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Canadian Geospatial Infrastructure & Innovation

A Natural Resources Canada perspective

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Geospatial World Forum 2023

Canada



Context

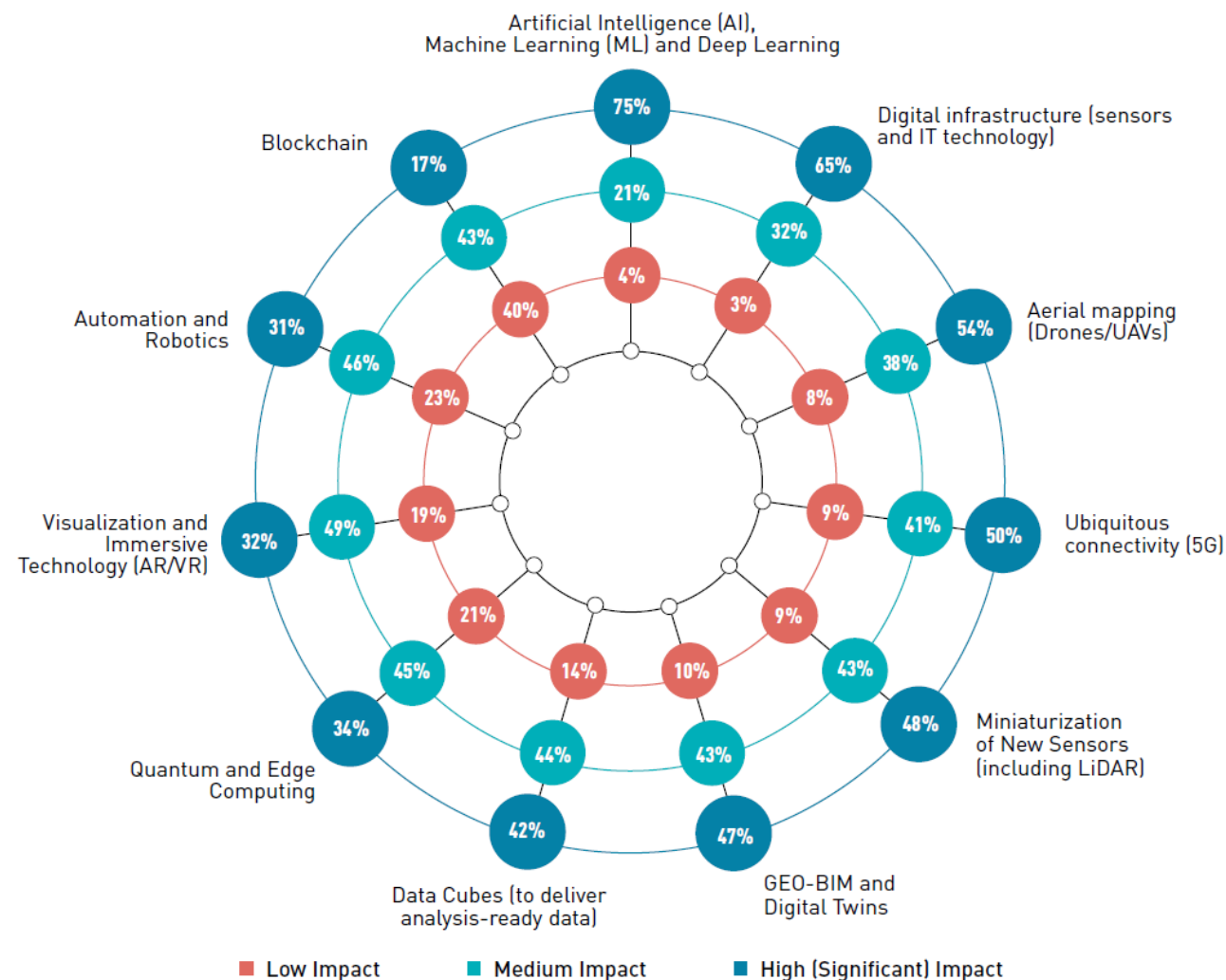
- **Geospatial ecosystem** is evolving: from custodians of data and basic infrastructure to innovative standards for interoperability, modernized tools to utilize increasingly accurate and diverse data, creation of knowledge base, meeting government priorities, and holistic System of Systems
- **Government priorities:** emergency management, climate change adaptation, sustainable development, green recovery, indigenous reconciliation
- **Vast geography** that balances resource extraction with evolving environmental impacts: massive wildfires, tornados, derechos and hurricanes in northern latitudes, melting of Arctic permafrost, release of frozen methane, melting coastline and erosion
- **New** technologies, business models, rise of citizen data providers, and social media changed how we create and share geospatial information



