Effect of nitrogen enrichment on the structure of soil microbial communities and carbon storage in Coastal Sage Scrub Soils

Kun Liu
University of California, Riverside

The mountains of southern California receive some of the highest rates of nitrogen (N) deposition in the world (approximately 40 kg ha\(^{-1}\) year\(^{-1}\)) (Meixner et.al 2001). One of the possible impacts on ecosystem is the change microbial structure. Previous studies showed nitrogen addition resulted in significantly lower fungal:bacterial biomass ratios. Furthermore, fungi dominated microbial community favors carbon sequestration. As a result, nitrogen deposition is hypothesized to lead to lower fungal: bacterial ratio, and less carbon storage in heavy N deposition areas. In past two years, we conducted a study to measure the fungal:bacterial ratio, soil inorganic nitrogen level and soil carbon on these sites over a two year period to test the above hypothesis. Results showed that there was no apparent shift in the fungal: bacterial ratio along the N deposition gradient. However, there was high variation in the soil inorganic nitrogen content over time, and the variations were not consistent with the N deposition gradient. Differences in site characteristics and vegetation also might confound the effect of N deposition on fungal: bacterial ratios. Lastly, the levels of inorganic nitrogen currently accumulating on these sites may be insufficient to trigger changes in fungal:bacterial biomass ratios and activity.

To further examine the effects of nitrogen on carbon accumulation in the coastal sage scrub ecosystem, we propose to study the effects of direct N fertilization at 5 locations and compare changes in fungal bacterial biomass and respiration activity. The direct fertilization treatments eliminate confounding effects of differences in vegetation and soils between sites and allow a more sensitive examination of the nitrogen effects on the soil microbial communities at different locations.

The experiment will be conducted in prior research sites along an N deposition gradient in western Riverside County. 50 kg ha\(^{-1}\) nitrogen will be applied on four plots (2m by 2m) four time a year and composite soil samples will be collected at the same time. After sampling soil will be submitted for organic matter analysis, and nitrogen analysis. fungi:bacteria biomass ratio will be examined by Inhibited Glucose Induced Respiration method and PFLA.

This project will help to achieve the goal of the Kearney foundation mission: understanding of mechanisms and processes governing the storage and flow of carbon pools in soils that support California's coastal sage scrub soils ecosystems.