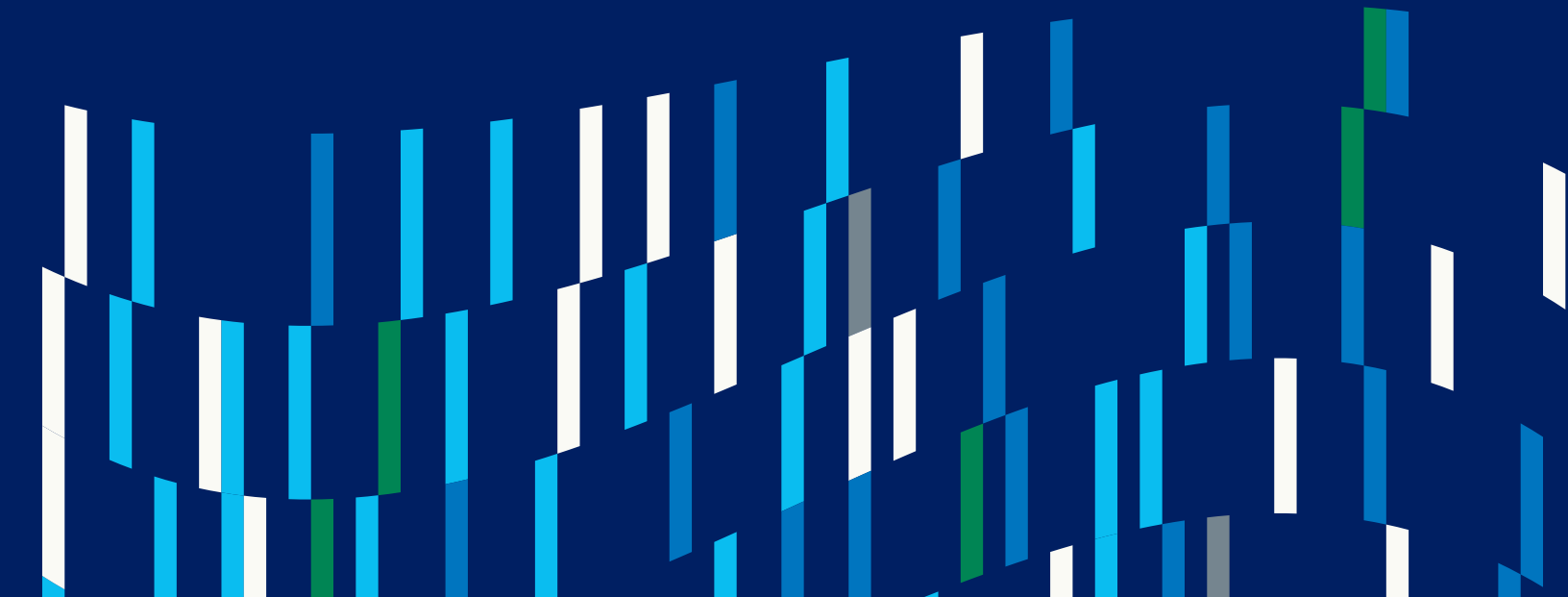
Genome Canada

Published March 2026

Genomics for Canadian Natural Resources and Biodiversity

Key insights shaping Genome Canada's next major mission-driven genomics initiative



Canada's natural resource sectors are under real pressure. Climate change is already reshaping ecosystems. Biodiversity is declining. Global competitors are moving fast, deploying cutting-edge technologies to unlock more value from their natural resources, improve product quality and strengthen their position in international markets. Genomics is one of those technologies—and Canada is not yet fully using it. Applied well, genomics technologies could give decision-makers the tools to detect threats earlier, manage resources more precisely and develop higher-value products—helping Canada's natural resource sectors compete on quality, sustainability and resilience.

Genomics is the science of deciphering and understanding an organism's entire genetic information encoded in DNA and related molecules. It applies to all living things—humans, other animals, plants and microorganisms such as bacteria, viruses and fungi.

Unlocking the power of genomics ultimately comes down to data. A rapid fall in the cost and time required for genome sequencing has produced an exponential increase in the amount of genomic data being generated worldwide. It's no longer just about sequencing a single genome to identify genetic markers. Today we can compare vast numbers of sequences to detect patterns, understand how systems function, and reveal relationships across species, ecosystems and environments.

