**SPRUCE Ingrowth Peat Extracellular Enzyme Potential and Temperature Profiles for Experimental Plot Cores Beginning June 2015**

**Summary:**

This data set provides the ingrowth peat extracellular enzyme potential for Deep Peat Heating (DPH) and Whole Ecosystem Warming (WEW) for 2015-2016 from the Spruce and Peatlands Under Changing Environments (SPRUCE).

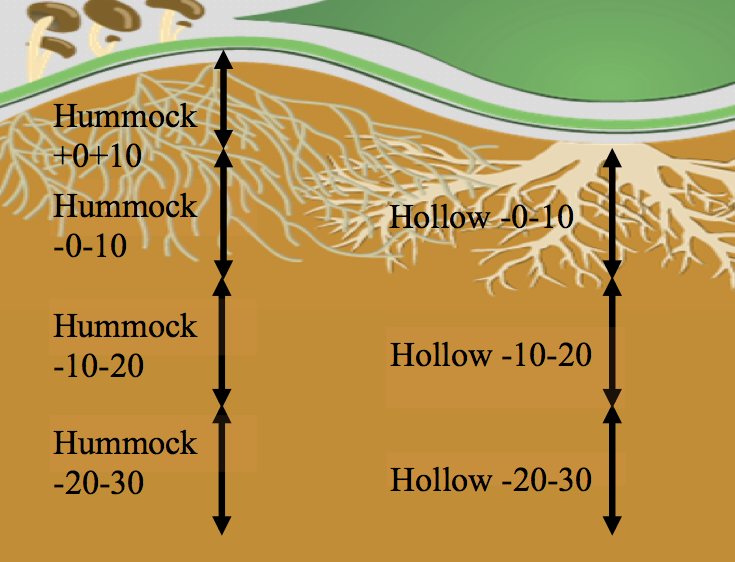
**Sampling Details:**

Samples were always collected from the following plots & treatments.

**Table 1.** Treatment temperature and CO2 concentration

|  |  |  |
| --- | --- | --- |
| Plot | Temperature Treatment | CO2 Treatment (500ppm) |
| 6 | +0 | 0 |
| 19 | +0 | +500 |
| 20 | +2.25 | 0 |
| 11 | +2.25 | +500 |
| 13 | +4.5 | 0 |
| 4 | +4.5 | +500 |
| 8 | +6.75 | 0 |
| 16 | +6.75 | +500 |
| 17 | +9 | 0 |
| 10 | +9 | +500 |
| 7 | Control | Control |
| 21 | Control | Control |

Cores are constructed with ingrowth bag, split into 10 cm increments. For hollows (Lo), samples were taken from 0-30cm below the surface. Samples taken from the hummocks (Hi) were taken from the surface of the hummock to 30 cm below the hollow surface. See image below for description.



**June 2015:** Ingrowth cores were installed on 05-31-2014. After approximately 13 months of incubation, cores were harvested from all plots. At the time of sampling, DPH had been active for 11 months.

**August 2016:** Ingrowth cores were installed on at two locations (Set A (installed 06/16/2015) and Set B (installed 05/31/2014)). Cores were harvested from all plots. At the time of sampling, DPH had been active for 25 months, and WEW had been active for 11 months.

**Table 2.** Sampling date details and treatment exposure information

|  |  |  |  |
| --- | --- | --- | --- |
| Year Sampled | Month | Months Exposed to DPH | Months Exposed to WEW |
| 2015 | June | 11 | 0 |
| 2016 | August\* | 25 | 11 |
|  |  |  |  |

\* Two datasets present for this month from two plot locations.

**SPRUCE Sponsor**

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The SPRUCE experiment is a multi-year cooperative interaction among scientists of the [Oak Ridge National Laboratory](http://www.ornl.gov/) operated by UT-Battelle, LLC and the U.S. Forest Service, [Northern Research Station](http://www.nrs.fs.fed.us/), [Marcell Experimental Forest](http://www.nrs.fs.fed.us/ef/locations/mn/marcell/).

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**1. Data Set** **Overview:**

This data set provides the extracellular enzyme potential (EE) at the time of sampling for peat ingrowth cores collected before and during the SPRUCE Deep Peat Heating (DPH) and Whole Ecosystem Warming (WEW) study. See table 2 for sampling dates.

EE potential was quantified and calculated following a protocol described by German et al 2011. Flouresence was measuring using a fluorometer (360 nm excitations and 460 nm emissions via Synergy HT or Synergy 2 Multi-Mode Microplate reader, BioTek Instruments,Inc., Winooski, VT, USA).

