Office of the Chief Science Advisor of Canada
Bureau du conseiller scientifique en chef du Canada
Canada

# Towards Indigenous-Relevant Indicators for the Implementation of Biodiversity Conservation Plans

A Report from the Office of the Chief Science Advisor of Canada

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*Vers l'élaboration d'indicateurs pertinents pour les Autochtones en appui à la mise en œuvre des plans de conservation de la biodiversité.*

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# Towards Indigenous-Relevant Indicators for the Implementation of Biodiversity Conservation Plans

## EXECUTIVE SUMMARY

The use of Indigenous knowledge in biodiversity conservation is increasingly recognized as an important aspect of effective environmental management. Indigenous communities hold deep ecological knowledge that enhances biodiversity monitoring and policy-making when it is made integral to conservation strategies. Canada's 2030 Nature Strategy[1] and associated Biodiversity Monitoring Framework, informed by the Kunming-Montreal Global Biodiversity Framework (GBF)[2], offer a valuable opportunity to prioritize Indigenous-led monitoring and governance by blending Indigenous knowledge systems with conventional scientific approaches.

In support of the Minister of Environment and Climate Change, the Office of the Chief Science Advisor convened a roundtable of 23 experts from academia, public institutions and Indigenous communities. The discussions focused on developing an Indigenous biodiversity monitoring framework with indicators that accurately reflect Indigenous values. These efforts align with Canada's commitment to using multiple knowledge systems in biodiversity conservation planning, decision-making and policy development.

The roundtable identified key values that underpin Indigenous biodiversity monitoring, including the importance of rights-based perspectives, cultural identity, adaptive management and relationality. Participants emphasized that existing conservation frameworks often fail to capture these values, necessitating a shift towards localized and distinction-based approaches[3]. Indigenous biodiversity indicators, often qualitative, shared orally and rooted in lived experience, require adaptation beyond the conventional inclusion of quantitative measurements alone.

To support Canada's biodiversity strategy, the report provides the following four recommendations:

1 Canada's 2030 Nature Strategy: Halting and Reversing Biodiversity Loss in Canada [PDF – 4014Kb], available at: https://publications.gc.ca/collections/collection_2024/eccc/en4/En4-539-1-2024-eng.pdf (accessed Feb. 15, 2025)

2 The Kunming-Montreal Global Biodiversity Framework: https://www.unep.org/resources/kunming-montreal-global-biodiversity-framework?gad_source=1&gclid=EAIaIQobChMI6-LVpObAiAMVTGJHAR3SxSFZEAAYASAAEgJxBPD_BwE (accessed February 15, 2025).

3 A distinctions-based approach or methodology is one in which a government's work with First Nations, Métis, and Inuit will be conducted in a manner that acknowledges the specific rights, interests, priorities and concerns of each, while respecting and acknowledging these distinct Peoples with unique cultures, histories, rights, laws, and governments. See for example: Government of British Columbia, Distinctions-Based Approach Primer, December 2023, available at: at: https://www2.gov.bc.ca/gov/content/governments/indigenous-people/new-relationship/united-nations-declaration-on-the-rights-of-indigenous-peoples/distinctions-based-approach (accessed April 8, 2025).

1. Establishing a National Technical Working Group that would focus on the selection of headline or complementary indicators that reflect the values that Indigenous People ascribe to biodiversity.
2. Designing an Indigenous Peoples Biodiversity Monitoring and Assessment Framework (IP-BMA) within ECCC's Canadian Wildlife Service.
3. Co-developing, with the national technical working group, an action plan across science-based departments and agencies for the implementation of the IP-BMA.
4. Adopting a government-wide approach to the resourcing and building of Indigenous capacity within the federal public service and Indigenous nations to support an IP-BMA.

These measures will ensure Indigenous knowledge informs national conservation policies, fostering a more inclusive and effective approach to biodiversity management.

