SPRUCE S1 Bog Areal Coverage of Hummock and Hollow Microtopography Assessed Along Three Transects in the S1 Bog

Summary

Aerial coverage of hummocks and hollows was estimated in July 2012 in ten 4 m × 4 m plots each along three 60-m transects in the S1 Bog. Hollows were defined as the lowest elevation within plots and were typically at or near the height of the water table, hummocks included area above hollows, including the sides of the hummocks. The experimental work was conducted in a *Picea mariana* [black spruce] – *Sphagnum* spp. bog forest in northern Minnesota, 40 km north of Grand Rapids, in the USDA Forest Service Marcell Experimental Forest (MEF).

The data are provided in one comma separated (*.csv) file.

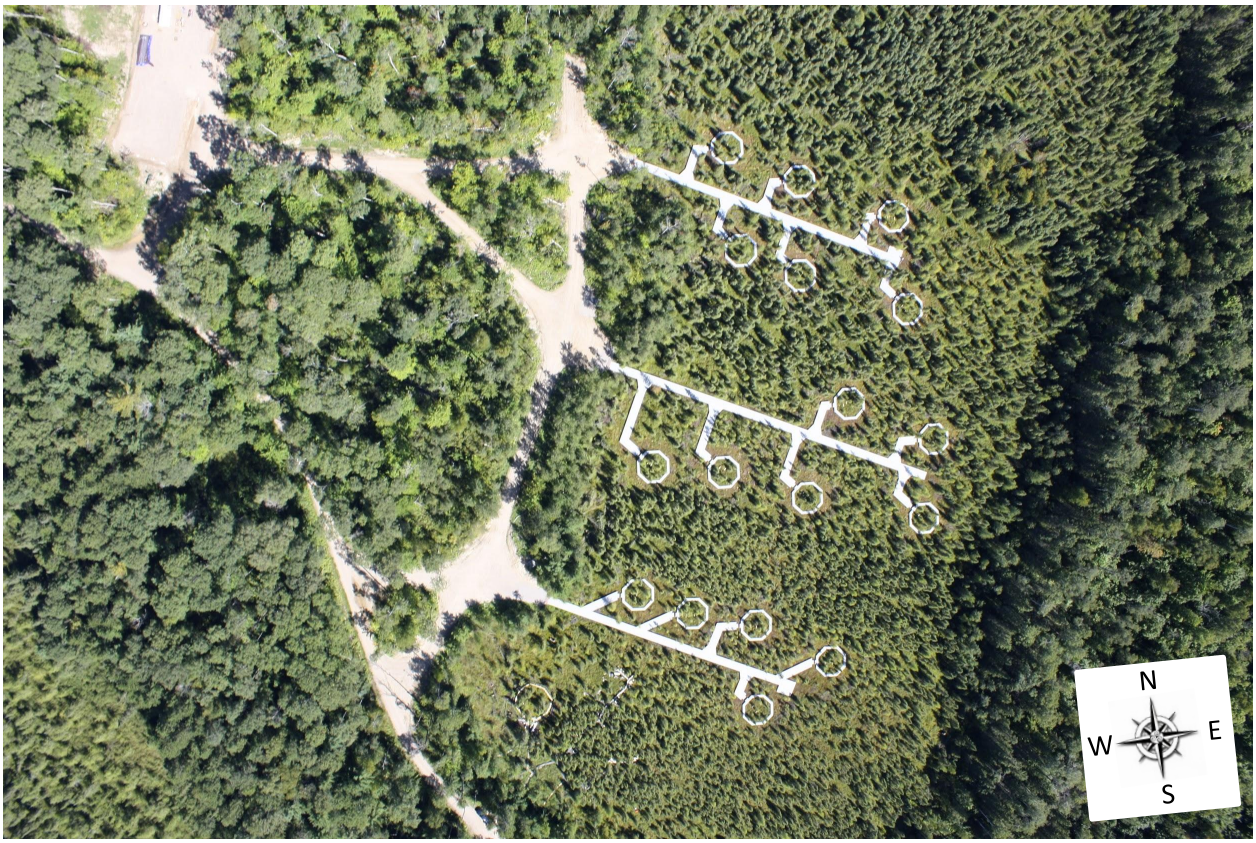

Figure 1. Location of three transects across the S1 Bog where hummock-hollow microtopography was assessed (and the future location of SPRUCE experimental plots, which are outlined here with hexagonal boardwalks). [Photo: AP_2012.08.20_S1Bog Composite.jpg (Hanson, 2015)]

Data Citation

Cite this data set as follows:

Ontl TA, Iversen CM. 2017. **SPRUCE S1 Bog Areal Coverage of Hummock and Hollow Microtopography Assessed Along Three Transects in the S1 Bog.** Oak Ridge National Laboratory, TES SFA, U.S. Department of Energy, Oak Ridge, Tennessee, U.S.A. https://dx.doi.org/10.3334/CDIAC/spruce.023.

