Census of Environment:
A Register of Ecosystem Assets

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Presented to

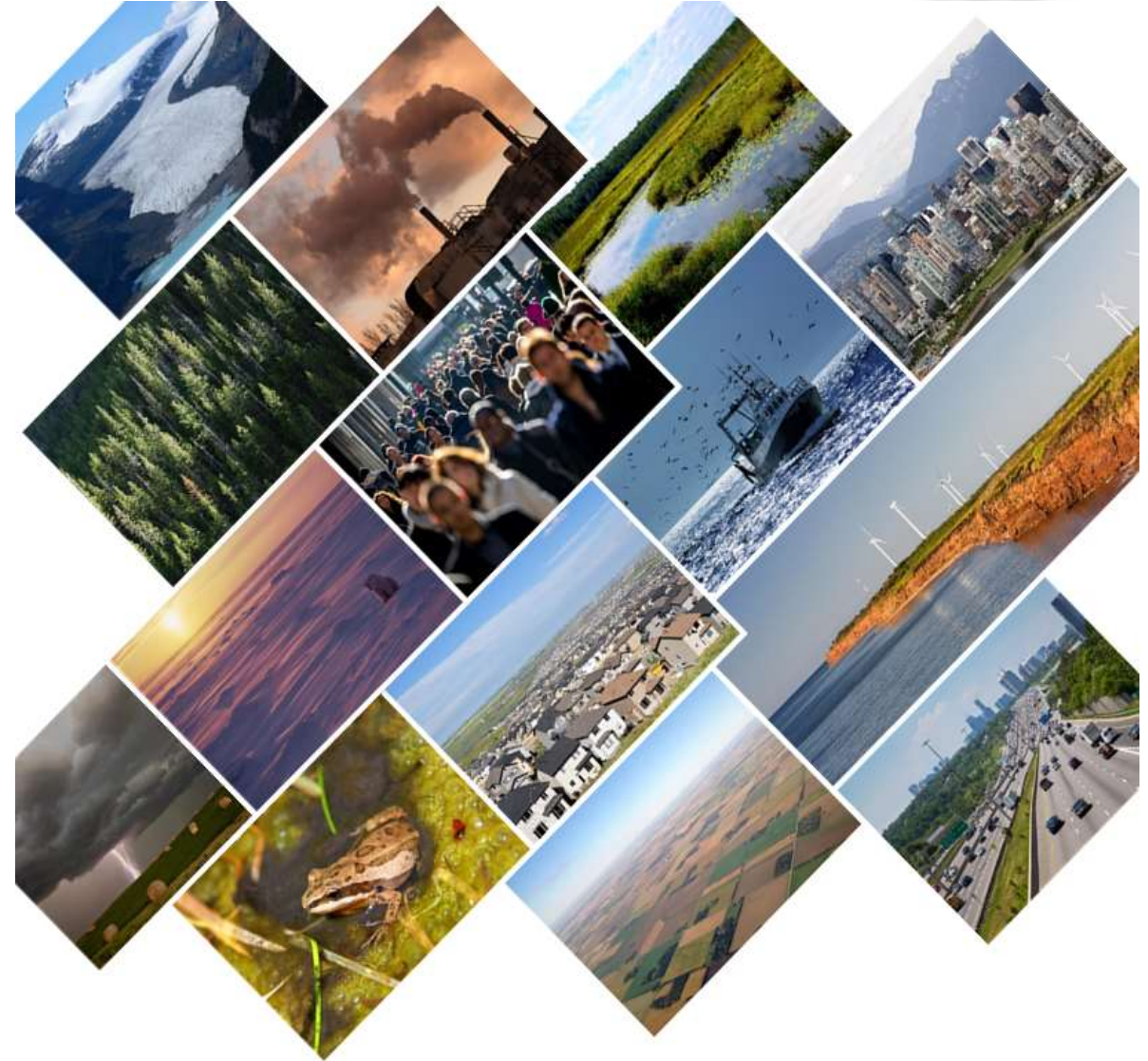London Group on Environmental Accounting

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The Census of Environment: Overview of presentation

1. Census of Environment

2. A Register of Ecosystem Assets for Canada

3. Discussion

Better Understanding Our Environment

"The government is committed to building a robust foundation of data to better understand the impacts of climate change and protect our diverse ecosystems. To increase our knowledge of Canada's environment, ecosystems, and species, and their relationship to local communities, the government plans to undertake Canada's first-ever Census of Environment." (Page 186, Canada Federal Budget 2021)

