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Towards meaningful research and engagement: Indigenous knowledge systems and Great Lakes governance [☆]

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ABSTRACT

For thousands of years, Indigenous peoples governed their relations in the Great Lakes region, guided by distinct political, legal, governance, and knowledge systems. Despite historic and ongoing exclusion of Indigenous peoples from Great Lakes governance in the Canadian context and other assaults on Indigenous sovereignty, authority, jurisdiction and responsibilities, Indigenous peoples have maintained their relationships with the Great Lakes. In recent years, Indigenous knowledge systems (IKS) have made inroads in Great Lakes governance, thanks primarily to First Nation political advocacy. However, it remains a challenge to include Indigenous knowledge and implement approaches that bridge Indigenous and Western ways of knowing. Instead of asking, "What needs to be done to support research into Indigenous knowledge systems?", more appropriate questions addressed in this paper are: "What needs to be done to support Indigenous peoples to uphold, strengthen, revitalize Indigenous knowledge systems so they are able to share knowledge if they wish?" and "How can external institutions, agencies, and people engaged in sustainable management of Great Lakes ecosystems better prepare to engage with IKS respectfully and in the manner required by First Nations?". In this paper, we demonstrate a First Nations-led knowledge sharing approach to research. In addition to making important contributions to Great Lakes governance and to the scientific research landscape in Canada, this paper points to the requirement to support Indigenous research capacity by building the necessary infrastructure and funding to ensure Indigenous people can lead their own research.

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Introduction

The Great Lakes were first visited by Europeans over four hundred years ago, and since then, the Lakes' environs have been severely altered. The evidence can be seen everywhere—massive multi-land highways, huge mega-cities, large-scale technological 'improvements' that have altered vast landscapes, mines, power plants, nuclear generating stations, paper mills, steel smelters,

water diversion projects—the list goes on and on. In technology's wake we see pollution of the air, water, our land, and even our own bodies. (Bellfry, 2014, p.xv).

The Great Lakes Ecosystem in North America holds 20% of the fresh water in the world and supports over 40 million people. The Great Lakes Ecosystem is the largest inland water transportation system in the world and is regarded as having the best source of fresh water on the planet (Freedman and Neuzil, 2018). The Great Lakes Ecosystem sustains over 4,000 species of flora and fauna and is one of the most ecologically diverse ecosystems on Earth (US-EPA & ECCO, 2017). For thousands of years, the Great Lakes Ecosystem was governed through Indigenous inter-national (between nations through treaties), regional (e.g., confederacies), and local (through clan systems) relations (Johnston, 2005). Many

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of these aspects exist to this day (King, 2014; Marshall et al., 2020; Whyte et al., 2018). The relationships between Indigenous peoples and Great Lakes have been disrupted (yet have not disappeared) due to colonization, settlement, industrial expansion, capitalism and now globalization. Guided by their own political, legal, governance and knowledge systems, Indigenous peoples have maintained their relationship with the Great Lakes despite historical and on-going assaults on their sovereignty, authority, jurisdiction, and responsibilities (Johnston, 2005; McGregor, 2014b).

Until recently, Indigenous peoples in the Canadian context have been excluded from Great Lakes governance; for example, the *Great Lakes Water Quality Agreement* (GLWQA, 2012), the primary agreement between Canada and United States to protect, restore and conserve the Great Lakes. First signed in 1972, various iterations of the GLWQA over the past four decades have “committed to a shared vision of a healthy and prosperous Great Lakes region in which the waters of the Great Lakes, through their sound management, use, and enjoyment, provide benefits to present and future generations [and] restore and protect water quality and ecosystem health” ((Government of Canada GoC, 2023a)GoC, 2023a). The current GLWQA (2012) reflects the long-standing history of cooperation between Canada and the United States to protect the Great Lakes. While Canada is responsible for participating in international negotiations regarding the Great Lakes, it cannot unilaterally implement provisions that fall under provincial authority and jurisdiction. Cooperation is therefore required with the provinces to deliver on the GLWQA. Thus, the first Canada-Ontario Agreement respecting the Great Lakes Basin Ecosystem (COA) was first signed in 1971 (COA, 2021; Ontario, 2023a). The first COA represented a joint effort between Canada and the province of Ontario to protect the Great Lakes. Over 50 years, nine COAs have been negotiated and signed, with the current Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health (COA) signed in 2021. COA is the federal-provincial agreement that “supports the restoration and protection of the Great Lakes basin ecosystem. The COA outlines how the governments of Canada and Ontario will cooperate and coordinate their efforts to restore, protect and conserve the Great Lakes basin ecosystem” ((Government of Canada GoC, 2023b; COA, 2021). First Nations involvement and input into COA negotiations formally began in 2001, at which time a distinct First Nations annex was called for. Over a decade later, the 2014 COA finally included Annex 13: Engaging First Nations, which has remained in the 2021 COA (COA, 2014; COA, 2021).

However, amendments to the GLWQA (2012) and 2021 COA, the domestic agreement charged with implementing Canada’s commitments in the GLWQA, are inadequate. First, although First Nations are regarded as stakeholders in Great Lakes governance, there is reluctance to recognize the legal, jurisdictional, authority, treaty, and constitutional rights of First Nations. For example, in the 2021 COA, in the Articles, under definitions we find mention of First Nations:

“Great Lakes community” means First Nations and Métis; municipal governments; conservation authorities; non-government organizations; the scientific community; the industrial, agricultural, recreational, tourism and other sectors; and members of the public with an interest in Great Lakes issues; (COA, 2021, p.8).

