

REPORT ON JULY 2021 CAN BON EXPLORATORY WORKSHOP

EXECUTIVE SUMMARY

This report summarizes findings of a two-stage process to gather information on the potential for creation of a Canadian Biodiversity Observation Network (CAN BON). The first stage was a call for Expressions of Interest (EOI) that obtained over 110 responses from interested individuals and organizations. They shared their perspectives on the potential value of a CAN BON, their current level of engagement with Indigenous peoples, and the contribution they could make to a CAN BON. The second stage was a facilitated virtual workshop held over 3 days in July 2021 that brought together over 60 participants, mostly selected from those who submitted an EOI. They discussed key requirements to implement a CAN BON; how a CAN BON could effectively engage Indigenous people; and priority monitoring gaps that a CAN BON could address.

This exercise was intended as an initial conversation to gather diverse perspectives and strengthen collaborations between the academic community, government agencies, non-government organizations, Indigenous rights holders, and other relevant stakeholders regarding biodiversity observation and monitoring in Canada. The intent of the workshop was to generate and share ideas, and not necessarily to come to a consensus on particular recommendations. For this summary, the discussions have been synthesized under three major categories:

Potential roles / goals of a CAN BON

- **Bringing together diverse stakeholders**, including governments, Indigenous peoples, policy makers, non-government organizations, conservation practitioners, and other members of the public to improve coordination and relevance of existing biodiversity monitoring efforts.
- **Promoting approaches to weave Indigenous perspectives and knowledge** with western science to support biodiversity conservation;
- **Enhancing the quality and effectiveness of monitoring** through development and promotion of standard monitoring protocols/best practices and enhanced use of emerging technologies.
- **Identifying and promoting Essential Biodiversity Variables** for reporting and decision-making at national and regional scales.
- **Coordinating efforts and funding to address the highest priority gaps** in biodiversity monitoring.
- **Improving access to biodiversity data**, through support for comprehensive accessible data repositories and networks and promotion of the [FAIR guiding principles](#) for scientific data management and stewardship and the [CARE principles](#) for Indigenous data governance;
- **Developing decision support, analysis and visualization tools** that synthesize biodiversity data across scales and technologies, and linking them to data on drivers of ecosystem change to maximize the value of monitoring data for conservation and policy decisions by stakeholders.

Key requirements to develop a CAN BON

- **Indigenous co-development and co-leadership** to ensure Indigenous viewpoints, methodologies, and concerns are considered from the outset.
- **Adequate dedicated resourcing and staff** to support consultation, development, and implementation.
- **Early engagement of end users of biodiversity information** in the planning to ensure that the outputs of a CAN BON actually support decision-making.
- **Well-defined goals and objectives**, to describe what a CAN BON would and would not deliver that considers the needs of stakeholders.
- **Strong linkages with existing monitoring efforts** within Canada and internationally.
- **Integration of social science** data and expertise to increase relevance of the work to communities and policy makers.

Considerations to ensure a CAN BON addresses Indigenous perspectives, needs, and ways of knowing

- **Co-development and co-leadership with Indigenous peoples** need to start from the beginning, at the top, and permeate all levels. A CAN BON would need to be an inclusive and ethical space.
- **Indigenous participants need to be properly compensated** for their participation in planning and other activities.
- **Recognition that Indigenous knowledge and Western science represent different approaches for understanding and require distinct tools**; consideration is needed for Indigenous approaches that leave room for storytelling and descriptions.
- **Indigenous governance** of biodiversity information must be respected, and **principles of ownership, control, access, and possession** implemented.
- **Resources must be allocated** explicitly to support Indigenous science based on priorities identified and driven by Indigenous groups and communities.
- Sufficient time and effort need to be invested to build and maintain **effective and meaningful long-term relationships**.
- **Development of protocols** for Indigenous engagement to ensure that there is guidance for meaningful and appropriate collaboration and **cultural safety**.

Next Steps:

The federal departments involved will continue to work with the GEO BON Secretariat in Montreal to seek opportunities to advance discussions about a potential CAN BON, in collaboration with Indigenous organizations.

SUMMARY OF EXPRESSIONS OF INTEREST AND WORKSHOP DISCUSSIONS

The July 2021 workshop was a convening event, bringing together different groups for an initial conversation to start discussions and share ideas on how to set up a potential Canadian Biodiversity Observation Network. This report has been developed to summarize the findings of the Expressions of Interest (EOI) and the workshop discussions, for dissemination to all parties who submitted EOIs or participated in the workshop and other interested groups. The inventory of content from the EOIs will help inform not just a potential CAN BON but also catalyze new collaborations, partnerships, and sharing of resources and data.

The report includes a synthesis of key discussion points and findings from this initial conversation but is not intended to provide consensus for how to move forward.

Background

The global GEO BON Secretariat moved to Canada in January 2021, giving Canada an opportunity to assess its capacity to efficiently monitor and protect our biodiversity and ecosystems. To initiate a conversation on this issue, the Natural Sciences and Engineering Research Council of Canada (NSERC), Environment and Climate Change Canada (ECCC), Fisheries and Oceans Canada (DFO), Parks Canada (PC), NatureServe, and the Canadian Space Agency (CSA), as well as the GEO BON Secretariat, came together to organize a workshop to discuss the feasibility and desirability of establishing a Canadian Biodiversity Observation Network (CAN BON) to transform Canada's capacity to research, survey, and monitor biodiversity, natural resources and ecosystem services in ways that will better inform management and conservation.

The intended emphasis of the workshop was to: (1) identify existing initiatives, data and resources related to biodiversity observation and monitoring that could contribute to a CAN BON; (2) evaluate ways that a CAN BON could enhance these initiatives through improved integration, collaboration or syntheses; and (3) strengthen collaborative efforts among the academic community, government agencies, non-government organizations, Indigenous rights holders and other relevant stakeholders regarding biodiversity observation and monitoring in Canada. The workshop was designed to serve as an initial discussion and encourage linking across the country, as well as allow for the start of an inventory of relevant activities, stakeholders, and data.

The call for Expressions of Interest (EOI) and the program for an online workshop were designed and attendees selected with representatives from the above group of agencies as well as Natural Resources Canada (NRCan) and Agriculture and Agri-Food Canada (AAFC). The Workshop Program, EOI Call and the list of participants for the workshop are provided in the Appendix. Over 110 EOIs were received by the May 2021 deadline for inclusion in the summaries presented at the workshop.

Workshop Overview

The virtual workshop took place on July 27, 28 and 29, 2021 with over 60 participants in attendance from multiple sectors across the country. The workshop had opening and closing

ceremonies from Designated Elder Fred McGregor from the Algonquin Anishinabe Community of Kitigan Zibi. The organizers provided an overview of the workshop and the proposed approach, then David Harper, the Canadian Principal for the Group on Earth Observations (GEO) and Director General of the Meteorological Service of Canada, ECCC provided opening remarks. Closing remarks were delivered by the NSERC President, Alejandro Adem. Presentations on the background of GEO BON and best practices for Biodiversity Observation Networks (BONs) were provided by a former co-chair of GEO BON, Mike Gill of NatureServe and a current co-chair of GEO BON, Andrew Gonzalez of McGill University. Presentations were provided by Sue Chiblow of York University on Weaving Two Worldviews in Respectful Ways and Neil Jones of ECCC on the Development of ECCC's Indigenous Knowledge Framework. The content of the submitted EOIs was summarized by question and connected to the key outcomes. Breakout groups were formed for each question and then reported back to plenary.

Summary of EOI Submissions for Question 1

How could a CAN BON enhance existing biodiversity monitoring in Canada?

A review of the content of over 110 EOIs indicated many submissions agreed on a number of priorities that a CAN BON could address:

- Coordinating monitoring, analysis and synthesis across initiatives through a dedicated BON facility and staff.
- Developing and supporting data standards and protocols covering collection and curation and the application of FAIR Guiding Principles for scientific data management and stewardship (Findable, Accessible, Interoperable and Reusable - <https://www.nature.com/articles/sdata201618>) and the CARE Principles for Indigenous Data Governance (Collective Benefit, Authority to Control, Responsibility and Ethics - <https://www.qida-global.org/care>) (66% of EOIs mentioned the importance of data curation and management)
- The scope of a CAN BON could encompass all aspects of biodiversity from genes to species to communities for all taxa and ecosystems, also considering ecosystem services, natural capital linked to biodiversity, and pressures and drivers of biodiversity change, including land use change, climate change and conservation actions.
- Monitoring should be designed to assess the efficacy of conservation action or the impact of anthropogenic pressures on ecosystems.
- Multiple monitoring technologies could be combined to address monitoring of multiple scales.
- Improving access to existing data across repositories (57% of EOIs mentioned the importance of implementing standardized biodiversity monitoring protocols and need for interoperability, while 53% of EOIs mentioned the creation of an open access data repository for researchers, decision makers and the public for non-sensitive data).
- Recognition and inclusion of community-based knowledge and data: vital recognition of traditional ecological knowledge held by Indigenous people, communities and citizen naturalists and observers.

