



University
of Manitoba

TURTLE ISLAND
INDIGENOUS
SCIENCE
CONFERENCE



14 - 16 June, 2022
Winnipeg, MB

Conference Program and Abstracts



ALFRED P. SLOAN
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Presented by the University of Manitoba Faculty of Science with generous support from the Alfred P. Sloan Foundation, the Canada Research Chairs Program and The University of Manitoba, Office of the Vice-President Research and International.

Scientific Program:

Tuesday June 14, 2022	
Time	Session
7:00 AM	Registration Check-in Opens
8:00 AM	Morning Ceremony with Elder Wanda Murdock (Optional) Location: Migizii Agamik Bald Eagle Lodge
9:00 AM	Welcome and Opening Remarks
9:30 AM	Plenary: Dr. James Makokis
10:30 AM	Session I: Scientific Knowledge Embedded In Indigenous Languages. Keynote: Jeannette Armstrong, University of British Columbia, Canada. <i>A sylvix language perspective.</i> Chairs: Myrle Ballard and Miguel Uyaguari, University of Manitoba
11:15 AM	Coffee Break
11:30 AM	Session I: Scientific Knowledge Embedded In Indigenous Languages. Jesse Popp, University of Guelph
12:00 PM	Yolanda Teran, University of New Mexico
12:30 PM	Wilfred Buck, Opaskwayak Cree Nation
1:00 PM	Lunch
2:15 PM	Mitacs Information Session
2:30 PM	Session II: Traditional Medicine and Health. Keynote: Nicole Redvers, University of North Dakota, USA. <i>The Science of the Sacred: Reflections through Land-based Healing.</i> Chairs: Ayush Kumar and Melanie Lalonde, University of Manitoba
3:15 PM	Darrel Manitowabe, Northern School of Medicine
3:45 PM	Coffee Break
4:00 PM	Session II: Traditional Medicine and Health. Marcia Anderson, University of Manitoba
4:30 PM	Wafa Hozein, Navajo Technical University
4:45 PM	Anita Murdock, University of Manitoba
5:00 PM	Wawatay Presentation
5:15 PM	Opening Reception

*A light breakfast will be available at 8:00 a.m.

Wednesday June 15, 2022

Time	Session
9:00 AM	<p>Session III: Two-eyed Seeing – Indigenous Ways of Knowing & Mainstream Science.</p> <p>Keynote: A. Blair Stonechild, First Nations University of Canada. <i>Spiritual Approach to Science.</i></p> <p>Chairs: Brian Rice and Shirley Thompson, University of Manitoba</p>
9:45 AM	Brian Rice, University of Manitoba
10:15 AM	Coffee Break
10:30 AM	<p>Session III: Two-eyed Seeing – Indigenous Ways of Knowing & Mainstream Science.</p> <p>Yurgen Kremer, University for Peace (Indigenous Science and Peace Studies) and Santa Rosa Junior College</p>
11:00 AM	Roger Dube, Rochester Institute of Technology
11:30 AM	Myrle Ballard, University of Manitoba
12:00 PM	Lunch and Poster Session
2:00 PM	<p>Session IV: Novel STEM Education Approaches that Include the Indigenous Way of Knowing.</p> <p>Keynote: Henry Fowler, Navajo Technical University. <i>Indigenous Ways of Knowing.</i></p> <p>Chairs: Emily McKinnon and Frank Deer, University of Manitoba</p>
2:45 PM	Emily McKinnon, University of Manitoba
3:15 PM	Edward Doolittle, First Nations University of Canada
3:45 PM	Coffee Break
4:00 PM	<p>Session IV: Novel STEM Education Approaches that Include the Indigenous Way of Knowing.</p> <p>Dawn Pratt, Askenootow STEM Enterprise Inc., Canada</p>
4:30 PM	Natalie Tufenkji and Joel Grant, McGill University (Zoom)
5:00 PM	<p>Panel Discussion:</p> <p>Christie Lavallee, Gordon Naylor, Benjamin Anderson-Sackaney, Teassa MacMartin, Raven Bennett</p>

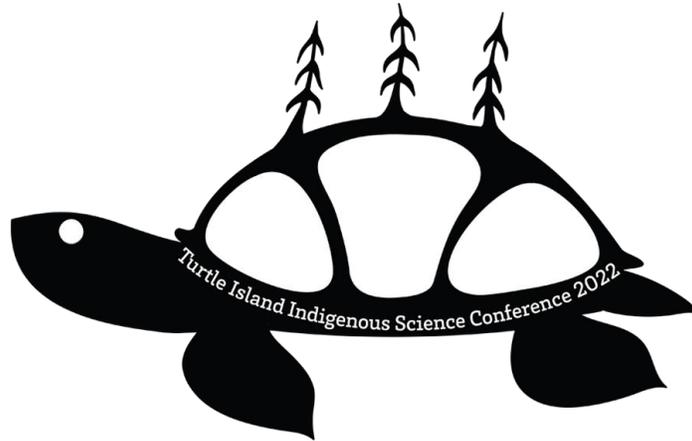
*A light breakfast will be available at 8:00 a.m.

Thursday June 16, 2022

Time	Session
9:00 AM	Session V: Indigenous Engagement with the Land and the Environment Keynote: Deborah McGregor, York University <i>Each Stories: Understanding Indigenous Climate Justice</i> Chairs: Nicole Wilson and Kyle Bobiwash, University of Manitoba
9:45 AM	Sue Chiblow, York University
10:15 AM	Melissa Arcand, University of Saskatoon
10:45 AM	Coffee Break
11:00 AM	Session V: Indigenous Engagement with the Land and the Environment Andrea Reid, University of British Columbia
11:30 AM	Chelsey Geralda, Simon Frasier University
11:45 AM	Jennifer Grenz, University of British Columbia
12:00 PM	Jonathan Ferrier, Dalhousie University
12:15 PM	Stewart Hill, Manitoba Keewatinowi Okimakanak
12:30 PM	Lunch and Networking
	Free Time
2:00 PM	Bus Departure for Walking Tour (pre-registration and ticket required)
4:00 PM	Bus Departure for Banquet
5:30 PM	Canadian Human Rights Museum Gallery Viewing
6:15 PM	Cocktail Hour
7:00 PM	Dinner Service

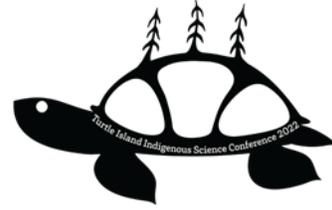
*A light breakfast will be available at 8:00 a.m.

2022 Turtle Island Indigenous Science Conference



Abstracts for Speaker Presentations

Scientific Knowledge Embedded in Indigenous Languages



A Syilx language Perspective: Science Knowledge

Dr. Jeannette Armstrong¹

¹University of British Columbia

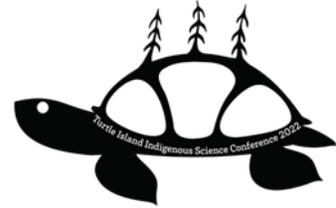
Like all Indigenous languages of Peoples who interact with the lifeforms in the places they live, occupy and use, language is a way of describing the essential and unique science of place. Science is a way of describing what is known and can be verified. In many ways the languages of Indigenous Peoples, whose very existence depended on intricate and complex relationships and interdependencies with other lifeforms, that science is embedded in the way their languages describe those dynamics. In particular in the different and complex ways a system and its components work in specific contexts of utility, aesthetic and accompanying reverence. My keynote will provide some examples to illustrate some points in the nsyilxcn language of which I am a fluent speaker and knowledge keeper.

Weaving Ways of Knowing Among the Trees

Dr. Jesse N. Popp¹

¹University of Guelph

Similar to the way diversity held within a mixedwood forest allows life to flourish; the inclusion of multiple languages, ways of knowing, and ways of being in the natural sciences and beyond provide holistic understandings that benefit all.



The Role of Indigenous Languages in the Conservation of Biodiversity

Dr. Yolanda Teran¹

¹University of New Mexico

Since millennial times Indigenous Peoples have been the guardians and protectors of Mother Earth and all her ecosystems. For us she is alive and sacred with all her beings interconnected and interrelated. Traditional knowledge is being transmitted orally from one generation to the next. We teach and learn by doing practical activities on the field and by deeply observing Mother Nature, Pachamama.

Women and elders have a key role in the maintenance and preservation of the languages because they are the cultural pillars within Indigenous families, communities, and nations. Indigenous languages are pivotal in the generation and transmission of knowledge, sciences, technologies, and innovations. Regarding biodiversity, this term does not exist in Indigenous languages. From Indigenous testimonies from alive people, in Kichwa language it will be Kawsay which means life, the essence of every single element of Mother Earth and the existence of cultural diversity. This diversity has an intrinsic link with the secure tenure of Indigenous Peoples lands, territories, waters, and resources and with the respect and implementation of our human rights such as the right to self-determination and Free, prior and informed consent among others. The concept of biodiversity in Indigenous languages is culturally rich and holistic and embraces all beings, humanity, relationships, diverse epistemologies and cosmovision.

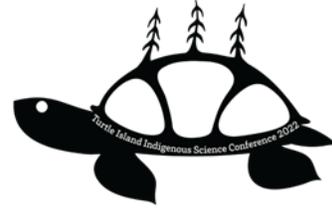
MIKINAK MINISTIK ACIMOWINUK: Turtle Island Narratives.

Dr. Wilfred Buck¹

¹Opaskwayak Cree Nation

Turtle Island narratives will address some of the questions as to WHY? This continent is referred to as turtle island. I will speak of oral histories that tell the listener Indigenous People were living on Turtle Island for a very long time. It touches on the concepts of particle and quantum theory as seen from an alternate perspective.... a perspective predating First Contact.

Traditional Medicine and Health



The Science of the Sacred: Reflections through Land Based Healing

Dr. Nicole Redvers¹

¹University of North Dakota

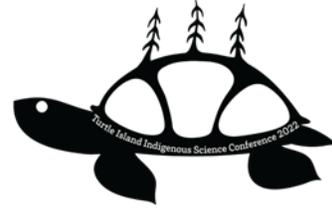
In May 2018, the first year-round urban Land-based healing camp opened in Yellowknife, Northwest Territories, run by the Arctic Indigenous Wellness Foundation (AIWF). Through self-determination, Land-based education, programming, and healing work has been increasingly common within Indigenous communities globally. Indigenous resilience has been at the center of these efforts with greater consideration emphasized on both the educational and healing benefits of Land-based interconnection. In this presentation, Dr. Redvers will consider the intersections between Western science and traditional healing work in Land-based settings from her work co-developing this urban land-based healing program with AIWF.

Mino-Bimaadizwin: Indigenous Preventive Medicine and Public Health

Dr. Darrel Manitowabe¹

¹Northern School of Medicine

Within Anishinaabe (Ojibwa) ontology, consultation with Indigenous herbalists (mshkiki-nini/ninikwe), ceremonialists (jiiskii-nini/ninikwe) or administering healing substances (mshkiki) is a response to poor health and disease manifestation. In the Anishinaabe language, there is no word that translates directly as health and mino-bimaadiziwin, meaning “living the good life” is the closest concept. Studies examining mino-bimaadiziwin are limited, and only a few accounts explore the meaning of this term in the context of an Indigenous explanatory model of health. Mino-bimaadiziwin is either referenced in passing as meaning holistic health or as an expression of culture, spirituality and health. This presentation examines the ontological meaning of mino-bimaadiziwin as a framework for preventive medicine and public health. Mino-bimaadiziwin represents a comprehensive Anishinaabek worldview and ontology expressing a connection with spirit-life (aadiziwin) and human beings. Accomplishing a healthy life takes place through respectful social relationships with humans, animals, land and spirit beings. In effect, mino-bimaadiziwin is a preventive medical model of disease avoidance since disease onset results from maanaaji-maadiziwin, meaning poor health or the need for healing to retain good health. Fundamentally, this concept of health focusses on relationships and conduct in life and disharmony can result in poor health outcomes and potentially death. Situated in a modern context, mino-bimaadiziwin demonstrates an Indigenous model of preventive medicine that may have utility in culturally appropriate public health and determinants of health medical models.



Indigenous Science, Teachings and Public Health

Marcia Anderson¹

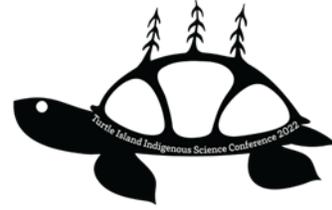
¹University of Manitoba

As a public health physician I often ask myself how would this intervention look different if it was Indigenous led? What different outcomes or impacts would be achieved if it was Indigenous led? The reasons these questions are so important is the inherent assumption that the intervention would look different if it was Indigenous led, and that difference would be informed by Indigenous science and teachings about health and healing.

