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Redefining the Role of Mapping Agencies: Data in the Era of AI and Real-time Insights

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Geospatial World Forum 2024

Canada

Embracing Change: From Data Abundance to Dynamic Utilization

"Is data really the new gold?"

With the exponential availability of data streams and the arrival of AI and machine learning, near real time knowledge creation to address issues such as climate change, resource management and natural disasters is rather the challenge that lies before us!

Traditional Role of National Mapping Agencies

NMAs were custodians of geospatial data

- Creation, curation and dissemination of fundamental geospatial data
- Meet needs of specific domains such as: military, land administration, geology
- Centralized management and need-based engagement with private sector to address gaps in data collection process
- Traditional management model linked to physical workstations and servers providing authoritative data

Canadian Examples

- 1908 - Geological Survey of Canada establishes its topographic division
- 1922 - Creation of a single topographic system
- 1947 - National topographic mapping depicting landforms, water bodies, man-made features
- 1962 - Canada develops first Geographic Information System (GIS)
- 1998 - Canada develops an ongoing program for internet-based National Atlas
- 2012 – Completion of National Topographic System for Canada

Evolving Geospatial Ecosystem: Paradigm Shift

Role of Mapping agencies - Federal and provincial agencies are no longer sole providers or custodians of geospatial data. Players from public and private sources are producing.

Complex environment of data wealth from diverse streams – Earth Observation, remote sensing, LiDAR providing increasingly precise and frequent data.

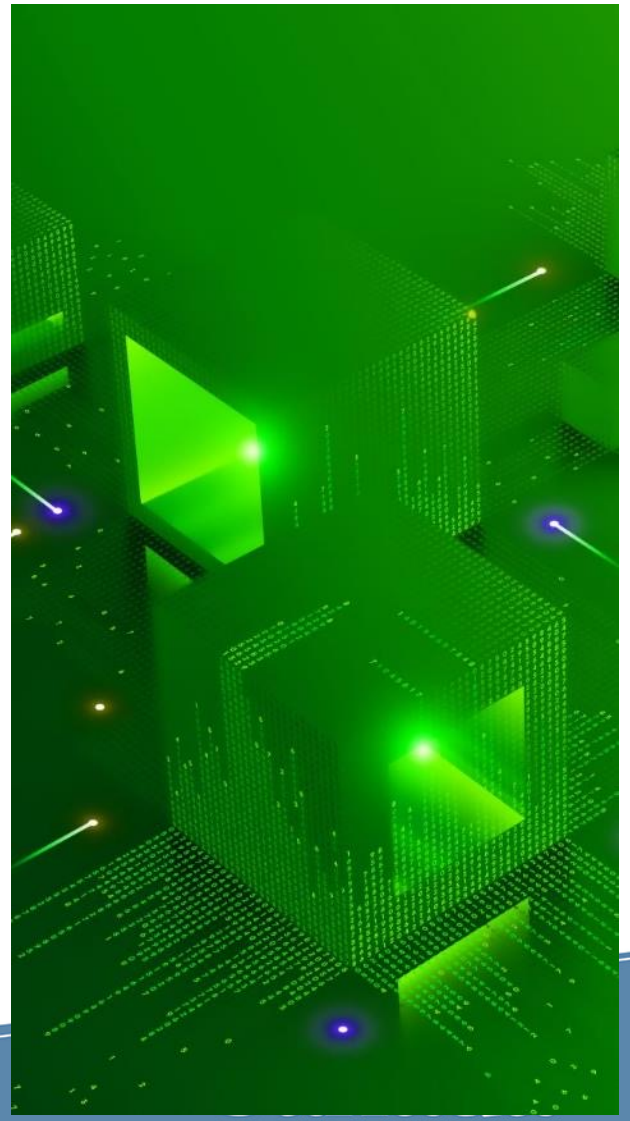
Adoption of advanced technologies - AI, cloud computing, big data availability, etc. is rapidly changing how geospatial is used. Moving away from physical workstations towards Data Cubes.

Changed policy landscape – Former permanent funding for geo-infrastructure or fundamental data production programs is transitioning to targeted priority-based temporary initiatives to meet specific user demands.

Updating national base mapping – Ongoing need to provide national coverage as a result of targeted programs; distinguishes the role of government from private sector.

Emerging priorities - Climate change and emergency management, necessitate transformation of available data, often in near real time, to provide value-added knowledge.

