Comprehensive Listing of SPRUCE Project Ongoing and Planned Measurements

15 April 2015

Core task measurements are listed first ahead of collaborator activities.
Future measurements that have not yet commenced are in blue text.

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SPRUCE Core Project Measurements

SPRUCE CORE TASKS	**Environmental Measurements – Hanson et al.**					
Principal Contact:	**Paul J. Hanson; hansonpj@ornl.gov**					
Co-Investigators:	**Jeff Riggs, Robert Nettles, Steve Sebestyen (WT), Natalie Griffiths (WT), Jeff Warren (Peat WC)**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
S1-Bog Environmental Data	Paul J. Hanson	2010 to date	EM1, EM2, EM3	Various measurements (30-minute data), not all will continue indefinitely due to the addition of SPRUCE plot environmental data	Data	**Level–0** **Level–1** Level-2
SPRUCE Plot Environmental Data **Deep Peat Heating**	Paul J. Hanson	June 2014 to June 2015	Constructed plots 4 to 21	TA/RH (0.5, 1,2E,2W,4 m) TS (9 depths) TH (3 elevations) WT (plot center) WPeat (hummock,shallow) PAR (2.5 m) Rain (6m) Wind (2D above chamber)	Data	**Level–0** Level–1 Level-2
SPRUCE Plot Environmental Data **Whole-Ecosystem Warming**	Paul J. Hanson	June 2015 into the future	Constructed plots 4 to 21	TA/RH (0.5, 1,2E,2W,4 m) TS (9 depths) TH (3 elevations) WT (plot center) WPeat (hummock,shallow) PAR (2.5 m) Rain (6m) Wind (2D above chamber)	Data	Planned
*Abbreviations: (TA is air temperature, RH is relative humidity, TS is soil temperature, TH is hummock temperature, WT is water table, WPeat is water content of peat, PAR is photosynthetically active radiation, Rain is rainfall, Wind is windspeed.						

SPRUCE CORE TASKS	Photographic Records – Hanson et al.					
Principal Contact:	**Paul J. Hanson; hansonpj@ornl.gov**					
Co-Investigators:	**Jeff Riggs, Robert Nettles, Les Hook, Todd Ontl**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Phenology Photographs	Les Hook	2011 to date	EM Site	Tree view – 9AM and 12PM Shrub view – 9AM and 12 PM Instrument view – 12 PM	Photos	**Level–0** **Level–1** Level-2
Phenology Movies	Paul J. Hanson	2010 to date	EM Site	Tree view – 9AM and 12PM Shrub view – 9AM and 12 PM Instrument view – 12 PM	Compiled Movies	**Level–0** **Level–1** Level-2
Aerial Photographs	Paul J. Hanson	Periodic since 2009	S1-Bog and SPRUCE site, Some other Marcell Forest Locations	Downward looking images and side looking Public Relations photos	Photos	**Level–0** Level–1 Level-2

SPRUCE CORE TASKS	Ecosystem Carbon Cycle and Vascular Plant Growth Observations – Hanson et al.					
Principal Contact:	**Paul J. Hanson; hansonpj@ornl.gov**					
Co-Investigators:	**Jana Phillips, Deanne Brice, Les Hook, Colleen Iversen, Rich Norby and other SPRUCE Project Staff**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
S1-Bog Survey	Paul J. Hanson	Sep 2009	20 x 20 m grid across the S1-Bog	Peat Depths, Tree diameters, shrub cover	Data Only	**Level–0** **Level–1** **Level-2**
Tree Allometric data	Paul J. Hanson	Summers of 2010 & 2011	Trees sampled from the south end of the S1-Bog	Tree DBH and various tree dimensional measurements including mass	Data Only	**Level–0** **Level–1** Level-2
Shrub Allometric Data	Paul J. Hanson	Summers of 2010 &2011	Shrubs sampled from the S1-Bog	Various dimensional measurements and	Data Only	**Level–0** **Level–1** Level-2
Tree Growth	Paul J. Hanson	Feb/Mar Annually	Plots 1 to 28	DBH, Height in some years	Data Only	**Level–0** Level–1 Level-2
0.25 m^2 NPP PLots	Paul J. Hanson	Early August Annually	All constructed boardwalk plots	Shrub and forb	Tissues from some years	**Level–0** Level–1 Level-2
Peat Elevations	Paul J. Hanson	2x annually May - Aug	2 locations within all constructed boardwalk plots	Multiple microtransects of peat surface elevations from two permanent stands.	Data only	**Level–0** **Level–1** **Level-2**
Net CO_2 x CH_4 Flux	Paul J. Hanson	Nominally monthly since 2011, less in winter	2011 & 2012 – x2 2013 & 2014 – x16	Large collar CO_2, CH_4 flux under light and dark daytime conditions; Also initial H_2O flux in the light	No	**Level–0** **Level–1** Level-2

Peat Sampling	Paul J. Hanson	August 2012	All constructed plots 4 to 21	Peat cores by depth analyzed for a wide range of characteristics including C, N, bulk density, elements, etc. (see archive) Add DOI?	Data and sample archive	**Level–0** **Level–1** Level-2
Peat ^{14}C and ^{13}C	Karis J. McFarlane	August 2012	All constructed plots 4 to 21	Peat cores by depth analyzed for 14C, 13C, and calibrated peat age	Data and ??	**Level–0** **Level–1** Level-2
Peat ^{15}N and ^{13}C and C and N	Erik Hobbie	August 2012	All constructed plots 4 to 21	Peat cores by depth analyzed for ^{15}N, ^{13}C, C and N. C-N ratio calculated.	Data and ??	**Level–0** **Level–1** Level-2
Plot Vegetation Sampling	Paul J. Hanson	August 2012, Summer 2013	All constructed plots 4 to 21	Current and older foliage for key plant species and *Sphagnum* mosses (2013)	??	**Level–0** Level–1 Level-2
Auto-dendrometer Bands	Paul J. Hanson	Starting in 2015	SPRUCE Plots 4, 6, 7, 8, 10, 11, 16, 17, 19, 20, 21	Automated dendrometer Bands 2 perhaps 3 trees per plot	Data	Planned

SPRUCE CORE TASKS	**SPRUCE Multi-Scale Mass and Energy Fluxes – Gu**					
Principal Contact:	**Lianhong Gu; Lianhong-gu@ornl.gov**					
Co-Investigators:						
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Shrub-level EC	Lianhong Gu	Future	Untreated location	Half-hourly, long-term	Data	Planned
Plot-level Flux	Lianhong Gu	Future	Treated/Untreated	Exploratory	Data	Planned
Intact *Picea* Peatland EC	Lianhong Gu	Future	Untreated location	Half-hourly, long-term	Data	Planned
Sun-induced fluorescence	Lianhong Gu	Future	Treated/Untreated	Exploratory to long-term	Data	Planned

SPRUCE CORE TASKS	**Plant Community Dynamics in Response to Warming and CO_2 - Palik**					
Principal Contact:	**Brian Palik; bpalik@fs.fed.us**					
Co-Investigators:	**Rebecca Montgomery, University of Minnesota**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Ground layer plant community monitoring	Brian Palik	June and August 2014	Three 1 × 2 m plots within each SPRUCE chamber footprint, both treated and controls	presence/absence within 50 quadrats within each 1 × 2 m plot	Data	**Level–0** Level–1 Level-2
Seed dispersion into the SPRUCE study site	Brian Palik	2013, 2014	Seed traps located adjacent to most chamber footprints	Seed	Stored dried in, Grand Rapids	**Level–0** Level–1 Level-2
PAR relationship to shrub cover	Brian Palik	2013	Selected plots outside of chamber footprints	PAR at ground level under varying levels of shrub cover within plots	Data	**Level–0** Level–1 Level-2
Preliminary ground layer plant community monitoring	Brian Palik	Summer 2012-13	1 m^2 plots located adjacent to chamber footprints	Plant cover estimates	Data	**Level–0** Level–1 Level-2
Ground Layer plant community monitoring	Brian Palik	June and August each year of study	Three 1 × 2 m plots within each SPRUCE chamber footprint, both treated and controls	presence/absence within 50 quadrats within each 1 × 2 m plot	Data	Planned
Seed dispersion into the SPRUCE study site	Brian Palik	Each year of study	One seed trap within each 1 × 2 m vegetation plot	seed	Data and physical samples	Planned

