Watching, listening and learning to understand change

Developing a Community-Based Monitoring (CBM) Initiative in Ontario's Far North

WCS CANADA

Gleb Raygorodetsky, Ph.D.
Cheryl Chetkiewicz, Ph.D.

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WCS CANADA

ABOUT WILDLIFE CONSERVATION SOCIETY CANADA

WCS Canada (www.wcscanada.org) was established as a Canadian conservation organization in July 2004. Our mission is to conserve wildlife and wild places by improving our understanding of and seeking solutions to critical problems that threaten key species and large wild ecosystems throughout Canada. We implement and support comprehensive field studies that gather information on wildlife needs and then seek to resolve key conservation problems by working with a broad array of stakeholders. We also provide technical assistance and biological expertise to local groups and agencies that lack the resources to tackle conservation concerns. WCS Canada is independently registered and managed, while retaining a strong collaborative working relationship with sister Wildlife Conservation Society (WCS) programs in more than 60 countries.

ABOUT THE AUTHORS

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EXECUTIVE SUMMARY

Ontario's Far North is one of the world's largest and most intact expanses of boreal forest and wetlands. The region has almost no industrial development today, but that could change with plans for mining operations, all-season roads, transmission lines, commercial forestry and hydroelectric facilities being put forward. Climate change could also rapidly reshape the region.

Ontario's Far North is the traditional territory and homeland of Cree and Ojibway Indigenous peoples, who have occupied the region for millennia. They rely on the land, freshwaters and air as they pursue economic development opportunities as well as hunting, trapping, fishing, and gathering food and medicines for nutritional and spiritual sustenance. First Nations' rights to maintaining their lifestyle, traditions and cultures on their ancestral homelands are constitutionally recognized and protected in Canada under Section 35 of the *Canada Constitution Act, 1982*[1].

The direct, indirect, and cumulative impacts of provincial and federal governments' resource management and development decisions on communities and their traditional territories, must be monitored to ensure that both Aboriginal and treaty rights are upheld and that the socio-ecological resilience of Ontario's Far North is sustained for future generations.

In 2010, the Far North Science Advisory Panel, convened by Ontario's Minister of Natural Resources to provide scientific advice to the government on land-use planning in the Far North, recommended that the Government of Ontario develop a program to monitor the state of the environment and First Nations health in a way that integrates Traditional Ecological Knowledge (TEK) in monitoring and planning processes. Similarly, in 2013, the Environmental Commissioner of Ontario, also recommended that any long-term monitoring programs in Ontario's Far North developed by the Government of Ontario, particularly in the Ring of Fire, must include TEK and actively involve First Nations communities. To date, little progress has been made by the Government of Ontario on implementing these recommendations.

[1] *Constitution Act, 1982*, Schedule B to the Canada Act 1982 (UK), 1982, c 11. Available online at: http://canlii.ca/t/ldsx

Allan Lissner

The Multiple Evidence Based approach is an innovative framework, adopted by the United Nation's Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, that helps weave together indigenous, local, and scientific knowledge for enhanced resilience and sustainability, while respecting the integrity of each knowledge system.

The Multiple Evidence Based (MEB) approach is an innovative framework, adopted by the United Nation's Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), that helps weave together indigenous, local, and scientific knowledge for enhanced resilience and sustainability, while respecting the integrity of each knowledge system. A monitoring framework rooted in MEB principles is a TEK-based Community-Based Monitoring (CBM) approach that reflects the interests and needs of local communities living with environmental change, whether due to climate change, industrial development, multiple stressors or some combination of them all (e.g., cumulative impacts). TEK-based CBM , within a comprehensive Multiple Evidence Based framework, offers an important opportunity in Ontario's Far North, especially the Ring of Fire, to enable Indigenous communities to carry out their own TEK-based monitoring by linking natural resource monitoring to the priorities, expertise and traditional management institutions of Indigenous communities. Such an approach would make such monitoring efforts more locally acceptable, relevant, and sustainable and, in turn, can lead to more effective conservation and land management outcomes.

This report develops the rationale for the design and implementation of a long-term, equitable, and adaptive TEK-based CBM initiative in Ontario's Far North. Drawing on the published scientific and publicly available grey literature, we describe the basic elements of and approaches to CBM, including trust, ethical principles, and knowledge co-creation for equitable decision-making.

We also explore these components more practically by presenting six Canadian and five international case studies that show how TEK-based CBM has been applied for monitoring, including species (moose and caribou); activities on traditional territories (e.g., mining, tourism, fishing, and hunting); and, subsistence needs in order to improve co-management of fish, wildlife, and plants. These case studies help illustrate how the basic components and approaches to TEK-based CBM are applied within various social, ecological and economic contexts and to meet different community needs and interests.

Our review of the case studies highlights the benefits of TEK-based CBM including: the creation and implementation of locally relevant monitoring protocols; consideration of cumulative impacts; better informed decision-making; and increased awareness and collaboration amongst the community, government agencies, and interested stakeholders. We also review the challenges associated with TEK-

based CBM, including cost, capacity within the community, longevity of the monitoring program, sharing of results, and establishing credibility to support their use and application by decision makers, project proponents and other interested parties. These challenges are not unique to TEK-based CBM projects, of course, and are applicable to all monitoring programs.

We conclude that a TEK-based CBM Project must be guided by ethical principles that advance the process of Multiple Evidence Based knowledge co-production, support "both-ways[2]" capacity building, and encourage an inter-generational transfer of traditional knowledge and skills at the community level. Our examination of the context in the Far North as well as the approaches to developing and applying CBM in practice leads us to make the following recommendations for developing a pilot TEK-based CBM project in Ontario's Far North, particularly with First Nations communities in the Ring of Fire.

Recommendations

- **Setting the stage for a pilot CBM project.** A CBM project should be created through a gradually unfolding "bottom-up" process with full community engagement through all of the phases (i.e., CBM introduction, laying the groundwork, defining appropriate terminology, defining indicators and methodology, incubation, and implementation). The introduction could begin as a series of informal and formal discussions with leadership and community members. A series of presentations and/or a workshop could be organized to connect respective local community members with CBM experts and CBM practitioners in other First Nation communities. The latter would be invaluable for sharing their practical experiences of running a CBM project to achieve community goals.

- **Laying the groundwork for a pilot CBM project.** A TEK-based CBM project requires long-term commitment from the participating community and its partners to the MEB-based process. CBM relies on TEK (but can use relevant modern technology and scientific data when necessary and appropriate) and should support ongoing land-based activities of local residents. Once a community (or several of them) decides to develop a Pilot CBM project, a CBM Working Group, including community members, should be established to guide and manage the development and implementation of the project (e.g., fundraising, training, monitoring, data management, reporting). At the same time, specific

[2] "Both-ways" refers to local communities learning about science, and scientists learning about traditional knowledge and cultural practices. See also: http://www.integrativescience.ca/Principles/TwoEyedSeeing/

mechanisms should be explored and developed for integrating the information and recommendations from the CBM project into local and regional decision-making processes. In Ontario's Far North, for example, this could include the Regional Framework Agreement signed in 2014 between the Government of Ontario and nine Matawa First Nations[3]. The Agreement creates an opportunity to develop a MEB mechanism for meaningful, equitable, and respectful knowledge co-creation in communities, whereby local TEK is valued alongside science-based expertise to detect and interpret environmental and social change in the Ring of Fire. Community-based land use planning and project-based impact assessments are two other decision-making processes in Ontario's Far North that would benefit from CBM outcomes.

- **Develop and define locally appropriate terminology for a pilot CBM project.** Work with the community to develop culturally appropriate terminology, preferably in the local language, in order to describe TEK-based CBM in a way that makes it meaningful for the community members, particularly Elders, women and youth. The results of these discussions could be captured in different forms (e.g., text, photo, video or audio recordings) and shared with the community and others.

- **Develop a set of TEK-based indicators based on local needs and interests.** Locally relevant indicators (for example, for Cultural Keystone Species[4]) should be developed through a process of full, active, and gender- and age-balanced participation by Indigenous community members in all aspects of project planning. A diverse team of trusted collaborators and advisors can help the community to develop approaches that are clear, culturally appropriate and methodologically robust. The process of engaging Indigenous communities in selecting these indicators and developing these methodologies provides an opportunity for community empowerment that conventional approaches to monitoring (e.g., scientific methods in environmental monitoring) or proponent-led monitoring (e.g., project-based impact assessment) fail to provide. At the end of this stage, a set of locally-relevant CBM indicators would be agreed upon and a set of methodological guidelines for their monitoring, data entry, analysis and reporting would be developed. This would include designing data collection, storage, and sharing protocols between the community and its external partners, as well as community member consent protocols for data gathering, use and sharing. All these methodologies should

[3] The Agreement is available for download at: http://www.mndm.gov.on.ca/sites/default/files/rof_regional_framework_agreement_2014.pdf

[4] Cultural Keystone Species influence the cultural identity of a group of people via the species role in subsistence, spirituality, and/or Indigenous economies and maintaining the connections to these species through traditional practices is crucial for the social-ecological resilience of Indigenous cultures (Noble et al. 2016).

Susan Morse

Cultural keystone species could be one of the indicators used in a CBM program.

be summarized in a user-friendly CBM Project Guide for use by the local CBM Project Researchers, allies, and community members. In Ontario's Far North, Eabametoong First Nation developed a biodiversity atlas as one way to document the animals and plants that were important to the community (Eabametoong First Nation 2016).

- **Enable CBM project incubation and implementation.** Once the indicators are defined, methodologies for data collection, storage and analysis are finalized, and initial training and support are underway, the pilot monitoring stage of the project would commence. Depending on the focus of the Pilot CBM Project, the monitoring cycle could be tied to the community's seasonal calendar (e.g., subsistence activities) and depend on community members' availability. It would include a series of interviews, data archival, and interpretation methods, verification workshops, as well as community discussions and information sharing sessions about the progress of the Pilot CBM project. The annual monitoring cycle could be designed in stages, so that community members receive periodic updates on the project's progress and have regular opportunities to provide input and verify the data interpretation.

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Allan Lissner

Opposite page: Leo Moonias with fish

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INTRODUCTION

At 452,000 km^2 – an area the size of California – Ontario's Far North is one of the world's largest continuous intact expanses of boreal forest free from industrial development (Chetkiewicz and Lintner, 2014) (Figure 1). Ecosystems in Ontario's Far North possess a "high level of ecological integrity and provide ecosystem services far beyond its borders" (Far North Science Advisory Panel 2010). The boreal forest is home to more than 50 species of mammals, including threatened boreal caribou (MNR 2009), and 190 species of birds. Lakes and rivers in Ontario's Far North support over 50 species of freshwater fish. The boreal forests, and wetlands and peatlands that comprise the Hudson Bay Lowland, contain the world's single greatest reserve of carbon stocks, critical for regulating the local, regional and global climate (Carlson et al. 2010). Forests and freshwater systems provide multiple ecosystem services, such as provisioning (e.g., source of timber, fuel, and food), supporting (e.g., maintain soils), and cultural (e.g., important for the well-being of local, particularly First Nations, communities) (Abraham et al. 2011).

Though described as *intact* (Far North Science Advisory Panel 2010), Ontario's Far North is by no means devoid of people. For millennia, it has been the traditional territory of Cree and Ojibway First Nations who number around 40,000 people and live in 34 communities, 31 of which are remote and connected to the rest of Ontario by winter roads and air transport (Figure 2). Most of these communities still rely on hunting, trapping, fishing, and gathering foods and medicines throughout their traditional territories for nutritional and spiritual sustenance. First Nations' rights to maintaining their lifestyle, traditions and cultures on their ancestral homelands are recognized and protected in Canada (Section 35, *Constitution Act, 1982*[5]).

Ontario's Far North is an interdependent social-ecological system (SES)[6] where First Nations' well-being is inextricably linked to the ecological integrity of the region. That is, changes in one (e.g., ecological, like early spring thaw and more intense wildfires) have direct implications on the other (e.g., social, like reduced access to hunting and fishing areas and evacuations due to flooding and fires) and vice versa (Chapin et al. 2004).

[5] Described online at: http://indigenousfoundations.arts.ubc.ca/home/government-policy/constitution-act-1982-section-35.html

[6] Socio-ecological systems (SES) are defined as: a coherent system of biophysical and social factors that regularly interact in a resilient, sustained manner; occur at several spatial, temporal, and organisational scales; may be hierarchically linked and contain a set of critical resources (natural, socio-economic, and cultural) whose flow and use is regulated by a combination of ecological and social factors; and are dynamic and complex systems with continuous adaptation (Berkes et al. 2008).

