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Scenario analysis: An integrative and effective method for bridging disciplines and achieving a thriving Great Lakes-St. Lawrence River basin

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ABSTRACT

The Great Lakes-St. Lawrence River basin community is challenged in achieving a basin that thrives ecologically, economically and socially. Although natural science, social science, policy, and law literatures offer insight into understanding and developing policies for the Great Lakes-St. Lawrence River basin, these literatures are constructed in disciplinary silos. Scenario analysis supports an approach that transcends disciplines and embraces uncertainty. It facilitates dialogue among stakeholders and adds depth and diversity to the science-policy interface. We provide evidence for why scenario analysis is effective, why it was used in the Great Lakes Futures Project, and how its results can be used to complement and strengthen interdisciplinary scholarship and current management within the basin.

Introduction

The challenge of meeting the social, economic, and environmental policy needs of the Great Lakes-St. Lawrence River basin is shared among scholars, policy makers, and stakeholders at' the local, state/provincial, federal, and binational levels. Barriers to meeting these needs are encountered at many levels. Institutional fragmentation in the region is prominent and complicates effective ecosystem governance. Horizontal and vertical cooperation requires actions by two federal governments, two provinces, eight states, four region-wide institutions, over 120 First Nations and tribes, and thousands of local government jurisdictions and agencies (Hildebrand et al., 2002). To meet policy needs, it is critical to engage each of these actors, made difficult because they come from different sectors (government, non-government, industry, public, academic) and operate at different scales (from international to local).

Confounding effective cooperation further is the difference among academic disciplines, such as the approaches taken in science and policy studies (Sarewitz and Pielke, 2000). The inability of science to provide absolute certainty in its predictions (Allen et al., 2001; Ehrlich and Ehrlich, 1998) complicates its integration into policy, as social values often desire high certainty (Steel et al., 2004). Furthermore, language and methodological barriers often prevent common ground between science and policy. For example, "the scientific community tends to consider the 'resource' as the starting point and the policy maker often considers the 'social consequences' of resource use as a starting point" (McLaughlin and Krantzberg, 2006). In light of these complications, multiple tools are being used in natural science, social science, policy, and law in attempts to overcome these barriers.

Here, we argue that scenario analysis is an important, but underutilized tool in Great Lakes basin resource management. Scenario analysis is an effective and valuable methodology that complements and can leverage current management strategies because it: 1) transcends disciplines; 2) considers uncertainty; 3) creates a common language for the science-policy discourse; 4) considers multiple overlapping and interacting scales; and 5) can reveal important questions for future research. To support our argument, we present a case study of the Great Lakes Futures Project (GLFP) and how scenario analysis was used to reveal policy gaps and recommendations (Friedman et al., 2015).

Abbreviations: IAGLR, International Association of Great Lakes Research; IJC, International Joint Commission; ILM, Intuitive Logistics Model; IPCC, Intergovernmental Panel on Climate Change; GLFP, Great Lakes Futures Project; GLOS, Great Lakes Observing System; FFP, Forest Futures Project; USEPA, United States Environmental Protection Agency.

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Why current approaches are incomplete

Scientific approaches

Scientists often design, conduct, and publish research with results that could be directly integrated into policy action and synthesis. For instance, to maximize the social and ecological benefits of restoration initiatives, Allan et al. (2013) used a high-resolution assessment of 34 cumulative stressors across the basin to inform areas where restoration would provide the greatest payoff (Fig. 1). In another example, Bosch et al. (2013) analyzed the efficacy of sediment and nutrient loading agricultural Best Management Practices to inform managers and policy makers on necessary implementation strategies to substantially reduce Lake Erie nutrient loading. Scientists also have recommended strategies to be taken to protect, restore, and remediate the Great Lakes basin (Bails et al., 2005; Mortsch et al., 2003). Although these are valuable research enterprises, it is often challenging to integrate these relevant findings into policy action.

Scientists facilitate knowledge transfer into policy by making their data and research findings publically accessible. The Great Lakes Science-Policy Initiative, conducted by the International Association of Great Lakes Research (IAGLR) (IAGLR, 2003), indicated that such information repositories are essential for effective knowledge transfer. Examples of such databases include the United States Environmental Protection Agency (USEPA)'s Great Lakes Environmental Database and Storage and Retrial Data Warehouse, as well as the Great Lakes Observing System (GLOS). The Great Lakes Environmental Database is one that facilitates Great Lakes basin data entry, storage and accessibility (USEPA, 2013a: http://www.epa.gov/greatlakes/monitoring/data_proj/glenda/index.html), while the Storage and Retrial Data Warehouse provides a publically accessible repository of national water quality monitoring data collected by water resource management groups (USEPA, 2013b: http://www.epa.gov/storet/). Complementing these two databases is GLOS, founded in 2003 to provide a binational observing system that strengthens linkages between data users and providers in support of informed policy and decision making for the Great Lakes basin (GLOS, 2011). Although these databases provide a rich and accessible resource, the relevance of these data need to be translated, and translated appropriately, to decision makers for effective policy and practice.