For years, the challenge was collecting enough data. Now, the challenge is making sense of it. This is where artificial intelligence (AI) is changing the game—detecting patterns across vast genomic datasets at a speed and scale no human researcher could match. Genomics and AI turn biological data into actionable intelligence. The sectors that harness that power earliest will have a significant advantage.

The opportunity: Canada's natural resource sectors span forests, fisheries, freshwater systems, soils, minerals and oceans. Researchers across the country are applying genomic tools to better understand and manage these resources—supporting environmental sustainability as well as economic growth. Each region brings its own expertise and priorities, shaped by local ecosystems, industries and bioeconomy opportunities.

As Canada and its allies navigate a more complex geopolitical environment, the ability to monitor ecosystems, track biological threats and manage critical natural systems is also becoming a critical dimension of national security and resilience.

The challenge: Unfortunately, much of Canada's genomics work in natural resources and biodiversity remains disconnected. Genomic datasets are often stored in different systems, described using inconsistent standards and difficult to discover or use together. Connecting these datasets could reveal patterns that individual studies cannot detect, enabling researchers in every corner of the country to ask new questions and generate deeper insights.

This fragmented data landscape limits the ability of researchers, policymakers and industry to fully harness the potential of genomics in Canada. At the same time, advances in artificial intelligence (AI) and data science are creating new opportunities to analyze large biological datasets, increasing the need for coordinated genomic data infrastructure. It is this coordination that makes it possible to get genomic tools into the hands of the people managing Canada's forests, fisheries, soils and minerals, so they can make better, faster decisions that strengthen our natural resource sectors.

Scoping a solution: Canada has valuable genomic data related to our natural resources, but it is scattered and hard to use. Genome Canada is on a mission to change that. We want to make sure that genomics and AI can be deployed in the field to make our natural resource sectors more resilient, sustainable and competitive.

With our national mandate and partnerships across regions, governments, academia and industry, Genome Canada is well-positioned to help coordinate a solution to these challenges and opportunities. Our next major mission-driven genomics initiative (to be launched in early 2026) will strengthen Canada's natural resource sectors, biodiversity and bioeconomy by advancing genomics and helping build the coordinated data infrastructure needed to support it.

Over the past three years, through research, consultation and strategic dialogue, Genome Canada has developed a clear picture of the challenges and opportunities facing biodiversity genomics and natural resource sectors across the country. These efforts have consistently pointed to several cross-sector challenges, including inconsistent standards, unclear data governance and barriers to data sharing.

As part of this engagement, Genome Canada convened virtual roundtables in January 2026 with stakeholders from Canada's biodiversity genomics and natural resource communities. This report summarizes what we heard during these discussions and highlights how genomics could help strengthen the sustainable management and future competitiveness of Canada's natural resource sectors.

The roundtables were one input among many. They were informed by prior conversations with partners and leaders across sectors, by feedback from Indigenous leaders and research community members on existing genomic data initiatives and challenges, and by review of relevant literature and monitoring of international biodiversity genomics initiatives—all of which pointed to consistent challenges and opportunities across Canada's natural resource sectors.

As we build out our upcoming natural resources initiative—deploying new funding opportunities and refining our approach to reflect current needs and contexts—we will further engage with knowledge holders across sectors. As part of this process, Genome Canada is firmly committed to investment in Indigenous-led solutions supporting genomics in biodiversity and natural resources.

Inside the roundtables

The roundtable discussions were held virtually in January 2026. Each session was facilitated by an independent third-party moderator who guided the discussion and ensured balanced participation. The discussions were conducted under Chatham House rules, allowing participants to speak openly and share candid views.

Participants were invited to reflect on the current landscape of natural resources and biodiversity genomics in Canada and consider where genomics could have the greatest impact within their respective sectors. Discussions explored opportunities for collaboration, challenges related to genomic data and infrastructure, and approaches to responsible governance, including the role of Indigenous leadership and data sovereignty.

Genome Canada staff and members of the regional Genome Centres attended the sessions as observers, allowing the organization to listen directly to the priorities and challenges raised by participants.

Insights from the three roundtables, along with previous discussions with international partners and ongoing engagement across sectors and communities, will help inform the design and priorities of a forthcoming funding call under the new natural resources initiative.

Key themes

Discussions across the roundtables reflected a wide range of views on Canada's biodiversity and natural resources challenges—and opportunities.