Under Article 3, Principles:

First Nations and Métis – their identity, cultures, interests, knowledge and traditional practices will be considered by the parties in the restoration, protection and conservation of the Great Lakes Basin Ecosystem; (COA, 2021, p.10)

The parties recognize First Nation interests, but not their laws, governance, authority, or jurisdiction. Furthermore, First Nations and Métis are categorized together, yet Métis do not have the same claims to authority, jurisdiction, and sovereignty in the Great Lakes Ecosystem. First Nations and Métis are distinct.

Second, traditional ecological knowledge (TEK) remains secondary to Western science and is not regarded or recognized as equal. There is a willingness to acknowledge the cultural and spiritual relations yet ignore First Nation authority and jurisdiction. Furthermore, Canada and Ontario ignore their own legal and treaty obligations to First Nations. It is important to make this point, as TEK should not be removed or extracted from communities; therefore, to utilize TEK requires First Nations to be involved in decision-making, not excluded, or marginalized in the process. TEK continues to be relegated as an “add on” to Western science and is not seen as valid in its own right; for example, in the 2012 GLWQA Annex 10 (Science) is meant to enhance “the coordination, integration, synthesis, and assessment of science activities. Science, including monitoring, surveillance, observation, research, and modeling, may be supplemented by other bodies of knowledge, such as traditional ecological knowledge” (GLWQA, 2012, p. 53, emphasis added). In other words, TEK is “supplemental” knowledge. TEK is not given its due respect nor is seen as equal to science. Likewise, the 2021 COA, Annex 13, First Nations and the Great Lakes, constrains TEK to particular activities and projects. It states that Canada and Ontario will:

“Together with First Nations, develop a process to engage First Nations in decision-making and the application of traditional ecological knowledge, when offered, as it relates to assessing lake status, identifying priorities for science and action, and taking action to address issues on a lakewide basis” (COA, 2021, p.78).

First Nations should decide when and where their knowledge will be used in Great Lakes initiatives. The term Indigenous knowledge (or knowledges, if one is emphasizing the diversity of such knowledge), is abbreviated as IK, and has over time been variously referred to as traditional knowledge (TK), traditional environmental knowledge (TEK), traditional ecological knowledge (TEK), or Aboriginal traditional knowledge (ATK), among other terms. The term is used in this paper in its broadest possible sense. That is, IK is knowledge that is an integral, inseparable feature of Indigenous societal systems, (also called Indigenous Knowledge Systems, or IKS). While governments and other non-Indigenous agencies have also recently taken to using the Indigenous knowledge (IK) term, they are generally referring to a much more limited concept that sees IK as data and/or information that can be extracted and transferred from one context (Indigenous) to another (non-Indigenous). As this paper explains, this limited conception is counter-productive to the all-important task of Indigenous–non-Indigenous reconciliation (McGregor, 2021, p. 2).

The most recent iterations of the GLWQA (2012) and, in the Canadian context, 2021 COA attempt to reconcile Indigenous knowledge systems with Western science. Indeed, there have been inroads over the past decade gained primarily through First Nation advocacy. For instance, TEK has been recognized in recent Great Lakes fora. However, TEK remains an “add on” or, “supplemental” to science in the GLWQA (2012), COA (2014; 2021), Great Lakes Protection Act (Great Lakes Protection Act, 2015), and 2015 Great Lakes Strategy (<https://www.ontario.ca/page/ontarios-great-lakes-strategy>). One of the major shortfalls of such “recognition” of TEK in these agreements, legislation, and strategies is that there is no guidance for how to implement TEK in Great Lakes governance efforts. Recent guidance from the United States in the form of, “Guidance Document on Traditional Ecological Knowledge Pursuant to the Great Lakes Water Quality Agreement” (Koski et al.,

2021) was developed by the United States Caucus of the Traditional Ecological Knowledge Task Team Annex 10 Science Subcommittee with Tribal involvement. No such guidance exists in the Canadian context despite the recognition of TEK/ATK/IK in Canadian environmental legislation for decades (McGregor, 2021). Canada continues to fall significantly short when it comes to addressing Indigenous knowledge systems (IKS) in Great Lakes governance.

This contribution asks the question: Why has it been so difficult to achieve the inclusion of IKS in Great Lakes governance despite sustained advocacy by First Nations and recognition of IK elsewhere in Canadian legislation and policy frameworks? For this special issue on bridging knowledge systems, we reflect on how external institutions, agencies, and people engaged in the movement for sustainable management of Great Lakes ecosystems can better prepare to engage with IKS respectfully and in the manner required by First Nations.

