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

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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 URA student selected for this project will take on field measurements and regular maintenance for an experiment planted in the summer of 2016. A total of 88 replicate plots were planted either with one, two or four varieties of switchgrass selected for their differences in above and belowground characteristics. Preliminary results indicated effects of diversity on an individual's growth; this project will build upon the previous work.

WHAT THE URA WILL LEARN

The URA will gain a variety of skills associated with measuring plant communities in the field, from measuring growth rates to assessing performance-related characteristics like leaf chlorophyll. The student will also gain proficiency in identifying and observing grasses as well as other common Michigan species. The URA will also learn how to use 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.