Research

Soil gaseous N emissions (N_2, NO_x, and N_2O) are often ignored in ecosystem nutrient budgets presumably because in mesic sites, hydrologic N losses generally balance N inputs. However, in regions with strong seasonality such as California, whose Mediterranean climate produces strong temporal gradients in soil moisture, gaseous N losses represent an important pathway for ecosystem N loss (Hall et al., 2008; McCalley and Sparks, 2009).

Nitrification and denitrification are known sources of both nitric oxide (NO) and nitrous oxide (N_2O) (Firestone and Davidson, 1989; Meixner and Yang, 2006), but in semiarid ecosystems, NO is of greater importance than N_2O; anaerobic soils are not typical of semiarid environments. **Paradoxically, however, the biological processes regulating NO emissions appear to intensify in summer dry soils—a period of low biological productivity—while becoming less important at wet-up, during which abiotic processes appear to control N emissions.**

To further our understanding of soil gaseous N production, I seek to evaluate two widely held paradigms: 1) that in dry soil the biological cycling of N is unimportant and 2) that gaseous N emissions through biotic/abiotic processes are not significant components of ecosystem nutrient budgets. In particular, it is my objective to address these questions:

1. Do biotic processes regulate NO emissions in dry soil and does biotic NO production decrease during episodic increases in soil moisture?

2. Does soil wet-up enhance abiotic NO production? Which soil N pools participate in abiotic NO production and at what time of the year is the substrate generated?

3. How does access to soil C regulate NO production and at what soil depth are both biotic and abiotic processes of NO production limited?