



PROJECT MUSE®

Incorporating Indigenous Knowledge Systems into Collaborative Governance for Water: Challenges and Opportunities

Suzanne von der Porten, Rob E. de Loë, Deb McGregor

Journal of Canadian Studies/Revue d'études canadiennes, Volume 50, Number/numéro 1, Winter/hiver 2016, pp. 214-243 (Article)



Published by University of Toronto Press

➔ For additional information about this article

<https://muse.jhu.edu/article/640810>

Incorporating Indigenous Knowledge Systems into Collaborative Governance for Water: Challenges and Opportunities

SUZANNE VON DER PORTEN, ROB C. DE LOË, AND DEB MCGREGOR

The importance of Indigenous knowledge systems for environmental decision-making is now widely recognized. In the context of collaborative approaches to environmental governance, scholars and practitioners have recognized that Western knowledge is not sufficient, and that ideas, practices, and knowledge from Indigenous peoples is essential. Collaborative environmental governance practice tends to make assumptions about how Indigenous knowledge systems can be incorporated into decision-making without reflecting satisfactorily on contrasting perspectives of Indigenous peoples themselves; these perspectives are partially captured in the Indigenous governance literature. This essay draws on empirical research in British Columbia, a place where First Nations have been approached by organizations involved in water governance to be involved in collaborative decision-making. The research reveals an important disconnect between the perspectives of Indigenous knowledge-holders and the people promoting “integration” of this knowledge into collaborative decision-making processes. We offer suggestions for reconciling collaborative approaches to water governance with Indigenous knowledge systems and the values and perspectives of Indigenous peoples.

Collaborative water governance; Indigenous governance; Indigenous knowledge systems; traditional ecological knowledge; water governance.

L'importance des systèmes de savoir autochtone pour la prise de décisions environnementales est maintenant généralement reconnue. Dans le contexte de démarches collaboratives de gouvernance de l'environnement, les intellectuels et les experts signalent que le savoir occidental n'est pas suffisant et que les idées, pratiques et connaissances des peuples autochtones sont essentielles. La pratique de gouvernance environnementale collaborative mène souvent à des hypothèses sur la manière dont les systèmes de savoir autochtone peuvent être intégrés dans le processus de prise de décisions qui ne tiennent pas compte des perspectives divergentes des peuples autochtones mêmes. Ces perspectives sont partiellement identifiées dans la littérature sur la gouvernance autochtone. Le présent article s'inspire de données de recherche empiriques de la Colombie-Britannique – un lieu où des organismes participant à la gouvernance de l'eau ont communiqué avec les Premières Nations pour prendre des décisions ensemble. La recherche révèle qu'il existe un écart important entre les perspectives des détenteurs du savoir autochtone et les gens qui promeuvent « l'intégration » de ce savoir dans les processus collaboratifs de prise de décisions. Les auteurs

offrent des suggestions pour réconcilier les démarches collaboratives de gouvernance de l'eau avec les systèmes de savoir autochtone et les valeurs et perspectives des peuples autochtones.

gouvernance collaborative de l'eau, gouvernance autochtone, systèmes de connaissance autochtones, savoir écologique ancestral, gouvernance de l'eau

Introduction

Multi-actor processes for shared or collaborative decision-making¹ have become an important part of the landscape of environmental governance (Gunningham 2009; Innes and Booher 2010). The rationale for using multi-actor approaches in the context of governance of the environment stems in part from the fact that many environmental problems affect diverse groups of people, and these problems are complex and can only be resolved by drawing on different types of knowledge (van Tol Smit, de Low, and Plummer 2015). Scholarship describing collaborative governance tends to emphasize processes where diverse stakeholders meet face-to-face, consensus is reached among actors through long-term dialogue, and high-quality information of many types is incorporated into decisions (Innes and Booher 1999). The need for diverse kinds of knowledge to support environmental decision-making has created growing interest in understanding how Indigenous knowledge systems do or can play a role in collaborative processes for environmental problem-solving. For example, collaborative environmental governance scholars have explored how Indigenous knowledge systems create a shared understanding in environmental management (Prober, O'Connor, and Walsh 2011). Additionally, they have evaluated the implications of integrating Indigenous and Western-scientific knowledge (Jackson et al. 2012), and have explored the role of Indigenous knowledge systems in jointly managed protected areas (Stacey, Izurieta, and Garnett 2013).

The growth of collaboration scholarship that recognizes the importance of Indigenous knowledge is a reflection of the real-world need for high-quality information and diverse forms of knowledge in environmental decision-making. In this paper, we draw on findings from the analysis of four Canadian cases in British Columbia,² Canada, where collaborative water governance was used within First Nations territories to address diverse water issues. We are specifically concerned with the extent to which, and how, Indigenous knowledge was expected to be, or actually was, incorporated into decision-making within those processes. By “incorporation,” we refer to situations where Indigenous knowledge plays a very significant or equal role alongside other knowledge systems in the environmental decision. The rationale for the inclusion of Indigenous knowledge systems into environmental decision-making, a process driven mostly by Western-scientifically trained individuals, has multiple

dimensions. These include the need for local and valid models for living sustainably (Turner, Ignace, and Ignace 2000), the importance of better data for environmental management (Watson 2013), growing awareness of the need for multiple forms of knowledges to address complex environmental problems (Weatherhead, Gearheard, and Barry 2010), and a desire to enhance First Nations water security through drawing on Indigenous knowledge systems and perspectives (Longboat 2015).

Nicole Wilson (2014, 1) argues that “The role of Indigenous peoples and their sociocultural relations to water is currently under acknowledged in the water governance literature.” Through focussing on Indigenous experiences in a specific water governance context, (collaboration in British Columbia, Canada’s westernmost province), we help to address this gap. British Columbia provides a rich empirical example for exploring the tensions between environmental (water) governance and the role of Indigenous knowledge systems. An important factor that differentiates BC from other provinces in Canada is that the majority of Indigenous nations in BC did not sign historic treaties with the colonial government or post-Confederation Crown. In more recent decades, a handful of modern treaties have been signed, while the vast majority of land remains “untreated” and thus the unceded traditional territories of Indigenous peoples. As a result of these circumstances, the political and legal landscape in BC is marked by the lack of written documents pertaining to the relinquishing of ownership of lands by Indigenous nations. Further distinguishing the province’s circumstances was the landmark 2014 Tsilqot’in Supreme Court of Canada (*Tsilhqot’in Nation v British Columbia*, 2014) ruling in which Tsilqot’in peoples (one of the subjects of this multicase study) proved their title to their lands within their traditional territory. The Indigenous-led Idle No More movement, which occurred across Canada following this research, demonstrates the building sense of frustration by Indigenous peoples beyond just BC: this movement disputed the legitimacy of colonial environmental decision-making control (The Kino-nda-niimi Collective 2014). These political-legal changes in the Indigenous governance landscape are occurring alongside a culture of collaborative environmental governance in British Columbia (Nowlan and Bakker 2007). In concert, these circumstances have provided a rich context for examining the role of Indigenous knowledge systems in collaborative water governance.

Positionality

As researchers actively engaged in the role of knowledges, our positionality drives our personal interest, and previous and ongoing academic collaboration together on the topic of the ongoing challenge of knowledge integration. One of us (McGregor) is an Indigenous Anishinaabe academic whose expertise includes Indigenous

knowledge systems, collaboration, and water and environmental governance; while the others (von der Porten and de Loë) are non-Indigenous scholars who study collaborative governance and Indigenous governance. Our work is situated within the “critical” typology of traditional knowledge literature, one of four streams of traditional knowledge literature (Latulippe 2015), each with its own timeline/evolution. The orientation (and stream of literature within which we are writing) argues that Indigenous knowledge systems are “embedded in uneven, colonial relations of power” (Latulippe 2015, 121). While Paul Nadasdy (1999) is the most prominent early author of this line of literature, the Royal Commission on Aboriginal Peoples (1996) predates that line of critical debate in the Canadian context. We participate in this academic debate by presenting emergent data on the role that Indigenous knowledge plays in collaborative water governance in British Columbia, Canada. This paper is a new extension from a project that investigated the role of Indigenous peoples in collaborative water governance and the assumptions held by non-Indigenous peoples about that role (von der Porten and de Loë 2013). That work revealed, but did not address, the issues under consideration in this paper.

Indigenous Knowledge and Environmental Governance

The term “Indigenous” refers broadly to people who are the “original people” in a place. Jeff J. Corntassel (2003) emphasizes that the term *Indigenous* has many nuanced meanings worldwide depending on circumstance, place, history, and other realities. The term “Indigenous knowledge systems” refers to collectively held understanding of a particular environment developed by the Indigenous peoples living on that landscape for thousands of years and passed down, often orally, through generations. Indigenous knowledge about the environment encompasses more than ecological knowledge (Allen et al. 2009). Also part of this knowledge system are the ways in which Indigenous peoples engage with the world (Raffles 2002). Importantly, like all forms of knowledge, Indigenous knowledge systems can be gendered (Lawless et al. 2015).

