MAPS Highlights 2018-2019, Year 2

Prairie Plant Response to Microbiome

Jim Bever

Figure 1. The three plants used for the microbiome study.

The dominant native grass, little bluestem, responded most positively to the presence of the soil microbiome and was most sensitive to microbiome composition, compared to smooth brome, a non-native pasture grass, and Sorghum, a commonly grown grain crop (Fig. 1).

Results from the soil microbiome experiments indicate that native soil microbiomes are better at promoting native plant productivity and soil function than the degraded microbiomes of agricultural soils. This study indicates that in order to establish one of the dominant prairie grasses in a restoration project, inoculating with a prairie soil microbiome will likely promote its growth and establishment, and promote soil health by improving soil structure.

This project in Professor James Bever's research program (Department of Ecology and Evolutionary Biology at the University of Kansas) seeks to understand how soil microbiomes influence plant growth and health in different environments. His group studied how the different soil microbiomes from prairies, agricultural, and post agricultural fields impact the growth of the native prairie grass, little bluestem, the non-native brome, and the grain crop Sorghum (Fig. 1). The group also studied their affect on soil fertility and structure (clumping, aggregation, small particles, etc.). Plant growth and soil structure were tested in a greenhouse experiment where plants were inoculated with soil microbiomes from the three agricultural sites mentioned above.

Little bluestem, the dominant native grass, was found to respond most positively of the three plants tested to the presence of the soil microbiome, is most sensitive to microbiome composition, and grows particularly well with the native microbiome associated with unplowed prairie. By contrast, smooth brome, a non-native pasture grass, and sorghum, were not sensitive to microbiome presence or composition. In addition, soils from treatments with native prairie or post agricultural soil microbiomes had greater soil aggregate stability than what was typical of agricultural soils. These results suggest the native soil microbiome is better at promoting native plant productivity and soil function than other microbiomes.

Microbes on the Move

Ben Sikes and Teresa MacDonald

The Microbes on the Move Mobile Museum Exhibition Tent

The *Microbes on the Move* mobile museum creates an awareness of the ubiquity of microorganisms, their diversity and living conditions, and their role in global cycles by engaging elementary-aged youth and their families in the exploration of microbial life in their local environment.

Microbiology education is key to helping public audiences better understand the importance of microbial life, counter biases/misunderstandings, make informed decisions based on this information, and support ongoing research.

Microbes on the Move mobile museum connects local communities with the world of microbes through museum collections and visitor-created living microbial community displays.

The mobile museum features 15 portable exhibits, including: (1) a display of microbes related to fungi, lichen, and stromatolites; (2) 'Microbe Minute' information cards with engaging stories about microorganisms; and (3) activities that explore the local microbiome by collecting samples from the local environment in order to culture fungi; to create a public display of living art; to make mini-microbial gardens; and to observe individual microorganisms in samples with USB microscopes and "Foldscopes."

Microbes on the Move held its first exhibit at the Chanute, KS public library on March 15, 2019, and another exhibition on April 27, 2019 in conjunction with the Spencer Museum of Art's "Day of Creativity" at the University of Kansas. The next *Microbes on the Move* event will be September 7, 2019 in Emporia, KS.

Model Predicts Harmful Algal Blooms

Peggy Schultz and Amy Hammett

Climate Club students at Maize High School were able to develop a predictive model for harmful algal blooms (HABs) aided by biology teacher Ms. Amy Hammett. They were able to apply their model to predict HABs in Cheney Reservoir, a major source of drinking water for local residents. Ms. Hammett developed the lesson, *PBL – Water Quality Monitoring of Kansas Surface Water and Computational Modeling of HABs*, at the Kansas NSF EPSCoR Ecosystems of Kansas Summer Institute: http://www.kabt.org/2018/06/25/pbl-water-quantity-and-water-quality/.

Maize High School Students Collecting Data at the Cheney Reservoir

Maize High School Students Filtering Water Samples in their Lab

The students are working with Wichita city leaders, including the Wichita Mayor Jeff Longwell and members of the Environmental Division of Wichita, and leaders at the Kansas Water Office. The plan is to use the predictive model as a tool to explore proactive adjustments to the current water treatment process, which in turn could save the city utility up to $100,000 in water treatment energy and chemical costs.

During the 2018 Ecosystems of Kansas Summer Institute, Maize High School science teacher, Ms. Amy Hammett, created a lesson designed to have her students address the HABs contamination of the Cheney Reservoir. Knowing increased water temperatures cause HABs to produce Microcystin-LR, a cyanotoxin, her students used HOBO water quality data loggers strung in a vertical column to measure light, temperature, and thermal stratification in the reservoir. Then, her students entered the data they collected in the Environmental Data-Driven Inquiry and Exploration (EDDIE) Project General Lake Model programming module provided by Dr. Cayelan Carey's Lab at Virginia Tech. The students used special lake programming module to create a computational model that predicts when HABs release cyanotoxins. The City of Wichita's water utility company plans to use their model to create a proactive approach to water treatment ahead of algal blooms.

As a follow up to this lesson, Ms. Hammett entered her students' project in the 2018-19 Lexus Eco-Challenge, and they won $10,000 in scholarships for their Harmful Algal Blooms (HAB) predictive model.
The Maize High School students also presented their work at the Kansas NSF EPSCoR 2018 MAPS Symposium on March 18, 2019 in Manhattan, Kansas.