

Co-Creation of Indigenous Water Quality Tools

Trans-disciplinary, Community-led Research

Indigenous community experts are pooling their knowledge and experience together with Indigenous and Western scientists to address the needs of our communities with us and for us.

Principal Investigator: Dr. Dawn Martin-Hill (Indigenous Knowledge)

Academic Leads: Dr. Tina Moffat (Community Health Assessment), Dr. Patricia Chow-Fraser (Ecosystem Health Assessment)

Location: Six Nations of the Grand River Territory; Lubicon Lake First Nation

Description: A community-driven project (Six Nations and Lubicon Cree) in collaboration with McMaster University to address water security, water sovereignty, and environmental health solutions on First Nations reserves.

Update: The Indigenous Knowledge team has produced several digital stories; traditional governance resources; and workshops on digital mapping. Water words and concepts have been created in the language as well as workshops on digital mapping, archival retrieval of place names of waters. Training has been provided to community partners in archival research at the Smithsonian. 5 archival sites were visited and traditional teachings on water stories have been accessed. Project update details on pages 7-13.



L-R: Youth at the Lubicon Lake Cree Nation during summer sports camp; Faithkeepers Elan Henhawk and Cam Hill (Indigenous Knowledge team) at the Library of Congress audio archives listening to songs; Liliana Madrigal (Amazon Conservation Team- Virginia) hosting Six Nations youth for a luncheon.



Water security is one of the most pressing human rights issues faced by Indigenous people globally and locally. Canada is claiming a leadership role in recognizing and positioning Indigenous knowledge as parallel to western science with the creation of the Chief Science Advisor (CSA). The CSA will focus on how scientific information is disseminated and used by the federal government, and how evidence is incorporated into government-wide decision-making. As evidenced through a 2016 Canada - U.S agreement committing to “collaborating with Indigenous and Arctic governments, leaders, and communities to more broadly and respectfully include Indigenous science and traditional knowledge into decision-making, including in environmental assessments, resource management…”

A recent policy publication, “Quick wins for Canada’s Chief Science Advisor in Policy Options”, underscores ways Indigenous knowledge of



environmental topics is being sought by both government scientists and academic researchers.

Being systematic about establishing Indigenous knowledge as a resource for policy-making, he continued, requires going beyond “casual interactions of collaboration” toward “rigorous co-production that will stand up in a court of law whenever litigation seeks to challenge a particular set of decisions.”

The workshop will highlight challenges that will face the new scientific officer, and Indigenous rights and response to climate change and water security “...under what conditions does Indigenous knowledge count as authoritative evidence on a par with scientific claims? Who counts as a bearer of Indigenous knowledge, and under what conditions may this knowledge be shared with scientists and policy-makers? How should facts be adjudicated, when the claims of Indigenous knowledge and science diverge?”

From the perspective of the traditional Haudenosaunee, we speak in terms of responsibilities with respect to water, not in terms of water rights. From time immemorial, we have held the view that the “law of the land” is not man-made law, but a greater natural law, the Great Law of Peace.⁹ ...the root words for “rain” in Mohawk means expensive, or precious or holy. Culturally, we would not abuse this resource (Cornell Journal;King:2007)

Whose laws will prevail in governance over water?

– Dr. Dawn Martin-Hill, 2018

Guiding Principles

Ohneganos
Ohnegahde:gyo



Guiding Principle

The guiding philosophies for the project are drawn from the late Confederacy Chief Harvey Longboat; Rotinonshonni or Haudenosaunee (People of the Longhouse), our perspective on the river and the relationships of respect and responsibility that should exist among all parts of creation are contained in the words of our Ohen:ton Karihwatehkwen (Thanksgiving Address). This teaching instructs us to believe

in the interrelatedness and interdependency of all parts of the natural world. We believe that in order to gain a true understanding of any aspect of the natural world, respect must be shown for the entire web of relationships that exist and form our natural environment...The environmental philosophy as instructed by the Oheniton Karihwatehkwen and the political philosophy as governed by the Kahswenhtha would establish a relationship based upon peace, power and righteousness and would restore harmony, strength and balance to our natural world and to the Kaniatarowanenne. (Blaser et al. 2004).

Ohenton Kariwatehkwen Thanksgiving Address

The Ohenton Kariwatehkwen is recited before any issues are talked about when a gathering of the people takes place or to quote a Mohawk expression, "to open the door" (a comparable expression might be "to open the meeting") and serves as a reminder to the people that everything on this land was provided for human existence and in return, we are to be thankful. Indeed, it is a solemn responsibility. The consequence of forgetting the human responsibility to give thanks to Creation, to water, is that one day, if a particular part of Creation is not addressed, and we fail to give thanks, we are told this part of Creation will disappear. (King: 2007)



