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Power and politics in research design and practice: Opening up space for social equity in interdisciplinary, multi-jurisdictional and community-based research

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Opening up space for social equity in interdisciplinary, multi-jurisdictional and community-based research

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> *The significance of water to the Keweenaw Bay Indian Community is profound, as it has been since ancient times. Most notably, water is a primary element in the Creation Story of the Anishinaabe people which describes the creation, out of nothing, of rock, water, fire, and wind. Into each one was breathed the breath of life and each was bestowed a different essence and nature. Each substance had its own power which became its soul-spirit. Waters were given powers of purity and renewal. Water, or nibi, is the life blood of existence. Ceremonies are conducted to give thanks to the water. The protection of the life of the water is the essence of survival for the Keweenaw Bay Indian Community, both physically and spiritually. …Water is the life blood of our Mother Earth…Mother Earth gives us our medicine, her strength. If she is sick or weak, we will become sick and weak people.*

Erin Johnston of the Keweenaw Bay Indian Community Natural Resources Department shared this story in her presentation to more than 50 research participants attending a Community and Partner Workshop in November 2013 (Gagnon et al. 2014). These participants, including investigators from across social and natural science disciplines and community partners from multi-jurisdictional organisations, were gathered along the shores of Lake Superior in the Upper Peninsula of Michigan to commence a three-year National Science Foundation (NSF)-funded research project entitled 'Managing Impacts of Global Transport of Atmosphere-Surface Exchangeable Pollutants (ASEPs) in the Context of Global Change' (hereafter 'ASEP Project') (ASEP 2013). Johnston's presentation was one in a series of talks by investigators and community partners, who shared their insights and perspectives on global pollutants, regional fish toxicity and the subsequent impacts on human health for cultural groups, such as Indigenous communities, who are highly reliant on fish as first foods.

The workshop, designed to facilitate interactions between researchers, representatives of organisations and community groups, included a number of elements to 'open up space' for dialogue and to 'flatten' the power dynamics between participants. It was intentionally structured to prevent domination of the

researchers' approaches and perspectives. For example, the researchers called upon Frank Ettawageshik of the United League of Indigenous Nations to set the tone for the day by welcoming everyone to Anishinaabe homelands. Frank welcomed the guests by telling the story of his travels to the workshop earlier that morning and how, when he crossed the bridge from Lower Michigan into Michigan's Upper Peninsula, the ominous night sky cleared and gave way to the day's sunrise. He used this story as a metaphor to convey his sense of optimism for what we would accomplish that day in our gathering and the research in general. Both Johnston's and Ettawageshik's stories emerged through a thoughtfully designed research strategy that grounds the research to place, opens up space for counter-narratives and attends both to place and to culture.

In this article, we argue that interdisciplinary research addressing socio-ecological concerns and seeking community engagement can benefit from participatory forums in which power dynamics are intentionally flattened. Doing so allows for a diversity of voices to emerge and influence the project pathway. Accomplishing this, we argue, requires opening up space for non-dominant voices, such as those of Indigenous communities, to directly influence research design and practice. Opening up space requires a research framework that, from the start, is designed with time and space to accommodate such influence (Hanson & Ogunade 2016; Hart, Straka & Rowe 2016). This forethought sets the tone from a project's onset for genuine and more equitable collaboration, allowing information to flow in multiple directions. While much has been written about participatory research methods and design (Harvard Catalyst 2016; Minkler & Wallerstein 2008; Reason & Bradbury 2007), this article addresses a gap in the literature covering research methods and critical discourse related to power dynamics and counter-narratives, particularly where research involves Indigenous communities. Flattening power dynamics facilitates multi-directional exchanges and enhances the value of diverse ways of knowing for all research project participants, including researchers from various disciplines, across jurisdictions and at differing scales, and between researchers and community partners.

To illustrate the value of this method, we demonstrate its use in our ASEP Project. From the onset, the goal of the project was to ensure that the NSF investigation would be geographically grounded to Lake Superior and responsive to the priorities of the community partners. One aspect of the research included a series of biogeochemical modelling tasks to characterise the fate and transport of toxic compounds that contaminate fish locally and worldwide, allowing researchers to estimate the effect of those emissions on future generations. Another aspect involved assessing the capacity of the existing system of chemical governance to achieve reductions in emissions. Project leaders also wanted to ground an aspect of the project geographically, so that the analysis

would reflect the interests of actors at different jurisdictional scales, including those in Indigenous and non-indigenous organisations, and to involve real systems of local and national governance.

Although we did not know exactly how grounding the project geographically would affect the research trajectory, we believed that a participatory forum early on would be valuable. Through this process, the question of 'when can we safely eat as much fish as we desire?' surfaced as a priority community concern. This seemingly straightforward question, which was not part of the original inquiry, helped to focus and integrate the work of atmospheric modellers, physical chemists, limnologists and governance-focused social scientists on a question of direct interest to the project's community partners. Transitioning to a mindset of optimism – identifying an expected timeline that would no longer require restrictions on fish consumption – enhanced our purpose for doing participatory research. With the understanding that achieving safe fish would indeed take many generations to accomplish, the significance of this question lay within everyone's acceptance and willingness (including of community partners) to work towards a long-term solution to issues of contamination.

COMMUNITY ENGAGEMENT IN RESEARCH DESIGN AND PRACTICE

Academic-community partnerships are at the forefront of community-engaged research in addressing a wide range of environmental and human health issues (Glover & Silka 2013; Harvard Catalyst 2016; Minkler & Wallerstein 2008; Reason & Bradbury 2007). Known by various names – community-engaged research (CEnR), participatory action research (PAR) and community-based participatory research (CBPR) – each prescribes various levels of community integration and advocates mutual respect, co-learning and community capacity building. Minkler and Wallerstein (2008) also point out the value of community engagement throughout various phases of the research process. Often, these community-engaged investigations focus on biophysical health improvements through programs that can be implemented by communities.