One of the key differences between public health and health care is the upstream, health promotion and prevention focus. Indigenous science and teachings about health and healing provide an incredibly strong foundation for public health practice. When it comes to addressing systemic anti-Indigenous racism across the health care system re-examining the foundations of our practice is imperative.

The Mino Pimatisiwin Manitoba Model of STBBI (sexually transmitted and blood borne infections) Care has been informed by Indigenous science and teachings and continues to evolve to inform the improvement of public health services. The model was adapted to inform the operational model of urban Indigenous testing and vaccine sites during the COVID-19 pandemic, and is the founding model for an Indigenous led sexual health outreach strategy.

Equitable health outcomes require equitable access to the goods, services and opportunities necessary to be healthy, including health services. For Indigenous peoples, this includes health services that are responsive to and based in our own understandings of health and well-being. Through this presentation, the Mino Pimatisiwin Manitoba Model of STBBI Care will be used as an example of how this can be done.

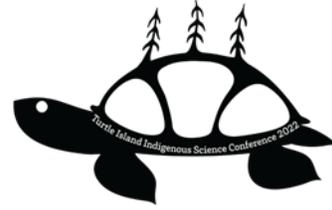


Developing an Indigenous Higher Education Engineering Curriculum

Dr. Wafa Hozien¹

¹Navajo Technical University

This is an in person oral powerpoint presentation. The Indigenous Engineering Higher Education research project at Navajo Technical University looks to engage Native American youth, the targeted high need demographic, in pursuing science, math, and engineering disciplines. The research aims to increase social and academic preparedness among Native students, advance collaboration with Tribal communities, and improve recruitment and retention of Native students at the university level. The objective of this research is to incorporate all components into a model that is transferrable to other Native American populations. The work undertaken through this project resulted in a range of complex issues to be addressed in the embedding Navajo perspectives. Engineering education, in comparison to other fields, is in the early stages of considering the relevance of Native American cultures and knowledge to its body of knowledge. Similarly, the implications for staff and students in providing effective student support are not yet well understood. Conversations held over the course of this research, and interviews with engineering academics, have identified that, at this time, the key need is to 'start' the conversation, rather than progress or refine it. Through workshoping with Indigenous and non-Indigenous academics and extensive collaboration with Navajo communities in New Mexico and Arizona, five elements were identified as critical for establishing any new initiatives. These were: 1. Embarking on embedding Navajo Perspectives. 2. Understanding and articulating the relationship between Navajo world-views and the engineering method. 3. Engaging in the process in a meaningful and respectful way. 4. Developing the educational experience for students. This research has set about reshaping the conversation around Indigenous inclusion in engineering education by focusing on the embedding of Navajo perspectives in curricula.

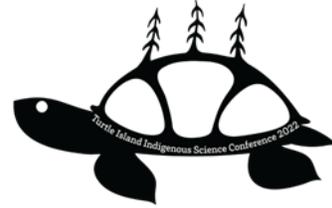


Surveillance of drinking water in First Nation communities: occurrence of bacteria and antibiotic resistance genes

Anita Murdock¹, Sabrin Bashir¹, Rakesh Patidar¹, Annemieke Farenhorst¹, Ayush Kumar¹
¹University of Manitoba

Across Canada, Indigenous communities are not guaranteed their drinking water is free from microbiological contamination. Currently, 60 short- and long-term drinking water advisories (DWA) in effect for First Nation communities across Canada. Often, microbial contamination is a frequent cause of implementing these advisories. Our work examined the water quality in two communities without a DWA. Our objective was to determine the variations concerning the amount of *E. coli* and total coliforms, waterborne pathogen *Campylobacter*, and antibiotic resistance genes (ARGs) found from pre-treated water as well as in post-treated water held in concrete and polyethylene cisterns. Water was sampled across the water distribution systems from source water to tap including the water treatment plant, water delivery trucks and taps in homes directly piped, or serviced by polyethylene or concrete cisterns. *E. coli* and total coliforms were cultured on selective media while *Campylobacter pylori*, *Campylobacter jejuni*, and seven ARGs previously detected in drinking water were quantified using qPCR. Each community produced post-treatment water free from coliforms, yet resistance contamination was detected, most frequently in cisterns. The results frequently showed free residual chlorine levels were typically less than 0.2mg/L which is required to suppress microbial growth, subsequently more drinking water contamination in concrete cisterns than plastic cisterns. *Campylobacter* spp. were present across the drinking distribution systems of both communities. Of piped homes, only 13% of the piped homes tested positive for coliforms and always with a maximum count of 1 CFU/100 mL however ARGs were detected in these samples. The presence of *Campylobacter* spp. or selected ARGs coincided with traditional indicator bacteria, *E. coli* and coliforms hence the DNA extracted from drinking water supplies is concerning as it can suggest bacteria from these waters may harbour genes elevating the risk for infectious diseases of individuals exposed to these bacteria.

Two-eyed Seeing – Indigenous Ways of Knowing & Mainstream Science



Spiritual Approach to Science

Dr. A. Blair Stonechild¹

¹First Nations University of Canada

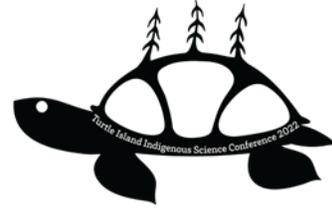
This presentation will investigate the differences between Indigenous and mainstream conceptions of science. Can Indigenous spirituality influence and guide decisions and developments that have taken in the fields of contemporary science? Can concepts of respect for, interrelatedness and directive to act as stewards guide rationales for and approaches to scientific inquiry? Can Indigenous spirituality and philosophy challenge some of the basic assumptions and approaches of contemporary science? Did Indigenous peoples have different ways of interacting with the environment that were respectful of the spiritual integrity of creation and produced radically different results?

Indigenous land-based history, nature, and health in an urban setting.

Dr. Brian Rice¹

¹University of Manitoba

Based on my experiences during my doctoral studies in the Traditional Knowledge Program in the 90's, I have been teaching Indigenous land-based courses in the Winnipeg area. The purpose is to get students out of the classroom to learn in a more healthy natural environment which includes long walks through urban parklands to Indigenous sites, and camping out on our University of Manitoba agricultural lands.

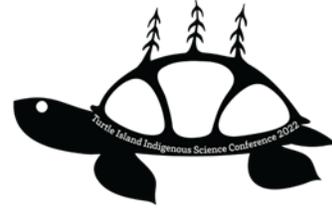


Two-Eyed Seeing on the Edges of Western and Indigenous Sciences

Dr. Jürgen Werner Kremer¹

¹University for Peace (Indigenous Science and Peace Studies) and Santa Rosa Junior College

Quantum theories have fundamentally refuted the received or classical views of Western science and reality and identified it as naïve local realism. Quantum field theories empirically and paradigmatically are the cutting edge of Western science and it is there that we can discuss two-eyed seeing most meaningfully and reframe the traumatic encounters of Indigenous science during the history of coloniality/modernity with healing possibilities. A review of central implications of quantum field theories for our understanding of science and reality and of central assumptions of Indigenous science establish an onto-epistemological and ethical framework for two-eyed seeing that is grounded in Indigenous cultural practices and consistent with quantum field theories; the roles of perception, experience, and story are among the cornerstones of two-eyed seeing within this paradigm. It affirms and asserts the validity of decolonial realities and opens avenues for the resolution of the crises that Western sciences have failed to address successfully. In the field of psychology, this framework can be fruitfully applied to such phenomena as depression, for example. It implies an educational approach that is transformative and grounded in ceremony and storytelling.



The STEM of Turtle Island

Dr. Roger Dube¹

¹Rochester Institute of Technology

Contrary to accepted “western” beliefs, the Indigenous nations across Turtle Island were prodigious inventors and observers of science in nature. Archeological evidence of inventions over time show two important facts. First, the rate of innovation by our ancestors across Turtle Island was increasing exponentially until the arrival of the Europeans. Second, many of the inventions, such as the scalpel, the compass and astronomical precision, often predated the same invention elsewhere in the world by centuries. In this talk, we will review these important findings and focus on how the Indigenous approach to science and mathematics differs from “western” approaches and can lead to insights that produce significant advances in STEM.

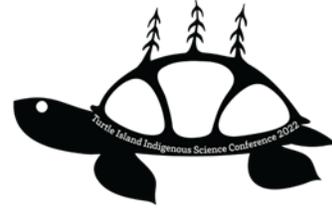
Three-eyed seeing and Three-voices: an ethical space for understanding biodiversity and natural law(s)

Dr. Myrle Ballard¹

¹University of Manitoba

This talk explores a three-eyed and three-voices framework that is premised on ethical space on respecting biodiversity and natural laws. Examples based on Anishinaabe mowin / Indigenous places/spaces/land forms will be used to explain this framework. Examples will also be presented of what western science cannot decipher and Indigenous aquatics knowledge regarding water and its “character”. This talk also will explain how the knowledge of the water is premised on Anishinaabe mowin that is based on “laws” and how it is an important baseline monitor.

Novel STEM Education Approaches that Include the Indigenous Way of Knowing



Indigenous Ways of Knowing

Dr. Henry Fowler¹

¹Navajo Technical University

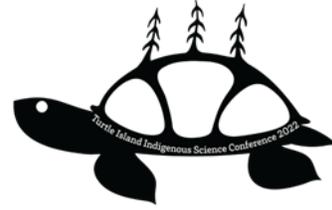
Indigenous people have lived many years using traditional knowledge to survive and solve problems. Such knowledge evolves from centuries of mathematical activities and modeling, based on the unique perspectives of the Indigenous/Navajo people. This knowledge is infused with every changing season and connection to Mother Earth and Father Sky and tied to their language and culture. Such is also a vital part of Indigenous communities. This presentation focuses on examples of Indigenizing math curriculums to bring traditional education into mainstream math education.

Applying culturally responsive pedagogy in introductory science courses

Dr. Emily McKinnon¹

¹University of Manitoba

The application of culturally responsive teaching is an appropriate and necessary component of decolonizing education at all levels. In universities, momentum is gaining for changes such as Indigenous course requirements for all students, and incorporation of non-Western views and approaches in all courses. How can this be done for science, which is often seen through a fixed, Western-European lens? As a science instructor at the University of Manitoba, I have been evolving my first-year biology and statistics courses to better reflect the principles of culturally responsive teaching. Since 2016, I have taught small cohort classes that are 90-100% Indigenous (First Nations, Métis, Inuit) students, thus I have focused on including Indigenous science, and disrupting the historical narrative that science can only be a Western/European discipline. I have incorporated assessments and additional content that allow students to bring their authentic selves to the classroom, as well as engage in a critical discussion of the status quo. During my presentation I will illustrate through examples ways that culturally responsive pedagogy can allow for a rich, holistic educational experience for both the instructor and the learner.



Bridging Indigenous Mathematics and Global Mathematics

Dr. Edward Doolittle¹

¹First Nations University of Canada

In a series of articles for the high school level problem solving journal *Crux Mathematicorum*, Edward Doolittle has explored connections between topics in global mathematics (meaning the mathematics commonly taught in schools and universities the world over) and Indigenous mathematics and culture. Edward draws connections between the Starblanket design found in Indigenous art and arithmetic sequences, arithmetic series, and the calculus of finite differences; between the design of a water drum and topics in number theory like modular arithmetic, arithmetic series, skip counting, multiplication, greatest common divisor and the Euler phi-function; and between Indigenous language and art and group theory. Edward believes that this body of work will help to bridge global mathematics and Indigenous mathematics, will show Indigenous students that studying global mathematics does not require leaving their culture behind, and will provide resources that teachers and mathematicians can build upon.

Nihiyew & Anihšināpē Pimatisiwin (Cree & Ojibway Cultural Lifeways)

Dawn Pratt¹

¹Askenootow Stem Enterprise Inc. Canada

Ms. Pratt reinstates Indigenous knowing and practices into education in Treaty 6 territory and beyond through her company askenootow STEM Enterprise Inc. She is a member of Muscowpetung Nation and her educational business integrates Elder and Knowledge Keeper teachings into lesson plans and workshops for educators to reach children and youth in the fields of science, technology, engineering, and math (STEM). With combined and unique expertise as an Indigenous chemist, educator, community member, and mother, Ms. Pratt empowers educators and learners. Through the delivery of workshops like Tipi STEM & Aerodynamics, she benefits Indigenous Peoples' futures and the future of all Treaty people.



An Indigenous Approach to Learning: Connecting Community, Science, and Engineering with Traditional Knowledge.