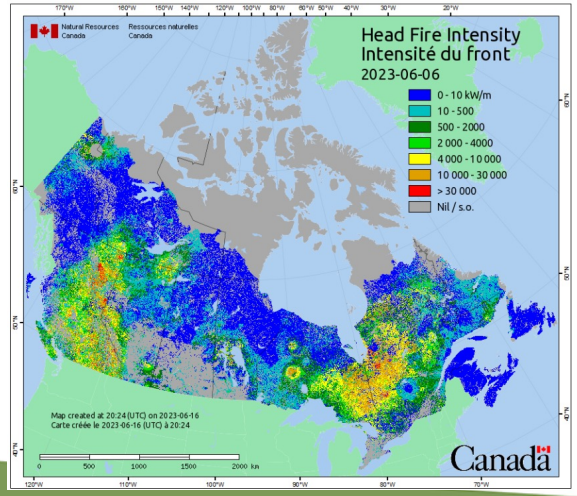
Confluence of data, technologies and collaboration to jointly develop solutions to global issues and bridge the digital divide.



Navigating New Horizons: Innovations and Strategies for Meeting Evolving Priorities

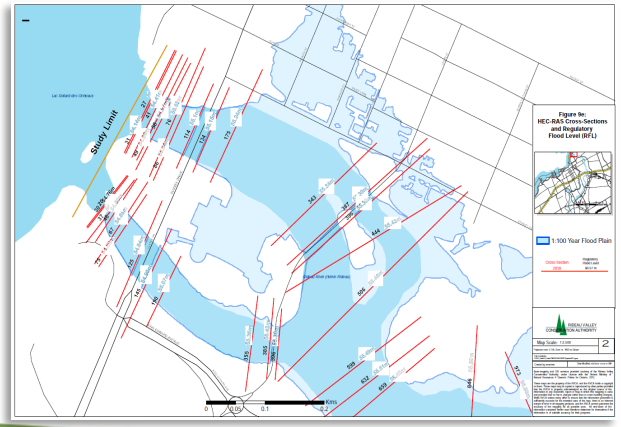
Canadian Wildland Fire Strategy

Delivering and operating a new wildfire monitoring satellite system



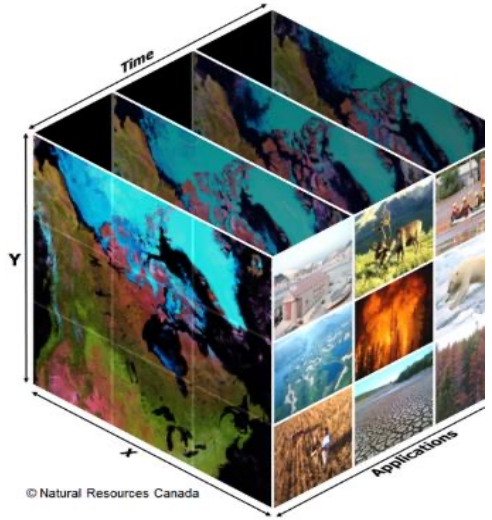
Flood Hazard Identification and Mapping Program (FHIMP)

Work with provinces and territories to develop flood maps for higher-risk areas nation wide



EO for Cumulative Effects:

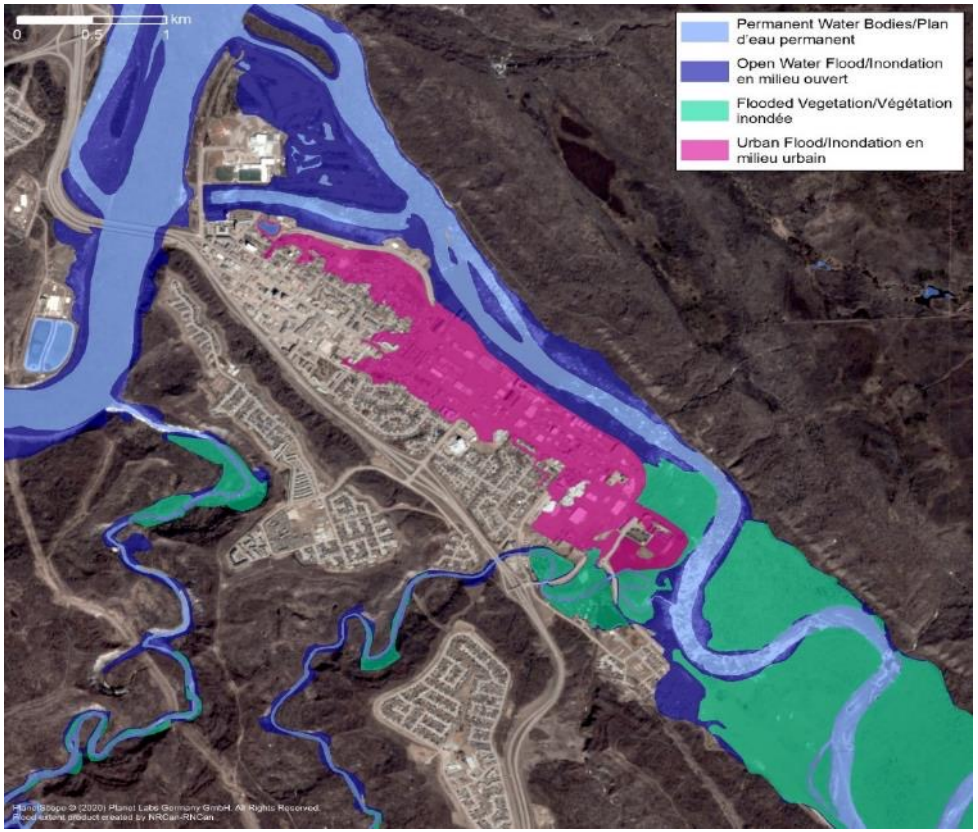
Multi-decadal records of environmental change