## BACKGROUND

The development of environmental and biodiversity indicators that are meaningful to Indigenous communities is increasingly recognized as a crucial aspect of effective conservation and environmental management. Indigenous Peoples have developed intricate knowledge systems through generations of interaction with their lands and waters, which are essential for understanding and sustaining biodiversity.

In implementing the Kunming-Montreal Global Biodiversity Framework (GBF), Canada's 2030 Nature Strategy and its accompanying Biodiversity Monitoring Framework present a significant opportunity for Indigenous biodiversity knowledge to be at the forefront of enhancing Canada's monitoring efforts through enhanced regional coordination and prioritization of local governance systems. Within the strategy, the importance of bridging multiple knowledge systems, including the best available science, is highlighted as essential to achieving Canada's commitments under the GBF.

## CONTEXT

The Chief Science Advisor, in support of the Minister of Environment and Climate Change, undertook to organize several roundtables of national and international experts to address specific challenges related to the acquisition, use and communication of scientific data and information to support the GBF's implementation.

In this context, the Office of the Chief Science Advisor of Canada (OCSA) convened a roundtable of experts to discuss the development of an Indigenous biodiversity

monitoring framework that includes biodiversity indicators that capture and appropriately represent the full range of Indigenous values and concepts of biodiversity. Indigenous knowledge[4], being place-based and connected to lived experiences alongside local biodiversity, offers crucial insights into ecosystem management and conservation reflective of local priorities relevant to Indigenous communities. Targets 14 and 21 of the GBF emphasize the need for accessible, useful data for decision-making and the integration of biodiversity's multiple values into governance across all sectors. Canada's commitment to developing a domestic biodiversity monitoring network will further create an opportunity for stakeholders and rights holders alike to determine the future of data governance and use in conservation.

The roundtable included 23 experts from North America representing both academia, the public service and Indigenous communities. It was co-chaired by Dr. Mona Nemer, Chief Science Advisor of Canada, and Prof. Kyle Bobiwash, Researcher in Residence at the OCSA, and featured Indigenous researchers, biodiversity scientists and experts from a variety of public institutions and federal science-based departments and agencies (see Appendix A for the complete list of participants).

## ISSUES AND OBJECTIVES

The GBF identifies multiple targets, specifically targets 14 and 21, which necessitate the recognition of Indigenous knowledge and Indigenous rights as core elements to a successful Canadian conservation strategy. To effectively progress towards this goal, it is necessary to both map the range of values ascribed to biodiversity within Indigenous knowledge systems (IKSs) and identify the appropriate indicators that will enable the evaluation of initiatives and policies put in place to preserve these values.

*Issue:* To achieve targets 14 and 21 of the GBF, Canada must understand the scale and configuration of the socio-ecological network derived from IKSs to develop engagement strategies and monitoring tools that allow conservation management strategies to fully reflect and measure aspects of biodiversity that represent the entire suite of values ascribed to biodiversity by Indigenous communities across Canada.

*Objective:* The roundtable was convened to solicit expert advice on designing a framework that would support the development of biodiversity conservation and assessment approaches that reflect the full range of Indigenous biodiversity values with indicators that allow for the evaluation of conservation practices. Participants were asked to address three questions:

4 Indigenous knowledge is a set of complex knowledge systems embedded in the unique cultures, languages, values and worldviews of Indigenous Peoples that is community-specific and place-based, arising from Indigenous Peoples' intimate relationship with their environment and territory over thousands of years. It is generally understood to be collective knowledge that encompasses community values, teachings, relationships, ceremony and oral stories.

1. What sociocultural values and biophysical attributes of biodiversity or ecosystems are important to Indigenous communities and their knowledge systems?
2. Do Indigenous communities use indicators linked to key Indigenous values or concepts of biodiversity?
3. Have biodiversity indicators been developed using knowledge from non-Indigenous knowledge systems that nonetheless inform or are associated with Indigenous values of biodiversity or concepts of ecosystem wellbeing? If so, what are they and what values are they associated with?

