GUIDANCE DOCUMENT ON
TRADITIONAL ECOLOGICAL KNOWLEDGE PURSUANT TO THE GREAT LAKES WATER QUALITY AGREEMENT

Prepared by the United States Caucus of the
Traditional Ecological Knowledge Task Team
Annex 10 Science Subcommittee

February 2021

Acknowledgement

The authors of this document first acknowledge that the Great Lakes bioregion includes the ancestral, traditional, and contemporary lands and waters of numerous Indigenous nations. We also acknowledge the region's many more-than-human relatives that have been inhabitants of the Great Lakes since time immemorial.

Indigenous people are the original caretakers of these lands and waters. As such, the authors respect the value of Indigenous knowledge and perspectives in aiding the Parties to the United States-Canada Great Lakes Water Quality Agreement ("GLWQA" or "Agreement") to make well-informed decisions to protect the world's largest system of freshwater and associated ecosystems. We also acknowledge the spiritual worldviews on the sacredness of water shared across many, if not all, Indigenous communities of the Great Lakes. We recognize the growing appreciation of Indigenous knowledge and wisdom, as well as the conservation ethics of the first peoples of the Great Lakes to inspire and inform our collective understanding and stewardship of the Great Lakes for generations to come.

A list of the Indigenous nations who currently call the Great Lakes region home is provided in Appendix A. Because this Guidance Document is a product of the United States (U.S.) Caucus of the GLWQA Traditional Ecological Knowledge ("TEK") Task Team, this list currently includes those Tribes and Inter-Tribal organizations with present day reservations and/or usufructuary treaty rights in the Great Lakes region of the United States. However, the authors acknowledge the many additional Indigenous peoples that historically resided in the Great Lakes region[1] and the numerous First Nation and Métis communities that have resided in the Great Lakes region of Canada, both historically and currently, including 66 First Nations in Ontario alone.[2]

The U.S. Caucus of the TEK Task Team developed this Guidance Document on behalf of Tribal and Federal Task Team members located on the United States side of the Great Lakes basin. The U.S. Caucus of the TEK Task Team welcomes and will continue to encourage opportunities for engagement and collaboration with Indigenous communities on the Canadian side of the basin. Additional voices and perspectives would provide further guidance and support to aid in the protection of, and respect for, the Great Lakes and their ecosystems.

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[1] National Archives Native Communities Research Guide (2018). "Native Peoples of the Great Lakes Region." https://www.archives.gov/files/education/native-communities/greatlakes-nativecommunities-guide.pdf

[2] Union of Ontario Indians (2015). "Anishinaabek Great Lakes Round Table Gathering Final Report." http://www.anishinabek.ca/wp-content/uploads/2016/07/UOI-GLG-Final-Report-FINAL.pdf

[3] Appendix D provides a full list of additional TEK Task Team U.S. Caucus members who contributed throughout the development of this document.

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I. Purpose Statement

The U.S. Caucus of the Traditional Ecological Knowledge ("TEK") Task Team[4] sets forth this Guidance Document on Traditional Ecological Knowledge ("Guidance Document") to provide a starting point for understanding how TEK can be appropriately supported and engaged to contribute to the achievement of the objectives of the Great Lakes Water Quality Agreement ("Agreement"). This document seeks to provide a base from which a common understanding of TEK can grow. It provides an explanation of how TEK relates to and can enhance western science and priority-setting under the Agreement, and shares examples of how TEK can initiate and be integrated into interjurisdictional Great Lakes research and management activities. Lastly, it lays out possible next steps for future engagement with Indigenous nations and TEK under the Agreement.

This is to be a living document, designed to continue to cultivate and strengthen an understanding of how the insights of Indigenous peoples and nations throughout the Great Lakes can inform and contribute to the work of the Annex subcommittees to achieve the shared goals of the Agreement. Moreover, as it evolves, this guidance document may help to inform and guide additional protection and restoration activities and initiatives throughout the Great Lakes.

While this document focuses on fostering a greater understanding of why and how to appropriately engage TEK, direct engagement of primary TEK is not the only method by which Indigenous communities should be incorporated into the Agreement. It is important for the Parties to remember the necessity to engage Indigenous nations on a nation-to-nation basis. This means proactive, early, and consistent engagement with Indigenous nations on all levels of decision-making under the Agreement. Engaging Indigenous communities on TEK and meaningfully incorporating Indigenous knowledge and place-based community perspectives into ongoing and future work to protect and restore the Great Lakes is undertaking a more fundamental commitment to develop and maintain respectful relationships with those nations and communities. A commitment to respectful and consistent relationship building with Indigenous nations and their natural resource professionals and knowledge holders will only add to, inform, and strengthen a multitude of work pursuant to the Agreement.

Indigenous nations must continue to be engaged on a government-to-government basis with the Parties and other Great Lakes Executive Committee ("GLEC") members. Decisions regarding scientific inquiry and resource management are often made by Indigenous nations based on community concerns and TEK observations. By directing research and analysis based on local community-originated concerns, Indigenous nations can provide intensely place-based and long-term observational data that can provide early warnings for emerging and cumulative issues affecting Great Lakes ecosystems. Engagement of Tribal, First Nation, and Métis natural resource management and scientific staff is paramount for meeting the objectives of the Agreement.

[4] This paper was developed and drafted by the United States caucus of the TEK Task Team to provide guidance to the Agreement's ten Annex Subcommittees on how TEK can be incorporated to enhance their respective work. As such, this guidance document does not represent Canadian/First Nation/Métis perspectives, but does not preclude the future involvement or endorsement of Canadian/First Nation/Métis Task Team participants.

Moreover, after centuries of suppression of Indigenous philosophies and lifeways, the process of engaging and respecting TEK can inspire and support cultural revitalization and maintenance within Indigenous communities. This further supports internationally recognized rights of Indigenous peoples to revitalize their cultural traditions and customs, to maintain and strengthen their distinctive spiritual relationship with their traditional lands and waters, and to uphold their responsibilities to future generations in this regard.[5]

The pictograph above, known as the "Symbolic Petition of Chippewa Chiefs" (Wisconsin Historical Society, 1851), illustrates the inseparable and historical connection of Indigenous peoples to their ancestral lands and waters of the Great Lakes region. In 1849, a Chippewa delegation journeyed to Washington with this pictograph on a birch bark scroll to petition Congress and the President to protect their residence in the Great Lakes region. This led to the establishment of permanent reservations in their beloved homelands. The figures symbolize the clans of each delegation member, and the lines illustrate their hearts and minds connected in purpose, further connected to the region's lakes. Reprinted with permission of the Wisconsin Historical Society.

[5] Articles 11, 25, and 31 of the United Nations Declaration on the Rights of Indigenous Peoples, September 2007. *Available at* https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html

II. Introduction

There has been growing recognition that the collaboration of Indigenous knowledge with western science can deepen and improve our understanding of the interconnectedness of the natural world and help to better inform management and policy decisions. Under Annex 10 of the 2012 Great Lakes Water Quality Agreement, the federal governments of Canada and the United States committed to:

> *"...contribute to the achievement of the General and Specific Objectives of this Agreement by enhancing 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."*

Following this commitment, a TEK Task Team was established under the Annex 10 - Science Subcommittee to facilitate and support opportunities for Indigenous knowledge to be incorporated into all activities undertaken pursuant to the Agreement. Greater integration of Indigenous knowledge will add significant value, wisdom, and depth to the work of the Annex Subcommittees.

While the specific goals and challenges within individual communities can vary, Indigenous communities of the Great Lakes generally share a concern with the stewardship and overall quality and health of the Great Lakes, their interconnecting waters, and associated ecosystems. These concerns are grounded in traditional Indigenous worldviews that understand the Earth as an interconnected system in which the health of any one part affects the health and well-being of the whole.[6] Indigenous communities often seek to promote the protection of water quality, ecological health, and community well-being through holistic approaches informed by long-standing principles, values, practices, and observational knowledge. The practice and sharing of traditional values and knowledge foremost supports the continuation of Indigenous cultures and lifeways that have existed in the Great Lakes since time immemorial. Appropriate and equitable cross-cultural exchanges also carry invaluable lenses and distinct perspectives for better understanding and protecting the Great Lakes.

To pursue the overarching concerns noted in the paragraph above, tribes, First Nations, and Métis pursue Indigenous community-led projects that support the protection of the Great Lakes and their associated ecosystems and interconnected waterways. This ongoing work carried out by Indigenous nations throughout the Great Lakes illustrates how their priorities and perspectives, informed by TEK, can meaningfully contribute to the shared goals of and work being done under the Agreement and its Annexes.

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[6] These principles are laid out in the Tribal and First Nations Great Lakes Water Accord, November 23, 2004. This Accord was signed by representatives from 38 U.S. Tribes and Canadian First Nations. In part, the Accord states: "[t]raditional teachings and modern science combine to strengthen our historical understanding that Water is the life-blood of our Mother Earth. [...] We understand that the whole earth is an interconnected ecosystem. The health of any one part affects the health and well being of the whole. It is our spiritual and cultural responsibility to protect our local lands and Waters in order to help protect the whole of Mother Earth." https://www.nofnec.ca/PDF/2012/Tribal-and-First-Nations-Great-Lakes-Water-Accord.pdf

Ongoing Indigenous work in the Great Lakes includes:

- **Informing appropriate management actions** concerning contamination and the restoration of Areas of Concern located within traditional use areas and territories (*Annex 1 -- Areas of Concern*);
- **Identifying issues, setting priorities, and informing solutions** for lakewide intergovernmental management and coordination to protect water quality and ecosystem sustainability in the Great Lakes basin (*Annex 2 -- Lakewide Management*);
- **Increasing knowledge of exposure pathways** and the human health risks associated with legacy and emerging contaminants, which can be disproportionate for Indigenous communities that rely on Great Lakes fish, wildlife, and plant resources for subsistence, cultural, and ceremonial purposes (*Annex 3 -- Chemicals of Mutual Concern*);
- **Addressing water quality concerns** associated with excess phosphorus and nutrients in Great Lakes watersheds including Chequamegon Bay (Lake Superior), Fox River (Lake Michigan), and Saginaw Bay (Lake Huron) (*Annex 4 -- Nutrients*);
- **Preventing the release and spread of aquatic invasive species** that threaten native species of subsistence, cultural, and economic importance to Indigenous communities and that upend the balance of ecosystems (*Annex 5 -- Discharge from Vessels; Annex 6 -- Aquatic Invasive Species*);
- **Protecting intact habitats** and those that provide important ecosystem services, restoring degraded habitats, and increasing capacity to monitor and protect tribally important plants, fish, and wildlife (*Annex 7 -- Habitat and Species*);
- **Addressing groundwater protection concerns** through coordinated groundwater modeling efforts to identify and fill knowledge gaps regarding the important role of groundwater to the health of ecosystems within the Great Lakes basin (*Annex 8 -- Groundwater*);
- **Adapting management priorities, actions, and planning** to respond to seasonal weather pattern changes and increases in extreme weather events that threaten the continuation of Tribal lifeways and community well-being (*Annex 9 -- Climate Change Impacts*); and
- **Increasing recognition of the role of Indigenous nations**, Indigenous-led research, and Indigenous Knowledge with various governmental and non-governmental partners to aid in protecting the Great Lakes and their associated ecosystems (*Annex 10 -- Science*).

