Forum of Experts in SEEA Experimental Ecosystem Accounting

Session 1: Ecosystem Accounting Units

Advancing the SEEA-EEA Project

United Nations

UNEP

Convention on Biological Diversity

NORWEGIAN MINISTRY OF FOREIGN AFFAIRS

Overview: Spatial units

1. Why spatial units?
2. Criteria for spatial units
3. The SEEA-EEA representation
4. Issues
5. An example
6. Recommendations for testing
7. Recommendations for further research

Why spatial units?

- **Why?**
  - **Units + classifications = structure**

  - Accounting needs **statistical units** about which information is compared and aggregated
    - e.g., business statistics are built on locations, establishments, companies and enterprises
  - Need a common definition of Spatial Units for all accounts (Assets, Condition, Services, Water, Carbon, Biodiversity…)
    - i.e., scale, compile, analyse, compare and report on same spatial units
  - Information is collected on many **spatial levels**
    - Different information available at different levels
    - Needs to be consolidated and compiled

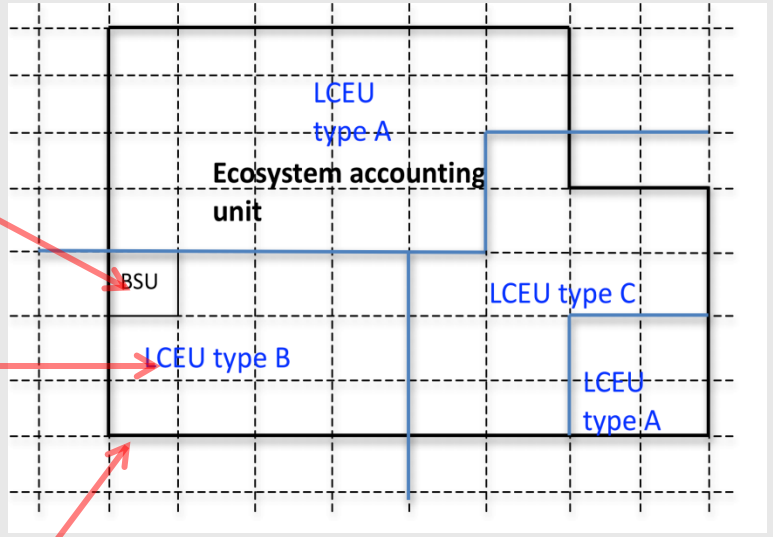
Criteria for spatial units (provisional)

- Available globally & frequently
- Homogenous at some level
  - Represent “optimal units” in terms of patterns
  - With respect to ecosystem services (processes?)
- Represents **all** ecosystem types, including gradients between them (ecotones)
- Hierarchical & scalable
- **MECE**: **M**utually **E**xclusive, **C**ollectively **E**xhaustive
- Time-invariant?

The SEEA-EEA representation

Three levels: hierarchical and mutually exclusive:

1. Basic Spatial Unit **(BSU):** Pixel or grid cell
2. Land Cover Ecosystem Functional Unit **(LCEU):** Homogenous according to criteria (e.g., cover, slope, drainage area, elevation…)
   - Consolidate for tables by LCEU type
3. Ecosystem Accounting Unit **(EAU)**
   - For reporting (e.g., sub-drainage area, administrative area…)