- Address the need for baselines and reference sites and data as well as the need for ID references and standards.
- Encouraging the use of user-friendly tools and data visualization to engage public, decision-makers, and researchers.
- Encouraging use of international standards to contribute to the broader global community (over 33% of EOIs cited coordination, or alignment with work done on the global scale).
- Providing infrastructure via consistent long-term funding for ongoing monitoring.
- Support for capacity building via workshops, training and shared expertise, and tools.
- Enhancing collaboration amongst diverse stakeholders and rights holders.

Summary of Plenary Discussions on Day 1:

What are the essential elements for a successful CAN BON?

Topics raised during discussions can be grouped into a number of essential elements for a successful CAN BON.

Support and funding: In order to be successful, CAN BON would require a dedicated staff and stable funding to support the staff. The idea behind the Biodiversity Observation Networks (BONs) is that much of the data collection and analysis is done on a voluntary basis by experts, but there is a need for coordination and support by properly resourced staff. Examples from other existing BONs indicate that the most successful have been those with a dedicated staff (e.g., the Arctic BON has a secretariat and each thematic group has a coordinator). Dedicated staff would facilitate curation, quality control, and coordinate with a steering committee both for specific projects and to facilitate the overall long-term goals of CAN BON. The staff would work closely with this scientific and coordinating steering committee. Indigenous perspectives would be an integral part of the development of the management structure and framing of CAN BON. Staff should include individuals with expertise in biodiversity and monitoring, perspectives of Indigenous Knowledge and methodologies, communications, data visualization, and technical expertise such as database management and programming. However, it is necessary that CAN BON have access to stable, long-term funding to support those positions, as this would ensure long-term sustainability of the BON. Funding would also be necessary to support the initiatives of CAN BON, including data collection and assessment to fill gaps, and efforts to coordinate monitoring activities.

Goals and objectives: A successful CAN BON needs to define clearly its goals and objectives, based on the needs of end users. It needs to be able to address key policy objectives by various levels of government and other decision makers / action takers supporting biodiversity conservation in Canada and internationally. It also needs to consider key reporting requirements and commitments such as the post-2020 biodiversity goals and objectives from the Convention on Biological Diversity.

Inclusivity and equity: CAN BON would need to be an inclusive and ethical space, and an equity lens applied from the start of network planning. There would need to be discussion of who are the data users and data providers, how to involve marginalized communities, whether

there are biases or barriers inherent in the design, and what are the obligations to those who are acquiring the data. In order to be successful, CAN BON would need to engage with a wide variety of people and organizations from the start, highlighting the imperative of meaningful Indigenous inclusion, which would be in the form of co-development and co-leadership. Current monitoring activities in Canada lack coordination. Getting buy-in and involvement from the various groups conducting monitoring (e.g., federal departments, provincial/territorial governments, regional governments, academia, industry, museums, indigenous communities, the public and other community groups) is important to move towards cooperative monitoring efforts, harmonization of methods, and curation of a centralized national data infrastructure. This effort should be co-developed and co-led by Indigenous representatives to ensure Indigenous viewpoints, methodologies, and concerns are incorporated. Related to the issue of equity, CAN BON would need to engage with youth to ensure that biodiversity knowledge creation, collection, and dissemination are supported in the long term. CAN BON could support youth engagement by developing training on data management and open science as well as biodiversity knowledge. Youth should also be part of the management structure of CAN BON.

Prioritizing actionable and existing data: CAN BON would need a strong action plan with clear goals and a mandate for long-term collaboration. These goals should guide CAN BON priorities in terms of the scale and resolution of the biodiversity data that will be preserved or sought. Following the BON model, identification and collection of existing monitoring data is an early step and a precursor to developing biodiversity baselines and early demonstration products for Canada. A great deal of data exists already in Canada, and an early task would be to identify the existing data and develop an interoperable and open access data catalog. Further, development of some early assessment products based on this existing data and knowledge that addresses key policy priorities would strengthen support, demonstrate the value of an integrated national approach, and inform the need for additional monitoring capacity. This would require cooperation from those who currently hold the data, including government (federal, provincial/territorial, regional), academia, industry, community groups, and museums. Several biodiversity data sharing and publishing networks are already in place in Canada, and could serve as a starting point to assess the state of biodiversity knowledge in Canada. In part, CAN BON could look to existing BONs for support and collaboration in the early tasks, as thematic BONs include Canadian members and efforts to collect data and assess biodiversity status and trends are already underway. For example, the Arctic BON has already identified, collected, and assessed biodiversity data for marine, freshwater, and terrestrial ecosystems in the Canadian Arctic, and a CAN BON could use and build upon that information, rather than repeating the same effort.

Follow best practices in data management and stewardship: To support long-term goals of a centralized access to biodiversity data in Canada, CAN BON would have to put effort into database development and curation, supporting the harmonization and linking of existing data and facilitating the addition of new monitoring data as they are collected. Examples of existing open source data infrastructures that exist in other countries and in the biodiversity informatics community should be considered as potential models for ongoing development. All this will include consideration of open data principles, data protocols, standards and best practices for data and knowledge synthesis. Existing data will need to be assessed for data quality, and data

will need to be standardized to ensure they are reliable and interoperable. The rescue of historically-collected data may be a rich source of information on biodiversity change. Data should be documented with metadata to support comparisons of sampling methods and ensure comparability. There would also need to be discussions regarding best practices in data sharing and exchange of information, to ensure both FAIR (concerning the usability of data) and CARE (concerning Indigenous data governance) data practices are followed. Trust would need to be built with data providers, for respectful data sharing and maintaining the attribution of data. Indigenous Knowledge experts should be engaged as part of this process, to discuss respectful and acceptable approaches to the sharing and use of Indigenous Knowledge.

Which elements may be less important in the initial development of a CAN BON?

Although an ultimate goal of CAN BON could be to support and conduct new monitoring of biodiversity within Canada, this should not be the immediate goal. Successful application of monitoring requires a clear understanding of where the spatial and temporal gaps are, and where there are priority areas to be monitored. To reach such an understanding, it is first necessary to take stock of the data that currently exist in Canada, and use the distribution of data and diversity patterns in the data to inform future monitoring plans.

Adoption of and investing in new technology is also desirable, but should not be the focus of the early stages of a CAN BON. Initially, CAN BON should rely on and adapt technology that is proven and understood. Later, when the capabilities and limitations of new technologies are better understood, they could be integrated into monitoring and assessment efforts. This could be done in collaboration with and contributing to a strong existing international biodiversity informatics community whose goals are to share and develop best practices in data acquisition, management, and publication.

Other Considerations

CAN BON should be linked to the post-2020 Biodiversity Framework that is currently in development by the Convention of Biological Diversity, to ensure Canada plays a role in international biodiversity conservation efforts. Deliverables of CAN BON should follow from the recommendations of the post-2020 Biodiversity Framework to ensure relevance.

Social science data and expertise of social scientists should be integrated into CAN BON, as this would help with developing the socio-economic implications of biodiversity change, which may increase relevance of the work to communities and policy makers.

The end users of biodiversity information, including those in both the public and private sector, should be involved in the planning stages to ensure that what is built is useful. Public engagement and outreach should also be explicitly incorporated in CAN BON planning.

Summary of EOI Submissions for Question 2

How has your organization worked with Indigenous Peoples?

Of the expressions of interest, more than 80% reported varying degrees of collaboration with First Nations, Inuit or Métis. This collaboration took a variety of forms: direct involvement and co-design of research and monitoring activities; balancing different knowledge and monitoring systems through the use of Indigenous ecological knowledge in research as well as the incorporation of Indigenous knowledge or the "two-eyes approach"; capacity building by providing traditional knowledge keepers with the resources and means to work towards the conservation of their territory and resources; the use of systems such as OCAP and CARE as a framework for monitoring, consulting and disseminating biodiversity data; prioritizing needs with an emphasis on raising awareness of changes to species and ecosystems based on traditional knowledge; and working with Indigenous peoples to share their knowledge of how nature is changing.

Summary of Plenary Discussions on Day 2

Approaches to address co-development of CAN BON.

Participants in the workshop, inspired by individual experiences of participating in research projects with Indigenous communities, felt that there was real interest by Indigenous communities and by Western scientists to collaborate on building a CAN BON. Co-leadership needs to start from the top and permeate all levels, including community and person-to-person levels. This requires long-term support and both establishing as well as building on long-term relationships. The past practice has been "Western scientists working with Indigenous communities". CAN BON would need to do things differently. Social scientists also need to be integrated early in the planning to help with questions such as how do we go forward in the governance process. If integration of knowledge - from data to action, is a core goal, then CAN BON would want to incorporate this early on. CAN BON would need to determine what the priorities are for local and Indigenous communities and identify how CAN BON could help and how to incorporate Indigenous science at all levels. CAN BON would be more successful if questions come from communities. One example here would be long term monitoring.

