The Nature Conservancy
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How Much is Enough?

Conservation Effects Assessment Project (CEAP)

The Conservancy's work in the Saginaw Bay Watershed is focused on answering a fundamental question that has plagued resource managers for decades: How much conservation is enough to actually achieve desired ecological outcomes?

To answer this question, the Conservancy and partners completed a two-phased research project to link 1) aquatic ecosystem health to water quality variables and 2) water quality variables to conservation practices. The final product of these analyses is an approach that can directly link conservation practices on agricultural landscapes to ecological outcomes. Modeling these relationships based on historical conditions and data, it's possible to model alternative conservation implementation scenarios and their corresponding ecological outcomes. These modeled alternative scenarios can provide information to determine what ecological outcomes are possible for a particular watershed and the associated conservation investment necessary to achieve it, thereby informing realistic and attainable watershed goals.

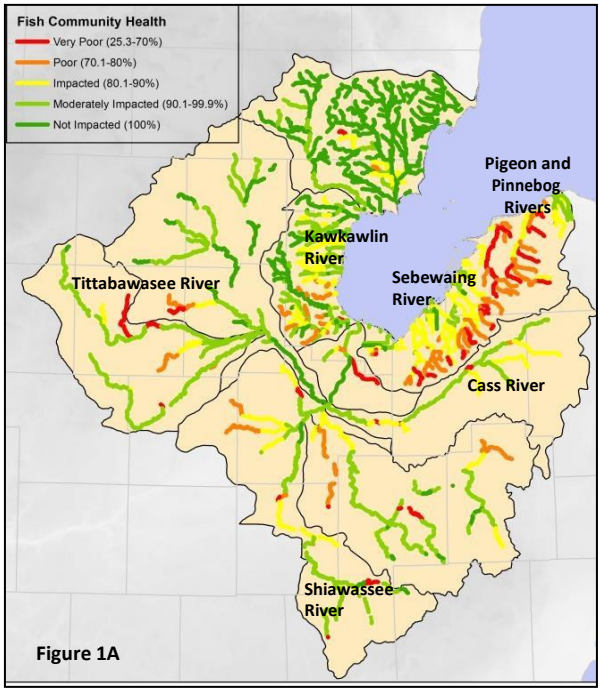

Figure 1A

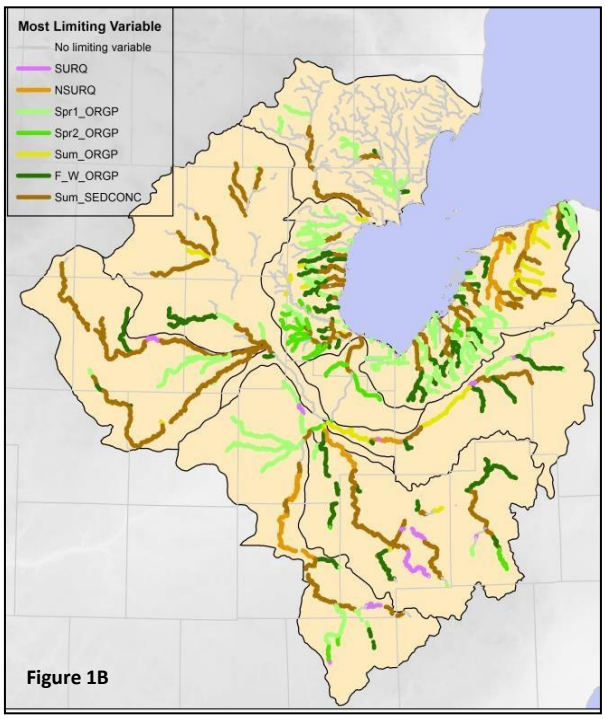

Figure 1B

The analyses that underlay this approach were performed as part of the US Department of Agriculture - Natural Resources Conservation Service's (NRCS) Conservation Effects Assessment Project (CEAP). Phase One of the project analyzed landscape characteristics (land-use and management, soil type and slope) to estimate water quality and flow conditions by stream segment across a large watershed, such as the Saginaw Bay Watershed. The relationships between water quality and flow conditions with actual fish community health data were used to identify the primary water quality or flow variables that limited stream health (**Figure 1B**), as measured by the Index of Biotic Integrity (IBI) a composite measure of fish diversity and abundance and an indicator of overall watershed health.

These relationships could then be used to identify both the potential level of stream health for the river segment, as opposed to current levels (**Figure 1A**), as well as the threshold at which fish communities would be expected to improve or stay healthy given a particular level of a water quality or flow variable. Stream segments where water quality or flow variables were below the threshold for fish community response and where potential fish community health was greater than present conditions represented areas where conservation practices can have an effect on stream ecological health.

Conclusion: Summer levels of sediment and seasonal levels of organic phosphorus are the most common water quality variables limiting aquatic ecosystem health in the Saginaw Bay Watershed.

