

## **Short and long-term temperature acclimation of root systems in woody plants and the moderation of warming-induced enhancement of soil CO<sub>2</sub> efflux**

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We will assess the degree to which temperature acclimation occurs in root systems of a variety of woody plants and determine if such acclimation is a short-term, direct physiological adjustment to warmer temperatures (days to months) or a longer term response to changes in nutrient, moisture and C availability and mycorrhizal status as the ecosystem adjusts to long-term warming (years).

Specific questions we will address include: Does rapid temperature acclimation occur in roots of large perennial woody plants? How do root biomass, root N concentration, and root respiration rates adjust to long-term changes in soil temperature and moisture and concomitant changes in N availability? How are rates of mycorrhizal infection influenced by the effects of warmer soil temperatures on host C balance and soil N availability? How do the short- and long-term responses of roots and mycorrhizae to warming and associated changes in soil nutrient cycling affect soil CO<sub>2</sub> efflux and C availability for aboveground NPP? Are the interrelationships between warmer soil temperature regimes and C fluxes to and from roots and mycorrhizae adequately described by current ecophysiological models?

To understand both immediate and long-term effects, plots with 0 to 16 years of warming will be utilized. These include northern hardwood forests in Michigan, with warming to be initiated after a year of pre-treatment measurements; willow and alder in the shrub layer of a fen peatland in Michigan, with warming to be initiated in 2008; and mixed hardwoods at Harvard Forest that have been warmed since 1991, 2003 and 2006.

We will measure specific root respiration, root N concentration, root biomass, N mineralization, root N uptake, litter inputs, biomass increment, soil C content and mycorrhizal abundance, community composition and respiration. Treatments at the two Michigan locations include both soil warming and moisture manipulations, allowing us to examine the interaction of these two important global change factors.

We will know in the first year if rapid, physiological acclimation of root respiration occurs or if warming immediately alters mycorrhizal abundance. What may be of more importance are the amounts of C allocated to root respiration and mycorrhizal symbiosis that will exist in an ecosystem after N cycling, aboveground productivity, litter quantity, quality and decomposition, and microbial community composition and function have equilibrated to the altered climatic regimes. We will assess the interrelationships that exist between such processes and determine the factors that will ultimately control soil CO<sub>2</sub> efflux and NPP in an altered climate.