomass and traits. Fresh, moist soil was mixed with DI water in a wet soil: water ratio of approximately 1:10 for organic soils and 1:5 for mineral soils (w:w). The high ratio of soil: water used for organic horizon soils was necessary due to the extremely fibrous texture and low bulk density of many of the soils. Mixtures were allowed to stand for 5 minutes prior to reading with a digital pH meter.

Gravimetric Water Content

Gravimetric water content was determined by weighing out 5g of fresh soil from each sample which was then dried at 72 °C for 48 hours. The remaining dry soil weight was used to calculate water content as a percent of dry soil weight.

Bulk Density

Bulk density was calculated using soil core volume, total fresh soil weight, and gravimetric water content determined on a subsample of the core. Calculations were corrected for the

presence of rocks and gravel over 2 mm in size (collected from subsamples processed for live fine root biomass).

Bulk soil %C and %N

Dried gravimetric water content samples were ground to a fine powder (SPEX SamplePrep 2010 Geno/Grinder, Metuchen, NJ) and carbon (C) and nitrogen (N) content by weight were measured on a Costech ECS 4010 Elemental analyzer (Valencia, CA) or a LECO TruSpec elemental analyzer (St. Joseph, MI). The majority of the samples were run on the Costech, samples run on the LECO are detailed in the "Notes" column.

Water Extracts

Subsamples of approximately 10 g of fresh soil were placed in specimen cups and 50 ml of DI water purified through a milli-Q water system was added. Samples were agitated on a shaker table for one hour. One soil-free blank was prepared for every ten soil samples extracted. After agitation, soil solutions were allowed to settle for 20 minutes and were then vacuum filtered through pre-leached Whatman GF/A filters. Filtered soil extracts were then frozen at -20 °C for storage prior to chemical analysis.

Extract Analysis

Soil extracts and blanks were thawed and analyzed for dissolved organic carbon (DOC) and various forms of dissolved nitrogen. Total nitrogen (TN) and DOC were measured on a Shimadzu TOC-L instrument with a TNM unit (Kyoto, Japan). Dissolved ammonium, nitrate and phosphorus nitrogen and phosphorus on an autoanalyzer (Lachat QuickChem QC8500 Automated Ion Analyzer, Loveland, CO). Measurements of DOC, TN, ammonium and nitrate were blank corrected. Dissolved inorganic N (DIN) was calculated as the sum of dissolved ammonium and nitrate and dissolved organic N (DON) was calculated as the difference between TN and DIN.

References

Gee, G., and Or, D. (2002). "Soil Particle Size Analysis," in *Methods of Soil Analysis: Part 4 Physical Methods*, eds. J. H. Dane and C. G. Topp (Madison, WI), 255–278.

Supplemental Files:

See associated file for more information on plot locations and environmental observations.

1. Colleen Iversen, Amy Breen, Verity Salmon, Holly Vander Stel, Stan Wullschleger. 2019. NGEE Arctic Plant Traits: Vegetation Plot Locations, Ecotypes, and Photos, Kougarok Road Mile Marker 64, Seward Peninsula, Alaska, 2016. Next Generation Ecosystem Experiments Arctic Data Collection, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee, USA. https://doi.org/10.5440/1346196.
2. Colleen Iversen, Verity Salmon, Amy Breen, Holly Vander Stel, Stan Wullschleger. 2018. NGEE Arctic Plant Traits: Soil Temperature and Moisture, Kougarok Road Mile Marker 64, Seward Peninsula, Alaska, beginning 2016. Next Generation Ecosystem Experiments Arctic Data Collection, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee, USA. https://doi.org/10.5440/1346195.

Data Center Contact:

support@ngee-arctic.ornl.gov

Data Access:

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