The Census of Environment: Basic information

→ Lead department:
  → Statistics Canada (Co-sponsored by Environment and Climate Change Canada)

→ 2021 Federal Budget:
  → Allocated $25.6 million to Statistics Canada and $1.7 million to ECCC over 5 years, and $6.1M ongoing ($5.8M to StatCan)

→ Overarching objective:
  → to deliver and maintain a full suite of accounts and profiles describing the relationship between ecosystems and the Canadian society

→ Overarching process:
  → Integrate existing and new data to track Canada's ecosystem assets, and measure or model resulting flows of ecosystem services and benefits
  → Maximize interoperability of environmental and socio-economic information

The Census of Environment: 3 main Components

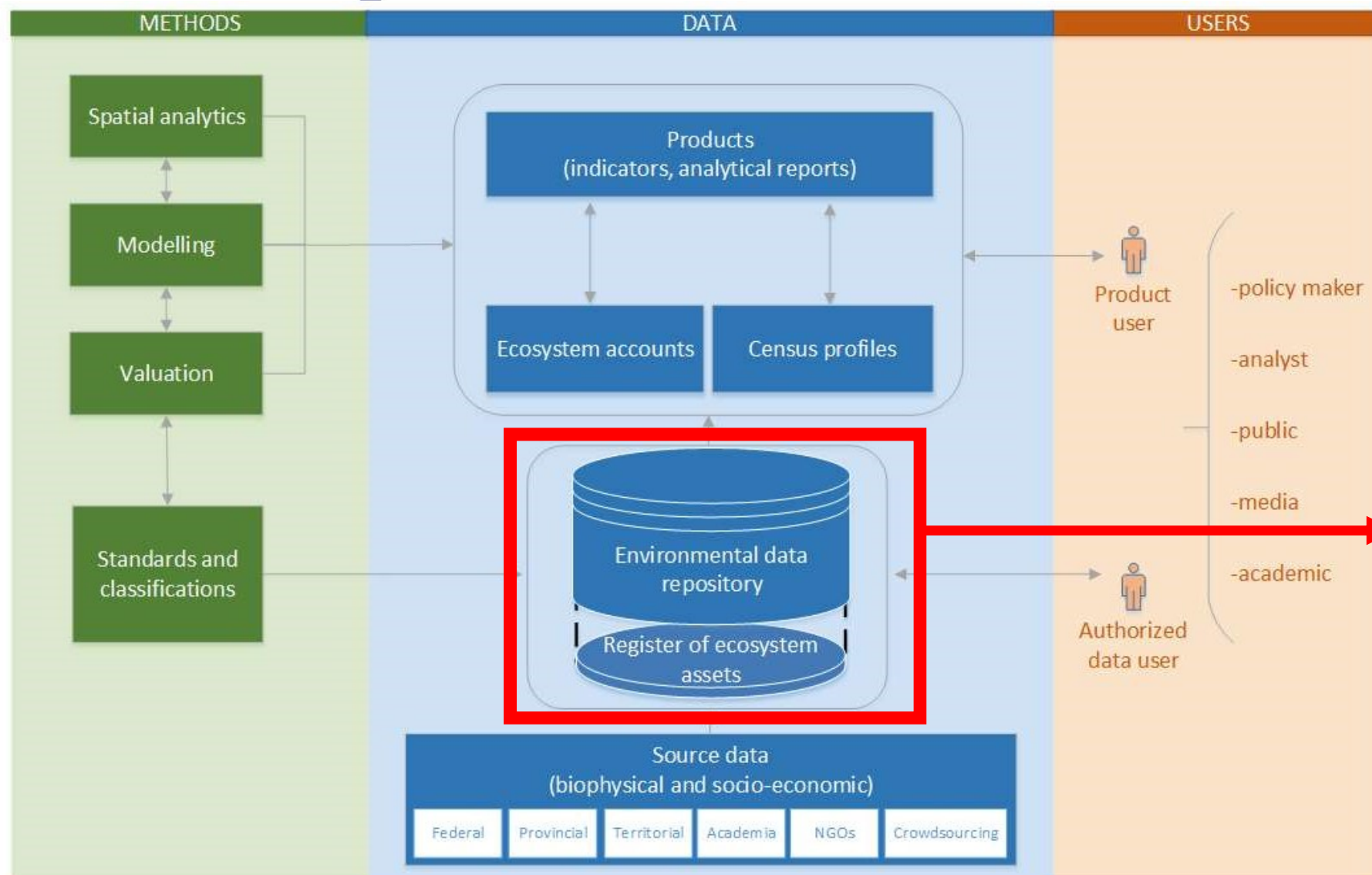➥ 1. Register of Ecosystem Assets
  ⤷ A register of ecosystem assets supporting an evergreen central repository of baseline information on ecosystems in Canada.