We answer this question by reflecting on the findings from a knowledge sharing gathering held in Thunder Bay, Ontario, in January 2019 to bring together First Nations Elders, youth, and environmental practitioners/professionals, and leaders to discuss the terms and conditions that TEK can be shared with others. Instead of asking the predominant question sought by governments, the academy, proponents, environmental NGOs, and other external interests who covet IKS, “What can First Nations do to share IKS?”, participants at the gathering considered, “What do First Nations require of others in order to feel comfortable sharing IKS?” We were particularly interested in the IKS/Western Science nexus in part because when IK is mentioned in the 2012 GLWQA and 2021 COA, it is mentioned along with Western science. For example, in the Principles and Approaches section of the amended 2012 GLWQA, Canada and the United States commit to:

science-based management – implementing management decisions, policies and programs that are based on best available science, research and knowledge, as well as traditional ecological knowledge, when available; (GLWQA, 2012p.7)

In the 2021 COA, Canada and Ontario commit to:

Science-Based Management - provide advice to establish management priorities, policies and programs based on best available science, research and knowledge, including Traditional Ecological Knowledge when offered; (COA, 2021, p.10)

Here, we question what these statements really mean considering decades of reliance on Western science and the invisibility of Indigenous peoples and TEK in these agreements, until recently. We reflect on the current state of knowledge and what has been achieved through the advocacy of Chiefs of Ontario and First Nations over the past few decades for the inclusion of TEK in Great Lakes governance/decision making (i.e., in addition to COA, policy and legislative inroads include the 2015 Great Lakes Protection Act). The gathering convened through this project provided the opportunity to take stock of these advancements. We focus on the IKS-Western science nexus and what contributes to successfully bridging knowledge systems. After establishing the key assertions of the project, we share key elements of our methodology, then move into the case study where we reflect on the perspectives, experiences, and knowledge of First Nations experts who shared at the TEK gathering. Two days of dialogue resulted in a series of recommendations and seven key take-aways which are shared in this paper. Recommendations derive from individual and collective experiences and living knowledge, which are inseparable from the ethical imperatives inherent to diverse Indigenous ways of knowing. To communicate these recommendations with

an external audience, we have created thematic groupings. Each grouping contains participant observations on the topic. Each section closes with concrete, actionable recommendations.

Key findings include the need to support Indigenous knowledge, research sovereignty, and Indigenous-led research agendas, and to remove external jurisdictional and other barriers (Whyte, 2018; Williams et al., 2020). Other ways by which Indigenous environmental governance, research, and bridging work can move forward in respectful and sincere ways include the development of and adherence to Indigenous research protocols and the fulfilment by external institutions of their role in building respectful relationships and advocating for fundamental changes to dominant systems. Our contribution also contains teachable moments for those looking to work with First Nations people and IKS.

Literature review

This article is necessary because the ethical and respectful incorporation of IKS into environmental governance in Canada continues to elude governments, proponents, and others despite decades of attempting to do so (Eckert et al., 2020; McGregor, 2021). Indeed, there have been inroads, due to Indigenous advocacy, including the recognition of TEK in federal legislation in Canada and more recently the draft *Indigenous knowledge policy framework for Project Reviews and regulatory decisions* (GoC, 2022), the first policy framework on TEK. Despite legislative requirements and policy commitments, implementing approaches that bridge Indigenous and Western ways of knowing remains a challenge (Alexander et al., 2021; Walsey and Brewer, 2018). Caution remains as the predominant paradigm of “incorporating” IKS into environmental management and decision-making is one of “extraction” by governments, the academy, proponents, ENGOs: those external interests who covet IKS (Baker and Westman 2018; Joly et al., 2019). As Indigenous scholar Sarah Hunt (2014, p. 29) states, “Indigenous knowledge is rarely seen as legitimate on its own terms, but must be negotiated in relation to the pre-established mode of inquiry”. In response, a number of First Nations have developed IKS protocols to protect their knowledge from unauthorized or unethical use (Hayward et al., 2021; Maar et al., 2007; McGregor, 2013; McGregor, 2021; Morton Ninomiya et al., 2020). Tensions remain regarding the conditions in which Indigenous Nations/communities choose to share (or not share) their IKS (McGregor, 2014b).

Our research begins with the premise that Indigenous peoples have their own worldviews, theories, epistemologies, and methodologies, which can and should inform critical discussion related to IKS and bridging knowledge systems. This assertion builds on international scholarship that has emerged in which Indigenous theories and knowledge systems have become a required starting point for inquiry (McGregor et al., 2018). This approach avoids the all-too-common pitfall of scholarly endeavors that, while possibly intending to be constructive, end up undermining or otherwise causing significant harm to Indigenous epistemologies and subsequently Indigenous peoples themselves through a lack of consideration and respect for IKS and modes of inquiry (Kuokkanen, 2007). Universities and non-Indigenous institutions remain largely ill-prepared to receive the gift of Indigenous epistemologies. What might respectful, meaningful and appropriate bridging of knowledge systems look like were Indigenous worldviews, philosophies, and theories to form the basis of our understanding and approaches? There are many Indigenous theoretical and intellectual innovations to draw on, such as the recognition of IKS in environmental governance and conservation (Houde, 2007; Kimmerer, 2012; Latulippe, 2015b; Popp et al., 2020; Reo et al., 2017; Whyte, 2013;), the increasingly distinct modes of Indigenous

research inquiry (Lambert, 2014; McGregor et al., 2018), revitalization of Indigenous legal traditions (Borrows, 2010; Craft, 2014), and role of IKS in achieving justice (McGregor, 2018a).