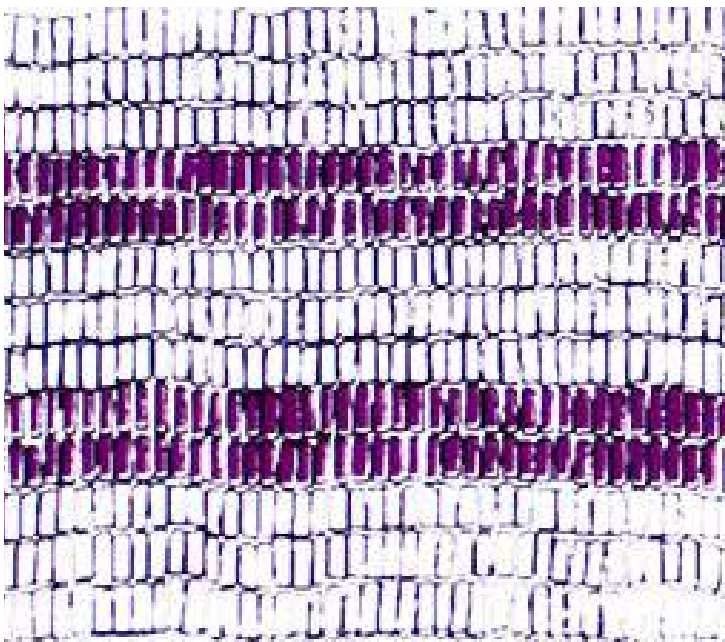
DISH WITH ONE SPOON

The One Dish/One Spoon principle represents a tenet of the Great Law of Peace and is a succinct expression of our ongoing responsibilities to conserve what sustains us. The Kaianerekowa has four directives that reinforce this tenet:

1. Offer thanks;
2. Don't take the first "catch" you encounter;

3. Take only what you need in life to sustain yourself and your family;
4. Leave some of the "catch" for the future, ensuring the future of seven generations for your family and the species' survival. (King: 2007)

TWO ROW WAMPUM



In order to coexist on this land with the Europeans, the Haudenosaunee arrived at a mutual understanding with the Dutch, the French, the British, and later, the Americans through the exchange of wampum. 36 The Kaswentha, or Two Row Wampum, also known as the Covenant Chain, was a treaty agreement first made with and first recorded by the Dutch in 1613. (King: 2007)

“Water has an original instruction to quench the thirst of the people, and to replenish underground waters that satisfy the thirst of our Mother Earth making them all healthy.” - (late) Jake Swamp, Water Voices from Around the World.

UNITED NATIONS DECLARATION ON THE RIGHTS OF INDIGENOUS PEOPLES (UNDRIP)



Why UNDRIP matters for Water Governance?

Arts. 25 and 32.2 of UNDRIP make explicit reference to water. Along with the UN Resolution 64/292, they are the main ground to legally protect the human right to water and sanitation of indigenous communities and they have been apply in several international human rights cases. Moreover, UNDRIP's requirement for the Government to obtain the “free, prior and informed consent” of First Nations prior to undertaking new development projects on their territories (articles 10 and 19) provides the foundations of a new for a water governance.

The Research Project “Co-creating of Indigenous Water Quality Tools,” funded under the Global Water Futures (<https://gwf.usask.ca/>) will examine the water security status and climate change impacts in two distinct communities, namely, Six Nations of the Grand River (Ontario) and Lubicon Cree Nation of Little Buffalo (northern Alberta).

GWF project-governance focus activities will explore and synthesize a range of water management challenges and outline innovative governance mechanisms to facilitate sharing and integration of contemporary science and Indigenous and Local Knowledge for sustainable water future. Contacts: **Jorge Fabra**, **Nancy Doubleday**, and **Nidhi Nagabhatla**.

Article 25 of the UN Declaration on the Rights of Indigenous Peoples states: Indigenous peoples have the right to maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, waters and coastal seas and other resources and to uphold their responsibilities to future generations in this regard.

Article 26.1 Indigenous peoples have the right to the lands, territories and resources which they have traditionally owned, occupied or otherwise used or

acquired. 2. Indigenous peoples have the right to own, use, develop and control the lands, territories and resources that they possess by reason of traditional ownership or other traditional occupation or use, as well as those which they have otherwise acquired.

Article 28.1 Indigenous peoples have the right to redress, by means that can include restitution or, when this is not possible, just, fair and equitable compensation, for the lands, territories and resources which they have traditionally owned or otherwise occupied or used, and which have been confiscated, taken, occupied, used or damaged without their free, prior and informed consent.

Article 28.2 Unless otherwise freely agreed upon by the peoples concerned, compensation shall take the form of lands, territories and resources equal in quality, size and legal status or of monetary compensation or other appropriate redress.

Article 29.1 Indigenous peoples have the right to the conservation and protection of the environment and the productive capacity of their lands or territories and resources. States shall establish and implement assistance programmes for indigenous peoples for such conservation and protection, without discrimination.

Article 32.1 Indigenous peoples have the right to determine and develop priorities and strategies for the development or use of their lands or territories and other resources.

Article 39 Indigenous peoples have the right to have access to financial and technical assistance from States and through international cooperation, for enjoyment of the rights contained in the Declaration.

