[UC Berkeley] [College of Natural Resources]

OUR ENVIRONMENT AT BERKELEY
DEPARTMENT OF ENVIRONMENTAL SCIENCE, POLICY, AND MANAGEMENT

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Education

- PhD Ecosystem Ecology Yale University, 1992
- MS Forest Science Yale School of Forestry and Environmental Studies, 1987
- B.I.S. Environmental Studies School for International Training, 1982

Research Interests

Ecosystem ecology, biogeochemistry

Research Description

My research interests are in the field of ecosystem ecology, and include biogeochemical cycling in the plant-soil-atmosphere interfaces, the effects of disturbance on nutrient cycling, and the relationships among nutrient cycling, land-use, and biodiversity. My lab group works on themes linking climate, plant community characteristics, and biogeochemical cycling in tropical forests, as well as the effects of changing cover types at local and regional scales. Some of the mechanisms we use to study the relationships between climate and ecosystems are to determine the impact of spatial and temporal variability in rainfall, temperature, and relative humidity on plant productivity, ecosystem nutrient dynamics, and soil C, nutrient, and gas fluxes. A second focus of our research concerns the effects of natural and human induced disturbances on forest ecosystems, and the impacts of different rehabilitation or reforestation strategies on biogeochemical cycling. We are interested in determining how long the biogeochemical signal of disturbance events persists, and how species composition alters long term patterns in the flow of carbon and nutrients through ecosystems.

Current Projects

Climate Impacts on Tropical Forest Productivity and Biogeochemical Cycling Systematic climate changes along elevation gradients offer convenient surrogates for climate change. We are currently working along elevation gradients in the Luquillo Experimental Forest (LEF), Puerto Rico, to identify linkages among climate and biogeochemical processes, and to determine any direct or indirect plant and soil responses to soil oxygen availability, temperature, and light. In wet tropical forests, we have found that soil oxygen availability is inversely related to rainfall, and can reach very low levels in non-flooded humid environments. We are measuring the effects of low oxygen levels on biogeochemical processes such as methane production and emission, nitrogen cycling, and P availability. Tropical forest productivity appears to be highly sensitive to very small changes in temperature (19-21 oC). Our research group is working to identify the mechanisms responsible for this apparent temperature sensitivity.

Nitrogen Cycling: Dissimilatory Nitrate Reduction to Ammonium Tropical forests are the largest natural source of nitrous oxide production, a radiatively important greenhouse gas. The general conditions under which nitrous oxide is produced (low soil oxygen, high carbon and available nitrate) also facilitate a less studied process called dissimilatory nitrate reduction to ammonium (DNRA). Our lab, in collaboration with the Firestone lab group, has documented high rates of DNRA in tropical forests. We have shown that DNRA effectively conserves nitrogen in the ecosystem, and is likely to limit nitrous oxide production. We are now exploring other ecosystems for DNRA and determining the factors that favor DNRA over trace gas production. Our work is expanding to temperate forests, grasslands, and boreal forests in systems where redox fluctuates.

Carbon Dynamics is Disturbed and Recovering Tropical Forests The storage of carbon in soils and biomass in tropical forests plays an important role in the global carbon cycle. High rates of tropical deforestation have prompted growing concern about the loss of carbon storage capacity, and increasing rates of carbon emissions to the atmosphere. Considerable recent efforts have focused on documenting the effects of deforestation and land use change on plant and soil carbon pools. Much less research has explored possible mechanisms to help offset carbon losses through reforestation of pasture and agricultural land. In Puerto Rico, we are determining the rate of new carbon accumulation in soils and plants following forest reestablishment. Our preliminary results suggest that carbon allocation patterns among species are likely to affect the rate of ecosystem carbon accumulation and the relative distribution of carbon between plants and soils.