CABBI
CENTER FOR ADVANCED BIOENERGY AND BIOPRODUCTS INNOVATION

# Seasonal Activities of the Phyllosphere Microbiome of Perennial Crops

## Background/Objective

- Perennials, such as miscanthus, are crucial targets for sustainable biofuel development, offering a broad range of ecosystem services in addition to high biomass yields.
- Management of the plant microbiome is one proposed tool for promoting the vigor and stress resilience of bioenergy crops. However, this aim is challenged by difficulty in identifying beneficial members of the plant microbiome and by the temporally dynamic nature of agroecosystems.
- Previous work identified core bacteria that are present in the switchgrass and miscanthus phyllosphere. This work expands on these observations to elucidate the functions of these communities and why they may persist in the phyllosphere.

## Approach

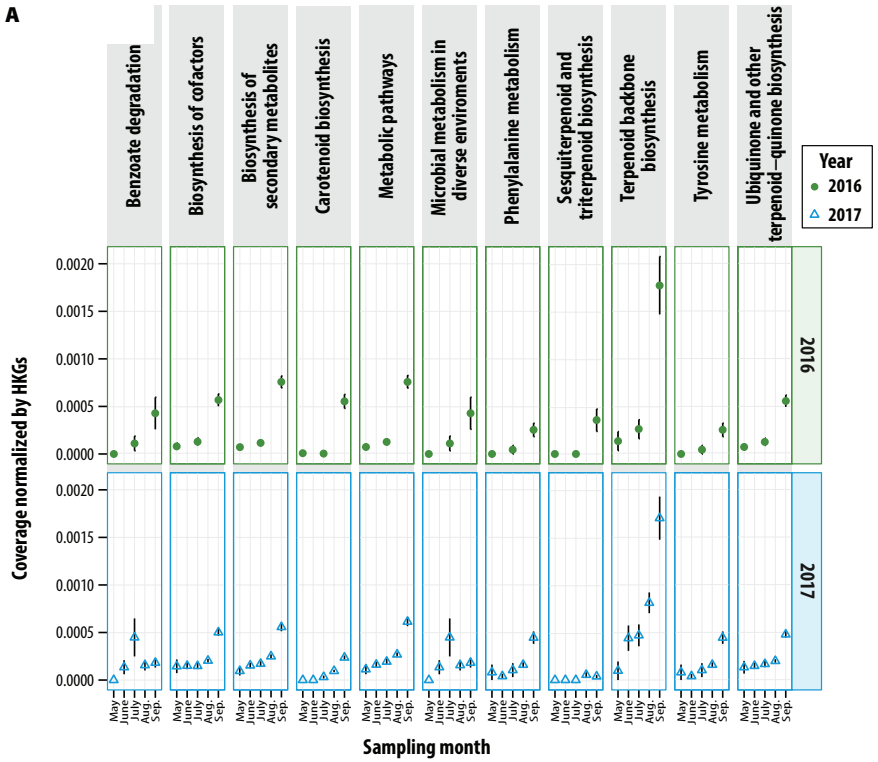
Researchers performed a seasonal analysis of phyllosphere metagenomes for miscanthus and switchgrass. Longitudinal metagenome data were paired with metatranscriptome analyses at select points to determine seasonally active functions. A focal subset of metagenome-assembled-genomes (MAGs) binned from these data informed functions that are actively transcribed in the phyllosphere during their growth.

## Results

Overall, this work provides evidence of a thriving, dynamic, functionally diverse, leaf-specialized, and host-responsive microbiome on the phyllosphere of perennial grasses. It provides evidence of specific phyllosphere functions that are seasonally activated in a temperate agroecosystem and suggests several hypotheses of important host-microbe interactions in the phyllosphere, for example via central metabolism, isoprenoid biosynthesis, and stress response engagements.

## Significance/Impacts

This work contributes to our broad understanding of phyllosphere microbial community dynamics and activities and points to specific target microbial functions that may be useful for managing plant-microbiome interactions for sustainability goals.




**2016 (green, circle) and 2017 (blue, triangle) switchgrass leaf transcript dynamics associated with terpene metabolism. Volatile terpenes engage in indirect and complex feedback with methane and nitrous oxide greenhouse gases. They also help protect leaf photosynthesis against short episodes of high temperature.**


Howe et al. 2023. "Seasonal Activities of the Phyllosphere Microbiome of Perennial Crops." *Nature Communications*. DOI: 10.1038/s41467-023-36515-y.