Related concepts that sometimes are used interchangeably with Indigenous knowledge systems include “traditional ecological knowledge,” “traditional knowledge,” and “traditional ecological wisdom and knowledge.” “Traditional ecological knowledge” refers to a way of thinking that includes respect for non-human entities, the incorporation of non-humans into decision-making based on the bonds between humans and non-humans, emphasis on local environments, and acknowledgment of humans as a part of the ecological system (Pierotti and Wildcat 2000). The term *traditional knowledge* describes

a cumulative body of knowledge, know-how, practices and representations maintained and developed by peoples with extended histories of interaction

with the natural environment. These sophisticated sets of understandings, interpretations and meanings are part and parcel of a cultural complex that encompasses language, naming and classification systems, resource use practices, ritual, spirituality and worldview ([International Council for Science 2002](#)).

The related concepts of “traditional ecological wisdom and knowledge” refers to a holistic way of knowing whose characteristics can include a philosophy or world view, practices of resource use, and ways of knowledge exchange ([Turner, Ignace, and Ignace 2000](#); [Whyte 2013](#)).

For all of these terms, it is notable that that “knowledge” is in fact a Western notion, and that its equivalent in some Indigenous cultures is more a “way of life” encompassing spiritual relationships with the land ([McGregor 2009](#); [Nadasdy 1999](#)) where “land” is seen as a living environment ([Berkes 2008](#)). In this paper, we use the term “Indigenous knowledge systems” to situate Indigenous knowledge as part of a way of life (rather than as a knowledge that can be compartmentalized and defined) and consider it to be inclusive of these other commonly used terms. “Western” knowledge is also considered here in an inclusive manner and includes all knowledge that is the product of dominant Western institutions ([Coombes 2007b](#)). Hence, the term covers knowledge generated through the natural sciences, social sciences, and humanities.

Although the need for Indigenous knowledge systems in environmental decision-making is recognized, collaboration scholarship tends to make assumptions about how Indigenous knowledge can be incorporated into decision-making processes. In particular, as illustrated below, authors advocating for the use of Indigenous knowledge often assume that it is equivalent to scientific knowledge. Reflection on paradigmatic and practical differences between types of knowledge, consideration of the role of colonization on Indigenous knowledge systems, and lack of awareness of the hegemony of scientific knowledge, are commonplace. For example, the assumption that Indigenous knowledge systems can be integrated into science-based collaborative environmental planning ([Bark et al. 2012](#)) is based on the idea that both knowledge systems have “strengths and deficiencies and therefore can complement one another” ([Sileshi et al. 2008](#), 100). Unfortunately, given the importance of self-governance in environmental management processes ([Bowie 2013](#)) and the power imbalances that typically exist in collaborative environmental decision-making processes ([Nadasdy 1999](#); [von der Porten and de Loë 2013](#)), this assumption can be misleading.

Assuming that Indigenous and Western-scientific knowledge can be combined equally in science-dominated collaborative environmental processes led by non-Indigenous peoples may be inappropriate. For example, Potawatomi scholar [Kyle Whyte \(2013\)](#) argues that the many different definitions of traditional ecological knowledge

in collaboration suggest that a more meaningful line of inquiry would focus on its role in non-Indigenous and Indigenous institutions for environmental governance. This research continues the conversation among the “growing array of actors engaged in the field of traditional knowledge” by challenging the idea that Indigenous knowledge systems are “held as a means of empowerment for Indigenous peoples” (Latulippe 2015, 188, 124) in the context of collaborative environmental governance. Following three decades of academic conversation about the role Indigenous knowledge *ought* to play (e.g., World Commission on Environment and Development 1987), we question the role Indigenous knowledge *does* play “on the ground” in a colonial context.

Importantly, many collaborative environmental governance scholars do have nuanced perspectives about the tension surrounding the use of Indigenous knowledge systems in science-dominated planning processes. For example, Javina M. Shackeroff and Lisa M. Campbell (2007) suggest that Indigenous knowledge systems can only be incorporated into mainstream collaborative conservation research through a conscientious, informed approach that involves awareness of ethics, situated knowledge, and power imbalances. Similarly, some collaborative environmental governance scholars note the power imbalance that tends to exist where Indigenous knowledge systems are proposed to be integrated into environmental decision-making processes (Barbour and Schlesinger 2012; Greskiw and Innes 2008; Pragnell, Ross, and Coghill 2010; Tipa and Welsh 2006). We argue that the acknowledgement of these power imbalances do not go far enough in actually addressing them. Specifically, we suggest that simply aiming for the “inclusion of Indigenous knowledge systems in integrated management” (Berkes, Berkes, and Fast 2007, 159), whether or not power imbalances are problematized, does not meet expectations regarding Indigenous knowledge systems and self-determination advanced by Indigenous scholars. Despite the recognition of power imbalances by many scholars and Indigenous communities themselves, Indigenous knowledge systems continue to be advanced in Canada as part of comprehensive land-claim settlements, self-government agreements, and environmental collaborative processes (Bowie 2013; Ellis 2005). Indigenous peoples themselves call for the recognition of their knowledge in various environmental governance initiatives (Christensen and Grant 2007; O’Flaherty, Davidson-Hunt, and Manseau 2008).

Indigenous governance literature (a body of scholarship written largely by Indigenous scholars and concerned with Indigenous self-determination, inherent rights, and Indigenous ways of knowing), makes different assumptions about Indigenous knowledge systems. For example, in the Canadian context, Indigenous legal scholar John Borrows asserts that Indigenous people seek affirmation “of their intimate knowledge of the land” (2005, 17) and argues that the colonial government should

“act by removing itself from Aboriginal lands or seeking consent from Aboriginal peoples for its use of those lands” (60). Not only do Indigenous peoples face the challenge of ensuring that Indigenous knowledge systems play a part in natural resource management (Memon and Kirk 2012), but Indigenous knowledge systems are also critical to Indigenous self-determination: “European methods of inquiry have built very limited understanding, space, and place for [Indigenous] life ways [and] knowledge systems. ... Elders maintain that we must continue to tell our own story by following our protocols, in our own ways and language” (Claxton 2008, 60).

There is a marked difference between an Indigenous-led paradigm shift, where Eurocentric ways of viewing the world are replaced with a view contextualized by Indigenous knowledge systems (Youngblood Henderson 2000), and simply “incorporating” Indigenous knowledge systems into existing Eurocentric environmental decision-making (e.g., Hoverman and Ayre 2012). Although Western ways of knowing differ in many ways from Indigenous knowledge systems, Indigenous scholars Raymond Pierotti and Daniel Wildcat (2000) argue that Indigenous knowledge systems have the potential to contribute insights and concepts to Western science. Whether or not and how these knowledges can be integrated into environmental governance remains debatable. Given the diversity of Indigenous experiences and knowledge around the world, we suggest that context must be respected. Hence, in this paper we explore how Indigenous knowledge systems are viewed by Indigenous peoples and by practitioners of collaborative processes for water governance in British Columbia. This allows us to identify both challenges and opportunities, not only for practitioners, but also for those interested in Indigenous and other knowledge systems.

Methods

This study draws on a data set that was created originally for a project that explored the extent to which the perspectives of Indigenous peoples in British Columbia, Canada, are reflected in collaborative practices in the realm of water governance (von der Porten and de Loë 2013). The data on Indigenous knowledge presented in this paper emerged from that study. Participants in the study were not asked directly about the role of Indigenous knowledge. None the less, numerous insights related to Indigenous knowledge emerged during the research. These were set aside. For this paper, we reanalyzed the data, and conducted additional research, to address the research question: “What role do assumptions regarding Indigenous peoples play in the integration of Indigenous knowledge systems into collaborative processes?”

The main study focussed on four organizations involved in collaborative governance for water in BC. The research applied a decolonizing methodology to examine

how these organizations approached Indigenous people/organizations for the purposes of collaborative decision-making about water. These cases were selected for their ability to provide insight into the extent to which the perspectives of Indigenous peoples in British Columbia, Canada, are reflected in real-world collaborative practices. Cases were chosen based on four selection criteria: their acknowledged role in governance for water, their use of collaborative approaches, their operation in the traditional territory of one or more First Nations, and an expressed desire on the part of the organization to engage with or collaborate with First Nations. Issues and views relating to Indigenous knowledge and collaboration emerged during this work, but were not addressed in publications resulting from the main study (von der Porten and de Loë 2013, 2014a, 2014b). The organizations involved in collaborative water governance included Friends of the Nemaiah Valley (FONV), Okanagan Basin Water Board (OBWB), Columbia Basin Trust (CBT) and the Water Stewardship Division of the BC Ministry of Environment³ (table 1; figure 1).

