Urban Accounts (Ecosystem Accounts for Urban Areas): A discussion

François Soulard

Statistics Canada

LONDON GROUP ON ENVIRONMENTAL ACCOUNTING

24th MEETING
1-4 OCTOBER 2018

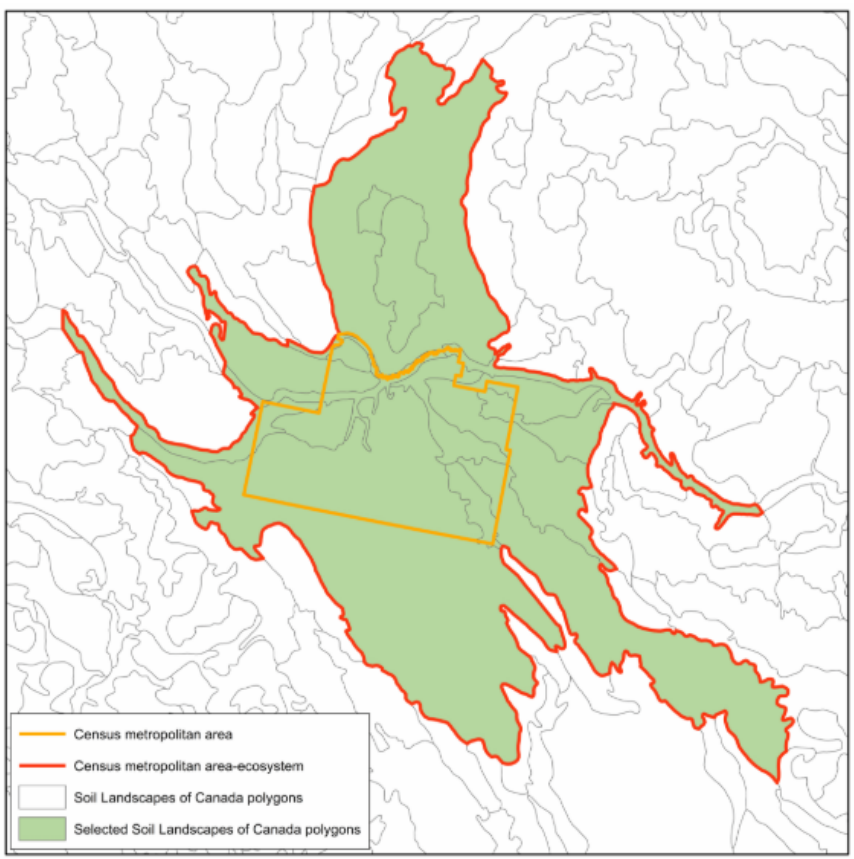
Central Statistics Office of Ireland

SEEA 2017 Technical recommendations

3.30. There have also been, as yet, relatively few projects focusing on accounts for urban ecosystems. Tentatively, it seems appropriate that in the case of urban ecosystems various ecosystem types can also be differentiated based on the combination of cover, use and the services they supply. This may include, for instance, urban parks within city boundaries, different types of parks nearby cities but outside residential zones, and perhaps even specific areas such as rivers flowing in urban areas, river beds, canals or cemeteries.

Discussion paper 1.4: Delineation of urban areas for ecosystem accounting

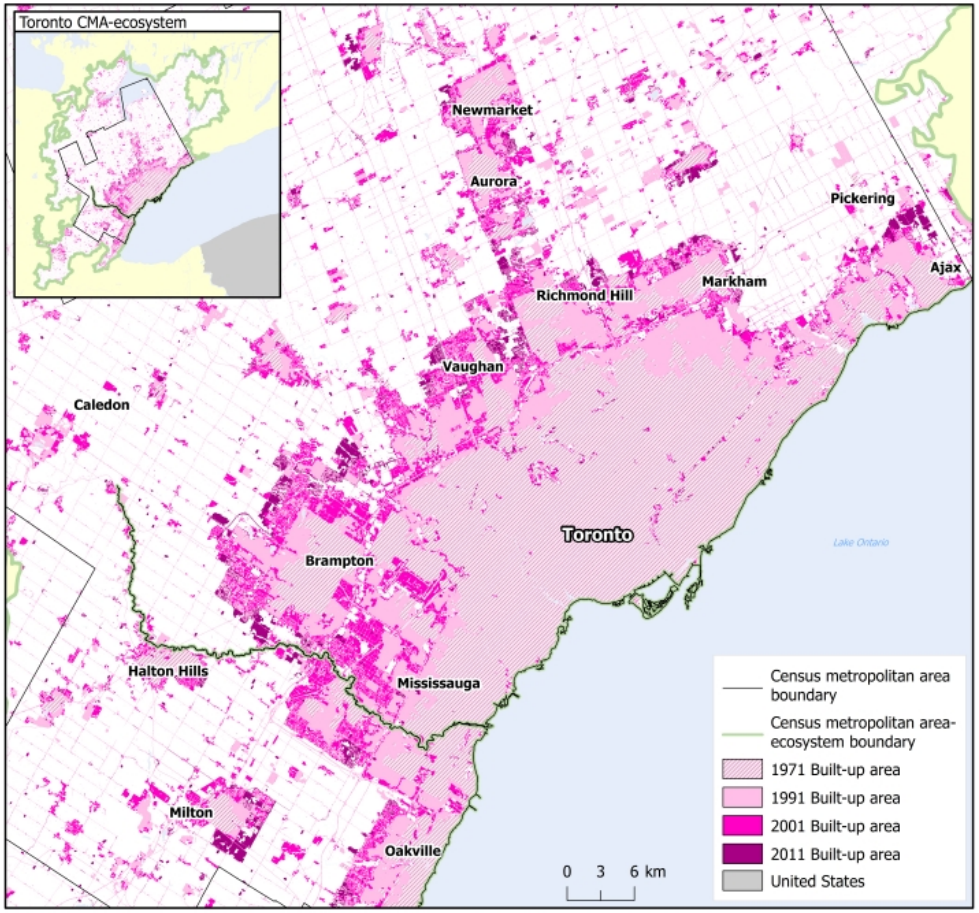
Creating the Census Metropolitan Area – Ecosystem



Note: The census metropolitan area (CMA) layer was overlaid onto the Soil Landscapes of Canada (SLC) polygons. SLC polygons that intersect or that were contained within the CMA boundary were selected. Selected SLC polygons were extracted to create the CMA-ecosystem (CMA-E) boundary.