**2. Data** **Characteristics:**

**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). These coordinates are the central location of the S1 bog.

**Table 3.** Site boundarylatitude 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 |

**Data File Description:**

There is one archived file provided in comma separated value (\*.csv) format, encompassing data from 2015-2016. See “Data Directory” for details and information on column headers.

Peat temperatures were calculated following methods described by Gutknecht, J. et al (2017).

**2015-2016\_IngrowthPeat-EEA.csv**

**Variable Naming Conventions** – Naming conventions are described in the Data Dictionary.

**Missing values** – Missing values are represented by blank cells.

**Note** – Samples from 06/16/2015: enzyme assays were incubated at room temperature. All other samples measured at field temperature.

**Data Dictionary:**

See Data-Dictionary.txt for column header information.

**3.** **Applications and Derivation:**

To understand microbial affects on and responses to elevated temperature and CO2, DPH and WEW are applied to simulate environmental change and provide a playground to study and understand insitu responses. This data set is specifically focused on extracellular enzyme potentials to understand nutrient need.

**4. Data Acquisition, Materials, and** **Methods:**

**Site Description:**

The site is the 8.1-ha S1 bog, a *Picea mariana* [black spruce] – Sphagnum spp. ombrotrophic bog forest in northern Minnesota, 40 km north of Grand Rapids, in the USDA Forest Service Marcell Experimental Forest (MEF). The S1 bog was harvested in successive strip cuts in 1969 and 1974 and the cut areas were allowed to naturally regenerate. The 1974 strips are characterized by medium density of 3-5 meter black spruce and larch trees with an open canopy. The 1969 harvest strips are characterized by a higher density of 3-5 meter black spruce and larch trees with a generally closed canopy.

**Experimental Applications- Deep Peat Heating (DPH) and Whole Ecosystem Warming (WEW) + Elevated CO2:**

Deep Peat Heating (DPH) treatment was initiated on July 2014. This consisted of heating below ground at 2m depth to the target temperature above ambient.

Whole Ecosystem Warming (WEW) treatments were initiated in June 2015. WEW treatments were preceded by approximately one year of deep peat heating (DPH) only.

Approximately 10 months after WEW was initiated at 5 warming levels (+0, +2.25, +4.5, +6.75 and +9 °C), elevated CO2 treatments were initiated in June 2016, with treatment levels at +500 ppm above ambient.

**5.** **References:**

Hanson, P.J., Riggs, J.S., Nettles, W.R., Phillips, J.R., Krassovski, M.B., Hook, L.A., Gu, L., Richardson, A.D., Aubrecht, D.M., Ricciuto, D.M., Warren, J.M., Barbier, C., 2016. **Attaining Whole-Ecosystem Warming Using Air and Deep Soil Heating Methods with an Elevated CO2**; Atmosphere. Biogeosciences Discussions, 1-48.

Hanson, P.J., Riggs, J.S., Nettles, W.R., Krassovski, M.B., and Hook, L.A. 2015. **SPRUCE Deep Peat Heating (DPH) Environmental Data, February 2014 through July 2105**. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee, U.S.A. <http://dx.doi.org/10.3334/CDIAC/spruce.013>

Gutknecht, J., Kluber, L. A., Hanson, P.J., Schadt, C.W. 2016. **SPRUCE Whole Ecosystem Warming (WEW) Peat Water Content and Temperature Profiles for Experimental Plot Cores Beginning June 2016**. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee, U.S.A. <http://dx.doi.org/10.3334/CDIAC/spruce.041>

German, D. P., Weintraub, M. N., Grandy, A. S., Lauber, C. L., Rinkes, Z. L., & Allison, S. D. (2011). Optimization of hydrolytic and oxidative enzyme methods for ecosystem studies. *Soil Biology and Biochemistry*, *43*(7), 1387–1397. https://doi.org/10.1016/j.soilbio.2011.03.017

﻿German, D. P., Weintraub, M. N., Grandy, A. S., Lauber, C. L., Rinkes, Z. L., & Allison, S. D. (2012). Corrigendum to “Optimization of hydrolytic and oxidative enzyme methods for ecosystem studies” [Soil Biol. Biochem. 43 (2011) 1387-1397]. Soil Biology and Biochemistry. https://doi.org/10.1016/j.soilbio.2011.11.002