Issues

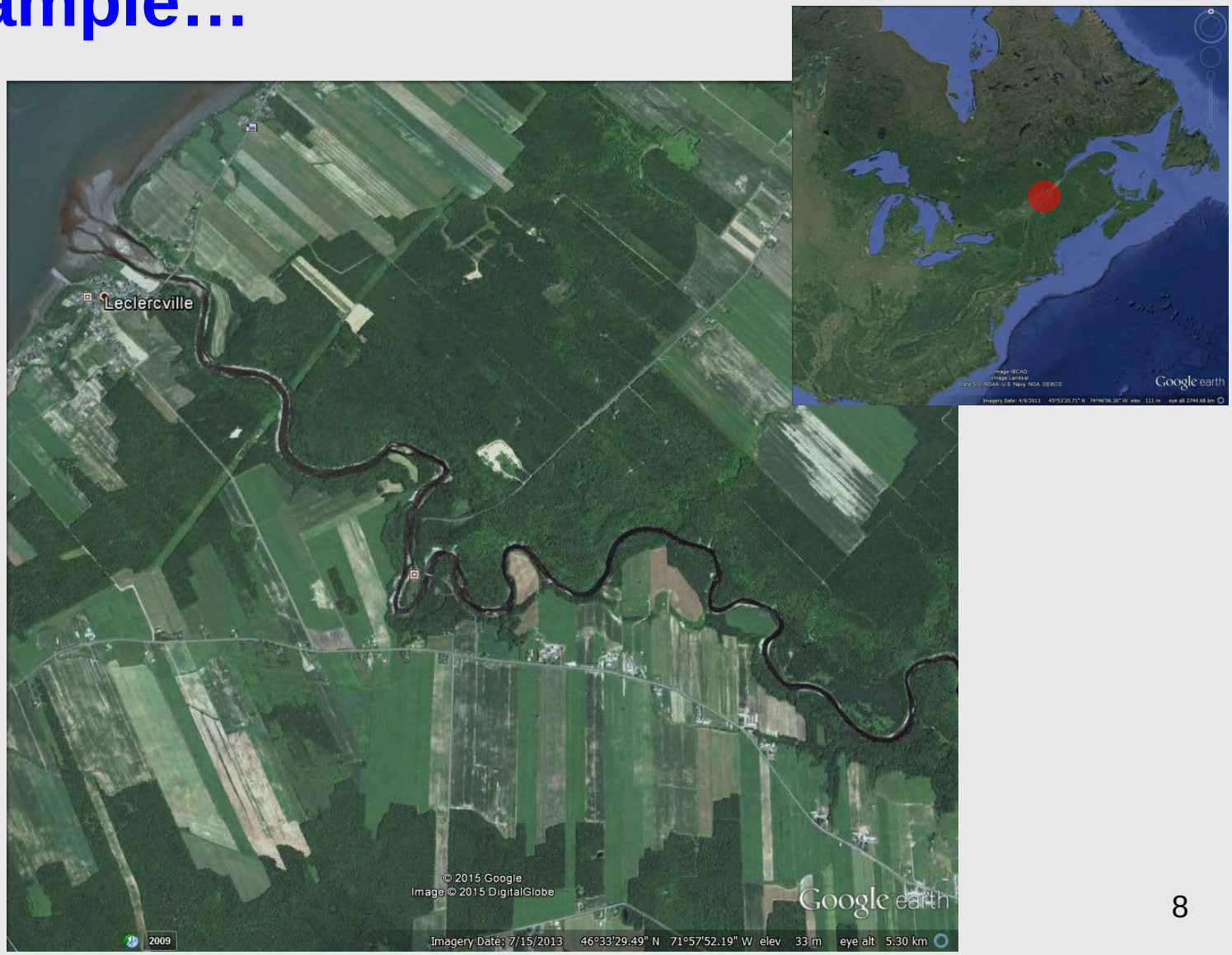
- **Does it represent all ecosystems?**
  - If only land cover:
    1. How to treat freshwater, coastal and marine?
       – Upstream/downstream, benthic vs pelagic
    2. May exclude vertical dimension
       – Wetlands, soil, mountain areas
    3. Not homogenous for conditions: quality, management regime, use, ownership
    4. Excludes connective phenomena:
       – airsheds, migration routes, water networks…
    5. Classification may exclude ecotones