To synthesize themes and developments in the literature, we present a core set of three assertions. First, Indigenous peoples have their own knowledge systems that have flourished on these lands for thousands of years. Indigenous peoples have their own reasons for inquiry, modes of inquiry, ways of knowing, and ways of mobilizing or sharing knowledge. Indigenous peoples possess a complete knowledge system that is innovative and responds to changes (including dramatic environmental change) and supports healthy, sovereign, autonomous Indigenous societies. Upon contact with Europeans, Indigenous peoples and their knowledge supported other societies and continues to do so (RCAP, 1996).

Second, at this point in time, Western researchers/scientists/scholars lack appropriate paradigms for how to equitably share knowledge and research resources (e.g., funding, careers, institutional support). The overriding research paradigm is still one of “extraction” of knowledge (or data) from Indigenous peoples as opposed to supporting Indigenous well-being and self-determination. Indigenous peoples, their lives and knowledge remain “researched” as opposed to a major paradigm shift in which Indigenous peoples become the “researchers” with support for research infrastructure that universities take for granted. Emerging paradigms developed by Indigenous peoples offer alternatives to the extractive paradigm of knowledge production and generation; for example, Two-Eyed Seeing (Bartlett et al., 2012; Reid et al., 2021); Braiding/Weaving Knowledge Systems (Henri et al., 2021; Kimmerer, 2013; Popp et al., 2020; Whyte et al., 2016); Two Row Wampum principles (Ransom and Ettenger, 2001); Ethical Space (Ermine, 2007) and treaty approaches (Latulippe, 2015a; Luby et al., 2018).

Third, research must meaningfully support Indigenous self-determination and Indigenous knowledge sovereignty, a two-pronged strategy that entails practices that strengthen Indigenous knowledge systems (including use, transmission, governance, etc.) by Indigenous peoples, and the removal of external barriers (policy, jurisdictional, etc.) to the expression of these practices on the land (Norgaard, 2014a, 2014b; Whyte, 2018). Without the removal of external barriers, we can expect ongoing conflict that characterizes contemporary relationships (Linden, 2007; RCAP, 1996) and undermines the goals of reconciliation.

Research methodology

As an embodiment of these three core assertions, the approach to examining our questions utilized a knowledge-sharing paradigm. As our First Nation partner, Chiefs of Ontario (COO; <https://chiefs-of-ontario.org/about/>), the coordinating and advocacy body for all 133 First Nations in Ontario as they assert their sovereignty, jurisdiction, and chosen expression of nationhood, invited Elders and Knowledge holders to participate in the Thunder Bay gathering. “Gathering” itself is recognized as a culturally appropriate approach or method for Indigenous knowledge sharing and transfer (Craft, 2014, 2017; COO, 2015; Ermine et al., 2005; UOI, 2015). As a First Nation-led project, invitations were sent by COO to First Nations in the Great Lakes area, and First Nation leadership and communities decided for themselves who would participate. Elders and knowledge holders were “invited” through an open process convened by the First Nations in the Great Lakes. The research mobilized existing research relationships and knowledge in order to highlight the successes/failures, opportunities and limitations of past and current IKS initiatives involving First Nations in Ontario. An important feature of the knowledge sharing framework is an emphasis on creating a forum in which Elders and

youth could share their knowledge *with each other*, along with First Nation environmental experts, practitioners, professionals and scientists, to support environmental and research capacity in First Nation communities (McGregor, 2017). Research activities and outputs oriented to external non-Indigenous agencies, institutions, and people (like this article) are meant to provide insight into the conditions required to respectfully receive and embrace IKS (Kuokkanen, 2007) and build trustworthiness (Wilson et al., 2022). Our approach is significant because it is based on input from and support for knowledge exchange specifically among First Nations Elders, youth and other knowledge holders. IKS and youth have rarely been considered together; that is, youth are not often recognized as knowledge holders, but it is their future after all! Moreover, First Nation environmental professionals engage in both IKS and Western science in their work and have tremendous experience working with and weaving divergent knowledge systems (natural science, engineering, biology). First Nation environmental professionals, as well as Elders and other traditional knowledge (TK) holders, reconcile diverse knowledge systems on a daily basis, including science and social science as well as the complexity and complementarity of IKS and Western science/technology.

This project, its approach and goals, are significant given current global and national contexts in which environmental protection regimes are failing and increasing species extinction, water pollution, contamination, scarcity, climate change, and so on are all vying for our immediate attention (Biggs et al., 2017), and ongoing and increasing conflict for control over lands and resources throughout the world further demonstrate that existing environmental governance, policy, legal and regulatory frameworks are failing at every scale (McGregor and McGregor, 2016; Whyte, 2013). This context has given rise to ever-growing interest in IKS as a complementary body of knowledge, perhaps better equipped to deal with compounding global challenges (McGregor, 2014a). While Indigenous peoples have shared IKS quite liberally, their knowledge has not been well received. Our methodology prioritizes First Nations environmental and research capacity even as it addresses the conditions required of external agencies, institutions, and individuals to respectfully receive and embrace IKS.

