

Environmental Control of Microbial N Transformations in Redwood Forests¹

Damon Bradbury and Mary Firestone²

Scenarios of global change predict alterations in patterns of temperature, rainfall and oceanic fog impacting continental margins. The response of redwood (*Sequoia sempervirens*) forests to climatic changes will be, in part, predicated on the response of soil N dynamics to the altered environment. Our research focuses on how patterns in climate affect microbial community composition and rates of soil N transformations in redwood forests. Rates of gross N-mineralization are a primary controller of N availability to the plants in these ecosystems and rates of nitrification, denitrification, and nitrous oxide production control important N-loss mechanisms from these episodically wet soils. Rates of all of these N-cycling processes were determined in soils from two northern California redwood forests, incubated at field and lab temperatures under aerobic and anaerobic conditions. Gross rates of nitrification were high in these redwood forest soils, a result contrary to older studies that quantified simple rates of nitrate accumulation. High rates of gross nitrification under anaerobic conditions suggest the possibility of heterotrophic nitrification. Although higher temperature incubations did generally tend to increase the rates of all processes, the impacts of warming on the anaerobic processes of denitrification and dissimilatory nitrate reduction to ammonium (DNRA) suggest unanticipated interactions between temperature and water in controlling these important anaerobic processes. Warmer temperatures increased DNRA more than denitrification suggesting that increasing temperatures may promote nitrogen conservation by DNRA in these wet forests. We are currently exploring the impacts of climate on the abundance, composition, and activity of the nitrifying and denitrifying communities in old-growth redwood forests. The relationship between microbial community composition and rates of soil N transformations may provide insights that help predict the response of the N dynamics in these forests to future changes in temperature and precipitation.

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² University of California at Berkeley, Department of Environmental Science Policy and Management, Ecosystem Sciences Division, 151 Hilgard Hall, Berkeley, CA 94720, (510) 642-3677. email: mkfstone@nature.berkeley.edu