Engaging with Indigenous communities necessitates further methodological considerations, especially when research design and practices are defined primarily by investigators (Kovach 2009; Smith 2012). After all, socio-ecological issues involve multiple interpretations of the problem and solution (Holifield, Porter & Walker 2010; Nadasdy 2004). Anishinaabe scholar Wendy Makoons Geniusz (2009, p. 52) explains that research must be 'meaningful for the people' who are asked to participate. Describing an alternative orientation, Geniusz asserts (pp. 8, 51–52): 'Our priority is to revitalize knowledge within our own lives so that it will be there for our children and grandchildren and their children and grandchildren … [R]easons for conducting research is not about explaining to others, but to regain and

revitalize teachings that were or are being lost from our families and communities.' For Indigenous communities, priority issues centre on physical and cultural survival and recovery (Smith 2012). Involving Indigenous peoples and environments means recognising the role of research in their larger healing process (Berkes 2008; Whyte, Brewer & Johnson 2015). Thus research desiring Indigenous participation clearly requires inclusion of Indigenous priorities.

To ensure participatory research reflects Indigenous priorities, space for engagement is essential. As Miqmak scholar Marie Battiste (Denzin, Lincoln & Smith 2008, p. 503) states, '[I]t is vital that Indigenous peoples have direct input into developing and defining research practices and projects related to them.' However, community-engaged research is a political process fraught with power dynamics, hence providing physical space for engagement is but half the work. Informed by Indigenous methodologies, Denzin, Lincoln & Smith 2008, p. 5) suggest that research be designed to 'create a space for critical, collaborative, dialogical work … [to] bring researchers and their research participants into a shared, critical space, a space where the work of resistance, critique, and empowerment can occur'. Further, Indigenous methodology is guided by social justice as a process, not an event, throughout a project (Nicholls 2009).

Indigenous research engagement guided by social justice is a long-term commitment. Cree scholar Shawn Wilson (2001, pp. 175–76) asserts that 'research has to do something beneficial in this world: that is part of the axiology [ethics and judgement] of an Indigenous research paradigm … an Indigenous paradigm comes from the fundamental belief that knowledge is relational'. Several scholars have articulated this notion: Indigenous research methodology is inseparable from and a reflection of an Indigenous world view (Cajete 2004; Deloria & Wildcat 2001). Ultimately, relationships are fundamental to Indigenous knowledge and world views. Researchers engaging with Indigenous communities become bound to relationships that extend beyond the life of a project.

Guided by community-engaged and Indigenous research scholarship, our strategy involved opening up physical space through the use of participatory forums and maintaining open intellectual space to ensure that non-dominant voices and counter-narratives could influence the project in ways that addressed their priorities (Gagnon 2014; Gagnon et al. 2014). This is particularly important for Indigenous peoples who have had a history of being researched rather than being active research participants. Thus, reclaiming research on their own terms is about rebuilding trust, which has, in many areas, been lost. Moreover, we assert that flattening power dynamics in such an inherently political process is essential to community-engaged research. This requires that both physical and intellectual space be constructed into the research plan, incorporated early on, and actively and graciously defended throughout the project. Practised thoughtfully, it provides

space for multiple ways of knowing and seeing the world. Doing so is especially important when involving communities with deep and sustained connections to their environment, rooted in cultural practices such as harvesting and consuming fish (Basso 1996; Donatuto et al. 2011; Gagnon 2016; GLIFWC 2010). In addition, the 'fixity to place' that Indigenous peoples have to their homelands, both in terms of long-term connections and reserved treaty rights, demands an approach that is connected to place (and communities), even if the issue, as in this case, is transboundary (Norman 2012, 2014).

ATMOSPHERE–SURFACE EXCHANGE POLLUTANTS

Chemical contamination is a cross-boundary, global problem with many long-term impacts on ecosystem and human health. Lake Superior, often perceived as 'the most pristine' of the Great Lakes, contains the highest concentrations of polybrominated diphenyl ethers (PBDEs) and toxaphene, and the second highest levels of mercury in the basin (USEPA–GLNPO 2015). Colder temperatures, low biomass density and the large volume and surface-to-drainage-area ratio contribute to elevated atmospheric inputs to Lake Superior. Two of the most prevalent toxic pollutants in the region are mercury and polychlorinated-biphenyls (PCBs), both of which belong to a class of semi-volatile compounds that are capable of being globally transported through cycles of deposition and re-emission (Perlinger et al. 2016a). Mercury and PCBs also biomagnify in food webs, resulting in toxic concentrations being significantly more amplified in fish than in the surrounding atmospheric and aquatic environments (USEPA 2016). As a result, a serious concern is human exposure through fish consumption, which can cause neurological deficiencies, especially from exposure in developmental stages, and/or a range of immune and reproductive system diseases (USEPA 2012).

At the time of early contamination discoveries, environmental and public health officials did not recognise the global nature of the problem and envisioned that advisories would cease to be necessary as soon as officials eliminated local sources of contamination. Advisories are 'recommendations' that provide information on how to limit and avoid water bodies and fish species that have the greatest health risks from elevated toxicity. In the early 1970s, fish advisories were intended to be 'temporary' in the United States (O'Neill 2004). However, compounds such as mercury and PCBs continued to be transported through the atmosphere, resulting in the continuation of fish consumption advisories to protect the public. Indeed, for nearly five decades, data collected on fish toxicity show accumulations of toxic compounds at levels that are unsafe for Great Lakes residents (GLIFWC 2016; USEPA–GLNPO 2015). The Environmental Protection Agency (EPA) and the Food and Drug Administration have jointly issued a nationwide mercury advisory for store-bought and restaurant fish; and 38 states, including all Great Lakes states,

issue statewide mercury advisories for fresh-caught fish (USEPA 2016). At the time of writing, fish advisories cover almost half of the nation's lake acreage, river miles and coastlines.

Given that toxic compounds bioaccumulate, fishing communities are burdened with the majority of negative impacts (Cassady 2010; Donatuto & Harper 2008; Donatuto, Satterfield & Gregory 2011; O'Neill 2007; Ranco & Suagee 2007). Studies have shown that many populations remain culturally dependent on fish and, as a result, do not, cannot, or will not adhere to advisory recommendations. Of increasing importance, Native American tribes have some of the highest documented fish consumption rates in the United States, with Great Lakes tribal populations currently consuming the associated toxics at rates that are well above human health criteria (O'Neill 2004). Despite being protected by 19th-century treaties and reaffirmed by 20th-century statutes (McCammon-Soltis & Kekek 2009; Wilkinson 2005), studies suggest that Native American fishing rights and cultures have been severely impacted by toxicants (Cassady 2010; Gagnon 2016; Hoover 2013; Norman 2013; O'Neill 2007; Ranco et al. 2011). This underscores a perspective that is often lost when discussing the problem of contaminated fish: consumption advisories are not and should not be viewed as a permanent policy solution to the problem of fish contamination (NEJAC 2002).