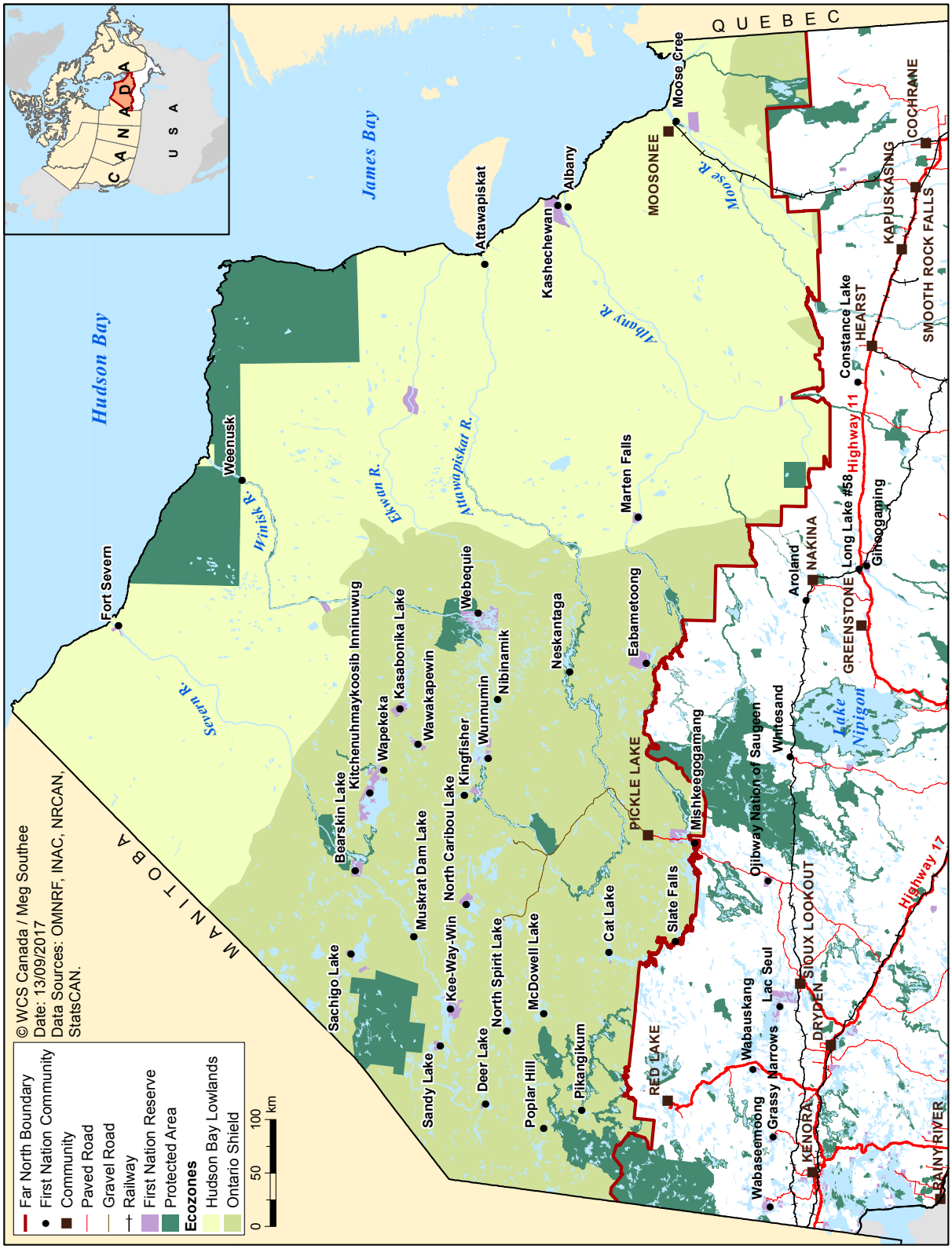

Figure 1. Ontario's Far North

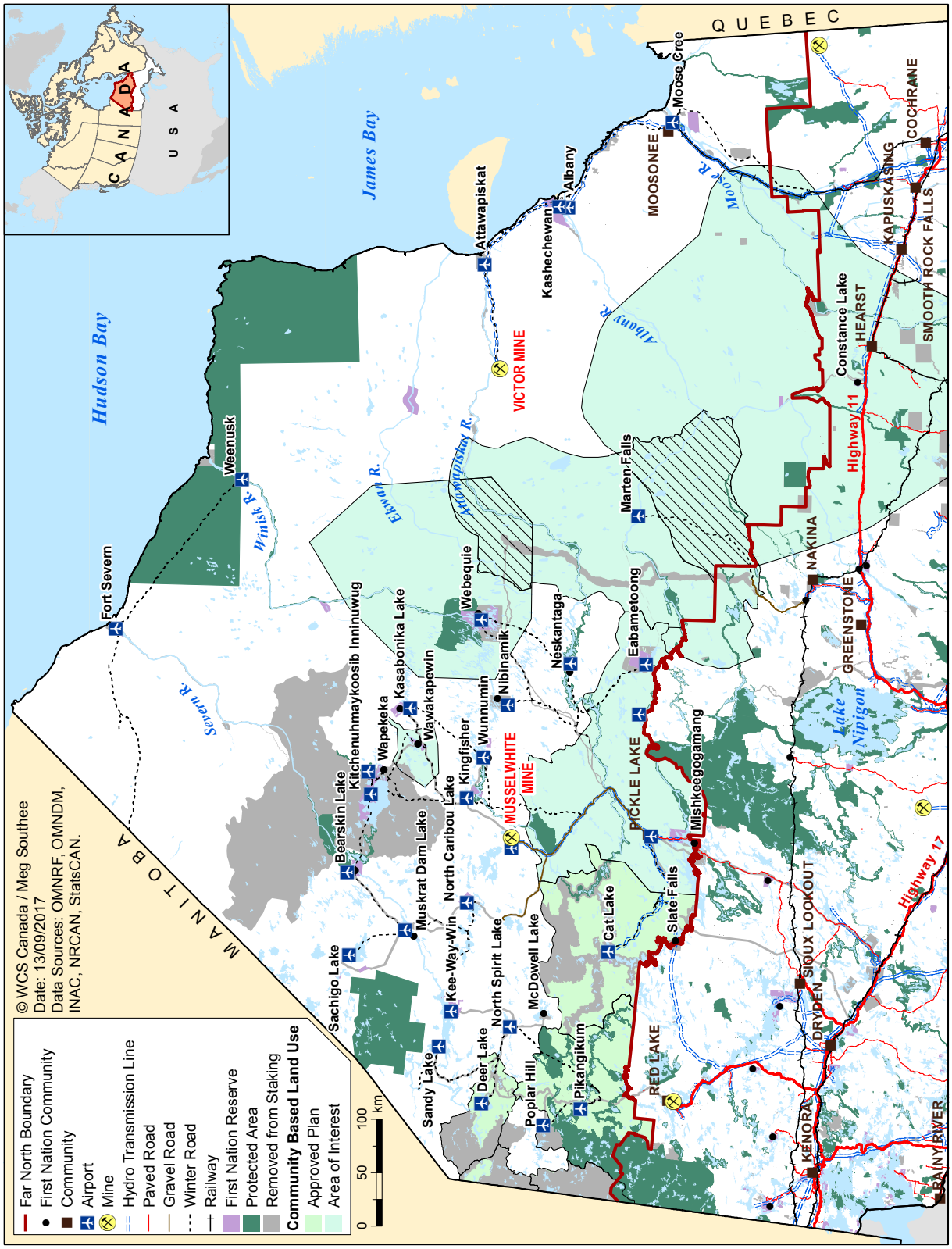

Figure 2. First Nation communities and infrastructure in Ontario's Far North

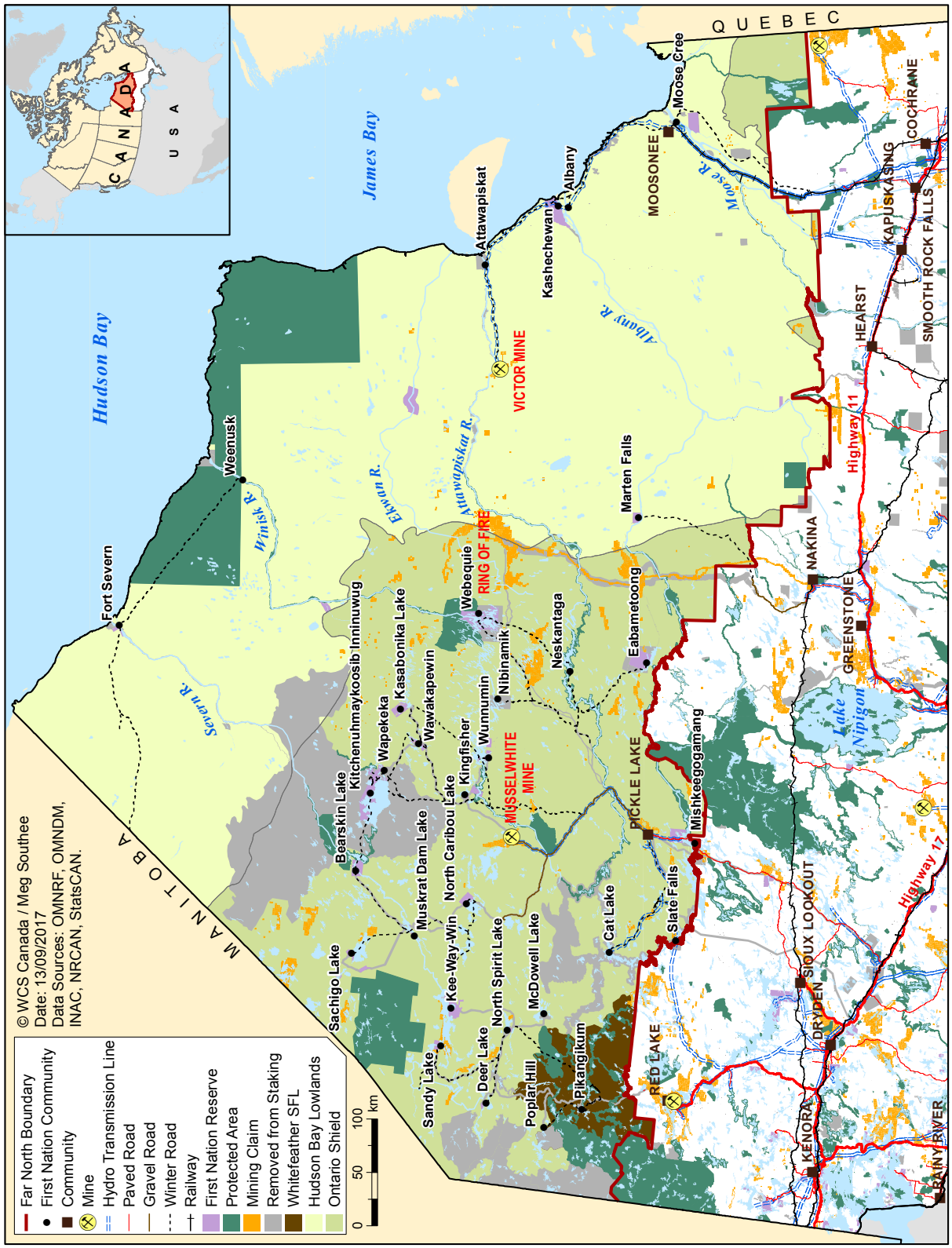

Figure 3. Land use in Ontario's Far North.

The resilience[7] of this system is being increasingly tested by expanding mineral exploration (e.g., Ring of Fire[8]), logging, and hydroelectric projects. These developments will require the construction of all-weather roads and transmission lines in order to facilitate access of wood and minerals to southern markets and provide energy to supply remote mines and First Nations communities in the region (Figure 3). A warming climate also poses serious threats to Ontario's Far North, as later freeze-ups, warming waters, and more severe fire seasons, together with shorter periods of ice cover and flooding, affect wildlife distribution and human mobility on the landscape (Far North Science Advisory Panel Report 2010, Golden et al. 2014, McDermid et al. 2015).

The resilience of a social-ecological system is sustained through institutional arrangements[9] that have evolved over time to regulate human-environment interactions in order to avoid tipping the system into a new and potentially irreversible state (e.g., from grasslands to deserts due to overgrazing or from commons to private property because of market demand) (Walker and Salt 2004, Kinzig et al. 2006). These states may not always be as desirable from the society's perspective. Tight feedback loops between the ecological and social systems — an important part of these institutional arrangements — is maintained by monitoring[10] environmental conditions through Traditional Ecological Knowledge (TEK) (Huntington 2000, Bohensky and Maru 2011). TEK is a cumulative body of knowledge, practices, and beliefs about the relationships between people, other living beings, and their environment, handed down through generations, primarily through oral and hands-on transmission (Berkes et al. 2000). TEK provides valid and practical information about various ecological processes including, for example, daily movements of animals, their seasonal distribution and multi-year changes in abundance (e.g., Parlee and Manseau 2005, Parlee et al. 2014, Tengö et al. 2014). TEK-based feedback allows for timely detection of environmental changes, and development of appropriate community responses that help maintain the integrity and resilience of a local SES (Walker et al. 2002, Stevenson 2012). Further, TEK is an attribute of societies with historical continuity in resource use practices; by and large, these are "non-industrial or less technologically advanced societies, many of them Indigenous or tribal" (Berkes 1993).

[7] Resilience refers to the capacity of a system to recover after disturbance, absorb stress, internalize and transcend it, while maintaining the system's key functions and processes.

[8] The Ring of Fire, located in the central portion of Ontario's Far North, along the eastern boundary of the Ontario Boreal Shield is an arc-shaped, mineral-rich zone that is the focus of intense mineral exploration activity, particularly nickel and chromite. Proposed mining projects and infrastructure in the Ring of Fire would directly impact nine First Nations (Matawa First Nations) as well as communities downstream (e.g., Mushkegowuk First Nations) in Ontario's Far North.

[9] Informal rules of conduct and formal regulations that define who gets access to Common Pool Resources (CPR), such as wildlife, what is harvested and when, and who makes relevant management decisions (National Research Council 2002).

[10] The institutionalized process of gathering data and information about the changes in the status of natural resources, environmental processes, and ecosystem services.

For generations, Indigenous peoples and communities around the world have been paying attention to what has been unfolding on their traditional territories, such as shifts in the abundance of a subsistence species, seasonal or multi-year fluctuations in weather patterns, or changes in the frequency and intensity of extreme weather events (Alexander et al. 2011, Sheil et al 2015). Based on these observations, they have often been able to develop adequate responses (i.e., adapt) to changes in their environment (e.g., adjusting the timing and/or intensity of harvest, relocating seasonal camps or permanent settlements, etc.) (Parlee et al. 2005). As the natural and anthropogenic pressures on the Indigenous peoples' traditional territories escalate in scale, frequency and intensity (e.g., due to resource extraction and climate change), the need for monitoring changes, and understanding their impacts on local systems and developing appropriate responses becomes more critical than ever (Huntington et al. 2013). Most Indigenous communities view their local environment not as a combination of discrete resources — the view typical of western approaches to resource management, land use planning, and impact assessment — but as an integrated whole, which is a view better aligned with cumulative effects assessment (McKay and Johnson 2017a).