Table 1. Characteristics of organizations involved in water governance

Characteristic	Provincial-Scale Organization	Regional-Scale Organizations		
	WSD	CBT	OBWB	FONV
Type	Division of BC provincial Ministry of Environment	Statutory regional development corporation	Board (overseen by 3 regional district governments)	Non-profit society
Number of interviewees	19	15	9	6
Administrative/affiliation	Province of BC	Enacted by Province of BC	Legal status conferred by Province of BC; overseen by 3 regional districts	Independent grass-roots organization
Geographic scope	BC (whole province)	Columbia Basin Watershed	Okanagan Basin Watershed	Xeni Gwet'in Territory
Size*	Medium (31+)**	Medium (33)	Medium (20)	Small (7)
Rural/urban	Urban & rural	Semi-rural	Semi-rural	Rural (remote)
Corresponding First Nations traditional territory	203 bands, 1 "extinct" band	5 nations	1 nation	1 nation

* Size is the number of people in the organization including staff, managers, board members, and technical advisors.

**The WSD is an agency of the provincial government. Thus, its staff are embedded in a much larger organization (the Government of British Columbia).



Fig. 1. First Nations traditional territories in British Columbia with water governance case study areas indicated.

Data used in this paper related specifically to views of Indigenous and non-Indigenous peoples on Indigenous knowledge systems that emerged during the main project. Data sources included primary interviews, personal observations, and documents. A total of 49 people were interviewed using a semi-structured format. These interviews included (1) non-Indigenous provincial bureaucrats in decision-making positions regarding all uses of water;⁴ (2) non-Indigenous decision-makers within organizations involved in collaborative water governance; (3) key informants (Indigenous and non-Indigenous) with expertise on the cases from the fields of academe, law, and ENGOs (environmental non-governmental organizations), and (4) individuals who self-identified as Indigenous or First Nations⁵ (table 2). Of those interviewees identifying as Indigenous or First Nations, three were academics, while the remainder were in leadership positions within First Nations governments, nations, or organizations. Importantly, we do not claim to have captured a representative sample of the types of people involved in collaborative governance for water in British Columbia. This was not practical because there are hundreds of ediverse organizations engaged in governance for water in BC (Morris and Brandes 2013). Instead, the goal was to assemble a set of practitioners with deep and relevant knowledge who had views germane to the research question.

Potential interview participants were identified from personnel profiles of organization employees, and from recommendations made by other interviewees. Interviews were digitally audio recorded, transcribed verbatim by the first author, and member checked through returning the transcripts to the interview subjects for verification. For each of the cases, representativeness through data collection was sought from interviews, documents, and personal observations. Subject saturation was determined through identifying the point where no new ideas, themes, or topics emerged from the interviews.

Table 2. Interview participants

Participant	Number of Interview Participants
(1) Provincial bureaucrat	7
(2) Water governance organization	13
(3) Key informants (experts and researchers in the fields of law, ENGOs, Indigenous governance and environment)	19
(4) Indigenous leader/decision-maker	27
Total Interviewed*	49

* A total of 49 people were interviewed. Some participants were qualified to speak about more than one case where there was overlapping jurisdiction.

Interview data were supplemented with themes and concepts that emerged from analysis of 183 documents relevant to the four cases. Documents included two major types: 54 “First Nations” (publications originating from First Nations governments, including open letters to the provincial government, water declarations, media releases, and planning documents); and 129 “Policy” (including publications originating from water governance organizations, court documents, publicly available meeting minutes, and management plans). Personal observations by the first author during field research completed between August 2011 and January, 2012, provided another perspective on collaborative relationships. None the less, while these played an important role in the main study, they were not a major data source for the research reported in this paper.

For the main study, data from documents, interviews, and personal observations were organized, coded, and analyzed using a conceptual framework that revealed how collaborative environmental governance typically approaches Indigenous peoples. QSR NVivo 8 was used to store and analyze data from all sources. Data in the main study were coded using first-pass codes; emergent themes between coding categories were then coded using axial, second-pass coding (Gladstone, Dupuis, and Weyler 2006; Seale 2004). Participants in the main study were not asked directly about the role of Indigenous knowledge. Instead, during the interviews and document analysis for the main study, data related to Indigenous knowledge continually emerged. These data were not used in the main study. Instead, placeholders were used to flag data relating to Indigenous knowledge systems and collaborations. For this paper, these placeholders provided a starting point for third-pass coding that addressed the research question posed above, which focussed on Indigenous knowledge systems and collaborative processes. Coding for this paper was organized around themes reflected in the literature reviewed above, and on emergent themes. These included knowledge integration, power imbalances, knowledge-sharing, and Indigenous knowledge systems.

Results

The major findings that emerged from the analysis are presented in the five categories below. These categories emerged from the analysis of the data as a whole (49 interviews). Themes emerged during the coding process, as described in the methods section. They relate to the roles, challenges, and/or assumptions surrounding the incorporation of Indigenous knowledge systems into collaborative governance for water. Quotations from the interviews are used throughout the results to add richness and depth of insight to the findings.

A. There is a perceived need or place for Indigenous knowledge systems in collaborative environmental decision-making, but a persistent lack meaningful implementation.

Interviewees from all four of the organizations involved in collaborative governance recognized the potential value of incorporating Indigenous knowledge systems into their environmental decision-making. None the less, only interviewees from the organization Friends of the Nemaiah Valley noted having meaningfully incorporated Indigenous knowledge systems into water governance decisions. Interviewees within organizations involved in collaborative water governance were aware of Indigenous knowledge systems and their potential importance to decision-making, but consistently lacked understanding or ideas regarding how Indigenous knowledge systems could be incorporated into collaborative processes. The following quotation (from a non-Indigenous key informant) illustrates the gap that exists between the recognition of Indigenous knowledge systems and their application in non-Indigenous environmental governance:

10,000 years of [Indigenous] knowledge is tremendous when we have such little understanding currently of the state of our water. ... 10,000 years' knowledge to contribute to better management of resource is invaluable. The challenge is how to apply that knowledge, which is mostly [oral], into something that corresponds with modern day decision processes. So I think that modern-day processes have to be changed significantly to allow for that. There is a big disparity. ... Verbal knowledge of cultural views on ecological management ... doesn't just fit into these boxes that we have, current-day, for allocating water licenses. ... It just does not fit. So we need to broaden those boxes, I do not know how.

Barriers to the meaningful application and sharing of Indigenous knowledge systems on water are noted by Indigenous leaders as well. The following quotation from one Indigenous leader demonstrates the perceived functional and ontological challenges of Western-scientific versus Indigenous perspectives on water and environmental governance, as well as an Indigenous perspective on the challenges to incorporating Indigenous environmental observations:

It seems that the way others operate is very much in silos. [They] look at the water separate from the land, the land separate from the animals. The Western scientific world view puts everything in little compartments and looks at them separately. For example, when I am talking to [my Indigenous] community about species at risk, they will say, "[the animals] don't have enough habitat, their habitat is not suitable because the water levels are dropping

and now there are weeds growing in there.’” So it is all part of the same issue which makes perfect sense to me, but you can’t go to a person from the Canadian Wildlife Service ... and talk to them about water. They will [say], “we don’t have anything to do with that.’” Or if you talk to somebody about how you are clear-cutting the logs, you are clear-cutting too much, and the water is coming off the mountains too fast, you need to stop and slow down. Well, how many different government people do you talk to about that issue?

While the scholarly literature points to important potential for the meaningful application of Indigenous knowledge systems on water, barriers remain. This is at least true in the context of BC where Indigenous voices do not yet significantly influence most Western-scientific water governance practices. There are also perceived pragmatic barriers to incorporating Indigenous knowledge systems such as the incongruence of oral and written forms of knowledge. This is reflected in an observation from a BC civil servant: “Let’s say that there’s a FN elder who has information that’s incredibly valuable. But, they’re an oral storyteller ... how, in a current government process, can you capture that information? You can’t even manage those records. Document retention [laws] in BC do not talk about audio recordings, [so you] can’t even do it.”

There are additional barriers to applying Indigenous knowledge systems to collaborative water governance processes. The barriers discussed in the following two sections relate to the differing world views between Western science and Indigenous knowledge systems, and unresolved power imbalances between Indigenous peoples and settler society.

B. Differing world views of Indigenous knowledge systems holders and scientific knowledge holders can be hard to align for the purposes of collaborative decision-making.