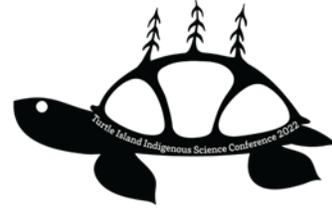
Dr. Natalie Tufenkji¹ and Joel Grant¹

¹McGill University

Joel Grant (Métis Nation of Alberta, Region 3, Treaty 7) lived at the First Peoples' House (FPH) at McGill University while pursuing a Master's degree in Chemical Engineering. With a strong network of support provided by FPH and his academic supervisor, Prof. Nathalie Tufenkji, Joel participated in several initiatives including serving as President of the American Indian Science and Engineering Society McGill Chapter, senior camp councillor at the Eagle Spirit Science Futures Camp, and pursuing a Pathy Fellowship to make educational science videos for Indigenous youth. This presentation will discuss some of those initiatives and summarize Joel's research findings from his Master's thesis work.

Joel's Master's research examined the effects of freeze-thaw cycling (such as that observed in the climate of southern Quebec) and UV irradiation on the fragmentation of bulk plastics into microplastics and nanoplastics. The effects of weathering on polystyrene sheets were investigated by examining bulk mechanical properties, surface roughness variations, and particle release. Weathering polystyrene sheets via 18-weeks of UV exposure followed by fourteen 24-hr cycles of freeze-thaw in filtered reverse-osmosis water led to increases in bulk and surface hardness of the polystyrene. The storage modulus curve of weathered polystyrene underwent a shift and increase in glass transition temperature. This showed a change in stiffness and embrittlement of the surface layer due to the formation of crystallites and oxidation. Surface roughness measurements also increased because of erosion of the core surface. Particles released into the leachate were analyzed by Scanning Electron Microscopy and Nanoparticle Tracking Analysis. It was found that micron-sized and submicron-sized particles were released upon weathering of the plastic. Films of the particles were confirmed to be polystyrene with Fourier Transform Infrared Spectroscopy. These data suggest that seasonal variations may be associated with increased release of polystyrene particles from the bulk plastic.

Indigenous Engagement with the Land and the Environment



Earth Stories: Understanding Indigenous Climate Justice

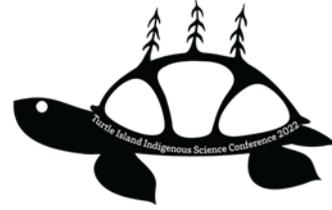
Dr. Deborah McGregor¹

¹York University

What does it mean to “live well” with the Earth in the face of climate/ecological crisis? What does a self-determined climate future look like for Indigenous communities and peoples? What do our own stories and teachings tell us about our responsibilities to Mother Earth and all beings and those yet to be born? What responsibilities and obligations do we have in relation to determining our own climate change future? How can we “pass on solutions” to future generations rather than “problems”?

The current climate crisis is not the first time Indigenous peoples have had to face devastating environmental change. Our stories are instructive in providing guidance how to navigate the current climate crisis. I suggest there is a need for Indigenous climate stories as most of the world’s currently cited climate change knowledge is derived from the same models of human-nature interactions that have caused the problems in the first place. The climate knowledge of Indigenous peoples has been marginalized, with Indigenous people unable to contribute their own climate change knowledge to broader governance processes. Indigenous peoples have distinct formations and contributions to make to the dialogue on global environmental/climate crisis.

Indigenous-derived solutions must be generated based on knowledge, language and legal systems which have fostered Indigenous survival despite centuries of environmental upheaval affected by colonization. I will explore how these themes merge to envision a self-determined climate change future that may inspire others to “live well” with the Earth.

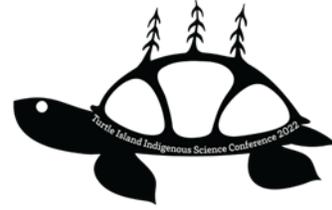


Unearthing Indigenous soil knowledge for supporting sustainable Prairieagroecosystems

Dr. Melissa Arcand¹

¹University of Saskatoon

The soils across the Prairies are rich in fertility and organic matter from millennia of complex interactions among grassland plants and microorganisms, grazers such as bison, and Indigenous peoples. Grassland ecosystems were plowed over to make way for agricultural expansion and continue to be one of the most threatened ecosystems on the planet. While the rich soils developed under grasslands support agricultural production, First Nations were systematically marginalized from the lands and participation in the agricultural sector. Today, agriculture remains the prominent land use on First Nations reserve lands in the Prairies, but with little economic benefit to First Nations as most of the land is farmed by non-Indigenous farmers. As First Nations expand their land bases through purchases enabled by Treaty Land Entitlement and Specific Claims, soil knowledge has become increasingly critical to ensure that agricultural management supports soil health and avoids soil degradation. At the same time, many First Nations are looking to repatriate bison on their lands and are seeking solutions to restore lands to support healthy forage for the herds—healthy soils underpin these goals. This presentation will provide an overview of First Nations and agricultural dynamics on the Canadian prairies through the lens of soils and argue for the vital importance of Indigenous soil knowledge for the future of agriculture and the land.



Sayt K'il'im Goot – Of One Heart: Connecting Youth, Elders, Land, and Water Through Nisga'a Science and Culture

Dr. Andrea Reid¹

¹University of British Columbia

Land-based learning and knowledge form the foundation for many Indigenous education systems in Canada and around the world. However, colonial power systems are embedded in educational institutions, schools, and disciplines that have historically worked to disconnect Indigenous youth and families from the land and water, and continue to do so to this day.

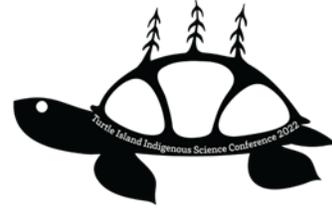
Hence, for many Indigenous communities, there is pronounced distrust in the education system and an ongoing movement towards self-determination in education. Alongside these colonial legacies, the effects of climate change are disproportionately impacting Indigenous communities in Canada. Changes in the landscape alter knowledge and disrupt generational knowledge transfer. Today, there is great concern that youth are not learning the necessary skills and knowledge for the continuation and well-being of the culture, land, and water. It is thus imperative that youth are educated about ongoing changes, and empowered to measure, monitor, and respond to ongoing impacts for the continuity of Indigenous cultures and knowledges. Here, we focus on one such multi-year program in the Nisga'a Village of Gingolx on the British Columbia–Alaska border. This program engages Nisga'a youth of all ages through multi-day land- and water-based experiential and curiosity-driven learning activities that constitute a biannual science and culture camp in and around the community. Camps are co-led by a team including Nisga'a knowledge keepers, fisheries and wildlife technicians, and other community members. Together, we are responding to the crises created by climate change, colonization, and capitalism, and the linked consequences for Indigenous lands, waters, cultures, and knowledges.

Anishinaabek Women's G'giikendaaswinmin (knowledge)

Dr. Sue Chiblow¹

¹York University

This presentation will share Anishinaabek women's knowledge on Nokomis Giizis laws from the Great Lakes Territory. Nokomis Giizis has her own laws as it relates to women and water. These laws are embedded in responsibilities, relationships, and reciprocity. The spiritual and lawful relationships is based on the cycles of women and Nokomis Giizis stemming from Nokomis Giizis law. Continued engagement with Nokomis Giizis provides knowledge of women's responsibilities to N'bi and all life.



Persistent Legacies: Historical Ecology of Forest Gardens and Orchards in Coast Salish and Ts'msyen Territories

Dr. Chelsey Geralda¹

¹Simon Fraser University

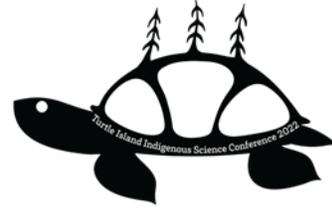
Land-use scientists increasingly recognize that ecological and anthropogenic forces have long interacted in complex ways, forming many of the landscapes we observe today. A great example is forest gardens—ecosystems dominated by edible fruit, nut, and berry producing trees and shrubs, managed by Coast Salish and Ts'msyen communities in the past, and which continue to grow today. This presentation will provide an overview of collaborative forest garden and orcharding research, which combines ethnoecology, archaeology, and functional ecology at two ancestral villages in Gitselasu (Ts'msyen) and Sts'ailes (Coast Salish) homelands (in so-called British Columbia). This relatively new research contributes to a growing body of evidence which reveals the ways in which Indigenous peoples' land-use has positive effects on the lived landscapes and supports descendant communities seeking to re-integrate land-based foodways and livelihoods in unprecedented times.

Honouring Stories, Past, Present and Future to Guide Adaptive and Resilient Land Healing

Jennifer Grenz¹

¹Department of Forest Resources Management, University of British Columbia

The colonial nature of ecological restoration is such that common approaches could be described as non-specific, based on static, aesthetic notions of naturalness, and disregard relationality. Long-term failures of ecological restoration projects may be a testament to these. Colonial approaches to ecological restoration planning may inhibit climate adaptation and relatedly, Indigenous food security and food sovereignty. While Indigenous knowledge is increasingly being sought and integrated into ecological restoration, planning processes and decision-making structures for projects often continue to perpetuate colonialism and accentuate power imbalances. Storytelling provides an Indigenous methodology for planning that transforms ecological restoration into Indigenous land healing that better ensures long-term outcomes that serve community needs and are consistent with community values. Through a project with Cowichan Tribes, by honouring the stories of the past, present and future of ancestral lands, we were able to broaden the focus of land healing such that we could adapt and reclaim traditional stewardship practices, create the necessary connection of human relationship to land in the modern context, bring multidimensional healing to community, and account for the adaptability and resiliency needed for the community in a changing climate.



Ethnobiology of Animoshag, Mississaugas of the Credit First Nation

Jonathan Ferrier¹, MacDonald Brandi², Ai Zonghua¹, Watkins Dianne¹, Sherry Fukzawa³, Tina Sault⁴, Garry Sault⁴, Carolyn King⁴, Chris Tobicoe⁴, Veronica King-Jamieson⁴

¹Dalhousie University, ²University of Missouri, ³University of Toronto Mississauga, ⁴Mississaugas of the Credit First Nation

Animoshag (Place of Dogs or Wolves) is a Mississauga, Anishinaabe (Ojibwe) favoured summer and winter territory for water, game, foods, medicines and materials. Mississauga ecological knowledge in Animoshag naturally connects to Anishinaabemowin, Anishinaabeg art, and Mississaugas of the Credit First Nation's ethnobiology. Our Anishinaabemowin biology meta-analyses provides dialect level consensus on food, medicine and material culture in the territory. Mapping this data, starting with geopolitical place-names helps with context in forensic restorations of art, culture, and Mississauga Ecological Knowledge. Ecological roles, responsibilities and language linkages are emerging with ecosite level trends in biodiversity. Our group's expertise in metabolomics and analytical chemistry assists in describing the biochemical relationship with territorial food, medicine and materials while receiving guidance from Mississauga pictograph ochre studies, Elders and Knowledge Keepers. In Animoshag, Ryerson's technological schools, farms, churches, mills, and man camps complex with other Canada Indian Act processes have grossly impacted Mississauga culture. Outcomes from the Truth and Reconciliation Council, Two-eyed Seeing, Community-engaged Learning (CEL), and Community-led Research (CLR) are revitalizing Mississauga Nation's ethnobiological heritage.

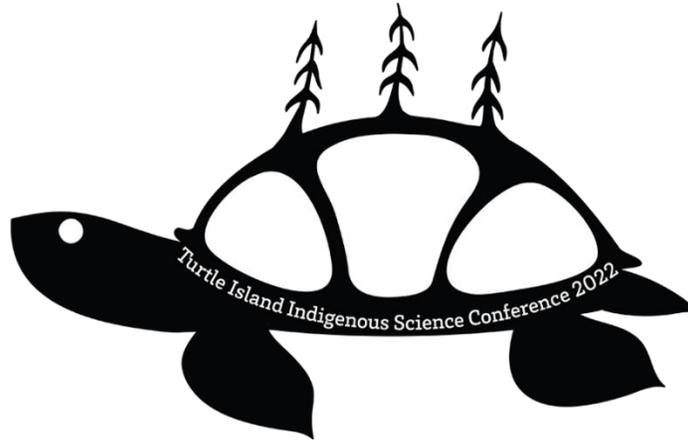
The Autoethnography and Science of an Ininiw from God's Lake, Manitoba, Canada: First Nation Water Governance Flows from Sacred Indigenous Relationships, Responsibilities and Rights to Aski

Stewart Lloyd Hill¹

¹Manitoba Keewatinowi Okimakanak (MKO)

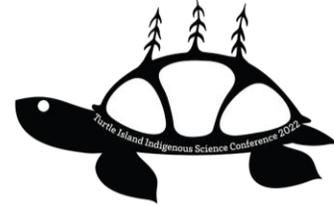
The Ininiw of Manitou (God's) Sakahigan (Lake), now known as God's Lake First Nation (GLFN), are an Indigenous people of Turtle Island, now called North America. As a GLFN Ininiw, I tell my autoethnography, drawing on a half-century of experience, both personal and professional, as well as a literature review, government data, and fieldwork. The medicine wheel framework required that I consider the spiritual, physical, emotional, and mental aspects of GLFN's water governance. I applied another Medicine wheel teaching regarding the Indigenous learning process to analyze this data, which provided an analytical framework to systematically process the data through heart, mind, body, and spirit. As the Ininiw people, we do not accept Canada's labelling of us as "wards of the state", as our worldview of Manitou (Creator)-given rights is at odds with this derogatory designation. Manitou's natural laws provide for resources from which all humans may make a living from their own efforts and sweat. The legal, water and other systems in place in Canada need to be reconciled with natural law, and one component of that would be for the Ininiw people of God's Lake to assert their governance over the waters of their territory and ancestral lands. There is great hope for water governance and self-determination as Indigenous people rise up and assert their science and sovereignty over their lands, waters, and their lives.