SPRUCE CORE TASKS	Root and rhizosphere dynamics – Iversen et al.					
Principal Contact:	**Colleen M. Iversen; iversencm@ornl.gov**					
Co-Investigators:	**Joanne Childs, Rich Norby, Todd Ontl, Randy Kolka, Deanne Brice, Karis McFarlane, Paul Hanson**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Root standing crop, production, phenology, mortality (trees and shrubs, hummocks and hollows to ~-80 cm depth)	Colleen Iversen	July, 2010 to September, 2012	Sound end of S1 bog (*n* = 12, six locations with hummock-hollow in each location) and north end of S1 bog near FS well (*n* = 12, six locations with hummock-hollow in each location)	Minirhizotrons	Images	**Level–0** Level–1 Level-2
Spruce tree basal area increment	Colleen Iversen	May, 2011 to October, 2011	North end of S1 bog near FS well (*n* = 8 trees)	Automated dendrobands	Data	**Level–0** Level–1 Level-2
Spruce tree basal area increment	Colleen Iversen	May, 2012 to September, 2012	North end of S1 bog near FS well (separate set of trees, *n* = 8 trees)	Manual dendrobands	Data	**Level–0** Level–1 Level-2
Root morphology, C/N	Colleen Iversen	May, 2011	South end of bog	Voucher specimens	Ground roots	**Level–0** Level–1 Level-2
New root morphology, C/N, depth distribution (spruce, larch, shrubs, hummocks to -10 cm and hollows to -30 cm)	Colleen Iversen	June, 2013 to June, 2014 (summer, winter)	South end of S1 bog (*n* = 12, six locations with hummock-hollow in each location, adjacent to minirhizotrons)	Ingrowth cores	Ground roots	**Level–0** Level–1 Level-2

Plant-available NH_4+, NO_3-, PO_4- with soil depth (hummocks and hollows)	Colleen Iversen	May, 2011 to July, 2012 (bi-weekly collection)	Sound end of S1 bog (*n* = 9 access tubes, three at -10 cm, three at -30 cm, three at -60 cm)	Ion-exchange resins	Data	**Level–0** Level–1 Level-2
Root standing crop, production, phenology, mortality (trees and shrubs, hummocks and hollows ~-80 cm depth)	Colleen Iversen	October, 2012 to current	SPRUCE experimental plots (*n* = 4 per plot, two locations with hummock-hollow in each location) Plots 4, 6, 7, 8, 10, 11, 13, 16, 17, 19, 20, 21	Minirhizotrons	Images	**Level–0** Level–1 Level-2
Root and hyphal standing crop, production, phenology, mortality (trees and shrubs, hummocks only to ~-50 cm depth)	Colleen Iversen	October, 2012 to current	SPRUCE experimental plots (*n* = 1 per plot in a hummock) Plots 4, 6, 7, 8, 10, 11, 13, 16, 17, 19, 20, 21	Automated minirhizotrons	Images	**Level–0** Level–1 Level-2
New root morphology, C/N, depth distribution (spruce, larch, shrubs, hummocks to -10 cm and hollows to -30 cm)	Colleen Iversen	June, 2014 to current (summer, winter)	SPRUCE experimental plots (*n* = 4 tubes per plot, 2 tubes in two locations in hummock-hollow) Plots 4, 6, 7, 8, 10, 11, 13, 16, 17, 19, 20, 21	Ingrowth cores	Ground roots	**Level–0** Level–1 Level-2
Root morphology, standing stock, depth distribution, C/N, 14C (spruce, larch, shrubs, hummocks and hollows)	Colleen Iversen	August, 2012	All SPRUCE plots with boardwalks (*n* = 16, hummock-hollow, treed, non-treed for transect 1) Plots 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 19, 20, 21	Biomass cores	Ground roots	**Level–0** Level–1 Level-2

Plant-available NH_4+, NO_3-, PO_4- with soil depth (hummocks and hollows)	Colleen Iversen	June, 2013 to current (monthly collection)	SPRUCE experimental plots (*n* = 12 tubes per plot, two locations with 6 tubes distributed across hummock-hollow surface) Plots 4, 6, 7, 8, 10, 11, 13, 16, 17, 19, 20, 21	Ion-exchange resins	Data	**Level–0** Level–1 Level-2

SPRUCE CORE TASKS	Woody Plant Physiology and Water Relations – Warren et al.					
Principal Contact:	Jeffrey M Warren; warrenjm@ornl.gov					
Co-Investigators:	Anna Jensen, Stan Wullschleger; Joanne Childs; Deanne Brice; other SPRUCE Project Staff					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Picea mariana (spruce) Gas exchange, C:N, LMA	Jeffrey Warren	May-Oct 2010-2014	Across S1 bog	Amax, gs, Jmax, Vcmax, Rd, N and LMA for Spruce foliage – mainly 1st, 2nd cohorts T, CO_2, Light response curves seasonally	Yes, dry leaf and data	**Level–0** Level–1 Level-2
Larix laricina (larch,tamarack) Gas exchange, C:N, LMA	Jeffrey Warren	May-Oct 2010-2014	Across S1 bog	Amax, gs, Jmax, Vcmax, Rd, N and LMA for Larch foliage – mainly 1st cohort T, CO_2, Light response curves seasonally	Yes, dry leaf and data	**Level–0** Level–1 Level-2
Shrub Species Gas exchange, C:N, LMA	Jeffrey Warren	May-Oct 2010-2014	Across S1 bog	Amax, gs, Jmax, Vcmax, Rd, N and LMA for Chamaedaphne and Ledum foliage T, CO_2, Light response curves seasonally	Yes, dry leaf and data	**Level–0** Level–1 Level-2
Other vascular species Gas exchange, C:N, LMA	Jeffrey Warren	May-Oct 2010-2014	Across S1 bog	*Limited* Amax, gs, Jmax, Vcmax, Rd, N and LMA for other vascular species seasonally	Yes, dry leaf and data	**Level–0** Level–1 Level-2
Gas exchange	Jeffrey Warren	May-Oct 2010-2014	Across S1 bog	*Limited* (all species) twig respiration	Data only	**Level–0** Level–1 Level-2

Leaf water potential	Jeffrey Warren	May-Oct 2010-2014	Across S1 bog	Predawn, midday and diurnal measurements for all vascular species (limited for lily)	Data only	**Level–0** Level–1 Level-2
Non-structural carbohydrates	Jeffrey Warren	Seasonal 2013-2014	Along each Transect	Root, branch, foliage spruce, larch and shrubs	Yes, dry tissue, data	**Level–0** Level–1 Level-2
Sap flow	Jeffrey Warren	Seasonal 2010-2014	S End near EM1	Sap flux density for spruce and larch	Data only	**Level–0** Level–1 Level-2
Pressure Volume curves, leaf hydraulic conductivity	Jeffrey Warren	July,Sept 2011-2013	Across S1 bog	Spruce and larch pressure-volume curves and Kleaf	Data only	**Level–0** Level–1 Level-2
Root PLC	Jeffrey Warren	2011-2013	S End near EM1	*Limited* data from spruce and larch roots – sapflow calibration trees	Data only	**Level–0** Level–1 Level-2
Sapwood depth	Jeffrey Warren	2010-2014	Across S1 bog	Spruce and Larch stems @ ~1m	Data only	**Level–0** Level–1 Level-2
Tree sap flow	Jeffrey Warren	Varies - Annually or every 2 years	0-6 sensors per treatment plot	Sap flux density in larch or spruce (> 5 cm dbh)	Data only	Planned
Leaf water potential	Jeffrey Warren	Seasonal annually	From all treatment plots	Predawn, midday and diurnal measurements for all vascular species	Data only	Planned
Non-structural carbohydrates, leaf water potential, physiology, anatomy, conductivity	Jeffrey Warren	During extreme weather events	From targeted treatment plots	Varies - Branch and foliage from spruce, larch and shrubs	Planned	Planned
Foliar morphology	Jeffrey Warren	Seasonal annually	From all treatment plots	Branch foliage leaf mass per unit area (LMA), C:N, anatomy	Planned	Planned

Foliar phenolics	Jeffrey Warren	Seasonal Annually	From all treatment plots	Varies - foliage tissue from spruce, larch and shrubs	Planned	Planned
Branch PLC/anatomy	Jeffrey Warren	Periodically	From all treatment plots	Xylem vulnerability to embolism curves hydraulic anatomy of spruce, larch and shrubs	Planned	Planned
Soil water content	Jeffrey Warren	Automated	3 pairs of sensors per treatment plot	Hummock volumetric soil water content from bottom of hummock and mid hummock	Planned	Planned

SPRUCE CORE TASKS	**Sphagnum Growth and N Cycling – Norby et al.**					
Principal Contact:	**Richard J. Norby; norbyrj@ornl.gov**					
Co-Investigators:	**Joanne Childs, David Weston**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Sphagnum mosses growth	Rich Norby	May and October Annually	All constructed plots: 4, 6, 8, 10, 11, 13, 16, 17, 19, 20	Brush wire and bundle methods	Data	**Level–0** Level–1 Level-2
Sphagnum community assessment	Rich Norby	Annual in October	Community Assessments within permanent plots: 4, 6, 8, 10, 11, 13, 16, 17, 19, 20	??	Data	**Level–0** Level–1 Level-2
Sphagnum N Fixation	Rich Norby		Off plot measurements until a viable assessment method is established	In development	---	---