Source: Statistics Canada, Environment, Energy, and Transportation Statistics Division, 2016.

Toronto CMA-E Built-up area 1971 to 2011



Data sources

Census

Ecological land classification

Land use product (Landsat 30m)

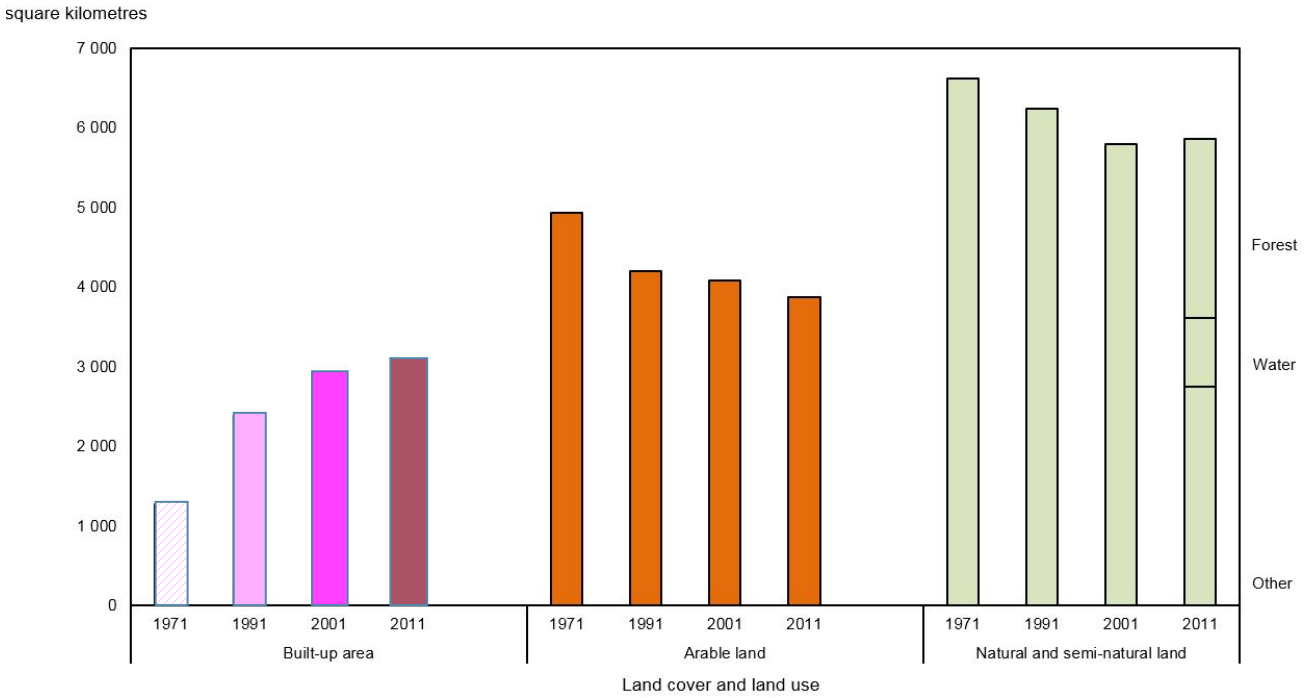
Census of agriculture

Residual (+ Landsat 30m)

	CMA [1]	CMA-E [2], [3]	1971					
			CMA		CMA-E [3]			
	Total land area	Total land area	Total built-up area [4]		Total built-up area [4]		Arable [5]	Natural and semi-natural [6]
			Settled	Roads	Settled	Roads		
	square kilometres							
Abbotsford–Mission	605	5,313	11	7	37	23	470	4,783
Barrie	898	3,766	14	10	54	40	1,310	2,363
Brantford	1,073	4,196	24	20	137	96	2,363	1,600
Calgary	5,108	12,444	158	116	162	170	6,172	5,940
Edmonton	9,427	19,900	185	157	189	225	10,501	8,984
Greater Sudbury	3,411	35,921	60	26	86	65	353	35,416
Guelph	594	2,599	22	13	68	44	1,289	1,198

Official Applications in Canada
Metropolitan Landscapes

Land cover and land use, Toronto census metropolitan area-ecosystem (CMA-E), 1971, 1991, 2001 and 2011



HAE 2015 : The changing landscape of CMAs

Ecosystem asset account, Toronto census metropolitan area-ecosystem , 1971 to 2011

	Total built-up area[1]		Arable[2]	Natural and semi-natural[3]
	Settled	Roads		
	square kilometres			
Opening stock 1971	850	418	4 930	6 615
Land lost to settled area	...	...	-961	-448
Balance of change[4]	1 409	403	-102	-300
Closing stock 2011	2 260	821	3 867	5 866