Over the years, substantial developments in the scientific understanding of toxic chemicals and their governance have occurred (Gorman, Gagnon & Norman 2016; Perlinger et al. 2016a). It is now known that sources of contamination originate from both local and global sources, with re-emission of these persistent compounds into the atmosphere being extremely problematic. In general, they accumulate in bodies of water, soils and vegetation, and on all types of surfaces, and are able to be re-emitted into the atmosphere when conditions change (Agnan et al. 2016; Zhang, Holmes & Wu 2016). Therefore, even if all new releases of these compounds were stopped tomorrow, secondary emissions from existing reservoirs would continue for decades. Hence ASEP-related problems are inherently multi-generational and multi-jurisdictional. Although significant challenges remain, a framework for reducing future emissions of these compounds has begun to emerge in the form of loosely connected governance structures at the regional, national and global level (Selin 2010).

THE ASEP PROJECT

The remainder of this article is organised into three sections. We begin with 'The Case', which provides the context for the NSF-sponsored ASEP Project and for situating the research in Lake Superior's Keweenaw Bay. Then, in 'Opening up Space for Equitable Exchanges', we describe the main elements of the methodology we employed to open up space for non-dominant voices to influence this research project. In the third section, 'When can we eat the fish?', we draw attention to the value of attending to power dynamics, which allowed community-directed interests to emerge

as an interdisciplinary scientific inquiry. This seemingly simple question prompted a substantial portion of this project to be broadened to an investigation that required the participation of investigators from multiple disciplines. As a result, the co-creation of knowledge by the investigators and community partners has become an ongoing process. It is our hope that this article will provide practical methodology guidance for other researchers, particularly those who wish to engage with Indigenous communities.

The Case: The Global Transport of Toxic Compounds

The ASEP Project, led by a physical chemist, is an NSF-sponsored Coupled Natural-Human Systems project that is investigating the fate and transport of toxic substances as a global process with local consequences. In August 2013, this project brought together more than 30 investigators from five universities and more than a dozen community partners. Partnering organisations include, among others, the Keweenaw Bay Indian Community in Upper Michigan, EPA's Integrated Atmospheric Deposition Network and the Arctic Monitoring and Assessment Programme in Norway. A major focus of the research is to improve scientists' ability to incorporate secondary emissions into computer models so that future atmospheric concentrations can be forecast more confidently. For example, with better computer models it would be possible to more accurately forecast expected emissions of mercury under the yet to be ratified Minamata Convention on Mercury. Given that water body chemical concentrations are generally in balance with their surrounding atmosphere, predictions can be made about concentrations in fish tissue for specific aquatic ecosystems (Urban et al. 2016). With that information, it would also be possible to make a general assessment of the effect that the Minamata Convention would have on a large population of fish consumers, such as those of the United States, and, ultimately, the US economy (Giang & Selin 2015). The aim is to determine a set of actions that could lead to an acceptable level of future global emissions (Perlinger et al. 2016b).

Grounding the project geographically

When researching toxic compounds that disseminate globally through processes of atmosphere–surface exchange, one has to consider all sources of emissions, wherever they occur in the world, and all systems of chemical-related governance, which exist in many different scales and forms. After all, what happens in one part of the world affects all other parts. However, it is also desirable to ground such projects geographically because the actual impacts depend on the specific aquatic ecosystems through which the contaminants biomagnify and on the fish consumption patterns of those who live in an area.

Our decision to ground the ASEP research project in Lake Superior's Keweenaw Bay was based on several factors. First, the host university for the project, Michigan Technological University, is located within the region and several investigators

have experiences with community-engaged research in the area. Second, the Great Lakes basin is particularly susceptible to the effects of ASEP deposition and contamination (USEPA 2012). Third, fish consumption advisories are common in the Great Lakes region, with many overlapping jurisdictions – bi-national, tribal, state, provincial and municipal governments – having some role in generating and/or disseminating advisory information (USEPA 2016; USEPA–GLNPO 2015). In parallel with these efforts, the US–Canada Great Lakes Water Quality Agreement commits these nations to eliminating the need for fish advisories (GLWQA 2012).

The project team also decided that communities directly impacted by ASEPs should be involved with the research. We proceeded to invite community partners to collaborate and sought support letters from surrounding tribal, state, federal and bi-national groups. Often, large research projects such as these frame 'community engagement' as part of education and outreach, with most of the information flowing *to* communities. However, in this case, engagement was designed in the project for community partners to influence aspects of its research trajectory. Participatory forums held early on in the project were an initial part of the design. We are also planning a closure workshop with community partners, to take place at the end of the project, to share results and engage in dialogue for future participatory research opportunities.

From the project's beginning, particularly in the workshops, methods to flatten power dynamics – guided by the literature on community-engaged and Indigenous research scholarship – were explicitly employed. One result of these efforts was the emergence of the question 'When can we safely eat as much fish as we desire?'. Answering this question came to be one goal of the research team, ultimately advancing the science in a direction consistent with the main concern of participants most affected by ASEP contamination.

Foundations for community-academic relationships – trust building

The process of engaging community partners began in the proposal phase when various potential partners were invited to be a part of the ASEP Project. In the case of Indigenous organisations and community members, the invitation process included face-to-face meetings with tribal leadership to seek their support. Grounding the ASEP Project in Lake Superior's Keweenaw Bay allowed the project to build on previous trust building and long-term engagement with Indigenous communities. Who initiates university-community engagement is an important but often overlooked consideration (Glover & Silka 2013). This point is critical: the ASEP Project was able to connect with tribal communities through *existing* community-academic relationships. In particular, one of the authors had collaborated extensively with the Keweenaw Bay Indian Community (KBIC), as well as other Great Lakes tribes. Another of us had worked with Indigenous

cultures throughout the world and, more specifically, with the Coast Salish Indigenous communities through her role as faculty member of Northwest Indian College (NWIC) in Bellingham, Washington State.

As soon as the project was funded, we – the authors and members of the research team advocating for community-engaged research – focused on planning a Community and Partner Workshop. We invited each of the project investigators and community partners, and also extended invitations to a number of other researchers as well as to state, tribal and federal organisational representatives. Given the expected diversity in participation, we began the process of intentionally designing the workshop to allow non-dominant voices to be heard in ways that could influence the project pathway.