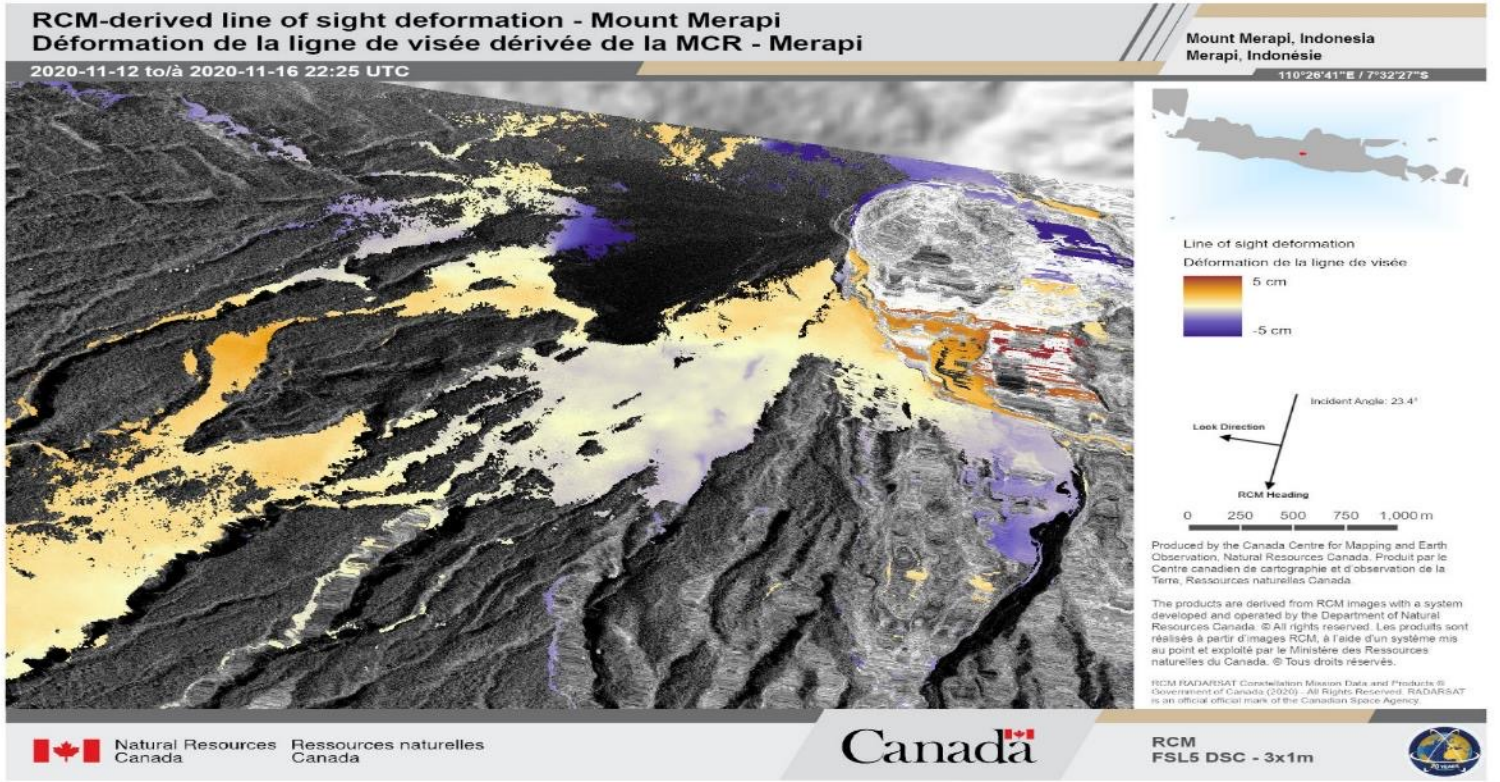


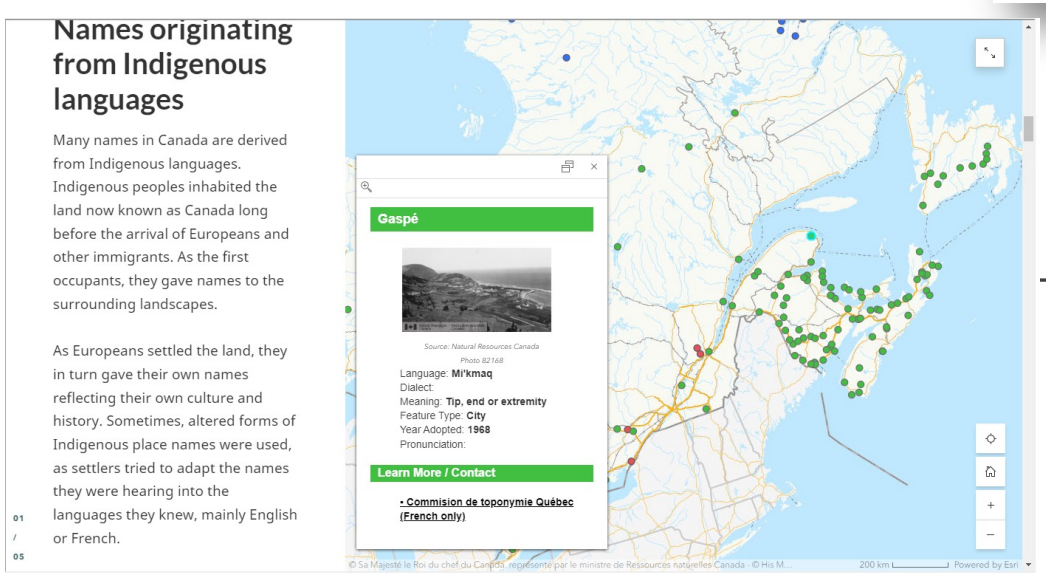
Federated Open Data Search

Canadians now have access to over 9,500 datasets in centralized locations: GEO.ca, Open Science Data Platform, Open Maps