In each of the summaries outlined above, Indigenous nations are acting on concerns in response to TEK observations and/or community-led concerns. Regardless of whether the ensuing work is being done on a community-, habitat-, or regional-scale, Indigenous-led work in the Great Lakes relates to and supports every Annex under the Agreement.

The next section introduces TEK as a common foundation upon which further education can be built. This introduction is purposefully brief – this document is not meant to be represented as a treatise on TEK or Indigenous Knowledge. Rather, this document is meant to demonstrate how TEK and western science can collaborate in management structures around the Great Lakes. There is an abundance of rich resources available to provide a deeper understanding of Indigenous knowledge that the author team encourages readers to access. A substantial, but not comprehensive, list of available resources can be found in Appendix B of this document.

This introduction is followed by examples of the role TEK is currently playing in Tribal and interjurisdictional management at varying scales. The final section outlines recommendations for how the TEK Task Team can assist the Annex Subcommittees with appropriately engaging with and incorporating TEK into work being done under the Agreement.

III. Understanding Traditional Ecological Knowledge

This Guidance Document has used both "Traditional Ecological Knowledge" and "Indigenous knowledge" up to this point. It is important to recognize that, to those who embrace the term, TEK is one component of Indigenous knowledge systems. Indigenous knowledge encompasses environmental, socio-economic, cultural, and other elements of overall knowledge held by Indigenous peoples and practiced within Indigenous communities. Elements of Indigenous knowledge systems are known by many names, including Traditional Ecological Knowledge, Traditional Knowledge, and Native Science, among others.[7]

TEK is the term used for what has come to be recognized as the subset of Indigenous knowledge systems that is specific to ecology, and is the term specifically called out in the Agreement. Therefore, TEK is the term that will be primarily referred to in this document. However, it is important to acknowledge and understand that TEK is directly connected to, and therefore inseparable from, broader Indigenous Knowledge systems as a whole. It is also important to understand that TEK encompasses not only the knowledge systems held by Indigenous communities, but also the underlying beliefs, philosophies, relationships, and practices. Although there are multiple definitions or interpretations of TEK and what type of information it includes, these definitions should be viewed as fluid. While this makes it difficult to define TEK, this guidance attempts to provide a beginning that is firm and substantive enough to offer a useful introduction to how Indigenous knowledge systems can play a role in resource management contexts.

TEK is commonly recognized to be based upon relations with one another and the natural world. These relationships include direct environmental observations, connections, and interactions that are customarily transmitted interpersonally and orally from generation to generation through stories, oral histories, songs, ceremonies, customary laws, and other ways. TEK is intrinsically

[7] Berkes, F. (2012). "Sacred ecology." New York, Routledge; Agrawal, A. (1995). "Dismantling the Divide Between Indigenous and Scientific Knowledge. Development and Change." 26(3):413-439; Cajete, G. (2016). "Native Science: Natural Laws of Interdependence. Clear Light Publishers."; Whyte, K.P. (2018). "What Do Indigenous Knowledges Do For Indigenous Peoples? In Traditional Ecological Knowledge: Learning from Indigenous Practices of Environmental Sustainability." Edited by M.K. Nelson and D. Shilling, 57-82. Cambridge University Press.

linked to spiritual beliefs, cultural practices, and ways of life and encompasses the whole being - mind, spirit, and emotion. For the purposes of the U.S. Caucus of the GLWQA TEK Task Team, if an Indigenous entity, person, or persons share information for contribution to the work being done under the Agreement, that information must be respected and acknowledged in a way deemed appropriate by the knowledge holder or holders.

One way to understand TEK is to compare it with western science. The author team is equally reluctant to provide a single definition for western science. However, for the purposes of this paper and this comparison, the term "western science" is the label provided for working through the defined scientific process. Through this process, western science works to understand through simplifying and dividing complexity by isolating discrete parts of the whole. Western science is reductionist and objective by design – values are removed from the scientific process in an attempt to eliminate bias and encourage repeatability. Western science is hierarchical and based on mathematical models. With some input through qualitative methods, western science uses quantitative analysis, all of which are captured in written records. Knowledge gained through western science is often done so "rapidly," in comparison to that gained in TEK, and verification is done on a broad scale.

This view Indigenous knowledge works to understand through drawing out and embracing complexity, viewing all things in relation to others, and recognizing the world as a series of interconnected components that cannot and should not be divided or separated. Because of this, there are no isolated disciplines within Indigenous Knowledge. TEK is holistic and subjective, and values are embraced as an integral part of understanding the world. This holistic and interconnected approach is also reflected in TEK models that are, most often, cyclical rather than linear. Analyses are done more qualitatively than quantitatively, and these qualitative records are made and transmitted orally through examples, anecdotes, parables, and different types of cultural stories. TEK is accumulated over the long term, for many generations, and verification of gained knowledge is done on a local, and often personal, scale.

There is also overlap between the ways of knowing. Both western science and TEK are used to explain complex environmental systems. They are both based on empirical observations, and analyses and conclusions are subject to change over time and through further observations. Conclusions are verified, in both, through repetition. Description, observation, and analysis all combine to establish a fact for both systems of knowing. Facts are tested through further experimentation. Accurate observation can arguably have higher stakes in TEK, however. When communities relied solely on the adequacy of harvest for subsistence, mistakes in observations could make survival difficult, and sometimes impossible.

The differences and similarities between western science and Indigenous Knowledge have been visualized in many ways. The following diagram offers one example of how a comparison can be visualized:

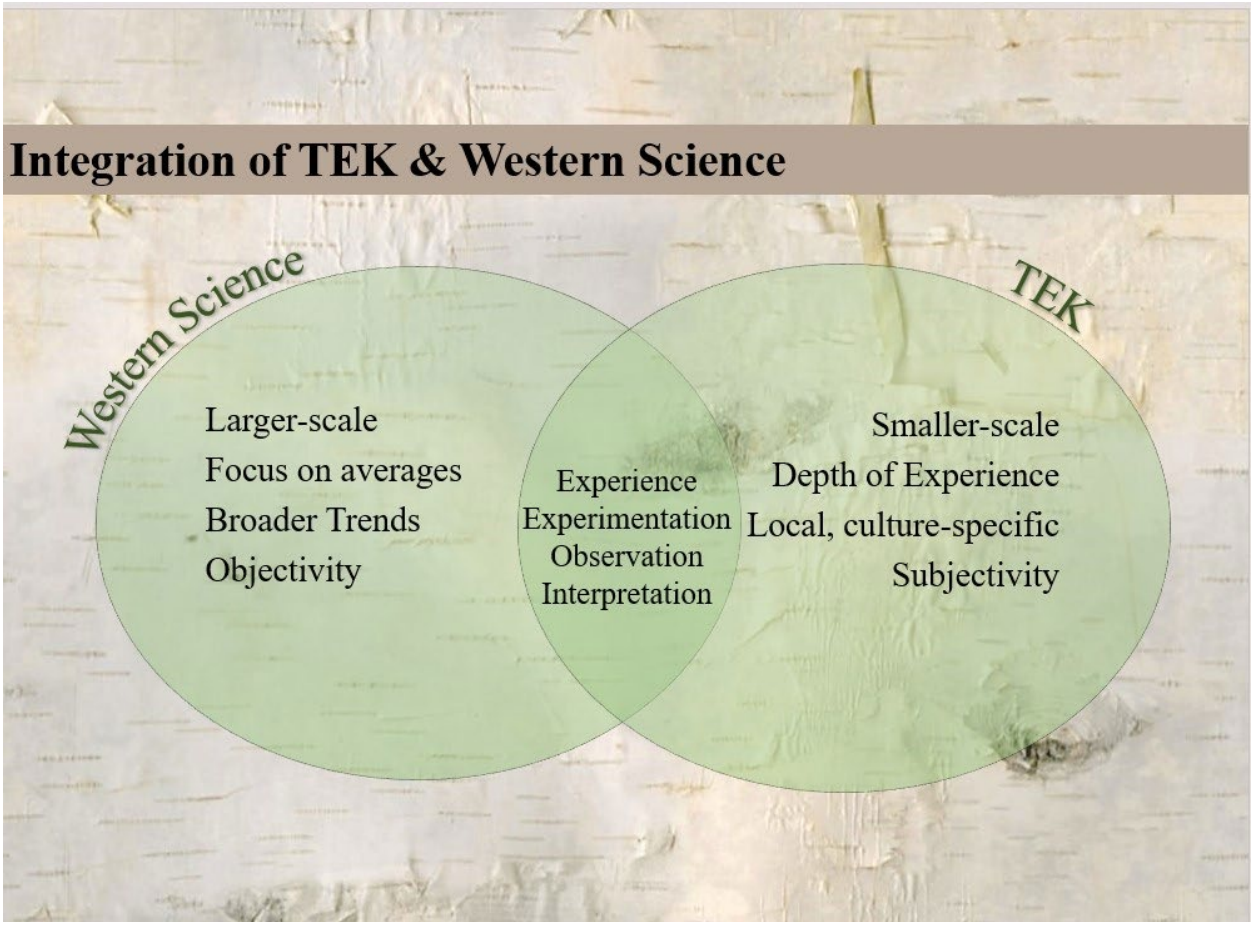


Diagram by Great Lakes Indian Fish and Wildlife Commission

Both TEK and western science are independent ways of knowing. However, it has been increasingly recognized that collaboration between the different ways of knowing enhances our ability to understand the Earth and lead to better management decisions. Collaboration between the different knowledge systems makes for a richer, more productive understanding of both the environment, and the human place within it. This collaboration has been described as braiding knowledges, as elements of a sister garden, and as two-eyed seeing. In each of these descriptions, each knowledge system has a distinct and integral role in supporting the well-being of the whole.[8] In each illustration, western scientific knowledge is strengthened by the addition of the values, traditions, and ceremonies of TEK.