Opening up Space for Equitable Exchanges

The Community and Partner Workshop, held in November 2013, allowed investigators and community partners to engage in dialogue on the broader goals and the types of questions that various partners would like to see addressed. More than 50 ASEP investigators, community partners, invited community members, and state and federal guests attended this one-day forum. The community-based question, 'When can we safely eat as much fish as we desire?', emerged from this workshop.

Emerging initially as a loosely articulated question rooted in a long-term perspective, it was transformed into a more precise question that included, among other things, assumptions about the type and quantity of fish being consumed. Grounding these assumptions in actual practices necessitated acquiring more specific information from the community partners. Towards this end, we later held A Talking Circle Event for the purpose of learning about the importance of fish and fishing in the tribal community. This informed our efforts to determine the specific water bodies, fish species and quantity of fish that members of the tribal community might consume if toxicity were not an issue. These pieces of information were essential in determining the point at which fish might be considered safe to consume without restrictions.

Here, we describe our strategy and approach in preparing for the workshops using three heuristics: 1) time and space; 2) structure and specifics; and 3) products and processes.

Time and space

The community engagement component of the ASEP Project succeeded, in part, because the project left time and space for some aspects of the research to be community-directed. Including this time and space in the project design was essential because, once funding was granted, steps to engage community partners had to be intentional and taken early on; otherwise, little opportunity for partners to influence the direction of research would have been possible (Denzin et al. 2008).

In addition to allocating time in the project schedule, it was important to consider how that time was used – that is, within participatory forums. In the case of the initial ASEP Community and Partner Workshop, more time was devoted to presentations by community partners than by investigators. In addition, an even greater amount of time was devoted to group meetings and general discussion than to presentations. This use of time was consistent with the overall goal of facilitating dialogue on ASEP issues between groups with diverse perspectives. Additionally, we aimed to strengthen the ongoing collaboration between the project research team and other community partners, including community groups, educators, and environmental, health and resource agencies.

How space is used is an essential consideration in flattening power dynamics (McGregor 2004; Soja 1989). First, there were decisions as to where collaborative forums would take place. Our initial forum, the Community and Partner Workshop, was held at the Great Lakes Research Center at Michigan Technological University, which was chosen for its location overlooking an inlet of Lake Superior. Committed to establishing the future of Great Lakes research, we viewed the Center as the ideal space to engage in creating research in common. However, given that this space is located on the Michigan Tech campus, having a member of the Indigenous community provide the welcome was critical.

The second workshop, A Talking Circle Event, was hosted by a project partner, the Keweenaw Bay Ojibwa Community College (KBOCC), in June 2014. KBOCC is located about 50 kilometres south of Michigan Tech on the L'Anse Indian Reservation. This event was attended by 21 participants, half of whom had not participated in the first workshop. We chose to host this event at the local college because most of the event's participants were community members in Keweenaw Bay or worked within tribal institutions (e.g. natural resources, public health, and the tribal college). This decision was also relevant to the place-based information needed for the project (local fishing behaviour and preferences) and important for strengthening a community-university relationship based on reciprocity.

In general, then, we are arguing that leaving space open in the design of a project for new directions is useful, if not essential, for conducting meaningful community-engaged research. A regimented research plan without workshops for community-focused activities is unlikely to provide opportunities for community partners to make a portion of 'the' research 'their' research.

Structure and specifics

To provide an equitable opportunity for diverse voices to be heard, decisions on the specifics of how a forum is structured also need to be considered (Nichols et al. 2013). Examples of explicit choices lay in the presentation sequence and the design of the focus groups. Following the welcome, each forum was structured into

two main parts. Morning sessions were a series of informational presentations and afternoon sessions were dedicated to focus groups. The intention was to provide community partners ample opportunity to voice their perspectives. For focus groups, each discussion was guided by a set of open-ended questions.

To facilitate a productive exchange in the opening workshop, we assigned participants to one of five different focus groups. Each focus group had about the same number of participants who, together, represented a diversity of knowledge and perspective. The formation of each group was as follows:

—*Academic*: A representative (either student or professor) from each of the physical, social and educational sciences
—*Organisation/agency*: A representative from a federal, tribal and state agency (i.e. both tribal and non-tribal organisations)
—*Scale*: An individual with a local, regional, national and international perspective, representing various scales of issue focus
—*Expertise*: A range of expertise from assorted environmental and social mediums such as water, air, forests, fish or policy
—*Gender*: Among groups, gender was balanced.

The authors and two additional individuals served as group moderators, encouraging all participants to speak (and listen). A less structured session for reporting our results, involving all the groups, followed.

In the case of the second workshop, the talking circle provided an alternative structure for flattening power dynamics. A talking circle is a long-established way of sharing information within Ojibwa communities. Although the circle protocol varies from community to community, the main rule is to 'speak from the heart', with the intention being to get to the heart of issues from a foundation of trust. For all who participated, this workshop further solidified the value of the community-based aspect of the project.

As mentioned earlier, we also paid attention to details such as how to (and who would) begin the workshop. We wanted the welcome speaker for each of our workshops to encourage equitable participation, and so we asked an individual from the region's tribal community, Frank Ettawageshik, if he would provide the welcome for the event. His opening remarks preceded the greetings by the event planners and administrative representatives. In doing so, he provided space for Indigenous narratives to be a part of the dialogue from the onset. His welcome also engendered a sense of a shared problem and a hopefulness of creating solutions in common.

For the second workshop, held to learn more about the importance of community fishing and levels of consumption, KBIC tribal forester Gerald Jondreau opened the day by involving participants in a smudge ceremony. He also shared a traditional story, the telling of the Seven Prophecies of the Ojibwe people. Jondreau set the tone for the day with the following words, which reinforced the goal of equity among participants:

> *Have you ever watched a flock of geese as they fly through the skies? They all stay together in their v-shape form while one leads the way*

> *for the flying flock. But in the course of their journey, not just one leads the entire way. They are constantly taking turns leading the others — they are all leaders. Like the geese, we are all leaders, and we will all take turns leading the way to bring change in our human community.*

Additional details included choices involving food and gifts, and here, specific community protocols matter a great deal. Some protocols are learned through the process of relationship building but, certainly, asking local community members for guidance is encouraged. We were required to use the university catering services for the first event. To ensure that the menu reflected community values, the head chef of catering services worked with us on every detail. As a result, we included local seasonal items on our menu, including fish. For the second event, we worked with a caterer from the local community, who incorporated traditional foods, such as wild rice and berries, in the menu. Not only is sharing a meal together culturally important, it also signifies what the communities are advocating – their inherent and sovereign right to culturally relevant foods harvested from their traditional territory.