## SUMMARY OF DELIBERATIONS

### 1) What values and attributes of biodiversity or ecosystems are important to Indigenous communities and their knowledge systems?

Participants identified a variety of broad values and specific biodiversity attributes that are not at present effectively represented or measured in common conservation management. Similarly, the identification or creation of novel indicators that reflect broader Indigenous priorities and ways of knowing is key to their relevancy. Defining Indigenous-relevant indicators will require characterizing attributes of species, populations and ecosystems that best reflect values that Indigenous nations identify as crucial components in the consideration of the health and resiliency of ecosystems. Many of the values highlight the role and interactions of humans or society with natural systems and include:

- *Rights-based perspectives:* Biodiversity and the integrity of ecosystems are intricately linked with the capacity of Indigenous Peoples to meet their responsibilities in maintaining ecosystem health. The socio-ecological network or kinship networks in which Indigenous Peoples are embedded represent a governance system that allows for the creation of laws or rules that can dictate management practices and/or assign responsibility. Rights-based indicators would support the capacity to determine whether Indigenous rights are being supported or eroded over time, once communities determine the extent of the relationship between particular elements of biodiversity and Indigenous rights.
- *Indigenous cultural identities:* Ecosystems, including specific species, landscapes and ecological processes, are integral to cultural practices, IKSs and the spiritual beliefs of Indigenous communities. The concept of land stewardship represents more than the simple management of the biophysical environment; it also represents the maintenance of Indigenous identity and ethical co-existence with ourselves and the surrounding environment.
- *Adaptive management and flexibility:* The measurement of biodiversity attributes that reflect a determined Indigenous biodiversity value necessitates

adaptation to reflect unique contexts and changing economic, environmental or social conditions and community needs. This flexibility allows for the continuous integration of new knowledge to further refine and adjust management practices to optimize the maintenance of current interpretations of "health" or wellbeing across all actors in a kinship network.

- *Relationality:* Relationality is a fundamental value across many, if not most, Indigenous communities that broadly defines the scope and multiplicity of Indigenous relationships for a distinct IKS. It represents the diversity and influence of interactions between elements (and interactions themselves) within a network. Mapping cultural, economic, ethical, physical, social and spiritual relationships across biodiversity/ecosystem elements will necessitate understanding the unique topography of these networks. Many of the core values of particular elements or interactions within an ecological network are encoded within Indigenous languages and IKSs. Through ceremonies, cultural practices and stories, the scope of relationality for an Indigenous community is shared and updated over generations and identifies standards in maintaining a relationship that may or may not currently exist. Development of indicators reflecting prevalence, extent or resilience associated with differing aspects of relationality may in fact dictate the appropriate conduct or research associated with particular elements or interactions within the socio-ecological network.

Important values and attributes of biodiversity and ecosystems are shown in Table 1. Participants noted additional context that is necessary to ensure accurate descriptions of these values:

1. Land-based practice is essential to the understanding of biodiversity values and the capacity to translate those values into concepts that can be acted upon;
2. Indigenous biodiversity values are the by-product of generational knowledge transmission that has adapted over time to reflect solutions to human-environmental challenges;
3. Distinction-based approaches are needed to accurately reflect differences in values at the local scale and may not always be generalizable.

## Table 1. Identified Indigenous values or attributes of biodiversity that necessitate specific considerations in developing indicators.

