

Minnesota bogs offer ecosystem lessons for researchers

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By Kitty Mayo

Peatland does not look like much to the untrained eye, but the bogs of northern Minnesota are home to a rich diversity of plant life - sphagnum moss, and black spruce flourish here. Even more importantly, our humble bogs are a keystone ecosystem in the global warming equation.

Because of that, the Oak Ridge National Laboratory (ORNL) has come to the Marcell Experimental Forest in Balsam Township and about 25 miles north of Grand Rapids. The Spruce and Peatland Responses Under Climate and Environmental Change Experiment (SPRUCE) is being run by the Tennessee based company with Department of Energy funding.

“The Department of Energy asked us to take our expertise to a new ecosystem where implications for climate change are understudied,” said Sara Shoemaker, communications and media relations for ORNL.

Connected by a network of boardwalks put up to protect the sensitive bogland, 10 fully constructed octagonal enclosures will provide data on what happens when heating the ground to six feet of depth, and ambient air heating. Two other plots have no walls, and will provide a control for comparison. The enclosures are heated to five different temperature treatments, adding a set number of degrees on top of the seasonal average temperatures.

The decade-long study will look at the peatland ecosystem on a large scale, assessing reactions of carbon release and plant changes to artificially increased temperatures.

Peat bogs, which are plentiful in northern Minnesota, naturally store high levels of carbon because of the cold weather and high water table. The scientists want to know what will happen if those massive amounts of carbon

are released as temperatures rise. Warmer temperatures and consequently drier conditions are expected to contribute to the release of carbon from peatlands, but just exactly how that will affect plant species and atmospheric conditions are the mystery ORNL is trying to sort out.

With a fifty year track record of monitoring the watershed and temperatures in the Marcell Experimental Forest, the U.S. Forest Service has been able to offer a wealth of historical data. “That’s why we already know that the temperature increases at Marcell are consistent with many other places around the world,” stated Paul Hanson, Coordinating Investigator for SPRUCE. USFS data has already found that mean annual air temperatures have increased about 0.4°C per decade over the last 40 years.

In addition to measuring the carbon cycle with temperature changes, ORNL also will be studying the organisms that live on the peatland. “How the plants grow, faster or slower, if they survive or if there is a change in composition will all be measured,” stated Hanson.

Projected levels of climate variability, atmospheric change and resulting vegetation responses are now considered by the scientific community to be certainties, just how they will unfold leaves a lot of unknown variables. By studying a keystone ecosystem like the MEF peatland, SPRUCE hopes to find out if deep below-ground warming will lead to the release of 10,000 years of accumulated carbon. Storing a third of the earth’s terrestrial carbon, peatlands are found at similar latitudes around the world, and determining whether carbon will be released as carbon dioxide or methane will help form future decision-making.

“Our primary research concern is what happens to all of that stored carbon as it warms up? There is a lot of it stored in the peatlands of the northern hemisphere and it could be a continuum or acceleration of warming response,” stated Hanson.

Currently the carbon stored in peatlands is pretty stable by virtue of the colder climate, and anaerobic conditions created by water saturation that slow or even halt decomposition. “If we warm it up it might dry out and become oxygenated and decompose faster, releasing carbon at high rates and make it even warmer,” explained Hanson.

Saying that climate change has gone too far down the road to stop, Hanson concedes that this study will not offer any simple solutions to the complex problems of global warming.

“The science is often about how we can adapt to future change, it’s not just a science question, it’s really a societal question,” Hanson said.

Without any way to reduce greenhouse gases already in the atmosphere, and the inevitability of more greenhouse gases being emitted by the nature of rising temperatures, Hanson says that understanding what effect those warmer temperatures are going to have at each level of an ecosystem can help create global models. That additional information can potentially lead to constructive plans for adaptation.

Meanwhile, Hanson believes that the easiest change to make in terms of current energy consumption that is contributing to carbon loads in the atmosphere is investing in energy efficient systems.

SPRUCE researchers say that the public is welcome to visit the site and look around, but not interfere with any of the experimental equipment. Tours can also be arranged by contacting the project site manager W. Robert Nettles at: nettleswr@ornl.gov.

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