Gifting is highly valued among Indigenous peoples, representing reciprocal relationships. In appreciation of the shared knowledge, we honoured our welcome speakers with traditional gifts such as locally harvested preserved foods. As in any community, the protocols associated with gift-giving can be specific. However, in Keweenaw Bay, the most symbolic detail centres on the good intentions of the giver and less on the specific gift. At the closing of the second workshop, KBIC community partners shared traditional gifts with the research investigators. This gesture acknowledged the mutual relationship being strengthened as part of this project.

Products and processes

To reinforce the importance of equitable interactions in participatory research, the use of collaborative products is valuable. For the ASEP Project, investigators and community partners co-constructed a proceedings of each workshop (Gagnon 2014; Gagnon et al. 2014). In the case of our project forums, more than 70 workshop participants contributed to the creation of these proceedings. Producing such documents also provides a structure for grappling with and synthesising the diverse content resulting from such participatory forums.

Less recognised as a 'product' of research is the process of building relationships. Within disciplines, relationship-building processes usually occur through institutional mechanisms such as conferences and journal publications. Building equitable relationships between investigators and community partners (and, for that matter, between diverse disciplines) requires other mechanisms, such as the participatory workshops used in this project. Ideally, new relationships are created (and others strengthened), contributing to the capacity for collaboration during a project and also into the future.

Opening up space for equitable exchanges was our primary intention for both forums and we used similar strategies to achieve this. However, the type of information of interest to guide the research was different for each forum. In the first workshop, we opened up space for sharing research priorities across scales and expertise. Even with this vast diversity, it became clear that ecosystem and human health was the research priority and, in particular, those who are most dependent on safe fish. The second event focused on defining the parameters associated with safe fish, such as the fishing and consumption preferences of a community dependent on fish. Thus, by design, local participant voices were the most prevalent.

'When Can We Eat the Fish?'

Can large research projects actually be responsive to community-directed interests? In this case, the answer is yes. The question, 'When can we safely eat as much fish as we desire?', is a direct outcome of opening up space in the ASEP Project for community input and reflects the potential value of such an approach. Among other things, this community-based priority focused the trajectory of the investigation on a time endpoint – on a day when fish consumption advisories will no longer be needed.

Process

ASEP investigators worked together to transform the community-based concern into a scientific inquiry. The interdisciplinary question became: How many *years* will it take before the most *sensitive populations* in Keweenaw Bay are able to *safely consume* the amount of fish that they *desire*? Research was divided into specific tasks based on the expertise required at each step (Figure 1). Tasks included identifying the policy scenarios required to reduce mercury and PCBs to levels that would no longer require restrictions on fish consumption and modelling an expected timeline to attain such a recovery. Decisions involving the italicised items above (denoted by yellow spheres in Figure 1) required the expertise of and were made in consultation with project community partners.

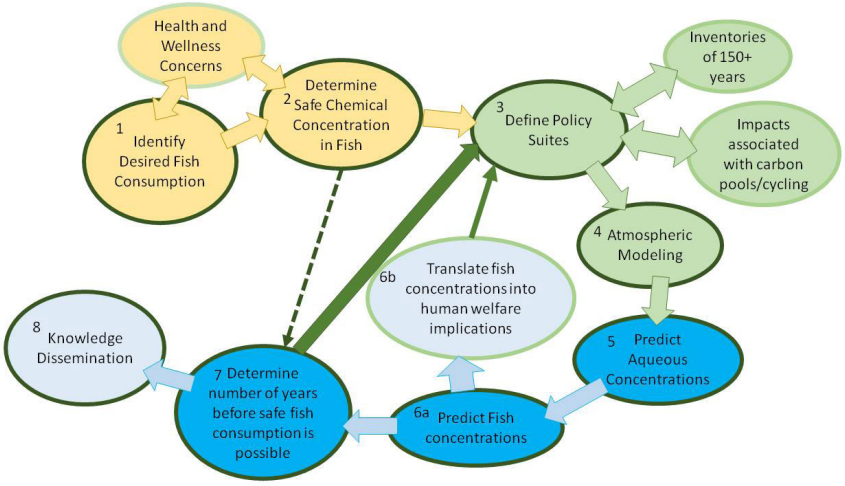

Figure 1: ASEP Project Ordered Tasks by Expertise. (Schematic created by Noel Urban, Michigan Technological University, 2016)

The general steps involved in addressing this question included three parallel efforts.

1 Determining what fish tissue concentration is considered safe

The goal, here, was to determine the fish tissue concentrations that would protect the most sensitive population from health risks. Doing so required that the most sensitive populations be identified, as well as the water bodies and fish species, and how much fish they desired to consume quantified. Once established, the fish tissue concentration could be determined to be below safety thresholds for fishing-consuming individuals.

Sensitive populations: In consultation with community partners, the ASEP Project defined 'sensitive populations' as women of child-bearing age, developing children and those who depend heavily on marine diets. By 'depend heavily', we mean Great Lakes fish consumers whose average fish consumption is currently 2 to 13 times higher than the national average (O'Neill 2004).

Safely consume: Here, safe consumption was defined using the most stringent human health standards at the time, which meant that fish tissue concentrations should not exceed a particular contaminant reference dose (RfD) (the product of fish tissue concentration times the quantity consumed). EPA's threshold for methyl-mercury (MeHg) is the most protective, set at 0.1 micrograms per kilogram of body weight per day (µg/kg/day) (USEPA 2016). Given that several jurisdictions set regulatory standards for different purposes, a variety of such safety thresholds exist (Cassady 2010). For example, RfDs for MeHg range from 0.1–0.5 µg/kg/day.

Desired fish consumption: Current calculations of safe fish tissue concentrations do not reflect the *desired* level of fish consumption among groups of people who rely on fish for subsistence and socio-cultural purposes (Donatuto & Harper 2008). 'Desired' fish consumption is different from the 'current' fish consumption rates typically used for creating advisories. In our second workshop, ASEP community partners defined 'desired' fish consumption as two 225-gram meals per day, which represents the height of regional fishing, the spring *ogaa* (walleye) harvest. It is consistent with the desired rates of communities in the Pacific northwest and in northeast United States (Donatuto & Harper 2008; Ranco & Suagee 2007). It is important to note that the project's desired rate exceeds current human health criteria by 25 times. This highlights the sheer magnitude of ASEP-related issues for sensitive populations and emphasises the urgency for research rooted in and guided by community engagement.

