Sacred Science – Indigenous women and our relationship with water

We listen with three ears. The two in our head and the third in our hearts.

Indigenous women have an unbreakable and sacred connection with the land and the water. Indigenous women are holders of scientific and technical knowledge and have been instrumental in the conservation of water and land, traditional teachings around medicines and foods, as well as the preservation of culture and language. Sophisticated and interwoven, these systems of distinct and diverse knowledges have protected and perpetuated Indigenous identity and societal roles where women are on the ground first responders, or stewards of Indigenous science, and experts in inter-generational scientific and technical knowledge transfer.

Indigenous women are among the most marginalized of all Peoples.[1]

Indigenous women have also borne the brunt of the effects of colonization via invasive acts that include, but are not limited to, changes in domestic and familial roles, perceptions of gender and identity, child-rearing and parenting norms, political and spiritual life, as well as work and social activities.[2] This has resulted in many Indigenous women experiencing violence, abuse, loss of culture, traditions and language, unemployment, poverty, lower levels of educational attainment, and reduced access to resources – all because systems have failed to protect and serve our most vulnerable. For instance, when Canada's Indian Act came into effect in 1876, women were not yet considered persons, therefore, First Nation women could not vote or run for Band Council positions. First Nation women also lost their Indian status if they married a non-status person. It was not until the 1960, that Indigenous women were allowed to vote. This was a significant disruption to passing traditional ways of knowing to their children and the ability to attend to day-to-day livelihoods, was especially marked in Nations with matrilineal leadership structures.

Indigenous representation in STEM is less than 1% and Indigenous women make up less than 0.1% of all students enrolled in STEM fields.

[1] United Nations Office of the Special Advisor on Gender Issues and Advancement of Women

[2] From the report on Canada's National Inquiry into Missing and Murdered Indigenous Women and Girls.

Women make up less than 25% of those employed in STEM (Science Technology Engineering and Math). The number of racialized women in STEM is lower still.[3,4] Indigenous student representation in STEM is less than 1% and Indigenous women make up only about 8% of Indigenous People enrolled in STEM fields.[5,6,7] Despite 30 years of effort to increase the numbers of women in science, the uptake rate of women in the field has stagnated. Some of the reasons for this are varied but a common thread is harassment in the workplace. Half of women in STEM report that they have experienced systemic harassment, and for Indigenous women, rates of sexism and racism are higher still. Women working in fields such as climate change – an area of natural synergy with several areas of Indigenous scientific enquiry, also report extraordinary levels of online harassment, as well as death and rape threats. Given the many barriers that exclude or undermine the success of Indigenous women, it is not surprising that Indigenous women have also been described as "pure strength, courage and resiliency".[2]

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Resolving these issues will be difficult and will require the restoration of Indigenous women's rights. To revitalize Indigenous science systems, greater respect for and equitable treatment of the value of traditional roles and responsibilities will be central to a future that is more inclusive, sustainable, and respectful of Indigenous Peoples.[1,2] For Indigenous women engaging in research, traditional or otherwise, additional research and community-based supports will also be needed. Some of the tools that will help might include financial supports, peer-to-peer mentoring networks, flexible work-life balance opportunities, access to affordable daycare and independent equity, diversity and inclusion working groups to support the equitable division of resources. These tools and supports will also be needed for future generations, in order to nurture and promote Indigenous women in science long-term. These supports will need to be developed with the future candidates in mind and then adapted with the help of the successful candidates in the room.