SPRUCE CORE TASKS	***Sphagnum*** **Physiology and Water Relations – Weston et al.**					
Principal Contact:	**David J. Weston; westondj@ornl.gov**					
Co-Investigators:	**Jeff Warren and other??? SPRUCE Project Staff**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
In vitro physiology assessments	Dave Weston	All year	lab	A-Ca Response; Temperature Response, tissue water content response, N response	Data	**Level–0** Level–1 Level-2
In situ Sphagnum moss community CO_2 Flux	Dave Weston	April - November	LiCor 8100 observations adjacent to Plot 14	CO_2 flux	Data	**Level–0** Level–1 Level-2
Sphagnum moss water content	Dave Weston	April - November	LiCor 8100 observations adjacent to Plot 14	Echo probes, tissue water content	Data	**Level–0** Level–1 Level-2
In vitro Sphagnum – microbiome constructed communities	Dave Weston	All year	lab	Growth, photosynthesis, N fixation rates	Data	**Level–0** Level–1 Level-2
Sphagnum monolith water retention curves	Jeffrey Warren	Periodic	Samples collected along all transects and processed at ORNL or at Decagon	Mid-sample water content vs. 10HS signal vs. surface *Sphagnum* water content/ water potential	Data	**Level–0** Level–1 Level-2
In situ Sphagnum moss community CO_2 Flux	Dave Weston	April - November	LiCor 8100 observations in selected plots	CO_2 flux	Data	**Planned**

SPRUCE Core TASKS	**Microbial Community Composition and Enzyme Activity – Schadt et al.**					
Principal Contact:	**Christopher W. Schadt; schadtcw@ornl.gov**					
Co-Investigators:	**Meg Steinweg, Laurel Kluber**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Microbial Community Assessments (pre treatment)	Schadt	Seasonally in 2010 - 12	EM1&2 Area Transects 1, 2, & 3	Frozen Peat (-20C) DNA samples (-20C) QPCR data (rRNA for archaea/bacteria/fungi, as well as mcrA for methanogens)	Yes	**Level–0** Level–1 Level-2
Microbial Community enzyme activity (pretreatment)	Schadt	Seasonally in 2010 - 12	EM1&2 Area Transects 1, 2, & 3	Frozen Peat (-20C) Carbon and Nitrogen Cycle panel of 8 enzyme activity measures	Yes	**Level–0** Level–1 Level-2
Microbial Community Assessments (DPH)	Schadt	June and August 2014	Heated and Control Plots	Frozen Peat (-20C & -80C) DNA samples (-20C) QPCR data including rRNA for Archaea/Bacteria/Fungi, as well as mcrA for methanogens	Yes	**Level–0** Level–1 Level-2
Microbial Community Assessments (DPH)	Schadt	Biweekly, June – Oct 2014	Heated and Control Plots	Frozen Porewater (-20C) (Were going to use for QPCR/rRNA-gene seq, however DNA yields not good)	Yes	**Level–0** Level–1 Level-2

Microbial Community Assessments (DPH)	Schadt	June and August 2014	Heated and Control Plots	Frozen Peat (-80C) DNA samples 16S rRNA-gene (Archaeal/Bacterial) and ITS (Fungal) community sequencing analyses with JGI	Yes	**Level–0** Level–1 Level-2
Microbial Metagenome Assessments (DPH)	Schadt	August 2014 (4 depths)	Heated and Control Plots	Frozen Peat (-80C) DNA samples 16S rRNA-gene (Archaeal/Bacterial) and ITS (Fungal) community sequencing analyses with JGI	Yes	**Level–0** Level–1 Level-2
Incubations	???	???	???	???	???	???

SPRUCE Core TASKS	Litter Decomposition – Griffiths and Kolka					
Principal Contact:	**Natalie Griffiths; griffithsna@ornl.gov; Randy Kolka, rkolka@fs.fed.gov**					
Co-Investigators:	**Colleen Iversen, Cassandra Ott (moss decomp), Scott Tiegs (cotton-strip decomp)**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Moss decomposition experiment	N. A. Griffiths	2014 – 2017	South end of S1 and Bog Lake Fen	Moss decomposition (*Sphagnum* sp., *Polytrichum*) in hummocks, hollows, lawns. Litterbags at 0, 1, 3 years. Analyses: mass loss, C, N, P.	Data	**Level–0** Level–1 Level-2
Main decomposition experiment	N. A. Griffiths	2015 – 2025	10 expt plots	Decomposition of spruce needles and fine roots, Labrador tea leaves and fine roots, and *Sphagnum magellanicum* and *Sphagnum angustifolium* in hummocks and hollows. Litterbags at 0, 0.5, 1, 2, 5, 10 years. Analyses: mass loss, C, N, P, lignin.	Data	**Level–0** Level–1 Level-2
Cotton-strip decomposition experiment	N. A. Griffiths	2015 – 2025	10 expt plots	Decomposition of 1-m long cotton strip (divided into 10-cm segments for depth-specific decomposition analysis). Yearly deployments to analyze inter-annual variability. 3 replicates per chamber per year. Tensile loss analysis.	Data	**Level–0** Level–1 Level-2

Sphagnum/litter mix decomposition experiment	N. A. Griffiths	2016– 2025	10 expt plots	Decomposition of mixes of *Sphagnum* with spruce needles or Lab tea leaves. Litterbag retrievals at 0, 1, 2, 5 years. Analysis includes mass loss, C, N, P, lignin.	Data	**Level–0** Level–1 Level-2
Decomposition of aboveground litter from elevated CO_2 vs ambient CO_2 plots	N. A. Griffiths	~2018 – 2025	10 expt plots	Compare decomposition of aboveground leaf litter grown in elevated CO_2 plots to litter from ambient plots. Litterbag retrievals at 0, 1, 2, 5 years. Analysis includes mass loss, C, N, P, lignin.	Data	**Level–0** Level–1 Level-2

SPRUCE Core TASKS	Hydrology and PoreWater Biogeochemistry – Griffiths and Sebestyen					
Principal Contact:	**Natalie Griffiths (griffithsna@ornl.gov), Steve Sebestyen (ssebestyen@fs.fed.us)**					
Co-Investigators:	**Kieth Oleheiser (keithcoleheiser.fs.fed.us)**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
SPRUCE depth-specific porewater chemistry		2013 – present	S1 plots	Unfiltered water sample from 1 nest of depth-specific piezometers per plot. Sampling was weekly/biweekly in 2013 and biweekly (10 expt chambers) or monthly (other plots) in 2014. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes. Samples – Yes but will be discarded	**Level–0** Level–1 Level-2
S1 depth-specific porewater chemistry (Test 1-6 piezometers)		2011 – present	South end of S1 (near EM1)	Unfiltered water sample from one nest of depth-specific samplers Test 1-6 (0 – 3 m depth) and EM1 (0 m) sampled weekly or monthly. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes. Samples – Yes but will be discarded soon	**Level–0** Level–1 Level-2

S1 depth-specific porewater chemistry (other south end piezometers)		2011 – 2013	South end of S1 (near EM1)	Unfiltered water sample from a variety of depth-specific samplers (Test 7-10, 29-34, Test 36-41) 0 – 3 m depth) sampled periodically. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes. Samples – Yes but will be discarded	**Level–0** Level–1 Level-2
S1 surface porewater samplers lagg to bog		2011 – 2013	South end of S1 (near EM1)	Unfiltered water sample from near surface (0 m) porewater samplers (N13-27) sampled ~monthly. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes. Samples – Yes but will be discarded	**Level–0** Level–1 Level-2
S1 outlet chemistry		2011 – present (historical data, some back to the 1980s available from USFS)	S1 outlet stream	Unfiltered water sample from the S1 outlet stream (~weekly unless not flowing). Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes. Samples – Yes but will be discarded	**Level–0** Level–1 Level-2
S1 groundwater chemistry		2013 – present	S1 uplands	Unfiltered water sample from each well (DW101, 102, 105, 106) ~monthly. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes. Samples – Yes but will be discarded	**Level–0** Level–1 Level-2

S1 precipitation chemistry		2013 – present	S1	Unfiltered water sample collected from each of 3 collectors (one per boardwalk) on an event basis. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes. Samples – Yes but will be discarded	**Level–0** Level–1 Level-2
S2 precipitation chemistry		2011 – present	S2 MET station	Unfiltered water sample collected from one collector at the S2 MET station on an event basis. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes.	Forest Service data, but can be made available through Steve.
S2 groundwater chemistry		2009 – present	S2 uplands	Unfiltered water sample from one well (DW202) sampled every 2 weeks. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes.	Forest Service data, but can be made available through Steve.
S1/S2/Bog Lake comparison		2014	S1, S2, Bog Lake	Unfiltered water sample from 3 nests of depth-specific samplers per peatland sampled monthly. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes. Samples – Yes but will be discarded	**Level–0** Level–1 Level-2
DOM degradation		2011 – present	S1	DOM degradation experiments are done periodically. Unfiltered or filtered water samples are collected from piezometers of interest, placed into amber glass vials, and stored (capped) on the benchtop for up to 1 year with periodic analysis for TOC.	Data – Yes.	**Level–0** Level–1 Level-2