Drivers of Change

- **Technology:** integration of technologies to create digital twins, high-res data, sensor data, real-time processing, automation, open access, quantum technologies
- **People:** consumer applications, knowledge stakeholders, citizen participation
- **Operations:** digital infrastructure, standards and interoperability, security, client-focused
- **Engagement:** public private partnerships, collaborative mapping, international partnerships
- **New trends and leadership:** 4th Industrial Revolution, forecasting, innovative programs, empowering policies

Figure 7: Impact of Leading Technology on Geospatial Market Growth



Source: GKI Report



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Applied Geospatial Standards Innovation



- **Standards and operational policies:**

- Enable exchange of data and information effectively and efficiently to address complex environmental and societal issues.
- Provide consistency and break silos for users and technology irrespective of expertise and applications.
- Allow creation of common frameworks to provide level playing fields - stakeholders influence implementation of technology.

- **Standards Development Organizations (SDO):**

- Open Geospatial Consortium Strategic Member and co-fund various initiatives
 - Current Projects: Disaster Pilot 2023, Marine SDI Pilot, Climate Resilience Pilot,
 - Facilitator of Ukraine's StateGeoCadastre membership
- ISO Technical Committee 211 Working Group 6 – Imagery.
- World Wide Web Consortium (W3C). Spatially-enable Web browsers with Map Mark-Up Language



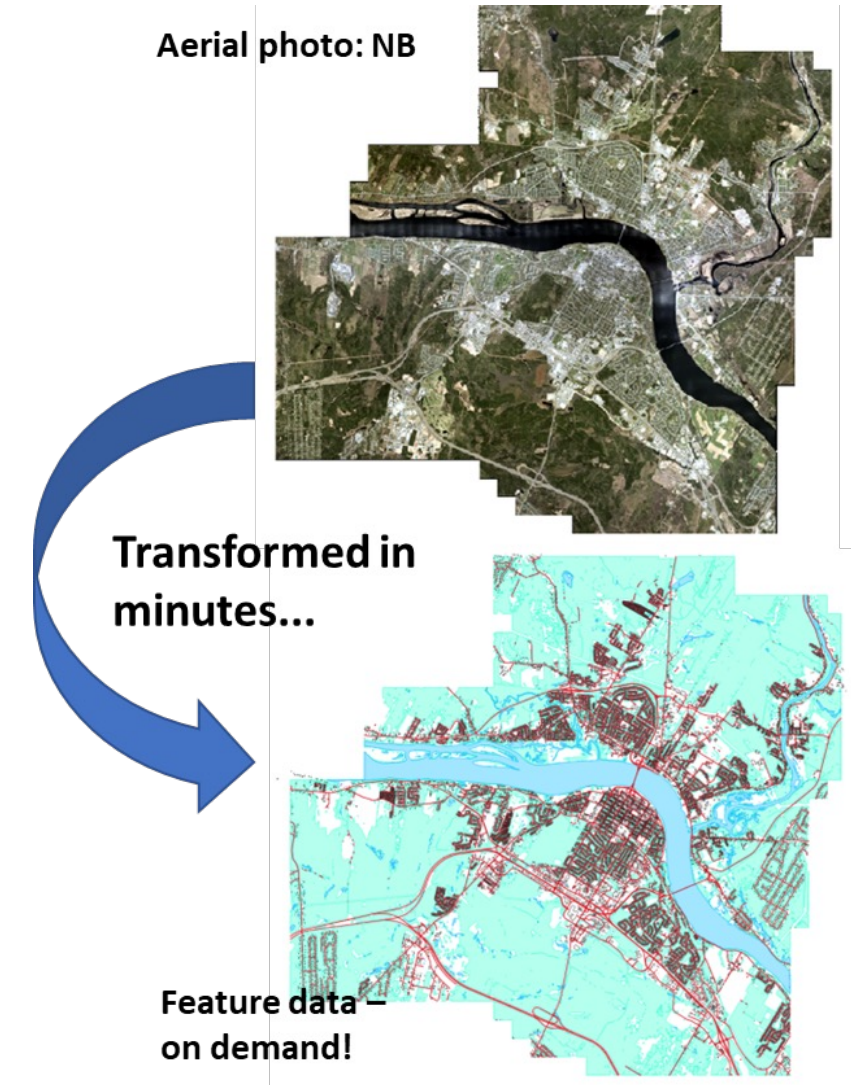
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A transformational paradigm shift: GEO AI

- **AI-based feature extraction:** incredibly efficient, high quality, automated data creation from imagery, air photos, paper maps
- Once **GeoAI models** are trained, generating extractions on new data is rapid and low-effort: truly on-demand
- Under-utilized data rapidly **transforms** to usable feature data, while also improving training models
- **Rapid iterations** provide exceptional support for change analysis, emergency response, predictive analysis / scenario modeling
- Projects to improve AI by exploring hybrid **classical-quantum machine learning and deep learning**; and investigations in quantum inspired optimizations