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[3] Stewart, M. 2021. Sexual Harassment Continues to Plague Women in Science. *Insight into Diversity*

[4] Arriagada, P. 2021. The achievements, experiences and labour market outcomes of First Nations, Métis and Inuit women. Statistics Canada

[5] Owens, B. 2021. First Nations communities bring expertise to Canada's scientific research. *Nature Index* 17 November 2021

[6] Wong *et al.,* 2020. Towards Reconciliation: 10 Calls to Action to natural scientists working in Canada. *FACETS* **5(1):** 769-783. DOI: 10.1139/facets-2020-0005

[7] Matthews, E. 2020. A world of difference: Shining a light on Indigenous women in science. *University of Saskatchewan News*

> *Indigenous women are water keepers. They carry water in their wombs, protect the water and share water laws with their communities. Water laws are the natural laws Indigenous communities have developed and applied to govern the relationship between humans and water.* – **APTN** [8]

Protocols towards the Application of Indigenous Science

Fundamental to any Indigenous research paradigm are relationships. For instance, what is the relationship between Indigenous sovereignty and well-being? Or, how does the well-being of all my human and non-human relations shape the environment that we all enjoy? That all the elements are interwoven and interconnected is considered a given and thus, these systems of knowledges are plural, dynamic, complex, and highly responsive to historical and contemporary changes in ecosystems. Indigenous scientists and their protocols have successfully protected wildlife for hundreds of thousands of years. These systems have worked, continue to work, and have been demonstrated on multiple occasions, to work better than many prescribed western approaches to ecosystem management. [9,10,11] Protocols are also often gender-specific and differ from Nation to Nation and community to community.[12, 13] These variations should be expected and are part of the extraordinary richness of distinct and diverse Indigenous Peoples. Some of these protocols will be part of an oral scientific and technology transfer mechanism that has existed since time immemorial. Some of these protocols are sacred and cannot be shared with outsiders. As with any scientific endeavour, respect for the process, or method, will be of paramount importance.

> *Evidence suggests that good governance… is probably the best way for a country to insure against the negative effects of climate change. […] Alternative models of governance, such as Indigenous-led fisheries management are better suited to address and adapt to uncertainties arising from climate change* – **S. Denny**[14]

At best, protocols will be strictly adhered to by those working with Indigenous community partners. However, that is not to say this will be simple. Even when the researcher

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[8] APTN National News, 2021. Opinion: Water crisis solution must involve traditional water law. Sept 17, 2021.
[9] For example, Maori approach to fisheries resource management: *Te Mana o te Wai* see factsheet here.
[10] Harmsworth, G. *et al.,* 2016. Indigenous Māori values and perspectives to inform freshwater management in Aotearoa-New Zealand. *Ecology and Society* **21(4):** 9 DOI: 10.5751/ES-08804-210409
[11] For example, How Indigenous burning practices can help curb the biodiversity crisis. *The Conversation*
[12] Inuit Tapiriit Kanatami (ITK). 2018. National Inuit Strategy on Research
[13] Métis Centre, National Aboriginal Health Organization. 2010. Principles of Ethical Métis Research
[14] Denny, S. 2022. ANKUKAMKUA'TU, 'Doing Treaty': An alternative Fisheries Governance Model for Mi'kmaq Aboriginal and Treaty Rights to Fish in Nova Scotia. PhD thesis, Dalhousie University.

is a member of the community, their responsibilities will need to be continuously responsive to the needs of the collective (e.g., see method guided by Two-Eyed Seeing[15]). Indigenous scientists must carefully consider how their work falls between their individual lived experience and their obligations and responsibilities to the communities they live and work with. As with any relationship, integrity, transparency, and accountability will be of paramount importance. For non-Indigenous scientists working with community this responsibility and expectation of reasonable due diligence should be higher still as the subtleties[16] of the relationships may not be as apparent to those western-trained academics who have not had the benefit of community life to support their work in this milieu in a "good way". For non-Indigenous scientists working with communities, co-development of research questions should be regarded as the new minimum and is increasingly expected[17] by communities at every stage of the research process. Indigenous research and protocols can transform and redefine western research priorities but will require an open, respectful, and ongoing dialogue with Indigenous Nations, governments, and community partners. Meaningful relationship-building will be required for this to be successful and will likely involve some very difficult conversations around needs, priorities, and expectations moving forward.

Water is Life

Indigenous women have a sacred relationship with water. Water is the giver of life. Traditionally, in many Indigenous cultures, responsibility and stewardship of water is the almost exclusive purview of women. A wide range of traditional activities depend on water for drinking, sustenance, cleaning, spiritual purification, transportation, and other cultural activities. Access to good water provides essential habitat for plants and wildlife such as fish that are integral to Indigenous culture, food, medicine, and economies. Without clean water, all life will perish.

