Pulling Food Out of Thin Air: the Importance of Nitrogen Fixation in Prairie Grasses

Mentors: Dr. Sarah Roley (Postdoctoral research associate – MSU Kellogg Biological Station and Great Lakes Bioenergy Research Center) and Dr. G. Phillip Robertson (faculty – MSU Department of Crop, Soil and Microbial Science)

Background: Plants require a variety of nutrients to grow, and one of the most elusive is nitrogen (N). Some plants, such as soy beans, can obtain their own N via their association with microbes, who can "fix" N from the atmosphere (i.e., convert N_2 into a form that's available for plant uptake). The plant provides carbon (energy) to the microbes, and the microbes provide N. This process was thought to occur only in particular plant species, but recent work suggests that it occurs in grasses, as well. We will tackle 2 important questions regarding N_2 fixation in grasses:

1. How do fixation rates compare among various species of native prairie grasses?
2. How do fixation rates change along a gradient of soil N availability?

Implications: In agricultural systems, farmers typically add N fertilizer to fields to help meet plant N needs. These applications improve yields, but also result in greenhouse gas emissions, water pollution, and drinking water contamination. Plants that can acquire their own N have less need for polluting fertilizers. Prairie grasses are candidates for use in cellulosic biofuels, and if they can meet their N needs via fixation, then they may be a sustainable option for bioenergy.

Student Experience: The student will gain experience with stable isotopes, soil sampling, and plant sampling, along with broad exposure to the field of ecosystem ecology. Furthermore, they will gain knowledge of current issues in agriculture and bioenergy and be part of a large, dynamic lab that is involved in a variety of projects relating to sustainable energy and agriculture. We will be in the field approximately 2-3 days a week, with other days spent in the lab or analyzing data.