The role of community-based traditional decision-making and TEK has diminished in the wake of a long legacy of imposed government policies (e.g., sedentarization, acculturation, residential schools, *Indian Act*[11], among others) and industrial development, eroding the social and ecological integrity of Indigenous territories (Nuttall et al. 2005). To maintain the integrity and resilience of Ontario's Far North's social-ecological systems as development pressures (e.g., Ring of Fire mines, energy and transportation infrastructure, mineral exploration, and expansion of existing mines) and climate change increase in Ontario's Far North, adequate tools and approaches must be applied based on the best available knowledge. To support First Nations' efforts to monitor and respond to environmental changes on their traditional territories, such tools must be developed on the First Nations' terms; based on TEK and customary governance; and, complement existing (*sensu* scientific) monitoring approaches.

[11] Available online at: http://laws-lois.justice.gc.ca/eng/acts/i-5/

FIRST NATIONS AND MONITORING CHANGE IN ONTARIO'S FAR NORTH

In Canada, environmental monitoring projects are implemented by different jurisdictions, agencies, and organizations for different reasons. At the national level, international environmental agreements, like the Convention on Biological Diversity (CBD)[12], require signatory countries (e.g., Canada) to undertake systematic monitoring of natural resources at the national level to meet their biodiversity conservation obligations (CBD 2014). The Northern Contaminants Program (NCP)[13] (e.g., Donaldson et al. 2010) and the Mackenzie Basin Impact Study (MBIS)[14] are examples of broad-scale federal programs collecting data on contaminants and climate change to evaluate how these complex processes impact northern ecosystems and the people that live there.

At the provincial level, management agencies evaluate progress toward achieving conservation and management targets by means of gathering and evaluating monitoring data. For example, in Ontario, the Broad-scale Inland Lakes Monitoring Program[15] was designed to monitor the health of Ontario's lakes over time, increase biologists' understanding of the state of fish and other aquatic resources, identify stresses on these resources, and report on changes (Furrer et al. 2014). Similarly, as a member of Ontario's Biodiversity Council, the Government of Ontario, outlined its commitments to conserving biodiversity in *Biodiversity: It's In Our Nature*[16] including developing a long-term biodiversity monitoring system for Ontario. The success of Ontario's Strategy is tracked by monitoring 15 specific targets that represent key areas of focus for biodiversity conservation in Ontario. These targets support national and international initiatives (e.g., Aichi Biodiversity Targets).

[12] Available online at: https://www.cbd.int/

[13] The NCP and relevant international and global agreements are available at: http://www.science.gc.ca/eic/site/063.nsf/eng/h_67223C7F.html

[14] The MBIS was a six-year research effort to assess the potential impacts of climate change scenarios on the Mackenzie Basin region of northwestern Canada. Available online at: http://www.usask.ca/geography/MAGS/Intro/Basin/mbis_e.html

[15] Information about Ontario's Broad-scale Monitoring Program is available at: https://www.ontario.ca/page/broad-scale-monitoring-program

[16] Action 23 in the Ontario Government *Implementation Plan for Ontario's Biodiversity Strategy*, 2011 available online at: http://ontariobiodiversitycouncil.ca/wp-content/uploads/MNR_BIION_accessibility_EN_Final.pdf

Direct, indirect, and cumulative effects of management decisions and development initiatives must not undermine First Nations' Aboriginal and treaty rights to their traditional livelihoods, which remain inextricably linked to the environment.

At the local level, monitoring is necessary to ensure that negative environmental impacts of development, such as mining, are detected in timely fashion and addressed (Corrigan and Hay-Edie 2013). In Ontario, proponents of development projects are required to carry out project monitoring under provincial and/or federal Impact Assessment (IA) processes in order to monitor how their activities, and approved mitigation approaches, are affecting the local environment and the community (Lindgren and Dunn 2010, Noble 2016).

Direct, indirect, and cumulative effects[17] of management decisions and development initiatives must not undermine First Nations' Aboriginal and treaty rights to their traditional livelihoods, which remain inextricably linked to the environment. Monitoring the direct, indirect, and cumulative effects of major drivers of environmental change in Ontario's Far North (e.g., industrial development, climate change) is critical at project (e.g., project-based environmental impact assessments), community (e.g., community-based land-use planning under Ontario's *Far North Act, 2010*[18]), and regional levels (e.g., Far North Land Use Strategy[19], the "Ring of Fire" region) (Chetkiewicz and Lintner, 2014).

Recognizing the need to monitor changes in both social and ecological systems, the Far North Science Advisory Panel[20] recommended that the Government of Ontario develop a program to monitor the state of the environment and First Nations health (Far North Science Advisory Panel 2010: 106). Such a program, according to the Panel's recommendations, "must be based on the integration of scientific data and TEK, both of which should be available for management, planning, and conservation purposes." The Panel emphasized that the scope and extent of scientific biophysical surveys and inventories in the region are limited, because of the remoteness of the Far North and, ironically, the low level of development (e.g., lack of roads), which makes monitoring expensive.

The Panel also stressed the need to fill in the gaps in available information by including TEK in monitoring processes and developing approaches to support the documentation of this body of knowledge and its use in land and resource use planning. More recently, the Environmental Commissioner of Ontario (ECO) recommended that any long-term monitoring programs in the Far North developed by the Government of Ontario, particularly in the "Ring of Fire" region where mines and infrastructure may impact multiple communities, "should incorporate traditional knowledge and actively involve First Nations communities" (ECO 2013: 71). To date, the Government of Ontario has not taken up any of these recommendations.

[17] Cumulative effects "result from the combined effect of multiple activities over space or time" (MacDonald 2000: 299).

[18] Ontario's Far North Act, 2010 is available online at: http://www.ontario.ca/laws/statute/10f18

[19] https://www.ontario.ca/page/far-north-land-use-strategy

[20] Established in 2008 by the Ontario Ministry of Natural Resources, the Far North Science Advisory Panel included experts in a variety of fields who provided scientific advice relevant to land use planning decisions in support of community based land use planning.

First Nation communities in the Far North, specifically those affected by infrastructure and new mine proposals in the "Ring of Fire" region, are currently engaged in various government-led planning processes, but how these processes include TEK and consider TEK in decision-making remains unclear. For example, under Ontario's *Far North Act 2010,* community-based land-use planning (CBLUP) is intended to bring scientific information and TEK together[21], but it is not clear what TEK is available and how it may be applied during these planning processes. CBLUP does not include a monitoring component, which is necessary to provide data for detecting environmental change associated with climate change, land use plans, and mining assessments[22]. Proponent- and consultant-led monitoring, mandated under federal and/or provincial processes (e.g., Noront's Eagle's Nest Project[23]) may not always address First Nations' concerns, Aboriginal and treaty rights, and the need to consider TEK as described recently by the Expert Panel who reviewed Canada's federal environmental assessment processes[24].

Similarly, sector-specific monitoring that focuses on single impacts in isolation is inadequate for environmental management across regions with a history of multiple industrial developments (Burton et al., 2014). Finally, while able to address some shortcomings of the IA process in terms of monitoring, agreements with industry such as Impact and Benefit Agreements[25] may also provide limited opportunities to enable TEK-based monitoring, given the emphasis in federal and provincial IA on conventional science-based monitoring (O'Faircheallaigh 2007, 2008, McDermott and Wilson 2010, Noble and Birk 2011).

In Ontario, there are no contemporary examples of how to develop a monitoring program that meaningfully integrates TEK and meets the needs and interests of First Nations, while informing environmental planning and decision-making amongst the Ontario government, industry, and other stakeholders. There are, however, emerging global, national and local frameworks, methodologies, and case studies that could guide TEK-based monitoring in Ontario's Far North using a Multiple Evidence Based approach.

[21] https://www.ontario.ca/page/land-use-planning-process-far-north

[22] https://www.ontario.ca/page/environmental_assessment-projects-category#section-1

[23] https://www.ontario.ca/page/noront-eagles-nest-multi-metal-mine

[24] Available online at https://www.canada.ca/en/services/environment/conservation/assessments/environmental-reviews/environmental-assessment-processes/building-common-ground.html

MULTIPLE EVIDENCE BASED (MEB) APPROACH

The Multiple Evidence Based (MEB) approach is an innovative framework developed and adopted by the UN's Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)[26] that regards Indigenous, local and scientific knowledge systems as different, but complementary, manifestations of humankind's collective knowledge (Tengö et al. 2014, 2017).

The MEB approach weaves together Indigenous, local, and scientific knowledge for resilience and sustainability, while maintaining the integrity of each knowledge system. The MEB approach recognizes that evaluating knowledge *within* rather than *across* knowledge systems enables joint appraisal of knowledge, leading to enriched understanding and new insights and innovations that is critical for knowledge co-production. One example is The Plan of Action on Customary Sustainable Use of Biodiversity under the Convention of Biological Diversity (CBD).

[26] Intergovernmental body that, under the auspices of the United Nations, assesses the state of biodiversity and ecosystem services, in response to requests from decision makers (https://www.ipbes.net/).

The Plan of Action on Customary Sustainable Use of Biodiversity under the Convention of Biological Diversity (CBD)

The objective of this Plan is to recognise, promote and support customary sustainable use at local, national, regional and international levels, and to ensure the full and effective participation of indigenous peoples and local communities at all stages of implementation of the plan. In 2004, it was recognized that there was a scarcity of practical information about and examples of customary sustainable use of biological diversity by indigenous peoples and local communities and how such use can be encouraged. In response to this call for advice, while also fulfilling the desire to document and safeguard their knowledge, indigenous organizations and support organisations from Bangladesh, Suriname, Guyana, Cameroon, Thailand and Venezuela, started to develop case studies to promote customary sustainable use. These case studies became a core stream of evidence contributing to the CBD processes to develop the Plan that was finally adopted in 2014 at the 12th Conference of the Parties. For more information see: http://www.forestpeoples.org/customarysustainable-use-studies and https://www.cbd.int/decision/cop/default. shtml?id=13375

The MEB framework aspires to engage Indigenous rights-holders, stakeholders, and their institutions in empathic, equitable, and empowering ways. It does so by focusing on five key elements associated with knowledge co-production:

- ***Mobilization*** includes articulating knowledge in forms that can be shared with others.
- ***Translation*** implies interactions between knowledge systems based on mutual comprehension of the shared knowledge.
- ***Negotiation*** means joint assessment of convergence, divergence and conflicts across knowledge contributions.
- ***Synthesis*** shapes a broadly accepted common knowledge that maintains the integrity of each knowledge system, rather than 'integrating' one into another.
- ***Application*** emphasizes knowledge that is useful for decision-making that in turn feeds back into respective knowledge systems.

The MEB framework aspires to engage Indigenous rights-holders, stakeholders, and their institutions in empathic, equitable, and empowering ways. It does so by focusing on five key elements associated with knowledge co-production.

There is a growing recognition that the direct comparisons between TEK and Western science are unproductive (Menzies 2006), as one epistemological system cannot be adequately evaluated by another (Tengö et al. 2017) and, just as is the case with science, TEK is not static but constantly evolving in response to the changing circumstances (Gómez-Baggethun et al. 2013). Still, there are consistencies between the way in which knowledge is produced and applied by the two knowledge systems (Barnhardt and Kawagley 2005) including:

- the use of empirical observations.;
- verification through repetition;
- subject to modification and/or improvements (*sensu* adaptive management);
- used to make inferences and predictions about environmental relationships.

WCS Canada / Justina Ray

A joint approach to monitoring can create new insights for both communities and scientists.

Despite these similarities, there are a number of important differences between these knowledge systems. TEK is intuitive and holistic, subjective, qualitative, diachronic (e.g., long-term in one place), orally transmitted, and of the view that relationships with nature are imbued with spirit (Stephens 2000). Western science, on the other hand, is analytical and reductionist, objective, quantitative, and synchronic (many observations over a large area) (Tsuji and Ho 2002). Still, as the MEB approach emphasizes, a joint approach can lead to joint appraisal of the diverse knowledge systems and a focus on knowledge co-production. The MEB approach creates the groundwork for the respectful and equitable inclusion of TEK in environmental monitoring and governance through community-based processes (Tengö et al. 2017).

COMMUNITY-BASED MONITORING (CBM)

For Indigenous communities throughout Canada faced with the prospects or consequences of industrial development — including mining, forestry, hydroelectric developments, and new infrastructure similar to those in Ontario's Far North - monitoring is critical for assessing the impacts of industrial development (as well as the mitigation activities) taking place on or near their traditional territories. First Nations must have access to approaches that are simple, reliable, financially sustainable, and culturally appropriate (Rist et al. 2010), including suitability for monitoring Cultural Keystone Species[27] (Garibaldi and Turner 2004, Noble et al. 2016).

Grounded in MEB principles, a new generation of monitoring methodologies, called Community-Based Monitoring (CBM)[28] (Danielsen et al. 2005) reflects the interests and needs of local communities living with environmental change, whether due to climate change, industrial development, ongoing land uses, or some combination of these changes (e.g., cumulative effects) (McKay and Johnson 2017b).

There is a growing recognition of the benefits that arise from creating a space for local people to participate in the development and implementation of monitoring programs, as reflected in the development of the MEB approach and a growing number of CBM approaches (Danielsen, et al. 2011). There are several basic types of CBM initiatives, depending on the degree to which governance of natural resources lies with either the government or local communities (Danielsen et al. 2008). At one end of the spectrum, are externally driven monitoring schemes designed and implemented by researchers, contractors, and consultants (typically organized and funded by government agencies, non-governmental organizations, and/or industry)(Powers et al. 2013). At the other end of the spectrum, are more autonomous, locally based monitoring initiatives where the entire monitoring process — design, data collection and analysis, and management decisions — is based on TEK and carried out by local communities (see the Gwich'in Harvest Study, in the *Canadian Case Studies: Subsistence Monitoring* section).

[27] Cultural Keystone Species influence the cultural identity of a group of people via the species role in subsistence, spirituality, and/or Indigenous economies and maintaining the connections to these species through traditional practices is crucial for the social-ecological resilience of Indigenous cultures (Noble et al. 2016).

[28] CBM is a process where local people and institutions, government agencies, industry, and academia collaborate to monitor, track, and respond to issues of common community concern (EMAN 2002).