> *Indigenous women are up to the task of fulfilling their roles as water protectors. Indigenous women are ready to help everyone secure access to safe, clean water in their homes and buildings. Indigenous women have the knowledge.* – **APTN**[8]

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[15] Martin, D.E. *et al.,* 2017. Two-Eyed Seeing in Research and its Absence in Policy. *International Indigenous Policy Journal* **8(4) DOI:** 10.18584/iipj.2017.8.4.6

[16] Traverse, M., & Baydack, R. (2005). Observing Subtleties: Traditional Knowledge and Optimal Water Management of Lake St. Martin. *Ethnobotany Research and Applications* **3:** 051–056 Retrieved from https://ethnobotanyjournal.org/index.php/era/article/view/51

[17] Unama'ki Institute Partnership Tenets, and Mi'kmaw Research Principles and Protocols

Article 25 of the United Nations Declaration on the Rights of Indigenous Peoples[1] provides protections for the special relationship Indigenous People have with water. Domestic application of Article 25 using Indigenous laws is a mechanism that would recognize Indigenous sovereignty and the spiritual relationships and responsibilities of Indigenous women around water. Other jurisdictions have navigated these changes by conferring legal 'personhood' to waterways.[18]

> *Indigenous Peoples have the right to maintain and strengthen their distinctive spiritual relationship with their traditionally owned and otherwise occupied and used lands, territories, waters and coastal seas and other resources and to uphold their responsibilities to future generations in this regard.* – **United Nations Declaration on the Rights of Indigenous Peoples**[1]

Clean water is recognized as a basic human right, as water is indispensable to healthy livelihoods and fundamental in maintaining human dignity. In the spring of 2020, during a global pandemic, 309 First Nations communities in Canada were living with long-term drinking water advisories in Canada. By 2021, the Canadian federal government lifted 108 boil water advisories but hundreds of Indigenous communities continue to live without safe drinking water. Limited investment in Inuit Nunangat further contributes to the profound infrastructure gap in the arctic compared to other regions of Canada. Access to drinking water in northern communities is often contingent on the quality of community infrastructure with overcrowding, inadequate housing, aging treatment systems all continuing to contribute to the high number of boil water advisories in arctic and northern communities.[19]

How Indigenous Languages can help with the preservation and transmission of Indigenous science and technology for future generations

English is the language of science.[20] Yet, the lack of precision in English often confounds interpretation. A majority of scientists indicate that English is their second or third language.[21] Yet a cursory look at the scientific literature strongly suggests that even multidisciplinary teams predominantly collaborate with other scientists who share their first language.[20,21] Lists of co-

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[18] Craft, A. 2019. Chapter 10, Navigating Our Ongoing Sacred Legal Relationship with *Nibi* (water). *In* Braiding Legal Orders. Borrows et al., (eds). Centre for International Governance Innovation. Waterloo, ON, Canada.
[19] Inuit Tapiriit Kanatami (ITK). 2020. Access to Drinking Water in Inuit Nunangat. *ITK Quarterly Research Briefing* Autumn 2020, Issue 2.
[20] Elnathan, R. 2021. English is the language of science — but precision is tough as a non-native speaker *Nature Career Column* 01 April 2021.
[21] Woolston, C. & J. Osorio. 2019. When English is not your mother tongue. *Nature Career Feature* 10 June 2019

authors on publications are even less likely to contain Indigenous women – although data for even high impact journals is scarce.[22] This is a form of systemic racism because women are already less likely to successfully publish and be highly cited. A recent example of this trend can be found in that only one third of all authors on COVID-19 publications have been women.[23] The hardest hit are likely early-career women, the most common entry point for Indigenous women in science, who likely have young families and are under immense pressures to be productive all while their efforts are more likely to be passed over. For Indigenous women whose first language is an Indigenous language the gap is wider still. These forms of conscious and unconscious bias limits our understanding – particularly in areas where the work is complex such as the braiding of knowledge systems, climate change, and conservation. Recognizing that these gaps are real and strategically addressing them is urgently needed.