➥ 2. A full suite of profiles and accounts
  ⤷ Environmental profiles that deliver data and indicators by watershed and ecological area (and other geographies).
  ⤷ Complete set of integrated environmental-economic accounts that link bio-physical and societal measures

➥ 3. A central user centric portal
  ⤷ A portal offering data analytics and access functions for including geospatial tools, calculators and open data, and a collaborative space for researchers and partners to access data securely.

Framework of the Census of Environment:
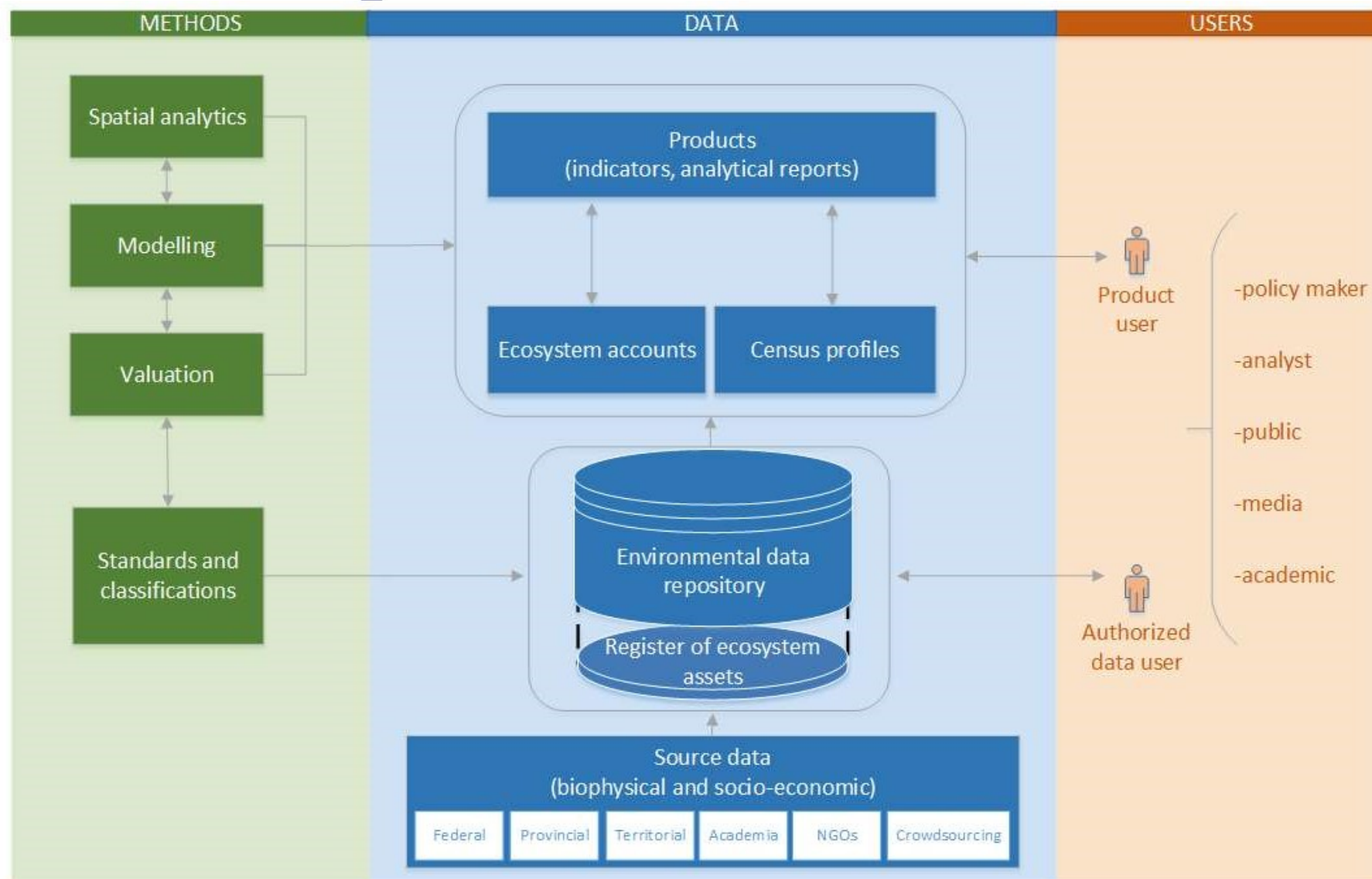
Structure of the Census of Environment : 1. Register of Ecosystem Assets