For more information regarding Indigenous Peoples' rights recognized through the adoption of international instruments and mechanisms please refer to the following links:

United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)

<https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html>

United Nations Permanent Forum on Indigenous Issues (UNPFII)

<https://www.un.org/development/desa/indigenouspeoples/>

Expert Mechanism on the Rights of Indigenous Peoples (EMRIP)

<https://www.ohchr.org/en/issues/ipeoples/emrip/pages/emripindex.aspx>

UN Special Rapporteur on the Rights of Indigenous Peoples (UNSR)

<https://www.ohchr.org/en/issues/ipeoples/srindigenouspeoples/pages/sripeoplesindex.aspx>

WALKERTON REPORT

“There is no justification for permitting lower public health standards for some residents of Ontario than those enjoyed by others. Members of First Nations are also residents of Ontario. There can be no justification for acquiescing in the application of a lesser public health standard on certain residents of Ontario than that enjoyed by others in the province. This is especially true when there is ample evidence that the water provided in First Nations communities falls well short of the standards of safety and adequacy that are considered acceptable in other parts of the province.”

–Justice O'Connor, 2002 Walkerton Inquiry Report, Chapter 15, Part II

INDIGENOUS CO-CREATION OF SENSORS AND WATER QUALITY MONITORING

Principal Investigator: Dr. Ravi Selvaganapathy (Engineering)

Indigenous Knowledge Leads: Dr. Dawn Martin-Hill

Description: Project training community members and youth to use well sensors and validate data collection. Based on feedback from both communities, the following sensors will be continuously monitored: free-chlorine, biological and chemical oxygen demand (BOD/COD), pH, dissolved oxygen (DO), conductivity, turbidity and temperature.

Project Updates

2018 update on Six Nations tap water testing for indicators of pathogenic bacteria

Principal Investigator: Dr. Pat Chow-Fraser

Community navigator: Denise McQueen, Kurt Gibson

Graduate student: Sawsan Makhdoom

Undergraduate assistant: Pascale Bider

During the summer 2018, the Ecosystem Health Assessment team collected tap water samples from 75 households on the Six Nations Reserve. The Community navigators contacted interested residents and arranged a convenient time to collect the sample—usually after work and in the evening. At the time of sampling, we ran the tap for at least 2 minutes (to drain water sitting in the pipes) so that we were actually testing the water source (well, cistern, treatment plant). While the tap is still running, we used a whirlpak bag to collect water in mid-stream. Samples were kept chilled in a

cooler until they were analyzed, usually within 6 hours of collection.

We tested for evidence of pathogenic bacteria in the water source. Pathogenic bacteria and viruses in drinking water can cause gastroenteritis and other diseases, with symptoms that include vomiting, nausea, fever and abdominal pain. Very old and young individuals are particularly susceptible. Feces of animals, including wildlife (raccoons, beavers), waterfowl, dogs, livestock and people will contain pathogens. Pathogens are difficult to isolate because they are rare (for every pathogen, there are millions of other bacteria) and they do not survive very long after they are outside the intestine. Therefore, we use indicators of fecal pathogens such as *E. coli*, a bacteria in the coliform group that exist in conditions similar to those of pathogens, but that are not



Graduate student Sawsan Makhdoom collects sample from a kitchen tap.

usually pathogenic themselves. Health Canada guidelines indicate that a 100-mL sample of drinking water should contain no colonies of *E. coli*. Therefore, we tested 100-mL samples of tap water to determine the presence of *E. coli*. Currently, **29%** of samples tested from all water sources (i.e. different well

types, cisterns, treatment plant) were contaminated with E. coli, compared with 19% and 27% in similar studies carried out in 2003 and 2004, respectively (Neegan Burnside 2005).

Residences with contaminated water have already been contacted by our team. Water contaminated with E. coli should not be used for drinking or preparing drinks, for washing food or for brushing teeth, unless the water has first been boiled in a pot, in a kettle on a stove, in a microwave oven, or in an electric kettle that does not have an automatic shut-off.

To kill the micro-organisms that cause disease, the water must be kept boiling at least one minute.

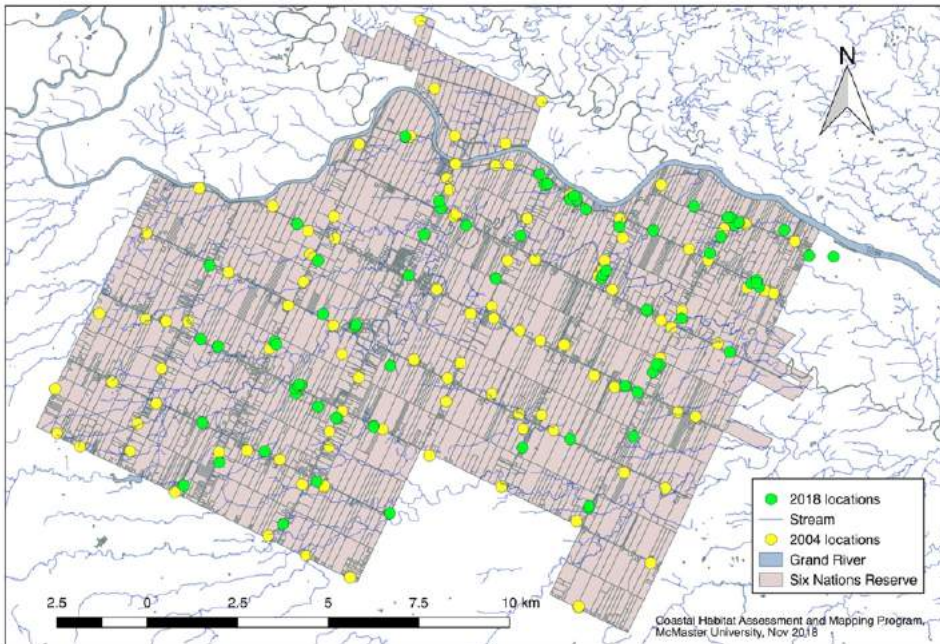
Tap-water testing should be carried out regularly (more than once a year) if water sources are suspected of being contaminated with pathogenic bacteria. Health Canada notes that risk of contamination is greatest in early spring after winter thaw, after an extended dry spell, or following heavy rains. Therefore, owners of private supplies should have their water tested during these periods. Since the scope of our project does not allow us to conduct repeated sampling of residences, community members should Dr. Pat Chow-Fraser (McMaster University) for follow-up information.

