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# Colonialism in Community-Based Monitoring: Knowledge Systems, Finance, and Power in Canada

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Community-based monitoring (CBM) programs are increasingly popular models of environmental governance around the world. Accordingly, a handful of review papers have highlighted the various benefits, challenges, and governance models associated with their uptake. These reviews have been pragmatic in their recommendations and have supported CBM scholars and practitioners in implementing and understanding the various possible forms of CBM, but they have largely been silent on issues around the power dynamics implicit in CBM. Structured around explorations of the colonial politics of knowledge, funding, and finance, this article argues that dominant knowledge systems—specifically those that underpin Western, colonial governments and liberal, capitalist economies—shape the provisioning of funding for local programs and determine the significance of different types of community observations in shaping management decisions. To make this argument, we situate our work at the intersection of political economy and knowledge systems, using theoretical insights and empirical examples to show that funding and finance are key sources of power in shaping CBM programs. These are important insights because CBM is often framed as a purely scientific—and therefore politically neutral—activity. Through this work, we explore questions of intellectual property, histories of institutional exclusion and the privileging of certain knowledge systems, and the relationships of trust and mistrust across different groups and authorities, with the aim of stimulating critical discussions on the power relationships in CBM that will be useful to scholars and practitioners. *Key Words:* colonialism, community-based monitoring, Indigenous, knowledge systems, political economy.

Community-based monitoring (CBM) is an increasingly popular model of environmental governance. Commonly defined as “a process where concerned citizens, government agencies, industry, academia, community groups, and local institutions collaborate to monitor, track and respond to issues of common community [environmental] concern” (Whitelaw et al. 2003, 410), CBM has garnered increased interest for several reasons. These include government budget cuts that limit monitoring activities by public agencies; a public appetite for greater community involvement in water and land use planning and governance; ongoing needs for baseline data—that is, a solid understanding of the starting point of environmental conditions—by governments and industry alike; and increasing recognition that local expertise contributes valuable insights into changing environmental conditions. Numerous reviews of CBM and related

programs have revealed emerging patterns within the field, including the challenges of integrating multiple forms of knowledge, the instability of programs owing to funding constraints, and the barriers posed by limited technical and resource capacities.

A growing area of research is the involvement of Indigenous communities with CBM programs, especially in countries such as Canada, the United States, and Australia, where settler governments are negotiating new relationships with Indigenous peoples. The position of traditional knowledge (TK)—with the broad term referring to a range of knowledge types, including Indigenous knowledge, local knowledge, and traditional ecological knowledge—in CBM programs is of wide interest in policy settings and in the academic literature (e.g., Huntington 2000; Dudgeon and Berkes 2003; Moller et al. 2004; Parlee, Manseau, and Łutsël K'édene First Nation 2005; Pollock and Whitelaw

2005; Berkes and Davidson-Hunt 2006; Berkes and Parlee 2006).

In this literature, CBM finance is identified both as an opportunity and as a constraint. CBM has been presented as a cost-effective alternative to government-led monitoring, in part owing to its reliance on volunteers (e.g., Danielsen, Burgess, and Balmford 2005; McCarthy 2005, 2006; Robins and Dovers 2007). Funding is often presented, however, as a significant constraint in program maintenance and stability (Kouril, Furgal, and Whillans 2016) and as a requirement for more effective monitoring activity. Reviews of CBM have been pragmatic in their recommendations, from promoting training and learning opportunities (Storey et al. 2016) and “rigorous validation studies” (Danielsen, Burgess, and Balmford 2005, 2537), to having local people, rather than scientists, oversee monitoring efforts (Danielsen et al. 2010) and identifying champions and securing stable funding (Whitelaw et al. 2003). These findings support scholars and practitioners in implementing and understanding the various possible forms of CBM.

A handful of review papers have sought to highlight the various benefits, challenges, and governance models associated with CBM. Work to date has largely been silent on issues around the power structures implicit in these programs, however. Knowledge and money are not independent, and both are deeply implicated in the power dynamics that structure resource governance programs. Funding from governments and the private sector for community monitoring is inextricably linked with Western systems of valuation, exchange, and payment. Such funding requires community programs to operate within existing governance structures, operational norms, and reporting mechanisms. As a result, the subsequent knowledge that these programs generate is constrained. It is not just a question of the amount of funding available (i.e., limited money to conduct monitoring) but the conditions placed on access to funding (limits on what kinds of monitoring activities are eligible for funding). Funding is not solely a technical program to be overcome, then, but a substantive epistemological and ethical issue as well, requiring further theoretical and empirical unpacking. Finance must be understood as a key source of power in shaping CBM programs, and it is these kinds of “invisible” power dynamics that we investigate here.

In our analysis, we identify a gap in the literature on the political economy of TK, and we offer a

synthesis of work on CBM that reveals the intersections between power, knowledge systems, and finance. We argue that dominant knowledge systems—specifically those that underpin Western, colonial governments and liberal, capitalist economies—shape the provisioning of funding for local programs and determine the significance of different types of community observations in shaping management decisions. Our work has the overarching goal of stimulating critical discussions on the power relationships in CBM that will be useful to both scholars and practitioners with interests in Indigenous resurgence, decolonizing practices, and knowledge production. Building on work that presents CBM programs as deeply political in both form and function, we reveal how the political economy of monitoring intersects with knowledge and ideas to reinforce, rather than transform, governance relationships.

To do so, the article proceeds as follows. First, we outline the colonial politics of recognition and generative refusal by examining the development and practice of the settler state in Canada. We then turn specifically to CBM for water. After a brief look at the rise of CBM, we highlight the ways in which CBM perpetuates settler state logics through the promotion and use of particular kinds of knowledge, as well as through the sources of and conditions for financing. Funding mechanisms, we explain, frame CBM as an activity, led by volunteers, to gain knowledge about local water bodies and provide information to government and industry. Such framings are problematic for a variety of reasons, obscuring the power relations that underpin resource control, as they silence the unique legal relationship between Indigenous peoples and the Canadian state; privilege the measurement of metrics unique to Western science; and are premised on an understanding of the land as, primarily, a site of extractive industry. In the concluding sections, we explore the implications of our arguments for both the theory and practice of CBM but also for participatory governance initiatives more broadly.