Participants broadly agreed that genomics has significant potential to strengthen the sustainable management of Canada's natural resources and support the country's growing bioeconomy. At the same time, stakeholders identified structural challenges that must be addressed to realize this potential.

Canada has valuable genomic data, but it's scattered and hard to use.

+ Participants consistently noted that Canada generates large amounts of genomic data related to biodiversity and natural resources, yet much of this information remains difficult to use.

+ This fragmentation limits the ability of researchers, policymakers, communities and industry to analyze genomic information across ecosystems, regions and disciplines. Data that could support scientific discovery, environmental monitoring and resource management are often difficult to locate, integrate, or use beyond the projects or regions where they were originally generated.

+ Participants in all sectors emphasized the need for a coordinated national genomics data infrastructure to help unlock the value of these datasets. Connecting genomic data generated across the country would allow researchers and decision-makers to analyze information at larger scales and identify patterns that individual studies cannot reveal.

+ Industry participants noted that access to national-scale datasets would improve their ability to develop new technologies, tools, and environmental monitoring approaches. If foundational genomic datasets were available nationally, companies could build on them rather than generating them independently.

+ Better coordination of Canada's genomic data assets could also strengthen the country's competitiveness in the rapidly evolving field of biodiversity genomics.

Data infrastructure must be interoperable, well-governed and built to last.

+ While participants broadly supported the idea of a coordinated national genomics data infrastructure, discussions focused on what would be required to build such a system effectively.

+ Establishing common data standards, robust metadata requirements and quality assurance protocols was widely seen as essential. These measures would ensure datasets are interoperable, traceable and trusted, allowing researchers and other users to integrate data across projects and sectors.

We have an opportunity to combine these datasets into something interoperable and AI-ready, so researchers, governments, communities and industry can easily use the data to inform decisions.

- Participants raised the importance of aligning Canadian data standards with existing international frameworks and repositories. This alignment would allow datasets generated in Canada to connect with global biodiversity genomics initiatives, supporting the country's role in international efforts.

- Clear governance and access policies were identified as critical. Tiered access models and role-based permissions could help balance the goals of collaboration and data sharing with the need to protect proprietary, sensitive data and Indigenous data sovereignty.

- Industry participants emphasized that addressing legal and reputational risks associated with data sharing will be particularly important for encouraging corporate participation. Establishing appropriate governance mechanisms and access controls from the outset could help build trust across sectors.

- Participants stressed the importance of ongoing engagement with data users, including government, industry, academic researchers and Indigenous communities. Continuous dialogue would help ensure that genomic data infrastructure evolves to meet real-world needs.

- Finally, stakeholders highlighted the importance of long-term sustainability. Ensuring that genomic data assets remain usable and accessible beyond initial funding periods will require clear plans for stewardship, maintenance and sustained investment.

Indigenous leadership, rights and data sovereignty must be central to genomics in biodiversity and natural resources.

- Participants emphasized that meaningful partnerships with Indigenous communities—and respect for Indigenous rights and sovereignty—must be central to any genomics initiative related to natural resources.

- Indigenous Peoples maintain deep relationships with the lands and waters that sustain environmental biodiversity. Indigenous communities hold specific individual and collective rights implicating activities related to land and data—including those outlined in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). And Indigenous knowledge systems reflect generations of observation, stewardship and cultural practice and represent distinct ways of understanding ecosystems and environmental change.

+ Roundtable discussions highlighted that dialogue, relationship-building and co-development with Indigenous communities should be intentional and ongoing.

+ Participants also stressed that research involving Indigenous lands—and the species, data and knowledge related to them—must respect Indigenous data sovereignty and established governance principles such as CARE (Collective Benefit, Authority to Control, Responsibility, Ethics) and OCAP (Ownership, Control, Access, and Possession), Métis data governance principles, Inuit Qaujimajatuqangit and the National Inuit Strategy on Research, as well as the National Inuit Strategy on Research.

Genome Canada notes that engagement with Indigenous partners is ongoing and separate from the roundtable discussions described in this report. These conversations continue to inform the development of the natural resources initiative and reflect broader discussions across the country on Indigenous leadership in biodiversity and climate-related initiatives, including work highlighted by the Nature-Climate Action Initiative. Importantly, Genome Canada is committed to ensuring that any Indigenous data remain within Indigenous control and governance.

