NESP Community Examples:
ESCMs as a Participatory Research Tool in Resource Management

A Use Case from Key-Log Economics
http://bit.ly/NI-ESUC

CONTEXT

Lake Erie provides drinking water to over 11 million people and produces more consumable fish than all the other Great Lakes combined. In the past 20 years, a decline in water quality from nutrient pollution has led to severe hazardous algal blooms and hypoxia events. Efforts by organizations, businesses, and governments, both at the local level and through binational agreements, have set a goal to reduce nutrient loadings of phosphorus by 40% to better maintain this critically important freshwater source. A project carried out by Key-Log Economics used an ecosystem service conceptual model (ESCM) framework to identify and quantify how phosphorus reductions in Lake Erie might lead to the improvement of key ecosystem service values and economic benefits in the region.

PROCESS

In Phase I of the project, we collected primary literature on ecosystem service values and delivery in the Great Lakes Region, with particular focus on Lake Erie. Our literature review of the region allowed us to create an annotated bibliography with relevant studies and laid a strong foundation of input data for an ecosystem services assessment. Phase II began by developing an ESCM that laid out the most important pathways by which the predefined stressor (phosphorus input) connects to biophysical and economic outcomes (Fig. 1). Once a management action (reducing phosphorus loads) and pathways between the action and ecosystem services were established, we used stakeholder input as a basis to develop the conceptual models and estimate how changes in ecosystem service provision in the Lake Erie subregion translated into economic benefits.

We incorporated stakeholder input using an online survey and two online webinars, to refine and prioritize ecosystem services that people in the subregion value and use. Through the online survey, we received 136 spatially explicit (relative to the western, central, and eastern basins) responses detailing stakeholder sentiments on the ecological and economic conditions in the Lake Erie area. The survey results allowed us to prioritize what key sectors, industries, activities, stressors, environmental issues, ecosystem benefits, values, and possible actions should be further discussed in the webinars. Stakeholders participating in the survey varied widely, ranging from business owners, retirees, teachers, farmers, local elected officials, recreationists, and academic experts. The webinars took a deeper dive into the most frequently mentioned topics in the survey. Participants provided local context on sectors, stressors, and ecosystem benefits, as well as provided sources to data and contacts.

The associated change in value of ecosystem goods and services is estimated using the "production function approach," which has been used frequently to estimate agricultural relationships and connect the amount of a commodity produced to units of inputs. For example, if one considers that gallons of clean water, days spent recreating on a beach, or trips taken by recreational anglers, are commodities, then the value of those goods and services are the number of gallons, days, or trips (respectively) multiplied by the value per unit. The advantages of this

approach include that it provides estimates of the biophysical and economic quantities associated with ecosystem outputs. We estimated the following outcomes (shown in bright green in Figure 1):

1. Consumer surplus gains for recreational anglers and beachgoers
2. Economic benefits from reduced beach closures
3. Avoidance of property value losses
4. Potential algae-related costs to public water suppliers sourcing directly from Lake Erie

In sum, we implemented this approach through three elements in this analysis:

- Evaluating means-ends using the National Ecosystem Service Partnership Guidebook
- Spatial analysis connecting nutrient sources, sinks, and benefit areas
- Estimating key ecological and economic outcomes

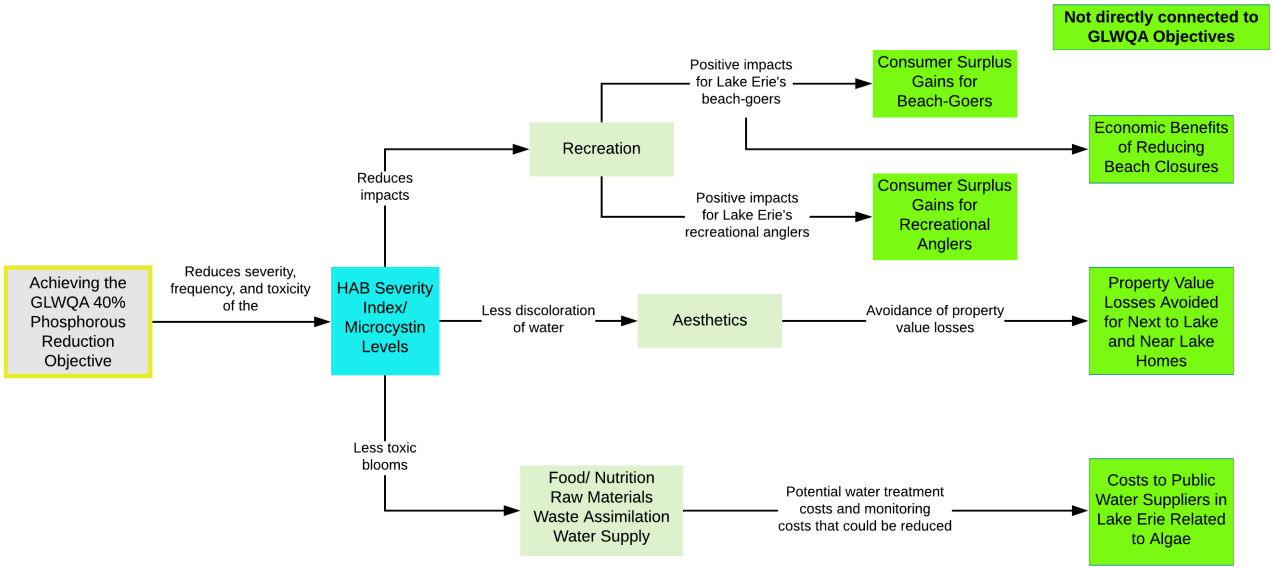
Resources Used

National Ecosystem Service Partnership Guidebook: The framework for concept mapping guided how these diagrams were introduced and developed in stakeholder webinars.

APPLICATIONS

The research will be utilized by officials and managers in local governments to help secure funding for cleanup efforts and to usher in new accountability legislation for industrial agricultural operations. Use of the ESCM (means-end diagrams) in the Lake Erie ecosystem service assessment facilitated quantitative estimates of the economic benefits to recreation, water quality, and aesthetic value not previously estimated for the entire Lake Erie subregion.

Figure 1. Lake Erie HAB Diagram



ADDITIONAL RESOURCES

Balmford, A., B. Fisher, R.E. Green, R. Naidoo, B. Strassburg, R. Kerry Turner, and A.S.L. Rodrigues. 2010. "Bringing Ecosystem Services into the Real World: An Operational Framework for Assessing the Economic Consequences of Losing Wild Nature." *Environmental and Resource Economics* 48(2): 161–175. https://doi.org/10.1007/s10640-010-9413-2

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Wang, S., C. Alkire, A. Perry, and S. Phillips. 2019. Lake Erie Ecosystem Services Assessment: Economic Benefits from Phosphorus Reductions. Report prepared for the Lake Erie Foundation. Charlottesville, VA: Key-Log Economics. 137 pp. Retrieved from http://www.keylogeconomics.com/uploads/1/1/9/5/119575398/le_ecosystemserviceassessment201911finalrevised.pdf.