Although our contributions are primarily to political economy and environmental governance literatures, we draw on a number of concrete Canadian examples to make our point and reiterate L. B. Simpson’s (2014) point that “‘theory’ isn’t just for academics; it’s for everyone” (7). It is our hope that our findings are of use to communities and CBM

fundes and practitioners, too. Similarly, we use Canadian examples throughout the article but expect that many themes arising from the article—questions around power, knowledge, finance, and colonialism—are not unique to the Canadian context.

## Colonial Politics of Recognition and Generative Refusal

Thinkers across the field of Indigenous studies continue to contend that Canada remains a settler colonial state, operationalizing various techniques of power and governance to maintain control over lands and territories. Coulthard's (2014b) analysis of contemporary colonial power relations in Canada offers crucial insight into this system of settler colonialism. His genealogy of the "politics of recognition" in Canada finds that through the activism and leadership of Indigenous people, there has been "an unprecedented degree of recognition for Aboriginal 'cultural' rights within the legal and political framework of the Canadian state" (Coulthard 2014b, 2). The state's recognition of these specific rights, however, serves the dual purpose of reinforcing the status quo operation of colonial forms of power and undermining Indigenous nations' prior and ongoing relations to land and territory. He argued that the partial and limited forms of recognition afforded by the state undermine the deeper political, material, and ethical claims of Indigenous peoples' demands for recognition, offering only more easily accommodated cultural recognition (Coulthard 2014b). Building on this, Daigle (2016) argued that "recognition-based strategies are founded on and materially reproduce colonial imaginaries of territory that continue to inflict violence on Indigenous legal and governance orders while facilitating the economic and political sovereignty of Canada" (267).

Whereas settler colonialism operates by both affirming and destroying Indigenous rights, the field on which it functions also plays a double role with both physical and ontological components. A. Simpson (2016) clarified that "when we speak of dispossession we are speaking of the materiality of land ... when we think about dispossession we have to think about it as an ongoing activity that the US and Canada are very involved in as these governmental projects also move Indigeneity—as a living thing, a corporeal thing and also a system of ideas and practices out of the way." Crucially, relationships

to land are not only material but also encompass a whole system of ideas and relations, which Coulthard (2014b, 13) described as "grounded normativity."

Using the lens of the colonial politics of recognition to analyze the context in which CBM operates clarifies the complexity of participation in monitoring efforts. Throughout this article, we address the variegated power dynamics of CBM in practice, differentiating between monitoring carried out by Indigenous communities and monitoring by non-Indigenous settler communities. This distinction is important for at least two reasons: First, Indigenous peoples have a different relationship with Canadian federal and subnational governments than do non-Indigenous Canadians.<sup>1</sup> That is, the relationship between the federal government and Indigenous peoples in Canada is governed by the Indian Act, which specifies fiduciary duties on the part of the federal government that are not applicable to non-Indigenous Canadians.<sup>2</sup> As a result, the rationales for Indigenous peoples participating in CBM differ from those of "concerned citizens." Second, the environmental contexts for Indigenous communities might diverge from those of settler communities: Land is often understood and used differently by Indigenous nations, and historical and contemporary environmental injustices mean that negative effects of industrial activity are disproportionately high in Indigenous communities (McGregor 2018). In considering these distinctions, we attend to the power dynamics associated with different knowledge forms. As elaborated later in this article, framing and enacting CBM within settler colonial governmentality presents a risk for participation by Indigenous people, because it can affirm state authority and control over environmental knowledge and subsequent policymaking, while undermining Indigenous peoples' legal, political, and ethical relationships to the land.

Even so, CBM could hold emancipatory possibilities for Indigenous people reclaiming territory. Whereas Coulthard's (2014b) analysis of the colonial politics of recognition provides an important critique of the context in which CBM operates, A. Simpson offered important insight into the form and function of Indigenous agency within this structure, in the form of a generative politics of refusal. A. Simpson (2017) described refusal as both an enactment and theory of the political, involving "very deliberate actions" taken by Indigenous peoples, "in the face of the expectation that they consent to their own

elimination, to having their land taken, their lives controlled and their stories told for them” (21). Refusal is more than the “repetitive stance of ‘resistance’” that reinscribes states with the power to define what does and does not matter across a terrain of struggle (A. Simpson 2017, 23). Instead, it is a “hard no” to engage with those determinative structures of power and an invocation of a different set of political relations.

## Understanding CBM

### CBM Background

Before unpacking the political economy of CBM, a few distinctions are needed. In the literature on public participation, numerous categorizations of participatory engagement exist (Bixler et al. 2015). Here, we start with Whitelaw et al.’s (2003) definition of CBM quoted in the Introduction, which focuses on collaborative environmental monitoring. Communities can participate in observing and protecting their local environments in multiple ways, and the variations in program leadership, resource provision, data ownership, and decision-making power are significant. These differences are also not static, and the arrangements for these programs can shift over time.

CBM can be understood under the broader umbrella of citizen science: “a time-honored, evolving practice that engages nonprofessional scientists in the practice of research” (Crain, Cooper, and Dickinson 2014, 642).<sup>3</sup> Unlike many citizen science programs, though, CBM initiatives are rarely efforts to increase local engagement with place or to enhance environmental literacy. Instead, CBM tends to emerge in response to environmental and local concerns from affected communities, whether because of proposed changes in industrial activity or because of felt impacts from existing developments.