Indigenous languages are deeply embedded in the understanding and interpretation of Indigenous knowledge systems. Indigenous languages are rooted in the natural law of the ecosystem, in how places and spaces are named according to their function in nature. Indeed, Western science is taking notice that Indigenous language is important in monitoring the changes in the biodiversity of ecosystems. Indigenous people represent less than ten percent of the global population, yet they are stewards of 80% of the earth's biodiversity.[24] In contrast to English, Indigenous languages can describe simply and yet with extraordinary beauty and detail, complex concepts that are only beginning to be described within the western paradigm (e.g., quantum mechanics among others, see Bear[25], Ferguson[26]). Indigenous science takes chaos theory, inter-connectedness, and Schrodinger's cat in stride. It is the western view that excludes reverence and renewal that is lacking. For Indigenous Peoples, language is central to cultural and spiritual traditions as well as scientific and technical knowledge transfer. Language, through song, law, and ceremony (among others), has a built-in knowledge transfer mechanism that has persisted because it is constantly evolving through intergenerational knowledge sharing and experience. In order to promote and preserve Indigenous science, Indigenous languages will also require supports and processes that recognize and revitalize Indigenous cultures. Language revitalization also supports traditional

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[22] Perish not publish? New study quantifies the lack of female authors in scientific journals. *The Conversation* 8 March 2018

[23] Gewin, V. 2020. The career cost of COVID-19 to female researchers, and how science should respond. *Nature Career Feature* 20 July 2020

[24] Alexander, S. M., et al. 2021. Bridging Indigenous and Western sciences in freshwater research, monitoring, and management in Canada. *Ecological Solutions and Evidence* **2**: e12085. DOI: 10.1002/2688-8319.12085

[25] Little Bear, L. 2000. Jagged Worldviews Colliding. *In* M. Battiste (ed). Reclaiming Indigenous voice and vision. UBC Press. pp. 77-85.

[26] Ferguson, E. 2005. Einstein, Sacred Science and Quantum Leaps: A Comparative Analysis of Western Science, Native Science and Quantum Physics Paradigm. University of Lethbridge MA Thesis.

and transformative roles for Indigenous women because it also creates ethical spaces[27] where ideas can be shared freely and on equal footing. According to Windchief [28], "*there are ideas that can only be communicated in the traditional Indigenous languages, and to translate them into English changes the original meaning and problematically aligns the idea with non-Indigenous values.*" Indigenous languages and values are essential for the communication of Indigenous sciences. Thus, language revitalization is required in order to support Indigenous science. These efforts must also be Indigenous-led because culture and language are inseparable.

Next steps – the future of Indigenous-led science and innovation

Indigenous women's contributions to science, research and innovation have been irrevocably altered through colonialism. To conceptualize the path forward we must chart a new course with new Indigenous indicators of success that reflect the needs and priorities of Indigenous Peoples and our aspirations in STEM. To further this aim we need to translate, exchange, and mobilize ideas. Employing Indigenous languages, terms, and concepts will help. Among the indicators of success would be the repatriation of Indigenous place names, putting Indigenous lands in Indigenous hands, and respect for sovereignty. This must not be a pan approach – communities are different and what works well in one area should not be applied willy-nilly elsewhere. Rather, the richness and diversity of those differences, both within and between Nations, should be celebrated and treated as part of a meaningful dialogue around respect, human rights, dignity, and self-determination. On an even playing field, Indigenous women will take their rightful place as sacred stewards, scientists, water keepers, knowledge holders, technical knowledge transfer specialists, medicine women, grandmothers, mothers, sisters, aunties, and daughters. All we need to do is listen.

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[27] Ermine, W. The Ethical Spaces of Engagement. *Indigenous Law Journal* **6(1):** 193-204.
[28] Tuhiwai Smith, L. 2021. Decolonizing Methodologies, 3rd edition. p. xxii