In approaching collaboration between western science and TEK under the Agreement, it is important to understand that TEK cannot simply be incorporated within, or along the edges, of western science. TEK should not be treated as an element to be quantified or incorporated into western scientific studies. Rather, TEK must be recognized as an independent and sovereign

[8] Kimmerer, R. (2019). "P-Values and Cultural Values: Creating Symbiosis Among Indigenous and Western Knowledges to Advance Ecological Justice." Ecological Society of America; https://www.youtube.com/watch?app=desktop&v=xKmKFJzviz0; http://www.integrativescience.ca/Principles/TwoEyedSeeing/.

knowledge system. One important role TEK can play is to help ground and guide western science. Many Indigenous cultures regard all people, plants, animals, and rocks that share our world as relatives, rather than resources. This view can have a significant influence on scientific analysis, as well as on management decisions. Without the guidance of TEK, western science can supersede and displace other ways of knowing – intellectual, emotional, spiritual, and physical. All ways of knowing are integral to understanding the interrelationships of all beings.

As it relates to management decisions, TEK provides intensive knowledge in specific and defined geographic regions and, in this way, adds depth to more general and often more geographically widespread data offered by western science. In addition, by focusing on the interconnectedness of the whole, TEK can, and sometimes has, acted as an early warning system for emerging issues, imbalances, and changes in relationships, thereby helping to set priorities for study and action. As will be demonstrated in the section below, these intense, place-based observations can be generalized, as appropriate, to encompass larger geographic regions. However, the local scale allows emerging issues to be detected earlier than observations that are undertaken basin wide.

The guidance of TEK in management decisions can shift and enhance management targets from those most often employed. For example, Indigenous people aim to ensure that natural resources are healthy and abundant enough to meet the physical and spiritual needs presently and for seven generations into the future. In the Great Lakes basin, TEK can inform precautionary and restorative water quality management needs based on what is required for the health and sustainability of interconnected life forms and culturally-important and treaty resources that depend on that water, such as wild rice and other native fish, wildlife and plant species.

TEK perspectives go much further than managing water quality based on technocratic methods that calculate allowable levels of risk. Rather than being considered objects and resources to be used, TEK teaches that both water and natural resources have rights and require reciprocity and respect. In this way, TEK guidance offers a significant source of wisdom to inform environmental values, norms, and ethics of Indigenous and non-Indigenous peoples alike, such as requiring a more complex measure for defining a "healthy community," subsequently informing management approaches and sustainable possibilities within the Great Lakes.

While TEK has its benefits, it also has its challenges. This is especially true for collaborating TEK with systematic western scientific processes that underlay non-Indigenous resource management. As orally transmitted information, TEK does not provide neatly categorical or quantifiable data. Furthermore, there are differences in language and worldview between TEK and western science that increase the difficulties for full or seamless reconciliation. Resource management agencies may be reluctant and uncomfortable making management decisions based on information that falls outside of traditional western academic practices and documentation.

Despite these difficulties, a commitment to build and maintain the relationships necessary to support the collaboration between TEK and western science for management decisions will only benefit the work to protect and enhance the health of the Great Lakes and associated ecosystems. Dedication to respect, reciprocity, responsibility and reverence for the earth, together with

equity, and empowerment is vital to support the collaboration of both knowledge systems.[9] In the U.S., many respectful relationships with Tribes already exist in the Great Lakes region, and TEK has already begun to be embraced in various interjurisdictional resource management decisions and activities. The following section provides examples of how the sometimes-disparate worldviews of TEK and western science can collaborate to enhance resource management in the Great Lakes.

IV. Traditional Ecological Knowledge and Great Lakes Resource Management

The examples to follow describe some of the ways TEK has been incorporated into various interjurisdictional priority-setting and management regimes within the Great Lakes basin. These examples are intended to demonstrate how TEK has been incorporated into decisions that have been made and actions that have taken place at different jurisdictional and geographical scales. These examples also clearly show how TEK has initiated, directed, and enhanced projects that work towards meeting the broad goals of the Great Lakes Water Quality Agreement, as well as the objectives of the Agreement's Annexes.

A. Integrating TEK into Areas of Concern ("AOC") Priority Setting: The Saint Regis Mohawk Tribe in the St. Lawrence River AOC

The Mohawk Territory of Akwesasne is a jurisdictionally complex Nation straddling the border of the U.S. and Canada on the St. Lawrence River, on the most downstream extent of the Agreement's boundary. Akwesasne spans portions of jurisdictions known as New York State and the provinces of Ontario and Quebec. Due to spanning several jurisdictional boundaries and other complexities, there are at least 3-governing bodies in Akwesasne. The Saint Regis Mohawk Tribe ("SRMT") is the U.S. federally recognized Tribal government, the Mohawk Council of Akwesasne ("MCA") is the Canadian federally recognized First Nations government, and the Mohawk Nations Council of Chiefs is the traditional government "fire" -- the council recognized by the Haudenosaunee Confederacy. Due to its unique geographic and political location, the Mohawk Territory of Akwesasne is also wholly within the Binational St. Lawrence River Area of Concern ("AOC") boundaries, even though the international border splits the community, dividing it into the U.S. and Canadian domestic AOCs.

Regardless of the political boundaries that define "Areas of Concern" in the Great Lakes, the Mohawk Territory of Akwesasne has been impacted by both Massena, NY (U.S. domestic) and Cornwall, Ontario (Canada domestic) industrial discharges and chemicals of concern ("COC"), which impact beneficial uses by Mohawk people. The primary chemical of concern that originated from Cornwall, Ontario is mercury, whereas the primary chemical of concern that originated from Massena, NY is polychlorinated biphenyls ("PCBs"). In addition, the Mohawk

[9] "Embedded in cultural frameworks of respect, reciprocity, responsibility and reverence for the earth, Indigenous science lies within a worldview where knowledge is coupled to responsibility and human activity is aligned with ecological principles and natural law, rather than against them." Indigenous Science Declaration, *available at* https://www.esf.edu/indigenous-science-letter/Indigenous_Science_Declaration.pdf.

community has also wrestled with air, water, sediment, soil, and groundwater impacts from industrial chemicals, such as poly aromatic hydrocarbons ("PAHs"), chlorinated pesticides, dioxins, furans, heavy metals (i.e. aluminum, lead, etc.), fluoride, VOCs, and phenols since at least the 1950s.

The SRMT Environment Division is the sovereign government branch on environmental issues in the southern portion (the U.S. domestic portion) of the Akwesasne Territory. While the SRMT Environment Division now has a long-standing relationship with State and U.S. Federal Agencies, working in cooperation toward many common environmental goals, a significant grassroots effort was led by Mohawk people prior to the strengthening of these government-to-government relationships to protect and preserve their way of life, culture, language, ceremonies and traditional teachings, tied closely with the natural environment. This effort took place through non-profit organizations such as the Akwesasne Task Force on the Environment ("ATFE") and Haudenosaunee Environmental Task Force ("HETF").

Haudenosaunee Environmental Protection Process ("HEPP")

Industrial contamination has negative impacts on the ways of life of Mohawk people and the relationship they have with the environment. As knowledge of contamination increased, Mohawk people became fearful of their environment and traditional foods, severing traditional practices in the hopes of protecting their families from harmful chemicals. This change in Mohawk people's relationship with the environment also affected cultural practices and the transmission of traditional teachings for decades. The Mohawk people then took the lead in restoring those relationships and teachings.

One of the most important TEK (scientific and applied) frameworks developed for this purpose was via the ATFE and HETF, titled *Iakotisa'tstentsera:wis Ne Ohontsia: Reducing Risk by Restoring Relationships* (2004-2008). The purpose was to begin the process of restoring healthy relationships between Mohawk youth and the natural world through traditional teachings by elders at the Akwesasne Freedom School.[10] This was one of the first efforts to blend scientific ecological knowledge ("SEK") from local environmental contamination data with TEK to educate youth and develop a culturally based process for protecting the environment.

Another significant outcome of this work was an environmental protection model created from Haudenosaunee teachings and principles, called the Haudenosaunee Environmental Protection Process ("HEPP") (Lafrance and Costello 2010). The HEPP reflects the Haudenosaunee (Cayuga, Oneida, Onondaga, Mohawk, Seneca, and Tuscarora) people's need to live in peace and harmony with the natural world as directed by the teachings of the *Ohén:ton Karihwatéhkwen* (words that come before all else), also known as the Thanksgiving Address. The Ohén:ton Karihwatéhkwen instructs human duties and responsibilities to the natural world,

[10] Arquette, Mary, et al. (2007). Final Report: Iakotisa'tstentsera:wis Ne Ohontsia: Reducing Risk by Restoring Relationships. *Available at* https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/6825/report/F.

and this is the same principle SRMT has used to integrate TEK into BUI assessments in the St. Lawrence River AOC.

Natural Resources Damage Assessment and the creation of the Akwesasne Cultural Restoration Program

During U.S. settlement negotiations for Natural Resource Damage Assessment ("NRDA") in Akwesasne, the SRMT Environment Division conducted interviews with elders and commissioned an anthropological report to identify cultural damages from the impacts of industrial contamination. The interviews provided proprietary TEK from community elders for SRMT.