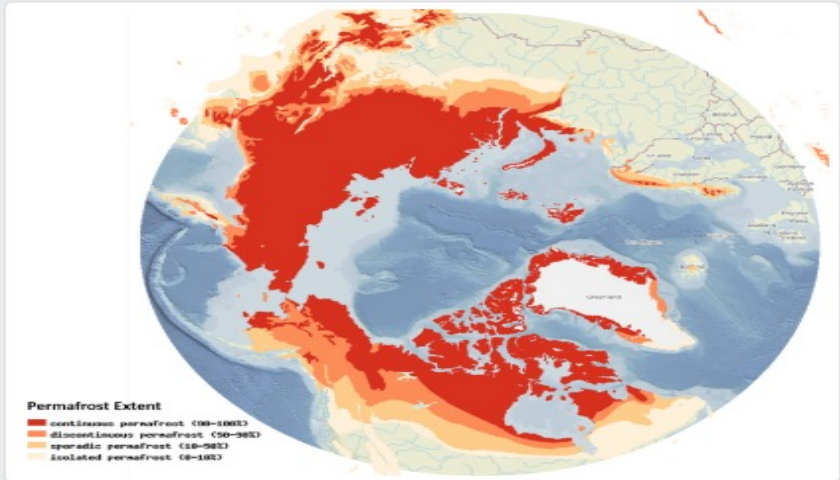
GEO.CA







Flagship initiatives in alignment with government priorities

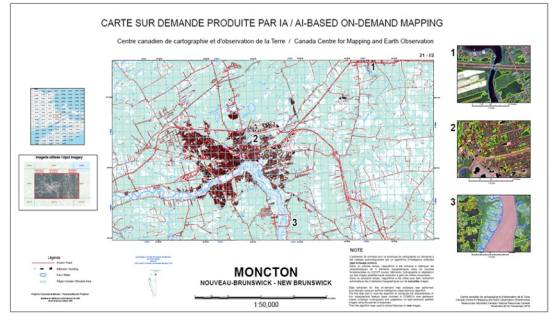


Map of pan-Arctic permafrost extent provided by Arctic SDI.