2022 Turtle Island Indigenous Science Conference



Abstracts for Poster Presentation

Traditional Medicine and Health



Abstract ID: 1

Nitêh Iskotew Program ᓄᓄᓄ Δᓄᓄᓄ (Heart Fire)

Marsland Seapieces¹, Eric Wilson¹

¹University of Saskatchewan

Nitêh Iskotew Program ᓄᓄᓄ Δᓄᓄᓄ (Heart Fire Program) is a Wholistic Therapy Circle & Mixed Martial Arts Combined Program. The pilot program was launched March 2022 in partnership with the University of Saskatchewan Student Wellness Centre, Peer Health and USask Rec. The vision of Nitêh Iskotew is to empower the next generation of leaders by providing wholistic mental health and wellness teachings and building buffalo-like confidence with a focus on physical health.

The focus of Nitêh Iskotew is to utilize an Indigenous approach for mind, body and spirit balance in relation to the natural world. The therapeutic circles were conducted by Seapieces Marsland, Indigenous Cree Counsellor, a graduate from Wilfrid Laurier University – Indigenous Focus of Study. The self-defense portion of the program was instructed by Eric Wilson, Métis Professional Mixed Martial Artist, Judoka, Personal Trainer and Combat Sports Specialist. Achieving the #2 ranked Bantam weight spot in Canada and capturing the Five Star Fight League Championship.

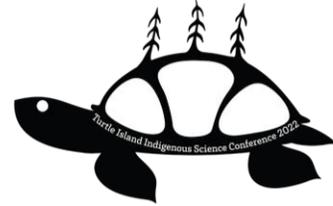
USask Students Testimonials:

"I feel more connected to my roots and who I am overall, the MMA portion helped me in a way of feeling that I can protect myself especially because of the stats of MMIW. I feel this program should continue for future students, coming from a reserve 7 hours north I had sense of community."

"The combination of Holistic Healing Circle and MMA has provided me with a newfound confidence both spiritually and physically."

"I've never had the opportunity to be in such a great program. I've learned so much, built great connections and made great strides in my cultural identity and self-confidence."

Two-eyed Seeing – Indigenous Ways of Knowing & Mainstream Science



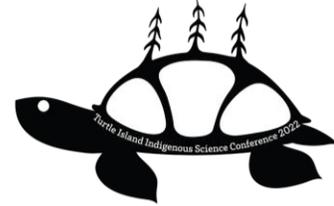
Abstract ID: 2

Higher COVID-19 Rates In Manitoba's First Nations Compared to Non-First Nations Linked to Limited Infrastructure On Reserves

Ajarat Adegun¹, Shirley Thompson¹

¹University of Manitoba

The relationship of COVID-19 rates to community infrastructure is explored through a literature review, mapping, and an ecological-level statistical analysis in this paper. The analysis was undertaken with data from Manitoba, Canada, for 23 of 63 First Nations and 67 non-First Nations communities. COVID-19 community-level per capita rates were estimated by dividing total cases, including active cases,—obtained from the COVID-19 Manitoba Open Data portal of the Public Health Information Monitoring System, PHIMS—for the community areas of Regional Health districts by the community 2021 Manitoba population report numbers. The geographical areas for COVID-19 data were identical to the census subdivision levels available from Statistics Canada, used for housing and other infrastructure data. COVID-19 per capita rates in Manitoba communities have a positive significant strong relationship with community rates for (a) overcrowded housing ($r = 0.532$, $p < 0.05$), (b) unsuitability of housing ($r = 0.623$, $p < 0.05$), (c) houses needing major repairs ($r = 0.561$, $p < 0.05$), (d) no access roads ($t = 2.281$, $p < 0.05$), and (e) lack of hospitals ($t = 2.024$, $p < 0.047$). The highest rates for COVID-19 and the worst infrastructure are located in First Nations, particularly in special access communities. This preliminary research signals a need to improve infrastructure in First Nations reserves to realize health equity. Further research on built environment conditions in all Manitoba communities with age- and sex-adjusted analysis of COVID-19 data is needed to comprehend the role of infrastructure more fully.



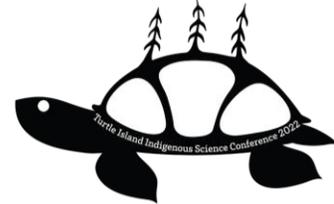
Abstract ID: 3

Practices for braiding Indigenous knowledge systems and Western science for research and monitoring of biodiversity

Ella Bowles¹, Dominique Henri², Jennifer Provencher², Steven Alexander³, Jade Steel⁴, Carmen Chelick⁴, Jessica Taylor⁵, Junaid Khan⁴, Britney Zacharuk⁴, Alana Wilcox², Oscar Hartman Davies⁶, Deborah McGregor⁷, Adam Ford⁴, Susan Chiblow⁸, Steven Cooke⁵, Jesse Popp⁹

¹University of British Columbia, Environment and Climate Change Canada, ²Environment and Climate Change Canada, ³Department of Fisheries and Oceans, ⁴University of British Columbia, ⁵Carleton University, ⁶Oxford University, ⁷York University, ⁸York University, University of Guelph, ⁹University of Guelph

Recognizing the need for a paradigm shift in approach to environmental research, monitoring and decision-making, Indigenous knowledges (IK) and Western science (WS) are increasingly being brought together for this work. Broad frameworks or models for bringing knowledge systems together are needed to help guide researchers and decision makers in mutually respectful engagement. Many models exist, and vary among Nations (e.g., Etuaptmumk (two-eyed seeing), SiQ, Kaswentha (two-row wampum)). However, practitioners continue to ask, “but how do we actually do it [employ both IK and WS]?”. To address this question, we conducted interviews or sharing circles with 40 Elders, knowledge holders, youth or lands staff over 12 First Nations and Metis communities in Canada to ask if, when and how IK and WS should be brought together. There was strong support for braiding IK and WS, though many challenges were also highlighted. Solutions and pillars to successfully braiding included, most critically, building and maintaining strong relationships. Other pillars included that IK needs to guide the work, respect for both knowledges, responsibility to the land and one another, reciprocity, gender and age representation, intergenerational knowledge transfer and language revitalization. We also conducted a systematic review of all biodiversity research, monitoring and management literature that has brought together IK and WS in Canada. >25 000 works were reviewed, with 156 meeting our criteria for data extraction. From these works, we documented the roles for each IK and WS at each stage of work (design, implementation, analysis, reporting and decision-making). Outcomes from the interviews are guiding our analysis of the literature review data. Overall, our analysis thus far shows that rather than there being specific prescribed instructions for how to braid knowledge systems, successfully doing so requires building and maintaining good relationships. This process requires time, and interactions at all stages of the research.



Abstract ID: 4

Project Delivery With Indigenous Communities and Methods to Incorporated Indigenous Ways of Knowing

Danilo Caron¹

¹University of British Columbia

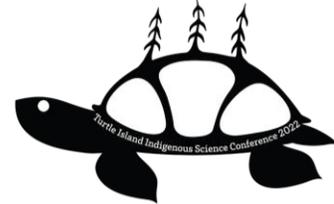
Incorporating Indigenous traditional knowledge in architecture, engineering and construction industry projects can enrich project design and strengthen relationships between the industry and Indigenous communities. Conventional project delivery methods leave little space for the necessary engagement and collaboration required to bring Knowledge Keepers together with designers.

Motivated proponents can employ various strategies from procurement, coordinated engagement with Indigenous communities and Knowledge Keepers, and assisting their designers through the project design cycle.

This research looks at two projects, each with different proponents in Coast Salish territory in what is now called Vancouver, British Columbia. The proponents and the First Nation territories the projects take place share enough similarities to offer combined insights although different project delivery methods were used. The designers and proponents are motivated to try, listen, share, and reflect with the goal of improving their processes.

Based on interviews, project team observations and project document review, an Indigenous Values Framework was developed that proponents can apply to projects to inform chosen mechanisms within project delivery. The goal being to enable designers to engage and learn from local Indigenous Knowledge Keepers and to incorporate Indigenous ways of knowing and being in design.

There is an interest from the architecture, engineering and construction industry in how to do this in an authentic and respectful way. The reasons for this include the benefit Indigenous perspectives bring to design challenges and the recognition that projects on Indigenous land should reflect the values of the original stewards of the land. The two projects studied in this research are on the unceded territory of the *xʷməθkʷəy̓əm* (Musqueam), *Sk̓wx̓wú7mesh* (Squamish), and *səlilwətał* (Tseil-Waututh) Nations and the engagement process and incorporation of local knowledge is seen as an important part of building trust and strengthening of relationships between the proponents and the local nations.



Abstract ID: 5

Water is Our Friend: Flood-Resilient and Climate-Adaptive Housing for Indigenous Communities in Canada

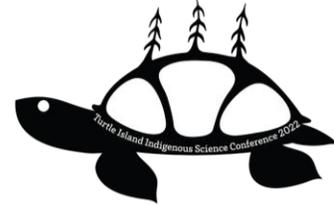
Elizabeth English¹, Laurie Pearce², Brent Doberstein³

¹University of Waterloo, ²Justice Institute of British Columbia, ³University of Waterloo

Canada's colonial legacy has pushed Indigenous communities onto land that is subject to frequent flooding, now exacerbated by climate change. It is especially crucial for Indigenous populations to find ways of reducing debilitating flood impacts without causing displacement from their land, to which they are culturally, generationally and spiritually deeply connected. Canada's current flood risk reduction policy of "managed retreat" ("assisted" relocation) is an insensitive reminder of the practices of colonialism.

Our research seeks to promote resilient communities by combining Indigenous Traditional Ecological Knowledge (TEK) with Western scientific methodologies. Our team includes members from both cultures and takes an interdisciplinary and collaborative approach. Our focus is on flood mitigation strategies that are innovative, inexpensive and applied to individual houses, thus promoting independence from large-scale, top-down, government-implemented solutions that are disrespectful and destructive of local ecologies and usually imposed without community input or approval. Our project invites Indigenous communities to discuss, evaluate and select the solutions for creating flood-resilient housing that will meet the particular needs and preferences of each community and align with its TEK and cultural practices. Western-science-trained researchers are invited to listen and learn about the spirituality and sacredness of water, the oneness of all beings and things on Turtle Island, and how fundamental respect for water is the basis for all TEK approaches to reducing the impacts of flooding.

Water can be recognized and respected as nurturing a land and its people, rather than considered a hazard to be subjugated. Our research challenges existing Western paradigms, to shift flood management practices from the imposition of control over nature to a paradigm of acceptance, accommodation and adaptation to natural events. As climate-change-induced flooding becomes more frequent, we are motivated by the potential for the blending of TEK and Western science to find solutions for our most intractable problems.



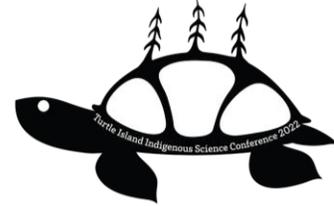
Abstract ID: 6

Student-led programming to support a culture of two-eyed seeing in postsecondary science research lab groups

Wylee Fitz-Gerald¹, Dr. Laura Lukes¹, Dr. Shandin Pete¹, Silvia Mazabel¹, Sarah Bean Sherman¹

¹University of British Columbia

Two eyed seeing provides the gift of multiple perspectives, in braiding together Indigenous knowledge and mainstream science. In responding to the Truth and Reconciliation's Calls to Action regarding reassessing educational practices, universities are in the process of figuring out what it means to incorporate Indigenous perspectives. While its importance is being routinely stated by universities, it's application at all levels within institutions is inconsistent. Currently, curriculum-related efforts have been focused on indigenizing/decolonizing science undergraduate courses. While this is an essential step towards equity, it does not address how two eyed seeing will be integrated in the research environment, and training future faculty (e.g., graduate students, postdocs). Graduate student training and professional development often takes place in one-on-one mentoring or small research group environments, which often focuses on disciplinary knowledge and skills but rarely includes Indigenous perspectives. The Earth Science Experiential and Indigenous Learning (EaSEIL) team at the University of British Columbia aims to help bridge these gaps. One effort includes the creation of resources and student-designed workshops for science research labs focused on increasing knowledge of Indigenous cultures, diversity, and knowledge systems, as well as how these can intersect and relate to western science disciplines and practices. These workshops are designed at an introductory level, allowing individuals to engage in these conversations with their research group, even if it is outside of their comfort zone. Sample topics of these workshops include terminology, land acknowledgements, two eyed seeing, indigenizing vs decolonizing etc. This presentation will present a single student-led workshop case, including design process, format details, lessons learned, and future implementation directions.