Over the next year, we plan to sample an additional 75 households that were part of the



The Tecta B16 allows 16 samples to be run simultaneously, and yields results within 18 hours. This is an efficient way to provide early warning of E. coli and coliform contamination

2004 study (see map) to see how results of the water testing may have changed over the past 15 years. We will also apply a landscape approach to determine if hydrological characteristics and land-use-land-cover features may influence the pattern of contamination on the reserve.



Map showing locations of residences tested for indicators of pathogenic bacteria in source watertap water was tested, whereas wells (bored/dug and drilled) were tested in 2004.

2018 update on Six Nations tap water testing for indicators of pathogenic bacteria

Principal Investigator: Dr. Pat Chow-Fraser

Community navigator: Makasa Looking Horse, Elan Henhawk (Faithkeeper)

Graduate student: Alana Tedeschi, Sawsan Makhdoom, Nick Luymes

Undergraduate assistant: Anjali Narayanan, Pascale Bider

Water in healthy streams is usually clear, with very little nutrient, has lots of oxygen, and support many types of benthic invertebrates, including aquatic stages of insects. When excess nutrient (phosphorus and nitrogen) from surface runoff on farmland or lawns enters the stream, it can fuel the growth of algae and make the water very turbid. Turbidity is essentially a measure of sediment and algae/bacteria in water. Levels of turbidity can be measured with expensive sensors such as the multi-parameter probe used by our team or with an inexpensive Secchi disk. If the stream is clear, the black and white quadrants of the disk should be easy to discriminate even if it is lowered to the bottom of the creek bed.

Increased algae in the stream can result in periods of low dissolved oxygen when the algae die. Some species of invertebrates and fish will not tolerate these degraded conditions (i.e., high nutrient, turbid and low oxygen) and will disappear from the



Anji uses an inexpensive Secchi disk to determine water clarity, while Nick uses an expensive multi-parameter probe (Aqua Troll 500) to measure water chemistry in McKenzie Creek.

ecosystem. Some of these intolerant species are insects such as mayflies, stoneflies, caddisflies and dragon flies; species of tolerant invertebrates include midges and aquatic worms. We can rank the tolerance of invertebrates encountered in the stream and calculate a score using these ranks to assess stream health. The best time to monitor benthic invertebrates in streams to determine ecosystem health is in spring, before the immature insects emerge as adults and fly away.

Total phosphorus (TP) is a measure of all forms of phosphorus (both dissolved and particulate), and is used by

ecologists to indicate the amount of algae in water. The level in rivers and streams varies seasonally, but the provincial objective is a seasonal mean of 30 $\mu\text{g/L}$; levels above 30 $\mu\text{g/L}$ are expected to lead to excessive plant growth in rivers and streams.

Nitrogen takes on various forms in water. Nitrite and nitrate are readily used by algae and can be measured as Total Nitrate-Nitrogen (TNN). Elevated levels of TNN in water usually indicate influence of urban and agricultural runoff. According to the Canadian Water Quality Guideline, mean stream concentrations of TNN

below 13 mg/L should protect aquatic life.

In areas suspected of being contaminated, *E. coli* sampling should be carried out at least several times over a month. If there are minimum 5 samples tested (i.e. over a 30-d period), advisories should be posted if the geometric mean exceeds 200 colonies per 100 mL. If there is only a single sample, swimming advisories should be posted if it contains > 400 colonies/100 mL.

Specific conductance reflect amount of ions in water, and can be an indicator of human activities, especially de-icing salts from road run-off. There is no specific maximum allowable level for human safety.

RESULTS

During September in 2018, our team sampled McKenzie Creek at five locations from Indian Line downstream to Hwy 6. We collected water samples to determine the concentration of phosphorus and nitrates, and *E. coli*, and used the Aqua Troll to measure turbidity, dissolved oxygen, and specific conductance.

- TP concentrations in McKenzie Creek varied from 90 to 200 µg/L, greatly exceeding the provincial objective of 30 µg/L.
- TNN values varied from 0.05 to 0.11 mg/L, which are well below the guideline of 13 mg/L for protection of aquatic life.
- *E. coli* concentrations in McKenzie Creek ranged from 450 to 600 colonies/100 mL, except at Hwy 6. These values exceed the allowable level for recreational contact.
- Turbidity values varied from 70 to 170 units, which are all above 50, the maximum recommended for recreational use.
- % saturation dissolved oxygen were above 70% except for one, which was 50%.
- Specific Conductance values ranged from 490 to 660 µS/cm, which are similar to those measured in most urbanized centers.