More issues

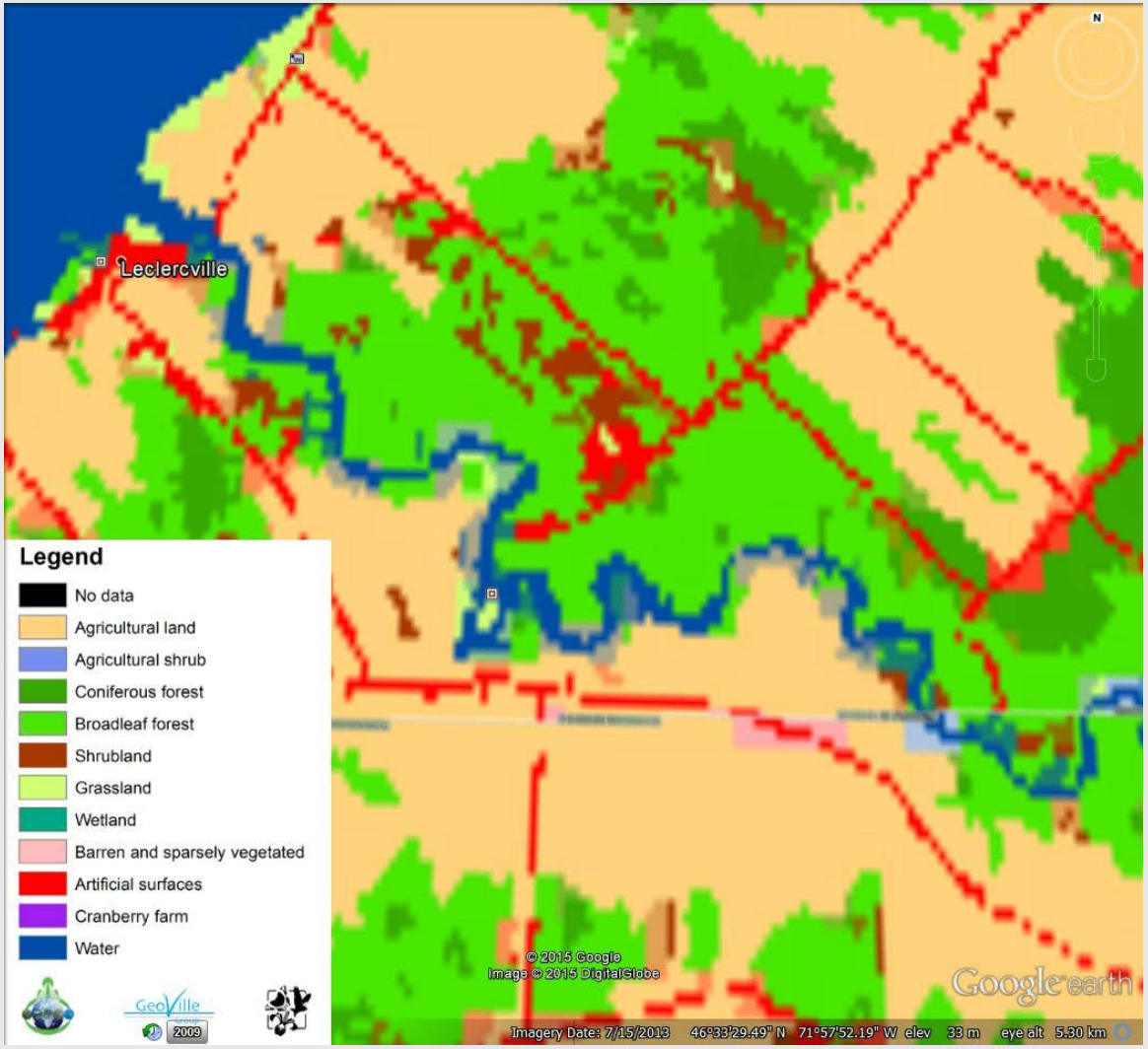
- **Homogenous?**
  6. LCEUs may not represent “optimal” unit in terms of capturing spatial patterns
  7. Large BSUs may hide important patterns
     - “averaging” may introduce unnecessary uncertainty
  8. How to deal with other sources of uncertainty: spatial interpretation?