Further, CBM diverges from comanagement and cogovernance institutions, where communities are involved not only in monitoring local environments, but also the decision-making processes that follow.<sup>4</sup> Because government–citizen (or corporate–community) relationships might be, among other divides, hierarchical or equitable, conflicted or collaborative, community participation in resource governance can range from passive recipients of governance decisions from above to autonomous control of local resources.

CBM lies within these divergent bounds.<sup>5</sup> Communities provide baseline data, participate in data synthesis, act as watchdogs and early alert systems for problems, and enable adaptive management to take place—but do not hold governance authority or autonomy. This is a crucial structural distinction that rends apart the intimate knowledge of place from the mechanisms of power.

### The Rise of CBM: Engaged Citizens and Government Cutbacks

CBM is increasingly popular around the world, particularly in North America, Europe, and Australia (Whitelaw et al. 2003; Conrad and Hilchey 2011; Deutsch and Ruiz-Córdova 2015; Carlson and Cohen 2018). In Canada, for example, more than 200 CBM groups exist—most arising after the year 2000 (Carlson, Cohen, and Hartwig 2017; Carlson and Cohen 2018). Scholars have attributed the increase to several factors: an increase in public knowledge and concern about anthropogenic impacts on natural ecosystems; nongovernmental organization concern about government environmental monitoring; and, of particular relevance to our arguments, perceived cost savings (Conrad and Hilchey 2011; Little, Hayashi, and Liang 2016). Indeed, Whitelaw et al. (2003) wrote about the phenomenon of perceived cost savings in Ontario and attributed the rise in community-based ecosystem monitoring to four factors: communities filling gaps in monitoring created by government cutbacks, the inadequacy of government monitoring programs to capture complex and emerging environmental concerns, the recognition by governments of the need for stakeholder and citizen engagement in planning and management processes, and citizens’ concerns about environmental threats and their desire to participate in environmental planning and protection (Whitelaw et al. 2003).

Although citizen engagement might be important and even laudatory, concerns arise when citizens are called on to address gaps in government practices. In such cases, as noted by Whitelaw et al. (2003), a host of questions follow about the ethical and practical implications of funding basic science with a patchwork of government, private, academic, and nongovernmental organization funding. Among them, analysts must consider whether such programs represent a form of outsourcing governmental



responsibilities, where the burden falls on community members rather than on government practitioners. A concrete example is the Atlantic Coastal Action Plan (ACAP). ACAP was founded in 1991 by Environment Canada, now Environment and Climate Change Canada. The program is made up of sixteen coastal communities in Atlantic Canada (Newfoundland, Nova Scotia, New Brunswick, and Prince Edward Island), each of which works to maintain and enhance its coastal, harbor, and estuary health. As stated by Environment Canada:

Most of the work done by the 16 ACAP organizations produces results that *deliver on Environment Canada's strategic outcomes*. Each year the organizations submit an annual work plan that is *designed to meet the collective objectives of each ACAP organization and the priorities of Environment Canada*. (ACAP 2008, 2, italics added)

ACAP community programs receive funding from Environment and Climate Change Canada, as well as from other federal departments, provincial and municipal governments, and local businesses and community partners (ACAP 2008). Since 1991, more than 800 projects have been completed under the ACAP umbrella, most of which “contributed directly to the priorities, or ‘business lines,’ of [Environment Canada]” (McNeil, Rousseau, and Hildebrand 2006, 371). Such outcomes underscore Whitelaw et al.’s (2003) point that community monitoring can generate cost savings; according to a 2002 study, “Environment Canada would have incurred *12 times* their current ACAP program expenditures” for the same results (Gardiner Pinfold Consulting Economists Limited 2002, 24, italics added).

## CBM and the Colonial Politics of Knowledge

Much of the CBM literature shares a Western science ontology and focuses on issues related to the replicability of data and reliability of citizen science. Studies focusing on the rigor, replicability, and quality of water information collected through CBM conclude that when proper protocols are followed, citizen scientists can collect data with similar levels of accuracy as professional scientists (Au et al. 2000; Fore, Paulsen, and O’Laughlin 2001; Shelton 2013; Kosmala et al. 2016; Storey et al. 2016; Carlson and Cohen 2018). This focus remains true for recent

work on Indigenous-led CBM, with Herman-Mercer et al. (2018) concluding that data collected through the Indigenous Observation Network in the Yukon River Basin shows no statistical difference from professional data and are “accurate, precise, reliable data” (9).

This recent turn focusing on data replicability and reliability echoes earlier scholarship in politics literatures focusing on the importance of nature’s “legibility” to state-builders, the classic example here being the German forest management practices documented by Scott (1998) in *Seeing Like a State*, involving the transformation of complex old-growth forests into same-age, single-species stands. Like Scott’s industrial forest, both the literature on and practice of CBM is heavily focused on such standardization and measurement. Indeed, many of the concerns raised in citizen science reviews (e.g., Conrad and Hilchey 2011; Crain, Cooper, and Dickinson 2014) focus on the replicability and reliability of data. Such work considers, for example, the degree to which volunteer citizen scientists can collect high-quality, scientifically valid data, as assessed by government scientists. There is a pervasive narrative among CBM practitioners—well documented in Carlson and Cohen (2018)—that they must conform to a scientific standard to have their findings formally incorporated into official government policy. The need to conform to such standards, whether actual or perceived, is connected to the rise of CBM as a replacement for government data collection and to supplement incomplete government monitoring.

Beyond questions of how to evaluate the validity of data collected by communities, a scholarly and practitioner focus on issues of standardization and replication encounters more fundamental challenges when CBM programs involve Indigenous communities and Indigenous knowledges. Although TK is not inherently connected to Indigeneity, in academia it has become synonymous with Indigenous communities, especially among non-Indigenous scholars and researchers (L. Simpson 2001). The consideration of TK in these programs involves not only resolving questions of metrics and terminology but data integration across fundamentally different worldviews and knowledge systems.

