MS, PhD, or post-doctoral positions in peatland microbiology and biogeochemistry: established climate change experiments

We seek multiple individuals to study microbiology and biogeochemical cycling in peatlands at Michigan Technological University, in collaboration with the USDA Forest Service, Northern Research Station. Positions will be filled depending on experience, and we are accepting applicants at the MS, PhD, or post-doctoral level. Two years (post-doc or MS) or three years (PhD) of support are anticipated for competitive salary or tuition and stipend, with projects centered on two NSF-funded studies. The first is entitled: *Does ectomycorrhizal tree encroachment in peatlands accelerate or suppress decomposition with altered hydrology?* In this study, we leverage the Houghton Mesocosm Facility and field experiments in asking cutting-edge questions about climate change effects on carbon cycle processes in peatland ecosystems. See **Background** for more details about the project.

We also seek individuals focused on a complementary NSF-funded study entitled: *Long-term changes in peatland C fluxes and the interactive roles of soil climate, vegetation, and redox supply in governing anaerobic microbial activity*. Please see details, below.

Position 1—biogeochemistry of peat anaerobic decomposition. This position focuses on questions related to above- and below-ground carbon balances in northern peatlands, as affected by changes in water table and plant functional groups. A background or strong interest in understanding mechanisms constraining trace gas fluxes (CO_2 and CH_4 efflux) and soil decomposition dynamics is desired. Research questions are broadly focused on linking above- and below-ground carbon fluxes in dissolved, gaseous, and solid forms. More specifically, this position investigates constraints to decomposition via microbial communities in aerated and hypoxic (or anaerobic) wetland soils in the controlled setting of the Houghton Mesocosm Facility.

Position 2—fungal mediation of decomposition in peatlands. The second position is seeking a PhD student or post-doc to work on questions related to fungal community composition, structure and function in northern peatlands, as affected by changes in water table, peat chemistry, and tree invasion. We are exploring the role of ectomycorrhizal and saprotrophic fungi in suppressing or stimulating decomposition of litter and peat in peatlands. A background in or familiarity with high throughput sequencing of DNA and RNA, metagenomics, metatranscriptomics, quantitative PCR, and fungal culturing, is desired. This candidate would work in close collaboration with the position described above, with questions broadly focused on linking microbial community characteristics to carbon and nutrient dynamics.

Consideration of applications begins immediately and will continue until the positions are filled. Start date is flexible, but ideally would begin the summer or fall of 2021. Please send a cover letter that states your research interests, your curriculum vitae, and any other relevant materials, and provide the names and contact information for three references, by email to Evan Kane (eskane@mtu.edu) (Position 1) and Erik Lilleskov (erik.a.lilleskov@usda.gov) (Position 2).

Position 3:-Alaska Peatland Experiment

F**our Years of Support** for a qualified individual to study response of peatland ecosystems to climate change at Michigan Technological University, in collaboration with The University of Alaska (Fairbanks) and Bonanza Creek Long-Term Ecological Research site. Four years of NSF support are anticipated for research, tuition and stipend, to work in the Alaska Peatland Experiment (APEX) (https://www.lter.uaf.edu/research/study-sites-overview). In this experiment we are manipulating the presence of sedges and shrubs as well as water table to understand their interactive effects on peatland carbon cycling. Specific questions pertain to mechanisms of anaerobic metabolism within deep organic soils (peat), and how these processes are likely to change with altered hydrology. The successful candidate should have a background or strong interest in biogeochemistry, ecosystems ecology, plant physiological ecology, soil science and/or wetland ecology. Demonstrated research experience, including scientific publications, is a plus.

The position involves field work in Alaska during the summer, while being enrolled as a graduate student at Michigan Technological University. The project is interdisciplinary and collaborative in nature, and there are ample opportunities to work with collaborators at the US Forest Service, Chapman University (Dr. Jason Keller), and The University of Colorado, Boulder (Dr. Merritt Turetsky). This allows exposure to multiple areas of expertise, depending on the student's interest and research questions.

Consideration of applications begins immediately and will continue until the position is filled. Start date is somewhat flexible, but we are ideally looking for someone in the Fall of semester, 2021. Please send a cover letter that states your research interests, your curriculum vitae, and any other relevant materials, and provide the names and contact information for three references, by email to Evan Kane (eskane@mtu.edu) and Jason Keller (jkeller@chapman.edu).

Additional Information:

Michigan Tech is located in the snowbelt (>200" annual snowfall) of Michigan's Keweenaw Peninsula on the South Shore of Lake Superior. The region is dominated by vast areas of lakes, forests and wetlands. Michigan Tech is in the small university town of Houghton, which was rated as one of the top 10 U.S. adrenaline outposts by National Geographic Adventure Magazine, boasting excellent skiing, hiking, kayaking and mountain biking. Michigan Tech was ranked #5 on College Factual's most recent list of the best schools for forestry majors in the U.S.

Background: Peatlands are carbon (C) dense ecosystems that store about 1/3 of soil C globally in 1/30th of the land area, yet are vulnerable to oxidation as a result of climate change or drainage. Peatland C stocks are generally protected under saturated conditions; however, many peatlands will become drier in the future climate or have been drained for agriculture or forestry. While it is generally assumed that drier conditions will increase decomposition, there are potential feedbacks that lead to major uncertainty in how long-term drying will alter the trajectory of decomposition. For example, drier conditions have been shown to favor the encroachment of woody plant communities in peatlands, which have implications for changes in decomposition strategies. Changes in fungal community associated with different plant functional groups (ectomycorrhizal trees, Ericaceae, sedges) are particularly important in mediating changes in decomposition, yet our understanding of how these different fungal groups influence decomposition *in situ* is rudimentary.

Our key motive is to understand the countervailing effects of woody plant encroachment and short- and long-term drainage on both aerobic and anaerobic decomposition in peatlands. Here, we propose a three-way full factorial experiment using large intact (1 m cubed) peat pedons in a climate controlled mesocosm facility, manipulating peat drainage history (peat from pristine and 80+ year drained adjacent sites), water table position, and tree presence. This will be paralleled by a field experiment in which we will manipulate tree root access over drainage gradients. We hypothesize that tree encroachment will increase decomposition in the short-term drainage treatment as a function of the extracellular enzyme suite of the ectomycorrhizal fungal (EcMF) community. Moreover, we hypothesize that divergent fungal decomposer pathways and drainage histories will generate peat with differing capacity for donating and accepting electrons under anaerobic conditions. Processes occurring over decades— changes in solid and dissolved phase organic electron donors and acceptors with changes in decomposer community—will interact with water table and plant community mediated processes driving oxidation and reduction, with a shift in decomposition processes from electron acceptor limitation to electron donor limitation. The mesocosm approach is the key to this study, allowing us to manipulate both drainage history and water tables, thus disentangling short- and long-term impacts of changing hydrology; whereas the field experiment will anchor results in the natural environment. Through this and detailed characterization of fungal community functional changes and consequent effects on oxidative enzymes, decomposition, peat chemistry, and "redox pumping" in peat, we will gain mechanistic insight into the long-term stability of peat in response to altered hydrology.