Indigenous perspectives need equity in CAN BON design. A co-chair and representatives within CAN BON that represent Indigenous peoples are essential to working with Indigenous communities. CAN BON would need a system in place to avoid barriers such as racism and colonial tendencies. It should also be recognized that a small pool of Indigenous people (representatives) are overworked and overstretched because they are frequently called on as Indigenous Knowledge holders. The "box-checking phenomenon" can easily lead to tokenization. Indigenous participants and reviewers need to be compensated properly for their participation. Finally, CAN BON would also need to interact with a broad group of Indigenous peoples.

Funding opportunities need flexibility to meet Indigenous needs. CAN BON would need appropriate space to support Indigenous science applications so that grantees are not penalized because of a lack of knowledge of Indigenous science from Western science focused

evaluators. The validation of knowledge is different between Indigenous science and Western science. Indigenous science and Western science represent different and complementary sets of tools in a tool box for understanding. Capacity transfer of knowledge and technology are examples where the two systems of Indigenous science and Western science learn from each other. There are many Indigenous knowledge systems frameworks that exist, and perhaps some knowledge systems are not compatible and may not be able to be woven with each other, and this needs to be accepted and built on. It is important to clarify what is meant by integration, braiding, and weaving, whether they are the same or different. There is a need to encapsulate traditional knowledge from the language of Indigenous communities into Western science. Language is so important as to how it is expressed and how it is perceived. The language CAN BON uses may be an obstacle to working with Indigenous communities where the language is about hypotheses to test, etc., but there is no room for storytelling and descriptions in a less “scientific” manner.

CAN BON products need to consider different perspectives. Approaches are needed to weave together western science and Indigenous knowledge to support information needs for both Indigenous and other users. For example, some of the outputs of CAN BON could be presented by linear models such as quantitative analyses, while at the same time weaving the Indigenous science into the descriptions through “storytelling” to better respond to community needs. Indigenous science includes elements of spirituality which CAN BON would need to incorporate. Indigenous science is very much place/ land-based which needs to be taken into consideration. For example, many places are named after Indigenous words that are descriptive of the place, as well, Indigenous names of species, are not just names, but include biological and cultural knowledge. NatureServe and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) are good places to look for examples of meshing of bio-cultural resources.

Respect for Indigenous governance of biodiversity information. Building tools to interact with data, data security and data knowledge issues (maybe outside the government), and mechanisms regarding who controls the data need to be addressed. Approaches such as the First Nations principles of ownership, control, access and possession - more commonly known as OCAP need to be implemented, and CAN BON would need to be respectful of the producers of this Indigenous science. Allocation of resources and dedicating some CAN BON resources exclusively for Indigenous science would be needed. One challenge is the use of government-hosted databases that cause barriers to sharing knowledge. At the same time, how do we ensure long-term support without government investment? Long-term government support needs to take into account Indigenous considerations for access and structure.

Summary of EOI Submissions for Question 3:

How do you or your organization’s activities relate to biodiversity observations and monitoring in Canada and how could these contribute to CAN BON?

Over 85% of the EOIs came from groups directly involved in monitoring and included highly relevant expertise and contributions towards the creation of a CAN BON. This included the standardization of sampling protocols across regions, biomes, biota of different classes, data

curation/management, spatial data analysis, genetics, the creation of large data repositories, statistical techniques and models for detecting and attributing change, spatial analyses and network design, new technologies for monitoring (eDNA, genomics, drones, artificial intelligence, earth observation). Many groups had considerable experience working with diversified partners including decision makers for the creation of policy resulting from bio-monitoring data. Many were working at the national scale, while some had a more provincial focus, and others were working at the international level. Many groups are specialized either in a specific ecosystem type or specific taxa. Some indicated their experience dealing with monitoring data from a wide range of ecosystems and taxa. Many groups had data and resources available to contribute to a CAN BON. Several groups mentioned the need for a two-way relationship where CAN BON could provide funding and capacity building to monitoring groups, who would offer their expertise in return.

Summary of Plenary Discussions on Day 3

Plenary discussions on day 3 continued various topics and themes discussed on days 1 and 2, considering issues such as data management, priority gaps in monitoring in Canada, and the roles that a CAN BON could potentially help fill. Topics are roughly grouped under a number of themes.

What role could a CAN BON plan in improving access to existing biodiversity monitoring data?

Data is difficult to access in Canada because it is distributed across many institutions that do not rely on a centralized data infrastructure. CAN BON would provide an opportunity to support the access, integration and organization of monitoring data into a centralized data infrastructure, or through a centralized query mechanism, that improves discoverability of, and access to historical data and brings together current and future data from monitoring programs. Therefore, CAN BON would need to make use of existing data from provinces, the federal government, academia, and others. In particular, data from community groups, parks agencies, and industry are often not considered, and should be integrated into a national data infrastructure. Although data quality from some sources may be an issue, industry databases are often among the few examples where multiple organism groups and ecosystem components are monitored simultaneously at the same location, because it is mandated; in addition, data quality is rarely defined in a vacuum, and should be instead considered through the lens of fitness for purpose. Furthermore, efforts to integrate existing data should involve engagement with Indigenous peoples, as Indigenous Knowledge (including oral histories) can provide different and unique information about biodiversity patterns and trends, often filling spatial and temporal gaps in scientific monitoring data. Paleolimnological data may also be useful to consider as a long-term record of biodiversity trends.

CAN BON could have a centralized data infrastructure that fills the important role of integrating, collecting, and bringing together existing data in that central data infrastructure. Under the BON model, implementation begins with identification and collection of existing data and their stakeholders to facilitate an assessment of the current status and trends in biodiversity. CAN BON could follow the example of the Arctic BON, which has completed these first steps in three

of its thematic groups, and can make use of the data that have already been compiled and integrated by the Arctic BON for the Canadian Arctic, building upon this information to create a national database. Examples also exist from other countries, such as Australia, where biodiversity data of all types are gathered, contributed to and used by researchers, government and citizens (for example, the Atlas of Living Australia, which in addition to data curation, publishes cloud-based tools to set up data repositories). Other thematic BONs may also have data or data sources that could support the creation of a centralized database. Building the database will require building of trust, and demonstrating to data providers the benefits of contribution while assuring them of continued involvement in the process.

This effort would require engagement with all branches of the federal government, provincial and local governments, academia, industry, community groups, and Indigenous communities for the collection of data, but also the curation and evaluation of data. As part of the process of compiling historical data, it will be necessary to assess data quality, ensure quality control of data, and harmonize taxonomic nomenclature across datasets. Furthermore, experts in Indigenous Knowledge will be required to guide the use of data from Indigenous communities and weaving of such data with other biodiversity monitoring data.

What are the most important gaps in existing monitoring programs that would be high priorities to support biodiversity conservation in Canada and that could potentially be advanced by a CAN BON?

There are key geographical gaps (e.g., the North, urban areas, large portions of the boreal forest) due to the large size of the country and challenges in accessing many areas. Geographic representation across biomes is important. As well, many biota are underrepresented – taxonomic gaps include insects, parasites, symbionts, microbes, and fungi. Biodiversity in soil, freshwater, and marine systems may be generally underrepresented, along with diversity that crosses multiple ecosystems (e.g., coastal that includes terrestrial and aquatic).

Monitoring efforts by government and academia are often focused on a single organism group or ecosystem component. This leads to a gap in understanding biodiversity across all organisms, but also gaps in understanding species interactions and processes, and the roles that they play in driving biodiversity patterns. A more holistic approach to monitoring in ecosystems is needed to support biodiversity conservation.

Temporal gaps in monitoring are a large issue for Canada, as biodiversity time series are generally lacking, particularly in areas that are difficult to access. CAN BON could work to support the development of a large-scale monitoring network with routine monitoring at key locations. But to do so would require a long-term plan for monitoring and access to long-term protected funding.

CAN BON could serve as a network of networks for Canada, supporting coordinated monitoring efforts by connecting governments and researchers who are conducting monitoring and ensuring there is less redundancy and more cooperation among those doing the work. Often similar monitoring efforts are taking place in similar locations because there is no

communication between those conducting the sampling, and CAN BON could serve to improve communication at national and regional levels.

CAN BON is needed to provide an overarching national perspective and to inform policies on the national scale, in addition to regional and local scale. As a nation, we are responsible for biodiversity on the international scale and CAN BON could help to meet this responsibility.

What are the key elements needed to move CAN BON forward?

To be successful, CAN BON would require Indigenous leadership and engagement in the process from the beginning (not as a monolith but as a plurality of groups). Indigenous priorities should be identified and driven by Indigenous groups, and Indigenous communities be empowered to lead their own questions. Indigenous knowledge can help to address gaps and provide a historical baseline, but this will require meaningful engagement – building these relationships is important and takes time. Protocols for Indigenous engagement need to be identified and recognized to ensure that there is guidance for meaningful and appropriate collaboration.