Piezometer hydraulic head		2011 – present	All locations	Depth to water and distance from bog surface to top of piezometer. Measured each time a water sample is collected for chemistry.	Data – Yes.	**Level–0** Level–1 Level-2
Test corral outflow		2012 – present	S1 SPRUCE test corral	Water height in the test corral reservoir. Measured every 4 hr when no or slow infilling rate or every 30 sec when the water level changed by 50 or more mm. Data will likely be released in summary form, whether weekly, monthly, or event-based.	Data – Yes.	**Level–0** Level–1 Level-2
SPRUCE depth-specific porewater chemistry		2015 – 2025	S1 expt treatment + ambient plots 7 & 21	Unfiltered water sample from 1 nest of depth-specific piezometers per plot. Biweekly sampling for 10 expt plots and monthly for 2 ambient plots. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes.	Planned
SPRUCE depth-specific porewater chemistry		2015 – 2025	S1 ambient plots	Unfiltered water sample from 1 nest of depth-specific piezometers per ambient plot (2, 5, 9, 14, 15). Sample 3x per year. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes.	Planned
SPRUCE outflow chemistry		2015 – 2025	S1 expt plots	Unfiltered water sample from each autosampler. Sampling every week or on an event basis. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes.	Planned

S1 depth-specific porewater chemistry (Test 1-6 piezometers)		2015 – 2025	South end of S1 (near EM1)	Unfiltered water sample from one nest of depth-specific samplers Test 1-6 (0 – 3 m depth) and EM1 (0 m) monthly. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes.	Planned
S1 outlet chemistry		2015 – 2025	S1 outlet stream	Unfiltered water sample from the S1 outlet stream (~weekly unless not flowing). Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes.	Planned
S1 groundwater chemistry		2015 – 2025	S1 uplands	Unfiltered water sample from each well (DW101, 102, 105, 106) ~monthly. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes.	Planned
S1 precipitation chemistry		2015 – 2025	S1	Unfiltered water sample collected from each of 3 collectors (one per boardwalk) on an event basis. Analyzed for pH, ANC, specific conductivity, TOC, nutrients (nitrate, ammonium, ortho-phosphate, TN, TP), cations, anions, TOC, water isotopes.	Data – Yes.	Planned
DOM degradation		2015 – 2025	S1	DOM degradation experiments will be done periodically. Unfiltered or filtered water samples are collected from piezometers of interest, placed into amber glass vials, and stored (capped) on the benchtop for up to 1 year with periodic analysis for TOC.	Data – Yes.	Planned

Piezometer hydraulic head		2015 – 2025	S1	Depth to water and distance from bog surface to top of piezometer. Measured each time a water sample is collected for chemistry.	Data – Yes.	Planned
Well water level		2015 – 2025	S1 expt plots	Depth to water and distance from bog surface to top of well. Measured every 2 weeks as a manual measurement to compare to logged water level data.	Data – Yes.	Planned
SPRUCE outflow		2015 – 2025	S1 expt plots and test corral	Water outflow from each experimental plot. Measured every 4 hr when no or slow infilling rate or every 30 sec when the water level changes by 50 or more mm.	Data – Yes.	Planned
Snow and ice depth		Planned	S1	Occasional measurement of snow and ice depth in S1 and snow water equivalents during winter	Data – Yes.	Planned
Throughfall		Planned	S1 expt plots	Throughfall volume and chemistry under different canopy types in the experimental plots.	Data – Yes.	Planned
Water level in piezometers via sensors		Planned	S1 expt plots and test corral	Sampling frequency and durations to be determined. In the expt plots, measurements will be occasional, though likely repeated seasonally or annually. The data will be used to calculate saturated hydraulic conductivities with depth in the plots.	Data – Yes.	Planned
Ammonium isotopes		Planned	S1 expt plots	Natural abundance ammonium isotopes in porewater from deep porewater samplers (2-3m).	Data – Yes.	Planned

SPRUCE Collaborator Data Sets

Projects listed in the order in which they joined the SPRUCE effort.
Subsequent data summaries are in that same order.

List of Collaborator Projects

Order	Principal Investigator	Project Title	Primary institution	Other Investigators and Institutions	Funding Source	Funded Project Duration	Postdocs, students	Summary of Meas. & Obs. Provided
1	Joel E. Kostka	The response of soil carbon storage and microbially mediated carbon turnover to simulated climatic disturbance in a northern peatland forest: revisiting the concept of soil organic matter recalcitrance.	Georgia Institute of Technology	Jeff Chanton, Florida State University	US DOE BER	2012-2013	Georgia Tech students: Patrick Chanton, Kait Esson, Melissa Warren; Georgia Tech postdoc: Xueju Lin; FSU postdoc: Malak Tfaily; ORNL postdoc: Meg Steinweg	Yes
2	Scott D. Bridgham	Understanding the mechanisms underlying heterotrophic CO_2 and CH_4 fluxes in a peatland with deep soil warming and atmospheric CO_2 enrichment	University of Oregon	Jason Keller, Chapman University	US DOE BER	2013-2015 (will ask for extension)	Laurel Pfeifer-Meister, Cassandra, Medvedeff, Anya Hopple	Yes
3	Brandy Toner	Mercury and sulfur dynamics in the spruce experiment	University of Minnesota	Ed Nater (University of Minnesota) in collaboration with Randall Kolka and Stephen Sebestyen (USDA Forest Service)	USDA Forest Service	2012-2016	Olha Furman	Yes
4	Andrew D. Richardson	Improving models to predict phenological responses to global change.	Harvard University	Morgan Furze NSC Work	US DOE BER	2013-2015	Miriam Johnston (PhD student, Harvard University); Donald Aubrecht (Postdoc, Harvard University)	Yes

5	Bruce McCune	Lichen community responses to warming.	Oregon State University	Sarah Jovan, USDA Forest Service; Peter R. Nelson, Univ of Maine Fort Kent.	USFS-FHM	2013-2017	Robert J. Smith, OSU	Yes
6	Erik Lilleskov	Fungal, bacterial, and archaeal communities mediating C cycling and trace gas flux in peatland ecosystems subject to climate change.	USDA Forest Service	???	Joint Genome Institute Support	2013-	???	???
7	Joel E. Kostka	Toward a predictive understanding of the response of belowground microbial carbon turnover to climate change drivers in a boreal peatland.	Georgia Institute of Technology	Jeff Chanton & William T. Cooper, Florida State University	US DOE BER	2014-2017	Georgia Tech students: Melissa Warren; Georgia Tech postdoc: Max Kolton; FSU postdoc: Rachel Wilson	Yes
8	Kirsten Hofmockel	Can microbial ecology inform ecosystem level c-n cycling response to climate change?	Iowa State University	Erik Hobbie, University of New Hampshire	US DOE BER	2014-	Fan Yang (Post-doc)	Yes
9	Carl Mitchell	Peatland Mercury Cycling in a Changing Climate: A Large-Scale Field Manipulation Study	University of Toronto Scarborough	Randy Kolka, USFS	University of Toronto, NSERC	2013-2015	Kristine Haynes, PhD Candidate	Yes
10	Adrian Finzi	Effects of experimental warming & elevated CO_2 on trace gas emissions from a northern Minnesota black spruce peatland: measurement and modeling.	Boston University	N/A [single investigator award]	US DOE BER	2014-2017	Allison Gill (PhD Student)	Mostly Planned
11	Karis McFarlane	Functioning of wetlands as a source of atmospheric methane: a multi-scale and multi-disciplinary approach.	LLNL-CAMS	Xavier Mayali, Mike Singleton, Ate Visser, Jennifer Pett-Ridge, Brad Esser, Tom Guilderson	LLNL LDRD	2014-	Gavin McNicol Mary Whelan	Yes

12	Brian Hill	Using microbial enzyme decomposition models to study the effects of peat warming and/or CO_2 enrichment on peatland decomposition.	US EPA, Duluth	Colleen M. Elonen, Terri M. Jicha, Mary F. Moffett US Environmental Protection Agency	US EPA	2014-		Yes
13	Joel E. Kostka	The role of the Sphagnum microbiome in carbon and nutrient cycling in peatlands - JGI's Community Science Program.	Georgia Institute of Technology	Gen Glass, Georgia Institute of Technology, David Weston Oak Ridge National Laboratory, Erik Lilleskov USDA Forest Service – Houghton, MI, Jon Shaw Duke University, and Susannah Tringe	Joint Genome Institute	2015-2017	Georgia Tech postdoc: Max Kolton	Yes?
14	Zoë Lindo	Soil fauna biodiversity sampling at SPRUCE	University of Western Ontario		?????	2015-		Planned
15	Michael J. Falkowski	Monitoring warming and elevated CO_2 induced changes in photosynthetic efficiency via canopy spectral reflectance.	University of Minnesota	Evan Kane Michigan Technological University, Brian Benscoter Florida Atlantic University, & Randy Kolka US Forest Service	????	2015-		Planned
16	Jonathan Schilling	Wood decomposition rates and functional types in a shifting climate	University of Minnesota	Jason Oliver, University of Minnesota, Randy Kolka, United States Forest Service	????	2015-		Planned