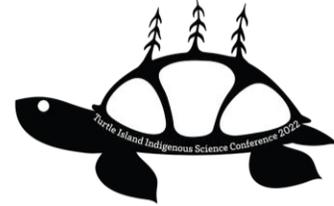
Abstract ID: 7

Examining the role of Indigenous primary healthcare across the globe in supporting populations during public health crises

Kayla Fitzpatrick¹, Anika Sehgal², Stephanie Montesanti¹, Emilie Pianarosa², Cheryl Barnabe², Amber Heyd², Tessa Kleissen², Lynden Crowshoe²

¹University of Alberta, ²University of Calgary

When health systems are overwhelmed during a public health crisis regular care is often delayed and deaths result from lapses in routine care. Indigenous primary healthcare (PHC) can include a range of programmes that incorporate treatment and management, prevention and health promotion, as well as addressing the social determinants of health (SDoH) and a focus on redressing health inequities. We examined how Indigenous PHC mobilises and innovates during a public health crisis to address patient needs and the broader SDoH. A rapid review methodology conducted from January 2021 to March 2021 was purposefully chosen given the urgency with COVID-19, to understand the role of Indigenous PHC during a public health crisis. Our review identified five main themes that highlight the role of Indigenous PHC during a public health crisis: (1) development of culturally appropriate communication and education materials about vaccinations, infection prevention, and safety; (2) Indigenous-led approaches to the prevention of infection and promotion of health; (3) strengthening intergovernmental and interagency collaboration; (4) maintaining care continuity; and (5) addressing the SDoH. The findings highlight important considerations for mobilising Indigenous PHC services to meet the needs of Indigenous patients during a public health crisis such as the COVID-19 pandemic.



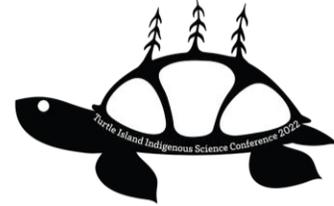
Abstract ID: 8

Reconceptualizing Cumulative Effects Assessment and Management Through Indigenous Knowledge Systems

Lawrence Ignace¹

¹University of Victoria

The consideration of Indigenous Knowledge systems in the management of natural resources is growing in Canada to meet legal requirements, fill gaps in knowledge, and improve reconciliation with Indigenous peoples. The recent *Yahey (Blue Berry First Nations) v. British Columbia*, Supreme Court of British Columbia decision has brought cumulative effects to the forefront. In this presentation, I will discuss three Indigenous frameworks that could be used to re-shape cumulative effects assessment and management. While it is recognized there are complementary aspects of western science and Indigenous Knowledge, there remain questions as to how best to align these worldviews. Much of the recent natural resource management literature reviewing the bridging Indigenous knowledge systems with western science continues to be generated from the dominant colonial point of view. There is a need to ensure Indigenous Knowledge systems are reflected in an equal manner while allowing Indigenous communities and nations the necessary capacity and time to consider these pressures more fulsomely. Cumulative effects on their own are complex, broad, and pervasive and are not well considered in natural resource management processes. As a result of the complexity, the assessment and management of cumulative effects suffer from limited baseline data, defining ecological thresholds and coordinating management responses. By exploring three examples of Indigenous worldviews, I will demonstrate how cumulative effects assessment could be reframed to better address these complexities while supporting community level needs and interests.



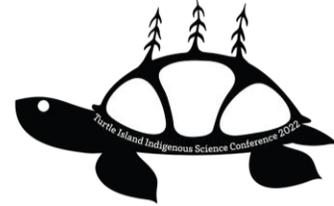
Abstract ID: 9

Weaving Knowledge Systems in Ecotoxicology and Wildlife Health: A Systematic Review

Lydia Johnson¹, Jennifer Provencher², Alana Wilcox², Heather Castleden³, Dominique A. Henri⁴, Steven Alexander^{5, 6}, Ella Bowles⁷, Diane M. Orihel^{1, 8}

¹ School of Environmental Studies, Queen's University, Kingston, Ontario, Canada, ²Ecotoxicology and Wildlife Health Division, Science and Technology Branch, Environment and Climate Change Canada, Ottawa, Ontario, Canada, ³School of Public Administration, Transformative Governance for Planetary Health, University of Victoria, Victoria, British Columbia, Canada, ⁴Wildlife Research Division, Science and Technology Branch, Environment and Climate Change Canada, Montreal, Quebec, Canada, ⁵Environment and Biodiversity Sciences, Fisheries and Oceans Canada, Ottawa, Ontario, Canada, ⁶Environmental Change and Governance Group, University of Waterloo, Waterloo, Ontario, Canada, ⁷Management Unit with the Migratory Birds and Wildlife Health Section Canadian Wildlife Service / Environment and Climate Change Canada, Ottawa, Ontario, Canada, ⁸Department of Biology, Queen's University, Kingston, Ontario, Canada

The status quo in natural science research has been to solve environmental problems using only Eurocentric methods. Within the last decade, post-secondary institutions and academics have been called upon to advance their understanding of reconciliation and to mainstream reconciliation in all aspects of the scientific endeavor; one way to do so in the natural sciences is to weave Indigenous and western ways of knowing. Weaving knowledge systems has been argued to increase the thoroughness and understanding of the research process. We conducted a systematic review of 17 studies that weave Indigenous and western ways of knowing to study environmental contaminants and wildlife health in Canada. We found that studies spanned across much of Canada's jurisdictional boundaries (but excluded British Columbia, Ontario, Nova Scotia, New Brunswick, and Prince Edward Island). The commonly studied contaminants were metals (n=6), mercury (n=3), and polycyclic aromatic hydrocarbons (PAHs) (n=3), and the commonly studied species (n=2) were lake trout, lake whitefish, arctic char, caribou, muskoxen, and common eider. The methodology used to weave knowledge systems was most often community-based participatory research. Most studies were considered 'collaborative' across all research stages and credit was most often given to Indigenous community members at the data collection phase. Weaving knowledge systems can provide a holistic approach and understanding when solving environmental problems related to ecosystem and wildlife health, helping to answer questions that each knowledge system cannot on its own. By highlighting how previous studies have woven knowledge systems across all stages of the research process, our review demonstrates how natural scientists can successfully conduct collaborative research that responds meaningfully to the calls for reconciliation in Canada.



Abstract ID: 10

Optimizing Community-based Wildlife Monitoring: Prioritizing Indigenous Knowledge & Values

Claire Kemp¹, Kathryn Yarchuk¹, Joseph Northrup², Nadine Perron³, Allyson Menzies¹, Jesse Popp¹

¹University of Guelph, ²Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry, ³Department of Lands, Resources, & Environment, Magnetawan First Nation

Community-based monitoring programs are becoming increasingly popular within environmental monitoring and management. This can be a useful approach for conducting environmental work on a community's own terms, ensuring alignment with community-specific knowledge and values. Through the application of two-eyed seeing, community-based monitoring can help weave together Indigenous and Western sciences in a highly practical, holistic way while addressing community priorities. In partnership with Magnetawan First Nation, this research is investigating how local knowledge and values can be prioritized in community-based wildlife monitoring to better understand the diversity of medium and large mammals, and how this is affected by roads and railways. Considering various monitoring tools, wildlife cameras and digital applications have been selected for their alignment with community values and goals, and ability to sustain long-term monitoring. Community values including reciprocity, interconnectivity, knowledge transfer, and respect have set the foundation for this research as a whole, and ongoing community engagement has helped weave them throughout the research process. As a case-study, this project demonstrates how the weaving of knowledge systems can help create community-driven, values-based approaches to wildlife monitoring, while building reciprocal and respectful partnerships between researchers and Indigenous partners.



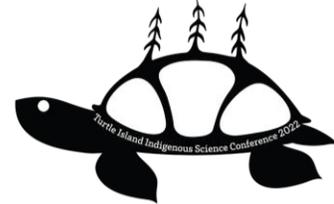
Abstract ID: 11

Journey to Finding New Antibiotics

Taylor MacLeod¹

¹University of Manitoba

Antibiotic resistance is a growing societal problem and without the discovery of new antibiotics we could face some detrimental impacts. For example, wounds that are of little concern now, could potentially lead to severe infection and even, death due to the adaptability of resistance to medications. Fighting the ongoing antibiotic crisis requires the discovery of compounds in which, have novel antimicrobial characteristics and modes of action that are capable of treating antibiotic-resistant infections. Many antibiotics are sourced from specialized compounds such as secondary metabolites. Secondary metabolites are small natural molecules biosynthesized mainly by plants, bacteria, and fungi. Only a few new antibiotics have made it to the clinical trial stage within the last 60 years. Here, we describe the techniques we have used to isolate- purify and subculture an interesting species of fungi which shows strong antimicrobial properties in hopes to find a novel compound responsible for these characteristics.



Abstract ID: 12

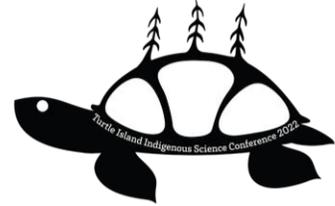
Multiple views, multiple experiences: Integrating Indigenous perspectives in science field-based education courses

Laura Lukes¹, Shandin Pete¹, Bean Sherman¹, Brett Gilley¹

¹University of British Columbia

In response to their institution's call to enhance student understanding of the intersection of Indigenous issues and their area of study, two instructors (one Indigenous, one non-Indigenous) in the Faculty of Science at a large university in Western Canada braided their views to design EaSEIL (Earth Science Experiential and Indigenous Learning). This project seeks to reimagine science field-based education courses, one goal being to respectfully integrate Indigenous perspectives with western approaches to field-based experiential learning. Our poster presents EaSEIL's model to achieve these goals.

Using a Community of Practice (CoP-A) model, we bring together multiple views and experiences (i.e., faculty, students, and staff across departments and units; currently working toward engaging field-site community members) to foster learning and community building around our shared topic of interest. CoP-A is a space where all members are knowers and learners and engage in social reflection, collaborative knowledge sharing, and collective production of teaching/learning materials. This collegial approach creates an ethical space to ensure all voices are heard, which can ease feelings of uncertainty and vulnerability that Indigenous and non-Indigenous folks often express regarding exploratory efforts to integrate Indigenous and western perspectives in teaching contexts. We will operationalize our work through situated and informed cycles of action and reflection (Halbert & Kaser, 2021). Each CoP-A faculty member will identify a goal to pursue in the context of this project (e.g., developing resources, curricula) and will inform/adapt their plan through reflection and collaboration with other members. In this process, students, staff, and community members are partners in knowledge and experience making. Research indicates that combining situated self-study and collaborative approaches in capacity building processes is promising to transform teaching and learning practice (Drago-Severson & Blum-Stefano, 2018; Mazabel Ortega, 2022). The poster also introduces instructors' initial goals and outlines our current planning for CoP-A (seeking feedback).



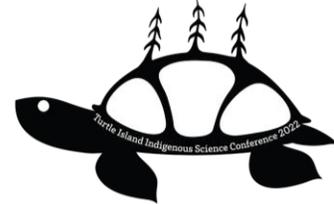
Abstract ID: 13

Weaving Together Ways of Knowing: A Lower Fraser River Case Study in Decolonizing Aquatic Ecology

Kasey Stirling¹, Kate Mussett¹

¹University of British Columbia

Fish and fish habitats in the Lower Fraser River watershed are increasingly at risk of population decline and degradation, respectively, due to the ongoing and interactive effects of industrial development, infectious diseases, climate change, contaminants, and poor management. Through partnerships with six of the Lower Fraser First Nations and the First Nations Fisheries Legacy Fund, this work aims to co-create a framework for fish habitat health assessment by weaving together ways of knowing, interacting in intentional relational processes, and co-creating ethical space. Co-development of this framework began with and continues through ongoing community workshops based in discussion of aquatic health and water relationality, alongside both riparian and eDNA-based field and lab work. Early results of this collaborative project have seen not only the formation of trusting relationships between Indigenous and non-Indigenous participants, but also effective models for weaving together ways of knowing, and patterns in riparian variables that align with community evaluations of watershed health.