The research revealed the extent to which the view held by some Indigenous people varied from mainstream Western views. The following quotation from one of the Indigenous leaders interviewed demonstrates the difficulty of integrating Western scientific and Indigenous views on the environment in a collaborative governance setting:

The world views are so different. With Western science, when you see something you believe something. And when you are looking at it from our perspective, you believe something and then you see it. It is pretty much the opposite. An example would be ... forestry. The Western science looks at it in terms of cubic board feet, they mark out their blocks, they study these trees, and delineate different aspects of the forest down to the most minuscule piece, they reduce everything. If you are a First Nations person, you see it

as a whole living, breathing organism that you know is there, that you know that you can feel that you go into that forest, that it's like a family when you go in there, and everybody is dependent on [the forest]. You don't see it as money. You go in there and you just know it, and you feel it in your body and in your heart. But to go into a meeting and tell these scientists that? You can't tell them, "you cannot cut this forest down, it has this meaning and this power'." They will look at you like you are crazy and say "'Well, prove it, I want to see this'."

In the following quotation from another Indigenous leader, the (perceived) incongruence between Western-scientific and Indigenous approaches to water governance is further underscored:

From an Indigenous perspective, water ... has its own spirits, and it's a [living] being. And it has the right to be free just like other beings do. ...When you look at bottled water ... it is not alive, and you don't get the same nourishment that you get from when you drink from a stream or river. That has spirit and it is sharing its spirit with you. ... Water isn't just something that you drink so that you stay alive. Water is something that takes care of us in so many different ways. Like in our ceremonies with sweats, water is such a vital part of having that ceremony. When you are feeling down or ... burdened in a negative way, they always tell you to go to the water and jump in the water. I have jumped in the river in the middle of winter before, and you come out of there gasping for air because it is so cold, but at the same time you have lost so much weight off of you, it takes care of you in that way. It is hard to explain that relationship that our [Indigenous] community has, and I think that a lot of people have to water. But when you have a [Western] structure and a system that is so mechanical that doesn't allow, have room for that sort of perspective to be incorporated, it is really difficult.

An Indigenous view of the environment, and in this case water, as something that is spiritual and an important part of tradition was noted by most Indigenous respondents. Examples from two different Indigenous respondents illustrate a common theme:

Water is something that, in a sense is very spiritual. Because our people talk about legends and stories, way back where animals, the birds and fish all spoke [our language] ... In terms of water, when you become an adult for example, where they are female or male, one week you are told to be in an area in the mountains and think positive, to work hard, and to drink very

little water and to have either dried salmon or dried meat, and you only take it when you need. Then you get your power. (Indigenous leader)

And there are certain rituals that we practise because we, when you are cleaning the salmon, you always throw the innards of the salmon back into the water, because that nourishes the water quality, and I guess it leaves that, put that essence back in the water for future generations. Just certain rituals like that. (Indigenous leader)

Indigenous perspectives on water stand in contrast from the mainstream science use to make decisions in conventional collaborative environmental governance. This was revealed starkly in an interview with a senior BC government official, who acknowledged that the Indigenous perspective was different, but laughed while explaining that First Nations people in BC viewed water through a spiritual lens. The diametrically opposed perspectives revealed during the research support the finding that part of the difficulty in incorporating Indigenous knowledge systems into collaborative environmental decisions led by non-Indigenous peoples is the range of how knowledge systems are understood. This lack of alignment between the perspectives is widened by power imbalances: the legitimization of Western interpretations of knowledge play a key role overpowering Indigenous knowledge. This power difference, gap in understanding, and difficulty in Indigenous knowledge systems integration is further compounded by the potential for knowledge misuse.

C. The sharing of Indigenous knowledge systems by knowledge-holders with collaborative organizations risks the misuse of that knowledge because of power imbalances and contested title to land.

The findings from this study indicate a wariness among Indigenous knowledge-holders to share Indigenous knowledge with external organizations involved in collaborative water governance. The wariness included (1) the potential for the knowledge sharing not to benefit the Indigenous knowledge-holders, (2) external use of the knowledge for tokenistic inclusion into decision-making, (3) power imbalances between knowledge holders, (4) perceived disregard for Indigenous ways of knowing, and (5) the risk that knowledge sharing relinquishes control of management of traditional lands. The wariness toward relinquishing control is articulated in the following quotation from an Indigenous key-informant:

I am wary of [environmental] non-governmental organization matchups, because I have seen a lot of the framing of those campaigns supersede real Indigenous interests ... I think there are some issues like water where

you have very little choice in terms of collaborating because it is considered a shared resource. ... I think the danger of that is that it appears that as Indigenous peoples we have relinquished control, it's almost like shared management ... And how scientific knowledge often supersedes Indigenous knowledge. So I'm always wary of it. It's not to say that shared arrangements like that cannot work ... But ultimately you want reclamation of that land for your own purposes for Indigenous peoples.

In BC, decision-making for resources such as water is assumed by the Crown. The following quotation from a BC provincial bureaucrat reveals a perspective about the role of Indigenous knowledge systems in Crown decision-making:

First Nations ... have a fundamentally different vision of water—what it is, what it means, how to take care of it. How to incorporate that into thinking about water management is something we haven't done much of. ... I do not know what [the government is] doing about [Indigenous knowledge systems] or with it. We agreed that we don't understand everything, therefore if First Nations have stuff to contribute and they want to bring that to this discussion about water management, we will certainly hear it and listen to it, and see what we can do with it.

This quotation demonstrates how considerations of power imbalances are absent from non-Indigenous reflections on the incorporation of Indigenous knowledge systems. This individual suggests that Indigenous people simply need to speak up, with the result that Indigenous perspectives would then be incorporated into the provincial decision-making around water. The next quotation, from one of Indigenous leaders interviewed, is an example of how power imbalances with regard to dominant scientific knowledge prevent the sharing or incorporation of Indigenous knowledge systems:

When I first started [going to meetings with government officials], I would talk about our Indigenous knowledge systems on water all the time. Then I got to the point where I felt that I shouldn't because it just wasn't being taken seriously. That is hard on an individual level to not be taken seriously. People don't speak from the heart at those meetings, they speak from their brains and the hats that they wear to the meeting. It is a 9:00-5:00 [job] for them. Whereas for me it is not, it is something different, it is my way of life. In that way, it is not equitable.

The results indicated that in many cases, Indigenous people perceived a power imbalance regarding the role of Indigenous knowledge systems in environmental

decision-making. The further potential for that knowledge to be misused, thus compromising assertions of Indigenous self-determination in their traditional territories, further discourages the sharing of Indigenous knowledge systems within collaborative decision-making processes.

D. Indigenous peoples and Indigenous knowledge-holders ought to be the ones who make the environmental decisions based on Indigenous knowledge systems.

While many interviewees noted that they had yet to meaningfully incorporate Indigenous knowledge systems into collaborative decision-making, interviewees from one organization, the Friends of the Nemaiah Valley had been successful. Interviewees from the Friends of the Nemaiah Valley described working closely with the Xeni Gwet'in First Nation⁶ whose traditional territory was the one where decisions were being made regarding water governance. This First Nation, who has been involved in a multi-decade struggle toward self-determination, developed an interrelationship with the Friends of the Nemaiah Valley that was unlike the relationship between First Nations and other water governance organizations. The Friends of the Nemaiah Valley collaborated directly with the First Nations chief and council. Since personnel within the Friends of the Nemaiah Valley did not view themselves as holders of Indigenous knowledge systems, they valued the knowledge by supporting the First Nation in using it for their own decision-making, as well as in collaboration between the First Nation and the organization. Instead of viewing the knowledge as something that could be incorporated in their own decision-making, they supported Indigenous self-determination by supporting and deferring to the First Nation's ongoing use of that knowledge in making decisions about their own lands. The following quotation from one Indigenous leader based near one of the other organizations involved in water governance highlights this point: "I think it is meaningful if ... First Nations groups take on and implement their own water policies in their own territories. I think that is the main step, because we have always been doing it. We have always had our own people looking after our water, keeping the territory clean, and keeping the water clean."

This case of the Friends of the Nemaiah Valley was an exception to the findings of the three other cases. This case is outside the norm in two respects. First, in both BC and Canadian contexts, Indigenous peoples are often legally prevented from making environmental decisions. It is somewhat unusual that the Xeni Gwet'in have had successes in asserting decision-making control within their traditional territory. Second, unlike the other non-Indigenous collaborative decision-makers in the other cases, the personnel of the Friends of the Nemaiah Valley deferred to the First Nation

to lead environmental decision-making. This finding points to a single exception that serves as a potential solution to problems of Indigenous knowledge integration.