In 2013, the NRDA was settled[11], and settlement monies were used to create an Akwesasne Cultural Restoration Program ("ACRP"), or Á:se Tsi Tewá:ton (We will make it new again), a 4-year curriculum (2014-2017) for a masters/apprenticeship for Mohawk people. This program was designed to help revitalize traditional teachings and healthy relationships between Mohawk people and their environment and reinvigorate intergenerational teachings between family transmissions between elders and young adults.[12]

The ACRP focused on Mohawk language (Kanien'keha) integration with four main teaching categories: 1) water, fishing, and river use; 2) hunting and trapping; 3) medicine plants and healing; and 4) horticulture and basket making. This program was integral in assisting SRMT staff working on the AOC to blend western science with TEK into the AOC Beneficial Use Impairment ("BUI") assessment process using a cultural lens. This was most evident in 2017 when 2-masters and 4-apprentices in the medicine plant and healing group worked with a botanist and the SRMT AOC Program Manager to conduct field surveys and reports to identify Mohawk plants of cultural significance for replanting in Treaty Rights areas of the AOC. This example of blending SEK and TEK will be used in future AOC BUI assessment studies for habitat, fish, and wildlife species where needed, and in the creation of Management Actions in the AOC.

SRMT Environment Division integration of TEK into BUI Assessment Studies

In 2010**,** SRMT received competitive Great Lakes Restoration Initiative funds from the U.S. EPA for the scientific assessment of BUIs in the St. Lawrence River AOC. This assessment included multiple components (i.e., avian, turtles, aquatic furbearer mammals, fish tumors, and freshwater mussel studies) through field studies conducted from 2011-2015. The scientific methodology proposed to assess healthy reproducing populations and/or habitat, when possible, and used a cultural lens, as established through the HEPP and ACRP, to select cultural use species in an integrated monitoring approach.

[11] U.S. Fish and Wildlife Service New York Field Office. "St. Lawrence Environmental Natural Resource Damage Assessment." *Available at* https://www.fws.gov/northeast/nyfo/ec/stlaw.htm.
[12] St. Lawrence Environment Trustee Council (SLETC). November 2012. "Preferred Cultural Restoration Projects." *Available at* https://www.fws.gov/northeast/nyfo/ec/files/stlawrence/St.Lawrence.CULT01.30.13%20(1).pdf.

For example, existing BUI removal criteria language did not include metrics for specific wildlife species of importance to Mohawk people, such as muskrat and beaver for Fish and Wildlife Consumption (BUI #1), Degraded Fish and Wildlife Populations (BUI #3) or Loss of Fish and Wildlife Habitat (BUI #14). However, because of traditional teachings (i.e., through the Creation Story and elder interviews), SRMT added contaminant and habitat assessments specific for those two species to ensure the relationship between Mohawk people and muskrat and beaver could be restored. Similarly, SRMT's assessment of turtle populations and reproductive health related back to the Haudenosaunee Creation story and Mohawk people's relationship with turtles.[13]

This type of SEK and TEK integration process is important for both scientific measures and community communication related to restoring the relationships of the people to the environment and building confidence within the community that their ways of life are being protected and kept in balance. Restored Mohawk relationships to the natural world for revitalized traditional practices is as important as western scientific ecological metrics for assessing beneficial uses of healthy reproducing wildlife populations.

Next Steps for modifying BUIs to include Mohawk cultural use removal criteria and endpoints

Building upon decades of Mohawk elder TEK leadership and the successes of the HEPP and ACRP, the SRMT Environment Division is continuing to gather and identify diverse and practical applications for TEK, especially as it relates to the boundaries of the Binational St. Lawrence River AOC and setting priorities. For the U.S. domestic AOC, the SRMT Environment Division is currently working on Mohawk cultural use removal criteria, metrics, and endpoints that apply TEK to BUIs in the St. Lawrence River AOC at Massena/Akwesasne, with a proposed draft planned to be completed by 2021. With support of the U.S. EPA Great Lakes National Program Office ("GLNPO"), this project will be the first of its kind in any AOC in the U.S. or Canada.

B. <u>TEK Enhances Lake-wide Priority-Setting: Saving Buffalo Reef</u>

In the late 1990s, Tribal fishermen began to express concern about the health of Buffalo Reef in Lake Superior's Keweenaw Bay based on changes they were seeing in the health and abundance of the lake trout and whitefish populations in that area compared to what they saw in years and generations past. The reef is an important spawning habitat, estimated to supply 23% of the Tribal commercial harvest of lake trout, 33% of the total trout spawning habitat, and 8.5% of whitefish spawning habitat in the U.S. waters of Lake Superior.

The information provided by the Tribal fishermen enabled the Great Lakes Indian Fish and Wildlife Commission ("GLIFWC" or "Commission") to obtain a grant from the U.S. EPA's Great Lakes National Program Office in 2005 to obtain sonar imaging of the reef. This imaging showed that the reef was being covered by stamp sands - mining waste that was dumped into

[13] Turtle is one of the three clans within the Mohawk Nation. In the 1980s, during the peak of industrial contamination awareness, Akwesasne was known as the "toxic turtle" due to the extremely high PCB concentrations found in snapping turtles in and adjacent to the territory from industrial contamination. To some Mohawk people, this 'chemical attack' on the turtle's health was viewed as harmful to both family and Nation.

Lake Superior and on its shoreline during the late 1800s and early 1900s. The stamp sands are moving into the water and destroying the spawning reef by filling in and contaminating the cobble substrate where the fish lay eggs. These stamp sands are high in copper, mercury, arsenic, and other contaminants that are toxic to aquatic life, illustrated by the fact that juvenile fish are not found in shoreline habitats that are covered in stamp sands. At that time, approximately 35% of the reef was no longer viable because it was covered with an inch or more of stamp sands, and modeling predicted that by 2025, 60% of the reef will no longer be viable for lake trout and whitefish spawning if no action was taken.

After twelve years of interjurisdictional coordination, through already-existing lake-wide priority-setting mechanisms, such as the Lake Superior Binational Program Work Group (now known as the Lake Superior Partnership Work Group), Lake-wide Action and Management Plan ("LAMP") priority setting, and the five-year Cooperative Science and Monitoring Initiative priority-setting mechanisms, the study and protection of Buffalo Reef was set as a priority in the 2016 Lake Superior LAMP. This was the final step that allowed support for cooperative efforts by the Keweenaw Bay Indian Community ("KBIC"), GLIFWC, Michigan Technological University, the Army Corps of Engineers, the EPA, and the State of Michigan; short-term dredging and disposal plans were developed, and a task force was created to work on long-term plans for protecting the reef.

If not for the initial information provided by Tribal fishermen and the recognition of the fishermen's intimate knowledge of the reef by Tribal and Federal agencies, the health of Buffalo Reef may not have been evaluated until more serious degradation made the impairment more evident. Any such delay would have complicated remediation and protection efforts for this important resource for Lake Superior and one of the most effective reefs in the Great Lakes. Early detection of the issue through local place based TEK coupled with long-established cooperative relationships developed through the Binational Program, and that continue to exist through the Lake Superior Partnership, are now saving Buffalo Reef. [14]

C. TEK Directs Research Questions to Address Community-Based Chemical Concerns: Collaborative, Integrative, and Multi-Jurisdictional Atmosphere-Surface Exchangeable Pollutants ("ASEP") Project in Michigan's Keweenaw Peninsula

In 2012, researchers from Michigan Technological University reached out to several Great Lakes entities to collaborate as partners on a research project titled "Managing Impacts of Global Transport of Atmosphere-Surface Exchangeable Pollutants ("ASEPs") in the Context of Global Change" ("ASEP Project") to be conducted in Lake Superior's Keweenaw Bay. This project investigated the fate and transport of toxic substances (such as mercury and PCBs) as a global process with local consequences, worked to improve computer modeling so that expected emissions of mercury could be more confidently forecasted, and aimed to determine a set of actions at different scales (regional, national, and international) that could lead to an acceptable level of future global emissions of these substances. Because the Great Lakes basin, as a whole, is particularly susceptible to the effects of ASEP deposition, and because the communities

[14] Great Lakes Indian Fish & Wildlife Commission. (2020). "Saving Buffalo Reef." *Available at* https://www.youtube.com/watch?v=VpcFiMx94Zk

around the Keweenaw Peninsula, in particular, rely heavily on fish for consumption, the decision was made to locate the project within Lake Superior's Keweenaw Bay (http://asep.mtu.edu/).

Funded by the National Science Foundation ("NSF"), the project brought together five universities and eleven multi-jurisdictional organizations, including KBIC, GLIFWC, the Environmental Protection Agency's Integrated Atmospheric Deposition Network, and the Arctic Monitoring and Assessment Programme in Norway. Most importantly, the project was designed so that the local community influenced its research trajectory and so that the priorities of that community would be integrated into the research. Many of the community participants for this project were members of KBIC. Through this pathway, TEK-derived community concerns led much of this project's research.

To ensure equitable community engagement, a series of participatory forums were integrated into the research design by: 1) holding an opening workshop to establish community research priorities, which were then integrated into the research investigation; 2) holding a workshop during the course of the research to integrate partner definitions and parameters into the investigation; and 3) holding a closure workshop to share the results and to engage in dialogue for future participatory research opportunities.

The initial engagement resulted in the following guiding research question: "When can we safely eat as much fish as we desire?" This question speaks directly to one of the Agreement's General Objectives, specifically that the Great Lakes be in such a condition as to "allow for human consumption of fish and wildlife unrestricted by concerns due to harmful pollutants."[15] The line at which fish consumption is considered to be "safe" is a moving target, and varies by community. Those communities for which the consumption of fish is tied to subsistence practices, cultural and spiritual customs, and the continuation of a way of life will find a lower level of pollutants concerning than those communities that rely on fishing on a more sport basis. The Great Lakes basin is particularly susceptible to atmospheric deposition, reflected in the many fish consumption advisories throughout the basin. In the Agreement, the United States and Canada commit to eliminate these advisories.