Abstract ID: 14

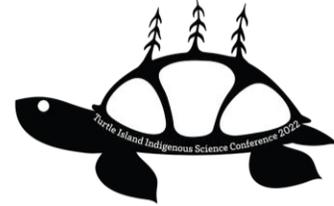
The Philosophical Commitments of Indigenous Scientific Thought: Towards understanding the edge effect of overlapping science traditions

Shandin Pete¹

¹University of British Columbia

The benefits of diversity in scientific thought have been thoroughly reviewed, including the potential to advance and support novel and innovative science understandings from Indigenous communities' approach to knowledge production. Furthering the diversity of thought in the process of science knowledge production requires advanced study of research traditions that are recognized as distinctly from Indigenous community perspective and worldviews. One challenge is locating where Indigenous and Western science boundaries overlap and experience an "edge effect"; edge effect referring to the intersection of two habitats thus increase overall biodiversity. Delineating where "edge effects" occurs require understanding philosophical commitments of both science systems, such as the different conceptions of meaning and purpose (ontology), sources and nature (epistemology) and the value of knowledge (axiology). Advancing the understanding toward the degree of blending and synthesis of the foundational philosophical commitments of these science knowledge systems will elucidate the inner workings of their respective worldview and paradigmatic frameworks; a direction many researchers have encouraged.

The challenge in this pursuit is to characterize the philosophical commitments that are operationalized to produce knowledge that serve the intent and purpose of Indigenous communities. Equally challenging is understanding levels of engagement between differing worldviews and the subsequent "cultural flexibility" or inflexibility encountered. Specifically, when is engagement transient versus static, lending to different conceptualizations of "data" versus "understanding". Also, to what degree does data, knowledge and understanding operate in the subconsciousness and remain inaccessible to the worldview of others? This presentation will focus on an Indigenous characterization of these levels of engagement with knowledge production pursuits and the inherent Indigenous philosophical questions that remain when our consciousness intersects with Western science.



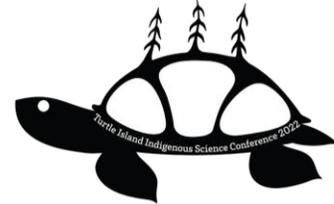
Abstract ID: 15

Braiding Indigenous Ways of Knowing Into Nursing Care

Rachel Radyk¹

¹RN, BScN, BAComMS

I am discussing my experience as an Indigenous nursing student and the importance of having Indigenous leadership positions within academic institutions and healthcare organizations. This will include the impact Indigenous youth have when given Leadership opportunities and how this can benefit communities. This includes my work in assisting in the regional rollout of the Covid Vaccine in the Waterloo- Wellington area and creating a space for Indigenous folks to access the vaccine. I will discuss the benefits of having these spaces within Western healthcare organizations and the positive experiences of community members.



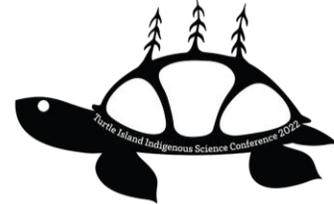
Abstract ID: 16

Community Based Environmental Monitoring: A coming-to-know approach of two-eyed seeing in northern Alberta

Sara Loutitt¹, Camille Scheibner¹

¹CBEM*

In 2016, the McMurray Métis Local 1935, Mikisew Cree First Nation-Government and Industry Relations (MCFN-GIR), Athabasca Chipewyan First Nation-Dene Lands and Resource Management (ACFN-DLRM), and Fort Chipewyan Métis Local 125 entered into a Memorandum of Understanding (MOU) to work together on strengthening economic participation in environmental monitoring. The Community-Based Environmental Monitoring Certificate (CBEM Certificate) was a collaborative initiative to move forward the efforts of Indigenous peoples living in the Fort McMurray region and Peace-Athabasca Delta (PAD) in ecological stewardship and strengthen their access not only to a related employment initiative, but more importantly to regaining cultural connections to place. The Community-Based Environmental Monitoring Training Program provided participants environmental training through a holistic, reflective approach in both Western and Indigenous sciences, also known as two-eyed seeing. This approach to community-based environmental monitoring is a balanced and equitable delivery model that involves Indigenous ways of knowing with the fundamental expectations of western science education requirements. This dual lens methodology is expressed and maintained from the creation of the program with the specific course outcomes grounded in the Indigenous teachings to the delivery of instructional objectives and on the land experiences. It is a place-based model that requires ongoing relationship-building with the region's people, plants, animals, birds, insects, waters, air, and landscape. Through a visual presentation, the authors will reflect on both the development and delivery of the two-eyed seeing programming, explore the lessons learned throughout the process and outline the key elements identified for a successful and meaningful educational experience for Indigenous learners in community-based environmental monitoring.



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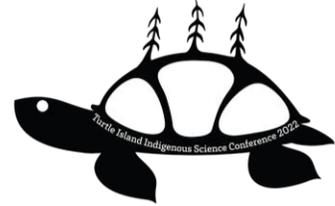
Beluga health and contaminants: Does local context mean difference outcomes?

Enooyaq Sudlovenick¹, Lisa Loseto¹

¹University of Manitoba

The beluga whale is a staple food items for many Inuit communities across the Arctic. Hunting methods and preferences in each community have adapted to the environment and biological diversity around them as well as cultural preferences. For example, the Inuvialuit in the NWT who hunt from the Eastern Beaufort Sea (EBS) beluga population and Inuit from the east who hunt from the Western Hudson Bay (WHB) population have differing practices in beluga hunting and food preferences. Where Inuit in Arviat do not commonly consume beluga meat, Inuit in the Inuvialuit Settlement Region widely consume it and prepare it in many different ways. Both Inuit cultures and regions hold local knowledge on belugas based on traditions that are shaped to local circumstances. Both regions also hunt from two of Canada's largest beluga populations.

Each region has had separate sampling programs on beluga harvests over the last several decades and have collected standardized information on morphometrics and contaminants data such as total mercury. This historical data combined with the regional differences in food practices could exemplify how similar sampling programs can translate into different applications of the results. We would also expect different messaging and overall conclusions for each region. These differences in regional contexts in relation to historical mercury data will be explored in this presentation.



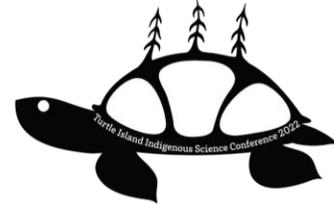
Abstract ID: 18

First Steps beyond the Land Acknowledgment

Helene Wagner¹, Tee Duke¹, Sanja Hinic-Frlog¹, John Crutch², Monika Havelka¹

¹University of Toronto Mississauga, ²University of Toronto

What can science instructors do to raise awareness and contribute to Truth & Reconciliation in their courses? We reflect on the following questions: (1) How can we make a Land Acknowledgment the start of meaningful change? (2) Why should we consider making this a personal commitment, as individuals, as educators, and as scientists in our fields? (3) How can we follow up and actually put this into practice in undergraduate science courses? (4) And what change can this bring about, how are the students likely to respond and what will make their learning meaningful?



Abstract ID: 19

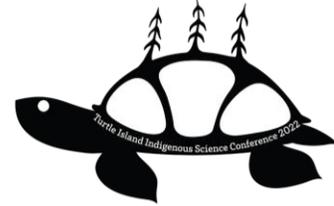
Co-creation of Ethical Space within Collaborative Research and Monitoring of Moose (*Alces alces*) in Ontario, Canada

Kathryn Yarchuk¹, Allyson Menzies¹, Joseph Northrup², Nadine Perron³, Claire Kemp¹, Jesse Popp¹

¹University of Guelph, ²Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry, ³Magnetawan First Nation Department of Lands, Resources, and Environment

The strengths of Indigenous Knowledges, coupled with the overarching need for reconciliation is increasingly recognized within wildlife monitoring. This has led to a rise in collaborative scientific research, particularly when discussing topics that are important through both an Indigenous and Western lens, such as moose (*Alces alces*). Despite fundamental differences in their worldviews, Indigenous and Western knowledge systems offer immense potential to be woven together to address shared concerns, when done so in a good way. Ethical Space acts as a knowledge systems interface grounded in core values such as trust, respect, and relationships. The process of creating Ethical Space varies depending on geographic location, partners involved, and context; however, case studies can offer direction on how to foster core values within collaborative projects. In the context of moose research and monitoring in central Ontario, this research explores the specificity of Ethical Space core values with the objective of developing guiding principles for ethical collaboration within wildlife research. Semi-structured interviews with First Nation communities, Crown government biologists, and academic researchers will be conducted to better understand how these values are expressed, fostered, and experienced among worldviews. Furthermore, a social network analysis will be used to determine who needs to be involved and barriers that may prevent equitable engagement. As a case-study, this research will outline best practices and recommendations for ethically engaging in collaborative wildlife research. Although explored in the context of moose monitoring and research in Ontario, the approach for creating Ethical Space can be broadly applied to ethical cross-cultural partnerships.

Novel STEM Education Approaches that Include the Indigenous Way of Knowing



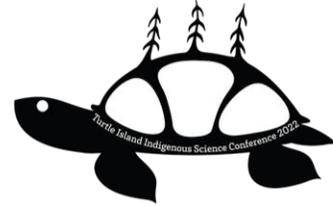
Abstract ID: 20

‘Nature will slow you down for a reason’: Virtual Elder-led Support Services During COVID-19

Grandmother Roberta Oshkawbewisens¹, Elder Isabelle Meawasige¹, Lynne Groulx¹, Chloe Hamilton¹, Lee Allison Clark¹, Dana Hickey¹, Wansu Qiu¹, Jared Leedham¹, Nishanthini Mahendran¹, Cameron Maclaine¹

¹Native Women's Association of Canada

In March of 2020, the world suddenly shifted with the onset of the COVID-19 pandemic; in-person programs were unavailable and a shift to virtual service delivery began. The Native Women's Association of Canada (NWAC) established virtual programming through the Resiliency Lodge model and connected with Indigenous women, girls, Two-Spirit, transgender, and gender-diverse people across Turtle Island and Inuit Nunangat through programs that provide a safe space to slow down and reflect on their lives, environment, and well-being. To continue to grow the virtual Resiliency Lodge model, NWAC needed to develop an understanding of three questions: how COVID-19 affects Elder-led support services, how Elder-led support services have adapted during the pandemic, and what Wise Practices need to be implemented to continue to develop, refine, and evaluate virtual Elder-led support services specifically for Indigenous women, girls, Two-Spirit, transgender, and gender-diverse people. Through funding from the Canadian Institute of Health Research, the goals of this project are to contribute to a more robust participatory analysis that reflects the complexities of Elder-led virtual cultural responses and the impacts of COVID-19 on Elder-led support services; develop culturally and contextually meaningful virtual protocols and wise practices for virtual Indigenous-led support; and develop an Evaluation Strategy to improve the capacity of the Resiliency Lodge model. Significant findings from the project include: Resiliency Lodge programs have provided participants with a sense of community and contributed to healing and wellness; Elder-led support services need greater/more stable funding to offer more workshops to more Indigenous women, girls, Two-Spirit, transgender, and gender-diverse people; and Elder- and Indigenous-led programs play a significant role in healing and building a sense of purpose among Indigenous people. These findings guide future Elder-led virtual support services and emphasize the need to increase access to Elder-led programming for Indigenous women, girls, Two-Spirit, transgender, and gender-diverse people.



Abstract ID: 21

Actua's InSTEM Program Advancing Indigenous Land Based Models in the Education System.

Noreen Demeria¹

¹Manager Actua's National InSTEM Program

Actua's InSTEM Program Advancing Indigenous Land Based Models in the Education System.

Discussion Theme

Systemic change to Indigenous education, grounded in Indigenous knowledge through land-based- STEM education.

Indigenous peoples have always known about science, technology, engineering and mathematics (STEM). Elements of STEM are intrinsic to Indigenous ways of knowing and the day to day life of Indigenous peoples. Actua facilitates connections between aspects of culture, Traditional Knowledge and modern science, thereby opening the pathway for youth to explore their potential as future innovators in STEM.

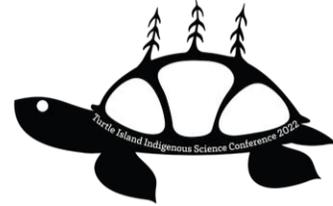
Actua's model of STEM education for youth is rooted in a strength and place-based approach that acknowledges and builds upon what youth and communities already know. Actua's national Indigenous Youth in STEM outreach program (InSTEM) represents a customised community-based approach that annually engages 35,000 First Nations, Métis, and Inuit youth in locally and culturally relevant STEM education. We are on a mission to unlock the infinite potential of youth while radically and relentlessly removing barriers to STEM and a vision for Canada to become a global leader in inclusive STEM education and outreach.