Related publication:

Iversen CM, Childs J, Norby RJ, Ontl TA, Kolka RK, Brice DJ, McFarlane KJ, Hanson PJ. 2017. Fine-root growth in a forested bog is seasonally dynamic, but shallowly distributed in nutrient-poor peat. *Plant and Soil*, https://dx.doi.org/10.1007/s11104-017-3231-z

Data and Documentation Access

Get Data:

For public access to SPRUCE data please visit the SPRUCE Website: mnspruce.ornl.gov

Description and Links to Supplemental Information:

Marcell Experimental Forest Website: www.nrs.fs.fed.us/ef/locations/mn/marcell

SPRUCE Project Website: Project plans, reports, and publications at mnspruce.ornl.gov

SPRUCE Data Policy - Sharing, Access, and Use Recommendations: spruce-data-policies

Related Data Sets:

Iversen CM, Childs J, Norby RJ, Garrett A, Martin A, Spence J, Ontl TA, Burnham A, Latimer J. 2017. **SPRUCE S1 Bog Fine-root Production and Standing Crop Assessed With Minirhizotrons in the Southern and Northern Ends of the S1 Bog.** Oak Ridge National Laboratory, TES SFA, U.S. Department of Energy, Oak Ridge, Tennessee, U.S.A. https://dx.doi.org/10.3334/CDIAC/spruce.019.

Iversen CM, Garrett A, Martin A, Turetsky MR, Norby RJ, Childs J, Ontl TA. 2017. **SPRUCE S1 Bog Tree Basal Area and Understory Community Composition Assessed in the Southern and Northern Ends of the S1 Bog.** Oak Ridge National Laboratory, TES SFA, U.S. Department of Energy, Oak Ridge, Tennessee, U.S.A. https://dx.doi.org/10.3334/CDIAC/spruce.024.

Iversen CM, Latimer J, Burnham A, Brice DJ, Childs J, Vander Stel HM. 2017. **SPRUCE Plant-Available Nutrients Assessed with Ion-Exchange Resins in Experimental Plots, Beginning in 2013.** Oak Ridge National Laboratory, TES SFA, U.S. Department of Energy, Oak Ridge, Tennessee, U.S.A. https://dx.doi.org/10.3334/CDIAC/spruce.036.

Iversen CM, Ontl TA, Brice DJ, Childs J. 2017. **SPRUCE S1 Bog Plant-Available Nutrients Assessed with Ion-Exchange Resins from 2011-2012 in the Southern End of the S1 Bog.** Oak Ridge National Laboratory, TES SFA, U.S. Department of Energy, Oak Ridge, Tennessee, U.S.A. https://dx.doi.org/10.3334/CDIAC/spruce.022.

SPRUCE Sponsor

Research sponsored by the Office of Biological and Environmental Research within the U.S. Department of Energy's Office of Science.
The SPRUCE experiment is a multi-year cooperative interaction among scientists of the Oak Ridge National Laboratory operated by UT-Battelle, LLC and the U.S. Forest Service, Northern Research Station, Marcell Experimental Forest.

SPRUCE Project Description

SPRUCE (Spruce and Peatland Responses Under Changing Environments) is an experiment to assess the response of northern peatland ecosystems to increases in temperature and exposures to elevated atmospheric CO_2 concentrations. It is a key component of the Terrestrial Ecosystem Science Scientific Focus Area of ORNL's Climate Change Program, focused on terrestrial ecosystems and the mechanisms that underlie their responses to climatic change. The experimental work is to be conducted in a *Picea mariana* [black spruce] – *Sphagnum* spp. bog forest in northern Minnesota, 40 km north of Grand Rapids, in the USDA Forest Service Marcell Experimental Forest (MEF). The site is located at the southern margin of the boreal forest. It is an ecosystem considered especially vulnerable to climate change, and anticipated to be near its tipping point with respect to climate change. Responses to warming and interactions with increased atmospheric CO_2 concentration are anticipated to have important feedbacks on the atmosphere and climate, because of the high carbon stocks harbored by peatlands.

Experimental work in the 8.1-ha S1 bog is a climate change manipulation focusing on the combined responses to multiple levels of warming at ambient or elevated CO_2 (eCO_2) levels. The experiment provides a platform for testing mechanisms controlling the vulnerability of organisms, biogeochemical processes and ecosystems to climatic change (e.g., thresholds for organism decline or mortality, limitations to regeneration, biogeochemical limitations to productivity, the cycling and release of CO_2 and CH_4 to the atmosphere).

The manipulation will evaluate the response of the existing biological communities to a range of warming levels from +0 to +9°C, provided via large, modified open-top enclosures. All temperatures, +0 through the +9°C warming treatment, are also conducted at eCO_2 (in the range of 800 to 900 ppm). Two plots without enclosures also are maintained. Both direct and indirect

effects of these experimental perturbations will be analyzed to develop and refine models needed for full Earth system analyses.