17	Jessica Gutknecht	Microbial growth and carbon and nutrient use partitioning under peatland warming and elevated CO_2.	University of Minnesota		UofM Start-up Funds	2014-		Yes

SPRUCE Collaborator TASKS	Response of Belowground C Stocks to Climate Change – Kostka and Chanton					
Principal Contact:	Joel Kostka, joel.kostka@biology.gatech.edu; Jeff Chanton, jchanton@fsu.edu					
Co-Investigators:	Max Kolton, MaxKolton@gmail.com; Bill Cooper, wcooper@fsu.edu, Rachel Wilson, rachelmywilson@gmail.com					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
DOC characterization by FTMS	Kostka Chanton	2013	Transect 1	Porewater	Data	**Level–0** Level–1 Level-2
Pore water CO_2, CH_4 Concentrations and $\delta^{13}C$:	Kostka	4, 6, 7 and 9 2014	1-10	Porewater	yes	**Level–0** Level–1 Level-2
Radiocarbon on PW DIC, DOC And CH_4 with LLNL (Karis, Tom)	Chanton	4, 6, 7 and 9 2014	1-10	Porewater	yes	**Level–0** Level–1 Level-2
Characterization of peat by FTIR and NMR	Kostka	6/2014	selected	Peat	yes	**Level–0** Level–1 Level-2
OUT FLOW DOC 14C	Chanton	9/ 2014	outlfow	Peat	yes	**Level–0** Level–1 Level-2
Microbial community characterization SSU rRNA genes	Kostka	6, 9 2014	1-10	Peat	yes	**Level–0** Level–1 Level-2
Microbial community characterization Meta-genomes/ transcriptomes	Chanton	6, 9 2014	selected	Peat	yes	**Level–0** Level–1 Level-2

Pore water CO2, CH4 Concentrations and d13C:	Kostka	4, 6, 7 and 9 2015	1-10	Porewater		Planned
Radiocarbon on DIC, DOC and CH4 with LLNL (Karis, Tom)	Chanton	4, 6, 7 and 9 2015	1-10	Porewater		Planned
DOC characterization by FTMS And parafac analysis	Kostka	4 and 9 2015	0 and 10C plots	Porewater		Planned
Characterization of peat by FTIR, FTMS, NMR	Chanton	6/2015	selected	Peat		Planned
OUT FLOW DOC 14C	Kostka	4 and 9/ 2014	Outflow and sites 1-10	Bog Water		Planned
Microbial community characterization SSU rRNA genes	Chanton	7, 9 2015	1-10	Peat		Planned
Enzyme Activity	Kostka	7, 9 2015	1-10	Peat		Planned
Microbial community characterization Meta-genomes / transcriptomes	Chanton	7, 9 2015	selected	Peat		Planned
Microbial community characterization SSU rRNA genes	Kostka	4/2015	selected	Peat		Planned
Microcosms Sample adjacent to enclosures	Chanton	7, 9 2015	selected	Peat		Planned
Living, green Sphagnum for microbiome studies	Kostka	7/2015	selected	Vegetation		Planned

SPRUCE Collaborator TASKS	Understanding the mechanisms underlying heterotrophic CO2 and CH4 fluxes in a peatland with deep soil warming and atmospheric CO2 enrichment – Bridgham et al.					
Principal Contact:	Scott Bridgham, Univ. of Oregon, bridgham@uoregon.edu					
Co-Investigators:	Jason Keller, Chapman Univ.; Qianlai Zhuang, Purdue Univ.					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Porewater H_2, acetate, phenolics	Scott Bridgham	6/2-9/14	small piezometers in Plots 4,6,8,10,11, 13,16,17, 19, 20	porewater H_2, acetate, phenolics, etc.	yes	**Level–0** Level–1 Level-2
Porewater H_2, acetate, phenolics	Scott Bridgham	7/21/14	small piezometers in Plots 4,6,8,10,11, 13,16,17, 19, 20	porewater H_2, acetate, phenolics, etc.	yes	**Level–0** Level–1 Level-2
Porewater H_2, acetate, phenolics	Scott Bridgham	9/8-10/14	small piezometers in Plots 4,6,8,10,11, 13,16,17, 19, 20	porewater H_2, acetate, phenolics, etc.	yes	**Level–0** Level–1 Level-2
Methane cycle observations	Scott Bridgham	9/8-10/14	peat cores	CH_4 and CO_2 production, CH_4 pathways, homoacetogenesis, total acetate production (along with other fermentation products)--all at *in situ* temps.	Data	**Level–0** Level–1 Level-2
Acetate, phenolics	Scott Bridgham	4/1-2/2015	small piezometers in Plots 4,6,8,10,11, 13,16,17, 19, 20	Acetate, phenolics, etc.	Porewater frozen at -20°C	Planned
Methane cycle observations	Scott Bridgham	3 times during 2015 growing season	peat cores	CH_4 and CO_2 production, CH_4 pathways, homoacetogenesis, total acetate production (along with other fermentation products), anaerobic CH_4 oxidation	Data	Planned

Determination of gross CH_4 production and consumption	Scott Bridgham	3 times during 2015 growing season	TBD	Determination of gross CH4 production and consumption using 13CH4 dilution in plots if OK'd, otherwise outside plots.	Data	Planned
Potentially mineralizable C in peat profile in long-term lab incubations	Scott Bridgham	Fall 2017 if renewal funded	peat cores	Potentially mineralizable C in peat profile in long-term lab incubations	Data	Planned
Addition of labeled organic substrates in lab to follow fermentation pathways	Scott Bridgham	2016, 2017 if renewal funded	peat cores	Addition of labeled organic substrates in lab to follow fermentation pathways	Data	Planned

SPRUCE Collaborator TASKS	Mercury and Sulfur Dynamics in the SPRUCE Experiment – Toner et al.					
Principal Contact:	**Brandy Toner, toner@umn.edu**					
Co-Investigators:	Edward Nater (nater001@umn.edu), Randall Kolka (rkolka@fs.fed.us), Stephen Sebestyen (ssebestyen@fs.fed.us)					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Sulfur XANES (peat; in progress):	Brandy Toner	"time zero" 2012	Chambers (analyzed, treed hollows): 4,6,7,10,13,16,17,20, 21 [3,5,8,9,11,14,15,19*] Chambers (analyzed, treed hummocks): 4,6,10,13,17 [7,21*] Chambers (no tree, hum): [4*] Chambers (no tree, hol): [4*]	Peat from cores, frozen under N_2	Yes, for un-analyzed samples, indicated with *	**Level–0** Level–1 Level-2
Total mercury and methyl-mercury, CNS (peat; in progress):	Brandy Toner	"time zero" 2012	Chambers (4,5,6,7,8,9,10,11,13,14, 15,16,17,19,20,21) Total for most samples; methyl-mercury for selected samples	Peat from cores, freeze-dried	Yes, for majority of samples	**Level–0** Level–1 Level-2
Dissolved sulfur and mercury species, hydrogen sulfide (H_2S), sulfate (SO_4^{2-}), S-DOM, total mercury, methyl-mercury	Brandy Toner	Summer 2013	Outside SPRUCE chambers (S1, S3, Bog Lake)	Piezometer water, frozen, freeze-dried	no	**Level–0** Level–1 Level-2