In one frequently cited definition, Berkes (1993) offered that “TK is a cumulative body of knowledge and beliefs, handed down through generations by

cultural transmission, about the relationship of living beings (including humans) with one another and with their environment” (3). This definition, focused on historically and socially contingent place-based knowledge, can be at odds with CBM’s focus on consistent measurements across a given resource or over time. Many TK systems rely on geographic and social specificity not replicable in other locales or contexts. As noted earlier, Coulthard (2014b) called this kind of situated place-based knowledge “grounded normativity,” which he defined as “Indigenous land-connected practices and longstanding experiential knowledge that inform and structure our ethical engagements with the world and our relationships with human and nonhuman others over time” (13).

Notably, and as acknowledged by many scholars, TK is a controversial term (McGregor 2000; L. Simpson 2001). Indeed, scholarship on TK has been on the rise since the early 1980s when the International Union for Conservation of Nature established a working group on traditional ecological knowledge (TEK; McGregor 2013). TK emerged within the dominant Western paradigm in the 1980s (Berkes, Colding, and Folke 2000; McGregor 2013; J. T. Johnson et al. 2016) as a term created to address the increasing need for recognition of Indigenous knowledges and beliefs (McGregor 2013). Berkes (2012) recognized the growing interest in TK (which he described as TEK) being attributed to “the need for ecological insights from Indigenous practices of resource use, and the need to develop a new ecological ethic in part by learning from the wisdom of traditional knowledge holders” (19). L. Simpson (2001) initially spoke of incorporation and consideration of TK in research as an area of growth because Indigenous people have been marginalized, ignored, and undermined for so long. Increased attention to TK can be seen in its uptake in academic and practitioner circles, as seen in conferences, symposia, and workshops on CBM.

Rather than focusing on a specific definition of TK, we follow in the path of Whyte (2013) and Latulippe (2015), focusing on the role that TK (in varying forms) plays in policy settings. As Latulippe (2015) clarified, there are “discursive and material implications of one’s conceptual approach to TK” (120), and this is especially true in the context of how those controlling CBM data understand such knowledge. Whyte (2013) pointed to “two kinds of assumptions about the meaning of [traditional

ecological knowledge]” (1)—related to knowledge mobilization and the relationship between TK and science—involving “differences about ‘whose’ definition of TEK gets privileged, who is counted as having expert authority over environmental governance issues, and how TEK should be factored into policy processes” (1). For our argument, we consider these differences, with attention to how the privileging of TK—which has the potential to challenge unequal power relationships by challenging the dominance of colonial knowledge systems (Arsenault et al. 2019)—can be appropriated and exploited if TK is incorporated into CBM programs that must answer to Western science criteria. This might be the case if TK is “cherry picked” to highlight “those elements of Indigenous knowledge that are compatible with a Western scientific worldview” (Nadasdy 1999, cited in Wilson, Walter, and Waterhouse 2015, 94).

Although engagement with TK occurs in a variety of settings and might involve good intentions, it can create opportunities for non-Indigenous scholars and researchers to appropriate Indigenous knowledges and for TK to lose its meaning when combined with Western thought (McGregor 2000; L. Simpson 2001). L. Simpson (2001) cautioned that incorporating TK into environmental programs can be problematic because such integration emphasizes ecological knowledge over its ontological foundations, separates knowledge from its context (especially in the conversion from oral to written forms), and, more fundamental, reinforces and supports Western science and governance. Further, and aligned with Coulthard’s (2014b) analysis of the operation of the colonial politics of recognition, the inclusion of CBM as a source of knowledge about, but not authority over, the lands and environment risks decoupling the political, ethical, and moral claims of Indigenous TK from forms of knowing that can be incorporated into the status quo structures of power and authority. As such, participatory environmental programs such as CBM can intensify power imbalances, rather than challenge them. L. Simpson (2001) wrote that “refusing to participate in co-management agreements, EIAs, treaty negotiations, natural resource management agreements, research projects and the Euro-Canadian educational system are effective ways of resisting the dominance of Euro-Canadian society, and its assimilative tendencies” (144). Indeed, by participating in CBM, Indigenous people might lose

control over how their knowledge and information is used or interpreted (L. Simpson 2001), and TK can be misinterpreted, appropriated, and taken out of context (Nadasdy 1999).

The mistrust of the state and other non-Indigenous authorities is grounded in long-standing and repeated experience: Colonial authorities were responsible for the destruction of TK, as “the foundation of Indigenous Knowledge was attacked by the invading culture as a mechanism to annihilate Indigenous nations and assimilate Indigenous Peoples” (L. R. Simpson 2004, 377). Beyond such histories, it is unclear whether or how standardization, with its focus on legibility, can be integrated productively with the heterogeneous, rich, and locally specific information provided by TK. Accordingly, Indigenous communities might be apprehensive about facilitating, teaching, and incorporating TK into their CBM practices if it seems like TK is being “scientized” for the use and consumption of and for Euro-Canadians and Western science (L. Simpson 2001). Nadasdy (1999) noted that TK holds stories, values, social relations, and practices and these influence Indigenous peoples’ relationships to the environment but these relationships can lose meaning when “distilled” into institutional frameworks of resource monitoring and governance. CBM is one example of these types of institutional frameworks. Similar concerns arise in other settings, as Watts (2016) noted in her critique of the integration of Indigenous ceremonies, such as smudging, into state and corporate venues. The state’s assimilation of ceremony places Indigenous knowledges and practices under its control, providing the appearance of recognizing difference while constraining its political significance (Watts 2016).

Financial and power implications arise from the conflation of the different ontologies underpinning Western and Indigenous knowledge systems under a single CBM umbrella. In his work on Indigenous resistance and resurgence, Coulthard (2014b) wrote that settler-colonial relationships are “characterized by a particular form of *domination* [that facilitates] the *dispossession* of Indigenous peoples of their lands and self-determining authority,” overwriting the foundations of Indigenous sovereignty (7–8).

