**NAME:** Paul Hanson
**ORGANIZATION**: Oak Ridge National Laboratory
**PROGRAM AFFILIATION:** TES
**ABSTRACT TITLE:** Peatland microbial responses to moisture manipulation in laboratory mesocosms

**ABSTRACT:** The unique microtopography of sphagnum bogs often results in the co-occurrence of elevated, moist hummocks and well saturated hollows of variable size and plant composition. These environmental differences may also result in spatially distinct microbial and invertebrate communities and function. The Spruce and Peatland Under Climate and Environmental Change (SPRUCE) project will be a temperature and $CO_2$ manipulation experiment in an ombiotrophic bog in the Marcell Experimental Forest, MN that features such hummock/hollow topography. We anticipate warming will alter plot water balance and lead to a strong declines in hummock moisture and moderate declines in hollow moisture. We were interested how microorganisms in well saturated hollows respond to moisture stress compared to the drier hummocks. In this mesocosm incubation study we sought to initially determine how microbial and invertebrate communities, enzyme activity and respiration in hummock and hollows would change following exposure to simulated moderate and severe drought without confounding warming effects.

In October, 2012 two 20x20x20cm sections of peat, hummock and hollow, were collected from the Marcell Experimental Forest, MN and divided into 15 hummock mesocosms and 24 hollow mesocosms. The mesocosms were maintained at one of three moisture regimes; ambient, 75% of ambient, and 50% of ambient to simulate different drying scenarios. Peat mesocosms were incubated at room temperature in quart mason jars for 112 days and on days 2, 13, 42, 91 and 112 days post drying we measured 1) exoenzyme activity, 2) bacterial, fungal, archaeal, and invertebrate abundance measured by qPCR, 3) microbial biomass measured with fumigation/extraction, 4) and dissolved organic carbon. Seven hydrolytic enzymes, involved in C, N and P cycling, and two oxidative enzymes were used in enzyme assays. In addition, respiration measured as $CO_2$, was monitored throughout the incubation.

The hummock and hollow peat mesocosms responded differentially to the drying scenarios, with the hollow microbial communities most affected by moisture. The hollow samples exposed to a 50% moisture reduction resulted in a decline in six of seven hydrolytic activities within two days of drying. This reduction was maintained throughout the experiment for three N-enzymes, one C and P enzyme. In the hollow mesocosms, there was also a decline in fungal gene copies with drought in the first 13 days following dry-down. In hummock samples, activity in the two peptidase enzymes increased under drought, while other microbial metrics, oxidative enzymes and microbial gene copy numbers, were unaffected by moisture treatment. Total respiration was similar between moisture treatments in the first 26 days following drying, however there was twice as much $CO_2$ respired from hummock mesocosm compared to hollows. Invertebrate analyses are still ongoing at this time. Overall, hummock microbial communities and function were largely unaffected by moisture stress perhaps suggesting their communities are adapted to the more variable moisture levels experienced in the native bog environment.