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Traditional knowledge can improve our scientific understanding of environmental changes.

There are at least two other types of collaborative monitoring schemes. In the first, the project design, data analyses, and interpretation are made by scientists outside of the local community, but the local community collects the data (e.g., methodologies for REDD+ and its associated monitoring and measurement, reporting and verification process[29]). In the second, the data collection, interpretation, and decision-making is community-based, but external scientists provide independent advice and training as needed (see NAILSMA I-Tracker Program[30], in *Global Case Studies: Traditional Territory Monitoring* section).

Within CBM, TEK plays a number of important roles. First, it can provide a baseline of historical data, against which contemporary environmental changes may be assessed (Cochran et al. 2013). Here, TEK can fill the gaps in scientific knowledge and offer alternative or complimentary interpretations of current conditions. Second, TEK provides factual information about the state of the environment (e.g., weather, ice, currents, animal behavior, traveling conditions, etc.) and includes knowledge about the historic and current use of the environment (e.g., land use and occupancy, harvest locations and intensity, etc.) that can be used in CBM. These tend to offer a more holistic and long-term understanding of the environment through the direct observations rooted in historical relationships between the community members and knowledge holders and their ancestral territories (Huntington 2008). For example, Indigenous peoples of the Arctic and Subarctic boreal regions have highly relevant knowledge of key components of their environment, such as sea ice (Laidler 2006), river ice (Golden et al. 2014), weather patterns (Weatherhead et al. 2010), climate change (Green and Raygorodetsky 2010, Cochran et al. 2013), and caribou ecology (O'Flaherty et al. 2008, Species at Risk Committee 2012, Parlee 2014).

Rooted in the understanding of the interdependence between human well-being and environmental health (Parlee 2011), TEK integrates key guidelines for proper ethical and moral behavior of people towards plants, animals and other living beings. Based on the Earth-centered obligations of Indigenous community members to care for their ancestral territories for future generations, such rules of conduct — like restrictions on harvest to certain age groups, sex, or seasons based on cultural significance of a species (Berkes 2008) — serve as a foundation for local environmental management and conservation.

[29] Reduced Emissions from Deforestation and Degradation, or REDD, is a scheme in which "developing" countries are rewarded financially for reducing emissions by decreasing the loss of forests to alternate land uses (Parker et al. 2009). Monitoring and Measurement, Reporting and Verification (M&MRV) was developed to standardize monitoring, measurement, and reporting of emissions data among REDD+ participating countries.

[30] The North Australian Indigenous Land & Sea Management Alliance (NAILSMA) is an unincorporated bioregional forum for Aboriginal land and sea managers across North Australia. More information is available at: https://www.nailsma.org.au/

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DEVELOPING A CBM FRAMEWORK IN ONTARIO'S FAR NORTH

While the Government of Ontario has invested in, and made progress towards, collecting scientific information in Ontario's Far North[31], it has made few gains in creating a framework or a process that considers TEK in environmental monitoring and decision-making, as per the recommendations from the Far North Science Advisory Panel and ECO. Ontario's engagement with First Nations on monitoring (e.g., species-at-risk recovery strategies for caribou, wolverine, polar bears, and lake sturgeon) and industrial development (e.g., mining, energy transmission, commercial forestry) has been limited, despite written principles and objectives on including TEK and working with First Nations (e.g., MNR 2014).

Current monitoring efforts in Ontario's Far North largely rely on outside expertise and do not adequately incorporate traditional knowledge.

Similarly, a review of TEK integration within three Ontario case studies, including the Moose River Basin Environmental Information Partnership, the Anishinabek/Ontario Fisheries Resource Centre, and the Whitefeather Forest Initiative, also highlighted the need for meaningful involvement of Indigenous partners from the outset (McGregor 2009). McGregor (2009) noted a lack of staff trained in Indigenous methods of observing, understanding, and explaining information (e.g., Elders or other traditional knowledge holders) as well as the need to define who has authority to mobilize knowledge sharing between both science and TEK holders in these efforts.

The lack of government actions toward the implementation of TEK-based monitoring could be explained by several interrelated factors. First, there is no commitment to environmental monitoring in Ontario's Far North (Chetkiewicz and Lintner, 2014). Second, when implemented, the monitoring efforts tend to rely on professional expertise from outside First Nations communities (e.g., consultants, government staff). The development and implementation of monitoring protocols are technically, logistically, and financially

[31] https://www.ontario.ca/page/science-and-information-support-planning

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demanding, and difficult to sustain over the long term, particularly throughout vast and remote regions like Ontario's Far North. More fundamentally, as the global experience demonstrates, externally driven monitoring approaches rarely consider the opinions, expertise, and priorities of local communities, whose livelihoods are interlinked with the ecosystems being monitored, but who may have little say in the design, implementation and use of monitoring programs (Danielsen et al. 2008). This is compounded by the lack of clear protocols for including TEK in monitoring efforts (Tengö et al 2014). As a result, local communities are often wary, and weary, of externally driven and top-down monitoring efforts, do not trust the goals and findings of these projects, and rarely endorse or support them or the outcomes (Danielsen et al. 2007).

CBM is an important opportunity for First Nations to meaningfully engage in monitoring efforts in the Ontario's Far North. These approaches can empower local, in particular Indigenous, communities, to carry out their own monitoring, based on TEK, complemented by other sources of information.

To overcome some of these shortcomings in Ontario's Far North, responsible government agencies, non-governmental organizations, and industry could explore the development of an MEB-based monitoring framework as a promising way forward. This approach includes TEK and reflects the interests and needs of the First Nations impacted by management decisions and development projects, including mining and infrastructure proposals for the "Ring of Fire".

CBM is an important opportunity for First Nations to meaningfully engage in monitoring efforts in the Ontario's Far North. These approaches can empower local, in particular Indigenous, communities, to carry out their own monitoring, based on TEK, complemented by other sources of information (e.g., scientific information gathered through government- or proponent-led monitoring programs). CBM approaches link natural resource monitoring to the priorities, expertise, and traditional management institutions of Indigenous communities, making such monitoring efforts more locally acceptable, relevant, and sustainable, which in turn potentially provides faster and more positive local management outcomes (Danielsen et al. 2014b).

In Ontario's Far North, the Regional Framework Agreement[3] , signed in 2014 between Ontario and nine Matawa First Nations, provides an important opportunity for implementing CBM approaches. In the Agreement, the Government of Ontario and Matawa communities agreed to a set of principles and objectives for addressing development, specifically mining and all-weather infrastructure, in the Ring of Fire. One of the objectives of this Agreement is to develop a "long term environmental monitoring program on a regional basis". Few public details are available to assess what this monitoring program would look like and how it will be implemented. However, the

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CBM approaches can ensure that First Nation interests and needs are reflected in monitoring efforts, particularly where new developments could lead to major landscape changes, such as in Ontario's Ring of Fire.

Agreement may provide a governance platform for the First Nations to develop and implement a TEK-based CBM initiative, laying the foundation for meaningful, equitable, and respectful knowledge co-creation, based on the principles of a MEB approach. TEK would be valued on par with science-based expertise in generating valid evidence for detecting and interpreting change in the Ring of Fire, and providing feedback (*sensu* adaptive management) for conservation and management actions.

Establishing a TEK-based CBM initiative in Ontario's Far North, particularly in the Ring of Fire, would help address outstanding TEK-related recommendations to the Government of Ontario by providing a practical mechanism for both TEK and science to become integral parts of the MEB approach to decision-making on environmental management and monitoring. CBM could also contribute to the development of future scenarios, and the understanding of the current and future relationships between the diverse elements of Ontario's Far North's social-ecological systems.

CBM TOOLBOX

Several approaches can be used within a CBM framework (Gofman 2010) as a foundation for an MEB approach to monitoring using both TEK and scientific information. Some or all of these should be considered in designing a CBM framework for Ontario's Far North:

- **The "Sentinel" or "Patrol"** approach involves an observer documenting environmental conditions that correspond with various local concerns. An example of this approach is the Coastal Guardian Watchmen Network[32] (see Canadian Case Studies: Traditional Territory Monitoring section of this report), where the community members from Canadian Coastal First Nations monitor their territory and collect data on a number of issues of concern to local communities (e.g., wildlife sightings, tourist activities, etc.). One method for implementing this approach is the "Journal" method, where a personal record of environmental observations is kept on a regular basis for an extended period of time. Examples include a diary kept by a local fishermen, hunter, or trapper; or, the field notes of a park warden. This inexpensive method offers rich contextual information that can contribute to a better understanding of a specific topic of interest to the community, like changing weather. An example where this method has been applied is the Community Moose Monitoring Project in Yukon (see Canadian Case Studies: Species Monitoring section), where every fall, hunters record their observations of moose sightings and harvest in a field journal. These observations are then used to support moose management decisions by government staff.

- **The "Surveying Human Sensors"** approach documents local residents' perceptions of the status of key species, processes, or functions in the environment and changes being observed. Methods for collecting these data include one-on-one or group interviews, and/or community meetings. For example, the Gwich'in Harvest Study relied on this method to monitor subsistence activities on the traditional territory of the Gwich'in people in the Northwest Territories (see Canadian Case Studies: Subsistence Monitoring section). This approach provides detailed spatial information over many areas and various species and populations, which

[32] http://www.coastalfirstnations.ca/

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would be costly and difficult to gather through typical scientific approaches. Moreover, the gathered information is not only current, but can also retrospective since past information can also be re-created and mapped, enabling researchers to "backcast" prior to when the monitoring program became established. Such historical data can lead to a better understanding of environmental change in an area over time and allow better interpretation of events and changes taking place at present.

Another method along the same lines is the "Group Meeting" approach, where local residents share their observations of natural phenomena over a specific period of time. With this method, a trusted researcher, who often facilitates the meetings, summarizes the discussions in a report, using information approved by the participants. Group meetings can be a cost-effective way to gather data and engage residents. The Łutsël K'e Dene First Nation's Ni hat'ni Dene Program in the Northwest Territories (Canadian Case Studies: Ni hat'ni Dene Program section) illustrates how this method is being used and its findings applied.

- **The "Maintenance Monitoring"** approach involves the regular collection of data on environmental risks in a specific part of a region, territory, or ecosystem (e.g., wetlands, coasts). The method is developed and carried out by local residents to document and monitor environmental problems on their territories. If records of activities and results are maintained properly, these data could be valuable for addressing various research and community needs. NAILSMA's Ghost Nets Program in Australia (see Global Case Studies: Traditional Territory Monitoring section) is an example of a project using this methodology to monitor the coastline, while also cleaning up discarded fishing nets and marine debris that can cause serious damage to "sea country" and marine life.

Additional CBM techniques have their origin in Participatory Rural Appraisal (PRA) methodologies designed to facilitate the collection and analysis of information by, and for, community members (Asia Forest Network 2002). PRA emphasizes local knowledge and involves communities in the inventory, monitoring, and planning of local natural resource management. The process of conducting PRA is as important as the gathered data itself, because it supports dialogue within the community, as well as between community members and managers, NGOs, and government officials. Examples of PRA tools that could be relevant for CBM in Ontario's Far North include:

- **Community maps** used to display and share information about land tenure and land use changes in visual ways that are compatible with traditional knowledge (Tobias 2009). These maps provide an important evidence base for local planning and have been used to assert land rights by Indigenous peoples. For example, Ogiek Indigenous people of Kenya use participatory 3D-mapping to plot their traditional territory and land use (Rambaldi et al. 2007).

- **Seasonal calendars** are useful in documenting annual changes in the abundance and distribution of fish and wildlife, plants, and other resources; people's seasonal socio-economic activities; and shifting weather patterns (Cochran et al. 2016). For example, Venda Indigenous people of South Africa developed a visual representation of their annual calendar to monitor changes in seasonal traditional activities (Gaia Foundation 2011).

- **Participatory media**, such as community radio (Tebtebba Foundation 2013) or video (Bali and Kofinas 2014) is also an effective tool for building awareness and capacity of communities and can be used to communicate the information collected by CBM projects, and to pass on TEK. For example, "*Voices of the Caribou People*" was a participatory videography project documenting and sharing the local knowledge of caribou peoples (Nunamiut Eskimo, Vuntut Gwich'in, Tlicho Chipewyan, Dogrib Inuit, and Naskapi) about social-ecological changes they have observed (Bali and Kofinas 2014).

- **Indigenous Language Documentation** is another important CBM tool. Place names in local dialects often provide important information about landscape resilience and change over time (Davidson-Hunt and Berkes 2003, Anderson 2011, Boillat et al 2013). For example, Alaska Native Place Names Project (ANPNP)[33] created a comprehensive record of the Indigenous place names based on all of Alaska's Native languages by building a multi-lingual geo-spatial database based on input from Indigenous language experts (Kari 2008).

Community maps used to display and share information about land tenure and land use changes in visual ways that are compatible with traditional knowledge. These maps provide an important evidence base for local planning and have been used to assert land rights by Indigenous peoples.

[33] http://www.uaf.edu/anpn/

KEY ATTRIBUTES OF A SUCCESSFUL CBM PROJECT

The CBM methodologies can reveal underlying temporal and spatial shifts in the availability and distribution of natural resources of interest and value to communities. Their application, however, includes some challenges that range from volunteers losing interest in the project due to the lack of economic incentives (e.g., wages) (Lefler 2010) to methodological inconsistencies over large landscapes and extended periods of time that limit the applicability of CBM results in policy and decision-making by government and industry (McComb et al. 2010).

Nevertheless, through careful design, and with appropriate, respectful "two-ways" (Muller 2012) capacity building — where both local people receive training in scientific methodologies, and outside experts learn to value and work with TEK — TEK-based CBM initiatives can yield quality results that address a number of management-related limitations (Rest et al. 2010). In general, successful CBM projects tend to:

- focus on management issues of greatest concern to local people, which gives them a better chance of influencing "on-the-ground" conservation action;
- enhance the capacity of local people to engage in governance of natural resources on their traditional territories on their own terms (Danielsen et al. 2005); and,
- tend to cost less, making them more financially sustainable.