2 Determining how low air concentrations need to decline before fish tissue concentrations reach safe levels

This part of the project, carried out by limnologists and environmental engineers, involved these steps:

— Linking safe fish tissue concentrations to safe water concentrations. The bio-magnification of contaminants depends on the specific aquatic system that is involved. Investigators examined the dynamics for Lake Superior and several inland lakes.
— Identifying the atmospheric concentrations of mercury and PCBs that will result in the target water concentrations.

Once the target atmospheric concentration is known, the question becomes focused on when that target will be reached.

3 Forecasting future atmospheric concentrations of an ASEP, such as mercury, based on various emissions scenarios

This part of the project, carried out by atmospheric modellers, engineers and natural scientists, involved two steps:

— Defining an aspirational emissions scenario, a business-as-usual emissions scenario and a failure-of-governance scenario to use as inputs to the fate and transport computer models. Various members of the modelling and natural science team drew on the published literature and made the appropriate adjustments to produce these different emission scenarios.
— Running the fate and transport computer models, using the emission scenarios as input and forecasts of future atmospheric concentrations of mercury as output. Much of the research involved making improvements to these computer models in terms of their ability to forecast the fate and transport of ASEPs.

In terms of the question, 'When can we safely eat as much fish as we desire?', the goal was to identify how long it would take to reach the target atmospheric concentrations.

Answering the question

ASEP investigators recognise that it is not possible to precisely predict when it will be safe to consume without restriction (Perlinger et al. 2016b; Urban et al. 2016). There are too many uncertainties, especially in forecasts of future emissions and differing dynamics between water bodies. Furthermore, when it comes to mercury contamination, target concentrations will take many decades to achieve, even under an emissions scenario consistent with the Minamata Convention. Here, too, community engagement made a difference.

Attempting to answer the question on safe fish revealed valuable insights on the value of attending to power dynamics in community-engaged research. The specific question of 'When can we safely eat as much fish as we desire?', for instance, emerged in the context of the 'Seven Generations' philosophy. From that perspective, identifying a specific number of years is less important than taking action that considers the wellbeing of Seven Generations (GLIFWC 2010). The focus is on long-term thinking and planning, which needs to be the reality when it comes to toxic compounds and safe fish. Engaging with community members pushed the science in a direction consistent with the problem

of toxicity and community-based concerns. Their contributions highlighted an overarching priority, which is about encouraging research and policy that reflects a multi-generational approach to addressing complex socio-ecological issues.

CONCLUSION

'When can we eat the fish?' is the result of opening up space and flattening power dynamics in the community-engaged research for the ASEP Project. Providing physical and intellectual space to ensure the emergence and influence of counter-narratives was the methodological priority. Interrelated decisions concerning time and space, structure and specifics, and products and process necessitated considerable forethought and pre-planning. Balancing spatial politics can enhance equitable collaboration and diverse information exchange. Research design is merely half the work – it must transition into actual practice. The ASEP Project accomplished this dual task, with the research design resulting in a question that directly reflected community-based priorities and community contributions that continue to guide interdisciplinary project practices.

Further evidence that the ASEP Project has been successful is reflected in the strengthened relationship between Michigan Tech and Keweenaw Bay. Although this may be a less tangible indicator of success, the relationship has resulted in continued interaction with the community partners. In the fall of 2016, members of the research team were invited to share more about the project with the larger community as part of a lunch-n-learn series in Keweenaw Bay. The luncheon allowed more community members to engage with the research and participate in discussions with the researchers. The strengthened relationship has also led to continued dialogue on community research needs. Members of the research team and the Keweenaw Bay Indian Community are currently engaged in research proposal discussions for the future.

In summary, the primary lessons that made a crucial difference to the ASEP Project are as follows:

—Begin opening up and flattening space for community engagement early on (in the proposal process and from the beginning of a project). This is important to facilitate community partners' influence on the initial research design and to ensure meaningful engagement through the research practices that follow.
—Choose the first speaker at participatory forums thoughtfully.
—Incorporate cultural protocols of local community participants. Here, the detail matters, for example, when considering what food to serve (locally sourced) and what gifts to give.
—Plan for a participatory forum for closure of the project (scheduled to take place in the fall of 2017).
—Make trust building the foundation of the research relationship. This provides project transparency and the cultural awareness necessary to make decisions about creating open, equitable forums.

—In participatory research with Indigenous communities, commit to a long-term approach to research and genuine relationships with the communities with which you engage.
—Trust the process. The more diverse actors (and world views) that are engaged in the process, the more innovative the questions that will be generated.

We also recognised ways to improve our university-community approach in the future. For one, there were no travel funds for interested parties to attend the first workshop. Later we learned that state agency representatives had wanted to attend but were unable to due to a lack of resources. Thus, if we had appropriated project funds for workshop travel, this would have better served equitable participation. This contributed to another shortcoming in the project – we lacked expertise in human health. Indeed, some of those who had wanted to attend were public health professionals. And finally, it would have been advantageous to have our most engaged community partners represented on the research team. Having an Indigenous research co-investigator, for example, would greatly enhance equity in university-community partnerships more broadly.

Many variances in research methods are particular to Indigenous communities, whose long overdue participation is likely to be an escalating consideration in the future. Certainly, our existing relationships with Indigenous communities enabled our project to directly, and immediately, focus on power dynamics in research framing and methodology. Our active role in facilitating engagement contributed to enhancing equitable collaboration and, ultimately, the project's success. Attending to power and politics in research design and practice has practical value: it is increasingly required by funding agencies *and* essential for ameliorating contemporary socio-ecological issues. Further, it reflects a genuine effort to address these issues alongside communities that are most impacted.

Mutual respect and co-learning are inherent to good research practice, but being *genuine* is the underlying approach to opening up space for social equity. In this project, genuineness enhanced a collective sense of meaningful work, whereby community partners and investigators engaged in a meaningful experience of participation. We encourage university-community research partnerships, as well as CEnR, PAR and CBPR scholarship, to further extend direct links to Indigenous research methods as these insights are particularly relevant to vulnerable populations and health disparities more broadly. Critical discourse related to power dynamics and counter-narratives is applicable across communities, where successful projects must be inclusive of both scientific and local knowledge. For Indigenous and non-indigenous peoples alike, participating in research is vital to socio-ecological recovery efforts. Relationships between disciplines, jurisdictions and communities heavily impact these efforts. It is important to evoke Gerald Jondreau's insights in thinking about participatory

research engagement as an investigator or community partner: *we are all leaders, and we will all take turns leading the way to bring change in our human community*. We cannot imagine a more significant mindset with which to approach equitable participatory research and social justice.

