Dr. Matthew Saxton, Assistant Professor in the Department of Biological Sciences at Miami University, completed an Ohio Water Resources Center funded project via USGS 104(b) subaward. The project titled **"Microorganisms and enzymes driving glyphosate degradation in Lake Erie"** aimed to understand how microorganisms in water react to pesticides running off from agricultural fields into downstream bodies of water.

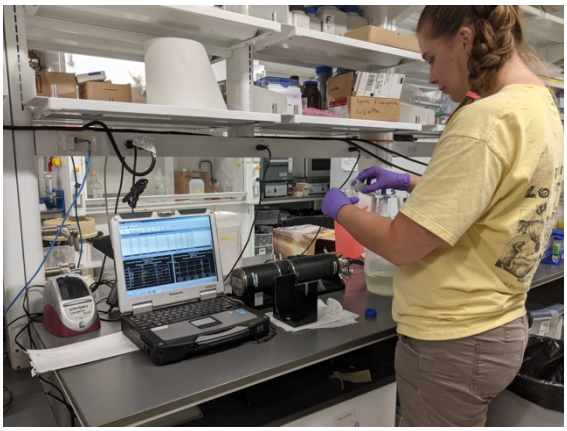

Figure 1. Undergraduate student Emma Jones using a fluoroprobe to investigate algal community structure.

The chemical structure of glyphosate, the most widely applied herbicide in the world, includes phosphorus and nitrogen, making the contribution of this chemical to eutrophication of increasing interest. Bacterial biodegradation of glyphosate has been observed in bacterial cell culture and is presumed to occur in nature, but the gene pathways that drive this metabolism in the environment are unclear. Understanding these processes will help obtain a full picture of Lake Erie's nutrient cycles and to specifically understand its recent algal bloom formation.

Dr. Saxton and his team added six different herbicides and five different insecticides to water collected from Acton Lake, a reservoir in a highly agricultural area of southwest Ohio, to study how algae and bacteria in the water reacted to the chemical application. They observed that while Acton Lake bacteria and algae did respond to individual chemicals, the bacteria nor the algae responded in a similar way to either the herbicides or insecticides. The team also exposed water collected from Sandusky Bay in Lake Erie to glyphosate and several of its breakdown products to study how the bacteria and algae in the ecosystem respond to this chemical by learning which genes they turn on when exposed.

Logistical and supply chain problems due to SARS-CoV-2 delayed data acquisition, but with their final data, the research team will be able to determine the gene pathway or multiple pathways used to degrade glyphosate in Lake Erie. The results will provide evidence as to the forms through which glyphosate-derived nutrients enter Lake Erie and the likelihood of downstream impacts on harmful algal blooms and hypoxia.

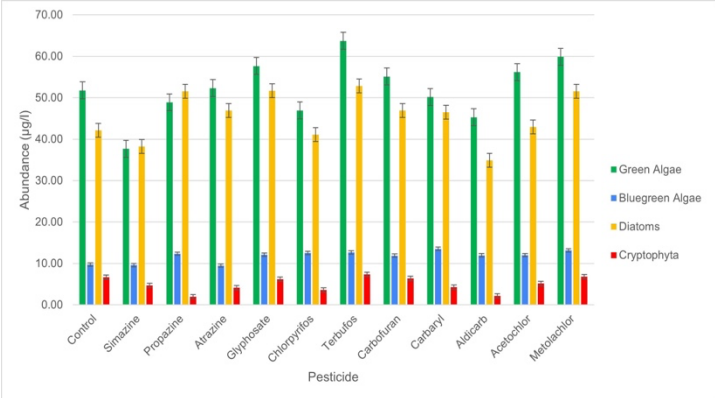

Figure 2. Algal concentration with pesticide treatment.

<u>Researcher Profile:</u> Dr. Saxton is an Assistant Professor at Miami University. His research focuses on how the strain on the world's freshwater, estuarine and coastal resources from a rapidly increasing global population influences microbial community dynamics and activity and how affected microbial communities impact important environmental issues, such as eutrophication, harmful algal bloom formation, hypoxia and climate change. He received his doctorate in Microbiology from the University of Tennessee, Knoxville.