Transforming National Mapping

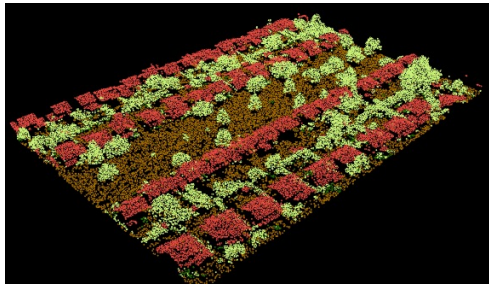
GEO AI

We train models on thousands of images and LiDAR data automatically recognize natural and man-made phenomena



INPUTS…

- High-Resolution Imagery
- Historical air photos
- Satellite/radar imagery
- LiDAR data
- Vintage (paper) maps



- AI as a Service : on-demand mapping
- Automated, fast and scalable
- Repeatable and adaptable
- High quality truth data in various contextual settings

Training data easily adapted to other areas and purposes

Raw data to analysis-ready information… in minutes.

OUTPUTS…

- Map features
  - Roads
  - Rivers
  - Lakes
  - Buildings
  - …on demand!

GeoAI: Mining value of 100+ years of geo-data…

AI feature extraction: Incredibly efficient, high quality, automated data creation from imagery, air photos, maps.

GeoAI

Rapid, reliable: Exceptional support for change detection, modelling, predictive analysis.

Resilience to Natural Hazards

- GeoAI offers immense potential for assessing risks before disasters occur and for supporting response in real-time.
- Up to date insight into state of environments and susceptibilities prior to a disaster.
- Monitoring progression of the event.
- Understanding changes from the disaster before and after events.
- **Impacts:**
  - Nation-wide mapping on flooding, identify areas requiring more or frequent modelling.
  - Emergency management: More robust and reliable post-disaster mapping in both urban and rural environments.

Fort McMurray, Alberta in 2014, and in 2016 after wildfires.
Green outlines show buildings before and after.

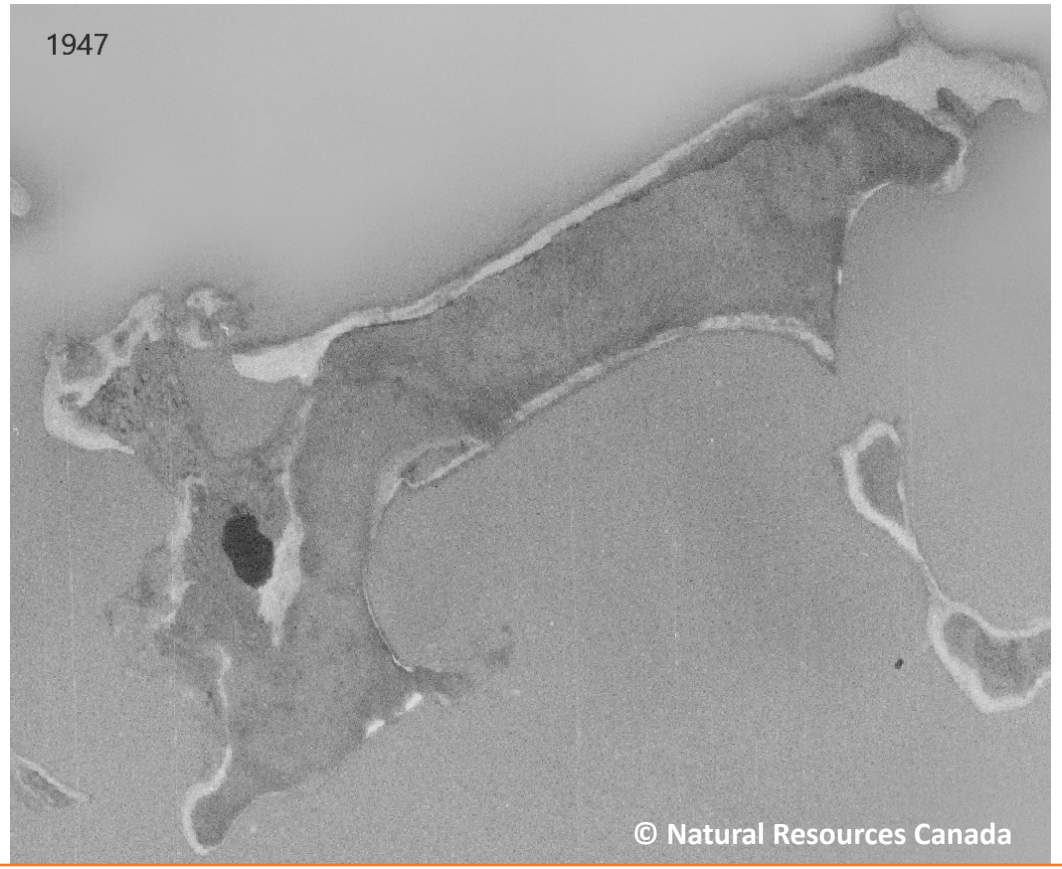
Flood Susceptibility Map generated from variety of data including elevation, and historical events