REFERENCES

Agnan, Y, LeDantec, T, Moore, C, Edwards, G & Obrist, D 2016, 'New constraints on terrestrial surface-atmosphere exchange fluxes of gaseous elemental mercury using a global database', *Environmental Science & Technology*, vol. 50, no. 2, pp. 507–24. doi: https://doi.org/10.1021/acs.est.5b04013

ASEP Project (ASEP) 2013, 'Managing impacts of global transport of atmosphere-surface exchangeable pollutants in the context of global change', Michigan Technological University, http://asep.mtu.edu/

Basso, K 1996, *Wisdom sits in places: Landscape and language among the Western Apache*, University of New Mexico Press, Albuquerque, New Mexico.

Berkes, F 2008, *Sacred ecology*, 2nd edn, Routledge, New York.

Cajete, G 2004, *Native science: Natural laws of interdependence*, Clear Light Publishers, Santa Fe, New Mexico.

Cassady, J 2010, 'State calculation of cultural survival in environmental risk assessment: Consequences for Alaska natives', *Medical Anthropology Quarterly*, vol. 24, no. 4, pp. 451–71. doi: https://doi.org/10.1111/j.1548-1387.2010.01118.x

Deloria, V Jnr & Wildcat, D 2001, *Power & place: Indian education in America*, American Indian Graduate Center and Fulcrum Resources, Golden, CO.

Denzin, N, Lincoln, Y & Smith L 2008, *Handbook of critical and indigenous methodologies*, Sage Publications, Inc., Thousand Oaks, CA. doi: https://doi.org/10.4135/9781483385686

Donatuto, J & Harper, B 2008, 'Issues in evaluating fish consumption rates for Native American Tribes', *Risk Analysis*, vol. 28, no. 6, pp. 1497–506. doi: https://doi.org/10.1111/j.1539-6924.2008.01113.x

Donatuto, J, Satterfield, T & Gregory, R 2011, 'Poisoning the body to nourish the soul: Prioritising health risks and impacts in a Native American Community', *Health, Risk, and Society*, vol. 13, no. 2, pp. 103–27. doi: https://doi.org/10.1080/13698575.2011.556186

Gagnon, V 2014, 'Synthesis and community brief: A Talking Circles Event', Proceedings, Great Lakes Research Center Contribution no. 15, viewed December 2014, <http://asep.mtu.edu/Workshops/asep-workshops-2014-06-03.htm>

Gagnon 2016, '*Ojibwe Gichigami* ('Ojibwa's Great Sea'): An intersecting history of treaty rights, tribal fish harvesting, and toxic risk in Keweenaw Bay, United States', *Water History*, doi: https://doi.org/10.1007/s12685-016-0185-7

Gagnon, V, Gorman, H, Morrison, M, Norman, E & Perlinger, J 2014, '2013 Community and Partner Workshop Proceedings: Managing impacts of global transport of Atmosphere-Surface Exchangeable Pollutants (ASEPs) in the context of global change', Michigan Technological University, Great Lakes Research Center Contribution no. 7, viewed December 2014, <http://asep.mtu.edu/Workshops/asep-workshops-2013-11-15.htm>

Geniusz, WM 2009, *Our knowledge is not primitive: Decolonizing botanical Anishinaabe teachings*, Syracuse University Press, Syracuse, NY.

Giang, A & Selin, N 2015 'Benefits of mercury controls for the United States', Proceedings of the National Academy of Sciences of the United States of America. doi: https://doi.org/101.1073/pnas.1514395113

Glover, R & Silka, L 2013, 'Choice, power and perspective: The neglected question of who initiates engaged campus-community partnerships', *Gateways: International Journal of Community Research and Engagement*, vol. 6, pp. 38–56. doi: https://doi.org/10.5130/ijcre.v6i1.3192

Gorman, H, Gagnon, V & Norman, E 2016, 'Local impacts, global sources: The governance of boundary-crossing chemicals', *History of Science*, vol. 54, no. 4, pp. 443–59. doi: https://doi.org/10.1177/0073275316681804

Great Lakes Indian Fish & Wildlife Commission (GLIFWC) 2010, 'Great Lakes Indian Fish and Wildlife Commission 2010 Strategic Plan', GLIFWC Board of Commissioners, viewed April 2014, http://glifwc.org/index.html

Great Lakes Indian Fish & Wildlife Commission (GLIFWC) 2016, 'Guidance for safe consumption of walleye from inland lakes within the Ceded Territories of Wisconsin, Michigan, and Minnesota', viewed September 2016, http://www.glifwc.org/Mercury/mercury.html.

Great Lakes Water Quality Agreement (GLWQA) 2012, 'Great Lakes Water Quality Agreement', The Government of Canada and the Government of the United States of America, entered into force February 2013.

Hanson, C & Ogunade, A 2016, 'Caught up in power: Exploring discursive frictions in community research', *Gateways: International Journal of Community Research and Engagement*, vol. 9, no. 1, pp. 41–57. doi: https://doi.org/10.5130/ijcre.v9i1.4729

Hart, M, Straka, S & Rowe, G 2016, 'Working across contexts: Practical considerations of doing Indigenist/anti-colonial research', *Qualitative Inquiry*, vol. 22, no. 6, pp. 1–11. doi: https://doi.org/10.1177/1077800416659084

Harvard Catalyst 2016, 'Community-Engaged Research', Regulatory Foundations, Ethics, and Law Program, viewed July 2016, https://catalyst.harvard.edu/programs/regulatory/cenr.html.

Holifield, R, Porter, M & Walker, G (eds) 2010, *Spaces of environmental justice*, Wiley-Blackwell, Chichester, UK.

Hoover, E 2013, 'Cultural and health implications of fish advisories in a Native American community', *Ecological Processes*, vol. 2, no. 4, doi: https://doi.org/10.1186/2192-1709-2-4

Kovach, M 2009, 'Indigenous methodologies: Characteristics, conversations, and contexts', University of Toronto Press, Toronto.