Preliminary Conclusion

Based on nutrients, *E. coli* and water chemistry, McKenzie Creek is currently in an unhealthy state and actions should be initiated to restore its health.



Community navigators Faithkeeper Elan Henhawk, (Cayuga), Makasa Looking Horse (Mohawk) work with undergraduate assistant Anjali Narayanan en route to McKenzie Creek to collect water samples.



McKenzie Creek just downstream of the dam on Indian Line.

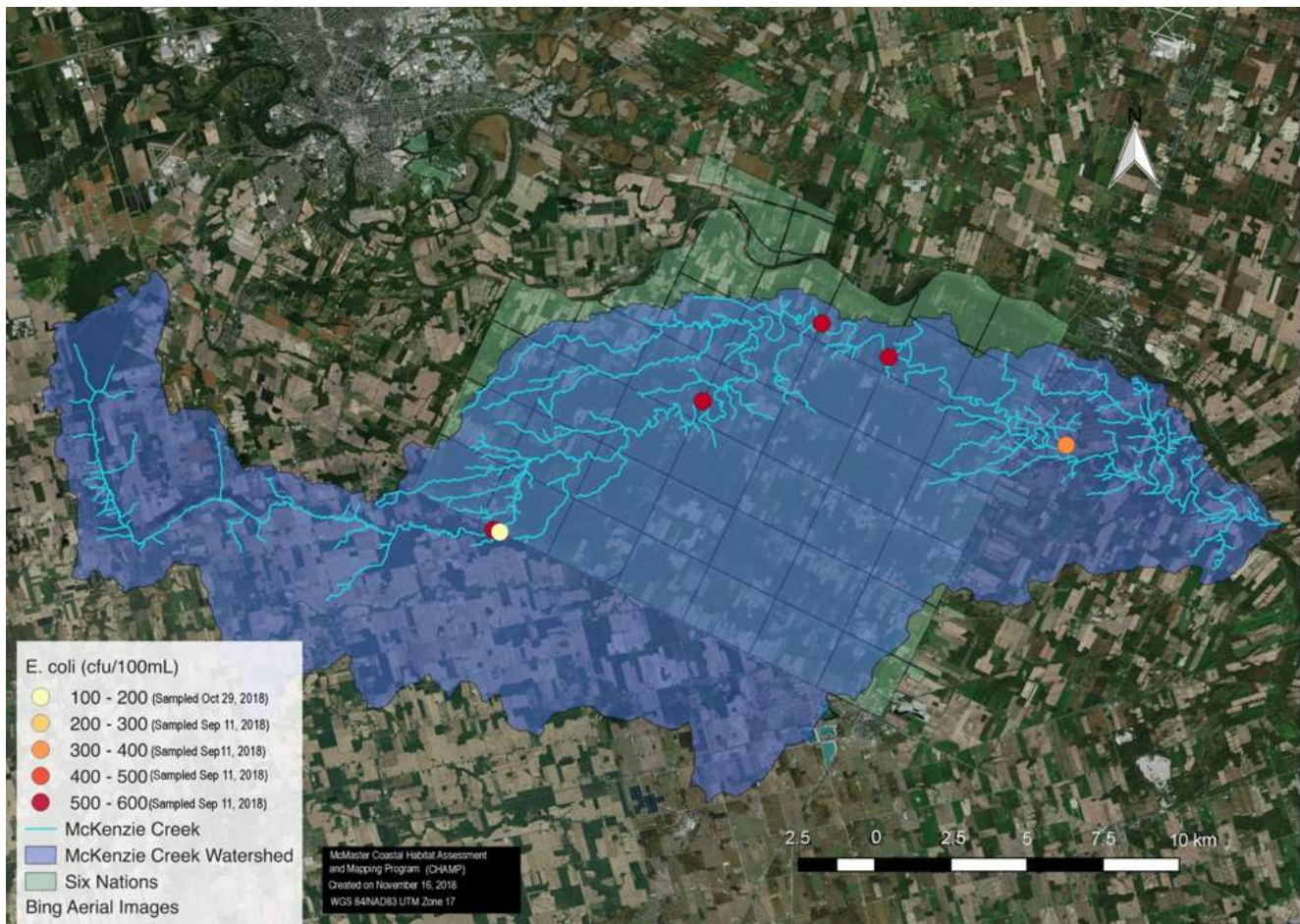
Dr. Patricia Chow-Fraser, (Biology) Environmental Assessment Team lead





Left: The eroded bank of McKenzie Creek showing exposed tree roots may be symptom of streambank instability.

Right: One of the many beaver dams in McKenzie Creek that can block stream flow and make the river difficult to navigate.



Map showing locations of sampling sites along McKenzie Creek within its watershed (depicted in blue). Data for two sampling occasions in early September and in late October are shown. High temporal variation at the same site is not uncommon and is the reason why monthly sampling during the ice-free season as well as targeted sampling at the same location before and after storms is required to formulate a more complete picture for ecosystem assessment. Sampling of McKenzie Creek will resume in Spring 2019 and continue at least monthly until the creek freezes (map prepared by James V. Marcaccio, McMaster University).

