**REACTIVE NITROGEN IN SOIL: MICROBES AND NITROGEN CYCLING**

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Reactive N refers to all biologically, chemically and radiatively active N and includes gaseous, ionic and organic species, such as NO$_x$, N$_2$O, NH$_4^+$, NO$_3^-$, amines, proteins, and nucleic acids. While some species of reactive N, e.g., NH$_4^+$ and NO$_3^-$ are essential to plant growth and ecosystem productivity, excessive amounts of reactive N are generally detrimental to environment, human health, and ecosystem service. Nitrous oxide and/or NO$_x$ have been well recognized for their roles in global warming, depletion of ozone in the stratosphere, formation of ozone in the troposphere, and therefore health-related problems due to ozone inhalation and/or increased UV exposure, such as respiratory illness, skin cancer and vegetation injury. Excess inorganic and dissolved organic N in water bodies can also promote eutrophication, a phenomenon of death of many species of aquatic animals and plants due to algal bloom-associated hypoxia. Some other negative effects of reactive N include soil acidification, biodiversity reduction, and health concerns associated with NO$_3^-$ ingestion with drinking water.

Microbial N processes, including N mineralization, nitrification and denitrification are the most critical soil processes that govern the pools and production of reactive N in soil. It is well known that microbial N processes are affected by a number of soil properties, including mineralogy and texture, organic matter quantity and quality, pH, moisture, and microbial population size, and these soil properties can vary considerably from one terrestrial ecosystem to another. A better understanding of the ecology of N-cycling microbial communities will help predict the rates of soil reactive N production and consumption and thus develop management practices to reduce N loss from soil to water.

Our goals are to (i) quantify soil reactive N in agroecosystems, (ii) identify the major soil properties that are related to the reactive N differences, and (iii) determine the diversity and abundance of N-cycling microbial communities. A suite of molecular, biochemical, and process-level techniques will be used for investigating N-cycling microbial community and soil N processes. The research will be mainly laboratory-based, but may include soil sample collection from research stations.