Western Lake Erie Basin Conservation Effects Assessment Project (CEAP) Wildlife Assessment Develops Models to Improve Stream Health with Agricultural Conservation Practices

The Conservation Effects Assessment Project (CEAP) is an effort sponsored by the Natural Resources Conservation Service (NRCS) to assess the effectiveness of agricultural conservation practices at reducing the impacts of agriculture on surrounding ecosystems.

In 2016, work was completed on a 4-year CEAP-Wildlife project focused on nutrient and sediment impacts on fishes in streams throughout the western Lake Erie basin (WLEB). This project convened partners from The Nature Conservancy, the USDA's Agricultural Research Service and NRCS, Ohio Sea Grant, The Ohio State University and Texas A&M University to develop a computer model that can assess in-stream ecological impacts of agriculture at spatial scales ranging from the entire western basin down to small watersheds. The analysis also focuses on the costs and benefits of conservation practices that reduce those ecological impacts.

The research team focused on western Lake Erie in part because of the region's connections to the harmful algal blooms (HABs) that have plagued the lake in late summer and early fall. Phosphorus and sediment inputs from the western Lake Erie watershed fuel those algal blooms, and improvements to stream health, even high up in the watershed, may well help reduce algal blooms in the lake. Of course, the streams themselves also offer important services like drinking water and recreational opportunities, and are home to a number of fish species that have declined dramatically over the past century.

The Maumee River, downstream of Providence Dam.
Credit: The Nature Conservancy

The research uses two indicators of environmental health:

- Top predators in a stream are fish (often sportfish like bass) that consume other fishes, but do not have predators themselves. Because these species are sensitive to environmental damage, their presence can be used to determine how healthy an ecosystem is overall.
- Index of Biotic Integrity (IBI) uses fish community structure to gauge stream conditions. It connects human disturbance on streams and watersheds to fish diversity, and gives managers a standard tool to use when targeting improvements to a damaged watershed.

The research shows that many streams in the western Lake Erie basin have high levels of sediment and nutrients (such as phosphorus and nitrogen), and that this is negatively affecting stream health. To manage agricultural water quality impacts, a suite of practices is needed to achieve measurable improvements to fish communities.

While the current model is focused on the western Lake Erie basin, the same approach can be adapted for use in other areas as well.

Figure 1, an example map from the research model shows how just a 20% reduction in nutrient and sediment inputs to streams can increase the health of top predator fishes. The more blue the map becomes, the healthier the watershed is considered to be, which in turn means water from that watershed is less likely to