Indigenous Co-Creation of Sensors and Water Quality Monitoring

The engineering team at McMaster University is developing a suite of sensors that can operate continuously to detect various contaminants in surface waters and drinking water. The contaminants of interest include, but are not limited to, bacterial pathogens (e.g. E. Coli), heavy metals (e.g. Mercury, Arsenic, Lead), nutrients (e.g. phosphates, nitrates), organic compounds (e.g. dissolved organic carbon) and dissolved inorganic compounds (e.g. free chlorine, dissolved oxygen). Currently methods for measuring these compounds continuously in the environment or in pipes are either very expensive, unreliable, or non-existent. Sensors for monitoring contaminants continuously must be both 1) sensitive and 2) resilient. They must be sensitive enough to measure concentrations that are of concern to the environment or to human health. They must also be resilient to a variety of conditions including, but not limited to, fouling, scaling, mechanical abrasion, temperature variability, and pH variability.

The research team lead by Prof. Charles de Lannoy is developing sensor surfaces that can operate under real conditions. In particular, the de Lannoy lab is studying the limits of sensor operation under real water conditions, developing sensors that are resistant to fouling and scaling, can clean themselves if they are fouled, and can operate under varying environmental conditions. In addition, the de Lannoy lab is measuring the water quality of Six Nations well, cistern, and tap water, to identify what contaminants might exist in this water to help guide the sensor-development research.

Chlorination is an effective way to eliminate pathogens and other bacteria that may be present in drinking water. However, the residual chlorine concentration has to be continuously monitored and accurately controlled in a certain range to ensure drinking water safety and quality. Prof. Jamal Deen's team has developed simple, low cost electrochemical method to measure free chlorine. These prototypes are currently being tested and validated, and will soon be deployed at Six Nations to monitor the quality of drinking water.

The data collected from various water sensors



requires a network or platform that is capable of analysing the water quality data mentioned above. Prof. Emil Skerinski's team is working on a sensor network that will be installed in the Six Nations community to collect data both from the source water as well as from wells and cisterns. His team will collaborate with the community members in co-creating software and appropriate user interface through which the community can access the data obtained from the sensing systems.

The final goal, is to develop a suite of inexpensive sensors that can operate continuously and reliably in real water conditions. Further, it is our hope that we can work together with First Nations people, specifically members of the Six Nations community, to build, test, and validate these sensors in their own waters. This will empower this community with real-time continuous data of their water quality.



The Engineering team (L-R): Drs. Emil Sekerinski; Charles de Lannoy, and Ravi Sevalganapathy

Indigenous Knowledge and Community Update

2018 has been a productive year for the Indigenous Knowledge team! In addition to producing digital stories, traditional governance resources, and workshops on digital mapping, in November, the team travelled with Six Nations community and youth partners to Washington DC to conduct archival research on traditional water stories. They visited the Library of Congress, the Natural Museum of History, the National Museum of the American Indian, and the Amazon Conservation Team headquarters. One of the outcomes of this research was the translation of Hewitt's 1896 story Tiohtsha' ahton (The 'Exhauster') from to English with Jeremy Green (Kaweni:io Immersion School).



Enjoying the fruits of their labour in the community garden at Six Nations.

Team members also presented at the 2018 World Indigenous Law Conference. Dr Nidhi Nagabhatla (UNU-INWEH, McMaster) and Dr Dawn Martin-Hill both spoke about water governance and security in First Nations communities. The purpose of the conference is to bring together lawyers, judges, academics, Knowledge Keepers, policy experts, community leadership, community advocates, students, and all interested parties to embark on and share in conversations and discourse about the implementation of Indigenous Law into western contemporary

legal systems. The conference was held on the traditional territory of the Three Fires Confederacy, which is comprised of the Ojibway, the Odawa and the Potawatomi.

In conjunction with the Health Assessment component led by Dr Tina Moffat, we constructed youth garden by traditional medicine house on Six Nations to teach about relationships between water, food and health, and build community relationships. All of the food grown in the garden was donated to elders in the community.



(L-R: Dr Martin-Hill presented at the World Indigenous Law Conference in November 2018; youth and community members at the Smithsonian's National Museum of the American Indian, November 2018; archival maps of Haudenosaunee land from the Smithsonian collection.



New Projects

Global Water Futures has funded the **Haudenosaunee Environmental Health Task Force (HEHTF)** office in partnership with McMaster University and Six Nations. It opened in December 2018; Rod Whitlow is its new director.

Also, **two new grants** are under way with community partners Kawenni:io Immersion School, Mohawk College, and Woodlands Cultural Centre. A Grandmothers Council is being established with Beverly Jacobs as Indigenous Community Lead, to provide project oversight in the areas of Indigenous Knowledge and Traditional Ecological Knowledge, and Governance.

OHNEGANOS OHNEGAHDE:GYO – INDIGENOUS ECOLOGICAL KNOWLEDGE, TRAINING & CO-CREATION

Principal Investigator: Dr. Dawn Martin-Hill (Indigenous Knowledge)

Indigenous community Co-Leads:

Dr. Beverly Jacobs – Assistant Professor at University of Windsor, Beverly.Jacobs@uwindsor.ca

Lori Davis Hill – Director of Six Nations Health Services, ldavishill@sixnations.ca

Academic Leads:

Dr. Christine Wekerle, Mental Health Team Leader, McMaster University, Associate Professor, wekerc@mcmaster.ca

Description: Working with Six Nations and Lubicon Cree, this community-driven research is focused on three components: bridging IK/TEK and Western Science, mental wellness for youth, and water governance. Please see next page for more details.

