From FOREST LANDSCAPE TOTAL INCOME to ECOSYSTEM ENVIRONMENTAL INCOME

RECAMAN project in Andalusia, Spain

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Organized by the United Nations Statistics Division (UNSD)
Long Island, New York
18-20 June 2018
RECAMAN Project

Environmental income accounting framework

✓ Forest landscape environmental income is the nature contribution to total income:

\[ TI = LC + CI_m + EI \]

✓ We estimate EI as the aggregated value of ecosystem system services and the change in the environmental net worth:

\[ EI = ES + CN\text{We} \]

✓ CN\text{We} denotes the other components of EI that they are not included in ES and adjustments for avoiding double counting:

\[ CN\text{We} = NGc - ICe + EAg \]

✓ Environmental asset gain:

\[ EAg = EAr - EAwd - NGO \]

✓ Environmental asset revaluation:

\[ EAr = EAc - EAo + EAw - EAe \]
Testing ES and EI in Andalusia forest landscapes, Spain

- Accounting period: 2010.
- Spatial unit: 4.4 million ha.
- Andalusia forest ownership: private: 73% and public: 27%.
- Independent economic management agents: Landowner and government

- Activities/sub-activities, products, EI and ES measured
  - 10 activities: 4 private (7 forestry sub-activities) and 6 public.
  - 14 ecosystem services
  - 16 environmental incomes
  - 18 products

- Andalusia forests landscape total product consumed valued:

Wood, firewood, cork, grass, browse, acorn, pine-nut, chest-nut, forestry conservation services, hunting services, residential service, private amenity service, carbon service, mushroom, water yield, open access recreation, landscape conservation and wildlife threatened biodiversity preservation.
Andalusia mosaic of forest landscapes vegetation covers
## Extended account total capital of Andalusia forest landscapes

**Surface:** 4,386,432 ha  
(2010: €/ha).

<table>
<thead>
<tr>
<th>Activities</th>
<th>Environmental asset</th>
<th>Manufactured capital</th>
<th>Opening total capital</th>
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## Extended capital balance account of Andalusia forest landscapes by types of capital (2010 €/ha)

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<th>1. Opening capital (Co)</th>
<th>2. Capital entries (Ce)</th>
<th>3. Capital withdrawals (Cw)</th>
<th>4. Revaluation (CCr)</th>
<th>5. Closing capital (Cc)</th>
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Extended production account
of Andalusia forest landscapes by activities (2010: €/ha).

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<th>Residential</th>
<th>Private amenity</th>
<th>Recreation</th>
<th>Mushrooms</th>
<th>Carbon</th>
<th>Landscape</th>
<th>Biodiversity</th>
<th>Water</th>
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<td>1.2 Final product (FP) (1.2.1 + 1.2.2)</td>
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<td>4.1</td>
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<td>2.5</td>
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Extended account ecosystem services by activities/sub-activities in Andalusia forest landscapes (2010: €/ha).

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<tr>
<th>Class</th>
<th>Total product consumed (\text{TPc}) (€/ha)</th>
<th>Intermediate consumption (\text{ICmo}) (€/ha)</th>
<th>Labor cost (\text{LCo}) (€/ha)</th>
<th>Immobilized capital user cost (\text{IMCmu}) (€/ha)</th>
<th>Forest landscapes ecosystem services (\text{ES}) (€/ha)</th>
<th>%</th>
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<td>1. Provisioning</td>
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AAS versus rSNA indicators comparisons in Andalusia forest landscapes (2010: €/ha)

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<th>Forestry GVA</th>
<th>Hunting GVA</th>
<th>Residential GVA</th>
<th>Private amenity GVA</th>
<th>Public recreation GVA</th>
<th>Mushrooms GVA</th>
<th>Carbon Landscape GVA</th>
<th>Biodiversity GVA</th>
<th>Water Forest landscapes GVA</th>
<th>Total GVA</th>
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<td>TI</td>
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Comparisons

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<th>GVA</th>
<th>AAS/rSNA</th>
<th>ES</th>
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Andalusian forests total ecosystem services values
Environmental incomes values of Andalusian forests

Abreviations: (A) wood, (B) cork, (C) firewood, (D) nuts, (E) grazing, (F) hunting, (G) private amenity, (H) public recreation, (I) mushrooms, (J) carbon, (K) landscape, (L) biodiversity, (M) water, (N) all products.
OPEN ISSUES FOR DISCUSSION

- AAS follows consistently with total economic value theory the SEEA-EEA concepts of:

  ✓ ecosystem services (ES),
  ✓ environmental asset (EA),
  ✓ environmental asset revaluation (EAr),
  ✓ environmental asset extraordinary destruction (EAwd),
  ✓ environmental asset withdrawals used (EAwu) and
  ✓ natural growth (NG).

