LAKE ERIE'S ECOSYSTEM SERVICES

QUANTIFYING THEIR $$ VALUE

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> We argue that ecosystem service valuation can facilitate the decision-making process by identifying cost-effective restoration actions.
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> Our literature review found that the $ values projected for ecosystem services in Lake Erie are **substantial**. These $ values are likely to be under-estimations, and include: water quality improvements, erosion risk reduction, recreation, and angling.

Background

Ecosystem services are the benefits that humans directly or indirectly gain from ecosystem functions (Costanza et al., 1997).

Ecosystem service valuation describes how human decisions affect ecosystem services and express these changes in $$ that allow for their incorporation in the decision-making process.

Current markets provide information about the value of a limited subset of ecosystem services that are priced as commodities (Pascual et al., 2010), which poses challenges in our ability to estimate values of a comprehensive set of ecosystem services typically considered in the decision-making process (Millennium Ecosystem Assessment, 2005).

Results

Method	Data requirements	Advantages	Notes / Limitations	Examples in Lake Erie
Hedonic valuation (revealed preference): assumes that the value individuals place on a commodity is based on the attributes it possesses.	▸ Property market prices ▸ Individual property characteristics ▸ Distance from environmental attributes	▸ Based on observed behaviour in property values	▸ Property market should be near-equilibrium with an appropriate size and coverage ▸ Assumes that buyers have complete knowledge about environmental attributes ▸ Difficult to isolate the effects of the environmental attribute on property value	Dorfman et al. (1996); Kriesel et al. (1993)
Travel cost modelling (revealed preference): rationalizes that the value of a site is reflected in the willingness to pay the associated travel cost.	▸ Individual travel costs ▸ On-site expenses ▸ License fees (if applicable) ▸ Capital expenditure on recreational equipment (if applicable) ▸ Value of time spent travelling ▸ Socioeconomic characteristics of users	▸ Based on observed behaviour	▸ Travel distances are ideally relatively short, and sample has a variety of distances, costs and socioeconomic characteristics ▸ Can be confounded if the visit is not intended for the specific ecosystems service (i.e., trip made for multiple destinations) ▸ Assumes that users have complete knowledge about the ecosystem service being used ▸ Cannot value ecosystems that are not visible or well understood (e.g., nutrient cycling, erosion control)	Chen (2013); Hushak et al. (1988); Kelch et al. (2006); Murray & Sohngen (2001); Sohngen et al. (1999); Sohngen et al. (2015)
Contingent valuation (stated preference): uses a context of a hypothetical market in which individuals about their willingness to pay for ecosystem services (for which markets do not exist) through questionnaires and/or interviews.	▸ Ecosystem characteristics/ function ▸ Socioeconomic characteristics of respondents	▸ Can be used to value almost all environmental attributes (i.e., ecosystem services without markets or parallel markets)	▸ Typically cost and time intensive to implement ▸ Biases are common in survey responses due to hypothetical nature of the market ▸ Low income constrains willingness-to-pay for ecosystem services	Brox et al. (1996); Kreutzwiser (1981)
Benefit value transfer (benefits transfer): estimates values by transferring values from a primary valuation study conducted for a similar site.	▸ Primary valuation results for a site similar to target site	▸ More cost and time effective than primary valuation studies ▸ Recommended to be used to scope if a more in-depth primary valuation study is required	▸ Estimates from primary studies can be outdated ▸ Results tend to be less accurate than the primary study since estimates are unlikely to be perfectly transferable	Hayder (2014); Palm-Forster et al. (2016); Wolf et al. (2017)
Benefit function transfer (benefits transfer): adjusts for differences in the characteristics of the population/site between the primary study and target sites. The result is more relevant to the targeted site.	▸ Primary valuation results for a site similar to target site ▸ Detailed site and population characteristics for both the primary study and target sites	▸ More cost and time effective than primary valuation studies (although requires more resources than benefit value transfers) ▸ Recommended to be used to scope if a more in-depth primary valuation study is required	▸ Estimates from primary studies can be outdated ▸ Results tend to be less accurate than the primary study since estimates are unlikely to be perfectly transferable (although result is more robust than benefit value transfer)	Palm-Forster et al. (2016)