AKWE:KON TEWATAHTONOKWE (WE ARE ALL RELATED)

Principal Investigator: Dr. Dawn Martin-Hill

Description: We're hosting 7 Indigenous Knowledge/Traditional Ecological Knowledge/health community-hosted, youth-focused round tables to develop a province wide environmental health research network.

Partner communities: Six Nations and Grassy Narrows

OHNEGANOS OHNEGAHDEꞌGYO – INDIGENOUS ECOLOGICAL KNOWLEDGE, TRAINING & CO-CREATION OF MIXED METHOD TOOLS

We, with our partner communities, have identified three primary areas of interest:

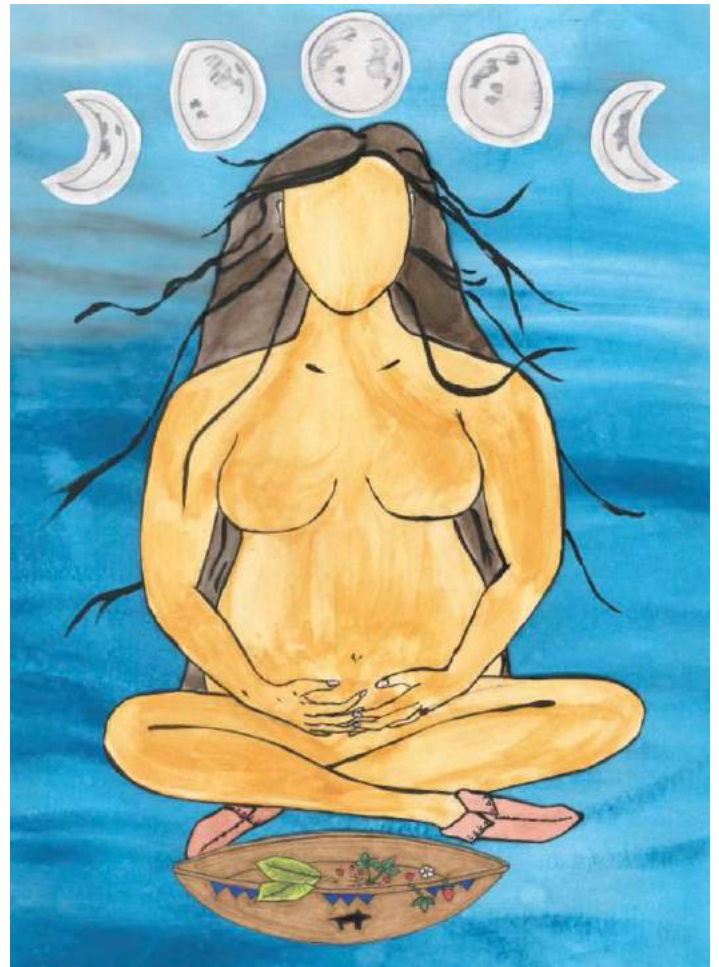
1. **IK Training:** bridging TEK and WS in the area of accredited water management training and bilingual texts/resources to build communities' capacity to manage future environmental challenges
2. **Mental Wellness:** building youth mental health resilience related to water security
3. **Water Governance:** assisting community and training youth in water governance, rights, and responses inclusive of Indigenous laws

In conjunction with guidance and feedback from the Grandmothers Council, Kawenni:io Immersion School, Six Nations Health Services, Indigenous Elder and Youth Council, Elders and Youth Water Council, and other community partners, our project is set to address these needs, via a co-creation team consisting of leading experts in TEK and WS in all three components. The three teams will focus on the issues of addressing stewardship over time; crafting bilingual, relevant resources; and fostering resilience.

Outcomes & Legacies

Some of the projected outcomes and legacies of this research will be:

- archival mapping of waterways, including placenaming in Mohawk/.Cayuga
- turtle tagging/monitoring
- youth training in UNDRIP and water governance
- development of bilingual educational material for IK/WS
- digital stories demonstrating how water quality shapes, informs mental wellbeing
- development of water governance framework within communities
- development of mental wellness app to provide tools for young people struggling with water and ecosystem anxieties/stressors
- development of mental health survey to determine impact of boil water advisories/no running water on youth
- establishment of NGO status for Indigenous Elder and Youth Council for ongoing participation of Indigenous Youth at the UN



What you can do to help



Donate to the Six Nations Community Food Bank
Contact: Ellen Rose Jamieson, Food Bank Coordinator
1741 4th Line
Ohsweken, ON N0A 1M0
Phone: (519) 771-0025

We need your help!

Thank you for participating in the Six Nations Community Health Survey.

We are currently looking for volunteers to be interviewed for our community health assessment, which is focused on health care access and environmental health in Six Nations of the Grand River.

