Mercury and Sulfur Dynamics in the SPRUCE Experiment

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Summary

The team in this proposal will lead studies assessing the influence of SPRUCE treatments on the cycling of THg, MeHg and S. Mercury is a contaminant that threatens ecosystem services, biodiversity, and human health at broad geographical scales. Mercury levels are determined by complex interactions between deposition, chemical transformation and transport, and accumulation along food webs, some of which lead directly to humans. These interactions are strongly influenced by aspects of ecosystem change, including those changes induced by climate. In this study we will assess how warming and elevated CO_2 influence the production of MeHg and the influence of native sulfur species on that production.

Hypotheses

We anticipate that the soil warming treatments alone or in combination with elevated CO_2 will increase productivity and lower water tables as a result of more transpiration and evaporation. As a result, we hypothesize that:

1) THg and MeHg concentrations will decline with lower water tables as deeper organic soils with lower mercury and sulfur burdens contribute to pore water chemistry.

2) During rainfall and snowmelt runoff, treatments with lower initial water tables will have more Hg available for methylation and thus higher MeHg concentrations, than those with initially higher water tables, especially under heated conditions.

3) Gaseous Elemental Mercury (GEM) fluxes will increase with temperature and lower water tables as microbial communities in newly oxidative peat are able to more efficiently convert soil Hg to GEM.

Anticipated Products

These studies will be first to assess how warming and elevated CO_2 influence the mercury-sulfur dynamics. We anticipate at least three papers investigating (1) THg and MeHg cycles, (2) S cycles, and (3) mercury and sulfur interactions. In addition funds dedicated here will train one post-doctoral scholar.