The main knowledge sharing activity involved a two-day gathering held on the shores of Lake Superior in Thunder Bay, Ontario, in January 2019. The purpose of the gathering was to share knowledge and experiences regarding how IKS has been considered in the environmental/Great Lakes realm (both strengths and weaknesses) and offer guidance for how IKS can be ethically and respectfully shared. The location and timing were chosen to facilitate participation from the far north and remote communities (winter roads). Elders, Grandmothers, Grandfathers, teachers, TK practitioners and youth were invited to participate by the Chiefs of Ontario. It was coordinated and facilitated by a group of Indigenous and non-Indigenous environmental researchers and practitioners based in the Great Lakes region, in southern and northeastern Ontario, Canada, and led by D. McGregor. Emerging scholars and established academic leaders synthesized and presented findings from settings of applied learning and study. Community voices from First Nations were prioritized, consistent with recommendations made repeatedly over time. The perspectives of Elders and youth were specifically highlighted in the context of the 40+ years of advocacy by First Nations, which builds on timeless understandings from living in the Great Lakes region for thousands of years. The philosophical and practical aspects of the gathering were structured on core assumptions developed by First Nations emanating from a large body of existing research, practice and past discussions related to the GLWQA, COA, State of the Lakes Ecosystem Conferences, and other efforts to align TEK from First Nations with regional and national policies and practices (Chiblow, 2014; Chiefs in Ontario (COO), 2010; Chiefs of Ontario

(COO), 2001, 2009b, 2011, 2015; Danard, 2010; McGregor, 2008; COO, 2009a; Dorries, 2009; US-EPA & ECCO, 2017; McGregor, 2018b).

The following questions guided dialogue over the two days:

- a) To mobilize existing knowledge: What knowledge, experience, expertise already exists? Why after decades is addressing IKS still elusive? What do we already know? What existing principles and values can we draw on? What foundations exist for respectful and ethical consideration of IKS?
- b) To facilitate dialogue and knowledge sharing: How can Indigenous Knowledge Systems find expression in environmental governance? What guidance is necessary for external interests to receive IKS?

Day one of the gathering consisted of sharing what is already known through presentations from community based Indigenous environmental practitioners, Elders, traditional teachers, youth and scholars, and facilitated dialogue sessions of shared experiences by all participants. Day two focused on case examples where IKS has been considered in the past and present through presentations from communities, scientists, Elders and youth, and women. The afternoon involved a facilitated discussion focused on the barriers that remain for the respectful inclusion of Indigenous knowledge in environmental governance, and the development of a shared path forward, including the conditions required of external interests in order to respectfully receive IKS. We sought to generate a climate of knowledge sharing and gathering as opposed to knowledge extraction. The gathering also offered opportunities for First Nation students to network and engage directly with Elders and IKS knowledge holders and contribute to broader dialogue on IKS, and environmental/Great Lakes governance.

Findings

The two-day gathering was recorded by Chiefs of Ontario and detailed notes generated. A content analysis was undertaken by the authors to determine important and key themes raised by participants at the gathering. The themes below are not exhaustive. We report on those themes deemed relevant for this particular call on bridging knowledge systems. Key themes are described and recommendations from each theme as identified by participants are provided.

Theme 1: Engaging Indigenous knowledge

It is essential that researchers understand and are open to learning from Indigenous peoples about history, treaties, worldview, philosophies as well as the ongoing policy and practice of colonialism and its continued impacts on Indigenous societies and communities. It is inappropriate, unreasonable and disrespectful to expect Indigenous peoples to share knowledge with researchers who remain ignorant of the historical and lived realities of Indigenous peoples. Instead of asking, "What needs to be done to support research into Indigenous knowledge systems", a more appropriate question is, "What needs to be done to support Indigenous peoples to uphold, strengthen, revitalize Indigenous knowledge systems so they are able to share knowledge if they wish?"

The following reflections, insights and experiences were shared by TEK workshop participants:

- Researchers/scientists are generally ignorant of the history of Indigenous peoples or fail to see how the history, treaties, current struggles are related to IKS/TEK work;

- Non-Indigenous people can be ignorant of cultural protocols and what is required to create a safe space for dialogue. Government staff who demonstrate respectful listening and humility were received better than those who did not demonstrate these skills, knowledge or abilities;
- IKS/TEK is best shared and articulated and understood in Indigenous languages;
- First Nation people do not want their knowledge appropriated, misused or homogenized;
- Collectively, we are starting from a place of mistrust. Knowledge holders do not know what happens to their knowledge once it is shared. Who makes the decisions? Why? Western scientists do not value IKS/TEK;
- Western 'science-based' decisions have hurt First Nation communities in the past and continue to do so; and
- IKS research/work is still not funded equitably in science-based initiatives, if at all.

Key Recommendations:

- a. Participants emphasized the requirement for researchers/scientists to know and respect the people (different nations, community priorities and protocols, distinct histories);
- b. Researchers/scientists should know the goals and priorities of a community, such as language revitalization, bringing youth on the land, caring for the land/waters and so on;
- c. Research questions must be generated from within the community and based on community concerns and priorities. The research questions posed need to be different; How can research support the goals of the Indigenous peoples?
- d. Research should support intergenerational sharing of knowledge within the community (internally) before being shared externally, e.g., elder – youth dialogue; and
- e. Research/science needs to support environmental interests, values and priorities as determined by Indigenous communities.