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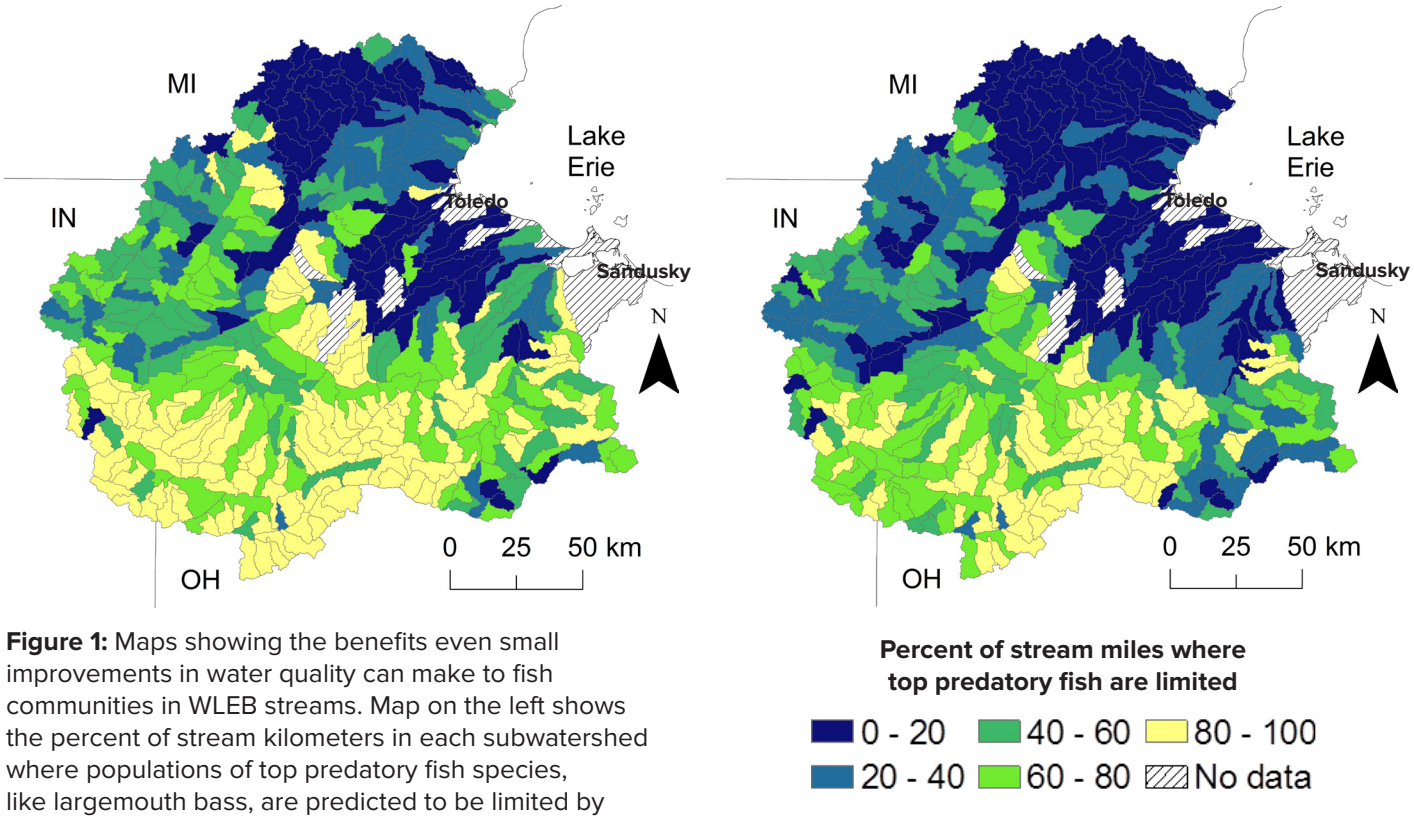

Figure 1: Maps showing the benefits even small improvements in water quality can make to fish communities in WLEB streams. Map on the left shows the percent of stream kilometers in each subwatershed where populations of top predatory fish species, like largemouth bass, are predicted to be limited by sediments and nutrients. Map on the right shows the same percentages after a simulated 20% reduction in sediments and nutrients. Note: The maps are based on model estimates and not direct observation.

contribute to harmful algal blooms and other problems in Lake Erie.

Shifting colors in the maps can also help pinpoint the small watersheds where future changes in land use practices would have the biggest impact on stream fish communities. While some spots don't change color at all, suggesting little if any improvement, others transition into healthier conditions. This is particularly evident in the northwestern map region, which shifts from regions of mostly 40-80% water quality impact to areas of 0-40% impact with a 20% reduction in nutrient and sediment inputs.

That 20% reduction can be achieved through a combination of best management practices on and around farm fields. On the field, proper timing of fertilizer use, such as not applying to frozen ground or before rainstorms, as well as incorporating fertilizer into the soil, significantly reduces nutrient loss to streams and saves farmers money in fertilizer cost. Managing the water that drains from fields via buffer strips of vegetation between fields and streams, as well as managing drainage water in tile systems, can help keep nutrients and sediment on the field instead of running into streams. Such practices are an integral component of comprehensive watershed management.

While efforts to reduce agriculture-related water quality impacts have increased in recent years, additional expenditures are likely needed to make a difference in stream fish communities. In addition, it is important to note that: efforts should not focus solely on phosphorus, but must also address nitrogen and sediments, we must include a combination of structural practices and nutrient management, and that a high percentage of agricultural lands, up to 100% in a given watershed, should be treated to see measurable in-stream benefits. While it will take a whole suite of practices to achieve those measurable improvements, change is definitely possible.

Additional scenarios are available in the full WLEB CEAP report, which can be found online at ***lakeerieceap.com***.

For more information about the Western Lake Erie Basin CEAP Wildlife Assessment, contact Amy Brennan at ***abrennan@tnc.org*** or use the Contact form at ***lakeerieceap.com***.