CAN BON would need a clear mandate to be strategic in meeting our international obligations towards biodiversity targets (2030 and 2050 goals). It needs to have a long-term plan, with quantified milestones at different temporal horizons, and CAN BON would need to demonstrate and showcase its usefulness as supported by science. Basic biodiversity distribution data and geospatial data should be used to model relationships and make predictions initially and provide early results, while in the longer term, change can be examined using a traditional trend monitoring approach. Because land use change happens quickly, results need to be produced quickly and geospatial data should be created annually. Two-way communication with policy makers is critical to figure out what they need and to help set priorities, while those who modify the land (e.g., industry, municipalities) should also be involved. Ensuring relevance to policy makers and gaining their support for monitoring and assessment efforts will be key to the success of a CAN BON.

In order to achieve its mandate, CAN BON would need long-term, protected funding and permanent staff, including Indigenous members and social scientists. Staff with a background in communications would also be useful to ensure the work and goals of CAN BON are communicated effectively to a wide audience. Funding would be needed to train people in monitoring methods and to improve taxonomic expertise, in order to ensure that data collected is consistent across sites. The funding should support data infrastructure and also data providers sufficiently so that they could, and would be willing to, contribute actively to CAN BON.

CAN BON should encourage data sharing and networking, and could fill an important gap as a connector of existing networks. Data in CAN BON should be open and free, preferably in a way that is compliant with the FAIR principles <https://www.go-fair.org/fair-principles/> but this will require trust to be built. Big data protocols for how to collate information and how to approach analyses and inference are needed. Machine learning experts should be involved to help automate the procedure of adding data to the centralized data infrastructure, and data quality be

assessed when combining data sources. Digital Research Alliance of Canada (formerly New Digital Research Infrastructure Organization), as well as the Canadian National Committee of the Committee on Data of the International Science Council (CODATA-ISC) integrates many of these research data management needs and advanced research computing, and CAN BON should make use of these resources.

Communications experts and storytelling are needed to help engage communities and ensure communication is effective for each audience. Targeted messages can improve communication with rights holders and stakeholders, and ensure that relevant information is presented to each audience (government, Indigenous communities, academia, industry, community organizations, etc.) in the most effective way. CAN BON could play an important role in bridging the gap between data, information and the decision-making process. However, effective leadership will be essential, and a sub-regional/nodal structure may also help. For example, regional or thematic nodes within CAN BON could help to organize and coordinate the work at a more manageable level, with direction from leadership at the national level.

Key Findings

Participants of the workshop clearly expressed their enthusiasm for establishing CAN BON. It was clear that stakeholders consider CAN BON an essential initiative to better monitor Canada's biodiversity and that many wished to contribute to share their data, protocols and knowledge. However, workshop participants also expressed concern that in order for CAN BON to be established, a sizable and stable budget needs to be dedicated to CAN BON and that this needs to happen soon to seize the momentum.

During the workshop, various key findings were identified as important to take into consideration in order to establish a CAN BON:

1. CAN BON would need to coordinate a diversity of stakeholders already in place who monitor biodiversity in multiple ways and for multiple different reasons. It should act as a network of networks, supporting harmonized and coordinated monitoring and assessment.
2. Indigenous communities and perspectives would be essential for establishing a successful CAN BON and every stage of the development process would need the direct involvement and integration of a diversity of communities.
3. Indigenous Science should be treated at the same level as Western Science and given equal weight in biodiversity monitoring and assessment. Indigenous Science needs to be included and braided with Western Science whenever possible.
4. CAN BON could look to existing BONs and other networks at the international level as examples and models of what to do and how to prioritize the process.
5. CAN BON should rapidly take stock of the data that currently exist in Canada, and use the distribution of data and diversity patterns in the data to inform future monitoring plans. This should include a clear picture of what data is available and what is missing to successfully monitor biodiversity and ecosystem changes across the country. Interoperability and respectful Indigenous data governance will be key considerations. The data infrastructure should include a metadata framework that maintains linkages to its source for supporting the

integration of new data as it is collected. CAN BON should also prioritize the identification of gaps in our national biodiversity engagement.

6. Dedicated funding would need to be available. This investment would need to happen quickly and be stable to properly establish and test the feasibility, use and needs of CAN BON and to help ensure CAN BON is sustainable, effective, and policy-relevant in the context of the new Global Biodiversity Framework of the Convention on Biological Diversity.

Next Steps

The July 2021 workshop was a preliminary convening event to bring together different groups for an initial conversation to start discussions and share ideas on how to set up a potential Canadian Biodiversity Observation Network.

This report is being disseminated to all attendees, all parties who submitted EOIs by the end of September, and other interested groups. The inventory of content from the EOIs can help inform not just a potential CAN BON but also hopefully catalyze new collaborations, partnerships, and sharing of resources and data.

The federal government departments involved in organizing this workshop, together with the GEO BON secretariat in Montreal, are continuing discussions to identify next steps for scoping a potential CAN BON in collaboration with Indigenous peoples.

Further details will be shared as they become available.

Appendices

- A. EOI Summary
- B. EOI Call
- C. Attendee List
- D. Workshop Program
- E. References

Appendix A - Summary of information in the Expressions of Interest

Prepared by Lorena Vidal and Andrew Gonzalez

We received EOIs from all over Canada, including a number of provinces and territories. We also received EOIs from government departments, non-profit organisations, as well as museums, universities and research institutes.

Question 1: How CAN BON could enhance existing biodiversity monitoring in Canada?

Dedicated CAN BON facility and staff: Most EOIs mentioned the crucial role of a consistent and organised staff dedicated to supporting the coordination and sharing of data, knowledge, and expertise among different institutions related to biodiversity and environmental monitoring.

In particular, the coordination of efforts in monitoring as well as the creation of working groups focused on ecosystems/species/ecotypes were mentioned as core needs. CAN BON was often identified as a promising opportunity to identify gaps (e.g. underrepresented taxa, ecosystems or eco-regions) to target priority monitoring tasks, or to focus on keystone or endangered species, as well as to avoid redundancy in monitoring and research.

Data standards and protocols: Second, numerous EOIs underlined the importance of developing data collection protocols, the use of data curation techniques and statistical analyse to compile past and future data into a large, interoperable and cohesive data set that integrates data from many ecosystems and taxa. For example, the application of FAIR data principles was often mentioned as potential reference standard.

Biodiversity facets: Several suggested biodiversity should be measured in a comprehensive manner, from genes to community diversity, ideally for all taxa and ecosystems. Reporting the ecosystem services and natural capital linked to biodiversity was also suggested as an important step in biodiversity monitoring.

Human pressures and drivers: A number of EOIs mentioned the importance of also monitoring trends in land use, climate change and conservation action. These are needed to assess the efficacy of conservation action or the impact of anthropogenic pressures on ecosystems.

Monitoring technologies: To achieve such a comprehensive monitoring of Canadian ecosystems, the development and use of sampling technologies (bioacoustics, remote sensing, camera traps), artificial intelligence and deep learning were considered crucial to success for such a large region.

Access to data: Another point was the need for greater access to non-sensitive data among researchers, decision makers and the public through a large open access data repository. This was seen as an imperative step in the establishment of CAN BON according to the EOIs.

Citizen/community-based data and knowledge: The vital recognition and use of traditional ecological knowledge, particularly those of Indigenous People and Local Communities, was recognized as crucial to

the making of CAN BON. Many techniques are being developed, in part by researchers who submitted EOIs, to combine community science, Traditional Knowledge and Western science into cohesive data. In this context, the contributions of citizen derived data (e.g. eBird, iNaturalist) was recognized as a way to increase the coverage of data generated by CAN BON.