| Indigenous-relevant values | Indicator considerations |
|---|---|
| Kinship network integrity and values associated with network health or quality | Kinship networks in Indigenous communities often extend beyond human relationships to include more than human beings, such as animals, plants, rivers and mountains, as well as non-biophysical concepts or spiritual entities. Relationships between elements within any given networks are often not direct nor physical, necessitating understanding the identity and role of distinct individual elements in the network.<br><br>Connectivity between elements in networks is not easily generalizable across Indigenous community actors with distinct responsibilities and network configurations shared through unique intra-community generational knowledge exchange. Many of the indicators used in contemporary network theory would support the understanding of the state of these networks. |
| Stewardship, reciprocity, respect and responsibility | Stewardship, management and interaction with ecosystems represent an opportunity through which Indigenous communities demonstrate and refine a communities' ethical agency.<br><br>Values associated with the ability to enact one's ethical system in the management of biodiversity allows the evaluation of current capacity to engage in reciprocal relationships between humans and the natural world.<br><br>Indicators associated with agency in biodiversity management also allows the continued review of whether current ethical frameworks (co-governance, research ethics protocols, engagement and partnership agreement, etc.) are sufficient to allow elements within a network to meet their responsibilities to others. Stewardship is both an active practice and a concept that allows for the generation of knowledge or information that can inform gaps in current IKSs and stewardship to refine management and understanding of relationships to meet current and future standards (e.g., The Seven Generations Principle)[5].<br><br>Indicators must consider current capacity to meet stewardship expectations as defined by IKSs, capacity for networks or elements therein to reciprocally interact, and measures of environmental respect and responsibility. |
| Knowledge system integrity | The integrity of a kinship or relational network can be affected by larger-scale influences that are not easily incorporated in IKSs. Geopolitical or global economic and environmental influences can impact the ability of interventions or traditional practices at the local scale to produce the desired result in biodiversity attributes. Similarly, knowledge imported from IKSs into conventional science policy systems may lose accuracy or effectiveness should it be dissociated from the local context or other important IKS elements needed to properly utilize the shared information.<br><br>Biodiversity indicators derived from IKSs must ensure that accessory cultural epistemology, practices and understanding accompany the shared biodiversity information. Indicators focused on the integrity of IKSs themselves require local understanding of the integrity of biodiversity knowledge embedded within these systems. |

5 The Seven Generation Principle is based on an Iroquois philosophy that the present-day decisions should result in a sustainable world seven generations into the future.

## 2) Do Indigenous communities use indicators linked to key Indigenous values or concepts of biodiversity?

One of the main difficulties in developing biodiversity indicators that are meaningful to Indigenous communities is that IKSs and conventional scientific approaches are based on different ways of understanding the world. These different perspectives can make it challenging to create indicators that respect and reflect multiple knowledge and values systems. While conventional approaches tend to insist on using quantitative measures as a means of best ensuring consistency and repeatability, Indigenous indicators may include qualitative aspects such as the health of culturally significant species, the timing of natural events and the cultural or spiritual significance of specific landscapes.[6] [7] Increasingly successful conservation initiatives have focused on ensuring equity in socio-ecological and biodiversity governance management. The inclusion of a broad range of experts and equity in governance augments conventional biodiversity monitoring and management to optimize responsiveness to biodiversity trends or changing sociological pressures. Frameworks that recognize this interconnectivity also theoretically ensure adaptive management practices can meet goals or priorities at different scales (spatial and temporal) in a diverse multi-actor governance system[8]. Although these practices have already been deployed in various conservation management systems, the unique relational social networks of Indigenous communities are not well resolved. Future efforts will require mapping of network configurations and delineation of the types of links (e.g., stories vs. harvesting), identities of nodes or actors, and particular values associated with these elements across the network. Through engagement and local leadership, generalized frameworks can be further refined by identifying particular values that reflect local ways of understanding the environment that will require special indicators tailored to the local context.

Participants noted that the need for standardization or generalization often results in indicators that do not properly represent or connect to the specific value that is being encouraged or supported. The place-based nature and the diversity of IKSs raise challenges to extrapolating values or indicators beyond locality or knowledge system in which they were created. For example, a biodiversity indicator meant to represent an Indigenous nation's principle of respect towards wildlife might manifest at distinct scales (individuals, species, ecological communities) or might be best tracked through distinct types of indicators (quality of a species vs. quantity of species). Therefore, it is essential to identify, where appropriate, whether place-based biodiversity indicators linked to values represent localized or more generalizable relationships between biodiversity and Indigenous biodiversity values.