E. Indigenous knowledge systems have most relevance in the local environment in which they were developed.

Engaging Indigenous knowledge systems in the local environment in which they were developed may have been overlooked by some organizations involved in collaborative water governance. The following quotation by one of the Indigenous leaders interviewed outlines a difference between Indigenous approaches to environmental governance, in contrast to the broad application of Western science:

Each [Indigenous] nation, [and] each people is their own distinct way of looking at an issue like water, their own distinct way of knowing about [the] issue, and their own distinct way of how they are going to deal with the issue. Each have their own responsibilities in their own territory, and that is specific to their territory unlike Western science that thinks it's that the same thing that blankets the entire globe. I would never be so arrogant to say that [our Indigenous] knowledge should apply outside of [our] territory, ever. That is only something that Western science does. That is very different from Indigenous knowledge.

This observation of the difference between local and universal applications of Indigenous knowledge systems and science respectively is important for organizations involved in collaborative water governance. It highlights the assumption being made by individuals familiar with the universal “laws” of science but less so with Indigenous knowledge systems. Application of Indigenous knowledge systems by Indigenous peoples tends to occur locally in their own traditional homelands and in culturally specific ways. In contrast, scientific environmental knowledge tends to be applied from microscopic to universal scales.

Discussion

The findings from the analysis presented above revealed two overarching themes: (1) challenges to the incorporation of Indigenous knowledge systems into non-Indigenous collaborative water governance processes, and (2) opportunities for the meaningful application of Indigenous knowledge systems in environmental decision-making. Two major challenges were evident. First, a gap clearly exists between recognition of Indigenous knowledge systems and their application in non-Indigenous collaborative environmental governance. A second major challenge centred on the differing world views between Western science and Indigenous knowledge systems and

unresolved power imbalances between Indigenous peoples and settler society. In BC, in the context of governance for water, there are challenges to meaningfully incorporating Indigenous knowledge systems into decision-making. This lack of meaningful incorporation resulted from disparate world views between Indigenous and scientific knowledge-holders, power imbalances, and contested title to land. This gap in world views has been identified in other collaborative environmental governance contexts, such as wildlife management, fisheries, and forestry (von der Porten and de Loë 2013). The findings used to characterize the broader picture of collaborative water governance in BC are built upon the four case studies selected. Although these cases represent only four of many other examples of water governance organizations, three of these cases are very prominent ones—those involving the province, Columbia Basin Trust, and the Okanagan Basin Water Board.

Although the results primarily pointed to the challenges of incorporating Indigenous knowledge systems in collaborative processes for water governance, two opportunities also emerged. One opportunity was for the meaningful application of Indigenous knowledge systems through better support of Indigenous peoples to make environmental decisions using Indigenous knowledge systems. The second opportunity relates to the role of Indigenous knowledge systems as situated knowledges, i.e., to consider Indigenous knowledge systems in the local environment in which they have developed. Within a single jurisdiction, such as a province, there could be a multitude of Indigenous knowledge systems. In collaborative environmental governance, more emphasis could be placed on ways to support the continued application of Indigenous knowledge systems by Indigenous peoples for environmental decision-making in their traditional territories. This opportunity for local application of knowledge systems is supported in academic literature. For example, while Coombes (2007a, 188) argues that Indigenous knowledge has been “recast as valued local knowledge, something which renders it parochial and, therefore, of limited applicability,” other authors have demonstrated the power and importance of locally applied Indigenous knowledge systems (e.g., Bowie 2013; Longboat 2015; Spak 2005).

The role of power emerged as a factor influencing the extent to which Indigenous knowledge systems were integrated into decision-making in this study. On the one hand, non-Indigenous interviewees from organizations involved in collaborative water governance viewed Indigenous knowledge systems as something that could possibly be integrated into decision-making if applicable, and did not demonstrate awareness of well-documented power imbalances and how they could hinder integration (Nadasdy 2007). On the other hand, Indigenous individuals noted the difference in world views and how power imbalances hindered their ability to use that

knowledge in decision-making. One person emphasized feelings of alienation that resulted from bringing up Indigenous knowledge systems in a collaborative setting with non-Indigenous environmental decision-makers. The inequality and tension between government scientists and Indigenous knowledge systems-holders has been documented elsewhere. In many settings, scientists have been, in effect, the “high priests of the positivist-reductionist paradigm” (Berkas 2010)—reluctant to share the legitimacy of their expertise. Nadasdy argues that despite the rhetoric about the value of Indigenous knowledge systems, the incorporation of Indigenous knowledge systems still implies data produced and verified by biologists rather than “the uncorroborated testimony of [First Nation] elders” (Nadasdy 2007); he asserts that Indigenous knowledge systems cannot truly be “incorporated” into management processes until Indigenous people have achieved full and meaningful decision-making authority (Nadasdy 1999, 13). Until that power divide is closed, Indigenous peoples will continue to face challenges in realizing meaningful incorporation of their knowledge systems into collaborative environmental governance.

Some collaborative environmental governance scholars have advocated for the better inclusion of Indigenous knowledge systems in decision-making (e.g., Jackson et al. 2012; O’Flaherty, Davidson-Hunt, and Manseau 2008). These assumptions stem from the set of ideas that collaboration is based on (e.g., inclusion-based problem-solving) and the idea that the two knowledges can be interwoven under the current science-dominated collaborative governance regimes (Innes and Booher 2010). Even so, there is a gap between the assumptions held by collaborative environmental governance scholars about how to incorporate Indigenous knowledge systems, and the view some Indigenous governance scholars hold about the role of Indigenous knowledge systems in realizing self-determination. Scholars of collaborative approaches to environmental problem-solving have taken steps towards closing this gap by recognizing (a) the epistemological divide that poses a challenge for integrating Indigenous knowledge systems into science (Cundill, Fabricus, and Marti 2005), and (b) the privileged position of scientific knowledge over Indigenous knowledge systems in mainstream processes of environmental decision-making (Jacobson and Stephens 2009; Lane and Corbett 2005). Still, the assumption that these knowledges ought to be integrated, despite the recognition of these gaps, needs to be reconsidered given the assertions of Indigenous governance scholars regarding self-determination (e.g., Alfred 2009; Corn tassel 2012). Views that Indigenous knowledge systems should be integrated into non-Indigenous environmental decision-making in contexts where “certain responsibilities [are allocated] to First Nations” (O’Flaherty et al 2008, 1) and where there is political pressure to “accommodate local First Nations’ interests” (11) short-change a more important application of the knowledge. That application

is for Indigenous nations to resume or continue their own environmental decision-making in their traditional territories using their Indigenous knowledge systems whether or not it is a part of non-Indigenous collaborative environmental governance. This contrasts from collaborative environmental decision-makers external to the Indigenous nation attempting to accommodate Indigenous knowledge systems.

An important result related to risk exposure emerged from the research in the BC setting where the title to Indigenous traditional territories is contested by the Crown and First Nations. One of the respondents in this research noted the risk of Indigenous peoples' sharing their knowledge because of the potential that this action could be viewed as relinquishing decision-making to the Crown. This risk is corroborated by Indigenous scholar Mucina (2008, 56), who notes that while there are positive aspects to the acknowledgement of oral traditions, it can also "expose Indigenous knowledge systems to cooptation." As in the case of BC, many issues of power and Indigenous title to land remain in colonial societies:

Resource management strategies that ostensibly create opportunities for traditional owners to exercise their rights and responsibilities to country under traditional law and custom but which in reality privilege Western management systems, demonstrate the strength of the epistemological divide between Western ways of understanding the world and [I]ndigenous knowledge. Until these misunderstandings and barriers are dismantled, [I]ndigenous disadvantage will continue (Ross and Bigge 2009, 239)

Therefore, if Indigenous nations chose to cultivate Indigenous nationhood (Alfred and Corntassel 2005) and self-determination (Corntassel and Witmer 2008), the sharing of Indigenous knowledge with non-Indigenous environmental decision-makers must be considered carefully while Indigenous peoples continue to negotiate relationships with colonial governments and peoples.

This research suggests that collaborative environmental governance ought to have a distinct set of considerations regarding Indigenous knowledge systems. An example of these considerations from this research was seen in the case of the Friends of the Nemaiah Valley where the organization followed the lead of the First Nation in how Indigenous knowledge systems should be shared or used. This distinction is supported by findings from the three other cases in this research; these findings indicated that considerations should include a better understanding of differing world views and the role of scientific knowledge as a dominant knowledge supported by powerful institutions such as governments and universities. These considerations should be further contextualized by Indigenous governance scholarship, which tends to view the ongoing growth and application of Indigenous knowledge systems as part

of self-determination (e.g., [Johnson 2010](#); [McGregor 2011](#); [Memon and Kirk 2012](#)). Further, Indigenous governance scholars [Jeff Corntassel and Cheryl Bryce \(2012, 156\)](#) emphasize the importance of Indigenous peoples' "relationships to their homelands and the transmission of this traditional knowledge to future generations." How that knowledge will be transmitted will be determined by Indigenous nations themselves. Indigenous communities, governments, and environmental NGOs are not homogeneous and there exists diversity of experience, expertise and opinions regarding the role of Indigenous knowledges and Western science in environmental governance ([Adams et al. 2014](#); [Martin-Hill 1996](#)). There are certainly some scientists and scholars seeking to utilize Indigenous knowledges in novel ways that move beyond the binary in collaborative water governance initiatives ([Castleden and Skinner 2014](#)).