The Register of Ecosystem Assets:

A national, spatially explicit framework used to provide integrated statistics on ecosystems that are comparable across space and time.

▦ A standard spatially-referenced grid of spatial units covering all of Canada's land, freshwater, and oceans

▦ Each grid cell is linked to standard geography units used for dissemination by Statistics Canada and other data producers. Multiple standards will be supported, which can change over time

▦ Each grid cell is assigned to an ecosystem type, according to a standard typology.

Purpose and scope of the register

Purpose:

The purpose of the Register of Ecosystem Assets is to provide a common framework for organising spatially-explicit data on ecosystems:

1. Supports the integration of multiple variables for the same Basic Spatial Units.
2. Allows the aggregation by standard and non-standard geographies at a range of scales
3. Provides authoritative delineation of ecosystem assets for the purpose of compiling ecosystem accounts

Scope:

The Register of Ecosystem Assets includes the following core elements:

1. A standard spatially-referenced grid covering all of Canada's land, freshwater, and oceans.
2. Each grid cell is linked to standard geographical units used for dissemination by Statistics Canada and other data producers. Multiple geographical classifications can be supported.
3. Each grid cell is assigned to an ecosystem type, according to a standard classification.

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Key concepts and scope

Data Model: based on a "data cube"

Cell = Basic Spatial Unit (BSU)

1. Basic attributes:
   - Unique ID
   - Position (e.g., centroid)
   - Dimensions (size)

2. Geography IDs (lowest level in hierarchies)
   - Standard Census of population geographies
   - Ecological land classification(s)
   - Drainage area classification(s)
   - Marine bioregions (TBD)
   - Others.

3. **Ecosystem Type**

Time

t-2
t-1
t
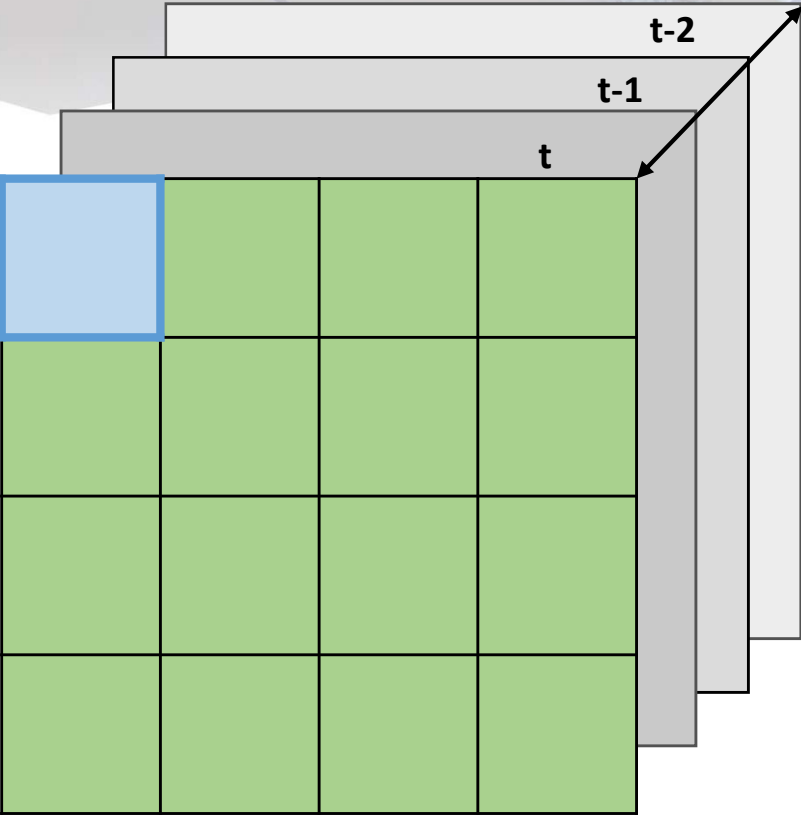
Space

GEO_ID	Latitude	Longitude	Size
0001			
0002			

Ecosystem Table

GEO_ID	Date	ECO_ID / Depth	Ecosystem Type	...
0001	2016			
0001	2021			
0002				
0002				