Fish carving at the Keweenaw Bay Indian Community Powwow Grounds.
Photo credit: Sarah Atkinson, Michigan Tech

Initially a loosely-articulated question rooted in a long-term perspective, the project participants were able to refine this community-based concern into a more scientifically-effective question: how many years will it take before the most sensitive populations in Keweenaw Bay are able to safely consume the amount of fish that they desire? Guided by this question, the

[15] GLWQA, Article 3(1)(a)(iii). *Available at* https://www.ijc.org/sites/default/files/2018-07/GLWQA_2012.pdf.

research began with assumptions about the type and quantity of fish being consumed. The second workshop was able to refine those assumptions by gaining more information from community members with regards to the importance of fish and fishing in the Tribal community. The information gathered at this workshop was also used to determine from which specific bodies of water tribal members would prioritize harvesting and the specific species of fish they would prioritize harvesting if toxicity were not an issue.

At this workshop, community members also defined the "desired" fish consumption as 225-gram meals per day, which represents the height of regional fishing of the spring *Ogaa* (walleye) harvest. This desired rate exceeds the current health criteria by 25 times. This alone highlights the urgency for research to be rooted in and guided by information gained from the community. After this, three scientifically rooted steps were completed: 1) determining what fish tissue concentration is considered safe; 2) determining to what level air concentrations need to decline before fish tissue concentrations reach safe levels; and 3) forecasting future atmospheric concentrations, based on various emissions scenarios.[16] This project shows how concerns that are informed by TEK can be refined to be scientifically addressed.

This project revealed valuable insights on the value of integrating knowledge systems through community-engaged research. Developing the research trajectory from community engagement, in this instance, rooted that trajectory in the Seven Generations philosophy. From this perspective, identifying a specific number of years is less important than taking action that considers the well-being of people and other beings seven generations into the future. Therefore, western science was undertaken in a way that was consistent with the problem of community-based toxicity concerns.

This project provides an additional illustration of the building blocks that are required for true TEK and western scientific integration. Building relationships and strengthening trust, although not often recognized as products of, or ingredients for, scientific research, are crucial for collaborative, integrated research. It was crucial that this project began in the proposal stage with face-to-face meetings with KBIC government officials, and that the second and final workshops were hosted by the local college in that community. This allowed for more engagement with the community, which, in turn, allowed for the gathering of the relevant, place-based information needed to address the localized research question. In addition, project participants and community partners worked together to develop workshop proceeding documents, which allowed for new relationships to be developed while others were strengthened. The result is increased capacity for present and future collaboration and integration.

D. TEK Enhances the Holistic Understanding of Species within Ecosystems to Solve Habitat Threats: NOAA-Tribal Partnership for Great Lakes *Manoomin* Restoration

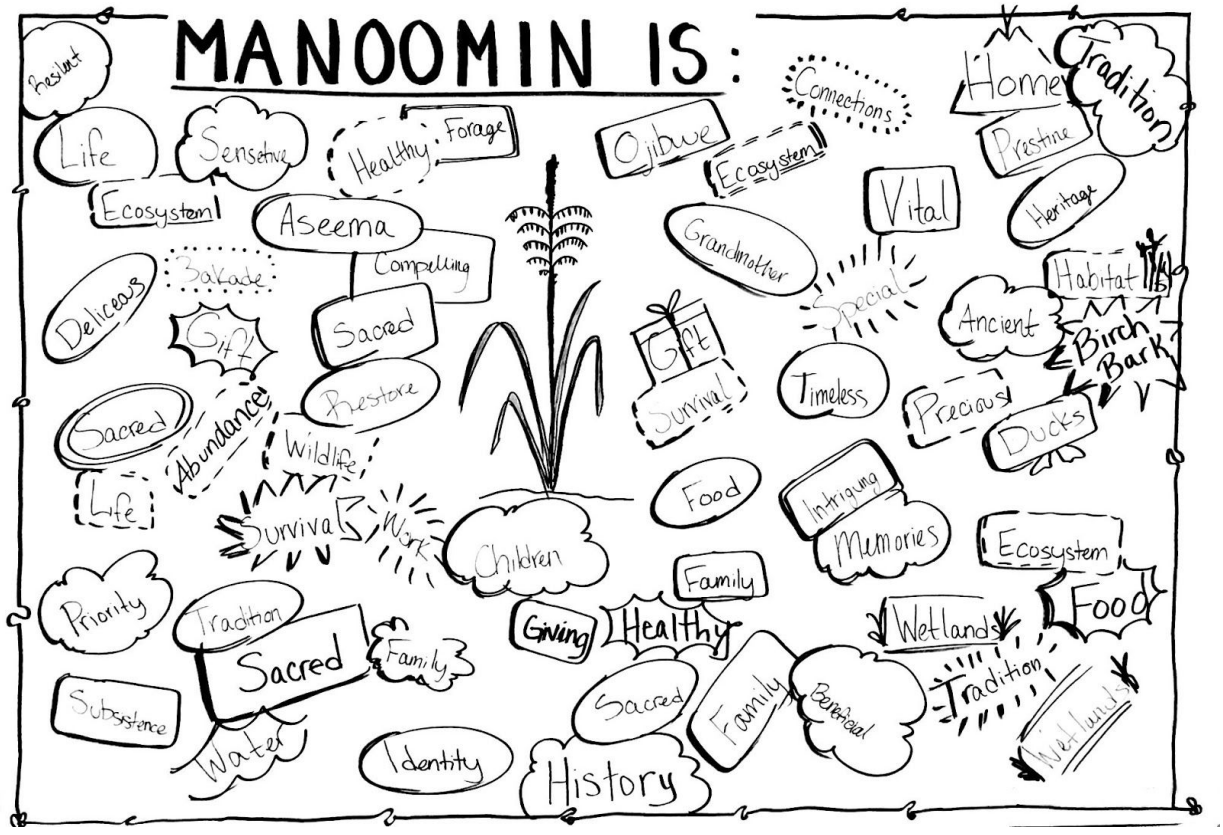
Often, western scientists and natural resource managers find TEK to be particularly helpful when attempting to better understand a certain resource or ecosystem. TEK within Anishinaabe communities is acknowledged as having fundamental importance with regard to the care and restoration of *Manoomin* (wild rice) in the Great Lakes region. Within Anishinaabe

[16] More information on the details of each of these steps can be found online at: https://pubs.rsc.org/en/content/articlelanding/2018/em/c7em00547d#!divAbstract.

communities, wild rice is the centerpiece of feasts, celebrations, and ceremonies honoring the water, in compliance with the original treaty between the Anishinaabe and the Creator.

At the heart of the Anishinaabe relationship with rice is the respectful, interactive, and reciprocal relationship between the rice and harvesters. Respectful attitudes recognize the power and spirituality of all of nature. Over thousands of years, these reciprocal relationships have developed adaptive strategies for monitoring, enhancing, and sustainably harvesting *Manoomin*. Maximizing the amount of harvest has never been the goal of *Manoomin* management. Instead, *Manoomin* is managed so that there is no degradation of habitat by taking away provisions that would sustain other life. Years of Tribal building relationships with Federal and State agencies allowed for the recognition of the relationship that Anishinaabe communities have with *Manoomin*.

In recognition of the importance of *Manoomin* and threats facing it, the National Oceanic and Atmospheric Administration ("NOAA") received Great Lakes Restoration Initiative ("GLRI") funding to support *Manoomin* restoration work in the Lake Superior basin with Tribal partners. NOAA reached out to Tribal, State, and Federal partners that work with *Manoomin* to collaborate. Workshops were held in 2017, 2018, and 2019 to discuss the cultural significance of *Manoomin*, the complexity of *Manoomin* management, and the challenges for restoration.

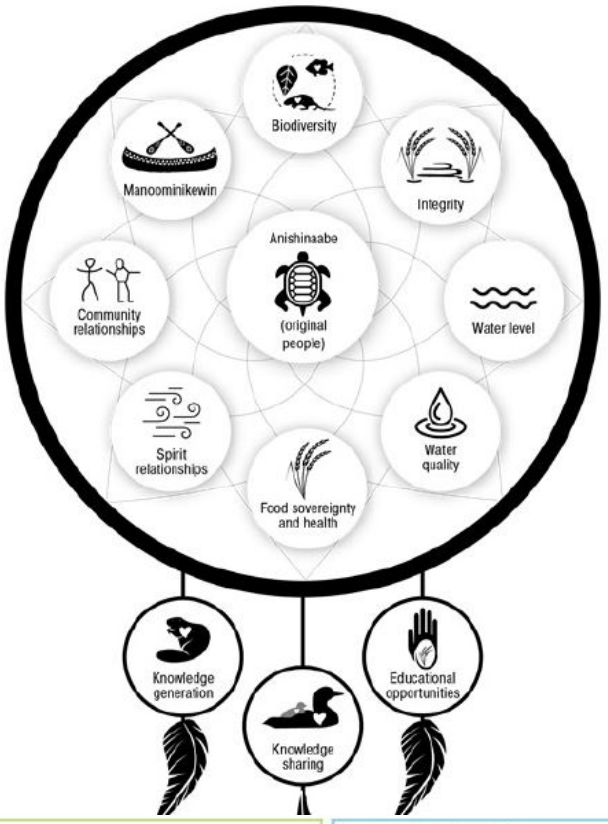


"*Manoomin is"* from the Lake Superior *Manoomin* Restoration Workshop, 2017. Odanah, WI.

Out of the first NOAA hosted *Manoomin* workshops, a *Manoomin* Characterization Study Project was developed.[17] The Project Team was made up of a group of Lake Superior Basin Anishinaabe communities, as well as federal and state agencies, and was supported by Abt Associates. The purpose of the project was to develop guidance to inform *Manoomin* management, protection, and policy in the Lake Superior Basin and throughout the Great Lakes.

