

# Climate Change Research at Lacawac

By Rachel Pilla, PhD Student at Miami University, Oxford Ohio

The Global Change Limnology Laboratory at Miami University of Ohio has been working at Lacawac Sanctuary for many years to understand the lake's ecology and its responses to weather events and long-term climate change. Over the past 30 years, the Pocono Plateau has seen marked decreases in acid rain following the Clean Air Act Amendments in the early 1990s, but has



experienced some of the greatest increases in rainfall and storm events in the country due to climate change. As rainwater runs through the forests surrounding Lake Lacawac, it transports leaves, twigs, soil, and other organic material into the lake. This movement of organic matter into the lake, combined with decreases in acid deposition across the region, has reduced the transparency of Lake Lacawac through a process called "browning." Browning can affect the physical, chemical, and biological properties of a lake. Rachel Pilla, a graduate student at Miami, has been working at Lacawac to better understand these changes by monitoring the lake's temperature and oxygen changes and the responses of aquatic organisms. Her research shows that the decreases in water transparency in Lake Lacawac have led to warmer surface waters and cooler deep waters as light and heat are quickly absorbed near the surface of the lake. In addition, oxygen availability is decreasing the deep waters of the lake, which can pose problems for plankton and fish, a topic several students in this lab are currently investigating.

While Rachel has documented these temperature and oxygen changes during the summer, conditions during the winter months are less understood. Beginning in 2016, Rachel and her fellow graduate students deployed a set of "hidden" underwater sensors that record water temperature and oxygen availability every 15 minutes year-round, including while the lake is ice-covered, to better characterize the winter lake environment. These sensors showed a remarkable pattern during the mild winter of 2016-2017. During this period, Lake Lacawac froze as it usually does, but experienced a unique mid-winter thaw in February, before refreezing again a few weeks later. Rachel is working to understand the effects of this mid-winter thaw on

temperature and oxygen in Lake Lacawac, and how it might affect the lake in the weeks to months after the event. These sensors are currently underwater (or under ice) in Lake Lacawac collecting another year of data, which Rachel hopes will help her understand how mild vs. severe winters affect the lake.

The Global Change Limnology Laboratory also maintains an advanced aquatic buoy that has been deployed on the lake during the summer since 2011. The buoy, named ARTHUR (Aquatic Resource for High-Frequency Underwater Research) in honor of the founder and steward of Lacawac Sanctuary, Arthur Watres, is programmed to collect water quality data. Every six hours, a suite of profiling sensors are slowly lowered through the water column to record measurements of temperature, pH, water color, algae, and more. ARTHUR also has a weather station that records air temperature, rain, and wind data. Data are wirelessly sent to a computer to see real-time data in Lake Lacawac. ARTHUR is an excellent way to monitor changes in Lake Lacawac in response to unpredictable weather events, to collect data when researchers cannot collect data by hand, and to compare data and responses with similar buoys around the world. Recently, data collected by ARTHUR was compared with 11 other buoys from around the world to understand how these technologies advance our understanding of algae in different types of lakes.