The connection between the use of Indigenous knowledge systems and "cultural survival ... empowerment, local control of land and resources, cultural revitalization, and self-determination" is also noted by non-Indigenous scholar Fikret Berkes (2008, 31). The continued application of Indigenous knowledge systems by Indigenous peoples does not necessarily support the incorporation of this knowledge into collaborative environmental governance processes directly. There is an opportunity for collaborative environmental governance practitioners to further deliberate on how to support the continued growth and use of this situated knowledge of Indigenous peoples who have made decisions in that context for millennia. This approach would shift the assumption that Indigenous knowledge systems can "fit" into predominantly science-based decision-making, and would also address, in part, the issue of power imbalances.

Conclusion

This empirical research in BC revealed attempts by people involved in collaborative water governance to integrate Indigenous knowledge systems into decision-making. Despite these attempts, and with one exception, this form of knowledge did not in reality play a significant role in the collaborative processes examined. This disparity between attempts to integrate Indigenous knowledge and the actual influence of the knowledge is consistent with the position of Indigenous knowledge systems in Canada more broadly. With a few exceptions, such as in the Northwest Territories, Indigenous voices do not have enough influence on water governance in Canada to date ([Sandford and Phare 2011](#)). As a result, it is unlikely that, in the near term, Indigenous knowledge about the environment will gain the same influence as more dominant, Western knowledge systems in decision-making: "The triumph of the scientific method, deploying the technically esoteric knowledge of its experts, has

led to its domination over all other ways of knowing” (Funtowicz and Ravetz 1993, 741). Given the historically subordinate position of Indigenous knowledge systems as compared to science (Tsuji and Ho 2002), and the disempowerment of Indigenous peoples in water-related decision-making in Canada, the co-application of Western science and Indigenous knowledge systems can only be meaningful if power differences can be overcome.

While some First Nations in Canada have indicated a willingness to share their knowledge to contribute to positive ways in which water is managed (Chiefs of Ontario 2007), there has been frustration in other First Nation communities regarding the ways in which their shared knowledge is documented by others, is filed away, and does not reach the next generations (Nadasdy 1999). This study reports that, despite 30 years of grappling with the question of integration of Indigenous knowledge systems, little has changed and the problems persist. The empirical observations from this research corroborate these problems with knowledge system integration, but also hint at potential solutions needed to alter the typical outcomes achieved to date. In the near term, Indigenous peoples can support their own knowledge systems by continuing to apply their own knowledge and ways of living. In some cases, such as in some examples from in this research, sharing the knowledge with non-Indigenous decision-makers may or may not align with goals such as resurgence and self-determination. Conversely, rather than trying to gain from and utilize Indigenous knowledge systems, this research supports the idea that non-Indigenous environmental practitioners could value this knowledge by finding ways to support Indigenous peoples in making decisions about their traditional territories. This argument emerges primarily from thinking in Indigenous governance scholarship, which has a global orientation. Hence, we suggest that the ideas advanced in this paper—which are grounded in Canadian experiences—may be relevant in other countries where colonization has occurred on Indigenous territories.

These practical-level findings should inform collaborative environmental governance, particularly that which recognizes and advocates for the incorporation of Indigenous knowledge systems (e.g., Forbes and Stammler 2009; Mow et al. 2007; Woodward et al. 2012). The barriers to Indigenous knowledge systems incorporation, such as power imbalances and differences in world views, are recognized by some collaborative governance scholars (e.g., Greskiw and Innes 2008; Shackeroff and Campbell 2007). None the less, the assumption that Indigenous knowledge systems can be incorporated into non-Indigenous collaborative environmental governance is problematic. Indigenous peoples who work within coercive, Western-scientific processes are forced to operate and think in non-Indigenous terms, frequently resulting in the loss of meaning of Indigenous knowledge systems (McGregor

2004). Additionally, Indigenous knowledge systems and Western science come from seemingly different human value systems, and comparing them is an “almost self-defeating task when the multidimensional nature of [Indigenous] knowledge is forgotten” (Kendrick 2003). Thus, Indigenous governance scholars assert a role for Indigenous knowledge systems that does not necessarily involve its incorporation into non-Indigenous decision-making: some Indigenous scholars suggest that this knowledge should be continually applied by Indigenous peoples as a part of Indigenous nationhood (Alfred 2009; Simpson 2008). The risks of Indigenous knowledge systems integration include dilution, assimilation, and co-optation. With these risks and challenges in mind, this research suggests a different approach by collaborative practitioners hoping to integrate Indigenous knowledge systems—namely, an approach where the plan for collaboration begins by incorporating concepts of Indigenous governance related to self-determination in discussions of Indigenous knowledge systems.

NOTES

We acknowledge and thank all the participants in this study, especially those from the Xeni Gwet'in First Nation, Okanagan Nation, Ktunaxa Nation, Sinixt Nation, Tahltan Nation, UBCIC, First Nations Summit, Friends of the Nemaiah Valley, Okanagan Basin Water Board, Columbia Basin Trust, and the Water Stewardship Division. This research was financially supported by the Social Sciences and Humanities Research Council and the Canadian Water Network.

1. Although *collaboration* is considered by many disciplines, the collaboration discussed in this paper is specific to collaborative or shared decision-making in an environmental context.
2. While the provincial jurisdiction of British Columbia was used to bound the context of this research, we acknowledge the importance of recognizing that BC is a colonial jurisdiction imposed upon the unceded Indigenous traditional territories within this area. Figure 1 shows these overlapping jurisdictions.
3. While First Nations reserves are managed at a federal level in Canada, fresh water in British Columbia is under Provincial jurisdiction. Provincial bureaucrats were interviewed because they make decisions about water in the province within unceded Indigenous traditional territory.
4. The province asserts the authority to make decisions about fresh water in the province, including, access, quality, allocation, drinking water, industrial use, diversion, etc.
5. No Métis or Inuit were interviewed in this research.
6. The Xeni Gwet'in First Nation are part of the Tsilhqot'in Nation and the originators of the landmark 2014 Tsilhqot'in Supreme Court of Canada case (*Tsilhqot'in Nation v. British Columbia* 2014) mentioned earlier in this paper; the decision came after this research was completed.

REFERENCES

- Adams, M., J. Carpenter, J.A. Housty, D. Neasloss, P.C. Paquet, C.N. Service, J. Walkus, and C.T. Darimont. 2014. *De-Centering the University from Community-Based Research: A Framework for Engagement between Academic and Indigenous Collaborators in Conservation and Natural Resource Research*. Bioéthique.
- Alfred, T. 2009. *Peace, Power, Righteousness: An Indigenous Manifesto*. 2nd edition. Don Mills: Oxford University Press.
- Alfred, T. and J. Corntassel. 2005. "Being Indigenous: Resurgences Against Contemporary Colonialism." *Politics of Identity* 9: 597-614. <http://dx.doi.org/j.1477-7053.2005.00166.x>.
- Allen, W., J.M. Ataria, J.M. Apgar, G. Hamsworth, and L.A. Tremblay. 2009. "Kia pono te mahi putaiao—doing science in the right spirit." *Journal of the Royal Society of New Zealand* 39(4): 239-42. <http://dx.doi.org/10.1080/03014220909510588>.
- Barbour, W., and C. Schlesinger. 2012. "Who's the Boss? Post-colonialism, Ecological Research and Conservation Management on Australian Indigenous Lands." *Ecological Management and Restoration* 13 (1): 37-45. <http://dx.doi.org/10.1111/j.1442-8903.2011.00632.x>.
- Bark, R.H., D.E. Garrick, C.J. Robinson, and S. Jackson. 2012. "Adaptive Basin Governance and the Prospects for Meeting Indigenous Water Claims." *Environmental Science and Policy* 19 (20): 169-77. <http://dx.doi.org/10.1016/j.envsci.2012.03.005>.
- Berkes, F. 2008. *Sacred Ecology*. 2nd ed. London: Routledge.
- . 2010. "Shifting Perspectives on Resource Management: Resilience and the Reconceptualization of 'Natural Resources' and 'Management'." *MAST* 9 (1): 13-40.
- Berkes, F., M.K. Berkes, and H. Fast. 2007. "Collaborative Integrated Management in Canada's North: The Role of Local and Traditional Knowledge and Community-Based Monitoring." *Coastal Management* 35 (1): 143-62. <http://dx.doi.org/10.1080/08920750600970487>.
- Borrows, J. 2005. *Crown Occupations of Land: A History and Comparison*. Prepared by the Ipperwash Inquiry. Office of the Attorney General of Ontario, www.attorneygeneral.jus.gov.on.ca/inquiries/ipperwash/policy_part/research/index.html.
- Bowie, R. 2013. "Indigenous Self-Governance and the Deployment of Knowledge in Collaborative Environmental Governance in Canada." *Journal of Canadian Studies* 47 (1): 91-121.
- Castleden, H., and E. Skinner. 2014. "Whitewashing Indigenous Water Rights in Canada: How Can We Indigenize Climate Change Adaptation If We Ignore the Fundamentals?" In *Adaptation to Climate Change through Water Resource Management: Capacity, Equity, and Sustainability*, edited by D. Stucker and E. Lopez-Gunn, 223-43. London, UK: EarthScan.
- Chiefs of Ontario. 2007. *Aboriginal Traditional Knowledge and Source Water Protection: First Nations' Views on Taking Care of Water*. n.p.: Chiefs of Ontario.
- Christensen, J., and M. Grant. 2007. "How Political Change Paved the Way for Indigenous Knowledge: The Mackenzie Valley Resource Management Act." *Arctic* 60 (2): 115-23.
- Claxton, N.X. 2008. "To fish as formerly: The Douglas Treaties and the WSANEC Reef-net Fisheries." In *Lighting the Eighth Fire: The Liberation, Resurgence, and Protection of Indigenous Nations*, edited by L. Simpson, 49-64. Winnipeg: Arbeiter Ring.

