NAME: Colleen Iversen
ORGANIZATION: Oak Ridge National Laboratory
PROGRAM AFFILIATION: TES
ABSTRACT TITLE: The distribution and dynamics of fine roots in a forested bog in northern Minnesota, USA

ABSTRACT:
Research objectives
We initiated an experiment to determine the distribution and dynamics of ephemeral roots in an ombrotrophic bog that is the future location of the Spruce and Peatland Responses Under Climatic and Environmental change (SPRUCE) experiment. Minirhizotrons, a technology that is rarely used in wetlands, provided an opportunity to examine ephemeral roots in an important and understudied ecosystem.

We used several methods to characterize the distribution and dynamics of ephemeral roots in the bog. We gathered an international team of minirhizotron and wetland experts and developed a consensus on, and a methodological framework for, the appropriate installation and use of minirhizotron technology in wetland ecosystems (Iversen et al., 2012, *Plant and Soil*). In July, 2010, we installed minirhizotrons across gradients of tree density and microtopography in the bog. We collected images from the minirhizotrons weekly throughout the growing seasons of 2011 and 2012 to quantify root production, mortality, and depth distribution dynamics. During the same time period, we tracked the growth of adjacent trees using automated and manual dendrometers. Last, we investigated the relationships among root order, root morphology, and root chemistry for common bog species to scale minirhizotron data to ecosystem carbon and nitrogen fluxes.

Results/Plans
We found that: (1) Minirhizotron technology allowed the quantification of ephemeral root dynamics in a bog and should be utilized in other wetland systems. (2) Root standing crop increased quickly in the spring, well before wood growth was initiated, and standing crop was lowest in areas of 'low' tree density that characterize many of the future SPRUCE experimental plots. (3) Bog surface microtopography exerted strong controls over root dynamics. Root standing crop and production were much greater in raised hummocks when compared with saturated hollow depressions. (4) The most common vascular plant species in the bog encompassed a range of root morphology and diameter distributions, as well as mycorrhizal colonization. Across a range of root orders, root diameter was strongly related with root mass per length and root nitrogen concentration.

Measurements taken prior to the SPRUCE experimental manipulation will be used to parameterize ecosystem and land surface models to refine hypotheses regarding the expected effects of warming and elevated CO_2 on ecosystem carbon and nitrogen cycling in the forested bog. This combined measurement and modeling approach will improve our understanding of root distribution, dynamics, and carbon and nitrogen cycling in globally important peatland ecosystems.