Theme 2: support indigenous sciences and holistic approaches

There is a lack of reciprocity between Indigenous communities and scientists. Scientists/researchers seek IKS from communities, but Western science is often inaccessible, unusable, and not shared in a reciprocal manner. At the same time, Indigenous peoples have their own knowledge and science traditions and seek to engage Western science as a tool that will advance their holistic knowledge systems and research goals (Brascoupé, 2001; Cajete, 1995; Johnson et al., 2016; Kimmerer, 2012; Whyte et al., 2016).

The following reflections, insights and experiences were shared by TEK workshop participants:

- Elders emphasized the importance of being on the land and water: 'take the classroom outside'. Empirical knowledge is derived from the land. Indigenous science is based on cultural values, facts, truths, and realities of living off the land holistically from time immemorial;
- There is a lack of trust of Western science because it has harmed people and the environment;
- Indigenous science takes a lifetime to learn and practice;
- Western science is inaccessible to First Nation communities and decision makers – they, too, may wish to make use of science;
- There is a language and communication barrier, i.e. terminology in conveying science and when Indigenous language has to be translated into English

- Western scientists have to realize they are working within a “system of knowledge” that is totally different from their own. There is an explicit inclusion of spirit and spirituality in IKS/Indigenous science;
- Western science continues to dominate; Indigenous science is considered an add-on to a broader research agenda;
- Western scientists are in positions where they can assist communities; or rather there are some scientists who are willing to listen and work with communities on their priorities

Key Recommendations:

- a. IKS is about doing; therefore, to support Indigenous science, knowledge keepers must have opportunities to share the knowledge ‘in the language’, by demonstrating and then giving younger generations the opportunity to learn by practicing;
- b. This absolutely necessitates advocating for Indigenous lands rights (access and benefit) and legal responsibilities (inherent jurisdiction), so people can actually practice and then pass on knowledge to future generations;
- c. TEK and Indigenous science is part of a way of life, a way of living in relationship with the land. Knowledge is inseparable from and interconnected with practices and beliefs (Reo and Whyte, 2011), this includes observation, classification, comparisons, harvesting, ecological management, respecting naturalized laws, ethics, and so on. Holistic includes legal rights and responsibilities according to Indigenous legal systems and Western legal systems. Thus, community-based scientific research led by First Nations should be supported and the First Nations will decide how TEK will be used; and
- d. Indigenous paradigms exist that can serve as models for equitable sharing of knowledge (science and IKS). Indigenous peoples need access to Western sciences for multidisciplinary informed decision-making that will serve their needs and priorities.

Theme 3: Science/TEK nexus

Seeking IKS/TEK in research is one strand of research that has occupied many researchers for decades (Inglis, 1993, LaDuke, 1994, Menzies, 2006, Whyte, 2018). This theme emerged as a critical area by workshop participants and requires specific attention. There is considerable interest in how IKS/TEK can work with science to address some of the most pressing environmental challenges of our times. This section seeks to contribute to this ongoing dialogue by reflecting on the experience, insights, and reflections from previous discussion of this nature with First Nations regarding the health of the Great Lakes ecosystem that can be applied more broadly. For example, different conceptions of time for spiritual and value-based traditions are not considered by scientists or factored into project timelines. Spirituality (e.g., prophecies and ceremony) is not recognized as relevant or as contemporary knowledge that informs approaches to describing environmental change, yet “spirit” forms the foremost foundational aspect of TEK. First Nations have called for a paradigm shift that respects the knowledge brought forth by Elders and TK holders/practitioners on their own terms. First Nations offer a different form of “knowing” the land, waters and ecological processes.

Great Lakes governance reveals that it has relegated TEK secondary to Western science as supplementary or simply to be “considered”. First Nations have stated over the decades that IKS/TEK can direct a science-based research agenda as evidenced in the EAGLE project - Effects on Aboriginal of the Great Lakes Ecosystem (COO, 2001).

The following reflections, insights and experiences were shared by TEK workshop participants:

- Government and industry often do not value Indigenous knowledge; it is viewed as an “add on” or “supplementary” knowledge/data to Western science and only believed when it is validated by Western science; however, IKS is valuable on its own terms without validation by Western science. Western science is biased, changes over time and cannot be trusted or relied upon;
- Scientists are also being carefully watched and judged to see what they will do; are they accountable? respectful? listening?
- Scientists need to know that they are not getting the full TEK/IKS, only what people are willing to risk sharing with them;
- Elders have stated, if you do not practice IKS, you cannot know it; and Western science is based on theories and is always seeking “proof”. Science changes over time. Indigenous/traditional knowledge has been reliable since time immemorial;
- Science and technology do not appear to be “saving” the planet, IKS/TEK is needed and Elders are willing to help;
- First Nation communities are utilizing science to address environmental challenges they face, along with TEK. Look to these examples to lead the way; and
- Young people continue to excel in science that can assist communities. There needs to be more First Nations youth who know TK and science. First Nations can then engage in their own scientific research.