Digital Transformation through AI-based integration of aerial photos with satellite imagery

- **Vast archives** in form of aerial photos reveal how the country's landmass has been changing
- **Air photos** from Canada's National Air Photo Library span back to the 1920's and were complemented with civilian **satellite imaging** starting only in 1970s.
- When combined with **AI techniques**, long term status and trends variables can detect change in:
 - land cover and land use
 - vegetation communities
 - landscape disturbances
 - terrestrial water storage
 - hot-spot regional coverages

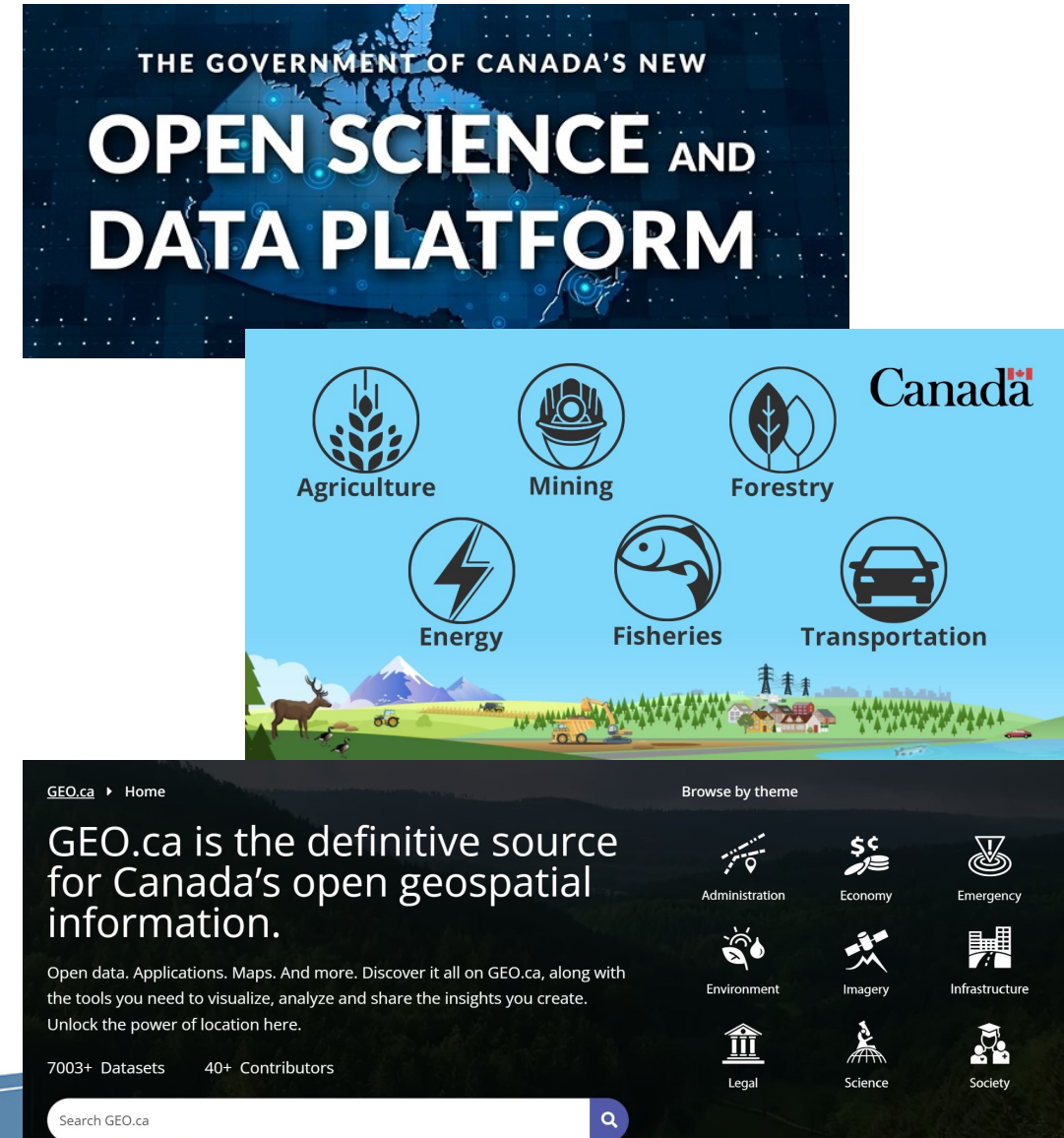


Output shows forested areas, surface water, roads, buildings



Open Data and Open Government

- **Open Data for Canada:** Efficiency by avoiding duplication and facilitating reuse of existing data and cross department data sharing; Advance the government's accountability and transparency; Support innovation and new technologies
- **Launched in March 2021,** Canada's Open Science and Data Platform (OSDP) provides access to science, data, publications, and information about development activities across the country to understand cumulative effects of human activities, including natural resources.
- **Publicly launched in Fall 2022,** **GEO.ca** is the result of seven years of collaborative effort between federal, provincial, and territorial stakeholders, led by Natural Resources Canada's CCMEQ.