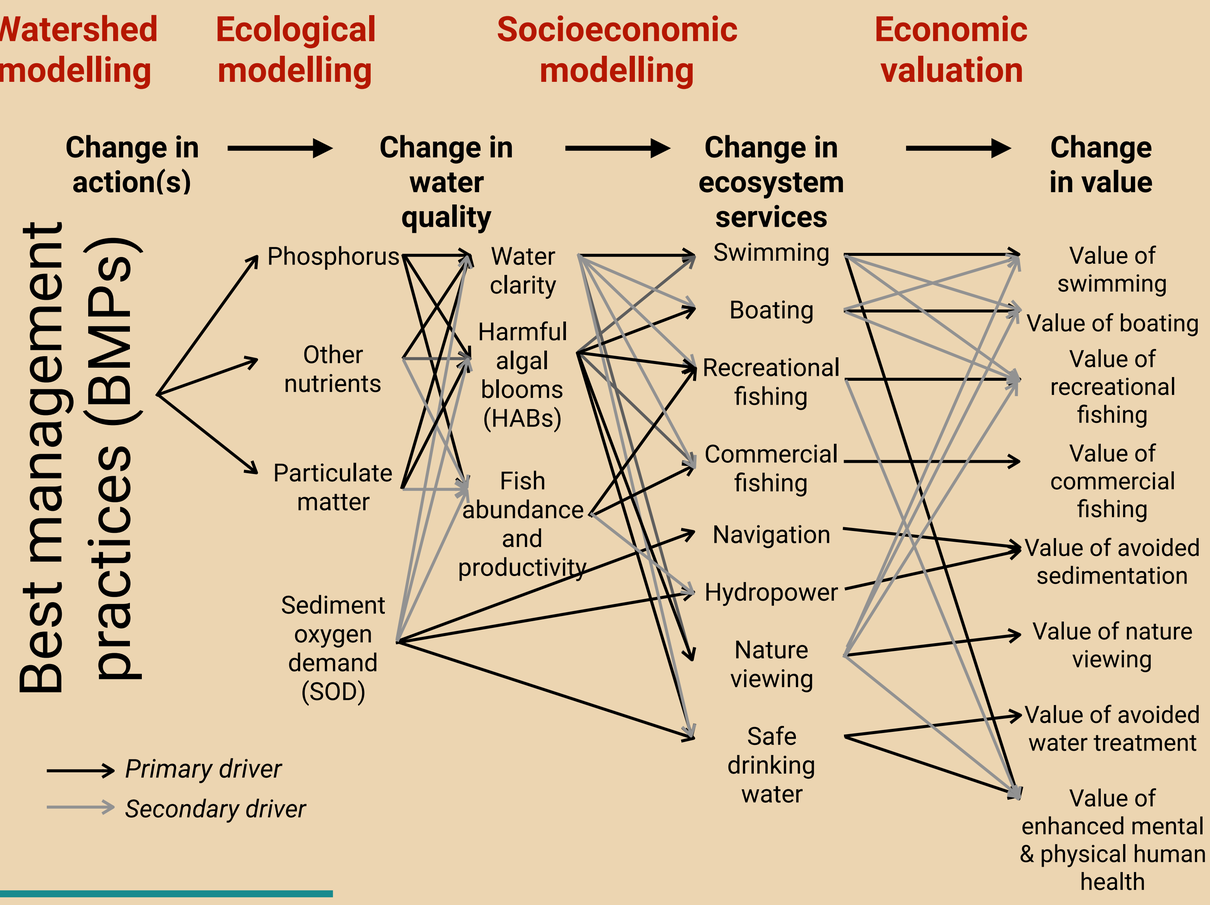
Significance

Ecosystem service valuation can **facilitate the active involvement of stakeholders** and allow for new insights and knowledge to be passed into the decision-making process — which can be particularly helpful in Lake Erie given its complex ecology and diverse stakeholder groups with divergent goals, priorities, and values. We argue that the efficacy of the **local restoration efforts will be significantly enhanced** by a rigorous framework that quantifies the economic benefits from a well-functioning ecosystem.

Rather than solely acknowledging their vulnerabilities, the **actual quantification of the value of ecosystem services is critical** when considering trade-offs among diverse policy decisions.

Future Directions

Integrating scientific knowledge with ecosystem service values can promote **knowledge co-production and co-learning** among technical experts, stakeholders, and decision-makers (Laniak et al., 2013). The wealth of watershed and aquatic ecosystem models in Lake Erie offers an excellent foundation upon which we can depict relationships among human actions, water quality trends, multiple ecosystem goods and services, and associated changes in values.



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How can you get involved?

https://arcg.is/1D5v4f

We are conducting an ecosystem service valuation survey for Cootes Paradise marsh in Lake Ontario to estimate its value!

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