Coulthard (2014b) presented these relationships as a form of structural dispossession, which we see as relevant to understanding the logic underpinning many CBM programs. The language of CBM can

reproduce the discursive silence that facilitates the erasure of self-determining authority. That is, to describe Indigenous peoples as “concerned citizens” and “community groups” obscures the unique legal rights and relationships that Indigenous people in Canada have with governments. Moreover, because that relationship is problematic (to say the least), replacing government-led monitoring initiatives with a lower cost, “community-led” alternative is not only concerning from a public goods perspective but also paternalistic. In addition, judging TK by Western scientific standards is dismissive of the unique historical and place-based knowledge present in many Indigenous communities that cannot be described in generalizable and replicable terms. By presenting knowledge mismatches and financing shortfalls as technical challenges rather than as reflections of the deep ethical and ontological challenges that Indigenous knowledge systems pose to Western science, CBM practitioners and scholars contribute to the ongoing discursive and material dispossession of Indigenous people and their self-determining authority.

## CBM and the Colonial Politics of Funding and Finance

The previous section on the colonial politics of knowledge looked at how different ways of knowing are recognized—or not—in contemporary CBM paradigms; this section looks at how funding and finance reinforce colonial norms. Questions around how specific CBM programs are funded are related to, but subtly distinct from, issues around finance. We understand funding as the money available for environmental monitoring—that is, cuts to government monitoring program budgets, the rollout of CBM funding opportunities, the competitive application processes, the terms of CBM grants, and so on. Funding shortfalls and requirements can be technical challenges to CBM. Such funds, however, are underpinned by the political systems that determine the economic models that govern society, what counts as productive, who allocates resources, and who has access to those resources. Finance, then, we view as greater than the sum of its parts: It relates to broader questions about power and equity and speaks to some of the systemic ways in which the everyday is rendered political.



Others have made parallel distinctions between funding and finance in other contexts. For example, with urban infrastructure, O'Brien and Pike (2019) noted that funding is “where the money comes from to pay for the infrastructure over time” (1452); it is the revenue streams that pay the upfront costs of infrastructure construction. Conversely, they explained that financing is “how the capital is assembled and structured to enable the investment to proceed” (O'Brien and Pike 2019, 1452). Similarly, in their work on “Smart Cities,” Hamilton and Zhu (2017) wrote that the difference between the two is temporal, where funding is relatively short term (property taxes, user charges, etc.) and finance is a longer term arrangement, such as deferring the costs of capital projects. Whereas funding refers to the availability of money, finance invokes the systems of power and structures of authority that control who can access, and who distributes, resources in society.

In the Canadian context (and elsewhere in the world), CBM programs are governed under neoliberal political economic systems, with three key features: the retention of power by settler colonial states and private companies, rather than Indigenous peoples; the privileging of metrics recognized by Western science, which align with capitalist economics; and the reinforcement of extractive logics through monitoring programs, whereby land is a site for extraction. First, because financing for CBM programs is often provided by state and corporate sources—or from grants from foundations whose wealth depends on the contemporary financial system (Tedesco 2015)—these initiatives are embedded from the outset in processes of dispossession. CBM programs are often designed as a response to existing or proposed industrial activities and land use change, where proposed developments reflect the priorities of an extractivist state (Peyton and Keeling 2017). Second, the dominance of Western scientific metrics reinforces a reductionist approach to the natural world and reinforces control by the state and industry. Third, these monitoring efforts enable and ensure ongoing state access to land and resources, which, as underscored by Coulthard (2014b), provide the foundation of capitalist development. The need for CBM programs follows from particular understandings of the natural world as sites of extraction and sources of wealth. Although those conducting CBM activities might consider the inherent value of ecosystems, the programs tend to be

created and financed because of interests in extraction and consumption. Tensions thus arise in CBM between not only TK and Western science but more fundamentally between different models of political economies, particularly those premised on different understandings of the nonhuman world as resources or as relations (see Behn and Bakker [2019] on how assessment processes can “render technical,” rather than sacred, relationships on the land). Finance is thus a key source of power in initiating and shaping CBM programs.

Much has been written about the neoliberal turn from a wide range of disciplines and areas of scholarship (e.g., Mansfield 2004; Castree 2010; Centeno and Cohen 2012; Ganti 2014; Bugarič 2016). For our analysis, the most relevant aspect of this work is the consistency between the rationales for CBM provided by Whitelaw et al. (2003) and Castree's (2008) description of neoliberalism, which features, among other things the “state-led encouragement of civil society groups ... to provide services that interventionist states did, or could potentially, provide for citizens” (142). We find the role and definition of *citizens* particularly important—that is, the supposed beneficiaries of the services provided (or delegated to other groups) by the state.

As Cohen and McCarthy (2015) noted, most of the environmental literature frames community as positive and hence as better than groups defined through formal governmental processes, such as cities, states, or provinces. This logic is evident in the CBM literature, where community is used to denote groups of citizens who are, presumably, interested in environmental monitoring. This same language about citizens and communities is reproduced in the CBM practice, where many of the rationales focus on the involvement of “concerned citizens” or “community groups.” This approach recognizes citizen attachment to place, concern over perceived threats, and desire to learn more about the environment. From the perspective of Indigenous peoples, though, such language is problematic. Such framing of citizen engagement is silent on questions of Indigenous rights and place-based Indigenous knowledge, as well as on the unique legal rights and relationships that many Indigenous people have with state, provincial, or national governments. Moreover, it obscures the degree to which Indigenous communities engage in CBM to generate baseline data to track and document the effects of large-scale industrial development—especially oil

and gas—in efforts not to “learn more about the environment” but to protect the lands to which they are legally entitled.