Geography Table(s)

ID	Date	SGC	DR	ELC	Marine	...
0001	2016					
0001	2021					
0002	2016					
0002	2021					

Key concepts and scope: The register - in theory

1. Each grid cell (BSU) in the Register is assigned to an **ecosystem type**
   - Acceptable 2-D simplification of continuous 3-D phenomena in nature
   - Never perfect, but suitable for statistical purposes: 'statistical ecosystems'

2. Ecosystem Asset: contiguous areas of a specific ecosystem type
   - Represents a distinct set of biotic and abiotic components and their interactions
   - Ecosystem services can be modelled based in this information

3. For accounting purposes (SEEA-EA):
   - Exhaustive (no missing areas)
   - Mutually exclusive (no double-counting)
   - Sum of ecosystem extents = Ecosystem Accounting Area

Key concepts and scope: The register for EA - in practice

1. Limited by available data
   - Of sufficient detail, coverage, and quality
   - Nationally comparable, multiple time points

2. Integration of multiple variables from multiple sources
   - Climate, topography, pedology, land cover, land use, etc.
   - Appropriate methods need to be developed for country-specific context

3. Scale & Resolution (in space and time)
   - Large impacts on aggregate estimates based on spatially-explicit data
   - Modifiable Areal Unit Problem (MAUP)

4. Coherence between Canada's Ecological Land Classification (ELC) and international ecosystem classifications
   - IUCN Global Ecosystem Typology, USGS terrestrial "World Ecosystems", others.

Key concepts and scope: Primary Results and Outputs

Desired primary results

1. Standard spatially-referenced grid
   - Adopted across the agency

2. Authoritative delineation of 'statistical ecosystems'
   - Local scale, nationally comparable

3. Concepts and methods for ecosystem delineation
   - R&D in progress (e.g. Saltmarsh paper)

Desired primary outputs

1. SEEA Ecosystem Accounts
   - Ecosystem accounts
   - Selected Central Framework accounts

2. Regional profiles
   - Integrated socio-ecological tables

3. Services of interoperable spatial data
   - Variety of products via online portal

Data Quality & Assessment Framework

1. Register and related outputs are based on multiple *input* data sets, with different **methods of collection, resolution, or policy focus**

   Therefore, input data need to be assessed to ensure an appropriate standard of **quality**, and are **fit for intended use**

   1. **Characteristics of the Data Producer**
      - Collection, quality assurance processes
      - Reputation as an authority
      - Support for users
      - Timeliness
   2. **Characteristics of the Data Set**
      - Usability: metadata, format, licenses, linkable attributes
      - Suitability: concepts, measurement methods, coverage & detail, accuracy
      - Internal consistency

- Based on Statistics Canada's data quality toolkit

Conclusion:

1. The Register should support the compilation of the ecosystem extent account
   - But it requires the integration and analysis of geospatial data from a variety of sources, such as in-situ and satellite Earth observations, administrative data sets, citizen science and other data sources.
   - We have the know-how in some case, but not in others.

2. The Register could be used beyond its application to the extent account
   - This spatially-referenced list of ecosystems on a standard grid creates a foundation to link a range of other spatial data, including ecosystem conditions, flows of ecosystem services, and even characteristics of the users and beneficiaries of these services.
   - A standard grid facilitates the integration of multiple variables for analysis and compilation of aggregate statistics. This should enable the efficient production of a range of outputs and products that will be accessible to users from specialized data analysts to policy and decision-makers and the general public.

3. StatCan is investigating such a Register to organize the data needed to compile SEEA EA accounts.
   - It includes a standard spatially-referenced grid covering all of Canada's land, water, and ocean territory, where each grid cell is a Basic Spatial Unit (BSU); each BSU is linked to alternative standard dissemination geographies for easy aggregation, depending on the area of interest; each BSU is also assigned to an ecosystem type.
   - Perhaps this approach can also help other NSO compile the data required for the accounts.

Questions for the London Group

- Do you think this approach is useful and implementable in your organisation?

- Can you imagine reasons NOT to adopt a similar approach?

- Are you aware of a NSO that have adopted such (or similar) an approach?

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