The InSTEM model is based on current thinking and documented successful practices in the engagement of Indigenous youth in STEM through a network membership of 43 universities and colleges across Canada.

We propose an interactive session intended for educators to actively participate and contribute to learning, and identify elements of western STEM education that directly align with local Indigenous ways of knowing. Actua will present successful community engagement and content development strategies that have led to strong ongoing relationships, and the successful integration of Indigenous knowledge into their STEM outreach programs.

Expected Session Learning Outcomes·

- Discussion Re: aligning Indigenous knowledge to STEM activities·
- Identifying Actua-Network Member and community engagement strategies·
- InSTEM education in Indigenous communities



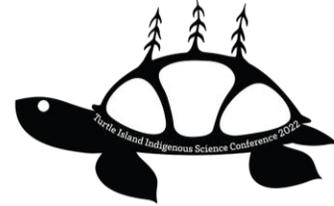
Abstract ID: 22

Earth Science Experiential and Indigenous Learning (EaSEIL) Project

Laura Lukes¹, Shandin Pete¹, Silvia Mazabel¹, Sarah Bean Sherman¹, Brett Gilley¹

¹University of British Columbia - Vancouver

COVID-19 restrictions created new opportunities for postsecondary Earth science instructors to revisit the core learning outcomes of field-based learning experiences, inviting them to: address barriers to student participation; explore the ethics of community engagement; consider why and how to respectfully include and address Indigenous histories, perspectives and knowledges; and produce digital supports to scaffold student learning of field-based skills. This poster describes the Earth Science Experiential and Indigenous Learning (EaSEIL) project, which broadly seeks to provide University of British Columbia (UBC) students with increased opportunities for interdisciplinary and field-based education, while also advancing UBC's Indigenous Strategic Plan's Call to Action to respectfully integrate Indigenous knowledges, histories, and ways of knowing into science courses. Currently, EaSEIL engages 30+ UBC students, faculty, and staff in a formalized interdisciplinary community of practice, creating space for regular, ongoing individual learning and collaborative reflection to reimagine, develop, and transform field-based experiential learning across multiple science programs at UBC. EaSEIL instructors are exploring positionally, two-eyed seeing frameworks for understanding the Earth and models for fostering respectful field-site based Indigenous community engagement and partnership in the co-development of science curriculum taught on the land. EaSEIL efforts at the instructor-level are further supported by the development and piloting of a novel 3-Tier model for engaging Indigenous communities and an embedded students-as-partners model for course curriculum co-development. Through EaSEIL, we expect to: (1) collaboratively produce of new tools and guidelines for instructors teaching on the land; (2) create a curated collection of curriculum or supplementary resources; (3) design a new 4th year interdisciplinary land-based field course at the Teck Geological Field Station through a novel 3-tier Indigenous engagement and partnership model; (4) increase instructor knowledge and confidence; (5) build instructors' capacity for offering all students experiential field-based learning opportunities, and (6) test relational models for scaling pedagogical change.



Abstract ID: 23

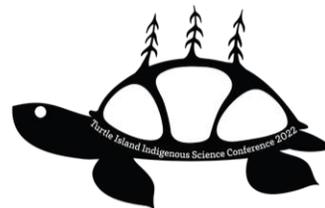
Barriers and Pathways to Indigenous Achievement in STEM:

Highlights of Indigenous Initiatives at the University of Manitoba

Samar Safi-Harb¹

¹Dept of Physics & Astronomy, University of Manitoba

Indigenous peoples are severely under-represented in science and this under-representation gets more enhanced as we go up the ladder in education. In Manitoba, while Aboriginal people make up ~18% of the province's population, a much smaller fraction goes into Post Secondary Education in STEM. In this presentation, I highlight some of the barriers encountered by Indigenous students in Science education, and particularly in the Mathematical and Physical Sciences. I then describe recent and upcoming efforts at the University of Manitoba (UofM), in the Faculty of Science, and in the Dept of Physics & Astronomy, all committed to creating pathways to Indigenous achievement, and more generally to implementing Equity, Diversity and Inclusion (EDI) in its strategic plan. Through our collaborative efforts, we hope to enhance our connections with the Indigenous communities, and incorporate the 'two-eyed seeing' approach into our activities in teaching, research and public outreach -- thus providing a broader view and a more welcoming environment to our students. Within Astronomy and Astrophysics, we aim to help recruit Indigenous students into our Physics & Astronomy program and educate the Indigenous youth in a field that has been traditionally an important part of their culture, beliefs and spiritual journey.



Abstract ID: 24

Lessons from Over a Decade of Post-Secondary Chemistry Education Incorporating Experiential Learning, Other Ways of Knowing and Oral Traditions.

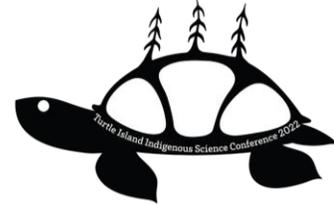
Sarrah Vakili^{1, 2, 3}

¹Department of Chemistry, Faculty of Science, University of Manitoba, ²Department of Chemistry, Faculty of Science, University of Winnipeg, ³Engineering Access Program (ENGAP), Faculty of Engineering, University of Manitoba

Within this presentation, I will discuss the progress and pitfalls of chemistry education and supports at the preparatory and first year university levels in the Winnipeg, Manitoba area for students whose personal worldview is supportive of and/or influenced by oral traditions and other ways of knowing. Topics to be touched upon will include experiential learning, the TRC's 'calls to action' pertaining to education and the hidden curriculum while trying to introduce newer educational approaches and/or other ways of knowing to chemistry 'lecture'. I will look at both the good and the bad effects of these topics in higher academic learning of chemistry by way of selected examples. These examples are based upon my experiences as an instructor working with students whose background and learning styles are non-Western (predominately Indigenous) for over a decade at the preparatory and first year university levels.

Recommendations in areas that still require improvement to further benefit students and/or support instructors will be suggested. Instructional techniques shown by experience to have had positive outcomes while teaching university level chemistry will be given.

Indigenous Engagement with the Land and the Environment



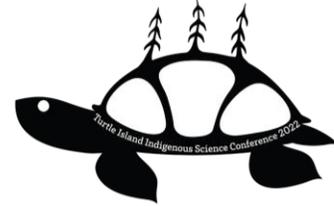
Abstract ID: 25

Why the sabotage to Indigenous farming practices created a never ending structural problems begins by Transmountain Oil Pipeline Project

Ali Goksu¹

¹Independent

Unlike the general stigmatization, Indigenous people are excellent farmers in fact their talents and knowledge of Manitoba Saskatchewan and Assiniboine communities led the government to give them special rights to govern the land. European settlers did their best to adapt to the soil and the weather but later they realized they need the guidance of the native people who have the natural experience in the location. In 1800 the church and the government encouraged aboriginal people to become farmers. The tribe leaders smooth transformation to farming allowed other members to join them. From 1830-to 1870 was a significant time for indigenous practices. The tribes are also extremely experienced in canines skillset. Canine's cognitive schema is shaped by allopatric cues which allowed them to search for more productive soils this led people around the area to search. The people's practices were incredible they were able to train the animals and learn from them. It was a very productive timeline for indigenous practices unfortunately later the government announced the peasant form that crippled the practices and created a structural food and water storage problem for future generations. The aboriginal farmers never recovered from the government's policies they have suffered unemployment issues creating a huge problem in regard to communities' accessibility to food and water storage. After so many years the Transmountain Oil Pipeline project was announced which created a worthy discussion point. Is this project really necessary to ensure the well-being of the lands and the peoples or is it going to create new never-ending problems for indigenous populations?



Abstract ID: 26

Physics and Culture: My experience conducting research on Traditional Territory

Kelly Graves¹

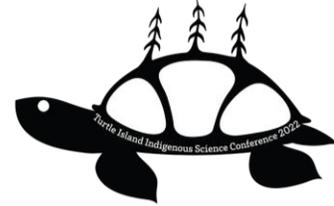
¹University of British Columbia - Civil Engineering - PhD. Student

My name is Kelly Graves, and I am a Ph.D. student at the University of British Columbia. I study the physical processes involved in the seasonal mixing of small, deep, ice-covered lakes. My field site is near Vancouver and is in a Provincial Park. It is on the Traditional Territory of the Squamish Nation.

For my talk, I would like to tell the story of how I naively went about my research and how that mistake led to me being able to combine my culture and my science.

When I started my research, I was granted permission to conduct frequent trips to the lake. I was excited and I thought all was good. However, later that year, I learned that not all the permissions were granted. It turned out that the Squamish Nation was not consulted, and I was called to their office. The Squamish Nation was not in favour of my research because the lake feeds into their last sacred site. From a "scientific perspective" our data collection did not harm the Land; however, from an Indigenous perspective, we were altering the water.

As an Indigenous person, I was horrified that I had not considered the impact my research would have on the Land. This was the first time my culture and my science collided. It was horrible, but it turned out for the better. After consultation, we were given permission to continue. Before we could continue, we met with a Hereditary Chief to learn the importance of the Land to the Squamish People. We were asked to carry ourselves as Witnesses on each trip. The Chief gifted me with an Eagle feather and gave me permission to perform smudges and brushing offs, and to teach the importance of the Land to each new field assistant.



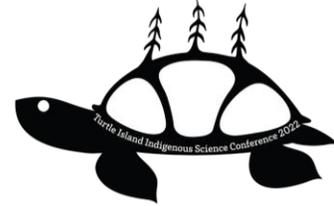
Abstract ID: 27

A Cree Engagement with the Land and the Environment

John Hansen¹

¹University of Saskatchewan

Many Indigenous peoples throughout the world are striving to preserve their lands, educational traditions and cultural way of life. My presentation, here, is as a sociologist who focuses on appreciating the perspectives of Indigenous peoples, while observing Indigenous responses to colonization. The presentation is based on land based teachings among Cree Elders that I have had contact with within academic studies and social life. The cultural and social significance of land based education is explored through the teachings received from Swampy Cree Elders. While the presentation is based on a Swampy Cree engagement with the land and the environment, its message is relevant to many other Indigenous and non-Indigenous communities.



Abstract ID: 28

Case study: an example of microbial water quality issues in a First Nation community

Teassa L. MacMartin¹, Christopher I. Graham¹, Annemieke Farenhorst², A. Karen Brassinga¹

¹Department of Microbiology, University of Manitoba

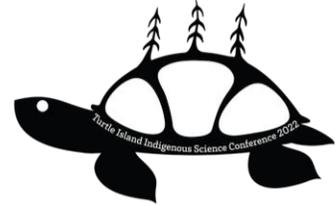
²Department of Soil Science, University of Manitoba

In collaboration with a Manitoban First Nation community, we investigated residential microbial water quality in a 2018 study. This community is supplied by Lake Winnipegosis surface water treated by a community-operated water treatment plant (WTP). A minority of homes are piped directly by WTP while many sites are in use of cisterns. We hypothesized that the use of alternative water storage, like cisterns, could result in introduction of organic particulate matter with subsequent chlorine decay; in turn, this could facilitate growth of potentially pathogenic microorganisms.

The focus of our study, *Legionella*, is one such microorganism that can be indicative of problematic water distribution methods. Once introduced to a system, it can persist for exceptionally long periods. Importantly, *Legionella* is an opportunistic bacterial pathogen that can cause a severe pneumonia in immunocompromised or elderly individuals when contaminated water is inhaled. Prior to this study, there was no specific data on presence of *Legionella* in potable water systems of First Nations communities. However, studies elsewhere have recorded presence of fecal-contamination indicator bacteria, a common measure of water quality, in communities with similar infrastructure.

Our findings show that cistern-bearing homes almost exclusively displayed available chlorine levels below recommendation by the World Health Organization. Consequently, *Legionella* was isolated only from sites in use of cement cisterns. This cistern type seems to specifically suffer structural damage, likely due to ground freeze-thaw cycles, thus facilitating entry of *Legionella* spp. from the surrounding environment.

This study is one example of ongoing drinking water concerns in First Nations communities that are not identified by Government-issued drinking water advisories. The study supports increased residential testing for waterborne pathogens to provide a more accurate view of water quality. Alongside building essential infrastructure like water treatment facilities, we emphasize the importance of improving aging or unsuitable residential water storage methods.