To be successful, CBM projects must possess a number of key attributes. First, the relationship between project participants must be based on ***trust*** through developing a common language and generating reliable information about the environmental variables of concern to Indigenous communities. Second, a set of ***ethical principles*** must be agreed upon to guide project design and implementation, as well as collection, interpretation and use of data to ensure that the

Opposite page: Lawrence Sakanee from Neskantaga FN

Allan Lissner

collective intellectual property rights of Indigenous communities are respected. Finally, CBM must support ***fair and equitable decision-making*** through facilitating MEB-based knowledge co-creation and supporting inter-generational transfer of TEK.

Trust

Language is a powerful tool, because setting the language of discourse defines the rules of engagement (Berkes 2004). Language differences can hinder communication and mutual understanding between project participants. Developing a common mutually understandable terminology for CBM is fundamental for establishing a just and equitable working environment.

The Chippewa chose the phrase "watching, listening, learning and understanding changes in the Dene way of life" to describe their CBM work because this more accurately describes the process, was easy to translate in their own language, and was conceptually more meaningful.

For example, at the community level, for many Indigenous peoples the word "*monitoring*" actually has a negative connotation since it is associated with an historical legacy of being "wardens of the state" whose behaviour must be overseen (Diablo and Pasternak 2011). Instead, the Chippewa chose the phrase *"watching, listening, learning and understanding changes in the Dene way of life"* to describe their CBM work because, for them, this more accurately describes the process, was easy to translate in their own language, and was conceptually more meaningful (Parlee 1998).

The scientific and technical expertise that dominates most research, planning, management, and monitoring approaches is communicated in English. It is critical to facilitate Indigenous access to this expertise when considering the development of CBM in Ontario's Far North where English is the second language for many members of First Nations communities, particularly Elders. In addition, there are no Indigenous equivalents for the technical scientific terminology associated with monitoring (e.g., adaptive management, cumulative effects assessment).

At the same time, staff within government or industry, who are responsible for implementing monitoring programs, may feel that CBM methods are more susceptible to bias than standard techniques. This includes suggestions that CBM approaches have low ***accuracy*** (i.e., the closeness of measurements to their true values). For example, in estimating abundance of reef organisms, accuracy of volunteer data varied with habitat type and taxon, and was lower in deeper water, but did not increase with volunteer experience (Mumby et al. 1995). Besides accuracy, the utility of CBM data is also perceived to be limited in the ***precision*** of the results (i.e., the closeness of repeated measures to each other). For example, compared with scientific

approaches, data collected using CBM approaches on the abundance of organisms are sometimes under- or over-estimated, while less familiar taxa are misidentified (Bray and Schramm 2001).

Several approaches have been used to address these challenges, including:

- Co-creation of community-specific CBM methodologies, procedures, guidelines and tools, where indicators and protocols are chosen by communities based on their TEK (UNU-IAS et al. 2014);
- Improved capacity building, explicitly focused on the monitoring needs of local communities (Janzen 2004); and
- Continued support from scientists (Greenwood 2003) with careful data analysis (Engel and Voshell 2002).

Local people are also considered by external experts to be less objective about the status of natural resources because of their vested interests in the use of those resources. Cross-referencing of monitoring results with accounts from other observers — both contemporary (e.g., shared local experiences, stories, and instruction) and historical (e.g., oral history and traditional teachings) — combined with independent, "expert peer review" (e.g., by TEK experts from within as well as outside of the community), may help address these concerns (Danielsen et al. 2011, Tengö et al. 2014).

Ethical Principles

As with any research project involving Indigenous communities, an important area of consideration for CBM projects is collective Intellectual Property Rights (IPR) (Kendrick 2003a, AFN 2009). This is especially relevant for TEK that is being recorded and subsequently shared outside of Indigenous communities (e.g., researchers, government), or the specific contexts in which it was collected.

TEK-based CBM activities must be guided by ethical principles that regulate the relationship between Indigenous peoples and other groups (CTKW 2014, Expert Panel 2017). There may be ethical protocols specific to a particular Indigenous group within a single nation state, such as those created by and for Canadian Inuit communities (Johnson et al. 2015). In addition, national codes of ethics can also be used to frame research and funding for academic research on, and with, Indigenous peoples (CIHR et al. 2014). Canada's Ownership, Control, Access and Possession (OCAP)[34] principles are national in scope and apply to Indigenous communities. These principles uphold

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[34] http://fnigc.ca/ocap.html

the sovereignty and stewardship of the knowledge holders over their own knowledge and data, including the right to determine how these data are managed and with whom they can be shared (Schnarch 2004). Finally, there are also codes of ethics developed for specific jurisdictions, such as the Code of Research Ethics[35] adopted by the Alaska Native Science Commission[36] that applies to all research occurring with, by, and for federally recognized tribes in Alaska.

A number of international standards, guidelines and best practices also provide important guidance on this issue (Fleener et al. 2004, Bavikatte and Jonas 2009) and should be considered in developing an ethical space for MEB-based knowledge co-creation as part of a CBM work in Ontario's Far North. One example is the Tkarihwaié:ri Code of Ethical Conduct to Ensure Respect for the Cultural and Intellectual Heritage of Indigenous and Local Communities Relevant to the Conservation and Sustainable Use of Biological Diversity. The Code was negotiated by the CBD[37]Article 8(j) Working Group[38] on Traditional Knowledge, Innovations and Practices and adopted in 2010 by the signatories of CBD, including Canada (CBD 2011). The Mohawk word *Tkarihwaié:ri* means "the proper way," highlighting to the signatories of the Convention the ethical standards underpinning a collaborative framework that includes Free, Prior and Informed Consent (FPIC) and the effective participation of Indigenous and local communities in various development, research, and monitoring activities proposed for their traditional territories.

The Tkarihwaié:ri Code highlights a number of key ethical principles fundamental to developing a CBM process as part of development projects, such as those being considered in the Ring of Fire, including:

- Full advanced disclosure of the nature, scope and purpose of any proposed activity.
- Securing FPIC of Indigenous peoples and local communities for any proposed research or development activity.
- Demonstrated respect for traditional knowledge, cultures and sacred sites, without imposing external concepts, standards, and value judgments.
- Respect for the rights of Indigenous peoples and local communities to safeguard their cultural heritage (tangible and intangible[39]) based on collective and individual rights and obligations.

[35] http://www.nativescience.org/html/Code of Research Ethics.html
[36] http://www.nativescience.org/
[37] The CBD also advances a code of ethical conduct including (a) to respect, preserve, and maintain the knowledge, innovations, and practices of indigenous and local communities embodying traditional lifestyles relevant to the conservation of biological diversity and sustainable use of natural resources; (b) to promote the wider application of indigenous knowledge with the approval and involvement of the holders of such knowledge; and (c) to encourage the equitable sharing of the benefits that arise from the utilization of such knowledge.
[38] https://www.cbd.int/convention/wg8j.shtml
[39] Tangible cultural heritage includes buildings and historic places, monuments, artifacts, etc., which are considered worthy of preservation for the future. Intangible cultural heritage includes oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts.

- Local criteria, indicators, and the full involvement of Indigenous peoples and local communities in the prediction and assessment of potential impacts.

- Indigenous and local communities participate in research that affects them or which makes use of their traditional knowledge and can develop their own research initiatives.

Another important international instrument that should inform the design of a CBM initiative is the CBD's Akwe: Kon Guidelines,[40] which provide directions for the development of cultural, environmental, and social impact assessments related to proposed developments on lands and waters traditionally occupied by Indigenous and local communities (CBD 2004). Adopted in 2004, the Akwe: Kon Guidelines call for detailed, open and participatory environmental and social impact assessments. The Guidelines articulate that environment and social impact assessments must be:

- guided by respect for, and the use of, TEK;
- include the establishment of sound and agreed-upon baseline data;
- incorporate a joint assessment of risks; and
- include consultations with all affected groups.

In order to effectively undertake an EIA for a proposed development project, a baseline data set of ecosystem components and services, including those of particular significance to the affected Indigenous or local communities, must be established in full consultation with communities.

Knowledge Co-creation for Equitable Decision-making

Ultimately, the importance of any monitoring program, including CBM, depends on how well it informs decision-making. When integrated into local governance processes within traditional community institutions (e.g., customs governing resource use that ensure a continued supply of benefits for local communities), the CBM approach has the potential to provide fast and meaningful feedback to guide local decision-making.

[40] https://www.cbd.int/traditional/guidelines.shtml

Within the CBM process, TEK helps identify the optimal and locally meaningful ways of monitoring environmental change. TEK generates a baseline of place-specific information for culturally relevant environmental variables over a long period of time, (e.g., millennia) against which observed environmental change can be evaluated (Hamacher and Frew 2010, Bond et al. 2012, Norris and Hamacher 2014).

Management actions arising from CBM initiatives tend to be respected by the local communities and can be relatively sustainable, both financially and organizationally (Danielsen 2007). For example, the Little Red River Cree Nation in Northern Alberta has developed and implemented an ongoing participatory monitoring system of forest management based on integrating traditional knowledge, values, and continued land-use needs into local decision-making (Natcher and Hickey 2002).

By fostering conditions for local people to spend more time on their traditional territory, CBM initiatives could also enhance master-apprentice transmission of language and TEK between Indigenous youth and elders.

To integrate CBM approaches into decision-making processes, rights and access to resources — as well as opportunities for education, information sharing and decision-making — must be fair and equitable for all community members, including women, at the household, community and regional scale (Tebtebba Foundation 2008). CBM initiatives work well when they are embedded within existing governance institutions and decision-making processes, particularly when they are part of a network. The Arctic Borderlands Ecological Knowledge Cooperative is an example of how this approach has been successful (Global Case Studies section).

An orally transmitted (though increasingly written), place-specific and practice-based body of knowledge, TEK is highly dependent on the uninterrupted inter-generational transfer of knowledge. The participatory nature of CBM initiatives tends to facilitate knowledge transfer, interactions and collaborations, creating conditions for TEK maintenance and use. For example, developing participatory photo-mapping monitoring, based on community goals and Inuvialuit culture, assisted TEK transfer between the local Inuvialuit elders and youth, as well as other stakeholders and communities (Bennett 2012). By fostering conditions for local people to spend more time on their traditional territory, CBM initiatives could also enhance master-apprentice transmission of language and TEK between Indigenous youth and elders (Berkes et al. 2005).

CBM INDICATORS

Any environmental monitoring program is only as good as the indicators[41] it relies on to track environmental change. The indicators simplify complex phenomena, making it possible to detect changes in a system and inform decision-making (SIDA 2002). Determining which indicators to use, for what purpose and how, are fundamental to the success of a monitoring program (Lindenmayer and Likens 2010a,b). Regardless of whether indicators are quantitative or qualitative, they must have a clear relationship with the natural or cultural variables the monitoring program is trying to address. In addition, they must detect change due to natural variation, management actions or development. Indicators should also reflect long-term changes at the scales relevant for management and be clear, effective, and easy to collect and analyze (Brown and Hay-Edei 2014). A CBM project must include a set of reliable indicators of relevant natural and cultural variables, relationships and processes, rooted in local TEK (Danielsen 2014b).

According to the UN Permanent Forum on Indigenous Issues (UNPFII)[42], the rights-based approach to resource development requires the use and monitoring of indicators that are relevant to Indigenous and tribal peoples. These indicators must be developed through a process of "full, informed and effective participation" of Indigenous communities at all stages of the monitoring process (Tebtebba Foundation 2008). They must incorporate indicators of particular significance to Indigenous peoples, and could include: access to their traditional territories and subsistence species; issues of discrimination of their economic, social and cultural rights; and, participation in decision-making.

There are many similarities in the way Indigenous peoples and scientists interpret environmental changes (Tebtebba Foundation 2008). As with scientific methods, TEK-based monitoring tracks the health of wildlife populations based on animal body condition using several indicators. (See sidebar on next page for examples.) Diversity and distribution of fish and wildlife species across the traditional territory is another important indicator of ecosystem health.

[41] Summary information about a natural phenomena or a process of interest.

[42] http://undesadspd.org/Indigenouspeoples.aspx

Shared approaches

There are many similarities in the way Indigenous peoples and scientists interpret environmental changes. For example, the percentage of body fat in harvested fish, birds and wildlife is an ecological health indicator commonly used by Indigenous groups, including the Cree of northern Québec (Berkes 1993), the Gwich'in of Alaska (Kofinas et al. 2002), and the Łutsël K'e Dene of the Northwest Territories (Lyver and Łutsël K'e Dene First Nation 2005). Caribou fat is used as an index of health of an individual animal, pasture conditions or caribou population dynamics. Back fat, stomach fat and marrow color, are important indicators of caribou health used by hunters of the Porcupine Caribou (Kofinas et al. 2002). Other examples of indicators used by both science and TEK, include catch per unit effort (e.g., number of fish harvested) and length/weight ratio of fish (i.e., "skinny" vs. "fat") as well as animal behavior (e.g., timing of waterfowl arrival and departure during migration).

Smell and taste of water and texture and color of fish flesh are examples of TEK-based qualitative indicators. Some of the key parameters of water quantity and quality revealed by local TEK experts include water levels (e.g., change in the river depth), flood patterns, extreme flooding, river navigability, ice thickness and color, and time of breakup and freeze up. For example, many First Nations communities have observed a marked decline in water quality in the Athabasca River over the last 50 years, including increases in muddy water, strong smells, algal blooms and "tea" scum (Parlee 2010).

Some examples of TEK-based indicators related to contaminants includes decreases in the quantity and size of fish eggs and changes in texture and consistency of fish flesh observed during capture and consumption of fish (Parlee et al. 2011); meat quality of various parts of waterfowl hunted during the spring along the James Bay coast (Tsuji et al. 2008); and changes in moose and caribou health, particularly related to Chronic Wasting Disease (Parlee et al. 2014).