Building trusted partnerships will require respectful and honest relationships, transparency and long-term collaboration with Indigenous communities and organizations.

Canada has the scale and diversity to lead the world in biodiversity and natural resource genomics—if we act now.

+ Participants expressed strong enthusiasm about the innovation and clean growth opportunities that could emerge from a coordinated national genomics effort.

+ Canada's vast geography and diverse ecosystems position the country to generate genomic datasets at a scale that few other nations can match. Coordinating these datasets across sectors and regions could unlock new opportunities for biodiversity monitoring, environmental management and sustainable resource development.

- Researchers noted that advances in sequencing technologies, computational tools and AI are rapidly expanding the ability to analyze large biological datasets. A coordinated genomics data ecosystem would allow Canadian scientists to take full advantage of these tools.
- Participants also emphasized that Canada's efforts should remain aligned with international initiatives focused on biodiversity genomics and data standardization. Working alongside global partners will allow Canadian datasets to contribute to broader scientific efforts while ensuring compatibility with emerging international standards.
- Participants saw an opportunity for Canada to build a collaborative genomics ecosystem that strengthens natural resource stewardship, advances scientific discovery and positions the country as a leader in biodiversity genomics.

What this means for Genome Canada's initiative

Insights from these consultations are helping shape the development of Genome Canada's upcoming natural resources initiative. Together, the discussions highlighted both the significant potential of biodiversity genomics and the structural challenges that currently limit its impact on Canada's natural resource sectors.

In response, Genome Canada is designing the initiative to help build a more coordinated and interoperable genomics data ecosystem that supports scientific discovery, environmental stewardship and innovation across natural resource sectors.

Participants noted that Genome Canada is well-positioned to play a coordinating role in this effort. With its national mandate, network of regional Genome Centres and partnerships across sectors, the organization can help connect data, expertise and infrastructure across the country.

Program elements to expect:

1. A national genomic data hub for natural resources

One key area of focus is the development of a national genomics data hub to help coordinate and steward genomic datasets related to Canada's natural resources.

The hub would serve as a common entry point where genomic data generated through the initiative can be accessed and used more effectively. It would support shared standards for genomic and environmental metadata, helping ensure that data are findable, accessible, interoperable and usable. By improving standardization and data stewardship, the hub would allow datasets generated across projects and sectors to be analyzed more easily.

Discussions during the consultations highlighted differing views on how genomic data infrastructure should be organized. Some participants favoured centralized repositories, while others pointed to federated systems that connect existing databases. Rather than reflecting strong disagreement, the discussions underscored the complexity of the issue.

In response, the initiative is exploring a hybrid approach: bringing datasets together within shared infrastructure where possible, while connecting existing repositories through interoperable systems where they remain distributed. The goal is to combine datasets where possible and connect them where they cannot be combined, creating a flexible national genomics data ecosystem.

By coordinating genomic and environmental datasets at a national scale, the hub could allow researchers and decision-makers to analyze information in new ways, supporting biodiversity monitoring, environmental management and innovation across Canada's natural resource sectors.

2. Collaborative research and data generation

The second area of focus is research projects built around specific problems. Each one targets a challenge in a natural resource sector—fisheries stock management, forest resilience, soil health, critical minerals—and is expected to produce real results within its funding term. These are not open-ended science projects. They bring together researchers, industry, governments and communities to do work with a near-term purpose. The genomic datasets they generate feed into the national data Hub, but that is a condition of funding, not the reason for it. Each project is expected to produce high-quality, well-curated datasets that feed into the national data hub and can be integrated across sectors—expanding the scale and utility of biodiversity genomics research nationwide.

Improved coordination of genomic and environmental data could also support the development of advanced analytical tools, including artificial intelligence–enabled approaches for analyzing large biological datasets. These capabilities may help researchers and decision-makers better understand ecosystem change, forecast environmental risks and inform sustainable resource management.

Access to coordinated, national-scale datasets could also accelerate innovation by enabling industry, policymakers and researchers to build shared data resources rather than generating datasets independently.

3. Investing in Indigenous data governance and leadership

A third area of focus involves supporting Indigenous-led approaches to data governance for genomic and environmental data connected to natural resources and biodiversity.

Working in partnership with Indigenous rightsholders, these efforts aim to support development of Indigenous-led governance frameworks that guide how genomic data involving Indigenous lands, species and knowledge can be accessed, used and shared. The goal is to ensure that data stewardship reflects Indigenous rights, community priorities and established principles and rights.