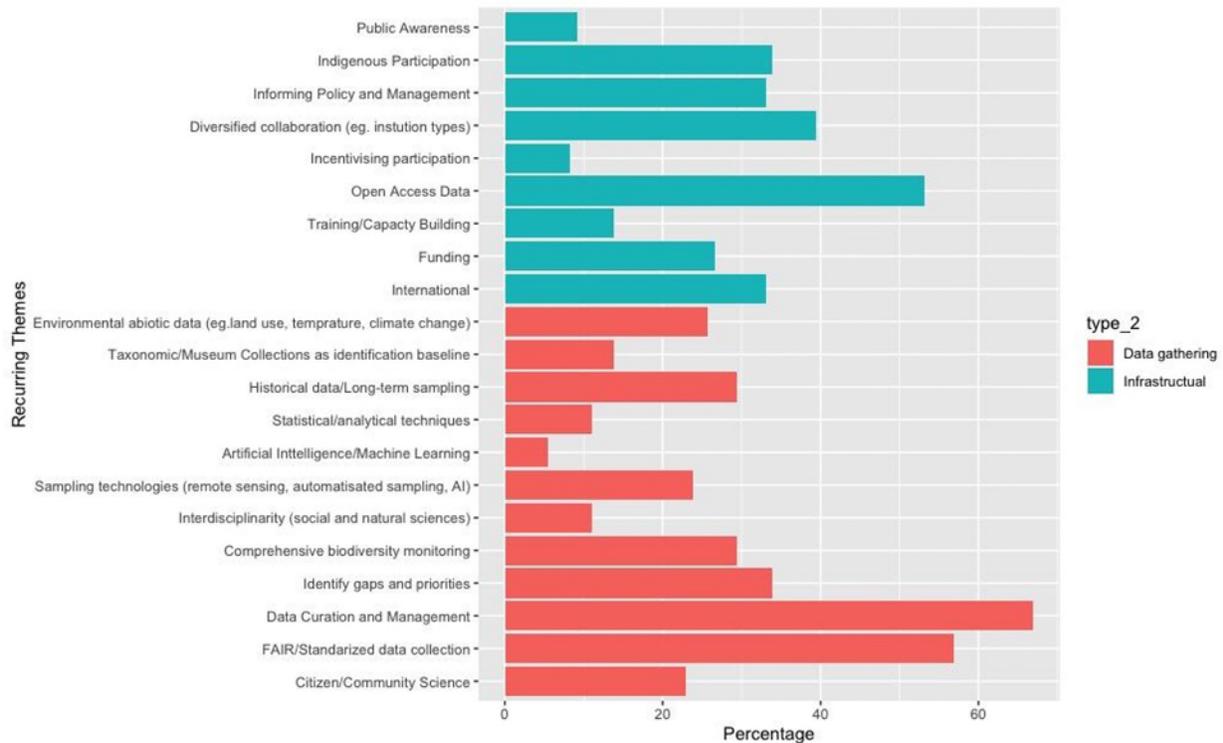
Baselines and reference data: The need for a unified and standardised national taxon relevant baselines, species identification references (eg. collections in museums) was also recognized as important to the creation of a standardized, fit-for-purpose, data sets for biodiversity in Canada, especially as species can easily be misidentified or as new species are discovered.

Tools and visualization: The development of user-friendly tools was often mentioned so that citizens could participate in science, but also for the public and decision makers to visualize and analyse the data easily (e.g. websites, dashboards). Data collection protocols, and general expertise in monitoring should be shared among the parties to invite researchers and other parties to take part in collective monitoring efforts and ensure the cohesiveness of the data.

International context: Finally, the alignment of CAN BON standards with other international organisation (e.g. GEO BON, EBV workflow and BON design) was referred to as an important aspect of CAN BON to make sure that the monitoring efforts could be integrated in international community. This has particularly clear practical applications when we consider migrating/large range species that are often found in Canada for only a few months a year.

Funding for infrastructure: a frequent focus of the EOIs was the need for consistent long-term funding to maintain monitoring activities and to create new monitoring programs, along with the training of future staff who will ensure the sustainability of long-term monitoring programs. Capacity building through workshops, training and the sharing of expertise, protocols, software and infrastructure were mentioned by many EOIs.

Stakeholders: A need to bring together diverse stakeholders from the start (public, policy makers, NGOs, governmental bodies) was identified, along with the importance that CAN BON can directly work to inform policy and management on conservation activities.



From the figure above:

For example, 66% of EOIs mentioned the importance of data curation and data management for the processing of monitoring data.

57% EOIs mentioned the importance of developing standardized biodiversity monitoring protocols to coordinate monitoring and make research and datasets interoperable.

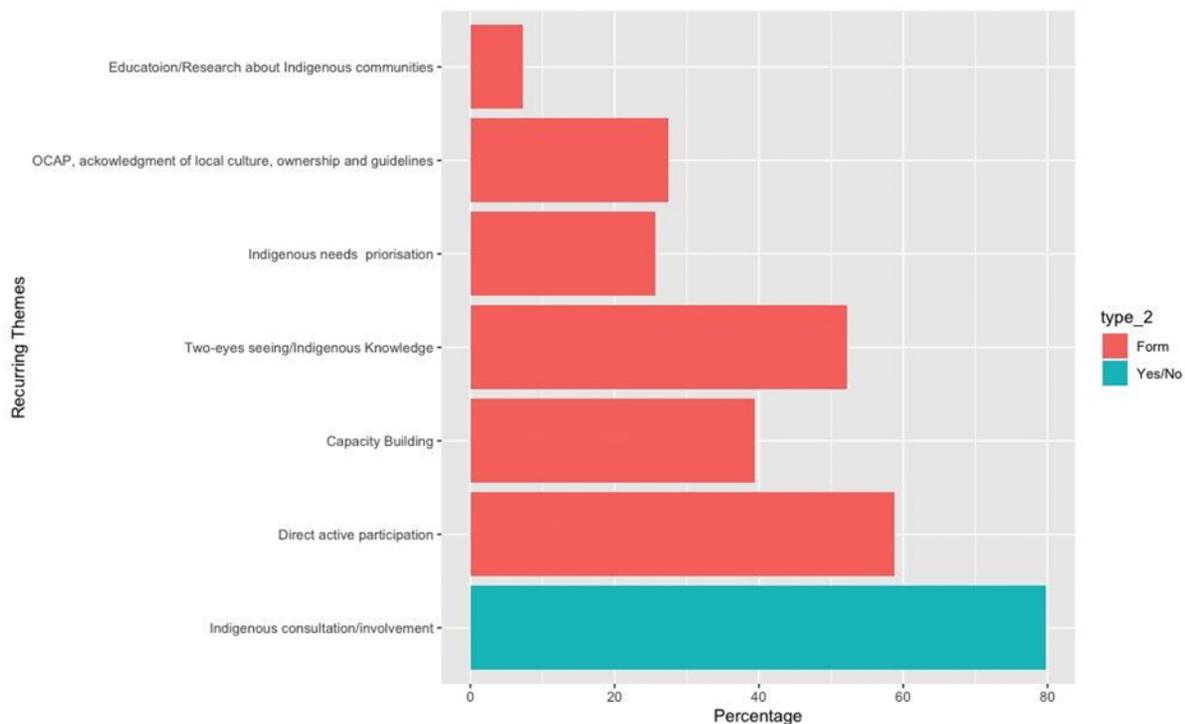
33% of EOIs cited coordination, or alignment with work done on the global scale (GEO BON, GBIF, UN)

53% of EOIs mentioned the creation of an open access data repository for researchers, decision maker and potentially the public in non-sensitive cases.

Question 2. Short description describing how your organization has worked with Indigenous groups

80% of EOIs expressed experience involving Indigenous People in their work. Numerous groups had organized programs to help researchers consult Indigenous groups, and in particular Indigenous knowledge holders such as elders. We identified six main ways that institutions adopted to collaborate with Indigenous people. From most common to less commonly found in the EOI submissions:

- Direct participation/co-production: Indigenous researchers/ research assistants helping monitoring activities, and/or active Indigenous voices in decision making on activities (research area, research protocols...)
- Two eyed seeing/weaving of Indigenous Traditional Ecological Knowledge: Use of Indigenous Ecological knowledge (e.g. use of Indigenous names for species/ areas) for research and/or weaving of Indigenous Knowledge in data as much as Western science data.
- Capacity Building: Providing the funding, training, tools, research data/results to Indigenous communities to empower them in the conservation of their land and resources.
- Application of OCAP principles or acknowledgment of local culture, ownership and guidelines: The OCAP principles were often mentioned in the EOIs as basis for Indigenous involvement in research/monitoring activities. Many other EOIS mentioned acknowledging, and complying to, local guidelines based on Indigenous culture and ownership of the land.
- Prioritization of Indigenous needs: Learning from Indigenous people about the species/areas that have a particular value to Indigenous people, for resource use or cultural valuation, and applying this to prioritise monitoring on the species/areas in question.
- Education/Research about Indigenous communities: A few EOIs mentioned working with Indigenous people to disseminate knowledge about Indigenous people to the public, or doing research linked to Indigenous people and their knowledge.



Question 3. How you or your organization's activities relate to biodiversity observations and monitoring in Canada and how these could contribute to a CAN BON?

Many of the EOIs submissions mentioned having expertise in aspects which are crucial to the creation of CAN BON such as: standardisation of sampling protocols across regions, data curation/management, spatial data, genetics, creation of large data repositories, statistical techniques for analysis of large diverse datasets.