Total mercury and methyl-mercury (peat; in progress)	Brandy Toner	06/03/2014	Chambers (4,6,8,10,13,16,17,19,20,21 [partial core])	Peat from cores, freeze-dried	Yes, for majority of samples	**Level–0** Level–1 Level-2
Total mercury and methyl-mercury (peat; in progress)	Brandy Toner	09/09/2014	Chambers (4,6,8,10,13,16,17,19,20)	Peat from cores, freeze-dried	Yes, for majority of samples	**Level–0** Level–1 Level-2
Total mercury (spruce needles)	Brandy Toner	Winter 2014	Outside SPRUCE chambers (S1, S3, S6)	Yr 1 Black spruce needles	no	**Level–0** Level–1 Level-2
^{14}C, ^{13}C for C-dating, bulk density, total C (peat)	Brandy Toner	Winter 2011	Outside SPRUCE chambers (S1, S2, Bog Lake)	Frozen peat blocks, 1 cm increments on cellulose extracted from sphagnum	yes	**Level–0** Level–1 Level-2
Sulfur XANES (peat):	Brandy Toner	Yearly? (August 2015-20XX)	Treatment and control chambers	Peat from cores, stored frozen under N_2	no	Planned
Sulfur XANES (pore water, i.e. S-NOM):	Brandy Toner	Monthly (April – November 2015-20XX)	Treatment and control chambers	Piezometer, stored frozen under N_2, analyzed freeze-dried	no	Planned
Total- and methyl-mercury (peat):	Brandy Toner	Yearly (August 2015-20XX)	Treatment and control chambers	Peat from cores, stored frozen	no	Planned
Total- and methyl-mercury (pore water)	Brandy Toner	Monthly (April – November 2015-20XX)	Treatment and control chambers	Piezometer, stored frozen	no	Planned
Aqueous sulfur species (H_2S), sulfate (SO_4^{2-})	Brandy Toner	Monthly (April – November 2015-20XX)	Treatment and control chambers	Piezometer, stored frozen under N_2	no	Planned
Total mercury	Brandy Toner	03/20/2015	Treatment and control chambers	Black spruce needles	no	Planned

<table>
<tr><td>SPRUCE Collaborator TASKS</td><td colspan="6">Improving models to predict phenological responses to global change – Richardson and Johnston</td></tr>
<tr><td>Principal Contact:</td><td colspan="6">Andrew Richardson; arichardson@oeb.harvard.edu</td></tr>
<tr><td>Co-Investigators:</td><td colspan="6">Miriam Johnston (mjohnston@g.harvard.edu)</td></tr>
<tr><td>Measurements</td><td>Primary Contact</td><td>Sample periods</td><td>Plot Locations</td><td>Sample Type</td><td>Archival Material?</td><td>Data Archive Status</td></tr>
<tr><td>Phenology Images</td><td>Andrew Richardson</td><td>2015 and beyond</td><td>Plots 4, 6,8,10,11, 13,16,17, 19, 20</td><td>Photographs (.jpeg) acquired using NetCamSC 1.3 megapixel Stardot cameras (Buena Park, CA).</td><td>Yes Images</td><td>Images will be publicly available on the PhenoCam web page (http://phenocam.sr.unh.edu/)</td></tr>
<tr><td colspan="7">We will install networked digital cameras to take photographs, every 30 minutes, of the vegetation in each experimental chamber. The cameras will be installed as soon as chamber construction has been completed (June 2015). The stated goal is to collect data during two complete growing seasons, but cameras will be kept in place for as long as feasible (ideally the 10 year duration of the experiment). Although DOE funding ends in August 2015, the PI will use other funds to support camera maintenance in future years.</td></tr>
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SPRUCE Collaborator TASKS	Long term responses of nonstructural carbon to elevated CO_2 and temperature in boreal peatland bog forest vegetation – Furze et al.					
Principal Contact:	Morgan Furze; mfurze@fas.harvard.edu					
Co-Investigators:	Andrew Richardson (arichardson@oeb.harvard.edu)					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Nonstructural Carbohydrates	Morgan Furze	April, June, September, November 2013	S1-Bog	Measured NSC (bulk sugars and starch) in tissue samples acquired from Anna Jensen: *P. mariana* (root, branch) *L. laricina* (root, branch) *C. calyculata* (foliage, branch) *L. groenlandicum* (foliage, branch)	Data	**Level–0** Level–1 Level-2
Nonstructural Carbohydrates	Morgan Furze	June 2015, January 2016, June 2016, January 2017, June 2017, June 2018 (annual sampling will continue indefinitely)	Within the 10 experimental chambers from designated tree/branch locations	At each sampling date, I will collect a 6 to 8 cm multiyear (2-3 yo) branch sample from n=3 trees of each of the below species per experimental chamber (n=10), to yield 120 samples per collection: *P. mariana, L. laricina, C. calyculata, L. groenlandicum* NSC content will be measured for each sample. Additional samples for each species will be collected, each sampling date, from plants growing outside of the enclosures.	Surplus freeze-dried and ground plant tissue that is not analyzed for NSC will be archived in a -80° freezer at Harvard for future analyses.	Planned

SPRUCE Collaborator TASKS	Lichen community responses to warming – McCune et al.					
Principal Contact:	**Bruce McCune, Oregon State University; Bruce.McCune@science.oregonstate.edu**					
Co-Investigators:	**Sarah Jovan, USDA Forest Service, Portland, OR; Peter R. Nelson, Univ of Maine, Fort Kent; Robert J. Smith, Oregon State University**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Document lichen community composition	Bruce McCune	Aug 2013 Aug 2014	4,5,6,8,10,11,13,14,16,17,19,20	Non-destructive observation	To do	**Level–0** Level–1 Level-2
Lichen transplant biomass	Bruce McCune	Aug 2013 Aug 2014	4,5,6,8,10,11,13,14,16,17,19,20	Non-destructive weighing	To do	**Level–0** Level–1 Level-2
Document lichen community composition	Bruce McCune	Aug 2015	4,5,6,8,10,11,13,14,16,17,19,20	Non-destructive observation	To do	Planned
Lichen transplant biomass	Bruce McCune	Aug 2015	4,5,6,8,10,11,13,14,16,17,19,20	Non-destructive weighing	To do	Planned
Document lichen community composition off-site	Bruce McCune	Aug 2015	Beyond SPRUCE area, Marcell Exp Forest	Non-destructive observation	To do	Planned

<table>
<tr><td>SPRUCE Collaborator TASKS</td><td colspan="6">Fungal, bacterial, and archaeal communities mediating C cycling and trace gas flux in peatland ecosystems subject to climate change - Lilleskov</td></tr>
<tr><td>Principal Contact:</td><td colspan="6">Erik Lilleskov</td></tr>
<tr><td>Co-Investigators:</td><td colspan="6"></td></tr>
<tr><td>Measurements</td><td>Primary Contact</td><td>Sample periods</td><td>Plot Locations</td><td>Sample Type</td><td>Archival Material?</td><td>Data Archive Status</td></tr>
<tr><td>Are any direct SPRUCE Study observations Planned?</td><td>Erik Lilleskov</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>S1-Bog Samples?</td><td>Erik Lilleskov</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Marcell Experimental Forest Samples?</td><td>Erik Lilleskov</td><td></td><td></td><td></td><td></td><td></td></tr>
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SPRUCE Collaborator TASKS	Can Microbial Ecology and Mycorrhizal Functioning Inform Climate Change Models? - Hofmockel and Hobbie					
Principal Contact:	Kirsten S. Hofmockel, kirsten.hofmockel@gmail.com					
Co-Investigators:	Erik Hobbie University of New Hampshire					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Peat hydrolytic enzyme assays	Kirsten Hofmockel	6/5/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC)	**Level–0** Level–1 Level-2
Peat hydrolytic enzyme assays	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
pH	Kirsten Hofmockel	6/5/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC)	**Level–0** Level–1 Level-2
pH	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Gravimetric water content	Kirsten Hofmockel	6/5/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC)	**Level–0** Level–1 Level-2
Gravimetric water content	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2

microbial biomass C and N	Kirsten Hofmockel	6/5/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC)	**Level–0** Level–1 Level-2
microbial biomass C and N	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Ergosterol	Kirsten Hofmockel	6/5/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC)	**Level–0** Level–1 Level-2
Ergosterol	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Bacterial 16S amplicon sequences (DNA)	Kirsten Hofmockel	6/5/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC)	**Level–0** Level–1 Level-2
Bacterial 16S amplicon sequences (DNA)	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Fungal ITS amplicon sequences (DNA)	Kirsten Hofmockel	6/5/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC)	**Level–0** Level–1 Level-2
Fungal ITS amplicon sequences (DNA)	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Fresh peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Sporocarp collection	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Sporocarps	NA	**Level–0** Level–1 Level-2
Peat hydrolytic enzyme assays	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2

Peat hydrolytic enzyme assays	Kirsten Hofmockel	6/18/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Peat hydrolytic enzyme assays	Kirsten Hofmockel	9/9/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
pH	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
pH	Kirsten Hofmockel	6/18/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
pH	Kirsten Hofmockel	9/9/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Gravimetric water content	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Gravimetric water content	Kirsten Hofmockel	6/18/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Gravimetric water content	Kirsten Hofmockel	9/9/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
microbial biomass C and N	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2

microbial biomass C and N	Kirsten Hofmockel	6/18/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
microbial biomass C and N	Kirsten Hofmockel	9/9/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Ergosterol	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Ergosterol	Kirsten Hofmockel	6/18/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Ergosterol	Kirsten Hofmockel	9/9/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Bacterial 16S amplicon sequences (DNA)	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Bacterial 16S amplicon sequences (DNA)	Kirsten Hofmockel	6/18/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Bacterial 16S amplicon sequences (DNA)	Kirsten Hofmockel	9/9/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Fungal ITS amplicon sequences (DNA)	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2