SEEA EEA, SDGs and Open Data

Make cities and human settlements inclusive, safe, resilient and sustainable

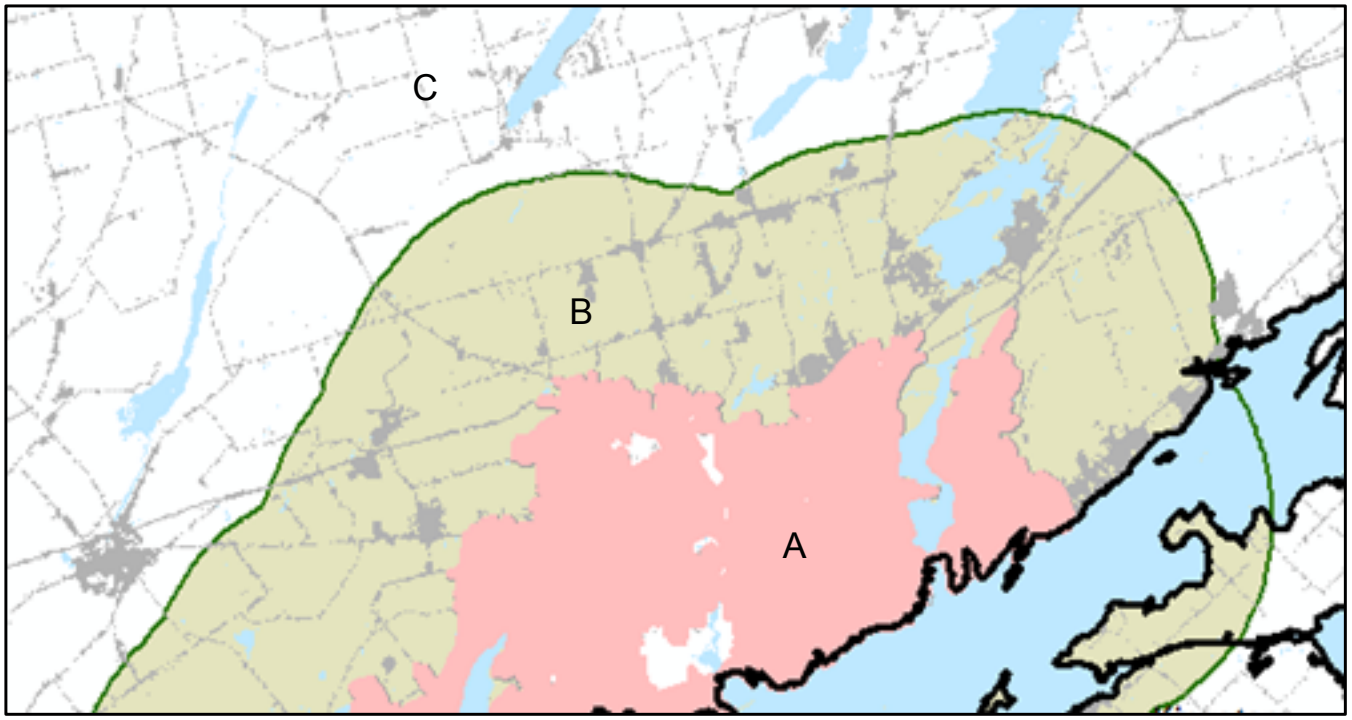
Targets	Indicators	Unit of measure	Reference period	Latest data	Previous period	Data for previous period	Data provider	Source
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	11.3.1 Ratio of land consumption rate to population growth rate	Percentage	2001-2011	0.47		1.36	Statistics Canada 2	Human Activity and the Environment, The changing landscape of Canadian metropolitan areas
	11.3.2 Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically	Indicator under development						

Examining the city proper, peri-urban and rural areas separately

A. continuously settled area or city proper (red area)

B. peri-urban, suburban buffer area(s) around the city proper (green area)

C. rural or remote areas



Integrating ecosystem extent and condition accounts in an urban context:

Conceptual issues and illustrations from the URBAN EEA project

Research area no 1: Spatial units

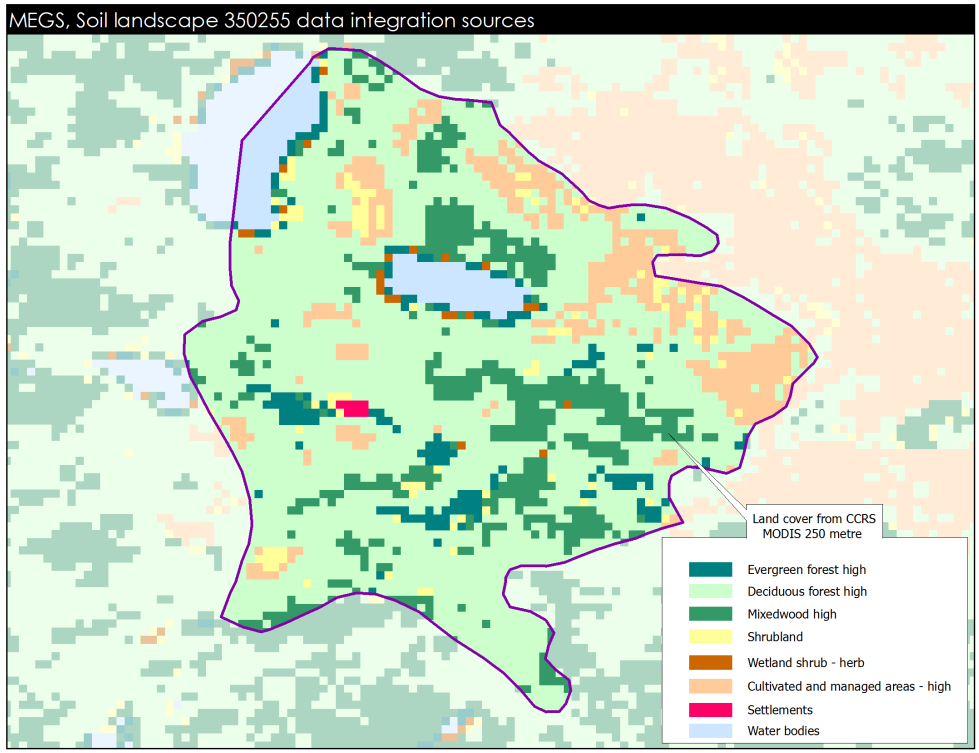
London Group, Dublin, 1- 4 October 2018

Per Arild Garnåsjordet (SSB/NINA), Margrete Steinnes (SSB), David N. Barton (NINA), Zofie Cimburova (NINA), Megan Nowell (NINA), Iulie Aslaksen (SSB)

