Nitrogen in the Environment and Critical Climate Change Impacts

Mentors:
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Research Project:

Nitrogen (N) is an essential nutrient for life. Cropping systems receive N additions from organic amendments, chemical fertilizers and biological nitrogen fixation (BNF). N can go through many transformations in the soil, be taken up by the crop or be lost from the field causing pollution to air and water. With climate change, there are more intense rainfall events thought the U.S., especially in the Midwest. As the Midwest is a very important agricultural region, growing 80% of national corn and soybean, we study how the changes in rainfall patterns influence N loss and acquisition in crop fields. Next summer, we are doing two projects, welcoming undergraduate students!

Consequences of altered rainfall patterns and topography on nitrous oxide: Nitrous oxide (N_2O) plays an important role in the greenhouse gas (GHG) balance of the atmosphere and contributes to climate change. A majority of anthropogenic N_2O emissions are from agricultural soils. At KBS, we have observed changing rainfall patterns increase N_2O emissions in corn cropping systems. Next summer, we will expand this project to fields with diverse topography and to a biofuel crop, switchgrass. Understanding the mechanisms behind increased agricultural GHG emissions could help develop effective mitigation strategies.

Impact of more extreme precipitation patterns on BNF across a field: In soybeans, BNF is carried out through a symbiotic association between plants and bacteria. Although farmers use fertilizers on soybeans, BNF alone has been shown to achieve similar yields. This past summer we carried out a project exploring the impacts of topography, rainfall patterns and tillage practices on BNF. Based on the findings, we will design field experiments to explore the effects of soil texture and organic matter. This can help inform farmer decisions, potentially reducing fertilizer inputs, leading to economic benefits and reduced pollution.


Photo credit: K. Stepnitz, Michigan State University

Supplementary Information:

We plan to recruit **2 students** through the KBS REU Program. Within the context of these projects, we will work with the students to develop a research project to help us understand the mechanisms driving responses in N_2O and BNF. The students will help with field and lab work, gaining complementary research experience by learning soil, plant and gas sampling techniques, setting up experiments and analyzing data.

The students will be expected to be resourceful, open to providing and receiving constructive feedback and enthusiastic. The work schedule will average ~40 hours a week. Field work associated with this project consists of long periods of time outside in often difficult weather conditions and will require strenuous physical labor for moving and installing equipment. We look forward to mentoring undergraduate students this summer. Feel free to e-mail k8g@msu.edu with questions.