6 Whyte, K. (2017). Indigenous climate change studies: Indigenizing futures, decolonizing the Anthropocene. English Language Notes, 55(1), 153-162.
7 Mazzocchi, F. (2006). Western science and traditional knowledge: Despite their variations, different forms of knowledge can learn from each other. EMBO reports, 7(5), 463-466.
8 Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. Science, 325(5939), 419-422.

This can enable broader principles to be embedded into national strategies; those that are more locally relevant would be supported in the implementation of regional management plans. To understand the capacity of indicators to be extrapolated beyond distinct communities, it is important to test and evaluate the link between Indigenous values and indicators across regions and communities. This underlies the importance of investing in broad engagement with Indigenous communities to support the development of a Canadian biodiversity monitoring system that is responsive to Indigenous community needs.

Potential Indigenous-relevant indicators, the values they represent and the necessary considerations needed to link them to changes in biodiversity can be found in Table 2. Indicators are often difficult to isolate from other pressures influencing the metric, necessitating local understanding of the appropriateness of particular indicators. Participants also highlighted some fundamental needs and priorities that are essential to the development of any indicator.

- Defining or delineating local or distinction-based approaches is not straightforward and might represent a variety of scales across regions, boundaries or ecosystem types that represent Indigenous perspectives of connectivity;
- Indigenous-relevant indicators may not necessarily integrate well within our current system of decision and policy-making, necessitating unique science to policy pathways or parallel biodiversity assessment processes;
- Indigenous-relevant indicators of biodiversity may operate counterintuitively to our currently used metrics (e.g., invasive species that fill a relationship niche viewed as positive to relational network);
- Currently used biodiversity indicators are likely very valuable to communities; however, their ability to support Indigenous decision-making and collaboration with federal and provincial bodies is not well resolved;
- Supporting the capacity (skills and resources) within Indigenous communities to use established indicators and develop locally relevant measures is important to enable self-determination in both conservation science and community priorities;
- Both quantitative and qualitative indicators need to connect to specific outcomes that are identified as high-priority for Indigenous communities;
- Indicators should consider quality of life for humans, biodiversity and ecosystems, encompassing health, social wellbeing and other context-specific attributes.

## Table 2. Identified potential classes of indicators and considerations for indicator design.

| Class | Indicator examples | Indicator characteristics and examples | Scale |
|---|---|---|---|
| Cultural | Prevalence of Indigenous language use associated with biodiversity, harvesting or land management activities | Indigenous languages contain ecological information and represent the types of relationships between species and interacting elements in the ecosystem.<br><br>Language use indicators (e.g., percentage of speakers, number of "ecological terms known," number of species with names in Indigenous languages) may represent competency in Indigenous knowledge of the local ecosystem.<br><br>Language-focused indicators are likely more relevant and valuable at smaller scales where a local context will determine the link between language maintenance and biodiversity. | Community, Nation or Indigenous regional governance |
| | Frequency of land-based traditional practices, harvesting and ceremonial capacity (frequency, quality, etc.) | The capacity of land or species to enable traditional practices represents a measure of conventional provisioning of ecosystem services but also a more nuanced accounting of the ability of ecosystems to support IKSs themselves.<br><br>Biodiversity's role as a provisioning element for cultural practices is well known but diverse across and within regions. Indicators associated with prevalence of traditional cultural practices involving biodiversity might not always be values for real time tracking of biodiversity health but represent a linked value susceptible to biodiversity loss. | Regional |
| | Access and use of biodiversity and ecosystems | The ability to access biodiversity is important to the capacity of Indigenous communities and land management. Access is a key component of the relationship between humans and wildlife.<br><br>It is necessary to determine both the potential and real access to wildlife as they represent distinct Indigenous values associated with either ecosystem and biodiversity health or the ability to utilize biodiversity for traditional practices.<br><br>Creating distinct indicators that identify both the capacity or limitation for access and those that are linked to particular characteristics of use (e.g., quality of harvesting) can drive improved biodiversity governance systems. | Local to regional |