Drawing on political ecology and critical political economy can help place these relationships into a broader scholarly context. Robbins (2004) defined political ecology in its most basic terms: It is the opposite of apolitical ecology—that is, ecology free of politics. Most scientific ontologies reinforce this way of knowing, and dominant forms of economic organization do the same. Quantifying stream recharge, identifying contaminants, and measuring water temperature and pH are often done in ways divorced from politics; in parallel, applying for grants, submitting accounting sheets, and sending reimbursements are similarly presented as technocratic processes. Indeed, the putative apolitical natures of science and funding are part of their appeal: Science-based policy, and not policy-based science, is a measure of good governance, and funding strategies that eschew partisanship and political influence are seen in the same way. Such separation of science, funding, and politics is replicated in CBM programs: Communities carry out the scientific exercise of measuring water quality through various indicators, often with the aim of influencing government policy (Carlson and Cohen 2018). These communities are supported by grants and funding streams that follow equivalent indicators and metrics. The apparent neutrality of the data and its financial support, however, can belie the political motivations for collecting ecological and social information. A stream’s temperature and a grant’s balance sheet are numbers without context. Funding tends to flow more easily to, and reinforces the influence of, groups following the monitoring protocols of Western science, however. The knowledge hierarchies that underpin capitalist economic models have consequences for CBM programs and thus require attention to grounded normativity (Coulthard 2014b) and the political relations to land (Daigle 2016).

A concrete example illustrates this point. The Canadian Government’s EcoAction Community Funding Program provides “Funding to protect, rehabilitate, enhance and sustain the natural environment” (Government of Canada 2019); CBM projects are eligible, but they are not the only type of initiative covered by the program. The program’s Web site states:

All projects must clearly demonstrate that activities are *measurable*, provide opportunities for community

members to take action and will result in a positive environmental impact. All projects and activities must include ... at least one (1) key *environmental indicator* as per the list of performance indicators. (EcoAction Community Funding Program 2017a, italics added)

As specified in the project application details, eligible groups include environmental, community, and youth groups, along with service clubs and Indigenous organizations (EcoAction Community Funding Program 2017b). Conflating Indigenous peoples with community groups is problematic, because it obscures the unique legal rights of Indigenous peoples in Canada and undermines the unique political and legal claims of Indigenous nations in favor of limited recognition of their status as stakeholders with equal interests to other community groups. The Canadian state has a constitutional obligation to respect the rights and title of Indigenous nations and holds fiduciary responsibilities with respect to Indigenous peoples that differ from the state’s fiscal and social responsibilities to other groups. Development plans that threaten the ability of Indigenous peoples to maintain their relationships with their territories—as might be tracked through community monitoring efforts—thus represent more than just activities that require the participation of affected local people. Such potential damage collides with legally recognized Indigenous rights and should invoke a different set of government actions and responses. It is constitutionally murky territory, then, to cancel a government program (e.g., the water survey of Canada) for budgetary reasons and replace it with a CBM program stream funded by the federal government to which Indigenous groups may apply. Such a system creates a scenario in which the constitutionally affirmed rights of Indigenous peoples are subject to competitive, project-based funding competitions. This undermines the unique political, legal, and ethical relationship that Indigenous nations have with their lands and territories in favor of a system that forces Indigenous nations to compete with non-Indigenous interest groups. In addition, for many Indigenous groups, applying for federal funding to monitor the health of an environment altered by and through colonialism compounds issues of environmental injustice and reinforces colonial legacies.

Further, the focus on indicators in the program might be problematic in terms of integration with Indigenous ways of knowing: As Norman et al.

(2013) pointed out, “Indicators are usually univariate (e.g., relating to either water quality or quantity), rarely integrating aquatic ecosystems and human health considerations, and/or land use and water management” (536, citing Wheater and Evans 2009). Because many Indigenous indicators of water health are multivariate—that is, they incorporate more than one indicator—the limiting of eligible measurements to single indicators might have the unintended consequence of disqualifying some forms of Indigenous knowledge. Measurability is not always at odds with Indigenous ways of knowing, but privileging certain kinds of metrics risks eliding knowledge that does not fit neatly into a spreadsheet. For example, Wilson, Walter, and Waterhouse (2015) worked with elders in Ruby, Alaska, and highlighted changes to the Yukon River that had not been previously considered by Western scientists, such as the acoustic qualities of river ice and changing sediment patterns. Such changes are difficult or impossible to measure with standard water monitoring tools. More important, they are historical, place-based, situated knowledges and do not appear on the lists of standard indicators that funders expect CBM programs to measure.

Here, we turn to the science–policy nexus in CBM, interrogating the politics, and especially the political economy, of knowledge. Why might there be a CBM program to track ice characteristics, and why might a stream’s sediment load be changing? Concerns about the deforestation of riparian zones, reduced flow from dams and diversions, or contamination from industrial output can all drive the creation of a CBM program in a given watershed, and these reflect particular accumulation-oriented values and interests in the nonhuman world. In many cases, communities undertake CBM to collect data to support claims about environmental harm from large-scale industrial development. At times, CBM programs involve predevelopment collection of baseline data in anticipation of ecological change; at others, they represent community efforts to document human and ecological harm already being experienced.

The Treaty 8 region of Canada offers an example of the latter situation. Signed in 1899, the Treaty is more than 100 years old and its area is larger than France, measuring some 840,000 square kilometers, spanning regions in what are now three Canadian provinces and one territory (British Columbia,



Figure 1. Treaty 8 land area (Centennial College 2020, 203).