- If based only on land cover, LCEUs are not homogenous “ecosystems” from an ecological perspective

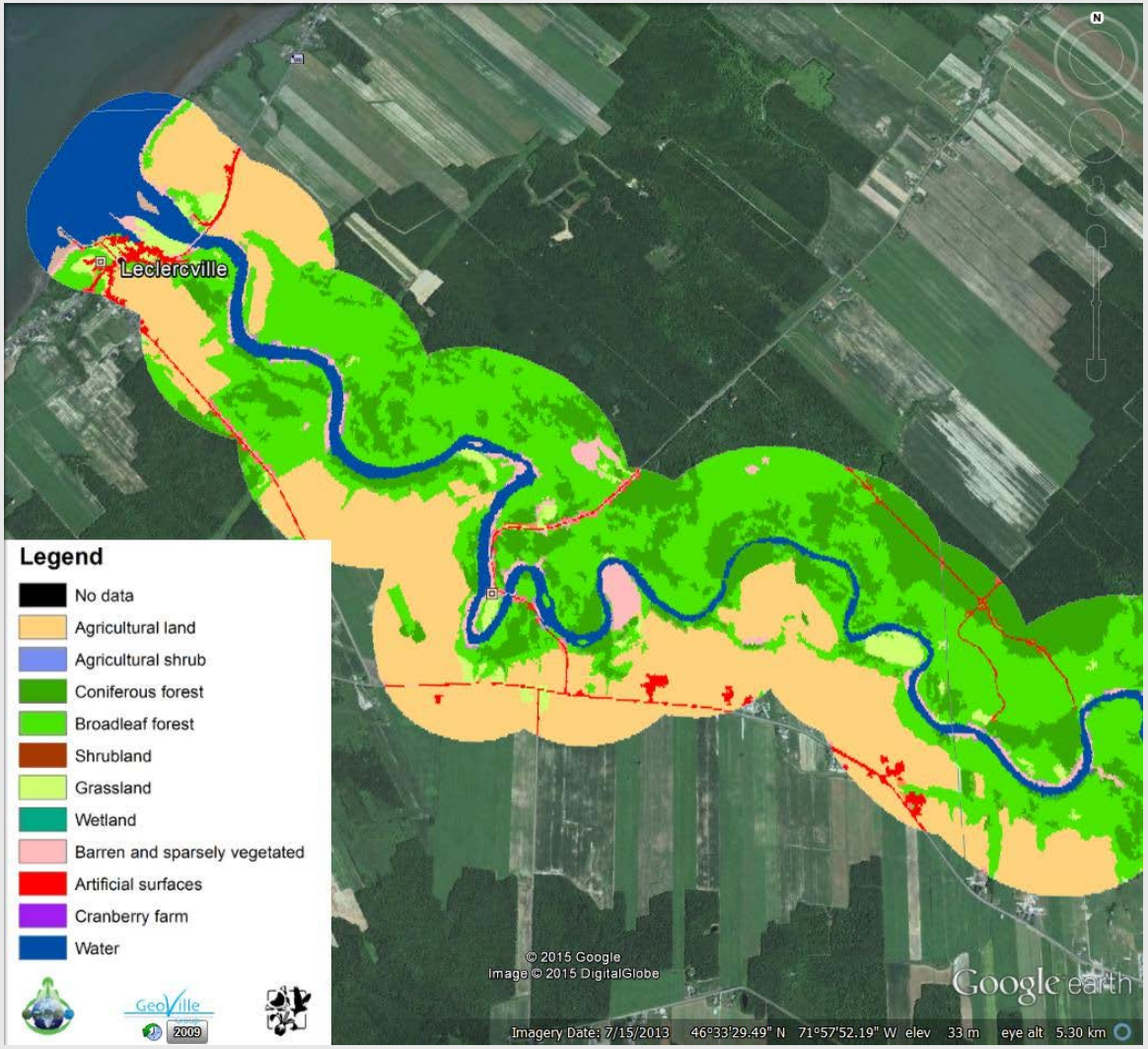
An example…


Leclercville
© 2015 Google
Image © 2015 DigitalGlobe
Google earth
2009
Imagery Date: 7/15/2013 46°33'29.49" N 71°57'52.19" W elev 33 m eye alt 5.30 km
Google earth

An example…


Leclercville
Legend
No data
Agricultural land
Agricultural shrub
Coniferous forest
Broadleaf forest
Shrubland
Grassland
Wetland
Barren and sparsely vegetated
Artificial surfaces
Cranberry farm
Water
GeoVille
2009
© 2015 Google
Image © 2015 DigitalGlobe
Google earth
Imagery Date: 7/15/2013 46°33'29.49" N 71°57'52.19" W elev 33 m eye alt 5.30 km