Fungal ITS amplicon sequences (DNA)	Kirsten Hofmockel	6/18/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Fungal ITS amplicon sequences (DNA)	Kirsten Hofmockel	9/9/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Fungal hyphae stable isotopic signature	Kirsten Hofmockel	9/20/2013	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Fungal hyphae stable isotopic signature	Kirsten Hofmockel	6/18/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Fungal hyphae stable isotopic signature	Kirsten Hofmockel	9/9/2014	S1 south end (outside of the rings)	Ingrowth peat cores: hummock 0 to -30 cm; hollow 0 to -20 cm	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Peat hydrolytic enzyme assays	Kirsten Hofmockel	5/31/2014	S1 (12 rings) ??Plots 4,6,8,10, 11, 13, 16, 17, 19, 20, 7, 21??	Fresh peat cores: paired hummock and hollow (0 to -30 cm); replaced with **ingrowth cores**	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
pH	Kirsten Hofmockel	5/31/2014	S1 (12 rings)	Fresh peat cores: paired hummock and hollow (0 to -30 cm); replaced with **ingrowth cores**	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Gravimetric water content	Kirsten Hofmockel	5/31/2014	S1 (12 rings)	Fresh peat cores: paired hummock and hollow (0 to -30 cm); replaced with **ingrowth cores**	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
microbial biomass C and N	Kirsten Hofmockel	5/31/2014	S1 (12 rings)	Fresh peat cores: paired hummock and hollow (0 to -30 cm); replaced with **ingrowth cores**	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2

Bacterial 16S amplicon sequences (DNA)	Kirsten Hofmockel	5/31/2014	S1 (12 rings)	Fresh peat cores: paired hummock and hollow (0 to -30 cm); replaced with **ingrowth cores**	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Fungal ITS amplicon sequences (DNA)	Kirsten Hofmockel	5/31/2014	S1 (12 rings)	Fresh peat cores: paired hummock and hollow (0 to -30 cm); replaced with **ingrowth cores**	Frozen (-80ºC) & Dried (105ºC)	**Level–0** Level–1 Level-2
Peat hydrolytic enzyme assays	Kirsten Hofmockel	6/1/2014	S1 (12 plots)	Fresh peat from Deep Peat Heating (DPH) experiment	Frozen (-80ºC)	**Level–0** Level–1 Level-2
Peat hydrolytic enzyme assays	Kirsten Hofmockel	9/9/2014	S1 (12 plots)	Fresh peat from Deep Peat Heating (DPH) experiment	Frozen (-80ºC)	**Level–0** Level–1 Level-2
Sporocarp identification	Kirsten Hofmockel	9/9/2014	S1-Bog Plots and transacts	Sporocarp removal from plots Essentially nondestructive	Data	**Level–0** Level–1 Level-2
Microcosm respiration	Kirsten Hofmockel	1/7/2015 – 4/11/2015 2015	Lab incubation	Fresh peat: hummock, 0 to -15 cm	Data	**Level–0** Level–1 Level-2
15N, 13N	Erik Hobbie					
Ergosterol	Kirsten Hofmockel	5/31/2014	S1 (12 rings)	Fresh peat cores: paired hummock and hollow (0 to -30 cm)	Frozen (-80ºC) & Dried (105ºC)	Planned
Bacterial 16S amplicon sequences (DNA)	Kirsten Hofmockel	6/1/2014	S1 (12 plots)	Fresh peat from Deep Peat Heating (DPH) experiment	Frozen (-80ºC)	Planned
Bacterial 16S amplicon sequences (cDNA)	Kirsten Hofmockel	9/9/2014	S1 (12 plots)	Fresh peat from Deep Peat Heating (DPH) experiment	Frozen (-80ºC)	Planned
Fungal ITS amplicon sequences (DNA)	Kirsten Hofmockel	6/1/2014	S1 (12 plots)	Fresh peat from Deep Peat Heating (DPH) experiment	Frozen (-80ºC)	Planned

Fungal ITS amplicon sequences (cDNA)	Kirsten Hofmockel	9/9/2014	S1 (12 plots)	Fresh peat from Deep Peat Heating (DPH) experiment	Frozen (-80ºC)	Planned
Metatranscriptomics on selected samples amplicon sequences (cDNA)	Kirsten Hofmockel	6/1/2014	S1 (12 plots)	Fresh peat from Deep Peat Heating (DPH) experiment	Frozen (-80ºC)	Planned
Metatranscriptomics on selected samples amplicon sequences (cDNA)	Kirsten Hofmockel	9/9/2014	S1 (12 plots)	Fresh peat from Deep Peat Heating (DPH) experiment	Frozen (-80ºC)	Planned
Peat hydrolytic enzyme assays	Kirsten Hofmockel	4/22/2015 – 4/25/2015	Lab incubation (peat from outside of the rings)	Fresh peat: hummock, 0 to -15 cm	Frozen (-80ºC) & Dried (105ºC)	Planned
Microcosm respiration	Kirsten Hofmockel	4/22/2015 – 4/25/2015	Lab incubation (peat from outside of the rings)	Fresh peat: hummock, 0 to -15 cm	Frozen (-80ºC) & Dried (105ºC)	Planned
microbial biomass C and N	Kirsten Hofmockel	4/22/2015 – 4/25/2015	Lab incubation (peat from outside of the rings)	Fresh peat: hummock, 0 to -15 cm	Frozen (-80ºC) & Dried (105ºC)	Planned
Gravimetric water content	Kirsten Hofmockel	4/22/2015 – 4/25/2015	Lab incubation (peat from outside of the rings)	Fresh peat: hummock, 0 to -15 cm	Frozen (-80ºC) & Dried (105ºC)	Planned
Bacterial 16S amplicon sequences (DNA)	Kirsten Hofmockel	4/22/2015 – 4/25/2015	Lab incubation (peat from outside of the rings)	Fresh peat: hummock, 0 to -15 cm	Frozen (-80ºC) & Dried (105ºC)	Planned
Fungal ITS amplicon sequences (DNA)	Kirsten Hofmockel	4/22/2015 – 4/25/2015	Lab incubation (peat from outside of the rings)	Fresh peat: hummock, 0 to -15 cm	Frozen (-80ºC) & Dried (105ºC)	Planned

SPRUCE Collaborator TASKS	**Peatland Mercury Cycling in a Changing Climate: A Large-Scale Field Manipulation Study – Mitchell et al.**					
Principal Contact:	**Dr. Carl Mitchell (University of Toronto Scarborough); carl.mitchell@utoronto.ca**					
Co-Investigators:	**Kristine Haynes (PhD Candidate); k.haynes@utoronto.ca** **Randy Kolka (USFS)**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Trial of Mercury Flux Monitoring Using Dynamic Flux Chambers	Kristine Haynes	Aug. 2013	two flux chambers placed (for 24 hrs) in each of Plots #6, 8, 10, 19	gaseous fluxes	N/A	**Level–0** Level–1 Level-2
Pre-DPH Gaseous Mercury Flux Monitoring using Dynamic Flux Chambers	Kristine Haynes	May-June 2014	two flux chambers placed (for 24 hrs) in each of Plots #4, 6, 10, 13, 17, 19	gaseous fluxes	N/A	**Level–0** Level–1 Level-2
Pre-DPH SPRUCE Peat Sampling for Total Mercury Analysis	Kristine Haynes	June 2014	Plots #4, 6, 8, 10, 11, 13, 16, 17, 19, 20	peat (0 - 50 cm)	remainder of lyophilized peat archived	**Level–0** Level–1 Level-2
Peak-DPH Gaseous Mercury Flux Monitoring using Dynamic Flux Chambers	Kristine Haynes	Aug. 2014	two flux chambers placed (for 24 hrs) in each of Plots #4, 6, 10, 13, 17, 19	gaseous fluxes	N/A	**Level–0** Level–1 Level-2
Peak-DPH SPRUCE Peat Sampling for Total Mercury Analysis	Kristine Haynes	Aug. 2014	Plots #4, 6, 8, 10, 11, 13, 16, 17, 19, 20	peat (0 – 100 cm)	remainder of lyophilized peat archived	**Level–0** Level–1 Level-2

Gaseous Mercury Flux Monitoring using Dynamic Flux Chambers		mid-June 2015	two flux chambers to be placed (for 24 hrs) in each of Plots #4, 6, 10, 13, 17, 19	gaseous fluxes	N/A	Planned
Gaseous Mercury Flux Monitoring using Dynamic Flux Chambers		mid-Aug. 2015	two flux chambers to be placed (for 24 hrs) in each of Plots #4, 6, 10, 13, 17, 19	gaseous fluxes	N/A	Planned
If annual SPRUCE peat sampling is occurring, Peat Collection for Total Mercury Analysis		?	Plots #4, 6, 8, 10, 11, 13, 16, 17, 19, 20	peat (0 – 100 cm)	remaining lyophilized peat material	Planned
If permitted, perform micrometeorological gradient technique to monitor peatland mercury flux (electricity required approx. 350W)		throughout 2015 growing season – set up analyzer following initial plot chamber measurements in June	at end of boardwalk #2 or #3 (centrally located in S1)	gaseous flux	N/A	Planned