This cultural and ecological characterization study used a combined Habitat Equivalency Approach ("HEA") which included (1) identifying case study sites as examples of degraded and restored *Manoomin* habitat, (2) refining and applying cultural and ecological metrics to characterize the degraded and restored *Manoomin* and its associated habitat at the case study sites, and (3) using HEA to quantify the amount of restoration need to counter-balance the lost *Manoomin* habitat functionality. Through the application of cultural and ecological metrics, illustrated on the following page, an enhanced holistic understanding demonstrated a value of rice that was based on the role of rice within the ecosystem, rather than the traditional western valuation base entirely on its monetary value.

[17] Abt Associates Inc. (2020). "Lake Superior *Manoomin* Cultural and Ecosystem Characterization Study, Final Report." National Oceanic and Atmospheric Administration Office for Coastal Management. https://lakesuperiorreserve.org/files/2020/09/Lake-Superior-Manoomin-Cultural-Ecosystem-Characterization-Study_2020.05.29.pdf



Cultural Metrics

Anishinaabe (original people) – The place provides manoomin, which is sacred to the Anishinaabe and central to the foundations of their culture, sovereignty, and treaty rights.

Community relationships – Manoomin at this place contributes to bonding, traditions, and strengthening family and community connections.

Spirit relationships – Manoomin at this place enables the Anishinaabe to maintain connections and balance with spirit beings (or relatives) from all other orders of creation (first order: rock, water, fire and wind; second order: other plant beings; third order: animal beings; fourth order: human beings).

Manoominikewin – This place allows for the Anishinaabe to harvest, prepare, and share (gifting, healing, and eating) manoomin in the ways practiced by their ancestors for centuries.

Food sovereignty and health – This place provides the capacity to provide for the sustenance, health, and independence of the Anishinaabe.

Ecological Metrics

Biodiversity – Healthy manoomin and appropriate habitat at this place supports diverse biological communities (e.g., free of invasive species) that indicate the capacity of the place to support abundant associated plant and animal species (e.g., other native aquatic vegetation, fish, waterfowl, muskrat), providing for spiritual and subsistence needs.

Integrity – Physical habitat and hydrology, water and sediment chemistry support stands of manoomin that exhibit natural annual variability; viable seed bank ensures that sustainable manoomin populations will persist even after occasional poor production years. Natural genetic diversity is maintained without impact from cultivated strains, or reduced gene flow from the loss of nearby manoomin populations.

Water quality – This place has clean water (e.g., sulfate levels below 10 ppm) and sediments that can support robust stand density and wildlife diversity; is free of contamination or impacts from industrial, agricultural, recreational, or residential influence; and is of sufficient areal extent to sustain a manoomin population.

Water level – This place has a natural or managed hydrologic regime that can maximize resilience under variable or extreme climatic conditions across the growing season (maintaining optimal depth range and flow).

Cultural and Ecological Education Metrics

Knowledge generation – This place allows for continued learning and generation of the Anishinaabe practices, values, beliefs, and language through experience.

Knowledge sharing – This place allows for the continued sharing and transmittal of the Anishinaabe practices, values, beliefs, and language among family members and community.

Educational opportunities – This place provides opportunities for language, land stewardship, and other educational programs, such as educational rice camps.

Dream catcher diagram holistically displaying the 12 cultural, ecological, and education metrics developed for the Lake Superior Manoomin Cultural and Ecological Characterization study.

E. TEK Guides Adaptation to Climate Change Impacts: The Tribal Climate Adaptation Menu

The Tribal Climate Adaptation Menu ("Menu") - Dibaginjigaadeg Anishinaabe Ezhitwaad - was developed by a diverse group of collaborators representing Tribal, academic, intertribal, and other governmental entities, focused in Minnesota, Wisconsin, and Michigan. The Menu provides a framework to integrate Indigenous and traditional knowledge, culture, language, and history into the climate adaptation planning process. Developed as part of the Climate Change Response Framework, a cross-boundary collaboration among scientists, managers, and landowners, the Tribal Climate Adaptation Menu is designed to work both with the Northern Institute of Applied Climate Science ("NIACS") Adaptation Workbook, and as a stand-alone resource.

The Menu is an extensive collection of climate change adaptation actions for natural resource management, organized into tiers of general and specific ideas. It also includes a companion Guiding Principles document, which describes detailed considerations for working with Tribal communities. While this first version of the Menu was created based on Ojibwe and Menominee perspectives, languages, concepts, and values, it was intentionally designed to be adaptable to other Indigenous communities, allowing for the incorporation of their language, knowledge, and culture. Primarily developed for the use of Indigenous communities, Tribal natural resource agencies and their non-Indigenous partners, this Tribal Climate Adaptation Menu may be useful in bridging communication barriers for non-tribal persons or organizations interested in Indigenous approaches to climate adaptation and the needs and values of Tribal communities.

During the writing process of the Tribal Climate Adaptation Menu, the author team, comprised of at least seven Tribal members, met on a near monthly basis for approximately two years until the document was considered ready for print. The Tribal members that were part of the team focused on the incorporation of Indigenous language and cultural values throughout the document. Several of the team members also conducted outreach with various Tribal Historic Preservation Officers, elders, and spiritual leaders. The author team holds periodic workshops teaching others how to use the Menu most effectively and how to not only consider but incorporate TEK into climate change-focused decision-making and practices. The workshops are focused on and involve tribes, those working with tribes and/or those working within areas where decision-making will impact tribes and its members. As a framework developed by an author team driven by Tribal members, and through the specific incorporation of TEK, the Tribal Climate Adaptation Menu offers all resource managers a way to integrate TEK into their climate adaptation decisions.

More information and the full Tribal Climate Adaptation Menu can be obtained at https://forestadaptation.org/learn/resource-finder/tribal-climate-adaptation-menu.

F. Integration of TEK to Guide Adaptive Resource Management: USDA Forest Inventory and Protocols for *Wiigwaasabak* (Birch) and Working with Anishinaabe Communities in the Upper Great Lakes Region

From the early 2000s, staff from GLIFWC and the United States Department of Agriculture's Forest Inventory and Analysis ("FIA") Program have been working to incorporate TEK into targeted forest inventories to research the health, availability, and sustainability of forest paper birch in the upper Great Lakes region of the United States. Forest inventories are fundamental to the United States Forest Service's forest management by documenting the effects of past management, disturbance, and successional processes that help guide decisions and fulfill the future management goals of their forests.

Wiigwaasabak is a keystone species for the Anishinaabe in the upper Great Lakes region, fundamental to their cultural identity because of its diverse role in diet, materials, medicine, and spiritual practices. As original forest managers, the Anishinaabe traditionally managed forests in favor of the birch, including intentionally burning specific areas to promote its growth, and developing harvesting techniques that were done in a respectful, protective manner.

In the early 2000s, GLIFWC staff began to hear from its member Tribes that harvesters were reporting increasing difficulty finding birch bark of sufficient quality to make canoes or crafts. The harvesters and GLIFWC staff suspected this was the result of changing forest management practices in the region. Already working together under a Memorandum of Understanding, staff from GLIFWC and the FIA Program were spurred by these concerns to collaborate on the design and implementation of a program to incorporate TEK into an inventory of birch bark characteristics in the Great Lakes region.

GLIFWC staff identified harvesters from five of its member Tribes who had decades of experience finding, choosing, harvesting, and using birch bark for multiple uses. From 2002 - 2003, these harvesters shared information about suitable bark characteristics and strategies for finding and identifying bark that is necessary for their purposes. This information was shared through photographs and oral interviews, captured with audio recordings and interview notes. GLIFWC then synthesized this information and identified frequently mentioned characteristics. Staff from GLIFWC and the FIA Program then incorporated those characteristics into regional inventory protocol in such a way that it could be expressed in terms of discrete variables that could be assessed objectively by forestry professionals with no experience harvesting birch bark. The protocol was shared with the Tribal harvesters to make sure that the information was adequately and appropriately captured.

The protocol went into practice in 2004. FIA Program staff initially reported difficulties in implementing part of the protocols, which lead to an editing process that took place from 2004 - 2006. The result of this process was a manual that was effective for FIA Program staff, while still reflecting the characteristics shared through TEK. This evolution illustrates the need for an adaptive, iterative approach to incorporating TEK into western scientific resource management activities, and the ways in which the different languages of TEK and western scientific knowledge can be resolved.

IV. Conclusion: A Path Forward for Incorporating TEK into the Great Lakes Water Quality Agreement

Through Annex 10 of the Agreement, the Parties have committed to *"…contribute to the achievement of the General and Specific Objectives of this Agreement by enhancing the coordination, integration, synthesis, and assessment of science activities. Science…may be supplemented by other bodies of knowledge, such as traditional ecological knowledge."* With this instruction, the Science Annex is to operate as the integrator, coordinator, and collaborator of work being done under the Agreement.

As the examples above demonstrate, the integration of TEK offers ways to spot threats earlier than western scientific assessments, refocus remediation metrics, and structure environmental health evaluations according to community concerns. Each of these can help to enhance the work being done under the Agreement to meet its general and specific objectives. As each of these also demonstrate, the integration of TEK involves trusting and continuous communication between jurisdictions, capacity to be involved in scientific and management decisions, and mutual respect.

The U.S. Caucus of the TEK Task Team undertook the development of this paper to begin the TEK integration and coordination role for the Annex 10 Subcommittee, as well as to provide a resource for Annex Subcommittees, and the jurisdictions that sit on them, to explore how TEK integration can enhance Great Lakes scientific assessments and management. The eagerness of governmental and academic entities to better understand and integrate TEK can be seen in the number of TEK-related projects being undertaken by interjurisdictional and academic entities throughout the Great Lakes basin. These current projects also show how TEK can be incorporated into the integration, coordination, and collaboration role of Annex 10, as well as how TEK can help the Parties meet the key commitments of the Agreement. Currently, outside of the specified structure of the Agreement and its Annexes, the following additional projects are underway or under development in the Great Lakes and incorporate some element of TEK:

- The development of interjurisdictional fish consumption advisories that take into account the specific physical, spiritual, cultural, and subsistence needs of Indigenous communities;

- The development of a framework through which regular horizon-spotting can be used to identify potential threats to the Great Lakes before they become issues;

- The development of guidance for understanding barriers to the use of TEK in lake- or basin-wide scientific inquiry; and

- The synthesis of Indigenous knowledge into a guidance document for shared stewardship and governance.