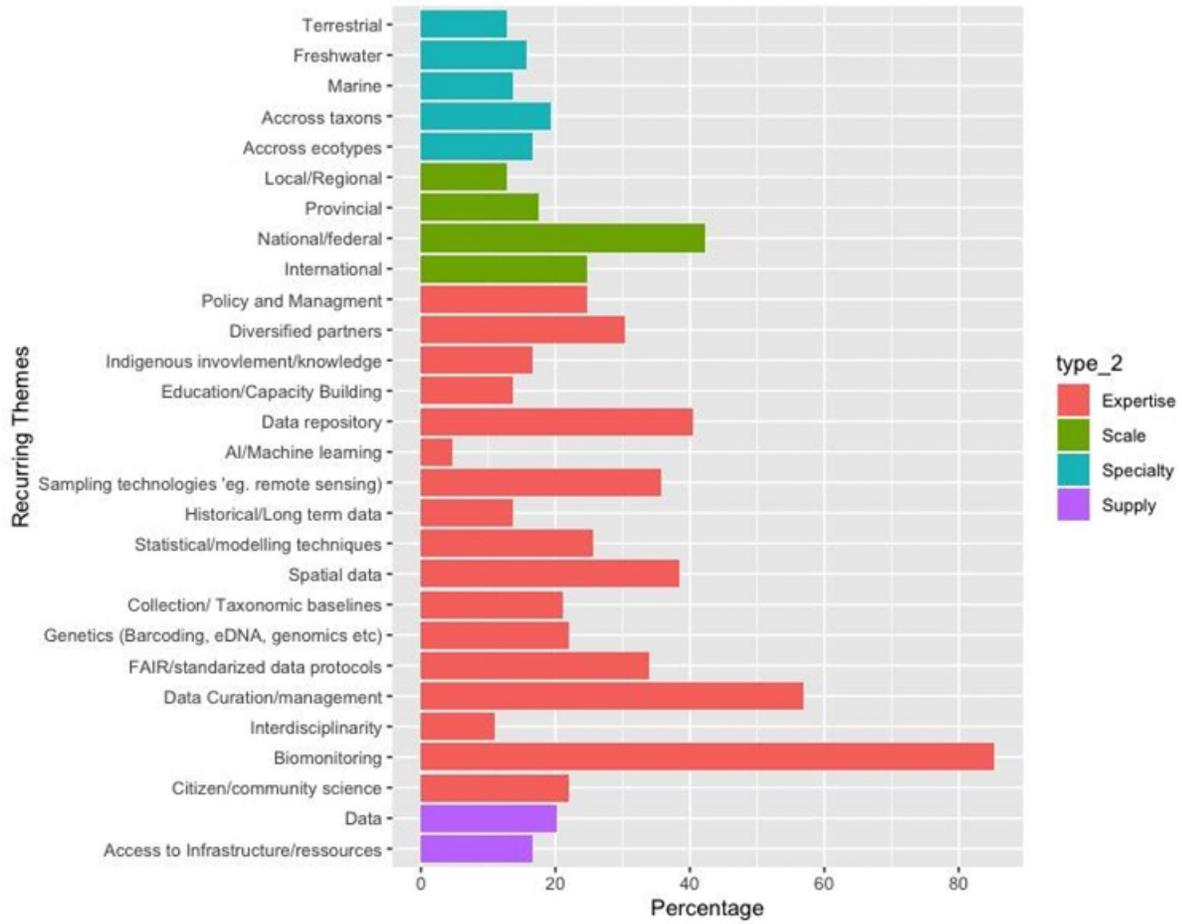
Indeed, **85% of the EOIs** came from people/institutions who are directly involved in monitoring activities.

Many groups also had considerable experience in working with diversified partners (government bodies, NGOs, universities), and in particular working with decision-makers in the creation of policy resulting from bio-monitoring data. Many had worked at the national scale, while some have a more provincial focus, and while some have experience working on the international scale in some way.

Many groups were specialized either in a specific ecosystem type (e.g. arctic ecosystems) or specific taxa (eg. fungi, bats), and some indicated their experience dealing with monitoring data from a wide range of ecosystem and taxa (e.g. research institutions, museums).

Many groups seem to have data available to contribute to CAN BON, as well as resources (infrastructure, protocols, software etc.) that could be beneficial to CAN BON, but only a fraction directly offered to share their data and resources at this stage (as you can see with the “Supply” type of contribution on the graph below, which refers to a direct offers of data/resources to CAN BON).

Several groups mentioned the need for a two-way relationship where CAN BON could provide funding, capacity building to monitoring groups, who would offer their expertise in return.



Appendix B - Call for expressions of interest

Workshop on a Canadian Biodiversity Observation Network (CAN BON)

Call for expressions of interest

Update: The CAN BON workshop will be held online from July 27 to 29, 2021. This workshop is a preliminary phase for identifying a need for a potential CAN BON. EOIs submitted by the May 31, 2021 deadline will be considered for attendance at the workshop. However, EOIs will be accepted until September 30, 2021 in order to enhance the collection of information on relevant activities as well as for inclusion on follow-up communications from the workshop.

Short summary

A workshop is being organized to discuss the feasibility and desirability of establishing a Canadian Biodiversity Observation Network (CAN BON) to transform Canada's capacity to research, survey, and monitor biodiversity, natural resources and ecosystem services in ways that will better inform management and conservation. The emphasis of the workshop will be: (1) identifying existing initiatives, data and resources related to biodiversity observation and monitoring that could contribute to a CAN BON; and (2) evaluating ways that a CAN BON could enhance these initiatives through improved integration, collaboration or syntheses.

Background

The Natural Sciences and Engineering Research Council of Canada (NSERC), Environment and Climate Change Canada (ECCC), Fisheries and Oceans Canada (DFO), Parks Canada (PC) and the Canadian Space Agency (CSA) are working together to strengthen collaborative efforts among the academic community, government agencies,

non-government organizations, Indigenous rights holders and other relevant stakeholders regarding biodiversity observation and monitoring in Canada.

Biodiversity monitoring is the process of observing biodiversity and tracking how it changes through time. Monitoring provides the data for predicting trends in biodiversity, evaluating the integrity of ecosystems, their responses to disturbances, and the success of actions taken to conserve or recover biodiversity. Biodiversity research can support monitoring by addressing key questions and testing hypotheses about how and why biodiversity is changing across locations. Such research provides essential context for interpreting monitoring results, guiding future monitoring, and supporting local, regional, national and international efforts to conserve and restore biodiversity. Sustainable biodiversity monitoring initiatives must be user-driven, directly serving policy and management needs. Sustainable initiatives also recognize that generating knowledge about the land and waters is a goal shared with Indigenous peoples with recognized rights, titles, treaties and land claim agreements and, as such, research should co-develop knowledge with Indigenous peoples.

NSERC, ECCC, DFO, PC and CSA are convening a workshop to discuss a potential Canadian Biodiversity Observation Network (CAN BON) that could transform Canada's capacity to survey, manage and conserve its biodiversity, natural resources and ecosystem services to support our transition to a sustainable economy. Existing biodiversity monitoring programs in Canada are delivered by many different players and occur in many different forms. These range from large-scale informal citizen science projects to statistically designed monitoring of managed species such as migratory birds or mammals, to inventories of rare species, to intensive site-specific monitoring, to use of satellite imagery for mapping and monitoring ecosystems. Linking these efforts could lead to synergies and efficiencies in analysis and reporting. Key to this will be improving interoperability of different data types and adopting common and open protocols for monitoring and inference. This will facilitate identification and targeting of gaps in coverage, and ultimately greatly strengthen efforts to conserve biodiversity in Canada.

CAN BON would be part of [GEO BON](#), the Group on Earth Observations Biodiversity Observation Network. GEO BON is a global network of 1500 researchers and more than

500 partner organizations. The mission of GEO BON is to improve the acquisition, coordination and delivery of biodiversity observations and related services to users and decision makers (e.g., Parties of the Convention on Biological Diversity). The aim of GEO BON is to establish a global network of biodiversity observation networks that contributes to effective management policies for biodiversity and ecosystem services.

Objectives

The main objectives of this workshop will be to

- obtain initial information on the state of biodiversity monitoring in Canada and the resources currently available to support monitoring
- identify ways that a CAN BON could support local, regional, national and international efforts to conserve and restore biodiversity, including meeting Canada's international commitments under the Convention on Biological Diversity
- initiate an inclusive approach to the design and implementation of a CAN BON drawing on perspectives from Indigenous peoples, scientists, government, private and public sectors—for Indigenous peoples, the expectation is to pursue a co-development approach to CAN BON that would allow equitable and meaningful participation of Indigenous peoples and a weaving of traditional knowledge and Western science

Anticipated outcomes of the workshop

- Identification of available resources and the existing monitoring capacity and gaps in Canada
- A vision for CAN BON that articulates how it could enhance existing monitoring activities and what decisions it could support
- Identification of opportunities for sharing and integration of observations

Submitting an expression of interest

This call for expressions of interest is intended for Canadian groups, institutes, networks, or teams (including federal, provincial and territorial government groups) who are currently undertaking significant biodiversity monitoring activities and related research. Relevant activities include but are not restricted to

- conducting systematic biodiversity observations to monitor the status and trends of biodiversity in Canada (this includes genetic, population, species, community, ecosystem diversity)
- using or integrating Indigenous knowledge for the assessment of biodiversity changes
- developing expertise in new technologies for biodiversity observations, including, but not restricted to observations from the ground, air or space
- using machine learning techniques related to visual and audio recognition technology to identify species
- integrating knowledge and data types to achieve synthesis and understanding from large databases
- developing expertise in statistical methods and models for making inference about biodiversity change, especially through the integration of multiple data types to estimate and forecast biodiversity change at large scales

The expression of interest (EOI) will be used to

- obtain initial information on relevant activities occurring in Canada that could be linked to a CAN BON network
- create an initial inventory of relevant potential collaborators engaged in monitoring activities in Canada
- identify participants for a workshop to discuss the framing, requirements and objectives of a potential CAN BON network

Interested parties are invited to submit an expression of interest (EOI) to NSERC by 8 p.m. (ET) on May 31, 2021. To submit an EOI please fill out the [CAN BON EOI form](#) online and submit the completed form to the [NSERC Secure site](#).