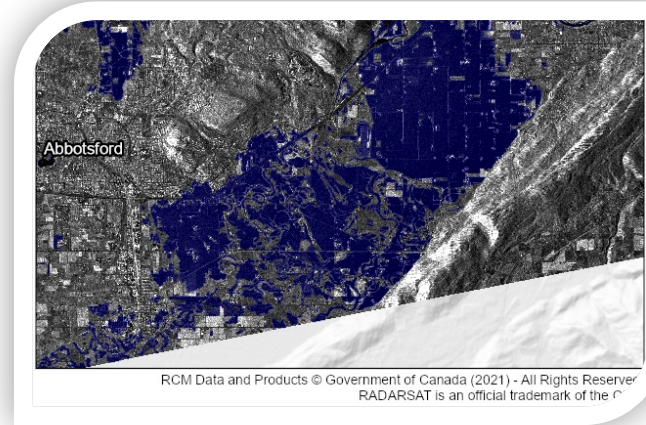
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Earth Observation Data and Science

International Disaster Charter

- Radarsat Constellation Mission and Canada's Earth Observation Data Management System
- Emergency Geomatics Service (EGS)



International Disaster Charter: Flood extent maps were generated for the atmospheric river events that hit Canada's and USA's west coasts a year ago.

Canada's Strategy for Satellite Earth Observation

- Maximize Benefits for Science, Innovation, and Economic Development Emergency Geomatics Service (EGS)
- Harness satellite EO to address climate change and issues that matter to Canadians
- Strengthen delivery of critical services
- Inspire skills and capacity development for the next generation

Digital Earth Canada Initiative

An Earth Observation exploitation platform:

- discover, access, and visualize EO and non-EO data
- process data, perform analytics and develop applications
- collaborate and publish data and application products



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Protect homes and communities from the impacts of climate change by

- \$63.8M (2021-22 – 2023-24) for mapping higher risk areas nationally, and disseminating this information publicly. Expansion (additional 138.4M / 5 years)
- Identified highest risk areas and engaged with Provinces and Territories
- Funded R&D to advance science and integrate climate-change scenarios
- Developed the Federal Flood Mapping Guideline Series and furthered the creation of national flood mapping standards

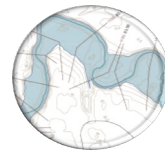
Flood Hazard Identification and Mapping Program (FHIMP)



Completing work with provinces and territories to develop flood maps for **higher-risk** areas



Advancing work to complete flood mapping **nation-wide**



Supporting the development of a portal to provide **centralized access to information** on flood risks



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Make our communities safe and increase forest resilience to wildfire

- The Government of Canada has approved \$176.81M over 11 years funding for an operational **wildfire satellite monitoring service** to provide near real-time information.
- Natural Resources Canada's:
 - CCMEQ – through its satellite ground segment – will be responsible for data acquisition, transmission and access.
 - Canadian Forest Service will be responsible for fire management products, science and user systems.
- Mission launch is planned for 2029-30. Full operations are planned for 2030.

Canadian Wildland Fire Strategy



Invest in measures to reduce risks from wildfire and supporting fire management by Indigenous communities



Deliver and operate a new wildfire monitoring satellite system



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A future where Canada's Northern and Arctic residents are thriving, strong and safe

Canada's Arctic and Northern Policy Framework: Shared vision and roadmap, guiding investments and activities through 2030.



Blue Economy Strategy: Build Ocean spatial frameworks similar to land (e.g. cadastre, 3D interoperability, service driven architecture). Connect the land and marine domains.

Arctic Spatial Data Infrastructure: Operational sharing and integration of Arctic data between nations and organisations. Broker land and marine data, three million circumpolar place names, maps, geoportal supporting Arctic Council's and stakeholders' decision making.

Inuvik Satellite Station Facility: Situated above the Arctic Circle, ideally positioned to track and receive data in near real-time from polar-orbiting satellites for scientific, mapping, weather, surveillance.

GeoConnections national program

..With mandate to maintain and evolve the Canadian Geospatial Data Infrastructure



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Geospatial mapping supporting Indigenous Reconciliation



- In Canada, close to 30 000 official **place names** are of Indigenous origin, and efforts are ongoing to restore traditional names to reflect Indigenous culture and heritage
- Ongoing identification of names and languages in **national geographical names database**, release of datasets and maps
- Aligned with UNDRIP and International Decade of Indigenous Languages



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