This Guidance Document is meant to serve as a helpful starting point to assist the Annex Subcommittees in considering how TEK can play a role in current and future work and priority-setting conducted under the Agreement. While incorporating TEK into Agreement activities will

have its challenges, the examples above demonstrate some of the ways in which these challenges have been addressed and overcome. The examples illustrate three overarching principles:

1. The recognition and integration of the values and knowledge of Indigenous communities will only strengthen collaborative science, policy, and management outcomes for the integrity of the Great Lakes and its ecosystems;

2. The successful incorporation of TEK into science, policy, and management plans at various scales fundamentally requires a commitment to respectful, timely, and ongoing engagement of TEK holders, Indigenous governments and organizations, and/or tribal environmental professionals who have established relationships with TEK holders and permission to share TEK; and

3. TEK can provide early identification of current and emerging issues and inform and guide scientific research questions once general and subjective TEK information is translated into discrete and objective scientific or policy questions or actions.

The TEK Task Team will continue compiling and developing resources to provide more information about TEK and appropriate ways to engage TEK holders. While the TEK Task Team itself will have a limited role in directly engaging and sharing TEK, it may serve as a resource to assist in identifying those areas in which the initiation or strengthening of TEK inclusion would best enhance activities under the Great Lakes Water Quality Agreement. Additionally, in some cases, the TEK Task Team may have more specific recommendations for individuals or communities who should be engaged and how. This could begin through increased capacity for and involvement of the TEK Task Team to regularly engage with other Annexes, their Subcommittee and task team Co-Leads to identify and advise where TEK incorporation may be appropriate.

To support the integration of TEK and western science as supported by the Agreement, the U.S. Caucus of the TEK Task Team envisions that the caucus will take the following next steps:

1. Identify and address current challenges for increased involvement for Indigenous peoples and the TEK Task Team to engage in a more active role throughout the Great Lakes Water Quality Agreement;

2. Continue to encourage further engagement, involvement and collaboration with First Nations and Métis to ensure full inclusion into an active and engaged Task Team;

3. Support the creation of a matrix of ongoing work under the Agreement from which the Task Team can determine how to best assist each Annex Subcommittee to incorporate TEK into its current work, priority-setting, and reporting requirements, as well as enhance the relevance of TEK in future Annex work and responsibilities;

4. Curate and maintain a living repository of TEK reports, scholarship, historical TEK articles and other resources with which the Parties, GLEC members, and Annex Subcommittee members can strengthen their understanding of TEK, its processes, and the

respect with which it should be shared, gathered, and cared for;

5. Provide opportunities for dialogue and engagement to strengthen knowledge and understanding of TEK among the Parties to the Agreement, Great Lakes Executive Committee members, Annex Subcommittee members, Indigenous communities, and other partners working on Great Lakes protection and restoration;

6. Provide support and guidance for GLEC members, Annex Subcommittees, Task Teams, and Indigenous governments with regard to specific TEK requests; and

7. Explore the development of an appropriately protected database of TEK relating to the health of the Great Lakes and their ecosystems, through which appropriate data and narrative information can inform cyclical priority-setting and reporting requirements.

Annex Subcommittees can proactively engage in the process of incorporating TEK into their work by building TEK integration into their existing priority-setting, data-gathering, and reporting cycles. The Annex Subcommittees' scheduled reporting cycles, dictated by the Agreement, has the potential to serve as a starting point. For example, the Annex 2 LAMP Subcommittee works closely with the individual Lake Partnerships. These Partnerships are tasked, on a 5-year cycle, with gathering data to inform an analysis of the state of their respective lakes and reporting the progress of LAMP implementation to the Parties and to the public. As evidenced in Annex 2, there are current systems in place to undergo cyclical priority-setting, data-gathering, analysis, and report-sharing. However, there are no current systems in place to ensure that this information is inclusive of TEK, which could be gathered through scheduled outreach and engagement with TEK holders, Indigenous communities, and/or Tribal, First and Métis Nation agencies.

In addition, it is important to be mindful that the process of gathering and incorporating TEK is a multi-year, potentially decadal, process. In some cases, it can also require enhanced capacity within respective Indigenous communities to be able to fully participate in initiatives where TEK could best be incorporated. Thus, a first step to incorporating TEK into work being done under the Agreement is to make a foundational commitment to long-term, continuous engagement with Indigenous governments and their scientific and resource management staff. Such commitment can begin to bridge the gap to understanding how TEK can contribute to restoring and protecting the Great Lakes and their ecosystems.

Finally, in addition to committing to relationship building and engagement for the specific purpose of incorporating TEK into scientific and management activities pursuant to the Agreement, the U.S. Caucus emphasizes the continuing obligations of the Parties, including through the Annex Subcommittees, to continue to strengthen established government-to-government engagement with Tribes, First Nations, and Metis on all priority-setting and substantive work being done under the Agreement.

Appendix A
Tribes & Inter-Tribal Organizations in the U.S. Great Lakes Region

This list includes Tribes with present day reservations and/or ceded territory usufructuary rights and Inter-Tribal treaty resource/environmental organizations in the U.S. Great Lakes region.

Tribes in Michigan

Bay Mills Indian Community
Grand Traverse Band of Ottawa and Chippewa Indians
Hannahville Indian Community
Keweenaw Bay Indian Community
Lac Vieux Desert Band of Lake Superior Chippewa Indians
Little River Band of Ottawa Indians
Little Traverse Bay Bands of Odawa Indians
Match-E-Be-Nash-She-Wish Band of Potawatomi Indians (Gun Lake Tribe)
Nottawaseppi Huron Band of Potawatomi
Pokagon Band of Potawatomi
Saginaw Chippewa Indian Tribe of Michigan
Sault Ste. Marie Tribe of Chippewa Indians

Tribes in Minnesota

Minnesota Chippewa Tribe (includes six Bands, four of which have lands and/or treaty rights in the Great Lakes):
- Bois Forte Band of Chippewa
- Fond du Lac Band of Lake Superior Chippewa Indians
- Grand Portage Band of Lake Superior Chippewa Indians
- Mille Lacs Band of Ojibwe

Tribes in New York

Cayuga Nation
Oneida Indian Nation
Onondaga Nation
Saint Regis Mohawk Tribe
Seneca Nation
Tonawanda Band of Seneca
Tuscarora Nation

Tribes in Wisconsin

Bad River Band of Lake Superior Chippewa Indians
Forest County Potawatomi Community
Ho-Chunk Nation
Lac Courte Oreilles Band of Lake Superior Chippewa Indians
Lac du Flambeau Band of Lake Superior Chippewa Indians

Menominee Indian Tribe of Wisconsin
Oneida Nation of Wisconsin
Red Cliff Band of Lake Superior Chippewa Indians
Sokaogon Chippewa Community (Mole Lake)
St. Croix Chippewa Indians of Wisconsin
Stockbridge Munsee Indian Community

Inter-Tribal Organizations

1854 Treaty Authority
An inter-tribal natural resource management agency that protects and implements the off-reservation hunting, fishing and gathering rights of the Bois Forte Band and the Grand Portage Band of Lake Superior Chippewa in the 1854 ceded territory of Minnesota. The 1854 Treaty Authority is headquartered in Duluth, MN. https://www.1854treatyauthority.org/

Chippewa Ottawa Resource Authority (CORA)
An inter-tribal management body for the 1836 Treaty fishery, and includes an Inland Lands and Waters Resources Committee to oversee inland resource matters in the 1836 ceded territory of Michigan. Member tribes include the Bay Mills Indian Community, Grand Traverse Band of Ottawa and Chippewa Indians, Little River Band of Ottawa Indians, Little Traverse Bay Bands of Odawa Indians, and the Sault Ste. Marie Tribe of Chippewa Indians. CORA is headquartered in Sault Ste. Marie, MI. http://www.1836cora.org/

Great Lakes Indian Fish & Wildlife Commission (GLIFWC)
An inter-tribal natural resource management agency that represents eleven Ojibwe tribes in Minnesota, Wisconsin, and Michigan who reserved hunting, fishing and gathering rights in the 1837, 1842, and 1854 Treaties with the United States government. GLIFWC provides natural resource management expertise, conservation enforcement, legal and policy analysis, and public information services in support of the exercise of treaty rights throughout ceded territories. GLIFWC is headquartered in Odanah, WI. https://www.glifwc.org/

Haudenosaunee Environmental Task Force (HETF)
An inter-tribal organization comprised of Haudenosaunee leaders, environmental technicians, and scientists who came together to create a restoration plan "Haudenosaunee Environmental Restoration: An Indigenous Strategy for Human Sustainability" which is recognized as one of the first comprehensive responses to the United Nations 1992 Earth Summit Agenda 21 for Sustainable Development Chapter 26 which recognizes Indigenous peoples rights to natural resources in their territories and to set policies to protect the natural world using holistic traditional knowledge. HETF is headquartered in Hogansburg, NY. http://hetf.org/

Appendix B
Traditional Ecological Knowledge Resources

Books

Absolon, Kathleen E. (2011) *Kaandossiwin: How We Come to Know*. Fernwood Publishers.

Berkes F. (2012) *Sacred Ecology: Traditional Ecological Knowledge and Resource Management.* 3rd ed. New York, NY: Routledge.

Cajete, G. (1999) *Native science: Natural laws of interdependence*. Clear Light Books: Santa Fe, NM.

Geniusz WD. (2009) *Our Knowledge is Not Primitive: Decolonizing Botanical Anishinaabe Teachings.* Syracuse University Press.

Hoover, Elizabeth (2017) *The River Is in Us: Fighting Toxics in a Mohawk Community*. University of Minnesota Press.

Kimmerer, Robin Wall (2013) *Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants*. Milkweed Editions.

Kukutai, T. and J. Taylor (2016), *Indigenous data sovereignty: Toward an agenda*, ANU Press.

LaDuke, W. (1999) *All Our Relations: Native Struggles for Land and Life*. Haymarket Books.