- Coombes, B. 2007a. "Defending Community? Indigeneity, Self-determination and Institutional Ambivalence in the Restoration of Lake Whakaki." *Geoforum* 38: 60-72. <http://dx.doi.org/10.1016/j.geoforum.2006.05.006>.
- . 2007b. "Postcolonial Conservation and Kiekie Harvests at Morere New Zealand: Abstracting Indigenous Knowledge from Indigenous Polities." *Geographical Research* 45 (2): 186-93. <http://dx.doi.org/10.1111/j.1745-5871.2007.00450.x>.
- Corntassel, J. 2003. "Who Is Indigenous? 'Peoplehood' and Ethnonationalist Approaches to Rearticulating Indigenous Identity." *Nationalism and Ethnic Politics* 9 (1): 75-100. <http://dx.doi.org/10.1080/1353711041233101365>.
- . 2012. "Cultural Restoration in International Law: Pathways to Indigenous Self-determination." *Canadian Journal of Human Rights* 1 (1): 93-125.
- Corntassel, J., and C. Bryce. 2012. "Practicing Sustainable Self-determination: Indigenous Approaches to Cultural Restoration and Revitalization." *Brown Journal of World Affairs* 18 (2): 151-62.
- Corntassel, J., and R.C Witmer. 2008. *Forced Federalism: Contemporary Challenges to Indigenous Nationhood*. Norman: University of Oklahoma Press.
- Cundill, G., C. Fabricius, and N. Marti. 2005. "Foghorns to the future: using knowledge and transdisciplinarity to navigate complex systems." *Ecology and Society* 10(2). <http://www.ecologyandsociety.org/vol10/iss2/art8/>.
- Ellis, S.C. 2005. "Meaningful Consideration? A Review of Traditional Knowledge in Environmental Decision making." *Arctic* 58 (1): 66-77.
- Forbes, B., and F. Stammer. 2009. "Arctic Climate Change Discourse: The Contrasting Politics of Research Agendas in the West and Russia." *Polar Research* 28: 28-42. <http://dx.doi.org/10.1111/j.1751-8369.2009.00100.x>.
- Funtowicz, S.O., and J.R. Ravetz. 1993. "Science for the Post-normal Age." *Futures* 25 (7): 739-55. [http://dx.doi.org/10.1016/0016-3287\(93\)90022-L](http://dx.doi.org/10.1016/0016-3287(93)90022-L).
- Gladstone, J.W., S. L. Dupuis, and E. Wexler. 2006. "Changes in Family Involvement Following a Relative's Move to a Long-term Care Facility." *Canadian Journal on Aging* 25 (1): 93-106. <http://dx.doi.org/10.1353/cja.2006.0022>.
- Greskiw, G., and J. Innes. 2008. "Comanaging Communication Crises and Opportunities between Northern Secwepemc First Nations and the Province of British Columbia." *Canadian Journal of Forest Research* 38: 1935-46. <http://dx.doi.org/10.1139/X08-015>.
- Gunningham, N. 2009. "The New Collaborative Environmental Governance: The Localization of Regulation." *Journal of Law and Society* 36 (1): 145-66. <http://dx.doi.org/j.1467-6478.2009.00461.x>.
- Hoverman, S., and M. Ayre. 2012. "Methods and Approaches to Support Indigenous Water Planning: An Example from the Tiwi Islands, Northern Territory, Australia." *Journal of Hydrology* 474: 47-56. <http://dx.doi.org/10.1016/j.hydrol.2012.03.005>.
- Innes, J.E., and D.E. Booher. 1999. "Consensus Building and Complex Adaptive Systems: A Framework for Evaluating Collaborative Planning." *Journal of the American Planning Association* 65 (4): 412-22. <http://dx.doi.org/10.1080/01944369908796071>.

- . 2010. *Planning with Complexity: An Introduction to Collaborative Rationality for Public Policy*. New York: Routledge.
- International Council for Science. 2002. *Science and Traditional Knowledge: Report from the ICSU Study Group on Science and Traditional Knowledge*. Paris: ICSU.
- Jackson, S., P.L. Tan, C. Mooney, S. Hoverman, and I. White. 2012. "Principles and Guidelines for Good Practice in Indigenous Engagement in Water Planning." *Journal of Hydrology* (474): 57-65. <http://dx.doi.org/10.1016/j.jhydrol.2011.12.015>.
- Jacobson, C., and A. Stephens. 2009. "Cross-cultural Approaches to Environmental Research and Management: A Response to the Dualisms Inherent in Western Science?" *Journal of the Royal Society of New Zealand* 39 (4): 159-62. <http://dx.doi.org/10.1080/0301422090510570>.
- Johnson, J.T. 2010. "Place-based Learning and Knowing: Critical Pedagogies Grounded in Indigeneity." *GeoJournal* 77 (6): 829-36. <http://dx.doi.org/10.1007/s10708-010-9379-1>.
- Kendrick, A. 2003. "Caribou Co-management in Northern Canada: Fostering Multiple Ways of Knowing." In *Navigating Social-Ecological Systems*, edited by F. Berkes, J. Colding, and C. Folke, 241-67. Cambridge: Cambridge University Press.
- The Kino-nda-niimi Collective. 2014. *#IdleNoMore in a Historical Context*. Winnipeg: ARP.
- Lane, M.B., and T. Corbett. 2005. "The Tyranny of Localism: Indigenous Participation in Community-Based Environmental Management." *Journal of Environmental Policy and Planning* 7 (2): 141-59. <http://dx.doi.org/10.15239080500338671>.
- Latulippe, N. 2015. "Situating the Work—A Typology of Traditional Knowledge Literature." *Alter-native* 11 (2): 118-31.
- Lawless, J., D. Taylor, R. Marshall, E. Nickerson, and K. Anderson. 2015. "Meaningful Engagement: Women, Diverse Identities and Indigenous Water and Wastewater Responsibilities." *Canadian Woman Studies / les cahiers de la femme* 30 (2-3): 81-88.
- Longboat, S. 2015. "First Nations Water Security: Security for Mother Earth." *Canadian Woman Studies / les cahiers de la femme* 30 (2-3): 6-13.
- Martin-Hill, D. 1996. *Designing a New Paradigm Based on Traditional Knowledge and Culture. Embracing Mother Earth: A Rapporteur's Report on the Indigenous Knowledge Conference*. Ithaca: Akwe:kon Press.
- McGregor, D. 2004. "Traditional Ecological Knowledge and Sustainable Development: Towards Coexistence." In *In the Way of Development: Indigenous Peoples, Life Projects and Globalization*, edited by M. Blaser, H.A. Feit, and G. McRae, 72-91. London: Zed.
- . 2009. "Honouring our Relations: An Anishnaabe Perspective on Environmental Justice." In *Speaking for Ourselves: Environmental Justice in Canada*, edited by J. Agyeman et al., 27-42. Vancouver: University of British Columbia Press.
- . 2011. "Aboriginal/Non-Aboriginal Relations and Sustainable Forest Management in Canada: The Influence of the Royal Commission on Aboriginal Peoples." *Journal of Environmental Management* 92 (2): 300-10. <http://dx.doi.org/10.1016/j.jenvman.2009.09.038>.
- Memon, P.A., and N. Kirk. 2012. "Role of Indigenous Maori People in Collaborative Water Governance in Aotearoa/New Zealand." *Journal of Environmental Planning and Management* 55 (7): 941-59. <http://dx.doi.org/10.1080/09640568.2011.634577>.