Many TEK-based indicators reflect the relationship between people and their land. For Indigenous peoples, physical and spiritual signs and signals that the land is healthy are very important to their own health and well-being as well as that of their communities (Bali and Kofinas 2014). The Cree and Inuit of Western Hudson's Bay, for example, conceive of indicators as the "voices" of the Earth that are always communicating with them (Tarkiasuk et al. 1997). As stated by a Cree man from Chissasibi Québec, "If the land is not healthy, how can we be?" (Robinson and Nguyen 2011).

Tebtebba Foundation (2013) describe examples of indicators that help reveal changes in the relationships between people and land, including:

- The degree of respect local people show to the land (e.g., prevalence of and attitude towards rituals, such as making offerings and prayers to the land and prey);
- Traditional practices that reveal how traditional knowledge is being used in everyday life;
- Local attitudes toward "bothering" local fish and wildlife (e.g., radio-tagging or catch-and-release fishing); and,
- Use of local language, including place names.

WCS Canada / Justina Ray

CBM IN PRACTICE

The available published research on CBM approaches is growing. This section of the report contains a brief overview of several CBM projects in Canada and around the world that have proven successful in their use of TEK to detect and respond to change over extended periods of time. Because each case study is context-specific and publicly available information is limited, developing a comprehensive comparative assessment across these projects is not possible.

To help inform the development of a CBM initiative in the Ontario's Far North, the case studies are grouped into several categories that should be relevant to Ontario's Far North communities in considering a CBM approach in the current ecological, social, and economic context. Canadian case studies are presented first, followed by several global examples. These include monitoring approaches for subsistence species, traditional territories, and development projects. Key features relevant to the success of designing and implementing a CBM initiative in Ontario's Far North are also highlighted.

Canadian Case Studies

Species Monitoring

An important reason for establishing a CBM initiative is the community's concerns over the present and/or future state of culturally important species (e.g., moose, caribou, lake sturgeon). The two case studies described below illustrate the importance of effective partnership with outside research institutions; the use of technology to make TEK data collection more accurate and efficient; a co-management structure as an effective platform for knowledge co-creation; and the need for paid staff and capacity building for successful implementation of a CBM project.

Community Moose Monitoring Project

The Community Moose Monitoring Project (CMMP)[43] has been operating in the Mayo area of the Yukon, on the traditional territory of the Nacho Nyak Dun First Nation[44] since 2001 (Gofman 2010). As part of managing their subsistence food resources, the Mayo community set up the collaborative CMMP to track the health and size of the moose herd in the surrounding region.

Susan Morse

The TEK component of the CMMP consists of interviews with local residents who have been most active on the land during the previous year. About 20 surveys are conducted each year with people who have experience in hunting, trapping and fishing as well as other traditional activities, such as berry picking. The surveys are based on protocols developed by the Arctic Borderlands Ecological Knowledge Cooperative's surveys (see Transboundary Monitoring section).

Each fall, hunters and other residents skilled in the bush record their observations of moose in small booklets with maps. Although there is some change in the number of participants from year to year, the same people have been involved in the project from the beginning, which maintains accuracy and precision of collected information over time. The CMMP has paid staff coordinating the program, conducting interviews, analyzing data and producing reports for review and feedback.

In addition, five long-term sites were set up in the surrounding forest as part of the technical monitoring component of CMMP. At these sites, community residents and a technician from the Yukon Fish and Wildlife office take measurements and make scientific counts of several environmental variables, including the volume of berries, the amount of snow cover, and the numbers of hares and mice. During the summer months, technicians from the local Yukon Fish and Wildlife office lead the monitoring. In the winter, these responsibilities are shared equally between the Fish and Wildlife office and community members. The collected data is analysed and published in an annual report that is widely distributed and presented to the local co-management board for review and feedback to the program.

[43] http://bit.ly/1UqpEqU
[44] http://nndfn.com/

Naskapi Nation Caribou Monitoring

In scale and scope, the Naskapi Nation[45] Caribou Monitoring project is similar to the Community Moose Monitoring Project (CMMP). Most of the 1,000 members of the Naskapi Nation (one of ten First Nations in Québec) live in the village of Kawawachikamach in northeastern Québec. Harvesting activities remain at the core of Naskapi economic and cultural life. Nearly all the members of the community hunt, fish and trap and a substantial number of Naskapi continue to depend upon wildlife for subsistence, particularly the George River caribou herd that has suffered dramatic declines from about 800,000 in 1993 to 15,000 in the fall of 2013. The decline has had profound social, cultural and economic consequences for the Naskapi First Nation (Mameamskum 2014).

To prevent further loss to the Naskapi way of life, rooted in their relationship with the caribou and the land, the Naskapi people developed a CBM project based on a knowledge co-creation process using TEK and science to monitor and understand the effects of climate change on the George River caribou herd. Naskapi First Nation partnered with the Circum-Arctic Rangifer Monitoring and Assessment (CARMA)[46] to keep track of changes in the health and migration patterns of the George River caribou herd; document impacts of climate change on Naskapi resource and land use patterns (e.g., hunting, subsistence harvesting); and, co-create climate change adaptation strategies.

At the beginning of the project, a community workshop "Learning from our Elders" brought together 45 Elders and community members to share their knowledge and observations about climate change and caribou. Participatory mapping exercises were included in the workshop to document changes in caribou seasonal distribution and migration routes, critical caribou habitat, areas of disturbance, and other information.

To facilitate data gathering for the CBM caribou survey, GPS-equipped electronic devices with CyberTracker[47]software were used to simplify field data collection. Project members and Local Research Assistants identified the parameters for the CyberTracker interface to be used for each CBM caribou survey, including number, age and sex of caribou, body condition, photographs, as well as additional notes on caribou and/or their habitat. Based on these data, the interface was designed and installed on the CyberTracker devices and was tested in the field prior to the actual caribou survey.

To document local perspectives on the relationship between climate and caribou, semi-structured interviews were carried out with active hunters and trappers, Elders, women, and youth. Topics covered included caribou ecology (e.g., habitat, range, distribution, population trends, and movement patterns), caribou health, caribou hunting practices, future use and management, and overall weather conditions (e.g., summer and winter air temperatures, dates and quantity of snowfall, ice thickness, etc.). A summary of the findings was prepared, published as a brochure, and distributed locally. Based on community recommendations, a Naskapi Climate Change Working Group was established. Educational materials were also developed for youth and students to learn about the cumulative impacts of human activities on caribou.

[45] http://www.naskapi.ca/

[46] CARMA is a network of scientists, managers and community people who have a common interest in the future survival of the northern Rangifer herds. CARMA is primarily focused on the status of most of the large migratory Rangifer herds and does not consider boreal or woodland caribou and Peary caribou in North America nor forest and marine reindeer in Fennoscandia and Russia. As well, they not consider domestic reindeer or the reindeer herding economy (from http://carma.caff.is/)

[47] http://www.cybertracker.org/

Watching over the land has been central to First Nations' culture for generations.

Traditional Territory Monitoring

Another important reason for implementing a CBM initiative is the need for Indigenous and local communities to keep track of the cumulative effects of multiple activities (e.g., development, tourism, hunting) on their traditional territories. The two case studies described below illustrate, among other things, the importance of "bottom-up" approaches to CBM design and implementation; the need to adapt monitoring activities to the community's seasonal calendar; and, the role of a review process and steering committee in guiding the CBM initiative.

Coastal Guardian Watchmen Network

The Great Bear Rainforest[48] Initiative of the Coastal First Nations[49] (CFN) is an Indigenous institution that coordinates a community-based network of Coastal Guardian Watchmen[50] along the central and northern coasts of British Columbia (Gofman 2010). The territories of coastal First Nations have been impacted by resource use in the past, and continue to be threatened by mining, oil and gas, and transportation infrastructure, yet federal and B.C. government agencies have not committed sufficient staff or funds to effectively monitor and patrol this bio-culturally rich and remote region. As the original stewards of their territories, the CFN have the constitutionally recognized authority and responsibility to protect important wildlife species, sources of food, and significant cultural capital on their ancestral land. The Coastal Guardian Watchmen program was established to improve ecological and human well-being within the CFN traditional territories and to re-establish their authority over their traditional territories.

The specific issues of concern identified by communities include damage to cultural sites, over-harvest and over-fishing, declining populations of fish and wildlife and the limited capacity of government law enforcement agencies.

Following the establishment of the Coastal Guardian Watchmen program, CFN created a Regional Monitoring System[51] (RMS). The RMS goals include:

- the development of a standardized approach to monitoring CFN priority issues;
- providing tools for communities to collect, store, and retrieve data;
- compiling and comparing coast-wide data for use by communities; and,
- empowering communities to collect and use data in planning and decision-making.

David Pearson/Four Rivers/Matawa First Nations Management

Through the RMS, the Guardian Watchmen are paid to collect data on a range of indicators, including:

- stream surveys — to improve knowledge of riparian habitats and fish stocks;
- wildlife sightings — to improve knowledge of habitat use and range;
- boat sightings — to get an idea of how their traditional territories are being used;
- tourist activities — to find out about their activities, develop relationships, and engage in education and outreach;
- cultural and ecological site impacts — to ensure these areas are used appropriately.

The RMS provides standardized methods for collecting and recording data, including using a portable device equipped with CoastTracker software[52] that allows the Guardians to collect data and transfer it to a secure online data management system for archiving and analysis. Each Coastal First Nation controls access to its information. Authorized users can download raw data or generate reports and maps. RMS data are used to inform First Nations land-use planning, management of fisheries and wildlife, as well as tourism and economic development at the local and regional scale (Lagasse et al. 2014).

[48] http://en.wikipedia.org/wiki/Great_Bear_Rainforest
[49] http://www.coastalfirstnations.ca/
[50] http://coastalguardianwatchmen.ca/
[51] http://coastalguardianwatchmen.ca/regional-monitoring-system
[52] http://www.nailsma.org.au/coastal-stewardship-network-gathering

TRADITIONAL TERRITORY MONITORING

Susan Morse

First Nations can monitor changes through all seasons.

Ni hat'ni Dene Program: Watching Over the Land

The Łutsël K'e Dene First Nation[53] (LKDFN) is currently negotiating a partnership with the Government of Canada for the establishment of Thaidene Nene[54] — a new National Park in the core of their traditional territory. Stretching over 33,000 km^2 of intact boreal forest and tundra, Thaidene Nene is a large landscape encompassing the eastern portion of the Great Slave Lake watershed in the Northwest Territories (Ellis 2013).

The LKDFN members have worked to be recognized as the rightful stewards of their land in order to maintain authority over all aspects of conservation and management of wildlife and their homelands. In establishing the Thaidene Nene Protected Area, the LKDFN is working towards developing a formal co-governance arrangement based on recognition of LKDFN as an equal partner in all aspects of conservation, management, and stewardship of the park. In preparation for this outcome, and as part of their hereditary responsibility for the stewardship of Thaidene Nene, the LKDFN launched the Ni hat'ni Dene Program[55].Ni hat'ni means "*Watching the Land*" in Denesoline Yati language. The Ni hat'ni Dene Program is based on a CBM Pilot Project developed in the late 1990s by LKDFN in response to concerns about the potential effects of mining, raised during the environmental assessment of the BHP Billiton EKATI Diamond Mine[56], northeast of Great Slave Lake in the Northwest Territories.

The Ni hat'ni Dene Program has a broad mandate to promote LKDFN stewardship of the Thaidene Nene by maintaining the integrity of cultural sites and the natural landscapes within the park. The mandate also includes: documenting and monitoring cultural features, along with environmental and wildlife values; hosting visitors and providing interpretive tours in the area, while observing visitor activity and impact on the land, waters and wildlife of the Territory; and, transmitting cultural and ecological knowledge to younger generations. The Ni hat'ni Dene Program is based on the Łutsël K'e Dene worldview that both culture and nature are intertwined and inseparable. The health and well-being of one is inextricable from the other.

continued on next page

[53] http://www.akaitcho.info/the_akaitcho_treaty_8_tribal_corporation_006.htm
[54] http://landoftheancestors.ca/
[55] http://landoftheancestors.ca/team/ni-hatni-dene-program.html
[56] http://www.ddcorp.ca/operations/ekati-mine

The Ni hat'ni Dene Program methods used to evaluate change are based on their TEK. The Program gathers information on socio-economic and environmental and land use indicators, following the Łutsël K'e Dene subsistence calendar (e.g., spring duck hunting season, fall caribou hunting season, etc.) throughout the territory of the Thaidene Nene. A Ni hat'ni Dene crew consists of two paid experienced land-users and two youths, who are based in Thaidene Nene all summer. They host visitors, conduct surveys, gather data and care for important cultural sites.

As part of the program, semi-structured interviews with land-users are digitally recorded, to document observations of seasonal abundance, distribution and condition of animals, plants and people, as well as their relationships across the Thaidene Nene. The interviews are transcribed and organized within a searchable geo-referenced digital database. The data are analyzed and interpreted based on cultural values and the historical context.

At the end of every monitoring cycle, interpretation workshops are held in which the Elders and community members who are active on the land review the collected information about the observed changes. In these workshops, the data are checked against the collective experience and historical knowledge of the Dene Elders to see how the observed changes match the range of natural variation they are familiar with through their direct experience or based on the community's oral history.

After the Elders and land users interpret the data, the information is communicated to the LKDFN Wildlife, Lands and Environment Committee for decision-making and to provide further direction on the monitoring process. This way the entire cycle of knowledge sharing continues, from information gathering, to evaluation, to decision-making, and back to monitoring.

Monitoring Development Activities

A major impetus for Indigenous peoples to establish a CBM program is the need to assess and interpret changes unfolding on their traditional territories due to development activities. The Mikisew Cree case study illustrates the potential benefits of establishing a collaborative relationship with external institutions that support the community's vision and the importance of developing culturally-appropriate indicators.

Mikisew Cree First Nation (MCFN) CBM Project

A signatory to Treaty No. 8 (1899), the 2,000 member-strong Mikisew Cree First Nation (MCFN)[57] is the largest First Nation in Alberta's Wood Buffalo Regional Municipality. Their traditional lands include the entire region known as the Athabasca Oil Sands Region. The majority of MCFN members continue to rely on traditional or country foods through hunting, fishing and gathering. The main concerns of the MCFN are linked to the impacts of oil sands development on their quality of life, the health of aquatic ecosystems throughout their traditional territory, and the cumulative impacts of multiple development projects (Lawe et al. 2005).