McCammon-Soltis, A & Kekek, J 2009, 'Fulfilling Ojibwe treaty promises: An overview and compendium of relevant cases, statutes and agreements', Great Lakes Indian Fish & Wildlife Commission Division of Intergovernmental Affairs, viewed April 2014, www.glifwc.org/minwaajimo/Papers/Legal%20Paper%20-%20DIA.pdf.

McGregor, J 2004, 'Editorial', *Forum: Qualitative Social Research*, vol. 46, no. 1, pp. 2–5. doi: https://doi.org/10.2304/forum.2004.46.1.4

Minkler, M & Wallerstein, N (eds) 2008, *Community-based participatory research for health: From process to outcomes*, 2nd edn, Jossey-Bass, San Francisco, CA.

Nadasdy, P 2004, *Hunters and bureaucrats: Power, knowledge, and Aboriginal-State relations in the Southwest Yukon*, UBC Press, Vancouver, Canada.

National Environmental Justice Advisory Council (NEJAC) 2002, 'Fish consumption and environmental justice', Report from the NEJAC Meeting of December 3–6, 2001, Seattle, WA, viewed April 2010, www.epa.gov/oecaerth/resources/publications/ej/nejac/fish-consump-report_1102.pdf.

Nicholls, R 2009, 'Research and Indigenous participation: Critical reflexive methods', *International Journal of Social Research Methodology*, vol. 12, no. 2, pp. 117–26. doi: https://doi.org/10.1080/13645570902727698

Nichols, N, Anucha, U, Houwer, R & Wood, M 2013, 'Building equitable community-academic research collaborations: Learning together through tensions and contradictions', *Gateways: International Journal of Community Research and Engagement*, vol. 6, pp. 57–76. doi: https://doi.org/10.5130/ijcre.v6i1.2822

Norman, E 2012, 'Cultural politics and transboundary resource governance in the Salish Sea', *Water Alternatives*, vol. 5, no. 1, pp. 138–60.

Norman, E 2013, 'Who's counting? Spatial politics, ecocolonisation and the politics of calculation in Boundary Bay', *Area*, vol. 45, no. 2, pp. 179–87. doi: https://doi.org/10.1111/area.12000

Norman, E 2014, *Governing transboundary waters: Canada, the United States, and Indigenous communities*, Routledge, Florence, KY.

O'Neill, C 2004, 'Mercury, risk & justice', Environmental Law Reporter News and Analysis, Environmental Law Institute, Washington DC, 34:11070–11115.

O'Neill, C 2007, 'Protecting the tribal harvest: The right to catch and consume fish', *Justice, Environmental Law, and Litigation*, vol. 22, pp. 131–51.

Perlinger, J, Giang, A, Zhang, H, Kumar, A, Selin, N & Wu, S 2016b, 'Atmospheric transference of the toxic burden of Atmosphere-Surface Exchangeable Pollutants to the Great Lakes region', paper presented at the 22nd International Symposium on Society and Resource Management, Michigan Technological University, Houghton, MI, 23 June.

Perlinger, J, Gorman, H, Norman, E, Obrist, D, Selin, N, Urban, N & Wu, S 2016a, 'Viewpoint: Measurement and modeling of Atmosphere-Surface Exchangeable Pollutants (ASEPs) to understand their environmental cycling and planetary boundaries', *Environmental Science & Technology*, vol. 15, no. 17, pp. 8932–34. doi: https://doi.org/10.1021/acs.est.6b03447

Ranco, D, O'Neill, C, Donatuto, J & Harper, B 2011, 'Environmental justice, American Indians and the cultural dilemma: Developing environmental management for tribal health and well-being', *Environmental Justice*, vol. 4, no. 4, pp. 221–30. doi: https://doi.org/10.1089/env.2010.0036

Ranco, D & Suagee D 2007, 'Tribal sovereignty and the problem of difference in environmental regulation: Observations on 'measured separatism' in Indian Country', *Antipode*, vol. 39, no. 4, pp. 691–707. doi: https://doi.org/10.1111/j.1467-8330.2007.00547.x

Reason, P & Bradbury, H (eds) 2007, *The Sage Handbook of Action Research: Participative inquiry and practice*, Sage Publications, Inc., Thousand Oaks, CA.

Selin, H 2010, *Global governance of hazardous chemicals: Challenges of multilevel management*, MIT Press, Cambridge, MA.

Smith, L 2012, *Decolonizing methodologies: Research and Indigenous peoples*, 2nd edn, Zed Books, London.

Soja, E 1989, *Postmodern geographies: The reassertion of space in Critical Social Theory*, Verso, New York.

United States Environmental Protection Agency (USEPA) 2012, 'The effects of Great Lakes contaminants on human health', Great Lakes Human Health Program, viewed March 2013, www.epa.gov/greatlakes/health/index.htm.

United States Environmental Protection Agency (USEPA) 2016, 'National listing of Fish Advisories', Fish and Shellfish Advisories and safe eating guidelines, viewed November 2016, www.epa.gov/choose-fish-and-shellfish-wisely/fish-and-shellfish-advisories-and-safe-eating-guidelines.

United States Environmental Protection Agency Great Lakes National Program Office (USEPA-GLNPO) 2015, 'Great Lakes fish monitoring and surveillance program: Background, trends, and general conclusions', viewed October 2015, www.epa.gov/grtlakes/monitoring/fish/index.html.

Urban, N, Perlinger, J, Sokol, E, Wang, H, Lin, H, Hendricks, A, Alakayak, W & Priyadarshini, M 2016, 'Contaminants within the landscape mosaic of lakes, from small to great: Health in space and time', paper presented at the 22nd International Symposium on Society and Resource Management, Michigan Technological University, Houghton, MI, 23 June.

Whyte, K, Brewer, J & Johnson, J 2015, 'Weaving Indigenous science, protocols and sustainability science', *Sustainability Science*. doi: https://doi.org/10.1007/s11625-015-0296-6

Wilkinson, C 2005, *Blood struggle: The rise of modern Indian nations*, WW Norton & Company, New York.

Wilson, S 2001, 'What is an Indigenous research methodology?', *Canadian Journal of Native Education*, vol. 25, no. 2, pp. 175–79.

Wilson, S 2008, *Research is ceremony: Indigenous research methods*, Fernwood Publishing, Nova Scotia.

Zhang, H, Holmes, C & Wu, S 2016, 'Impacts of changes in climate, land use and land cover on atmospheric mercury', *Atmospheric Environment*, vol. 141, pp. 230–44. doi: https://doi.org/10.1016/j.atmosenv.2016.06.056