The EOI will request the following information:

- The participant's name, affiliation (including name of institute, network, biodiversity monitoring project, agency, or department), phone number and email address
- A list of up to ten keywords related to the participant/group's current activities and areas of expertise
- A short description (up to 1,800 characters) describing your ideas for how a CAN BON could enhance existing biodiversity monitoring in Canada—questions to consider include: (1) what are the priority issues that CAN BON could address, and (2) what are the core elements required for such a network to succeed
- If applicable, a short description (up to 1,800 characters) describing how your organization has worked with Indigenous groups (e.g., types of work carried out by Indigenous groups, engagement efforts, integration of traditional knowledge, observation of and adherence to ethics guidelines such as OCAP)
- A short description (up to 1,800 characters) describing how you or your organization's activities relate to biodiversity observations and monitoring in

Canada, and how these could contribute to a CAN BON—please consider both resources (e.g., data, databases, program infrastructure, and data collection or data management technologies) as well as expertise (e.g., monitoring design, networking approaches, data integration, statistical analyses, and decision support systems), and also describe the scope and scale of your programs

- Consent to share information submitted in your expression of interest (name, affiliation, email address, area of expertise/keywords, short descriptions) with a working group including people from outside NSERC that will be organizing the workshop and other groups that have submitted an EOI
- Mandatory self-identification information form—self-identification information is not part of your EOI and will not be shared with other EOI submissions

The list of interested individuals (including name, affiliation, email address, keywords and descriptions) will be shared through a secure site. This will be crucial in facilitating connections and enhancing collaboration for the workshop as well as in later stages of the potential CAN BON.

Information provided through the EOI will be synthesized and shared prior to the workshop to initiate discussion. However, to ensure a manageable discussion, the number of participants may be limited to a subset of EOI submissions. Workshop participants will be selected to represent a broad range of perspectives, while maximizing inclusivity and diversity. All parties, including those not attending the workshop, will be kept informed of the outputs from the workshop. Attendance at the workshop may require engagement of attendees in preparation of additional materials in advance of the workshop.

Preliminary timeline

Date	Activity
May 4, 2021	Call for expressions of interest
May 31, 2021	Expression of interest deadline
June 2021	Invitations to workshop
July 27–29, 2021	Workshop (online)

Please note that these dates are subject to change.

Contact

If you have questions about the expression of interest for the workshop, please contact NSERC at atelier-CANBON-workshop@nserc-crsng.gc.ca.

Appendix C - List of Participants

CAN BON Workshop - List of Participants (as of 28 July 2021)

Name	Organization
Arbuthnott, Devin	Agriculture and Agri-Food Canada
Archambault, Philippe	Université Laval, ArcticNet
Ballard, Myrle	University of Manitoba
Barewal, Anita	Environment and Climate Change Canada
Bates, Amanda	Memorial University of Newfoundland, Ocean Sciences
Bayne, Erin	Alberta Biodiversity Monitoring Institute
Bennett, Joseph	Carleton University, Biology
Bird, Tom	Fisheries and Oceans Canada
Bourassa, Marie Josée	Canadian Space Agency
Bowman, Jeff	Ministry of Natural Resources & Forestry / Trent University, Environmental Sciences
Bruneau, Anne	Université de Montréal / Canadensys
Buxton, Rachel	Carleton University, Biology
Cameron, Erin	Saint Mary's University, Environmental Sciences
Chiblow, Susan	PhD Candidate, York University
Cihlar, Josef	Canadian Space Agency
Colla, Sheila	Centre for Bee Ecology, York University
Coops, Nicholas	University of British Columbia, Forestry & Geography
Costa, Maycira	University of Victoria Geography
Crew, Alexandre	Environment and Climate Change Canada
Currie, Jessica	World Wildlife Fund Canada (WWF-Canada)
Duffe, Jason	Environment and Climate Change Canada
Edwards, Jason	Natural Resources Canada, Canadian Forest Service
Fenton, Nicole	Forest Research Institute, Université du Québec en Abitibi-Témiscamingue (UQAT)
Francis, Charles	Canadian Wildlife Service, Environment Climate Change Canada
Gehman, Alyssa	Hakai Institute, University of British Columbia
Gibson, Joel	Royal BC Museum
Gonzalez, Andrew	McGill University, Geography
Goosney, Danika	NSERC Research Grants and Scholarships
Guo, Xulin	University of Saskatchewan, Geography and Planning
Hebert, Paul	Centre for Biodiversity Genomics, University of Guelph
Helbing, Caren	University of Victoria, Department of Biochemistry and Microbiology

Name	Organization
Henry, Patrick	NatureServe Canada
Huot, Yannick	Université de Sherbrooke / NSERC Canadian Lake Pulse Network
Janzen, Darren	Canada Centre for Mapping and Earth Observation, Natural Resources Canada;
Jones, Neil	Environment and Climate Change Canada
Jung, Thomas	Government of Yukon
Juniper, S. Kim	Ocean Networks Canada (ONC)
Kalacska, Margaret	McGill University, Geography
Kerr, Jeremy	University of Ottawa, Biology
Kirsebom, Oliver	Dalhousie University - MERIDIAN, Institute for Big Data Analytics
Lento, Jennifer	Canadian Rivers Institute (University of New Brunswick)
Lepage, Denis	Birds Canada
Lindo, Zoë	University of Western Ontario
Lougheed, Stephen C.	Queen's University / Queen's University Biological Station
Lu, Bing	Simon Fraser University, Geography
Macklin, James	Agriculture and Agri-Food Canada
Marshall, Shawn	Environment and Climate Change Canada
McAlpine, Donald F.	New Brunswick Museum
McCanny, Stephen	Parks Canada
McGregor, Fred	Elder
McRae, Nicole	Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)
Metaxas, Anna	Dalhousie University, Oceanography / Sustainable Nunatsiavut Futures
Miller, Jacqueline	Native Women's Association of Canada (NWAC)
O'Connor, Mary	University of British Columbia, Zoology / Biodiversity Research Centre
Pagé, James	Canadian Wildlife Federation
Pantieras, Aura	Environment and Climate Change Canada
Paterson, James	Ducks Unlimited Canada
Pohl, Greg	Biological Survey of Canada
Poisot, Timothée	Université de Montréal / Quebec Centre for Biodiversity Science
Popp, Jesse	<ul style="list-style-type: none"> University of Guelph, Environmental Sciences
Poulin, Dominique	Canadian Space Agency
Pye, Jon	Ocean Tracking Network (OTN), Dalhousie University
Raudsepp-Hearne, Ciara	Wildlife Conservation Society Canada
Reynolds, John	Simon Fraser University, Biological Sciences

Name	Organization
Robson, Diana B.	Manitoba Museum
Rousseau-Clair, Marie-Michèle	Nature Conservancy of Canada
Saarela, Jeffery M.	Canadian Museum of Nature
Sadik, Tonio	Assembly of First Nations (AFN)
Segers, Jordi	Canadian Wildlife Health Cooperative
Simon, Patrice	Wildlife and Landscape Science Directorate, Environment and Climate Change Canada
Soulard, François	Statistics Canada
Srivastava, Diane	Canadian Institute of Ecology and Evolution
Templeman, Nadine	Fisheries and Oceans Canada
Whitton, Jeannette	University of British Columbia, Botany
Wilson, Paul	Trent University, Conservation biology

Appendix D - Workshop Program

CAN BON Exploratory Workshop Program

July 27-28-29, 2021

Workshop Collaborating Agencies:

Natural Sciences and Engineering Research Council of Canada (NSERC)

Environment and Climate Change Canada (ECCC)

Fisheries and Oceans Canada (DFO)

Canadian Space Agency (CSA)

Natural Resources Canada (NRCan)

Parks Canada (PC)

Group on Earth Observations (GEO BON)

Workshop Objectives and Anticipated Outcomes:

