Big Data & Ecosystem Accounting

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10th Meeting of United Nations Committee of Experts on Environmental-Economic Accounting (UNCEEA)

24-26 June 2015, New York
Outline:

- Big Data for official statistics and ecosystem accounts
- Advancing Natural Capital Accounting through SEEA-EEA:
  - with Generic technical guidance and training materials
  - applications in pilot countries
- Global and continental applications
1. Big Data for official statistics and ecosystem accounts

Pilot areas to explore the use of satellite imagery and geospatial data:

1. Agricultural statistics
2. Land cover and land use statistics
3. Geocoding statistical frame, such as business register and postcode address file
4. Ecosystem accounting
5. Integrated statistical production process
6. Area of environmental statistics, such as biomass, carbon, water, vegetation, soil, etc.
7. Census enumeration areas, business areas, rural/urban localities
8. Transportation statistics, spatial statistics, regional/local statistics
9. Disaster risk management

Each study area may include the following:

Evaluated data sets based on the following criteria:

1. Dataset, type and format
2. Subject/purpose of the satellite
3. Spatial resolution
4. Time series availability
5. Sensor and Satellite
6. Coverage: Global, regional or national?
7. Cost: free or commercial?
2. Advancing SEEA-EEA: generic guidelines for pilot countries

- Generic technical guidance
- Strong on concepts and structure, but yet weaker on methods and data inputs
- Experimentation
- Physical accounts in focus first
2. Advancing SEEA-EEA

Pilot countries:
1. South Africa
2. Mauritius
3. Chile
4. Mexico
5. Indonesia
6. Bhutan
7. Vietnam

Associated countries:
- The Netherlands
- Australia
- Canada
- Brazil
- Colombia
- Costa Rica
- Norway
- Peru
- Philippines
- United Kingdom
- USA

Global applications
Continental applications
2. Defining, classifying and mapping ecosystem units

- Vegetation/habitat/biotope classification methods
- Mapping based on field work (existing inventories) aided by high-resolution remote sensing

Ecosystem Unit = EU
Land cover = LC
3. Mapping ecosystem units (biotopes) in Chile

Early work, Luebert & Pliscoff (2006)

1. Meso-climate (Med. Xeric, - oceanic)
2. Altitude (hills, pre-Andes, Andes, High Andes)
3. Geo-form (peaks, passes, plains, slopes shaded and illuminated)
4. Floristic composition and coverage (24 dominant species)
5. Dominant life forms (7 trees, 12 shrubs, 4 herbs, 1 succulent)

1. Non-vegetated areas (use of NDVI, SAVI)
2. Cultural vegetation (plantations, parks, crops)
3. Natural vegetation (object-based classification of imagery, sampling and fieldwork)

Pilot area: central, Mediterranean Chile

Results: 125 biotopes of natural veg. mapped (22 235 ha)

Mapping done at two levels:
- formations (coarse 1:100000, MMU 25 ha) equivalent ERA
- and biotopes (fine 1:25000, MMU 1.6 ha) equivalent to an EU
Vegetation Map of South Africa, Lesotho and Swaziland
2005

Vegetation units in South Africa
~440 vegetation types

Distribution of potential vegetation predicted by environmental variables
Mapping Ecological Vegetation Classes in Victoria (Australia)

- Developed by Department of Environment and Primary Industries, Victoria
- Mapped by ground work of species inventories and Landsat imagery

<table>
<thead>
<tr>
<th>EVC Group</th>
<th>Artificial surfaces (including urban and</th>
<th>2 Herbaceous crops</th>
<th>3 Woody crops</th>
<th>4 Multiple or layered crops</th>
<th>5 Grassland</th>
<th>6 Tree-covered areas</th>
<th>7 Mangroves</th>
<th>8 Shrub-covered areas</th>
<th>9 Shrub-dominated vegetation, herbaceous vegetation, shrubs and or</th>
<th>10 Sparsely natural vegetated areas</th>
<th>11 Terrestrial barren land</th>
<th>12 Permanent snow and glaciers</th>
<th>13 Inland water bodies</th>
<th>14 Coastal water bodies and intertidal areas</th>
<th>TOTALS</th>
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<tbody>
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System of Environmental-Economic Accounting

- 3,923 ELUs Mapped
- 250 m Spatial Resolution

6. Global mapping of Ecological land units
ESRI/USGS work (Roger Sayre 2015)

Bioclimatic maps showing distribution of bioclimatic zones across different continents.

Land Cover maps illustrating the distribution of vegetation types on a continental scale.
## 7. Mapping ecosystem carbon accounts in EU

<table>
<thead>
<tr>
<th>Carbon Accounting items</th>
<th>Data sources</th>
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<tbody>
<tr>
<td><strong>Opening Stocks</strong></td>
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<tr>
<td>1. Soil organic carbon (SOC)</td>
<td>JRC map of SOC (Hiederer and Köchy, 2012), global at 1km, 30 cm and 1m depth; EEA estimate of SOC, 30cm</td>
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<td>2. Biomass (TCB)</td>
<td>Downscaled forest biomass by EEA</td>
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<td>Upscaled biomass for non-forest biomass by EEA</td>
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<td><strong>Fluxes and transfers</strong></td>
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<td>3. Primary production (GPP)</td>
<td>Downscaled NASA-CASA NPP (from 8km to 1km), converted to GPP by adding autotrophic respiration from MODIS (Running et al.)</td>
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<tr>
<td>4. Carbon release / respiration (TER)</td>
<td>Downscaled NASA-CASA Soil respiration (from 8km to 1km), converted to TER by adding autotrophic respiration from MODIS (Running et al.)</td>
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<tr>
<td>5. Human use of primary production (TPPU)</td>
<td>Downscaled regional statistics on crops (EUROSTAT), timber (EFISCEN, National FI and EFIMED) and grazing livestock, using land-cover and vegetation indices</td>
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<tr>
<td>6. Carbon imports (TCR)</td>
<td>Downscaled deposition of dry sludge and manure (from livestock distribution)</td>
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<td><strong>Balances</strong></td>
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<tr>
<td>7. NEP, Ecosystem carbon balance (NECB)</td>
<td>NEP estimated from GPP and TER, NECB estimated by aggregating all flows</td>
</tr>
</tbody>
</table>
Balancing estimates

The two basic balancing items are designed to summarize ‘vertical’ and ‘horizontal’ carbon transfers.

Net ecosystem production = Gross Primary Production – Terrestrial Ecosystem Respiration

Balance of lateral imports and exports = Carbon returns – carbon ‘uses’
Estimation of NECB – Sinks and sources!

The maps show a decade average, with areas in green indicating prevailing sink (most of Europe) and in red – prevailing source functions (e.g. parts of North West Europe, Po valley in Italy, and spots of forest-burned areas of Portugal).

Statistics can be extracted on the carbon storage and sequestration at various scales and units, for example countries, NUTS, protected areas etc.
7. Concluding remarks

- Strong movement to expand from land-cover to stronger ecological foundations
- Scale
  - Work is being done at many scales
  - Challenge is linking classifications across scales and geographical domains
- Common methods for mapping ecosystem units are emerging
- Accounting criteria useful for improving consistency, comparability and methodological standardization
- Challenges related to estimating error in both spatial and tabulated data
- Sinks and sources
  - Spatial link to supply and use accounts
Thank You!

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