| | | | |
|---|---|---|---|
| Socio-economic | Knowledge of biodiversity and socio-ecological roles | Natural history derived from Indigenous ways of knowing can contain information beyond biological understanding of systems. Cultural norms and teachings, local history, Indigenous governance systems and laws are among the types of information transmitted or derived from concepts associated with Indigenous ecological networks.<br><br>These potential indicators can be used to determine the prevalence of and strength in the links between the current state of biodiversity and how they help structure community systems while providing an understanding of socio-ecological system health. | Local to national |
| | Quality of life (behavioural, health, economic) | The status of biodiversity is directly related to the wellbeing and capacity of humans and different components of biodiversity to live a "good life" according to standards determined by Indigenous knowledge systems. In many cases this is best described as some aspect of freedom or self-determination by the species or ecosystem.<br><br>The links between wellbeing and environmental health are increasingly being recognized in One Health[9] and One Welfare[10] models, where the capacity of an environmental system to support the varied biological and socio-economic needs of people is recognized.<br><br>Quality of life as an Indigenous biodiversity value provides actionable data that can lead to interventions that enhance environmental health while supporting local economic, environmental, mental and physical health. | Regional |

## 3) Have biodiversity indicators been developed using knowledge from non-Indigenous knowledge systems that nonetheless inform or are associated with Indigenous values of biodiversity or concepts of ecosystem wellbeing? If so, what are they and what values are they associated with?

During the session, participants recognized that there are likely many benefits that Indigenous Peoples, and their cultural or knowledge system, might derive from conventional biodiversity conservation. Nonetheless, they emphasized the need

9 One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent. The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development. Available at: https://www.unep.org/news-and-stories/statements/joint-tripartite-and-unep-statement-definition-one-health (accessed April 8, 2025).

10 "One Welfare" builds on the One Health concept and is a way to recognize the many social interconnections between human welfare, animal welfare and the integrity of the environment. https: //www.animalhealthcanada.ca/work-areas/one-welfare (accessed April 8, 2025).

for Canada's 2030 Nature Strategy and its Domestic Biodiversity Monitoring Framework to additionally reflect important Indigenous priorities for biodiversity conservation. Indeed, the development of biodiversity indicators can greatly benefit from integrating concepts from conventional scientific approaches, such as indicator species and ecological integrity. However, it is essential and possible within the current system to critically assess how these concepts have been historically applied and adapt them for Indigenous contexts. Adaptation involves expanding these concepts to incorporate Indigenous values including systems of relationships, language, and cultural practices.

When biodiversity indicators are created, it is important to involve Indigenous communities in the development and in the monitoring process, enabling them to share their knowledge and experiences. This collaboration not only strengthens local capacity but also ensures that the indicators reflect both ecological and cultural values.

Moreover, utilizing conventional indicators can be vital for Indigenous communities, as these data sets can facilitate meaningful engagement with government organizations and support their rights, interests and local decision-making processes. By bridging these two frameworks—conventional scientific approaches and Indigenous knowledge—biodiversity indicators can become more holistic and relevant, fostering sustainable practices that honour both ecological integrity and cultural heritage.

Initiatives and solutions that lead to improved collaboration between knowledge systems and indicators capable of addressing uniquely Indigenous values require processes and systems that reflect certain core attributes:

*Co-development and collaboration*

A significant aspect of Canada's 2030 Nature Strategy is the emphasis on co-developing policies and actions with Indigenous communities to strengthen

overall monitoring effectiveness. This collaborative process ensures that Indigenous perspectives, values and knowledge systems are not only acknowledged but are also actively contributing to decision-making processes. This includes partnerships in areas such as sustainable resource management and biodiversity monitoring.

*Indigenous knowledge equity*

The use of Indigenous knowledge in biodiversity conservation efforts necessitates the creation of ethical space to allow Indigenous knowledge to operate and drive decision-making independently of the dominant knowledge systems in our established science-to-policy action frameworks. This necessitates training within government and support for Indigenous nations, organizations and knowledge holders to create the necessary skills and conditions where knowledge can be evaluated in an equitable manner.