SPRUCE Collaborator TASKS	**Effects of experimental warming & elevated CO_2 on trace gas emissions from a northern Minnesota black spruce peatland: measurement and modeling - Finzi**					
Principal Contact:	**Adrien Finzi. afinzi@bu.edu**					
Co-Investigators:	**Allison Gill**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Small Collar Test Measurements	Adrien Finzi	2014	Plots 4,6,8,10,11,13,16,17,19, 20	Automated flux collars	Data	**Level–0** Level–1 Level-2
Automated Flux Collars	Adrien Finzi	2015-	Plots 4,6,8,10,11,13,16,17,19, 20	Automated flux collars: Hummock vs. Hollow	Data	Planned

SPRUCE Collaborator TASKS	^{14}C, ^{13}C, and ^{2}H of surface CO_2 and CH_4 fluxes, canopy air/local atmosphere; ^{14}C-DOC; ^{13}C and ^{15}N Chip-SIP of methanogens/trophs; ebullition history reconstruction with porewater noble gas profiles – McFarlane et al.					
Principal Contact:	Karis McFarlane					
Co-Investigators:	Tom Guilderson, Xavier Mayali, Ate Visser, Jennifer Pett-Ridge, Mike Singleton					
Measurements	Primary Contact	Sample periods	Plot Locations	Sample Type	Archival Material?	Data Archive Status
^{14}C, ^{13}C, ^{2}H of surface C fluxes	K. McFarlane	2014, April plus monthly June-Sept	All 10 treatment plots, **large surface chambers**	Gas/whole air	Data	**Level–0** Level–1 Level-2
^{14}C-DOC (w/Jeff Chanton)	K. McFarlane/ J. CHANTON	2014 April plus monthly June-Sept	All 10 treatment plots plus outflux. Depths tbd.	Liquid/porewater	Data	**Level–0** Level–1 Level-2
^{14}C of canopy/local atmosphere CO_2 and CH_4	K. McFarlane	2015- CO_2: weekly June-Sept? CH_4: one time mid-summer	Possibly only at Plot 2 (ambient reference site) OR at Plot 6 and Plot 17.	Gas/whole air	Data	Planned
Chip-SIP (w/ Joel Kostka and Jennifer Glass)	X. Mayali/J. Pett-Ridge	1 time, mid- to late-summer	TBD, will be multiple plots but undecided about replication.	Bulk Peat, incubated in lab.	Data, and Maybe	Need to discuss.
Noble gas from porewater profiles (coordinating w/ Steve Sebestyen)	A. Visser	1 time mid- to late-summer	TBD, will be multiple plots but undecided about replication.	Liquid/porewater	Data, and Maybe	Need to discuss.

SPRUCE Collaborator TASKS	Using microbial enzyme decomposition models to study the effects of peat warming and/or CO2 enrichment on peatland decomposition – Hill et al.					
Principal Contact:	Brian Hill; Hill.brian@epa.gov					
Co-Investigators:	Terri Jicha, Colleen Elonen, Mary Moffett					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Available and total nutrients	Brian Hill	06/03/14 and 09/08/14	All SPRUCE study plots	Peat- composites acrotelm (0-40) Catotelm (50-75) Deep peat (100-200) September only.	Stored frozen Duluth, MN	**Level–0** Level–1 Level-2
Microbial enzymes	Brian Hill	06/03/14 and 09/08/14	All SPRUCE study plots	Peat- composites acrotelm (0-40) Catotelm (50-75) Deep peat (100-200) September only.	Stored frozen Duluth, MN	**Level–0** Level–1 Level-2
Nitrification/denitrification	Brian Hill	06/03/14 and 09/08/14	All SPRUCE study plots	Peat- composites acrotelm (0-40) Catotelm (50-75) Deep peat (100-200) September only.	Stored frozen Duluth, MN	**Level–0** Level–1 Level-2
Dry wt/LOI	Brian Hill	06/03/14 and 09/08/14	All SPRUCE study plots	Peat- composites acrotelm (0-40) Catotelm (50-75) Deep peat (100-200) September only.	Stored frozen Duluth, MN	**Level–0** Level–1 Level-2
Available and total nutrients, microbial enzymes, nitrification/denitrification, dry wt/LOI	Brian Hill	08/04/14	Bog center (outside SPRUCE plots-transect 1 and 2), lagg, upland	Peat- composites acrotelm (0-40) Catotelm (50-75)	yes	**Level–0** Level–1 Level-2

Available and total nutrients, microbial enzymes, nitrification/denitrification, dry wt/LOI	Brian Hill	May, July, September Years???	Bog center (outside SPRUCE plots-transect 1 and 2), lagg	Peat- composites acrotelm (0-40) Catotelm (50-75)	yes	Planned

SPRUCE Collaborator TASKS	Soil fauna biodiversity sampling at SPRUCE - Lindo					
Principal Contact:	Zoë Lindo					
Co-Investigators:						
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
Micro-arthropod Community Survey	Zoë Lindo	Later in 2015 Growing Season	All Treatment Plots and perhaps some ambient plots	Small Surface *Sphagnum* ‘clumps’	Yes?	Planned

SPRUCE Collaborator TASKS	**Monitoring warming and elevated CO2 induced changes in photosynthetic efficiency via canopy spectral reflectance – Falkowski et al.**					
Principal Contact:	**Michael J. Falkowski Michigan Technological University**					
Co-Investigators:	**Evan Kane, Michigan Technological University, Brian Benscoter Florida Atlantic University, Randy Kolka, USFS**					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
NDVI	Falkwoski	Continuous during 2015 & 2016 growing seasons	One of Brian Palik's 1 x 2 m plots within each SPRUCE chamber footprint, both treated and controls	Spectral	Data	**Level–0** Level–1 Level-2
Thermal IR	Falkwoski	Continuous during 2015 & 2016 growing seasons	One of Brian Palik's 1 x 2 m plots within each SPRUCE chamber footprint, both treated and controls	Spectral	Data	**Level–0** Level–1 Level-2
Spectral Reflectance	Falkowski	Approximately bi-weekly during 2015 & 2016 growing seasons	One of Brian Palik's 1 x 2 m plots within each SPRUCE chamber footprint, both treated and controls	Spectral	Data	**Level–0** Level–1 Level-2

SPRUCE Collaborator TASKS	Wood decomposition rates and functional types in a shifting climate – Schilling et al.					
Principal Contact:	Jonathan Schilling, schillin@umn.edu					
Co-Investigators:	Jason Oliver (oliv0328@umn.edu); Randy Kolka (rkolka@fs.fed.us)					
Measurements	Primary Contact	Sample periods	Plot Locations	Sample Type	Archival Material?	Data Archive Status
Branch Wood Decay, Branch Wood Compositional Analysis, Branch Wood Microbial Community Analysis		Deployment – June 2015 Harvest – June 2016,2017, 2020, 2025	NPP areas, All Treatment	Litter Bag ($20cm^2$) with 10 pieces of spruce branch wood	Yes	Planned
Bole Wood Decay, Bole Wood Compositional Analysis, Bole Wood Microbial Community Analysis		Deployment- June 2015 Harvest- June 2020, 2025	NPP areas, All Treatment	Boles (Length= 20cm)	Yes	Planned

SPRUCE Collaborator TASKS	Microbial growth and carbon use partitioning under peatland warming and elevated CO_2 – Gutknecht et al.					
Principal Contact:	Jessica Gutknecht, jgut@umn.edu					
Co-Investigators:	None currently (funded currently from University startup). In the future possibly Brandy Toner, Ed Nater, Randy Kolka, and Steve Sebestyen					
Measurements	**Primary Contact**	**Sample periods**	**Plot Locations**	**Sample Type**	**Archival Material?**	**Data Archive Status**
d^{13}C PLFA	Jessica Gutknecht	2014 June/ September	Same location as group sampling, all plots and ambient plots. All depths were sampled but some depths will be combined for the analysis due to a limited amount of sample	Bulk peat	Unlikely, possibly from September	**Level–0** Level–1 Level-2
d^{13}C PLFA	Jessica Gutknecht	Annual	All treatments, with group sampling	Bulk peat	Archived material may be frozen or freeze-dried	Planned
Amino sugar analysis (potentially ^{13}C or ^{15}N)	Jessica Gutknecht	Annual	All treatments, with group sampling	Bulk peat	Archived material may be frozen or freeze-dried	Planned
d ^{34}SO4	Jessica Gutknecht	Annual and TBD	All treatments, with group and Toner lab sampling	Bulk peat and pore water	Archived material will be frozen	Planned