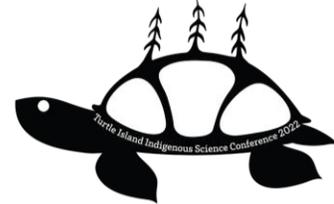
Abstract ID: 29

Prioritizing Indigenous Values in Environmental Monitoring and Research

Allyson Menzies¹, Ella Bowles², Deborah McGregor³, Sue Chiblow¹, Adam Ford⁴, Jesse Popp¹

¹University of Guelph, ²Canadian Wildlife Service, ³York University, ⁴University of British Columbia Okanagan

A major barrier to weaving knowledge systems in environmental monitoring and research is a general uncertainty of how to do so in practice. Developing approaches to environmental stewardship that truly respect multiple knowledge systems requires a deeper understanding of what it means to work together in a good way. In this poster, I will summarize insights obtained from a series of semi-structured interviews with Indigenous communities across Canada that specifically asked about the community values that should be prioritized in environmental work and what this looks like in practice. The intent is to provide guidance and inspiration for other researchers and environmental professionals to infuse community values (not just Knowledge) into their research, monitoring and management.



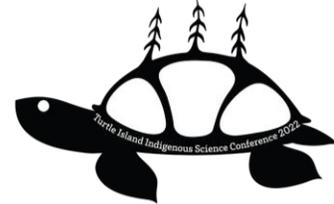
Abstract ID: 30

Thermophilic methane-oxidizing bacteria in Manitoba landfill cover soil

Jocelyn Plouffe¹, Parvin Berenjkari¹, Qiuyan Yuan¹, Richard Sparling¹

¹University of Manitoba

Methane is a potent greenhouse gas with 28 times the global warming potential of carbon dioxide. In Canada, 20% of our national methane emissions are produced by landfills. Topsoil covers are typically used to cap off landfills that have reached capacity to reduce gas emissions, however topsoil has a low porosity and does not provide ideal conditions for methane-oxidizing bacteria (MOB). These bacteria consume methane, converting it into the much less potent gas carbon dioxide. Alternatively, engineered biowindows can be used in replace of standard topsoil covers. Materials for biowindows can be taken from compost as it has optimal conditions for bacterial methane-oxidation, making them inexpensive, low maintenance options for communities with minimally developed waste management systems. As there is limited research on landfill methane-oxidation in cold continental climates characterized by wide seasonal temperature fluctuations, this study focuses on seasonal variations of the MOB community in landfill cover soil and a pilot biowindow in Winnipeg, MB. Previous long-term biowindow analysis revealed activity of thermophilic MOB in a climate that ranges from -30C to 40C, making thermophiles of particular interest to this study. Through genomic analysis, we have detected a high proportion of MOB in methane-rich biowindow soil, compared to conventional clay cover soil. We have confirmed the growth and activity of thermophilic MOB in liquid culture, and have purified and isolated several putative thermophilic MOB. DNA samples from enrichment cultures have shown vastly different community profiles found at mesophilic versus thermophilic incubation temperatures. Additionally, unusually dry conditions in southern Manitoba led to unexpectedly low levels of methane-oxidation activity detected in the landfill soil from summer through to fall. As climate change and weather extremes become increasingly prevalent, their potential impacts on greenhouse gas emissions warrants our attention.



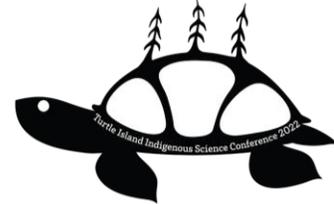
Abstract ID: 31

Atmospheric Deposition of phosphorous in streams impact on native microbiota / protozoans

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Atmospheric deposition of various macromolecules including nitrogen, iron and phosphorous within a territorial environment can stimulate the growth of otherwise nutrient-limited or depleted regions, for this reason, it is considered an important abiotic factor in terrestrial ecosystems. This collaborative project will be utilizing hydrogeochemistry practices in addition with molecular biology techniques to investigate the impacts of atmospheric phosphorous deposition in streams has on the present native microbiota. Native protozoans present in-stream and sediment/soil samples will be collected from pre-designated agricultural field sites near Randolph, Manitoba. RT-qPCR tests will be conducted to identify the presents of potential protozoans, qPCR-positive samples will then be genotyped with PCR and DNA sequencing techniques. The data obtained will be used as a proxy to evaluate the quality, health, and general levels of contamination located in the streams. The data will also identify any potential non-native protozoans that may be present in local streams that will ultimately flow into lake Winnipeg and other sources of fresh drinking water. A better understanding of the native and non-native microbes and the ever-present risk they present can help improve surveillance systems and corresponding sources of potential contamination in streams, rivers, and lakes. Further methodologies for disinfection, detection, and treatment of various disease-causing protozoan parasites can have long-lasting positive impacts on communities isolated from large industrial scale water sanitization plants.



Abstract ID: 32

Community-Based Participatory Environmental Monitoring and Traditional Land-Use Guardianship Program in Red Sucker Lake First Nation.

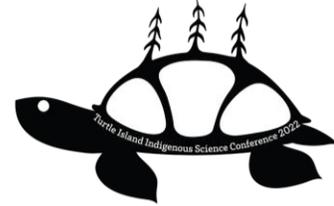
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Mineral exploration and extraction like gold mining threaten traditional land and water sacred to Red Sucker Lake (RSL) community members. RSL's traditional lands occupy the Hayes watershed. This watershed and traditional land in RSL are crucial to community members' cultural livelihoods. Spills and emissions from mining are a potential cause of environmental disturbance to RSL's traditional fishing, wildlife, and other traditional/cultural importance of the watershed RSL. Consequently, there is a need for participatory research and a community-led program to monitor RSL's environment and cultural aspects. This research aims to work with RSL elders and youth to become land guardians and develop new skills to be stewards of their traditional land and water to support fishing, hunting and medicine provisioning, and cultural activities. For land guardianship and Indigenous worldview, this research with RSL will take a two-eyed approach to embrace Indigenous Knowledge (IK) and western science. Western science approach to work with youths as Indigenous land guardians on the techniques and collection of environmental samples: water, soil, fish/plant tissues, and sediments for monitoring the ecological impacts of Yamana Gold. The IK will involve documenting the traditional ecological knowledge (TEK) on biological and cultural factors with elders and other community knowledge holders. Additionally, traditional land-use study as a mapping tool in RSL to decolonize industrial and colonial land use undermines community members' traditional/cultural activities, claims and stewardship. Lastly, using the two-eyed approach for our knowledge documentation/sharing research will help develop an Indigenous environmental justice model to help with advocacy for RSL environmental protection towards land-based reconciliation for Indigenous people and land.

Keywords: Indigenous Knowledge, western science, environmental monitoring, mapping, and land guardianship.



Abstract ID: 33

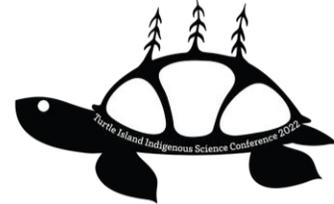
Documenting Indigenous Fishers' Aquatic Knowledge: Aquatic Indigenous Knowledge vis-a-vis Western Science

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In recent years, there has been an increasing combination of Indigenous and western science for understanding and decision-making about the ethics that govern humans and issues on the use of natural resources. Our study uses Aquatic Indigenous Knowledge System (AIKS) and Western Science (WS) to document qualitative and quantitative data on the aquatic water resources in Lake St. Martin and Dauphin River First Nations in Manitoba. Lake St. Martin and Dauphin River are part of the Lake Winnipeg watershed deteriorating due to algal bloom from the Lake's nutrient enrichment by total phosphorus and total nitrogen. The AIKS followed a community-based workshop with fishers through oral history, oral tradition, storytelling, and mapping knowledge. The western science approach collected water samples for laboratory analysis and YSI ProDSS multiparameter meter to record and document surface water's physical, chemical, and biological parameters. Results show heavy metals in surface water samples below Canadian freshwater and drinking water guidelines/standards. Total phosphorus levels measured in the water samples were below the 0.05 mg/L recommended target level for Lake Winnipeg. The total nitrogen levels across all water sample locations exceeded the 0.75 mg/L recommended target level for Lake Winnipeg. The blue-green algae and cyanobacteria enumeration count identified two (cyanophyceae spp. and fragilariophyceae spp.) out of six taxonomies ranging from Large to moderate amounts in the water samples. AIKS workshop from the fishers' knowledge sharing reported increased algal bloom (blue and harmful brown algae), reduced water levels, fish caught spoiling faster, tumour-like growth in fish, and disrupted fishing spawning grounds. The bridging of knowledge using aquatic Indigenous knowledge system and western science knowledge-based approach can improve water resources management and provide better accurate and coherent information for short- and long-term changes in freshwater ecosystem.

Keywords: Aquatic Indigenous Knowledge, western science, oral history, water quality, heavy metals, algae, cyanobacteria, and water levels.



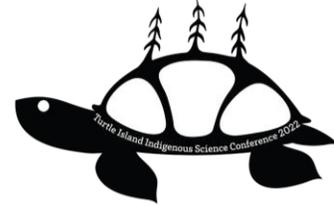
Abstract ID: 34

Indigenous Land Use Planning to Regain Mino Bimaadiziwin of Wasagamack First Nation in the Turtle Island.

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In Northern Manitoba, Indigenous peoples' governance and stewardship over their aki (land) is vital for their mino bimaadiziwin (the good life) and bringing the aki back to life. To understand how community-led Indigenous land-use planning can revitalize mino bimaadiziwin in Wasagamack First Nation, we video-interviewed ten Wasagamack Anishiniwuk. The Wasagamack First Nation members spoke about how governing their aki in their way is a precondition of mino bimaadiziwin for their community. The Anishiniwuk articulated that Indigenous land use planning was needed to enhance community strengths, minimize legal barriers, prioritize Anishiniwuk's needs, and decolonize aki. The Anishiniwuk identified an Anishiniwuk-led land use planning as an approach to holistically complementing Indigenous and Western knowledge and practices and collaborating with the Crown and other stakeholders.



Abstract ID: 35

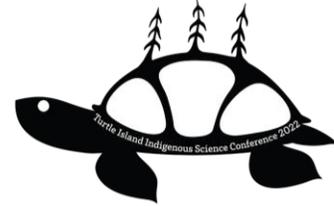
Wastewater Testing of SARS-Co-V2 in Oxidation Lagoons from First Nation Communities

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Since COVID-19 Pandemic started, the use of wastewater surveillance of COVID-19 as an early warning and outbreak control tools has been investigated. Wastewater surveillance of COVID-19 for large cities have been reported as a useful tool to prevent and control potential outbreaks. Significant correlations between SARS-CoV-2 concentration in raw wastewater samples and number of cases in the sewer sheds have been reported. While most research has been focused on the wastewater surveillance of COVID-19 for large populations, the research on the wastewater surveillance of COVID-19 in small communities such as First Nation (FN) communities is very limited. Regular monitoring of SARS-CoV-2 in the wastewater of small communities can ease and accelerate outbreak control process. Based on current findings and research gaps, our objective is to investigate the potential of wastewater surveillance of COVID-19 in Long Plain FN. The methodology of this research includes collecting wastewater samples, concentrating samples for the detection and quantitation of SARS-CoV-2 with qPCR. Additionally, we aim to understand the fate of SARS-CoV-2 in the submerged attached growth reactors employed in the study sites. For this purpose, we will collect sample from different locations at the wastewater treatment plants.

We already collected some samples and currently we are processing and analyzing the samples and results.



Abstract ID: 36

Deep-amplicon sequencing for monitoring impacted watersheds in rural Manitoba

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Canada harbors 2,850 billion m³ of renewable water, the 3rd largest freshwater reserve in the world. Aquatic environments across the country constantly receive discharges from anthropogenic activities. In this context, water is considered the main vehicle for the dissemination of pathogens and mobile genetic elements into the environment. The current assessment of microbiological water quality indicators focusses on bacteria such as total coliforms and *E. coli* counts, overlooking other intestinal parasites such as *Giardia* spp. and *Cryptosporidium* spp. and viruses. Even though studying viruses has always been a challenge, targeting specific viral groups might help understand the role of phages and their interaction with other domains. Identification of the major capsid protein gene (g23) of viral groups such as T4-like viruses which affect marine cyanobacteria and members of the family Enterobacteriaceae, will be performed to characterize their ecological relationship with bacteria and microeukaryotes. In this research, we propose a longitudinal analysis of aquatic bodies in rural Manitoba to elucidate the spatio-temporal composition of T4-like viruses, bacteria, and microeukaryotes. Water samples will be collected from waterways adjacent to urban and agricultural impacted areas. A case-control study will be conducted to compare microbiomes in a lesser impacted forested area. Direct precipitation with skimmed milk will be performed to concentrate microbial fractions. Taxa identification of bacteria, microeukaryotes, and T4-like viruses will be completed with deep-amplicon sequencing of 16S rRNA, 18S rRNA, and g23, respectively with Nanopore technology. Changes in α and β diversity and network analysis will also be conducted between waterways and through seasons. Assessing freshwater microbial composition and its impact on the ecosystem is an important focus of public health and water quality. The results to be obtained provide valuable information in the assessment of complementary indicators of aquatic pollution.