*Empowerment and capacity building*

Canada's conservation goals provide an opportunity to focus on empowering Indigenous communities through capacity building. This includes initiatives aimed at enhancing the capacity of Indigenous organizations to participate in biodiversity-related activities, such as environmental monitoring and resource management. Biodiversity strategies should also highlight the importance of supporting Indigenous-led conservation initiatives, ensuring that communities have the resources and authority to manage their lands according to their traditions and values.

*Economic and cultural sustainability*

The importance of supporting Indigenous economies that are based on sustainable practices and cultural traditions should be viewed as a conservation priority. This includes promoting Indigenous-led sustainable economic activities that contribute to biodiversity conservation, such as traditional hunting, fishing, and land management practices.

# RECOMMENDATIONS

In support of Canada's 2030 Nature Strategy and monitoring framework, and building on the results of this roundtable, it is recommended that the Government of Canada, in collaboration with Indigenous communities and partners, consider the following:

1. **Setting up a national Technical Working Group under the GBF** that would focus on the selection of headline or complementary indicators that reflect the values that Indigenous Peoples ascribe to biodiversity. This group should be supported by the departments and established interdepartmental working groups that are leading the development of GBF target indicators to ensure efficient integration into current development processes. The major roles for the working group include:
    i. Collecting and synthesizing available or proposed Indigenous biodiversity indicators (or metadata) currently used in regional and national conservation initiatives that actively involve Indigenous Peoples in design or implementation;
    ii. Building a data-sharing framework specific to environmental and biodiversity information that allows for tracking of progress and determination of biomonitoring coverage. These data-sharing networks should enable data sovereignty principles to be enacted by Indigenous nations and organizations but also to serve as a means of identifying areas lacking sufficient information to inform conservation management decisions;
    iii. Support and advise departments leading federal GBF target-specific implementation plans as outlined in Canada's 2030 Nature Strategy to enhance their capacity to appropriately utilize Indigenous knowledge and science.
2. **Designing an Indigenous Peoples Biodiversity Monitoring and Assessment Framework (IP-BMA) within ECCC's Canadian Wildlife Service** that includes:
    i. a set of well characterized values that are not only important to Indigenous Peoples but also directly linked to biodiversity and nature more broadly;
    ii. a set of associated indicators that would be the focus of monitoring and assessment by Indigenous Peoples and which would allow for inferences about the erosion or enhancement of Indigenous Peoples' biodiversity values;
    iii. a process to identify which existing biodiversity indicators—whether headline, complementary or component—are suitable for representing Indigenous values, and where additional indicators are required;

iv. An engagement strategy to co-develop with Indigenous communities new indicators that better reflect their identified values where current indicators are unsuitable.

3. **Co-developing, with the national technical working group, an action plan across science-based departments and agencies for the implementation of the IP-BMA** that explicitly considers, among other issues:
    i. implementation principles (e.g., co-development, data sovereignty, adherence to the United Nations Declaration on the Rights of Indigenous Peoples Act);
    ii. governance structures that prioritize distinction-based considerations and the transdisciplinary nature of Indigenous biodiversity values and indicators;
    iii. evaluative frameworks to track progress with implementation and operationalization of the IP-BMA across regions to maximize the development of practical, sustainable and adaptable monitoring across different governance models and established processes in regions and provinces.
4. **Adopting a government-wide approach to resourcing and building Indigenous capacity within the federal public service and Indigenous nations to support an IP-BMA.** Through leveraging established federal government infrastructure, programs and relationships, additional capacity can be built by:
    i. supporting the ability of federal granting agencies to continue exploring novel strategies to enhance the development of Indigenous scholars, researchers, research collaborations and networks;
    ii. establishing permanent advisory councils within key economic and science-based departments that are composed of Indigenous knowledge holders, scientists and community leaders. The council would provide guidance on the use of Indigenous knowledge for economic and policy development, ensuring that Indigenous biodiversity and environmental priorities are considered from the outset;
    iii. creating an Indigenous scholars' network across science-based departments and agencies to support their ability to mainstream Indigenous biodiversity and environmental priorities across the federal public service.