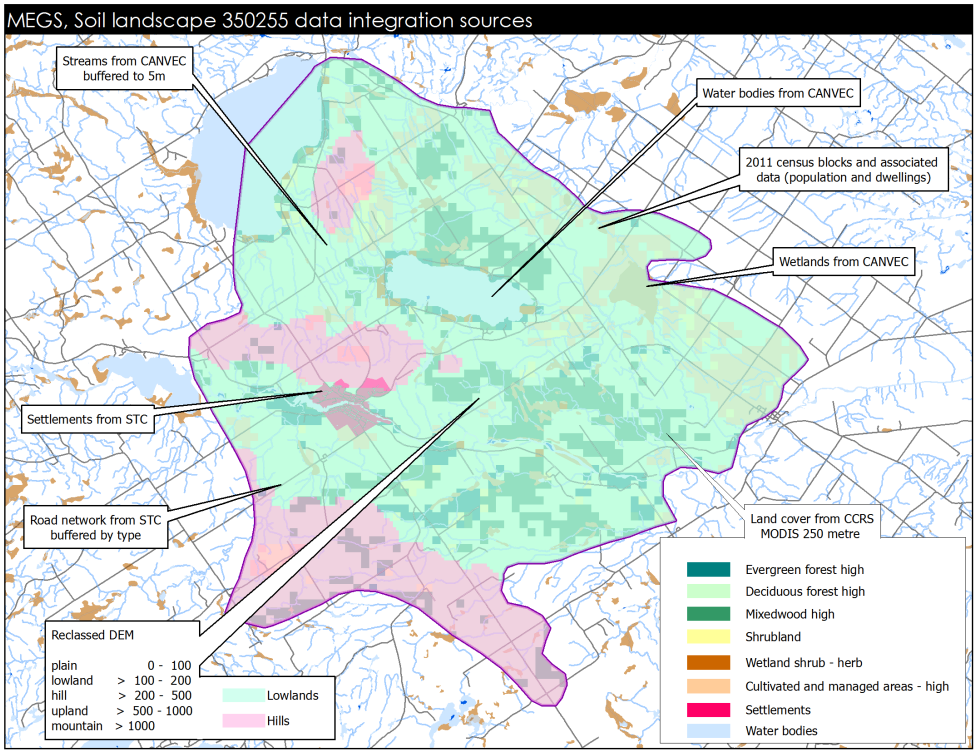
Conclusions and research agenda

- A fixed spatial unit in ecosystem accounting seems to be unnecessary, and data should as a rule be kept in their original (geo-referenced) form in order to be used in a flexible way, depending on purpose.
- There is need for flexible use of spatial units in order to link extent and condition variables, by introducing an element of condition parameters in the extent account.
- In urban areas an extent account based on cadastral units, showing land use and land cover, and adding on information from detailed satellite data to grasp the blue-green mosaic structure, seems to offer a large potential. The crucial question is if it will give us better models for ecosystem services like recreation, pollination and biodiversity.
- Another challenge is to compile yearly land use accounts (you know, most of the accounts we have seen so far have had a span of 10 years to make changes visible and valid). The idea in our research project URBAN-EEA is to use the high accuracy of map and administrative data, combined with satellite data, which are much more updated, to detect and correct lags.
- Then it is possible to create algorithms of automatic correction and classification of satellite data based upon defining categories of change patterns on aerial photos.