- Identify key elements of a CAN BON could enhance and complement existing monitoring and reporting activities to support local, regional, national and international efforts to conserve and restore biodiversity, including meeting Canada's international commitments under the Convention on Biological Diversity.
- Initiate an inclusive approach to the design and implementation of a CAN BON drawing on perspectives from Indigenous peoples, scientists, government, private and public sectors
- Clarify the status of biodiversity monitoring in Canada and the resources currently available to support monitoring programs
- Facilitate discussions amongst the major groups engaged in monitoring in Canada including identifying opportunities for sharing and integration of biodiversity observations and data
- Initial identification of priority gaps in biodiversity monitoring in Canada, including challenges to ensuring effective use of monitoring data to support decision-making
- Articulation of the essential elements required to develop a CAN BON through a co-development approach that would allow equitable and meaningful participation of Indigenous peoples and a weaving of traditional knowledge and Western science

Background and Notes for Participants:

- Workshop participant list with contact information
- EOI summary and analysis
- Links to articles
- Other background
- Roundtable introductions will be done at the start of each breakout session

CAN BON WORKSHOP PROGRAM

(All Times Eastern Standard Time)
Zoom link: <https://zoom.us/j/99268248187>

DAY 1 – JULY 27, 2021

A. Getting Started

10:45	Log on to Zoom, Address any Technical Issues	
11:00	Welcome and Quick Review of Zoom Platform Check that all are connected, virtual meeting etiquette Simultaneous interpretation (French/English)	Facilitator - Warren Wilson & Alison Janidlo, NSERC
11:05	Opening Ceremony/Prayer/Land Acknowledgment	Elder - Fred McGregor
11:15	Purpose of Workshop and Agenda Review	Alison Janidlo & Facilitator
11:30	Opening Remarks from Canada's GEO Principal	David Harper, ECCC
11:35	GEO BON and BON Best Practices	Andrew Gonzalez, McGill University, co-chair GEO BON Mike Gill, NatureServe
11:55	Q+A	Facilitator

B. A Vision for CAN BON

- *Key Outcomes: Identification of the key values of a CAN BON, including the priority issues that a CAN BON could address and the key elements required for a CAN BON to succeed.*

12:10	Overview of the EOI Submissions: Question 1 How a CAN BON could enhance existing biodiversity monitoring in Canada— questions to consider include: (1) what are the priority issues that CAN BON could address, and (2) what are the core elements required for such a network to succeed (Reference Document - EOI analysis/summary)	Andrew Gonzalez
12:30	Q+A	
12:45	Networking and Refreshment Break The main room is available for people if they choose to network	
13:15	Framing the Breakout Group Discussions	Facilitator
13:20	Breakout Group Discussions Question 1 <i>Introductions and backgrounds of participants and creation of a respectful space. Discussion of the following questions in relation to the EOI summary:</i> 1 What are the essential elements for a successful CAN BON? 2 Which elements may be less important at this stage? 3 Are there any key elements missing from the summary?	Breakout Group Chairs
14:30	Key Messages from Breakout Groups Key messages from facilitator/chair of each Breakout group Plenary discussion on top priorities for the development of CAN BON	Facilitator
15:25	Day 1 Closing Remarks	
15:30	Adjourn Day 1	

Day 2 – July 28, 2021

C. WELCOME DAY 2		
10:45	Log on to Zoom, Address any Technical Issues	
11:00	Welcome and Quick Review of Zoom Check that all are connected Simultaneous interpretation (French/English) Key messages from Day 1	Facilitator
D. Focus on Indigenous Engagement		
- <i>Key Outcomes: Identify approaches and considerations for meaningfully weaving Indigenous perspectives and ways of knowing with Western science in a CAN BON.</i>		
11:10	Weaving Two Worldviews in Respectful Ways	Sue Chiblow, PhD candidate, York University
11:45	Q+A	Facilitator
11:55	The Development of ECCC's Indigenous Knowledge Framework	Neil Jones, ECCC
12:25	Q+A	Facilitator
12:35	Overview of the EOI Submissions – Question 2 How has your organization worked with Indigenous groups (e.g., types of work carried out with Indigenous groups, engagement efforts, including perspectives of traditional knowledge, observation of and adherence to ethics guidelines such as ownership, control, access and possession (OCAP).	Andrew Gonzalez
12:50	Q+A	Facilitator
13:00	Networking and Refreshment Break The main room is available for people if they choose to network	
13:30	Framing the Breakout Group Discussions	Facilitator
13:35	Breakout Group Discussions – Question 2 <i>Introductions and backgrounds of participants and creation of a respectful space. Discussion of the following in relation to the EOI summary:</i> 1 How can we effectively and meaningfully weave Indigenous perspectives, knowledge, and ways of knowing with Western science in a CAN BON? 2 Share experiences about collaborative efforts, relationship building and co-development, including feedback from collaborators.	Breakout Group Chairs
14:35	Key Messages from Breakout Groups Key messages from facilitator/chair of each Breakout group Plenary discussion on Indigenous Engagement	Facilitator
15:25	Day 2 – Closing Remarks	
15:30	Adjourn Day 2	

Day 3 – July 29, 2021

E. WELCOME DAY 3

- 10:45** **Log on to Zoom, Address any Technical Issues**
- 11:00** **Welcome and Quick Review of Platform** *Facilitator*
Check that all are connected
Simultaneous interpretation and languages
Key messages from Days 1 and 2

F. GAPS AND THE PATH FORWARD

- *Key Outcomes: Identification of priority gaps in monitoring in Canada that a CAN BON could potentially help fill and key elements needed to move forward with development of a CAN BON*

- 11:15** **Overview of EOIs – Question 3** *Andrew Gonzalez*
How current activities relate to biodiversity observations and monitoring in Canada, and how these could contribute to a CAN BON—including both resources (e.g., data, databases, program infrastructure, and data collection or data management technologies) as well as expertise (e.g., monitoring design, networking approaches, data integration, statistical analyses, and decision support systems).
- 11:30** **Q+A**
- 11:45** **Framing the Breakout Group Discussions** *Facilitator*
- 11:50** **Breakout Group Discussion – EOI Question 3** *Breakout Group Chairs*
Introductions and backgrounds of participants and creation of a respectful space.
Discussion of the following questions in relation to the EOI summary:
1. Are there key biodiversity monitoring programs in Canada that have not been captured by the summary?
2. What are the most important gaps in existing monitoring programs that would be high priorities to support biodiversity conservation in Canada and that could potentially be advanced by a CAN BON? (refer to publication [Key Information needs for biodiversity conservation in Canada](#))
3. What are the key elements needed to move CAN BON forward?
- 13:00** **Networking and Refreshment Break**
A Breakout room is available for people to use if they choose to network
Opportunity for note-takers to summarize key messages
- 13:30** **Message from NSERC** *Alejandro Adem, President, NSERC*
- 13:40** **Key Messages from Breakout Groups and Plenary Discussion** *Facilitator*
Key messages from facilitator/note-taker of each Breakout group
Plenary discussion on gaps and elements needed to move forwards
- 14:55** **Next Steps** *Andrew Gonzalez*
- 15:15** **Closing Ceremony/Prayer** *Elder*
- 15:30** **Adjourn the Workshop**

Appendix E - References

1. Carmen Wong, Kate Ballegooyen, Lawrence Ignace, Mary Jane (Gùdia) Johnson, and Heidi Swanson. Towards reconciliation: 10 Calls to Action to natural scientists working in Canada. *FACETS*. 2020. **5**(1): 769-783. <https://doi.org/10.1139/facets-2020-0005>
2. Rachel T. Buxton, Joseph R. Bennett, Andrea J. Reid, Charles Shulman, Steven J. Cooke, Charles M. Francis, Elizabeth A. Nyboer, Gary Pritchard, Allison D. Binley, Stephanie Avery-Gomm, Natalie C. Ban, Karen F. Beazley, Elena Bennett, Louise K. Blight, Lauren E. Bortolotti, Alaine F. Camfield, Fawziah Gadallah, Aerin L. Jacob, Ilona Naujokaitis-Lewis, Ciara Raudsepp-Hearne, Dominique G. Roche, François Souldard, Diana Stralberg, Kella D. Sadler, Kevin A. Solarik, Carly D. Ziter, James Brandt, Christopher W. McKindsey, David A. Greenwood, Peter C. Boxall, Cyprian F. Ngolah, Kai M.A. Chan, David Lapen, Scott Poser, Judith Girard, Claudio DiBacco, Shari Hayne, Diane Orihel, Doug Lewis, Danika Littlechild, Shawn J. Marshall, Larry McDermott, Rod Whitlow, David Browne, Jennifer Sunday, Paul A. Smith, Key information needs to move from knowledge to action for biodiversity conservation in Canada, *Biological Conservation*, 2021, 256: 108983, <https://doi.org/10.1016/j.biocon.2021.108983>