An example…


Leclercville
Legend
No data
Agricultural land
Agricultural shrub
Coniferous forest
Broadleaf forest
Shrubland
Grassland
Wetland
Barren and sparsely vegetated
Artificial surfaces
Cranberry farm
Water
GeoVille
2009
© 2015 Google
Image © 2015 DigitalGlobe
Google earth
Imagery Date: 7/15/2013 46°33'29.49" N 71°57'52.19" W elev 33 m eye alt 5.30 km

Recommendations for testing

- Use multiple criteria to delineate LCEUs
  - e.g., land use, ownership, hydrology, infrastructure networks, topography, protected areas, species habitats
  - e.g., existing ecological classifications
- Test other “intermediate” spatial units:
  - e.g., landscape, viewscape, river units, coastal and marine units
- Maintain data at the appropriate scale rather than transforming to one scale
  - e.g., as above → scale for specific analysis
- Test effects of BSU size
  - e.g., compare interpretation and results of 30m vs 1km
- Test land cover data from alternative sources
  - e.g., different sensors & seasons, recent aerial photography, ground truthing

Recommendations for testing

- Link spatial levels with appropriate information, e.g.,

Table 1 Proposed framework for linking data and analytical output with spatial level

Spatial scale	Data	Type of analysis
BSU	Land cover, location	Land cover change
LCEU	Land use, soil type, slope, elevation, location within catchment, species abundance, biomass	Local service production, local service-beneficiary linkages
Landscape	Barriers, habitats, ecological interactions, beneficiaries, micro-climate, local drivers of change (e.g., population, industry), visitor rates, streamflow, erosion rates	Fragmentation, heterogeneity, inter-ecosystem flows, biodiversity
Drainage area	Freshwater availability, recharge rates	Water-based phenomena such as flow of water, pollutants and nutrients.
EAU	Management regime, environmental activities (expenditures, management), beneficiaries	Aggregate of all of the above.
National	Socio-economic drivers, beneficiaries	Trends in all of the above; national beneficiaries
Global	Climate, socio-economic drivers, beneficiaries	Global trends in all of the above; global beneficiaries;

Recommendations for testing

- Report sources of error in spatial data
  - Ground-truthing to minimize interpretation errors
  - Record uncertainty in underlying data
- Assess how spatial units, scaling and aggregation are treated in spatial ecosystem services models

Recommendations for research

- Develop coherent approaches for treatment of:
  - freshwater, coastal, marine (benthic, pelagic) ecosystems
  - connective phenomena (airsheds, hydrological networks, disjoint habitats)
  - uncertainty in land cover interpretation
- Develop link between soil classification and ecosystem condition and capacity
- Research on “optimal” spatial units for ecosystem accounting that meet the criteria suggested (service providing units?)

Conclusions

- The existing approach (BSU, LCEU, EAU) is a pragmatic starting point **if only land cover data are available**
- Meets many criteria:
  - ✓ Availability
  - × Homogeneity
  - × Representativeness
  - ✓ Hierarchical & scalability
  - ✓ **MECE**
  - × Time-invariance

- **Testing can work around some of the issues, but research can develop better solutions…**

Suggestions for breakout groups

- Priority issues, criteria, options for testing of Spatial Units in accounts for:

1. **Land/Asset** (delineation criteria, measurement of error)
2. **Water** (freshwater, coastal, marine, wetlands, quality)
3. **Carbon** (including stock, sequestration)
4. **Biodiversity** (indices, species, habitats)
5. **Condition & Capacity** (quality, biophysical)
6. **Services** (provisioning, regulating, cultural)

Acknowledgements

- This project is a collaboration of The United Nations Statistics Division, United Nations Environment Programme and the Secretariat of the Convention on Biological Diversity and is supported by the Government of Norway.

United Nations
UNEP
Convention on Biological Diversity
NORWEGIAN MINISTRY OF FOREIGN AFFAIRS