Experimental Applications in Canada



Experimental Applications in Canada

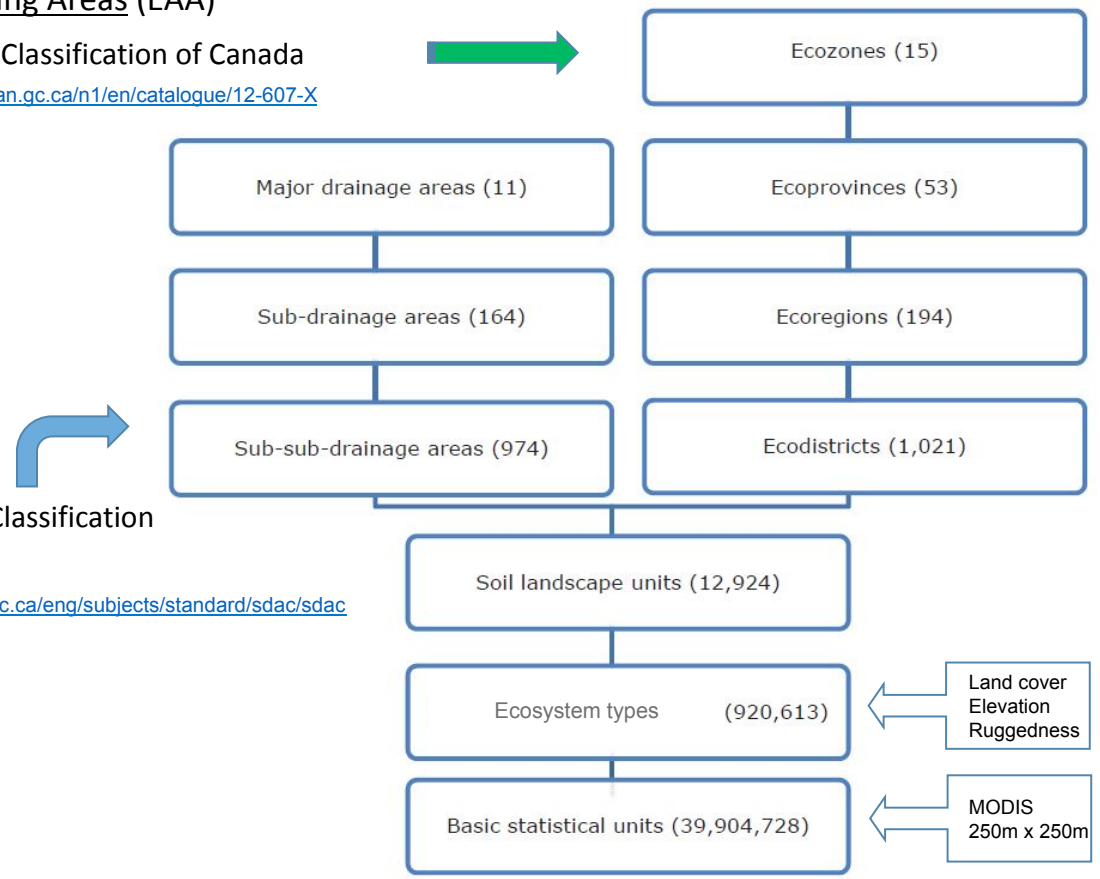


~~Experimental~~ Applications in Canada

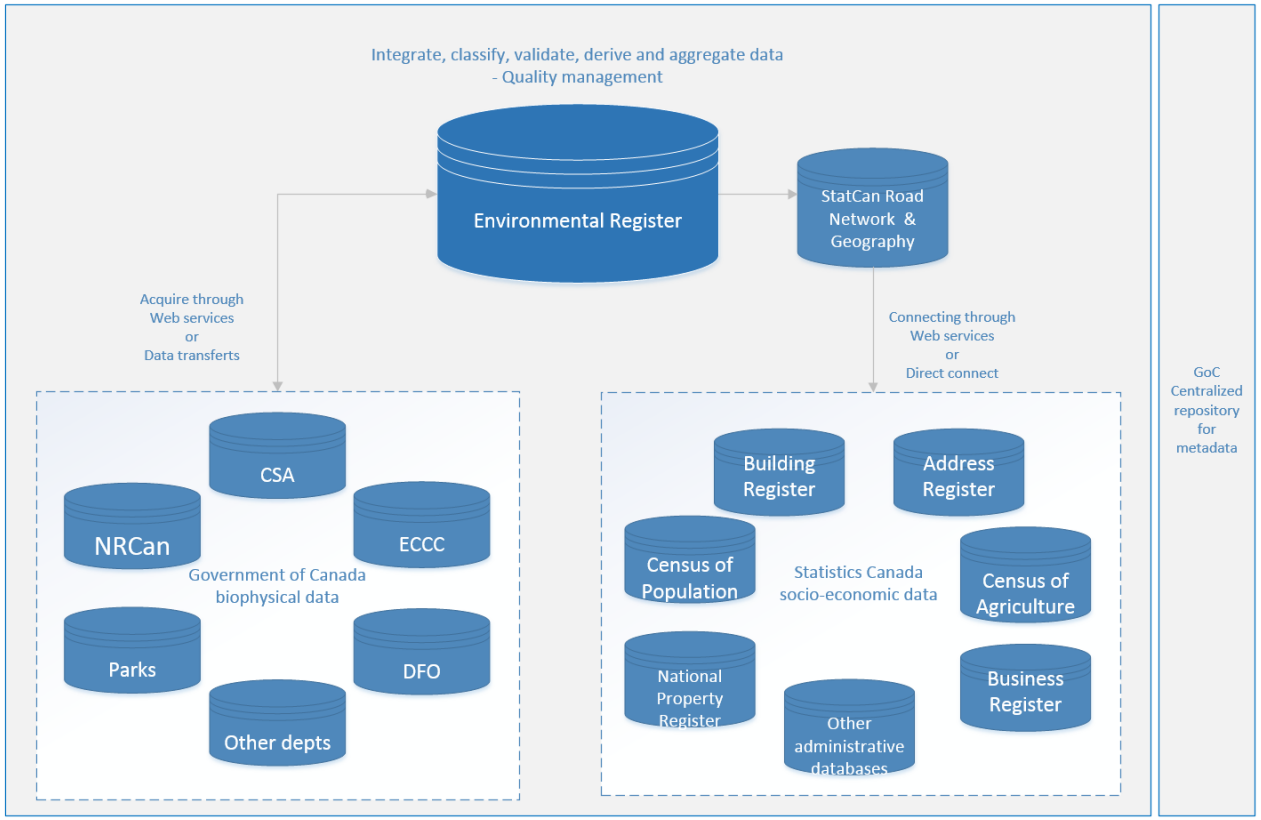
Ecosystem Accounting Areas (EAA)

