Systems thinking and the ecosystem approach

by Peter Stoett and Paula McIntyre

Large lakes are complex, open systems that face myriad threats. They cannot be managed over the long term without respecting the interactions between their component parts, including coasts, water, biodiversity, drainage points, economic sectors such as fisheries and tourism, and pollution, to name a few. Further, the human dimensions cannot be ignored nor minimized. The demands of adaptive governance of large lakes can only be met if policy makers and stakeholders alike take a systems approach to thinking about problems and solutions.

In our discipline-driven work, we can lose sight of the broader system in which we are engaged. Most environmental management efforts were initially focused on an equilibrium view—the pursuit of static as opposed to dynamic stability—and on the control of variables ("command-and-control" management). What does it mean to take a systems thinking approach to complex problems? In the words of Donella Meadows, a system is "an interconnected set of elements that is coherently organized in a way that achieves something" (Meadows 2008). Examining a system by observing only the component parts is generally referred to as a reductionist approach; a systems thinking approach, in contrast, implies that we need to consider how those parts interact (Waltner-Toews et al. 2008). As David Peter Stroh writes, "optimizing the system requires improving the relationships among its parts, not optimizing the individual parts as is often assumed and rewarded" (Stroh 2015).

> **"Optimizing the system requires improving the relationships among its parts, not optimizing the individual parts"**
>
> David Peter Stroh

One approach that has gained legitimacy at the regional and global levels is the ecosystem approach, which has been endorsed by the Parties to the United Nations Convention on Biological Diversity (CBD). According to Article 2 of the CBD, an ecosystem is "a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit." Ecosystems are not stable, pristine entities from which we can inexhaustibly draw beneficial resources. They are characterized by thresholds, regime shifts, resilience, leverage points, and feedbacks.

The ecosystem approach demands flexible thinking, adaptive management, and the ability to respond to feedbacks. This may entail interagency cooperation among governing authorities, or even deep organizational change, and the participation by many stakeholders in consensus-based decision making, rather than command-and-control by a few. Great Lakes management has proven a leader in this effort, and researchers focusing on various parts of these ecosystems have much to contribute and coordinate as they pursue the common goals of promoting sustainability and resilience.

In this pursuit, it's important to recognize that systems work is happening under different terminology, frameworks, and worldviews, and it can be helpful to learn from these existing approaches. For example, some researchers consider lakes as part of *socioecological systems*, a view highlighting that real people with rights and obligations live within the ecosystems being studied. Indeed, it is increasingly common to refer to *biocultural systems,* a framing stemming partially from a much older conceptualization of interconnected life originating in Indigenous worldviews (e.g., the Haudenosaunee Thanksgiving Address, see p. 6). Biocultural community protocols can represent these systems according to local understandings and governance arrangements, and be shared with national governments as well as researchers working in the area. Regardless of whether such protocols exist, simple research ethics demands the free, prior, informed consent of local communities before research is conducted, and the open sharing of results. It is foolhardy to ignore the accumulated wisdom of the caretakers of land and water, many of whom have been engaged in a form of systems thinking all along.

Systems thinking is a method that has emerged to guide people toward transformative change. It calls for relinquishing the idea of controlling a system or completely understanding it. Instead, Meadows writes, "We can listen to what the system tells us, and discover how its properties and our values can work together to bring forth something much better than could ever be produced by our will alone." On the following page, we share some ways to get started.

Peter Stoett is Dean of the Faculty of Social Science & Humanities at Ontario Tech University and co-chair of the IPBES Assessment on Invasive Alien Species. Paula McIntyre is communication director of the International Association for Great Lakes Research.

Stepping into systems thinking

Plan to adapt

Because lake ecosystems are open systems constantly influenced by external forces, we need to accept uncertainty as the norm and plan accordingly. Rather than making a fixed, long-term plan, know what you're aiming for, design an initial step with other stakeholders, and test it out. Monitor and evaluate what happens, learn from the experience, and adjust. Repeat with your next best shot.

Know the conditions

Understanding the conditions that affect a system helps us to prioritize our efforts. While there are different models (e.g., the iceberg model, the six conditions of systems change), in general, responding to the explicit conditions that demand our attention, such as news and events, will rarely leverage long-lasting change. Systems thinking requires us to go deeper, looking not only at policies, practices, and resource flows, but relationships, power dynamics, and underneath it all, our mental models that hold the system in place. Addressing these implicit conditions holds the power for us to transform a system (Kania et al. 2018).

Broaden your timelines

Systems thinking asks us to extend our timeline when considering our ecosystem work. We need to take a cumulative view that looks at impacts over time and focuses on sustainability (resilience promoted through adaptive management and governance). "It is easy to ignore larger systems if your time horizon spans only months and quarters," writes Peter Senge. "Your perspective shifts when you think about consequences of your decisions over decades." (Senge et al. 2010)

Set your boundaries

An ecosystem approach considers the whole array of ecosystem components (e.g., human activities, habitats, species, and physical processes) and interactions, as well as the services they provide. Yet analyzing every single component and linkage within an ecosystem would be physically and intellectually impossible. Instead, we should concentrate on what we feel are key elements and the interactions between them and set a suitable boundary around them. Meadows urges us to "invent boundaries for clarity and sanity," while also cautioning us that "boundaries can produce problems when we forget that we've artificially created them" (Meadows 2008).

Map your system

Mapping a system involves creating a visual representation of the relationships between parts, feedback loops that help drive the system, and forces affecting the system. It is a complex, subjective exercise that can help identify possible leverage points where concerted action can affect the whole. While it may seem that a map is the intended benefit of this exercise, the real benefit of systems mapping is that it provides a way for all stakeholders to engage in the process. It helps them to see how they contribute to the performance of the system as a whole, whether good or bad. (Stroh 2015).

Discover your story

How you tell the story of your system can have a profound impact on the success of your efforts. "Stories make, prop up, and bring down systems," writes Ella Saltmarshe. "Stories shape how we understand the world, our place in it, and our ability to change it." The creation of the Detroit River International Wildlife Refuge illustrates the power of story. One of the few urban refuges, and the only international one in North America, a story helped unite people with different perspectives around a shared vision. This binational story told of how cooperative conservation is re-creating gathering places for people and wildlife in the refuge. This story "had to be carried in the hearts and minds of all, and had to result in shared meaning" (Hartig 2015).

See yourself in the system

Becoming well-versed in systems is an important capacity to develop. Through systems thinking, we come to see that the greatest leverage we have to change a system begins with changing ourselves (Stroh 2015). Systems thinking helps us understand that developing collaborative skills, sharing information, building relationships, and adopting a learning mindset are not just niceties; they are vital for transformative change. Taking the responsibility to be the best version of our "systems self" and understanding our own position and role will help us to collectively design and sustain the healthy large lake ecosystems we envision.

By Paula McIntyre and Peter Stoett