Marcell Experimental Forest

Streamflow, weather, and well data collection began on the Marcell Experimental Forest in 1960. This 1100-ha site has six calibrated watersheds, each consisting of a mineral soil upland and organic soil peatland; an intermittent or perennial stream drains each peatland and its larger watershed. Formally established in 1962, the Marcell contains two units on land owned by the USDA Forest Service, Chippewa National Forest, State of Minnesota, Itasca County, and a private individual. Previous and ongoing research addresses the ecology and hydrology of peatland. Research concerns typical upland/wetland watersheds in the Lake States, atmospheric chemistry, nutrient cycling, soil quality, tree-stand dynamics, and a variety of watershed treatments applied to upland or bogs to investigate impacts on water yield, peak streamflow, water quality and nutrient processing.

Table of Contents

1. Data Set Overview

This data set reports the areal coverage of hummocks and hollows estimated in July 2012 along three 60-m transects.

2. Data Characteristics

The data are provided in one comma separated (*.csv) file.

Spatial Coverage

All measurements were made at the 8.1-ha S1-Bog forest site in northern Minnesota, 40 km north of Grand Rapids, in the USDA Forest Service Marcell Experimental Forest (MEF). The three transects from which data were collected were located at the southern end of the bog, outside of the SPRUCE experimental plots. These coordinates are the central location of the S1 bog.

Site boundaries: Latitude and longitude given in decimal degrees.

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Elevation (meters amsl)	Geodetic Datum
S1 Bog, Marcell Experimental Forest	-93.48283	-93.48283	47.50285	47.50285	418	WGS84

Temporal Coverage

These data were collected in July 2012.

Data File Description:

These data are considered at **Quality Level 1**. Level 1 indicates an internally consistent data product that has been subjected to quality checks and data management procedures.

Data Dictionary [*SPRUCE_S1_Bog_Hummock_and_Hollow_Areal_Distribution_2012.csv*]

Column_name	Units/format	Description
Year	**YYYY**	The year in which data were collected.
Month	**Month**	The month in which data were collected.
Transect	**Number**	Data were collected along three 60-m long transects that followed the SPRUCE experimental plot transects (Fig. 1).
Plot_Number	**Number**	There were ten plots per each of three 60-m long transects, 30 plots in total (numbered 1-10 on each of three transects).
Hummock_Percent	%	Of the ten plots surveyed in each 60-m long transect, the percentage of 100 grid points in a 4 m × 4 m area that were identified as hummock microtopography, including the sides of hummocks.
Hollow_Percent	%	Of the ten plots surveyed in each 60-m long transect, the percentage of 100 grid points in a 4 m × 4 m area that were identified as hollow microtopography, which was the lowest elevation in each plot.

Example Data Records:

```
Year,Month,Transect,Plot_Number,Hummock_Percent,Hollow_Percent,
2012,July,1,1,64,36,
2012,July,1,2,66,34,
2012,July,1,3,74,26,
2012,July,1,4,69,31,
2012,July,1,5,69,31,
2012,July,1,6,65,35,
2012,July,1,7,65,35,
```

3. Data Application and Derivation

These data were used to extrapolate observations taken from paired hummock and hollow microtopography to scale processes to a per unit ground area for the S1 bog.

4. Quality Assessment

These data are considered at **Quality Level 1**. Level 1 indicates an internally consistent data product that has been subjected to quality checks and data management procedures.

5. Data Acquisition Materials and Methods

In order to scale stratified measurements collected in different microtopographic positions, areal coverage of hummocks and hollows were estimated in July 2012.

Ten 4 m × 4 m plots were sampled along three 60-m transects (30 plots total); the three transects correspond to the transects along which the SPRUCE experimental plots were placed. The plots for sampling hummock-hollow microtopography were placed in-between the future locations of the SPRUCE experimental plots. Transect 1 is the furthest south in the S1 bog, while Transect 3 is the furthest north (Fig. 1). The center of each hummock-hollow data collection plot was located a minimum of 6-m apart. In each plot, microtopography was classified as hummock or hollow in 25 grid points sampled using a $1m^2$ point frame with adjustable-height legs placed in each quadrant of the larger plot (4 quadrants total, for a total of 100 points per plot). Hollows were defined as the lowest elevation within plots and were typically at or near the height of the water table; hummocks included area above hollows, including the sides of the hummocks.

6. References

Hanson PJ, Childs KW, Wullschleger SD, Riggs JS, Thomas WK, Todd DE, Warren JM. 2011. A method for experimental heating of intact soil profiles for application to climate change experiments. *Global Change Biology* 17: 1083–1096. https://dx.doi.org/10.1111/j.1365-2486.2010.02221.x

Hanson, P.J. 2015. SPRUCE S1 Bog and SPRUCE Experiment Aerial Photographs. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee, U.S.A. https://dx.doi.org/10.3334/CDIAC/spruce.012

Iversen CM, Childs J, Norby RJ, Ontl TA, Kolka RK, Brice DJ, McFarlane KJ, Hanson PJ. 2017. Fine-root growth in a forested bog is seasonally dynamic, but shallowly distributed in nutrient-poor peat. *Plant and Soil*, https://dx.doi.org/10.1007/s11104-017-3231-z

7. Data Access

For public access to SPRUCE data please visit the SPRUCE Web Site:
https://mnspruce.ornl.gov/

Contact for Data Access Information: https://mnspruce.ornl.gov/contact