Peatland Mercury Cycling in a Changing Climate: A Large-Scale Field Manipulation Study

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Peatlands constitute a globally important, but potentially very fragile pool of soil carbon. The very wet conditions in peatlands, where soils are saturated at or near the surface for much of the year, are an overarching control on the accumulation of carbon over time, and thus its sequestration away from the atmospheric pool. It is likely that increasing temperatures resulting from global climate change will affect the moisture balance in peatlands and thus the ability of peatlands to continue to act as net carbon sinks. Additionally, complicated positive and negative feedbacks are likely, making predictions about peatland ecosystem response difficult. Peatlands are also very important to mercury cycling in the environment. In particular, peatlands are important sinks of mercury pollution, but also tend to be "hot spots" of the microbial transformations that convert atmospherically-deposited inorganic mercury, into the bioaccumulative methylmercury form. Indeed, most of the processes involved in peatland mercury cycling (transport, gaseous emission, methylation, and sequestration in organic soils) are intimately related to carbon cycling. The complexity of the mercury cycling response to climate change necessitates a controlled, experimental approach. The funds from this award would be used to support one PhD student to begin working on a large-scale controlled peatland manipulation experiment (SPRUCE – Spruce and Peatland Responses Under Climatic and Environmental change; http://mnspruce.ornl.gov) to directly investigate how increased soil temperatures and increased CO_2 concentrations are likely to affect mercury cycling in peatlands. The principal objective of SPRUCE is to investigate the ecosystem and carbon cycling response of peatlands to direct manipulation (using large "chambers") of soil temperature and atmospheric CO_2 concentration. Funds from this award would be used to expand the project's objectives into mercury cycling and to provide the financial means for one Ph.D. student, Kristine Haynes, to participate in the study and focus her thesis on mercury cycling in a changing climate.

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