# APPENDIX A
# Roundtable participants

| Name | Position and Affiliation |
|---|---|
| **Participants from the Office of the Chief Science Advisor (OCSA)** | |
| Mona Nemer | Chief Science Advisor of Canada (Roundtable Co-Chair) |
| Kyle Bobiwash | Researcher in Residence at the OCSA (Roundtable Co-Chair) and Assistant Professor at the Department of Entomology, Faculty of Agricultural and Food Sciences, University of Manitoba |
| David Castle | Researcher in Residence at the OCSA and Professor at the School of Public Administration and Gustavson School of Business, University of Victoria |
| Scott Findlay | Researcher in Residence at the OCSA and Retired Professor in biology at the University of Ottawa |
| Gary Slater | Researcher in Residence at the OCSA and Professor at the Department of Physics, University of Ottawa |
| **External Participants** | |
| Devin Arbuthnott | Policy Advisor, Agriculture and Agri-Food Canada |
| Gillian Arraial | Indigenous Science Liaison Assistant, Agriculture and Agri-Food Canada |
| Myrle Ballard | Research Scientist, Canadian Wildlife Service (ECCC) and Adjunct Research Professor at Carleton University |
| Kaitlyn Gaynor | Associate Professor in the Department of Earth, Energy, and Environment, Faculty of Science at the University of Calgary |
| Andy Gonzalez | Professor, McGill University, Liber Ero Chair in Conservation Biology and Founding Director of the Quebec Centre for Biodiversity Science |
| Eduardo S. Brondizio | Distinguished Professor of Anthropology in the Department of Anthropology at Indiana University Bloomington |
| Warren Cardinal-McTeague | Assistant Professor, Department of Forest & Conservation Sciences at the University of British Columbia |
| Kristin Clark | Physical Scientist, Landscape Ecology Research Section at Environment and Climate Change Canada |
| Danielle De Baets | Scientist and Manager, Landscape Science and Technology at Environment and Climate Change Canada |
| Gillian Donald | Scientist and Principal, Donald Functional & Applied Ecology Inc. |
| Fred Fortier | Band member, Simpcw First Nation |
| Robert Gibson | Professor, School of Environment, Resources and Sustainability at the University of Waterloo |
| Glennis Lewis | Professor, Environmental Impact Assessment, Brandon University |
| Emily Macauley | Scientist and Director, Science Priorities and Planning, Fisheries and Oceans Canada |
| Matthew Munson | Band member and Technician, Dene Tha' First Nation, M.Sc. Candidate, University of Alberta, Catchment and Water Science |
| Erica Nitchie | Team Lead, Indigenous Food Systems at BC Ministry of Agriculture |
| Brett Painter | Biodiversity Indicators Lead, Environment and Climate Change Canada |
| Jesse N. Popp | Canada Research Chair in Indigenous Environmental Science and Associate Professor, University of Guelph |
| James Rattling Leaf Sr. | Tribal Advisor at the Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder |

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| Justina Ray | Wildlife Conservation Society Canada, and Adjunct Professor University of Toronto, and Trent University |
| Andrea Reid | Assistant Professor at the Institute for the Oceans and Fisheries, University of British Columbia |
| Andrea Service | Senior Policy Analyst with the Impact Assessment Agency of Canada |
| Bryan Vandenbrink | Polar Knowledge Canada |
| Erika Zavaleta | Professor in the Ecology and Evolutionary Biology Department, University of California at Santa Cruz |
| **Support staff from the Office of the Chief Science Advisor** | |
| Nancy Abou-Chahine | Policy Analyst |
| Serge Nadon | Senior Policy Advisor |