We are asking you questions about your general individual health, food access, water use and concerns, and general community health questions. **All interviews are anonymous and confidential.**

Please contact Tina Moffat for more details:
905-525-9140 ext 23906 | anthchai@mcmaster.ca



Our Team Members

CO-CREATION OF INDIGENOUS WATER QUALITY TOOLS

Indigenous Knowledge (IK) | Community Health Assessment (CHA) | Community Ecological Assessment (CEA)

Principal Investigator: Dr. Dawn Martin-Hill (IK, CHA)

McMaster University Co-PIs: Dr. Tina Moffat (CHA); Dr. Patricia Chow-Fraser (CEA)

Community Leads: Amber Skye (IK); Lori Davis Hill (CHA); Denise McQueen (CHA, CEA); Clynt King (CEA); Kurt Gibson (CEA)

Project Officer: Laura Beaudin

Knowledge Mobilization Specialist: Stephanie Morningstar

Academic Co-Investigators: Charles de Lannoy; Altaf Arain; Emil Sekerinski; Nancy Doubleday; Nidhi Nagabhatia; Zoe Li; Peter Kruse

Other Partners: James Knibb-Lamouche; Louise McDonald; Kathleen Padulo; Sandra Cook

Graduate Students: Jorge Zamora (IK); Sarah Duignan (CHA); Sarah Rabibeau (CEA); Jamie M (CEA)

Undergraduate Student: Makasa Looking Horse (IK)

SENSORS SYSTEM & DATA SYNTHESIS

Principal Investigator: Dr. P. Ravi Selvagnapathy

Academic Co-PIs: Dr. Dawn Martin-Hill; Kasten Liber; Scott Smith; Juewen Liu; Wahid Khan; Chang-qing Xu; Carolyn Ren; James McGeer; Jamal Deen; Charles de Lannoy; Philippe van Cappellen; Peter Kruse

Project Officer: Laura Beaudin

Knowledge Mobilization Specialist: Stephanie Morningstar

Academic Co-Investigators: Nandita Basu; Qiyin Fang; Claude Duguay; Jennifer Baltzer; David Emslie; Younggy Kim; Emil Sekerenski; Zeinab Housseindoust; Fereidoun Rezanezhad; Karl-Erich Lindenschmidt; Lorne Doig; Scott Brown; Merrin MacRae; Helen Baluch

Other Partners: Lubicon Cree; Six Nations; Center for Mining Excellence & Innovation; Hoskin Scientific; AREVA Resources Canada; International Copper Association; International Lead Association; International Zinc Association; Nickel Producers Environmental Research Association

OHNEGANOS OHNEGAHDE:GYO – INDIGENOUS ECOLOGICAL KNOWLEDGE, TRAINING & CO-CREATION

Indigenous Knowledge (IK) | Water Governance (WG) | Mental Wellness (MW)

Principal Investigator: Dr. Dawn Martin-Hill (IK)

McMaster University Co-PIs: Dr. Christine Wekerle (MW)

Community Co-PIs: Dr. Beverly Jacobs (IK, WG); Lori Davis-Hill (IK)

Project Coordinator: Karissa John

Knowledge Mobilization Specialist: Stephanie Morningstar

Academic Co-Investigators: Bonnie Freeman; Caitlin Davey; Linda Staats; Amber Skye; Nicholas J. Reo

Other Partners: Mary Sandy (Grandmothers Council); Norma Jacobs (Grandmothers Council); Renee Thomas Hill; Johanne McCarthy; Lorraine Vanderzwet; Kamala Kruse; Lubicon Band Council – Elders and Youth Water Council; Leroy Hill; John Williams; James Knibb-Lamouche; Amos Keye; Cam Hill

AKWE:KON TEWATAHTONOKWE (WE ARE ALL RELATED)

CIHR – NEIHR

Principal Investigator: Dr. Dawn Martin-Hill (IK)

Project Manager: Danielle Gendron

Partner Communities: Six Nations and Grassy Narrows

Graduate Student: Danielle Gendron

To stay up-to-date on the progress of our teams and these projects,
please visit our website:

cciwqt.squarespace.com

Scan the QR code with your mobile device to access the site immediately.



MANY NYA:WEHS TO OUR COMMUNITY PARTNERS & SPONSORS

Kawenni:io/Gaweni:yo Immersion School

Indigenous Elders & Youth Council

Mary Sandy – Grandmothers Council

Norma Jacobs – Grandmothers Council

Renee Thomas Hill – Elder in Residence,
Indigenous Studies Program, McMaster University

Joshua Dockstator – Indigenous Students
Services, McMaster University

Johanne McCarthy – Mohawk College

Lorraine Vanderzwet–Servos – Mohawk College

Kamala Kruse – Mohawk College

Lubicon Band Council – Elders and Youth Water
Council

Leroy Hill – Haudenosaunee Resource Centre

John Williams – Hamilton Ticats, Director of the
McMaster June Jones Youth Movement Program

James Knibb–Lamouche – Indigenous Elders and
Youth Council (IEYC)

Amos Keye – Woodland Cultural Centre

Cam Hill – Traditional Medicine Clinic at Six
Nations



CIHR
IRSC

Institute of Indigenous
Peoples' Health

Institut de la santé
des Autochtones



United Nations University



GLOBAL WATER FUTURES
SOLUTIONS TO WATER THREATS
IN AN ERA OF GLOBAL CHANGE