1. Ecological Land Classification of Canada
   https://www150.statcan.gc.ca/n1/en/catalogue/12-607-X

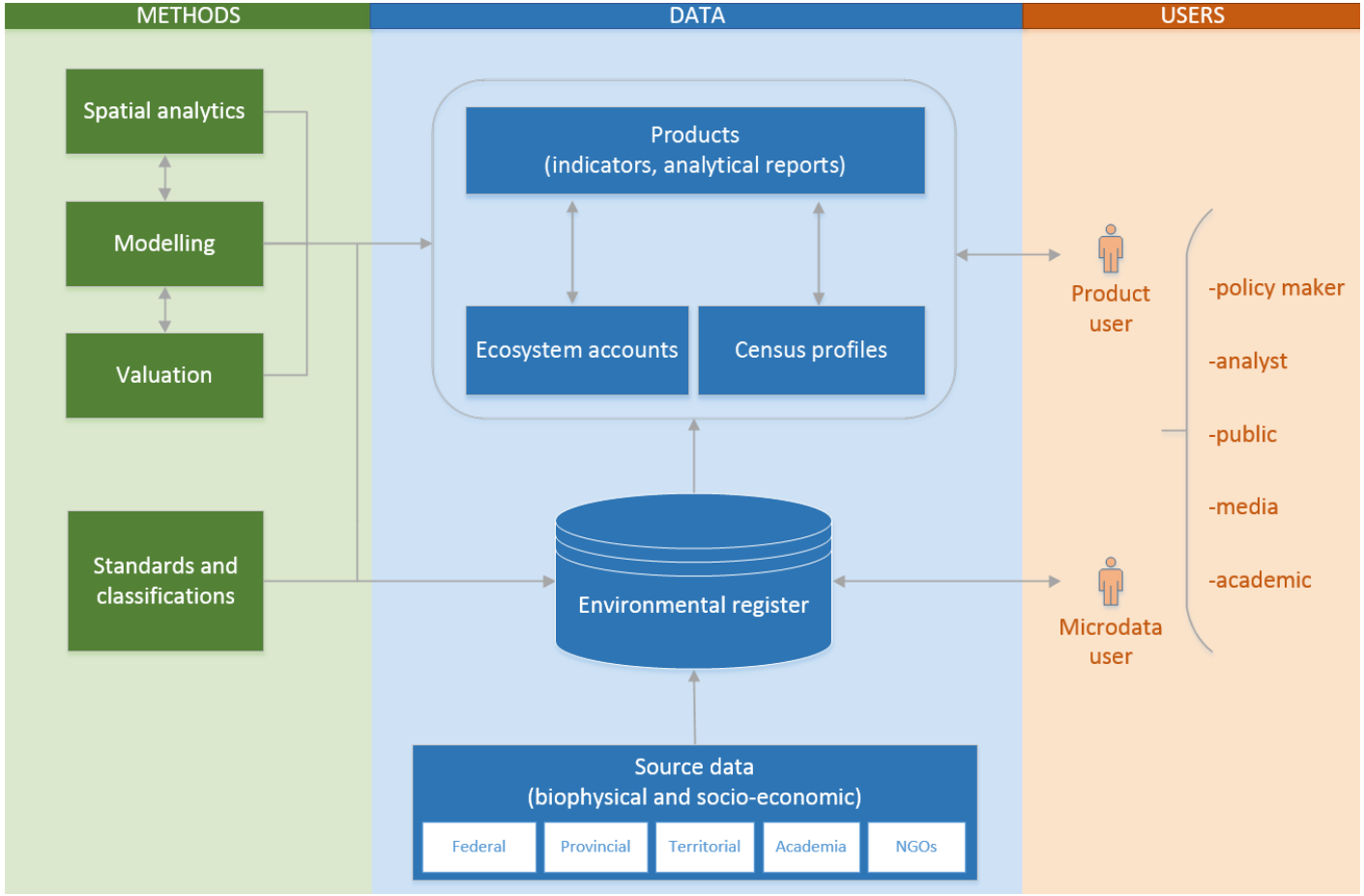
2. Drainage Area Classification of Canada
   https://www.statcan.gc.ca/eng/subjects/standard/sdac/sdac



National Spatial Data Infrastructure



National Spatial Data Infrastructure



Conclusions and research agenda

- A fixed spatial unit in ecosystem accounting seems to be unnecessary, and data should as a rule be kept in their original (geo-referenced) form in order to be used in a flexible way, depending on purpose.
- There is need for flexible use of spatial units in order to link extent and condition variables, by introducing an element of condition parameters in the extent account.
- In urban areas an extent account based on cadastral units, showing land use and land cover, and adding on information from detailed satellite data to grasp the blue-green mosaic structure, seems to offer a large potential. The crucial question is if it will give us better models for ecosystem services like recreation, pollination and biodiversity.
- Another challenge is to compile yearly land use accounts (you know, most of the accounts we have seen so far have had a span of 10 years to make changes visible and valid). The idea in our research project URBAN-EEA is to use the high accuracy of map and administrative data, combined with satellite data, which are much more updated, to detect and correct lags.
- Then it is possible to create algorithms of automatic correction and classification of satellite data based upon defining categories of change patterns on aerial photos.

Agence spatiale canadienne | Canadian Space Agency

Government Related Initiatives Program - GRIP
Project Summary

PROJECT TITLE:

Integration of earth observation data with socio-economic information to better measure the climate change resilience of built-up areas in the context of Ecosystem Accounting in Canada ***(EO4EA-Can).***

Federal government organization & division:

Statistics Canada, Economic Statistics Sector, Environment, Energy, and Transportation Statistics Division

Contact information / Project Leader:

Lead: Dr. François Soulard,
Chief, R&D section
Environmental Accounts and Statistics Program

PROJECT OBJECTIVE

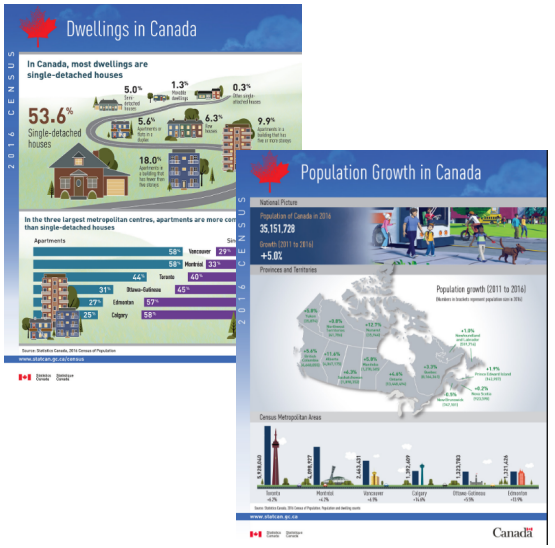
The Earth Observation for Ecosystem Accounting in Canada (EO4EA-Can) project is an extension of existing Statistics Canada activities geared towards the integration and improvement of data products derived from space-borne earth observation (EO) into Canada's national statistical system.

