Colloquium Abstract:

Permafrost carbon and climate feedbacks in a warmer world
At least 1218 Pg (billion tons) of soil carbon (C) are stored in permafrost soils in boreal and arctic ecosystems, almost twice as much C than currently contained in the atmosphere. Permafrost thaw, and the microbial decomposition of previously frozen organic C, is considered one of the most likely positive feedbacks from terrestrial ecosystems to the atmosphere in a warmer world. Yet, the rate of release is highly uncertain but crucial for predicting the strength and timing of this C cycle feedback, and thus how important permafrost thaw will be for climate change this century and beyond. We report results from a tundra landscape undergoing permafrost thaw, where net ecosystem C exchange and the radiocarbon age of ecosystem respiration were measured to determine the influence of old C loss on ecosystem C balance. Sustained transfers of C to the atmosphere that could cause a significant positive feedback to climate change must come from old C, which forms the bulk of the permafrost C pool that accumulated over thousands of years. Areas that thawed over the past 15 years had 40% more annual losses of old C compared to minimally thawed areas, but had overall net ecosystem C uptake as increased plant growth offset these losses. In contrast, sites that thawed decades earlier lost even more old C, a 78% increase over minimally thawed areas, which contributed to overall net ecosystem C release despite increased plant growth. These data document significant losses of soil C with permafrost thaw that, over decadal time scales, overwhelms increased plant C uptake at rates that could make permafrost a large biospheric C source in a warmer world, similar in magnitude in the future to current C fluxes from land use change.

Research Interests/Biography

Ted Schuur is an Associate Professor in the Department of Botany at the University of Florida as well as an Affiliate Research Associate in the Institute for Arctic Biology at the University of Alaska Fairbanks. He is an ecologist who studies interactions between terrestrial carbon cycling and climate change. In particular, he uses geochemical techniques for measuring natural abundance radiocarbon in ecosystem pools and fluxes to trace the sources of carbon emissions to the atmosphere. One of his major research interests is to understand feedbacks to atmospheric CO2 from warming temperature, thawing permafrost, and changing fire regimes in high latitudes ecosystems. His work on this topic has included over a decade of research in boreal and arctic Alaska and northeastern Siberia. He has participated in national and international meetings, workshops, and panels on the topic of ecology and the environment. He has received new investigator awards from NASA and the Andrew W. Mellon Foundation for his work on carbon and nutrient cycling in terrestrial ecosystems, and a CAREER grant from the National Science Foundation for research and education centered on the use of radiocarbon in ecology and earth system science. He is a native of Michigan and graduated Magna Cum Laude with a BS from the University of Michigan in 1991. He received a PhD from the University of California-Berkeley in 1999 and held a National Science Foundation Postdoctoral Fellowship in Bioinformatics at the University of California-Irvine before arriving in Gainesville, FL in 2001.