Resilience to Climate Change

- GeoAI draws on Canada's deep archives of maps, data and imagery.
- Capable of aligning historical imagery and analysing geophysical trends over time.
- Identify environmental changes (e.g. coastline, forest, rivers, lakes).

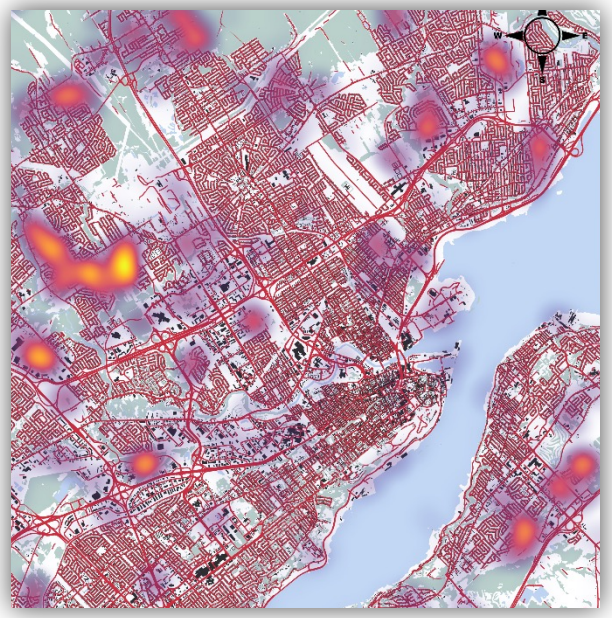
Impacts:

- Climate adaptation policy and action.
- Data for climate science.
- Supports coastal and northern communities confronting immediate climate challenges.
- Indigenous climate leadership.



GeoAI used to align historical photos and demonstrate retreat of the banks at Tuktoyaktuk Island, Northwest Territories, 1947 to 2004

Potential key input to national policy issues



Urban Growth, Quebec City 2006 - 2022

HOUSING

Individual Tree Inventory, Red Deer, Alberta

PUBLIC HEALTH

Photovoltaic Potential, Moncton, New Brunswick

ENERGY TRANSITION

What does it mean for our traditional role.. Need to change our paradigm

Shift from data provision to how it is used for various applications. Processing vast amounts of data in real-time to provide analytics and solutions for decision-making.

Need to change our paradigm, from treating data like an ''asset'' to keeping pace with increasing workload, innovations and costs. Requires corresponding shifts in IM/IT design.

Use of targeted programs and priority-based funding to enrich and create information that meets user demands.

UN-GGIM working on charting the path forward for a Future Geospatial Information Ecosystem:

- **Spatial Data Infrastructures** - human centered approaches to find web-based geospatial information, to
- **System of Systems** - democratization and distributed systems applying advanced technologies and Artificial Intelligence, to
- **Geoverse** - machine centered interconnected systems delivering knowledge in real time

Conclusion: Where do we go from here ?

- Embracing the changing geospatial landscape: paradigm shift to adapt to emerging priorities.
- Collaborating with multitude of data providers – government, private sector, academia, NGOs.
- Increasing importance of adapting to new technologies such as GeoAI and then change again.
- Enhancing defined role of government and encouraging collaboration to find synergies to ultimately provide near real-time user friendly and easily accessible solutions.
- Traditional mandate can be accommodated, sometimes indirectly / embedded in targeted programs.
- Significant changes required in our IM/IT practices, Data lifecycle management practices.

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