Key Recommendations:

- a. Those wishing to work with IKS need to clearly state their intent; what and for whom are they working, how and under which assumptions and biases, and what they are not able to do;
- b. Western researchers need to embody humility and the limits to what they know;
- c. IKS/TEK must be valued by decision makers and thus, planning and budgeting allocated for TEK research is a must along with compensating TK holders;
- d. Culturally competent, interdisciplinary scientists are needed to interact with First Nation communities and knowledge holders;
- e. First Nations have science questions as well. First Nation wish to direct their own scientific studies.
- f. Those wishing to work with Indigenous knowledges need to advocate for the removal of barriers facing First Nations, such as capacity issues, development on their lands without consent, “consultation” after the decision has already been made, and so on; and
- g. Highlighting efforts to mitigate/adapt/restore habitats and environmental factors is a way to share best practices regarding tek. there are multiple examples (walpole, saugeen, batchewana, etc.) of tek being used to enhance western science. building on the strength of those examples can be powerful, especially sharing in language and format that everyone understands (e.g., through multimedia)ing efforts to mitigate/adapt/restore habitats and environmental factors is a way to share best practices regarding TEK. There are multiple examples (Walpole, Saugeen, Batchewana, etc.) of TEK being used to enhance Western science. Building on the strength of those examples can be powerful, especially sharing in language and format that everyone understands (e.g., through multimedia)

These three themes speak to ways in which Indigenous knowledge continues to be depoliticized, misrecognized, and uncoupled

from Indigenous peoples and priorities. Non-Indigenous interest in Indigenous knowledge often elides Indigenous legal, ethical, and governance protocols and requirements, such as OCAP (ownership, control, access, and possession) principles and free, prior, and informed consent (FNIGC, 2014; UN, 2007). Predominant approaches that view Indigenous peoples and knowledge holders as stakeholders as opposed to rights-holders neglect even Canadian law; namely, the legal duty to consult and accommodate Indigenous peoples when the Crown contemplates actions that would adversely impact Aboriginal or treaty rights (Linden, 2007). Predominant approaches also ignore underlying relations of power that mediate interaction between different knowledge (and legal and governance) systems and their uneven implementation. For instance, IK conceptualized narrowly as epistemology misses the holistic and collective nature of Indigenous knowledge systems and the fundamental power relationship between Indigenous peoples and Creation (COO, 2008). Seeking to extract Indigenous knowledge, or even to 'bridge' knowledge systems, neglects what Senator Sinclair (TRC, 2015) argues is the crux of reconciliation: it is a Canadian (settler) problem that requires the reconsideration and transformation of virtually all aspects of Canadian society. Without critically naming and attempting to transform dominant epistemic, political-economic, socio-legal and other systems and relations, the dominant approach to IKS does not help one stay implicated (Ahmed, 2004) in the work required to achieve reconciliation. It minimizes the need for fundamental material change and decolonization (Yellowhead Institute 2019; 2021). Finally, pursuing cooperative approaches to environmental science, management, research, and governance is not always a priority for Indigenous peoples who may be otherwise engaged in everyday acts of resurgence, Land Back initiatives, political advocacy, policy development, and refusal research (and not striving to make their knowledge systems more legible to non-Indigenous institutions) (Daigle, 2018; Simpson, 2011; Tuck and McKenzie, 2015). These themes and comments are not a call for mutual disengagement, but rather for Indigenous leadership in research as well as for non-Indigenous people who wish to work with Indigenous knowledges and peoples to engage differently; that is, with respect, reciprocity, and responsibility.

Discussion and key take-aways

A significant portion of the Thunder Bay gathering focused on recent development in Great Lakes water governance. As noted above, both the 2012 GLWQA and 2021 COA seek a nexus point between Western science and TEK for decision making yet lack mechanisms to do so (until recently in the United States with the release of TEK guidance document). Canada and Ontario have no such guidance.

First Nations have commented on the lack of consideration of TEK in science-based decisions in previous Indigenous Great Lakes fora. Despite the explicit commitments, TEK has been ignored in a multitude of initiatives occurring throughout the Great Lakes Basin. Furthermore, TEK has been ignored in Great Lakes work that *does involve* First Nations. As First Nation representatives have stated, First Nations have inherent jurisdiction and responsibilities in relation to the Great Lakes and this is the foremost consideration. There are treaties among Indigenous nations (e.g., Dish with One Spoon) and treaties with settlers that outline their responsibilities for being on Indigenous lands, waters and territories (Borrows, 1997; Jacobs and Lytwyn, 2020). It was noted at the workshop that treaties with settlers have been violated and have not been honored, contributing to the marginalization of First Nations in Great Lakes governance. Participants emphasized that for thousands of years, First Nations exercised inherent responsibilities

and jurisdiction, developed laws and treaties to care for and pass on knowledge resulting in sustainable relationships with the Great Lakes. The obligations, rights, responsibilities, and duties are expressed in the *Water Declaration of the Anishinaabek, Mushkegowuk and Onkwehono* (COO, 2008). The Declaration forms the basis of the ongoing work to protect the waters, including the Great Lakes. There is mention of the importance of the Water Declaration in COA in the whereas statements: "and, whereas, First Nation in Ontario have adopted a Water Declaration that expresses their objectives regarding water protection" (COA, 2021, p.6), but COA does not meaningfully recognize the principles of the Declaration, just that it is important to First Nations.

