

# Donald R. Zak

## Microbial Ecology & Biogeochemistry

Research projects involve undergraduates in field and laboratory work.

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Plant Diversity, Soil Microbial Communities & Ecosystem Function: Are There Any Links? Human activity has decreased plant diversity on a global scale, yet the interconnection between aboveground plant diversity and belowground microbial community composition and function has been largely ignored. This interconnection is especially important because many ecosystem processes are controlled by microbial communities in soil. Undergraduate researchers will gain experience by conducting field research, molecular analyses of the microbial communities in soil, and stable isotope analyses to follow microbial metabolism of plant litter. Field portions of this research will take place at the Cedar Creek Natural History area in east Central Minnesota.

### Plant-Microbe Interactions Control Ecosystem Response to Climate Change:

A major limitation in predicting ecosystem response to a changing climate is our uncertainty as to how increases in plant and ecosystem productivity will be sustained as  $\text{CO}_2$  continues to accumulate in the Earth's atmosphere. Much of this uncertainty stems from potential interactions between rising atmospheric  $\text{CO}_2$  and other environmental factors, such as tropospheric  $\text{O}_3$ , which could diminish plant growth response to elevated  $\text{CO}_2$ . This research project seeks to understand the underlying mechanisms controlling ecosystem response to elevated  $\text{CO}_2$  and  $\text{O}_3$ , and is based on the premise that plant-microbe interactions in soil mediate key feedback mechanisms controlling ecosystem response to climate change. This project is being conducted at a free-air fumigation experiment in which forest trees are being exposed to concentrations of atmospheric  $\text{CO}_2$  and  $\text{O}_3$  that will occur by the end of this century. The experiment is located in Rhinelander, Wisconsin and is the only free-air release experiment in the world addressing how  $\text{CO}_2$  and  $\text{O}_3$  will interact to alter the structure and function of forest ecosystems. Undergraduate researchers will have the opportunity to conduct field work and learn molecular techniques to understand how changes in plant growth under elevated  $\text{CO}_2$  and have altered the composition (who's there) and function (what they're doing) of microbial communities in soil.