- Morris, T. and O.M. Brandes. 2013. *The State of the Water Movement in British Columbia: A Waterscape Scan and Needs Assessment of B.C. Watershed-Based Group*. Victoria: Polis Project on Ecological Governance.
- Mow, J.M., E. Taylor, M. Howard, M. Baine, E. Connolly, and M. Chiquillo. 2007. "Collaborative Planning and Management of the San Andres Archipelago's Coastal and Marine Resources: A Short Communication on the Evolution of the Seaflower Marine Protected Area." *Ocean and Coastal Management* 50: 209-22. <http://dx.doi.org/j.ocecoaman.2006.09.001>.
- Mucina, Devi. 2008. "Revitalising Memory in Honour of Traditional Maseko Ngoni Governance." *AlterNative: An International Journal of Indigenous Peoples* 4 (2): 39-58.
- Nadasdy, P. 1999. "The Politics of TEK: Power and the 'Integration' of Knowledge." *Arctic Anthropology* 36 (1-2): 1-18.
- . 2007. "Adaptive Co-management and the Gospel of Resilience." In *Adaptive Co-Management: Collaboration, Learning and Multi-Level Governance*, edited by D. Armitage, F. Berkes, and N. Doubleday, 208-27. Vancouver: University of British Columbia Press.
- Nowlan, L. and K. Bakker. 2007. *Delegating Water Governance: Issues and Challenges in the BC Context*. Vancouver: University of British Columbia Program on Water Governance.
- O'Flaherty, R.M., I.J. Davidson-Hunt, and M. Manseau. 2008. "Indigenous Knowledge and Values in Planning for Sustainable Forestry: Pikangikum First Nation and the Whitefeather Forest Initiative." *Ecology and Society* 31 (1). <http://www.ecologyandsociety.org/vol13/iss1/art6/>.
- Pierotti, R., and D.R. Wildcat. 2000. "Traditional Ecological Knowledge: The Third Alternative (Commentary)." *Ecological Applications* 10 (5): 1333-40. [http://dx.doi.org/1051-0761\(2000\)010\[1333:TEKTTA\]2.o.CO;2](http://dx.doi.org/1051-0761(2000)010[1333:TEKTTA]2.o.CO;2).
- Pragnell, J., A. Ross, and B. Coghill. 2010. "Power Relations and Community Involvement in Landscape-based Cultural Heritage Management Practice: An Australian Case Study." *International Journal of Heritage Studies* 3 (1-2): 140-55. <http://dx.doi.org/10.1080/13527250903441838>.
- Prober, S.M., M.H. O'Connor, and F.J. Walsh. 2011. "Australian Aboriginal Peoples' Seasonal Knowledge: A potential Bases for Shared Understanding in Environmental Management." *Ecology and Society* 16 (2): 1-12.
- Raffles, H. 2002. "Intimate knowledge." *Social Science Journal* 54 (173): 325-35. <http://dx.doi.org/10.1111/1468-2451.00385>.
- Ross, A., and C. Bigge. 2009. "Australia." In *The Indigenous World 2009*, edited by K. Wessendorf, 232-42. Somerset, NJ: The International Work Group for Indigenous Affairs.
- Royal Commission on Aboriginal Peoples. 1996. "Restructuring the Relationship." Vol. 2 of Report by the Royal Commission On Aboriginal Peoples. Ottawa.
- Sandford, R.W., and M.A. Phare. 2011. *Ethical Water: Learning to Value What Matters Most*. Vancouver: Rocky Mountain Books.
- Seale, C. 2004. "Generating Grounded Theory." In *Researching Society and Culture*, edited by C. Seale, 2nd ed., 239-47. Thousand Oaks: Sage.
- Shackeroff, J.M., and L.M. Campbell. 2007. "Traditional Ecological Knowledge in Conservation Research: Problems and Prospects for Their Constructive Engagement." *Conservation and Society* 5 (3): 343-60.

- Sileshi, G.W., E. Kuntashula, P. Matakala, and P.O. Nkunika. 2008. "Farmers' Perceptions of Tree Mortality, Pests and Pest Management Practices in Agroforestry in Malawi, Mozambique and Zambia." *Agroforestry Systems* 72 (2): 87-101. <http://dx.doi.org/10.1007/s01457-007-9082-5>.
- Simpson, L. 2008. *Lighting the Eighth Fire: The Liberation, Resurgence, and Protection of Indigenous Nations*. Winnipeg: Arbeiter Ring.
- Spak, S. 2005. "The Position of Indigenous Knowledge in Canadian Co-management Organizations." *Anthropologica* 47 (2): 233-46.
- Stacey, N., A.V. Izurieta, and S.T. Garnett. 2013. "Collaborative Measurement of Performance of Jointly Managed Protected areas in Northern Australia." *Ecology and Society* 18 (1): 1-19. <http://dx.doi.org/10.5751/es-05273-180119>.
- Tipa, G., and R. Welsh. 2006. "Comanagement of Natural Resources: Issues of Definition from an Indigenous Community Perspective." *Journal of Applied Behavioral Science* 42: 373-91. <http://dx.doi.org/10.1177/0021886306287738>.
- Tsilhqot'in Nation v British Columbia*, [2014] 2 Canada Supreme Court Reports 257, 374 Dominion Law Reports (4th) 1.
- Tsuji, L., and E. Ho. 2002. "Traditional Environmental Knowledge and Western Science: In Search of Common Ground." *Canadian Journal of Native Studies* 22 (2): 327-60.
- Turner, N.J., M.B. Ignace, and R. Ignace. 2000. "Traditional Ecological Knowledge and Wisdom of Aboriginal Peoples in British Columbia." *Ecological Applications* 10 (5): 1275-87. [http://dx.doi.org/10.1890/1051-0761\(2000\)010\[1275:TEKAWO\]2.0.CO;2](http://dx.doi.org/10.1890/1051-0761(2000)010[1275:TEKAWO]2.0.CO;2).
- van Tol Smit, E., R. de Loe, and R. Plummer. 2015. "How Knowledge is Used in Collaborative Environmental Governance: Water Classification in New Brunswick, Canada." *Journal of Environmental Planning and Management* 58 (3): 423-44. <http://dx.doi.org/10.1080/09640568.2013.860017>.
- von der Porten, S., and R.C. de Loë. 2013. "Collaborative Approaches to Governance for Water and Indigenous Peoples: A Case Study from British Columbia, Canada." *Geoforum* 50: 149-60. <http://dx.doi.org/10.1016/j.geoforum.2013.09.001>.
- . 2014a. "How Collaborative Approaches to Environmental Problem Solving View Indigenous Peoples: A Systematic Review." *Society and Natural Resources* 27 (10): 1040-56. <http://dx.doi.org/10.1080/08941920.2014.918232>.
- . 2014b. "Water Policy Reform and Indigenous Governance." *Water Policy* 16: 222-43. <http://dx.doi.org/10.2166/wp.2013.046>.
- Watson, A. 2013. "Misunderstanding the 'Nature' of Co-management: A Geography of Regulatory Science and Indigenous Knowledge (IK)." *Environmental Management* 52 (5): 1085-1102. <http://dx.doi.org/10.1007/s00267-013-0111-z>.
- Weatherhead, E.K., S. Gearheard, and R.G. Barry. 2010. "Changes in Weather Persistence: Insight from Inuit Knowledge." *Global Environmental Change* 20 (3): 523-28. <http://dx.doi.org/10.1016/j.gloenvcha.2010.02.002>.
- Whyte, K.P. 2013. "On the Role of Traditional Ecological Knowledge as a Collaborative Concept: A Philosophical Study." *Ecological Processes* 2 (7): 1-12. <http://dx.doi.org/10.1186/2192-1709-2-7>.

- Wilson, N. 2014. "Indigenous Water Governance: Insights from the Hydrosocial Relations of the Koyukon Athabascan Village of Ruby, Alaska." *Geoforum* 57: 1-11. <http://dx.doi.org/10.1016/j.geoforum.2014.08.005>.
- Woodward, E., S. Jackson, M. Finn, and P.M. McTaggart. 2012. "Utilising Indigenous Seasonal Knowledge to Understand Aquatic Resource Use and Inform Water Resource Management in Northern Australia." *Ecological Management and Restoration* 13 (1): 58-64. <http://dx.doi.org/10.1111/j.4442.8903.2011.00622.x>.
- World Commission on Environment and Development. 1987. *Our Common Future*. London, ON: Oxford University Press.
- Youngblood Henderson, J.S. 2000. "The Context of the State of Nature." In *Reclaiming Indigenous Voice and Vision*, edited by M. Battiste, 11-38. Vancouver: University of British Columbia Press.