While amendments to the 2012 GLWQA and 2021 COA are inadequate for considering TEK in decision-making, First Nation communities routinely use Western science along with their own knowledge in community-based initiatives. Elders have said that the foundation of decision making/governance should be TEK which has a proven track record of thousands of years of effectiveness and ensuring sustainability. This does not constitute a rejection of Western science or its worth in solving environmental challenges. First Nations determine when Western science is appropriate and engage with scientists as required, as the First Nation case examples demonstrate. It was noted that Western science does not stand the test of time, as principles, norms and findings changing over the years; for example, chemicals in the Great Lakes were deemed safe decades ago and now these same chemicals are found to be dangerous. TEK stands the test of time. There is value in science to support decision making at the community level, but should never replace, marginalize, or dominate TEK.

Ultimately, Indigenous people have been generous with sharing their knowledge yet as reported here there remains many significant challenges to fully realize the potential for Indigenous led or collaborative/partnership-based research. Indigenous peoples, communities, and organizations have "shared" much in terms of knowledge, time and energy to researchers and others, yet Indigenous peoples continue to be exploited and marginalized in research, in particular Western scientific research. Simply put, the conditions for the flourishing of Indigenous peoples and their knowledge for the protection, restoration and conservation of the Great Lakes are not yet in place.

Key take-aways include:

1. **Respect IKS/TEK as part of a knowledge system** that stands on its own and does not need to fit into Western science paradigms to be valid or useful. Indigenous peoples have relied on these knowledge systems since time immemorial and will continue to rely on them with or without government and academia. IKS/TEK should be supported in research, including supporting traditional ways of life and learning languages, on Indigenous people's terms.
2. **Support Indigenous peoples and their research goals:** Resources are required to support the research agendas of Indigenous peoples and communities. Being chronically underfunded and unsupported for numerous initiatives while other groups are well supported and funded creates further mistrust and frustration. Indigenous peoples should be able to access research funding on their own terms and not be required to partner with academic institutions if they do not want to, or because it is too much work for them and takes away from their own priorities.
3. **Indigenous knowledge mobilization/transmission:** Research should prioritize intergenerational sharing of knowledge within the community before it is shared externally. If communities decide to share their knowledge, it needs to be on their terms with recognition of ownership, with the resources to store

information, to determine how information will be protected, to determine how information will be shared and to determine who has access to the information.

4. **Indigenous knowledge systems, science and gender.** There is an increasing number of First Nations who are seeking careers in science and they should be supported to do so. However, there is an explicit need for women and girls to engage in science careers, as they bring unique knowledge and perspectives. Women/girls in science and engineering require peer and Elder support in light of the competing demands placed on women in other spheres of life.
5. **Indigenous research protocols:** Indigenous peoples require support to develop their own research protocols and the resources to govern their knowledge and to monitor researchers. Indigenous communities are not funded for research infrastructure and should be.
6. **Role of external institutions:** When Indigenous peoples seek to regain and/or assert their inherent responsibilities and rights, which is for and by Indigenous peoples, external institutions should provide meaningful and material support for this work (without stealing, taking credit, expecting something, acting unilaterally, hindering, misrepresenting etc.). Instead of pulling expertise from communities to fit into externally defined research agendas, institutions should invest in building long-term relationships and meaningfully supporting the Indigenous communities on whose traditional and treaty territories these institutions are located. This will take time, money, and commitment from multiple levels.
7. **Research relationships:** It is unreasonable to expect Indigenous peoples to share their knowledge to support a society that continues to threaten their very being and those of their descendants every day in every conceivable way (WEA and NYSHN, 2016). Outside institutions need to do the work to build the respectful, reciprocal relationships that are needed for (possible) cooperation or partnerships to take place. Innovation and creativity are required here to develop paradigms of knowledge sharing, rather than extraction or domination. There is a willingness and even desire to share knowledge to address current and future challenges. Indigenous worldviews have a place for non-Indigenous peoples and their knowledge, whereas non-Indigenous peoples have yet to fully understand, respect or apply that lens to IKS.

Concluding remarks

This research prioritizes First Nations environmental and research capacity even as it addresses the conditions required of external agencies, institutions, and individuals to respectfully receive and embrace IKS. We also demonstrate some of the priorities and principles of Indigenous research and knowledge sovereignty. It makes an important contribution to Great Lakes governance and to the emerging scientific research landscape in Canada, reflected in the Climate Science 2050 report (ECCC, 2020) in which there are calls for Indigenous leadership in research that employs both Indigenous knowledge and Western science. Indigenous led research avoids the pitfalls of knowledge 'integration' frameworks that remain pervasive in the Great Lakes region and elsewhere. It also addresses the reality that 'bridging' knowledge systems, an ostensibly better approach, is not always a priority for Indigenous peoples: "not all Indigenous communities choose to engage with Western science, nor acknowledge the settler-state's forms of governance" (Alexander et al., 2021, p.16). While 'bridging' work may not always be an explicit priority, "weaving" different knowledge systems is inherent and embedded in the concepts and practices of many Indigenous knowledge holders, practitioners, and researchers (Ibid.). Given the ever-growing

interest, legislative requirements, and policy commitments pertaining to Indigenous knowledge, the recommendations emerging from this research point to the requirement to support Indigenous research capacity by building the necessary infrastructure and funding to ensure Indigenous people can lead their own research.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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