Alberta, Saskatchewan, and the Northwest Territories). These Treaty lands are home to the most significant oil and gas development in the country (see Figure 1), including the tar sands of northern Alberta and shale gas projects in and around the Fort Nelson First Nation’s territory in northeastern British Columbia. The region has been shaped by significant migration around the city of Fort McMurray, Alberta, increasing economic dependence on oil and gas development and rapid regulatory adjustments to enable hydraulic fracturing (“fracking”) and other extractive technologies. The pace, scale, and effects of these developments shape the political economy of the region and might violate some of the foundations of Treaty 8:

When the Fort Nelson First Nation signed on to Treaty 8 in 1910, it agreed to share the land on the condition “that the treaty would not lead to any forced interference with their mode of life”; this included the right to “be as free to hunt and fish after the treaty as they would be if they had never entered into it.” (Laird, Ross, and McKenna 1899, cited in Garvie, Lowe, and Shaw 2014–2015, 48)

The agreement to not interfere is predicated on an implicit assumption about a shared understanding of what would have occurred without settler presence—what we would call baseline data—but such data are often missing. The Fort Nelson First Nation is open to economic development activities in their territory but take issue with assessments that take place only after new projects are underway (Garvie

and Shaw 2016). How can the Fort Nelson First Nation show that there has been “forced interference” in the absence of scientific data about what predated the current developments? Indeed, baseline measurements, by their very definition, are taken before development begins. In the absence of such studies, it is difficult to legally substantiate claims of environmental harm, let alone stop harmful activities before they start. Garvie, Lowe, and Shaw (2014–2015) explained that it is already “too late” in the Peace-Moberly region of northeastern British Columbia, citing a study that found that:

cumulative effects of landscape change from industrial development ... are synergistic, additive, and antagonistic in nature, and have reached a point at which they are threatening the ecological integrity of the area as a whole (Nitschke 2008). The alarming results of this study highlight the need for better industry regulation in [Fort Nelson First Nation] territory to ensure that this region does not suffer the same fate. (54)

Here, we see two reinforcing dynamics in the political economy of colonialism: When environmental harms arise from extraction for economic gain, the only avenues to challenge them are (1) through the colonial legal system, by laying bare the blatant violations of Treaty agreements (which have already been upheld in the courts; see, e.g., Coulthard 2014a, 154; Samson 2016, 88), and (2) using data documented through Western science. These constraints interact and are exacerbated by the limited regulatory requirements imposed on industry. As Garvie and Shaw (2014–2015) documented, “Industry is not required to conduct cumulative impact assessments or landscape-scale studies because these go beyond the scope of the single-permit regulatory process” and yet, “without adequate data, community concerns were frequently rejected by the [BC Oil and Gas Commission] and industry as too anecdotal” (86).

Deferring to a colonial government for permission, funding, and authority to monitor lands and territories compounds the already asymmetric position that Indigenous knowledge has within policy formation and implementation. This is not to say that funding for Indigenous-led CBM should not exist, particularly in a time where threats to Indigenous territories are acute and expanding, but a critical lens is needed to highlight the ways in which colonial power

continues to be exercised through seemingly technical water monitoring programs.

## Implications and Political Futures for Communities and Ecosystems

A focus on the technical challenges of CBM obscures the more fundamental political challenges that arise in designing and implementing such initiatives. The interest in monitoring systems arises not simply from community interest in their own homelands but from recognized or projected changes to local landscapes, usually as a result of suspected exposure to contaminants and toxicants or existing or anticipated industrial and extractive development pressures. Monitoring is then mandated, organized, and funded by corporate and state actors, who have interests in the generalizability and replicability of the outcomes. Without potential economic benefits from landscape changes, corporations and governments would be unlikely to prioritize the funding of local monitoring efforts; thus, these programs are not initiated from a disinterested standpoint on development activities. Such starting points—industrial interests, economic pressures, and large-scale data systems—inform the types of knowledge and information collected by CBM programs and also shape the funding arrangements (and associated reporting requirements) of these initiatives.

CBM programs are not politically neutral: They tend to be initiated and funded by governments, corporations, and academic institutions. The consideration of Indigenous knowledge systems and TK in CBM programs presents more than a technical challenge and more, too, than an epistemological one, focused on how to square different ways of knowing the world. A critical look at the political economy of CBM reveals that the motivation for these programs is often premised on particular understandings of the world not as a “system of reciprocal relations and obligations” (Coulthard 2014b, 78) but instead as a source of resources and as a site of extraction. As in the Treaty 8 example, CBM programs tend to arise in response to land use changes motivated by industrial development and economic growth, and the funding of monitoring efforts enables or sustains these extractive projects. Even when CBM programs are funded by foundations, these organizations tend to have accumulated wealth through corporate profit or investment—again, underpinning community engagement



through systems of exploitation and displacement. In considering these more fundamental rifts in environmental governance, especially in interrogating conflicting ontologies, we follow the lead of other scholars concerned about nature, society, and power (e.g., Goldman, Turner, and Daly 2018).

Given these dynamics of knowledge and finance, what are the consequences for Indigenous communities that engage with state- and corporate-funded CBM programs? A. Simpson's insights into the agency exercised through refusal suggest that partial participation in decision-making processes can still be valuable, because even incomplete local input from monitoring programs might inform industrial development and land use change outcomes or compensation and reclamation efforts. Further, the opportunity to engage in the everyday practices and relation to land might be an opportunity for nations to build and rebuild their relations to their lands and territories (Daigle 2016). For some communities, having some pathway into systems of governance might be useful and allow them to communicate concerns about projects' local impacts on ecosystems and ways of life. Some research suggests that, especially for monitoring projects related to climate change, community observation programs can consider interactions between social and ecological systems and can therefore "generate data to inform more comprehensive, targeted responses to particular public health challenges in the context of climate change that may be outside the scope or capability of other types of surveillance systems" (Sawatzky et al. 2018, 2). If the choice is to have some or no voice in managing and responding to local environmental change, communities might prefer the former. Further, some might see CBM programs as an entry point for engaging in more systematic change in governance processes.