Marchand, Michael E. and Kristiina A. Vogt, Rodney Cawston, John D Tovey, John McCoy, Nancy Maryboy, Calvin T Mukumoto, and Daniel J Vogt (eds) (2020) *The Medicine Wheel: Environmental Decision-making Process of Indigenous Peoples*. Michigan State University Press.

Whyte KP. (2018) What do Indigenous Knowledges Do for Indigenous Peoples? In *Traditional Ecological Knowledge: Learning from Indigenous Practices of Environmental Sustainability*. Edited by M.K. Nelson and D. Shilling, 57-82. Cambridge University Press.

Articles

Deloria, Philip J. and K. Tsianina Lomawaima, Bryan McKinley Jones Brayboy, Mark N. Trahant, Loren Ghiglione, Douglas Medin, Ned Blackhawk (2018) "Unfolding Futures: Indigenous Ways of Knowing for the Twenty-First Century." *Daedalus*, *147*(2):6-16.

Gagnon VS. (2016) "Ojibwe Gichigami ("Ojibwa's Great Sea"): An intersecting history of treaty rights, tribal fish harvesting, and toxic risk in Keweenaw Bay, United States." *Water History, 8*(4):365-384.

Journal of Contemporary Water Research & Education, 169: special issue, "Water in the Native World: Indigenous Water Issues." Free access available at: https://onlinelibrary.wiley.com/toc/1936704x/2020/169/1

Kozich, Andrew, Kathleen Halvorsen and Alex Mayer (2018) "Perspectives on Water Resources among Anishinaabe and Non-Native Residents of the Great Lakes Region." *Journal of Contemporary Water Research & Education*, *163*:94-108. Retrieved from and available at: https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1936-704X.2018.03272.x

McGregor, Deborah. (2005). "Coming Full Circle: Indigenous Knowledge, Environment, and Our Future." *American Indian Quarterly, 28*(3): 385-410.

McGregor, Deborah. (2012). "Traditional Knowledge: Considerations for Protecting Water in Ontario." *International Indigenous Policy Journal, 3*(3). DOI: 10.18584/iipj.2012.3.3.1

Reo, N. J., Whyte, K. P., McGregor, D., Smith, M. (Peggy), & Jenkins, J. F. (2017). "Factors that support Indigenous involvement in multi-actor environmental stewardship." *AlterNative: An International Journal of Indigenous Peoples*, *13*(2), 58–68. https://doi.org/10.1177/1177180117701028

Tekahnawiiaks King, Joyce (2007): "The Value of Water and the Meaning of Water Law for the Native Americans Known as the Haudenosaunee." *Cornell Journal of Law and Public Policy, 16*(3): 449-472. Retrieved from and available at: https://core.ac.uk/download/pdf/216744306.pdf (includes information regarding the Haudenosaunee Position Paper on the Great Lakes (2005), pp. 466-470).

Vinyeta, Kirsten; Lynn, Kathy (2013). "Exploring the role of traditional ecological knowledge in climate change initiatives." U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 37 p. Retrieved from and available at: https://www.fs.fed.us/pnw/pubs/pnw_gtr879.pdf

Wehipeihana, N., Increasing Cultural Competence in Support of Indigenous-Led Evaluation: A Necessary Step Toward Indigenous-Led Evaluation. Canadian Journal of Program Evaluation 2019, 34(2).

Reports and Guidance for Management and Stewardship Planning

David, Peter, and Lisa David, Heidi Kiiwetinepinesiik Stark, Kekek Jason Stark, Sean Niso-Asin Fahrlander, Jason Manidoonoodin Schlender (2019). Draft *Manoomin* Stewardship Plan and Appendices. Great Lakes Indian Fish and Wildlife Commission, Odanah Wisconsin. Available at: https://data.glifwc.org/manoomin/

Gagnon VS., D Seil, E Ravindran, S Smith (2020) Shared Governance and Stewardship: Rights and Responsibilities of the Keweenaw Bay Indian Community. Keweenaw Bay Indian Community Natural Resources Department, L'Anse MI. Available at: http://nrd.kbic-nsn.gov/sites/default/files/KBIC%20Governance%20Brochure%203.5.20rev.pdf

Gagnon, Valoree, Hugh Gorman, Emma Norman (2018) Eliminating the Need for Fish Advisories in the Great Lakes Region: A Policy Brief. Great Lakes Research Center, Report No. 50. Available at: http://asep.mtu.edu/docs/res-fishconsumption-policybrief-030718.pdf?

Great Lakes Indian Fish and Wildlife Commission (2018) Ojibwe Treaty Rights. GLIFWC Public Information Office. Available at: https://www.glifwc.org/publications/pdf/2018TreatyRights.pdf

Tribal Adaptation Menu Team. 2019. Dibaginjigaadeg Anishinaabe Ezhitwaad: A Tribal Climate Adaptation Menu. Great Lakes Indian Fish and Wildlife Commission, Odanah, Wisconsin. 54 p. Available at: https://www.glifwc.org/ClimateChange/TribalAdaptationMenuV1.pdf

Documentaries, Short Videos, and Websites

Akwesasne Cultural Restoration Program https://m.youtube.com/watch?v=oU_VVUce-E8

College of Menominee Nation Sustainable Development Institute Through Tribal Eyes: Change on the Menominee Nation: https://www.youtube.com/watch?v=Mu3i63YaBgk0

Discovering - Wild Rice NRCS Wild Rice Camp with Roger LaBine: https://www.youtube.com/watch?v=ZOh7w3F-HmI

Ecological Society of America Keynote P-Values and Cultural Values: Creating Symbiosis Among Indigenous and Western Knowledges to Advance Ecological Justice (Robin Wall Kimmerer 2019): https://www.yout0ube.com/watch?v=xKmKFJzviz0

IDEAS: The Brilliance of Beavers: Learning from an Anishnaabe World (2020) Leanne Betasamosake Simpson podcast:

Michigan Tech ASEP Project "When can we eat the fish?" https://www.mtu.edu/magazine/research/2018/stories/eat-fish/

Onkwarihwashon'a (Our Matters) – Akwesasne Cultural Restoration https://m.youtube.com/watch?v=tcWEYNwrRm8

PBS Great Lakes Now Buffalo Reef Restoration: https://www.pbs.org/video/buffalo-reef-restoration-ifbzzk/

PBS Wisconsin Education First Nations Education (2019): https://wisconsinfirstnations.org/

PBS Wisconsin Ma'iingan: Brother Wolf (2019): https://www.pbs.org/video/maiingan-brother-wolf-9apsy7/

Science Friday Widening The Lens On A More Inclusive Science: https://www.sciencefriday.com/segments/indigenous-science/

U.S. Department of the Interior National Park Service Interagency Traditional Ecological Knowledge Website: https://www.nps.gov/subjects/tek/index.htm

APPENDIX C
GLWQA Annex 10 TEK Task Team U.S. Caucus Members

The following is the current list of TEK Task Team U.S. Caucus members as of February 2021. Task Team members include Tribal natural resource professionals, Federal agency representatives, and two academic partners invited by Tribal and Federal members.

1854 Treaty Authority
- Tyler Kaspar, Environmental Biologist

Fond du Lac Band of Lake Superior Chippewa
- Wayne Dupuis, Environmental Manager

Great Lakes Indian Fish and Wildlife Commission
- Hannah Aarbuckle, Outreach Coordinator
- Jen Vanator, Policy Analyst/Great Lakes Program Coordinator
- Melonee Montano, Traditional Ecological Knowledge Outreach Specialist

Keweenaw Bay Indian Community
- Evelyn Ravindran, Natural Resources Director
- Karena Schmidt, Ecologist
- Shannon DesRochers, Great Lakes Resource Specialist

Lac Courte Oreilles Band of Lake Superior Chippewa
- Melissa Lewis, Wetlands Specialist

Little Traverse Bay Bands of Odawa Indians
- Spencer McCormack, Great Lakes Policy Specialist

Michigan Technological University
- Valoree Gagnon, Director, University-Indigenous Community Partnerships for the Great Lakes Research Center / Research Assistant Professor for the College of Forest Resources & Environmental Science

Red Cliff Band of Lake Superior Chippewa
- Linda Nguyen, Environmental Director

Saint Regis Mohawk Tribe
- Jessica L. Jock, Program Manager, Remediation and Restoration

University of Minnesota
- Jessica Lackey, Graduate Student - Natural Resources Science and Management Program

U.S. Army Corps of Engineers
- Curtis Sedlacek, District Archeologist and Tribal Liaison

U.S. Department of Agriculture

Jenn Youngblood, Special Assistant to the Regional Forester – Tribal Relations, Forest Service Eastern Region

U.S. Department of Commerce National Oceanic and Atmospheric Administration

Jennifer Ballinger, Environmental Scientist on contract to NOAA's Office of Coastal Management

U.S. Department of the Interior, Bureau of Indian Affairs

Albany Jacobson Eckert, Great Lakes Restoration Biologist -- Midwest Region

Harold Peterson, Natural Resource Officer -- Eastern Region

Jessica Koski, Regional Fish & Wildlife Biologist / Program Manager and GLWQA Annex 10 Science TEK Task Team U.S. Caucus Lead / -- Midwest Region

U.S. Department of the Interior, Geological Survey

Bryan Richards, Regional Tribal Liaison -- Interior Region 3: Great Lakes; Region 5: Missouri Basin

Jon Hortness, Great Lakes Science Coordinator / Great Lakes Restoration Initiative Program Coordinator -- Interior Region 3: Great Lakes; Region 5: Missouri Basin

U.S. Department of the Interior, National Park Service

Erin Williams, Great Lakes Coordinator and Co-Director Great Lakes-Northern Forest Cooperative Ecosystem Studies Unit (CESU)

U.S. Environmental Protection Agency

Elizabeth Hinchey, Monitoring, Evaluation and Reporting Section Chief and GLWQA Annex 10 Science Co-Chair for the U.S.-- Great Lakes National Program Office

APPENDIX D
Great Lakes Water Quality Agreement Organizational Chart