Building on the findings of the Phase One work, Phase Two of the CEAP analysis explored the effects of conservation best management practices (BMPs) on water quality and flow variables and ultimately fish community health outcomes. The effects of agricultural BMPs on water quality and flow variables and fish community health were captured in "dose-response" relationships, where a certain dose of BMPs would provide a response in fish community health. Conservation BMP implementation scenarios, representing 25% and 50% coverage of agricultural acres with conservation practices, were used to estimate the response in stream ecosystem health (Figure 2). Based on the projected stream ecosystem health under these different scenarios, it's possible to determine "how much conservation is enough", or not enough, to attain non-limiting conditions for fish community health in the sub-watersheds within the four Saginaw Bay watersheds analyzed (**Figure 2**).

Agricultural best management practices are often conventionally implemented opportunistically across broad landscapes, and often in a non-targeted manner. Although these activities produce many environmental and ecosystem benefits, greater results—i.e., ecological outcomes—can be achieved more efficiently with watershed and field level targeting. From maps, such as in **Figure 2**, it's possible to determine which sub watersheds will provide the most biological improvement per conservation investment.

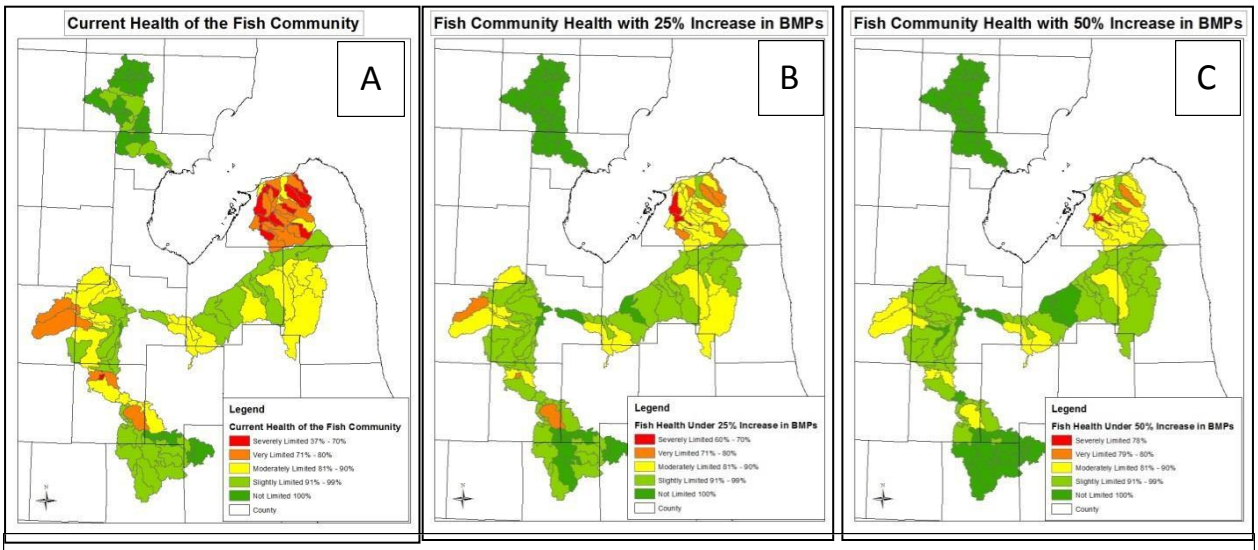

Figure 2. Fish community health depicted under the current level of practices (A), under a 25% increase in practices (B) and under a 50% increase in practices (C). Green reflects very healthy fish communities not limited by water quality or flow variables, while orange and red areas reflect moderately to extremely limited fish communities.

The Conservancy used the above analysis to set outcome based goals in these watersheds.

Conclusion: *Long-term BMP* implementation goals (totaling **209,000 acres**) will achieve a slightly to non-limited fish community health conditions in the Cass and Shiawassee River Watersheds and moderately limited fish community health conditions in the Pigeon-Pinnebog River Watersheds **(Figure 3).**

To learn how this data can be used by the agriculture community, stakeholders, and others, refer to the ***Great Lakes Watershed Management System*** *fact sheet.*

For more information on the Phase I and II CEAP projects, please refer to:

http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1047736.pdf
http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1088482.pdf

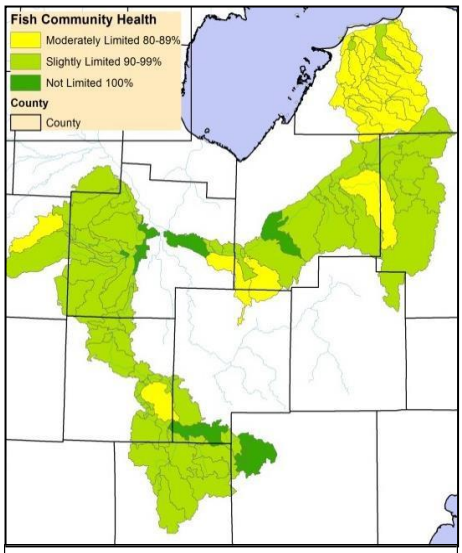

Figure 3. Long-term goals for ecological health: ≤80 IBI (yellow) in sub-watersheds of the Pigeon-Pinnebog River watersheds, and ≤90 IBI (light green) in sub-watersheds of all other Tier 1 focal areas.