MCFN, with assistance from the Centre for Indigenous Environmental Resources[58] (CIER) – a national, research-focused, First Nations organization – has developed a TEK-based CBM project to strengthen their voices in decision-making about resource use in the Athabasca River Watershed. The project's goals include: understanding current and future cumulative impacts of development; and, selecting and protecting lands with significant ecological, subsistence, and cultural values.

The MCFN CBM project aims to document and synthesize TEK about the biological and physical health of the Athabasca River Watershed. More specifically, the work has included the selection of indicators and the development of metrics for assessing future changes to the ecological integrity and health of the MCFN traditional territory.

The MCFN members identified fish health and water quality and quantity as environmental priorities. A set of appropriate TEK indicators was developed by MCFN cultural experts (Elders and resource users) and then selected by the community. CBM indicators of fish health, based on MCFN TEK, included visual abnormalities (such as lesions, tumors, discolored scales, missing or extra fins), and unusual taste and texture of fish meat. Another important indicator of fish health was the prevalence of fish mortality events, particularly fish "die-offs." The health of muskrat populations was also recognized as an important indicator of the health of the Athabasca River Watershed. Muskrat die-offs at various times of the year may be related to changes in the flow regime and water quality.

The CBM information is assisting MCFN in its discussions and negotiations around ongoing and additional development projects, land use planning, environmental monitoring, and other relevant regulatory (e.g., cumulative effects assessment) and natural resource management processes. The MCFN CBM also informs the Indigenous Wisdom Advisory Panel, legislated through Alberta's Bill 18 *"An Act to Ensure Independent Environmental Monitoring"*[59] in 2016, "to provide advice to the Chief Scientist and the Minister [of Environment and Parks] about how to incorporate traditional ecological knowledge into the environmental science program."

[57] http://mikisewcree.ca/
[58] http://www.yourcier.org/
[59] http://www.assembly.ab.ca/ISYS/LADDAR_files/docs/bills/bill/legislature_29/session_2/20160308_bill-018.pdf

Ensuring community subsistence needs can continue to be met is another reason for monitoring.

Subsistence Monitoring

A critical application of CBM approaches is to assess and monitor a community's subsistence needs in order to ensure effective management of wildlife on their traditional territories for future generations. The Gwich'in case study described below illustrates the importance of community consultations; the value of outreach and education to ensure community participation; and the need for, and approaches to, maintaining confidentiality (both internal and external to the CBM project).

Gwich'in Harvest Study

The Gwich'in people live in the Arctic and Subarctic regions of North America, including the Mackenzie River Valley in the Northwest Territories, Yukon, and Alaska. The Gwich'in number approximately 10,000 people living in 15 communities. Of the 2,440 members of the Gwich'in living in the Northwest Territories, 1,400 actually live in the area.

Under the terms of the Gwich'in Comprehensive Land Claim Agreement[60] (GCLCA 1992), Gwich'in can gather, hunt, trap and fish and continue their traditional harvesting and wildlife management customs throughout their settlement area, including Crown lands. According to the Gwich'in Agreement, a community-based harvest study must be conducted to generate data for calculating the Gwich'in Minimum Needs Level — the minimum amount of wildlife required to sustain the Gwich'in land-based economy (e.g., subsistence), and to ensure effective management of wildlife by the Gwich'in Renewable Resources Board (GRRB)[61] established through terms of the Agreement.

The Gwich'in Harvest Study (GHS) was conducted from September 1995 to July 2004 to document the number of animals, fish and birds harvested by Gwich'in as well as their harvest locations and biological information on harvested animals. The GHS was designed by the Gwich'in people to ensure they have full control of the study and its results to protect the hunter's confidentiality without compromising the accuracy of collected information. Community consultations were critical for maximizing participation in the study, collecting accurate data, communicating the study rationale, and ultimately for making the study meaningful to participants. GHS posters, radio announcements, prizes, presentations, and calendars were produced to increase awareness of the project.

The GHS was conducted by paid GRRB staff and Gwich'in harvesters — community members who hunted, fished, and/or trapped at least once a year — in the GSA communities of Aklavik, Tetlit Zheh, Inuvik and Ts'iigehtchic. Harvesters were interviewed once a month, and asked to recall their hunting, fishing and trapping activities for the previous month or longer if interviews for previous time periods had been missed. If the interviewees reported a harvest, they were asked questions about the species, number of animals, location and, for some species (e.g., caribou, black bears, moose, tundra swans, whitefish, etc.), the age class, and sex of the animals that were harvested. Any additional comments made by the hunter were also recorded. The data were recorded in a manner that ensured harvester confidentiality. An annual report was generated and distributed to communities and co-management boards for each of the five years of the GHS.

All information collected, whether in its raw form or after being compiled and analyzed, with the exception of identification of harvesters, was provided to the GRRB, the Gwich'in Tribal Council and participating government agencies on the Working Group. The Board established and maintains a public file for reports, research papers and data. Material may be shared, but only with full consent of the originator. The GRRB developed a Harvest Study Data Release Policy outlining the terms and conditions to be applied when outside organizations and individuals request information from the Harvest Study (GCLCA 1992).

The GHS became a useful tool for wildlife management as a source of harvest information that could be used for planning management activities. The GHS promoted a greater understanding of wildlife population co-management by communities, land claim organizations, government agencies and the public, thereby benefitting present and future generations of hunters and wildlife managers alike.

[60] http://www.daair.gov.nt.ca/_live/pages/wpPages/Gwich%27inLandClaim.aspX

[61] http://www.gwichin.nt.ca/grrb/

Global Case Studies

Traditional Territory Monitoring

As with the Łutsël K'e Dene and Coastal First Nations, the case studies described below, illustrate how Indigenous peoples around the world rely on CBM approaches in order to look after their traditional territories, whether they are concerned with managing natural resources, parks, or cultural resources.

CBM in Protected Areas (Philippines)

In 1992, a new Protected Area Act allowed for community participation in the management of protected areas in the Philippines. In 1996, the World Bank and the Danish aid agency (DANIDA) agreed to help the Philippine government and over a three-year period worked together to develop a CBM program for protected areas. The approach was designed to identify trends in important biodiversity resources that could be used to guide management action in protected areas. The project also focused on enhancing participation of local communities in protected area management (Danielsen et al. 2000).

Gleb Raygorodetsky

Data were collected by government rangers and volunteer community members. In each park, quarterly surveys focused on a list of 10–15 taxa and 5–10 indicators of resource use that were selected by local community members together with protected area staff. Protected area staff and community members interpreted the data. A report was presented every quarter to the Management Council of each protected area. The report included the data set, a list of important observations of changes in species and resource use, and a list of suggested management interventions describing the issue, the location, and the proposed action(s) recommended for the protected area council (Danielsen et al. 2005).

Before the CBM scheme was established, collaboration between local people and park authorities was minimal. After three years, plans to regulate Indigenous resource use were co-created by local people and park rangers and subsequently endorsed by the government. Even though financial support from DANIDA ceased in 2001, the government has promoted the CBM program as a standard management tool in protected areas, expanding it to new sites. The CBM project also led to more culturally appropriate and effective approaches to enforcement. The CBM program continues to operate in Philippines at most of the sites where it was first established.

Natural Resource Monitoring (Greenland)

To help Greenlandic fishers and hunters document trends in natural resources and to facilitate their input into management decisions, the Government of Greenland has developed a CBM approach to natural resource monitoring (Danielsen et al. 2014a).

During the project's pilot phase (2009-2012), meetings were held with local communities to select the CBM tools and adapt them to the local context. The tools were tested and adapted over a 24-month pilot period to identify methodological issues and address the needs of both the local communities and authorities. Based on a literature review and field tests carried out during the Pilot Phase of the Project, a CBM manual was drafted to guide project implementation and enhance local capacity building. Government staff subsequently made several visits to participating local communities to assist with the field implementation of the program.

In each community, the CBM project is implemented through a Natural Resource Committee (NRC) comprised of between 5–12 community members, typically from the households that have the most seasoned fishers and hunters and are significant users of natural resources. NRC membership is meant to be representative of different age groups, including youth, middle-aged men and women, and Elders. The NRC elects a coordinator who reports to the Village Council.

NRC members record their observations of key species and resource uses immediately after hunting, fishing and other land-based activities. These data are summarized and then reviewed at committee meetings where NRC members discuss:

- selection of monitoring targets, including wildlife populations of specific interest to NRC, as well as the boundaries of each monitoring site;
- organization of natural resource monitoring activities; and,
- management recommendations and advice to the Village Council and the local natural resource management authority based on their observations.

During the Pilot Phase, over 30 fishermen, hunters and other community members summarized their observations of 24 environmental indicators, including information on three species of fish, nine species of mammals and nine species of birds, as well as data on sea-ice, trawling activities and shipping traffic. Despite considerable differences in the ways in which their knowledge was obtained, the community members and the professional scientists produced similar results for many species (e.g., harp seal, humpback whale, caribou, and snow goose) (Danielsen et al. 2014b). For some species and populations, (e.g. coastal populations of Atlantic cod, Arctic fox, some populations of caribou and musk ox, snow goose, Canada goose, and white-tailed eagle), the CBM approach provided the only valid source of information due to the lack of scientific data. The results of the pilot project are informing Greenland's natural resource monitoring strategy.

NAILSMA I-Tracker Program (Australia)

The North Australian Indigenous Land and Sea Management Alliance (NAILSMA)[62] is an unincorporated bioregional forum for Aboriginal land and sea managers across northern Australia. NAILSMA supports Aboriginal land and sea management using strategic approaches to Caring for Country[63] (NAILSMA 2014) and focuses on practical natural resource management by Traditional Owners[64].

In response to the demand by Aboriginal Traditional Owners for tools to support their monitoring work, the I-Tracker Program[65] was conceived as a network of rangers using state-of-the-art, handheld touch-screen computer-based technology and scientifically robust standardized protocols to monitor, record, analyze and report on a range of environmental and cultural data. The NAILSMA I-Tracker Program was developed to ensure that knowledge and data remain in the hands of the Traditional Owners and can be used to address their priorities.

NAILSMA selected CyberTracker software (NAILSMA 2014) for the I-Tracker data collection tools because it is easy to use, free, and specifically developed for local TEK holders with limited literacy and numeracy skills. NAILSMA staff used CyberTracker to create customizable data entry and help screens on a mobile device or tablet. The CBM rangers use these devices to collect monitoring data in the field. They upload their data to a CyberTracker database on their own computers back in the office, from where the data are viewed, analyzed, mapped, or exported in a variety of formats.

This first I-Tracker tests involved 16 Indigenous sea ranger groups managing areas that span the north of Australia from Kimberley to the Torres Strait. Each group was provided with a device, CyberTracker software, digital maps, training and technical support. A data-sharing agreement between NAILSMA and each participant group allowed the data to be pooled across all locations and then archived and analyzed at NAILSMA's I-Tracker Project Secretariat. Over the course of the pilot phase, rangers collectively logged 343 patrol days and recorded 5,893 observations, including marine debris, live and injured turtles, turtle nests, live dugongs, commercial fishing nets, and foreign fishing vessels. The trial clearly demonstrated the significant amount of effort rangers put into looking after their sea country as well as the volume of data collected during their patrols. The I-Tracker Project Secretariat provided on-the-job training, technical help, workshops and skills development for rangers.

In 2011, NAILSMA secured additional resources to develop an I-Tracker application to support land-based activities. A working group consisting of rangers, Traditional Owners, researchers, and government experts was established, and, after extensive on-the-ground tests and modifications to the application, as well as feedback from rangers, the I-Tracker Land Patrol Application[66] was launched in early 2012. The Land Patrol Application allows rangers to collect data on issues including fire, weeds, feral animals, native plants and animals, visitors and habitat health. The application also meets the cultural requirements outlined by rangers and members of the working group. For example, it separates the cultural sites mapping and monitoring component into discrete stand-alone applications, ensuring that culturally sensitive data is never accidently included in reports sent to external agencies.

Customized report templates with cut-and-paste features were developed to help rangers quickly and easily produce high-quality reports from their patrol data. In addition, the Land Patrol Application meets the reporting requirements of government contracts, such as the biosecurity surveillance work for the Department of Agriculture, Fisheries and Forestry, and creates job opportunities for rangers in this area (NAILSMA 2014).

Gleb Raygorodetsky

[62] http://www.savanna.org.au/nailsma/about_nailsma/

[63] Through Caring for our Country, Australia Government provides funds for Indigenous-specific programs: Working on Country, Indigenous Protected Areas, Reef Rescue Indigenous Land and Sea Country Partnerships and the Indigenous Emissions Trading commitment (from http://www.environment.gov.au/Indigenous/)

[64] A descendant of the tribe or ethnic group that occupied a particular region before European settlement, especially when that occupation is recognized by Australian law.

[65] http://www.nailsma.org.au/hub/programs/i-tracker

[66] http://www.nailsma.org.au/i-tracker/i-tracker-land-patrol-application

Transboundary Monitoring

In some cases, there is a need to carry out environmental monitoring over large landscapes, crossing multiple jurisdictions, ecosystems, and even national boundaries. The case studies below illustrate that establishing and running an integrated network of multiple communities engaged in a CBM initiative may require more of a "top-down" approach to project design and implementation.

Bering Sea Sub-Network (BSSN) (USA and Russia)

The Bering Sea Sub-Network (BSSN) is a network of coastal communities located along the Bering Sea in the United States and Russia that systematically carry out various CBM activities (Gofman and Smith 2009). The goal of this long-term program is to enable the remote communities, together with their research and government partners, to systematically document physical and social changes occurring in the region. This allows them to predict, plan for, and respond to environmental changes and their subsequent socio-economic consequences. Approved by the Arctic Council as a Conservation of Arctic Flora and Fauna (CAFF) project in 2004, BSSN represents a working model for CBM facilitating positive and constructive dialogue about land and sea management to support decision-making.