The main objective of this project is to provide better built-up areas delineation and characterization for improving the land use reference layer used for ecosystem accounting.

The sub-objectives of this project are:

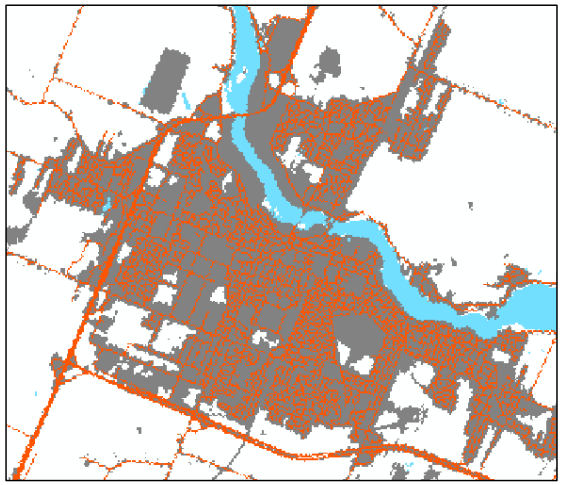
- to expand existing efforts to use EO (SAR and optical) data integrated with socio-economic data to improve the delineation and characterization of built-up areas and impacted ecosystems, over time;
- based on EO time series, adapt change detection approaches to the Canadian context to identify parameters and patterns of change in built-up areas;
- in conjunction with land use and land tenure data, to explore predictive models of built-up area development for the identification of potential areas of change
- analyze the areas of change, both in terms of expansion and intensification, in the context of climate change resilience and adaptation.

The project aims at integrating the earth observation (radar and optical) data with socio-economic information to better measure the climate change resilience of built-up areas in the context of Ecosystem Accounting in Canada.

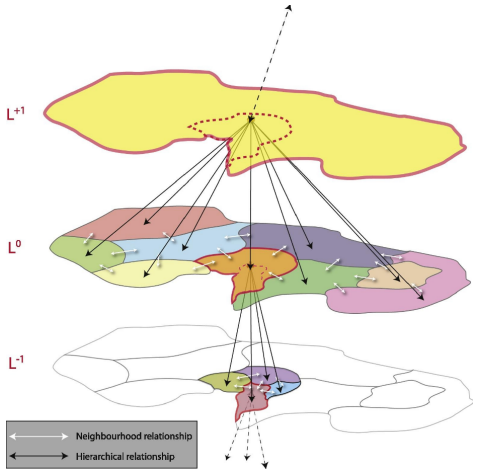


Geographic Object-Based Image Analysis (GEOBIA)

The Geographic Object-Based image analysis will be used to improve the **delineation** and **characterization** of built-up areas using a hierarchical approach



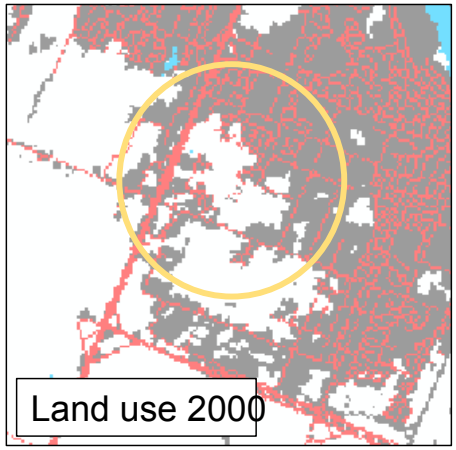
Pixel based approach, land use map 2010 (AAFC - 2015)

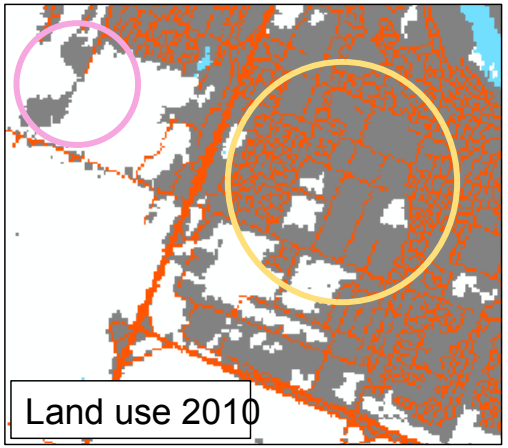


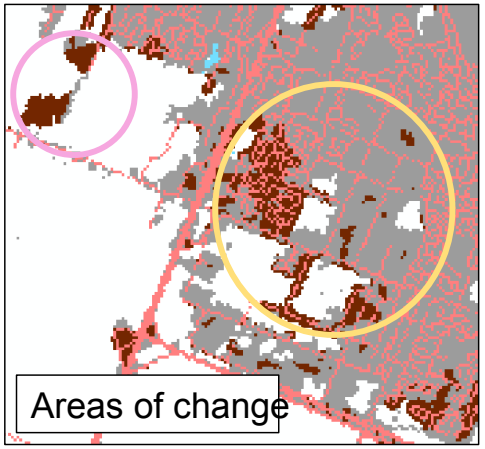
GEOBIA is a 'recent' approach (including theory, methods, and tools) to partition remote sensing imagery into meaningful image-objects, and assess their characteristics through scale. Its primary objective is the generation of geographic information (in GIS-ready format) from which new spatial knowledge or ''geo-intelligence'' can be obtained. Here, geo-intelligence is defined as geospatial content in context (Blaschke T., et al., 2014).