- The AAS and SEEA-EEA measurements of the EAr differ on accounting register conventions.

- Total and environmental incomes are consistent SEEA-EEA indicators.
Total and environmental incomes references


Extended accounts: Agroforestry Accounting System (AAS)

✓ Product function: \( P \equiv F(\ IC, \ LC, \ EFA, \ FCm) \)

✓ Total product: \( TP = TPc + GCF \)
  \[ TP = IC + LC + CFC + NOM \]

✓ Net operating margin: \( NOM = NOMm + NOMe \)

✓ Environmental asset:
  \[ EA = WPe + EFAbr + EFAl \]

✓ EA withdrawal used: \( EA_{wu} = WPeu \)

✓ EA revaluation:
  \[ EA_{r} = EAc - EA_{o} + EA_{w} - EA_{e} \]

✓ Total income: \( TI = NC + CNW \)
  \[ TI = NVA + CG = LC + CI{m} + EI \]
Extended accounts: Agroforestry Accounting System (AAS)

✓ Ecosystem services:
  \[ ES = TPc - ICmo - LCo - IMCmouc \]
  \[ ES = WPeu + NOMeo \]

✓ Change of environmental net worth:
  \[ CNWe = NIe + Age \]

✓ Environmental net investment:
  \[ NIe = NG - WPeu - ICee \]

✓ Environmental asset gain:
  \[ EAg = EAr - EAwd - NGO \]
## Extended capital balance account of Andalusia forests landscapes by activities/sub-activities/products (2010: €/ha).

### Class 1. Opening capital (Co)

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<tr>
<th>Activity</th>
<th>Bought (Ceb)</th>
<th>Own (Ceo)</th>
<th>Other (Cot)</th>
<th>Total (Cet)</th>
<th>Used (Cwu)</th>
<th>Destr. (Cwd)</th>
<th>Recl. (Cwrc)</th>
<th>Other (Cwo)</th>
<th>Total (Cw)</th>
<th>Reval. (Cr)</th>
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Extended production account of forestry in Andalusia forest landscapes (2010: €/ha).

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<th>Firewood</th>
<th>Nuts</th>
<th>Grazing</th>
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## Extended production account by activities/sub-activities in Andalusia forest landscapes (2010: €/ha)

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<th>Residential</th>
<th>Private amenity</th>
<th>Public recreation</th>
<th>Mushrooms</th>
<th>Carbon</th>
<th>Landscape</th>
<th>Biodiversity</th>
<th>Water</th>
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Forestry activity AAS versus rSNA indicators comparisons in Andalusia forest landscapes (2010: €/ha)

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Standard revised rSNA*

| | | | | | | | | |
| 1. Final product (FP) | 3.4 | 0.6 | 0.5 | 0.7 | 15.2 | 12.3 | 42.6 | 80.6 |
| 1.1. Consumption (FPcr) | 3.4 | 0.6 | 0.5 | 0.7 | 15.2 | 7.9 | 3.9 | 72.6 |
| 1.2. Capital formation (GPCFm) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.4 | 3.6 | 8.0 |
| 2. Total cost (TC) | 32.6 | 1.3 | 0.2 | 4.3 | 3.3 | 12.3 | 42.5 | 9.6 |
| 2.1. Intermediate consumption (IC) | 4.5 | 0.2 | 0.1 | 0.6 | 0.4 | 4.2 | 12.7 | 22.7 |
| 2.2. Capital consumption (CFC) | 1.2 | 0.0 | 0.0 | 0.1 | 0.7 | 0.0 | 2.7 | 5.0 |
| 2.3. Labor cost (LC) | 26.8 | 1.1 | 0.1 | 3.7 | 2.1 | 0.8 | 2.7 | 68.7 |
| 3. Operating surplus (rNOS) | -29.2 | 4.6 | 0.3 | -3.7 | 11.9 | 0.0 | 0.1 | -15.8 |
| 4. Gross value added (rGVA) | -1.2 | 5.7 | 0.5 | 0.1 | 14.8 | 8.1 | 3.0 | 57.9 |
| 5. Ecosystem services (ESrSNA) | 1.7 | 5.1 | 0.3 | 0.0 | 7.6 | 0.0 | 0.0 | 14.8 |

Government EAF **

| | | | | | | | | |
| 1. Final product (FP) | | | | | | | | 97.8 |
| 2. Intermediate consumption (IC) | | | | | | | | 49.7 |
| 3. Value added (GVA)** | | | | | | | | 4.8 |
| 3.1. Employee labor cost (LCe) | | | | | | | | 4.2 |
| 3.2. Operating surplus (GOS)** | | | | | | | | 0.6 |

Comparisons

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REFERENCES


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