Gleb Raygorodetsky

BSSN gathers data on subsistence and commercial marine species, including environmental observations at harvest sites. A questionnaire was developed based on discussions with community representatives and includes questions about environmental conditions and climatic change, changes in the abundance and quality of the resources, changes in migration patterns and habitat use, quality of the catch, and shifts or changes in harvesting locations. Each questionnaire has an associated map so respondents can include locations. Local project assistants interview the most experienced harvesters.

All data and survey results are the property of BSSN member communities. The BSSN Secretariat serves as the central point for communication and data management and a Steering Committee manages data access on behalf of the member communities. An electronic version of each interview is sent from the communities to the Survey Manager at the BSSN Secretariat, who enters the information in English or Russian (with English translation attached) into a database.

Monthly teleconferences with community assistants provide feedback to address problems and to assure quality control. The data are stored at the BSSN Secretariat until the communities acquire the capacity to manage and share the database themselves. Sensitive data, such as exact locations of hunting and fishing sites, are kept confidential and tracking sheets are used to disassociate names from the data. The BSSN data products include survey forms, project databases, community data summaries and overall data summaries.

Research assistants are paid for their work. BSSN also provides all participants with a small honorarium. The size and type of the honorarium is determined by the communities themselves within the approved project budget.

Community leaders have direct access to project management and can influence how the project is conducted in their communities. They can also consult the research team on the best ways to handle community concerns. How well the BSSN's data feeds into decision-making processes related to land and marine resource use, however, remains unclear, as no relevant information has been published to date.

Arctic Borderlands Ecological Knowledge Cooperative (ABC) (Canada, United States)

The Arctic Borderlands Ecological Knowledge Cooperative (ABC)[67] monitors ecosystem changes within the range of the Porcupine Caribou Herd and adjacent coastal and marine areas along the border between the United States and Canada (Russell et al. 2013). This is a collaborative partnership between eight local villages — Kaktovik, Old Crow, Aklavik, Tetlit Zheh, Tsiigetchic, Inuvik, Tuktoyaktuk, and Arctic Village. Local community concerns around climate change, industrial development and pollution led to a mutual decision to monitor effects on community well-being and ancestral territories.

The ABC relies on both science and TEK to monitor changes throughout the range of the Porcupine Caribou Herd, thereby improving communication and understanding between Indigenous communities, government managers and scientists about ecosystem management, as well as fostering capacity-building and training opportunities for local communities (Russell et al. 2013).

Data collection occurs through community-based interviews conducted by local residents who have been hired by the project and are paid for their work. Participants being interviewed are compensated for their time with a fuel voucher. Interviewees remain anonymous to ensure confidentiality and reduce the response bias of the surveys. Approximately 20 local experts, selected by their communities, are interviewed annually in each community and asked to describe observations about the weather, berries, fish, and animals on their traditional territory. The interviewees are also asked about their experience on the land over their lifetime.

The questionnaire data are entered into a database and associated spatial data are digitized. The ABC produce an annual report, based on the interviews, which is shared with the communities and posted on the ABC website. The wealth of information collected since 2000 provides insights into a variety of long- and short-term environmental changes, as well as unusual and extreme events in the surrounding ecosystems. The data are integrated with -- and compared to -- other scientific information.

The ABC created a working platform for governments and local First Nations to build relationships and lay the groundwork for a constructive land management dialogue. The ABC successes have come from being relevant to local communities, thinking long-term, economizing on financial resources, and planning toward stated management goals (Robinson and Nguyen 2011).

[67] http://www.arcticborderlands.org/

CBM REVIEW LESSONS

Our review of the CBM literature together with the case studies demonstrates how CBM facilitates TEK integration into Multiple Evidence Based environmental planning and management efforts on Indigenous territories. When well designed and properly implemented (e.g., "bottom-up", based on ethical standards, etc.), CBM approaches can enhance the capacity of Indigenous communities to meaningfully engage with external groups on issues related to resource management, impacts of industrial development and climate change, wildlife use and conservation and maintenance of ecosystem services (Danielsen et al. 2008). CBM programs yield reliable, culturally appropriate and locally relevant results critical for timely and effective decision-making (Bell and Harwood 2012). Yet, the paucity of precedents and guidelines demonstrating how to strengthen natural resource management through TEK-based CBM initiatives within a Multiple Evidence Based framework continues to undermine decision-making at all scales, from local to global (Johnson et al. 2015, Kouril et al. 2016, McKay and Johnson 2017b).

This review of the CBM literature along with the case studies highlighted in the report make it clear that there are several key elements that can determine success or failure (Clarkson and Andre 2002, McKay and Johnson 2017a):

- Community members must be involved in all aspects of monitoring, from deciding what should be monitored to how monitoring will take place and carrying out the monitoring and interpreting the results.

- Consultations between Indigenous communities and outside entities (e.g., government or industry) must take place at the inception stage of the project to provide clarity on how the proposed CBM activities will address the identified local concerns.

- The diverse needs, interests, and perspectives of different gender and age groups must be integrated into CBM whenever possible as part of the consensus-building process.

Opposite page: Roy Moonias on the Attawapiskat River

Allan Lissner

- To enhance Multiple Evidence Based (MEB) approaches to knowledge co-creation and to enable better integration of monitoring results into decision-making, a CBM project must include a diverse team of collaborators and advisors with different types of expertise (e.g., academia, community leaders, government), whose relationships are based on trust, reciprocity and respect.
- Appropriate measures must be put in place to ensure that politics between government managers and communities do not get in the way of CBM project implementation (e.g., funding for CBM is not used by the government as a "carrot" to gain concessions from Indigenous communities).
- CBM approaches must be clear, culturally appropriate, developed at a pace that can consider and support "both-ways" capacity building, and rely on technology that can be maintained locally with minimal recurrent costs.
- Straightforward systems and toolkits should be created to guide Indigenous community members through different stages of a CBM project and help Indigenous community allies (e.g., academia, government) engage with the community in a culturally-appropriate, respectful and ethical way.
- CBM methodologies (e.g., indicators, questionnaires) must be consistent over time and space.
- From the outset, there must be an explicit consideration of likely biases (e.g., over- or under-estimation of numbers of animals) and the best way to address these.
- Appropriate validation measures (e.g., within, rather than across, knowledge system validation, as highlighted by IPBES) must be put in place, to overcome the skepticism of external groups (e.g., consultants, industry, academics, government) about the results of local monitoring. This could be accomplished through traditional decision-making processes and community-based participatory "peer reviews" (e.g., community meetings with Elders) of CBM results before they are put forward as a basis for management and conservation recommendations.
- There must be a long-term commitment to CBM initiatives from the participating community and its partners.
- To ensure effective and meaningful participation of Indigenous peoples, CBM initiatives must be properly resourced through funding streams that provide multi-year, renewable funding mechanisms for CBM programs.

- Local capacity must be developed to have project data stored and used locally and protocols must be developed to make this information accessible based on the Indigenous communities' FPIC.
- Monitoring activities should be incorporated into the ongoing land-based activities of Indigenous residents (e.g., hunting, fishing) in order to lessen the time demands on the participants and to sustain a community's long-term engagement in the program.
- Clear pathways should be established at the beginning of the project for CBM program results to feed directly into management decisions at local and regional scales.

Integration of these elements into the design and implementation of a TEK-based CBM initiative would help provide information that is locally relevant, timely and reliable (Huntington et al. 2009, Bell and Harwood 2012, McKay and Johnson 2017b). Under such conditions, several CBM projects may also be interlinked to provide input into assessing and tracking large-scale environmental trends in populations and habitats, the ecosystem services they provide and the threats they face (e.g., climate change, cumulative environmental impacts over landscapes much larger than any individual community's traditional land use area).

A TEK-based CBM initiative could help develop and nurture a polycentric monitoring program that is relevant, respectful, respected, responsive and resilient. A CBM initiative could support the development of culturally appropriate tools and methodologies while enhancing local capacity to track, react and respond to change.

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Such a TEK-based CBM initiative could generate numerous ecological, social, and cultural co-benefits by enabling Indigenous communities to restore, sustain and enrich their biocultural heritage. Finally, a CBM initiative could support intergenerational knowledge transfer, inter-cultural dialogue, and co-governance of social-ecological systems.

A well-supported (both financially and programmatically) CBM initiative supported by the Indigenous communities, well integrated into decision-making, and resilient to political swings can achieve a high standard of monitoring of environmental change in northern Ontario. This could provide a platform for the Government of Ontario to implement the recommendations of the Far North Science Advisory Panel and the Environmental Commissioner of Ontario to address the role of First Nations' TEK in environmental monitoring.


OF COURSE WE
COME FROM
MONKEYS
JUST LOOK AT
YOUR MOM!

APPLYING CBM LESSONS TO ONTARIO'S FAR NORTH

Developing a CBM initiative in a given First Nation community is a gradual "bottom-up" process requiring full community engagement from the very first phase of project initiation, through incubation, implementation of the CBM program, interpretation of the results, and feedback into decision-making processes. Below is an outline of what such a process might look like for a First Nation community in Ontario's Far North.

If several First Nations are interested in developing and implementing a coordinated CBM initiative, a phased approach could be developed. In this case, the pilot phase would be limited to a small (1-3) group of communities and the program could later be expanded to other interested First Nations, but only as the pilot project begins delivering meaningful results.

Ontario's Far North CBM Pilot Project must be created through a gradual "bottom-up" process unfolding with full community engagement through several phases:

a. CBM introduction
b. Laying the groundwork
c. Defining appropriate terminology
d. Defining indicators and methodology
e. Incubation
f. Implementation

Opposite page: Orion McKay, from Kitchenumaykoosib Inninuwug, fishing on the Fawn River

Allan Lissner

Phase 1: Pilot CBM Introduction

The first phase in the development of a Pilot CBM project is for the communities interested in exploring the suitability of a CBM approach (e.g., Matawa First Nations), to become familiar with the specific requirements for developing such an initiative (e.g., who would be involved, stages of the process, what kind of work needs to be done, etc.). This could begin as a series of informal discussions between community leadership and its existing and/or potential partners. If there is interest in moving forward, a series of presentations and/or a workshop would be developed and held with respective community members, CBM experts and, ideally, CBM practitioners from First Nations' communities with a history of CBM work, who could share their practical experience of running a CBM project and using its results for achieving specific community goals. This stage should wrap up with a community discussion about the need for -- and feasibility of -- developing and implementing a CBM project in a particular community.

Phase 2: Laying the Foundation

Once a community (or several of them) decides to develop a Pilot CBM project, a CBM Working Group could be established to guide and manage the development and implementation of the initiative. This group would include community members — either embedded within the existing community governance arrangement or indirectly linked to it — as well as representatives of outside organizations assisting the local community with all stages of the CBM project, including fundraising, training, monitoring, data management, and reporting. The CBM Working Group would hold regular meetings to oversee, support, and coordinate project progress.

The first task for the Working Group would be developing a workplan and a fundraising strategy for the CBM project. As the funds become available, the Working Group would establish a Secretariat to manage all aspects of the project implementation. The Secretariat would include a Project Director/Coordinator and one or more local CBM Project Researchers. At the same time, specific mechanisms would be explored and developed for integrating the information and recommendations from the CBM project into local and regional decision-making processes (e.g., Regional Framework Agreement, CBLUP, environmental assessments).

Phase 3: Defining Locally Appropriate Terminology

Once sufficient funds have been secured to launch the project, the next step includes holding a series of community gatherings to discuss the CBM approach from the community perspective. This should include discussions (e.g., Elders workshops) of culturally-appropriate terminology, preferably in the local language, to describe CBM in a way that makes it meaningful for the community members, particularly Elders, women and youth. The results of these discussions would be written up or captured in different forms (e.g., photo, video or audio recordings), and shared with the community and its allies.

Phase 4: Developing CBM Indicators & Methodology

The next phase is developing a set of indicators reflecting issues of concern that the community wants to monitor. This could include community health factors, status of wildlife populations or pollution. The indicators should be based on local TEK and meet the criteria described above. This work would be carried out by the Secretariat, overseen by the CBM Project Working group and involve workshops, interviews, and broader community meetings. At the end of this stage, a set of locally relevant CBM indicators would be agreed upon and a set of methodological guidelines for their monitoring, data entry, analysis and reporting would be developed. This would include designing data collection, storage and sharing protocols between the community and its external partners, as well as community member consent protocols for data gathering, use and sharing. All these methodologies would be summarized in a user-friendly CBM Project Guide that would be used by the local CBM Project Researchers, allies, and community members in their work.

Phases 5 & 6: Incubation & Implementation

Once the indicators are defined, methodologies for data collection, storage and analysis are finalized, and project researchers receive initial training, the pilot monitoring stage of the project would commence. Depending on the focus of the pilot CBM project, the monitoring cycle could be tied to the community's seasonal calendar (e.g., subsistence activities) and depend on community members' availability. It would include a series of interviews, data archival, and interpretation methods, verification workshops, as well as community discussions and information sharing sessions about the progress of the pilot CBM project. The annual monitoring cycle would be designed in stages so that community members would receive periodic updates on the project's progress and have regular opportunities to provide input and verify the data interpretation.

The pilot monitoring stage of a CBM project could last a year or two, during which time the various aspects of running a CBM project would be refined, methodologies fine-tuned, and implementation issues addressed. This would lay a solid foundation for Phase 6 – the implementation a long-term CBM monitoring project and potentially expand this work to other interested communities. It would also create opportunities to explore how the CBM monitoring program could support ongoing traditional land use and occupancy work being conducted in some communities.

Opposite page: Bottom, Louie Tate and Joel Chapman on the Fawn River

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Ontario's Far North is an interdependent social-ecological system where First Nations' well-being is inextricably linked to the ecological integrity of the region. The direct, indirect, and cumulative impacts of provincial and federal governments' resource management and development decisions on communities and their traditional territories, must be monitored to ensure that both Aboriginal and treaty rights are upheld and that the socio-ecological resilience of Ontario's Far North is sustained for future generations.