Building a better monoculture – how does diversity within species affect yield and ecosystem services?

Mentors: Dr. Karen Stahlheber (Postdoctoral Research Associate at MSU Kellogg Biological Station & University of Wisconsin Madison) & Dr. Katherine Gross (Director – MSU Kellogg Biological Station & Professor, MSU Dept of Plant Biology)

BACKGROUND:

Biodiversity – often defined as the number of different species – is an essential component of natural ecosystems. Many experiments and studies to date have found connections between species diversity and ecosystem services (a positive benefit that people derive from an ecosystem). In agriculture, crop rotations including numerous different plants have allowed farmers to sustain high yields over time without continuously increasing chemical inputs. Diversity within species, however, is another important aspect of biodiversity and we know comparatively little about its effect on ecosystems, either in natural or agricultural settings.

Switchgrass (*Panicum virgatum*), a C_4 grass native to most of North America, is an important candidate cellulosic biofuel crop that displays considerable variation in physical characteristic or traits. In some cases, the extent of variation within switchgrass may be equivalent that between different C_4 grasses. Since an organism's physical traits are linked to its response to the environment, whole communities containing organisms with a diversity of traits may better resist environmental fluctuations. Previous Great Lakes Bioenergy Research Center (www.glbrc.org) research has also found that fields of a single-variety switchgrass monoculture provide ecosystem services such as supporting populations of biocontrol organisms and grassland nesting birds at levels nearly equivalent to more diverse prairies.

The REU student selected for this project will be central in developing a field project to examine how mixing different switchgrass varieties in plantings affects outcomes important for biofuel producers, including establishment success and growth.

WHAT THE REU WILL LEARN:

The student will participate in an immersive experimental design experience, beginning with asking questions and proposing hypotheses and continuing with how to design an effective field experiment. Depending on the specific focus of project, the student will learn commonly used field and lab survey techniques in ecology, potentially including some greenhouse work to establish seedlings. The student will also gain proficiency in identifying common herbaceous plants in Michigan, from weedy species to prairie grasses and using common computer software packages to organize and analyze their data.

This research project will take place at the W.K. Kellogg Biological Station from May 23 – August 5, 2016 (11 weeks). Participating in this program will connect the REU student to a group of researchers at the Kellogg Biological Station and elsewhere, all working on various aspects of understanding sustainable production of biofuel. Results of the student's work will be incorporated into these broader goals, and have implications for the design of sustainable agricultural practices in bioenergy.