In light of the power imbalances in the political economy of monitoring systems, however, others might view participation in CBM initiatives as upholding and perpetuating systems of colonial, capitalist control. Indigenous peoples can rewrite and reinterpret colonial institutions to create new space for assertions of sovereignty and self-determination. This was seen with Diné opposition to water settlements along the Little Colorado River in the United States, where "opponents reworked and repurposed colonial infrastructures toward Indigenous lifeways and decolonial nation building" (Curley 2019, 59),

and with the development, under provisions in the Clean Water Act in the United States, of tribal water quality standards that involve cultural and ceremonial considerations (Diver et al. 2019). Still, as recognized in the work of both Curley (2019) and Diver et al. (2019), working within state systems has inherent limits as a tool of decolonization.

## Conclusion

Indigenous communities face fundamental tensions in participating in CBM programs that are sanctioned by colonial governments and that operate within the contemporary capitalist economy. For existing or anticipated environmental change (and harm) to be recognized in government decision-making processes, communities must collect and communicate information in ways that are recognized by state authorities who hold much of the decision-making power. Lived experiences are rarely given equivalent weight as standardized, replicated results, and locally particular conditions are not as compelling to decision makers as shared regional patterns. Yet some of the most significant consequences of environmental change are locally, culturally, and socially specific—and might not be able to be known through, or translated into, Western knowledge systems.

Such critiques are not isolated to CBM: In line with Coulthard (2014b), Daigle (2016) argued that "recognition-based strategies are founded on and materially reproduce colonial imaginaries of territory" (267) that undermine Indigenous sovereignty and reinforce the state. Within a broad range of state-led and capital-supported systems, CBM represents one set of initiatives in which technocratic debates obscure political projects. States and corporations that refer to CBM outputs in their management regimes can present themselves as engaging in participatory processes of governance. By engaging in CBM, authorities might deflect more fundamental critiques of industrial development and land use change, focusing instead on technical challenges, such as mechanisms for increasing community participation in monitoring or for determining baselines and harmonizing data over time and space. CBM programs give the appearance of meaningful engagement with local citizens but that engagement happens on colonial terms in two ways. First, it collapses ontologies into a single body of knowledge (i.e., Western science) and, second, by extension, it



requires that Western science act as a baseline for governmental decisions about land protections in the legal and policy realms. Despite the apparent integration of Indigenous people into decision-making processes through CBM initiatives, then, these characteristics of the programs reinforce existing hierarchies of knowledge, economics, and power.

As a result, CBM programs might not only have limited influence on the decisions of authorities, they might also contribute to sustaining unequal and exploitative governance systems. Coulthard (2014b) documented such processes occurring through Dene engagement in land claims and economic development projects, which have “resulted in a partial decoupling of Indigenous ‘cultural’ claims from the radical aspirations for social, political and economic change” (19). Similarly, participation in CBM initiatives might dampen the possibilities for more organized community resistance and refusal. The political economy analysis of these programs that we have undertaken in this article thus clarifies the colonial underpinnings of monitoring programs, opening space for questions about more systematic change in power over the futures of communities and places. Still, the agency and autonomy of Indigenous people, expressed through both participation and nonparticipation, and through a choice of consent and withdrawal of consent, must be maintained, to avoid falling into the trap of the power imbalances in the politics of colonial recognition.

It is the duality of generative refusal that offers critical insight into the complex role and position of CBM for Indigenous communities and the use and integration of Indigenous TK within CBM more generally. CBM could serve political and structural conditions that facilitate the removal of Indigenous people from their territories. Centering on the generative relations that might be created and practiced through the exercise of Indigenous agency and refusal, CBM also offers the space for something new. Following Daigle’s (2016) interventions that relational geographies that are created and re-created through the “every day lived practices of reclaiming these life-ways” (261), we are responsible for envisioning how decoupling CBM from colonial knowledge systems and political economies might play a role in facilitating Indigenous nations’ ongoing reclamation of sovereignty and relations of grounded normativity.

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## Notes

1. Note that the Canadian state recognizes First Nations, Inuit, and Metis as holding Aboriginal and treaty rights under Section 35 of its Constitution, with the 1982 Constitution specifying First Nations as “Indian”: In this Act, “aboriginal peoples of Canada” includes the Indian, Inuit and Métis peoples of Canada. (<https://laws-lois.justice.gc.ca/eng/const/page-16.html>). For individuals, recognition of their Aboriginal status is constrained by colonial legislation and histories; for a detailed treatment of the colonial prescription of Indigenous identity by the Canadian state, as well as strategies Indigenous nations’ resurgence and self-determination, see Palmater (2011).
2. As specified by King and Pasternak (2018, 11), as part of a broader critique of Canada’s legislative and policy reform vis-à-vis Indigenous people, fiduciary responsibilities arise from the Canadian state to Indigenous peoples from Section 91(24) of the British North America Act of 1867. We note that there are strong critiques of the state’s interpretation of its fiduciary duties, as treating Aboriginal and treaty rights as fiduciary responsibilities, rather than as recognition of ongoing Indigenous sovereignty, can reinforce colonial control (Iwase 2012).
3. As Strasser et al. (2019) noted, “The specificity of the current understanding of ‘citizen science,’ as a mode of public participation in science, is the claim that amateurs (‘general public’) can contribute to the *production of science*” (54, italics in original). Such engagement is termed by others (e.g., Clark

and Illman 2001; Bäckstrand 2011) as civic science, which, although seen as “rather vague and elusive” still “serves as an umbrella for various attempts to increase public participation in the production and use of scientific knowledge” (Bäckstrand 2011, 439).

4. Such arrangements can be part of the decentralization of natural resource governance regimes (see Larson and Soto 2008), where governance authority is shared or might even be fully held at the local level.
5. For example, Conrad and Hilchey’s (2011) definition of CBM involves communities collecting data and using the information generated to promote informed decision making—a view that lies at the more active end of the spectrum. At the other end is what N. Johnson et al. (2015) described as community-based observing networks, which, as the name suggests, focus on observations couched in cultural and historical context.

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