Building a framework for the future

Taken together, these areas of focus represent an initial step toward building a more coordinated biodiversity and natural resources genomics landscape in Canada.

Rather than attempting to address every challenge at once, the initiative is designed to establish key foundations—shared data infrastructure, collaborative research and effective governance—that position Canada to better leverage genomics in support of environmental stewardship, economic competitiveness and the growth of the country's bioeconomy.

What's possible if we get this right

Canada's natural resources span vast and diverse ecosystems, from coastal waters and inland waterways to forests, grasslands and Arctic environments. These landscapes support extraordinary biodiversity and sustain industries and communities across the country, forming the foundation of Canada's natural resource economy—and the health and sustainability of our environment. The consultations described in this report reflect Genome Canada's effort to listen carefully to the challenges facing Canada's natural resources and biodiversity genomics communities before shaping the next phase of its work. What emerged is not just a picture of current limitations, but a clear vision of what becomes possible when those barriers are removed.

If Canada gets this right—if we build a coordinated, accessible and ethically governed genomics data infrastructure—the impact will extend far beyond the research community.

For **industry**, better coordinated data means Canadian companies can stop generating foundational datasets from scratch and instead build on national-scale genomic resources. This would accelerate innovation in biobased products, environmental technologies and AI-enabled decision tools, allowing Canadian technology developers and companies to compete more effectively in the growing bioeconomy. Access to high-quality, standardized genomic data would enable more precise resource management, improve product quality and help Canadian natural resource sectors sharpen their competitive edge in international markets.

For **regulators and governments**, coordinated genomic data infrastructure would enable more effective biodiversity monitoring, greater regulatory efficiency and more sustainable resource management—areas where Canada must lead to remain competitive in a rapidly changing global landscape. High-quality genomic and environmental data underpin the advanced analytics used in climate adaptation, environmental protection and threat detection, contributing to advancements in security, emergency preparedness and infrastructure modernization.

For **Indigenous communities**, investment in capacity building and Indigenous-led governance can help ensure genomic data initiatives reflect community priorities and uphold Indigenous rights and sovereignty. Grounded in distinctions-based approaches and governance principles for First Nations, Inuit and Métis data, this investment can support long-term, trust-based partnerships that respect Indigenous jurisdiction, knowledge systems and self-determination.

For **researchers**, a coordinated national genomics data infrastructure would enable analysis at scales and resolutions that isolated studies cannot achieve. It would position Canada to lead globally in biodiversity and environmental genomics, shaping international standards, driving innovation in AI and bioinformatics, and serving as a model for how genomics supports sustainable resource management.

This shared infrastructure can enhance Canada's ability to track ecological change, anticipate biological risks and protect critical natural systems. By supporting sustainable resource management and strengthening environmental resilience, it will also contribute to food security, supply chain stability and international efforts in bio surveillance and environmental monitoring.

This is what success could look like: genomic data and AI deployed in the field to make Canada's natural resource sectors more productive and competitive—while also advancing biodiversity conservation and ecosystem stewardship. By aligning economic and ecological goals, the data infrastructure we build today can continue to grow in value, supporting innovation, resilience and responsible resource management for years to come.

Genome Canada's role in making it happen

In Canada, researchers are already using genomics to better understand these ecosystems. As these efforts expand, connecting data, expertise and partnerships across regions will become increasingly important.

Realizing this potential will depend not only on scientific research but also on systems that allow genomic data to be shared, connected and used responsibly. Genome Canada is uniquely positioned to deliver this solution. Through its national mandate, networks and partnerships, Genome Canada will invest in direct research to enrich our understanding of biodiversity and act as the coordinating backbone for Canada's biodiversity genomics ecosystem.

The timing is right and the need is real. Provincial governments are actively looking for this kind of support. Canada's natural resource sectors are under pressure now. Genome Canada's new natural resources initiative will put genomics to work in the field, delivering impact in the near term while the data infrastructure it builds continues to grow in value over time—positioning Canada as a leader in biodiversity genomics and the sustainable bioeconomy.

About Genome Canada

Genome Canada is a national not-for-profit leading large-scale research missions that translate excellent science into economic, health and environmental solutions. We align Canada's genomics ecosystem for impact. **Learn more at genomecanada.ca**