Pixel based approach for change detection

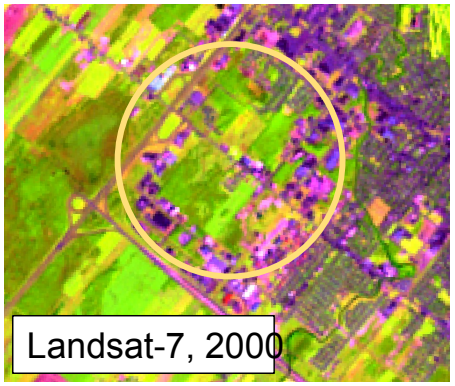
Classification maps

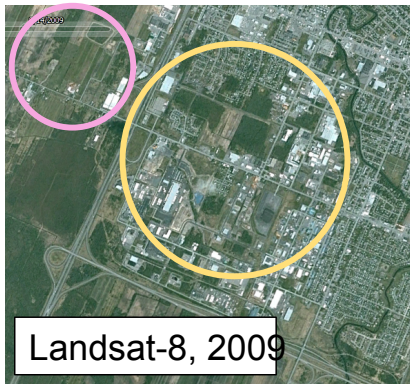


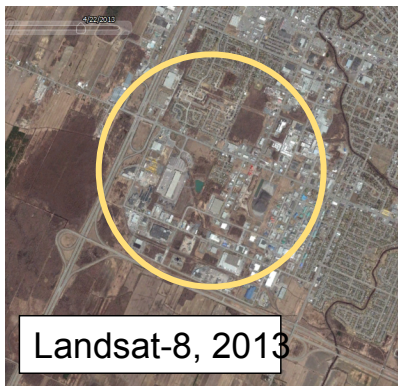




Reference data







Post classification comparison change detection is widely used in remote sensing. The two maps are compared on a pixel by pixel basis. The accuracy of the change detection depends on the accuracy of the two separate classification maps. Every error in the individual date classification map will also be present in the final change detection map. The geometric correction can also introduce error in the results

Conclusions and research agenda

- A fixed spatial unit in ecosystem accounting seems to be unnecessary, and data should as a rule be kept in their original (geo-referenced) form in order to be used in a flexible way, depending on purpose.
- There is need for flexible use of spatial units in order to link extent and condition variables, by introducing an element of condition parameters in the extent account.
- In urban areas an extent account based on cadastral units, showing land use and land cover, and adding on information from detailed satellite data to grasp the blue-green mosaic structure, seems to offer a large potential. The crucial question is if it will give us better models for ecosystem services like recreation, pollination and biodiversity.
- Another challenge is to compile yearly land use accounts (you know, most of the accounts we have seen so far have had a span of 10 years to make changes visible and valid). The idea in our research project URBAN-EEA is to use the high accuracy of map and administrative data, combined with satellite data, which are much more updated, to detect and correct lags.
- Then it is possible to create algorithms of automatic correction and classification of satellite data based upon defining categories of change patterns on aerial photos.

ECONOMIC COMMISSION FOR EUROPE
CONFERENCE OF EUROPEAN STATISTICIANS

ECE/CES/BUR/2018/OCT/3
27 September 2017

Meeting of the 2017/2018 Bureau
Geneva (Switzerland), 14-15 October 2018

For discussion and recommendations

Item 2 (b) of the Provisional Agenda

IN-DEPTH REVIEW OF SATELLITE IMAGERY / EARTH OBSERVATION TECHNOLOGY IN OFFICIAL STATISTICS

Prepared by Canada, Mexico, Austria and Eurostat

This in-depth review examines the use of satellite imagery and earth observation technology in official statistics. ***The Bureau is invited to discuss the issues and challenges in this area and consider how to address them.***

- U.N. Global Working Group on Big Data for Official Statistics
  - Task Team on Satellite Images and Geospatial Data
    - Task Force on Spatial Extent and Quality of (water related) Ecosystems
      - AI for Humanitarian_Project Scoping - Land Cover

Recreation services from engagement with urban nature - illustrating some methodological challenges for ecosystem accounting

David N. Barton,
Norwegian Institute for Nature Research (NINA)

LONDON GROUP ON ENVIRONMENTAL ACCOUNTING
23rd MEETING 1-4 OCTOBER 2018 Central Statistics Office of Ireland
Session D. METHODOLOGICAL WORK SEEA Experimental ecosystem accounting revisions and applications 21. Urban accounts
Tuesday, 2 October 2018

- One of my difficulties with urban ecosystem is that few of the assets are non-SNA in densely populated areas.

- The granularity of the scale that is discussed is way finer than anything we have looked at so far at STC.
  - We are still trying to identity the real impact of built up expansion on surrounding , and data stream to identify urban environment at proper scale.
  - I.E., few insight

Canadian Government wants to know more

- Department of finance and the CMHC approached me. Wanting to know why there is not more housing supply on the market?
  - Developers are saying the government is protecting too much land
  - Government is saying that developers are sitting on too much land

- Ecosystem accounts could inform this situation, e.g.
  - Net vs gross population density
  - Identify areas that are suitable/not for housing development
  - Potential differentiated market value of development based on urban ecosystems characteristics (Proximity to parks, geographical characteristics)

Other discussion points

1. Does it make sense to focus the accounts on assets within an urban area?
2. What spatial detail do we need in order to understand the nature of the assets?
3. What would be the best spatial units to use?
4. What condition indicators give the best indication of the capacity of the assets to provide services?
5. Which services are most important and how should we best value them?
6. Can hedonic values ever be used directly within this accounting approach?