Scientists also participate in advisory boards and councils. For the Great Lakes basin, scientists communicate and translate science into recommendations for policy makers to inform policy needs around Great Lakes basin's management (IAGLR, 2003). Such boards include the Great Lakes Water Quality Board, the Great Lakes Science Advisory Board, and the Council of Great Lakes Research Managers of the International Joint Commission (IJC) (IJC, 2013a (http://ijc.org/boards/cglrm/), IJC, 2013b (http://ijc.org/en_/sab); Krantzberg, 2004). These boards provide mechanisms for informing policy with science. Although scientists do participate in these important advisory boards, effective communication is not guaranteed. As noted by Aumen and Havens (1997), a new type of scientist is needed, those that are “highly competent applied scientists possessing the desire, creativity, and

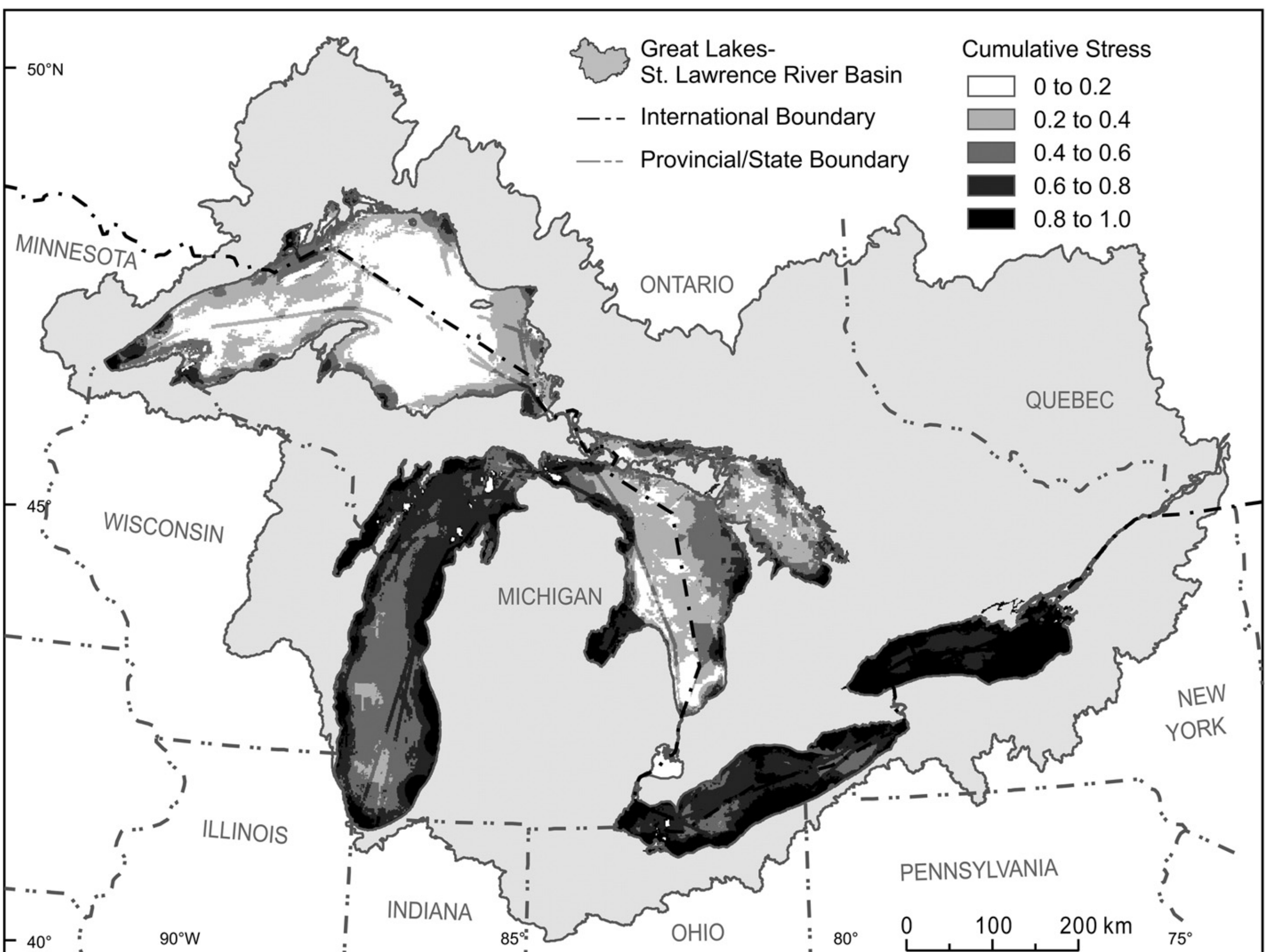

Fig. 1. Map of cumulative stressors for the Great Lakes-St. Lawrence River basin (data source: Great Lakes Environmental Assessment and Mapping Project, published in Allan et al., 2013).