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What is Ecosystem accounting?

Which of the following statements is not true?

A. Ecosystem accounting is a tool to understand and monitor the contributions of economic activity to ecosystems.

B. Ecosystem accounting aims to measure both the contribution of ecosystems to economic production, and to household consumption.

C. Ecosystems only include natural systems. Man-dominated systems such as croplands or intensive pastures are not part of the ecosystems.
Key concepts and links to policy

Monitoring ecosystem state and use

Understanding links ecosystem – economy

Ecosystem change and stakeholders

Designing ecosystem payment mechanisms

Ecosystem accounts

Land cover and use

Ecosystem Condition

Ecosystem service flows

Ecosystem assets (extent, capacity)

Biodiversity

Integration (e.g. supply – use)
The link between assets, services & benefits

Ecosystem asset
- Land cover: shows extent of LCEU
- Ecosystem condition
- Specific components relevant for policy (carbon, water, biodiversity)
- Capacity to generate ecosystem services

Service flow accounts
- Provisioning
- Regulating
- Cultural

Integration of all accounts
- E.g. supply use tables

Produced capital, labour

System of National Accounts

Ecosystem

Ecosystem Service

Benefits

Beneficiary
Ecosystem accounting is spatial!

Ecosystem accounting is spatial
• Maps are used to analyse ecosystem condition, ecosystem service flow, ecosystem asset, and biodiversity

Why?
1. Ecosystems are spatially diverse and spatial information is needed to properly understand ecosystems
2. To facilitate the use of both spatial and non-spatial data, and modelling and spatial interpolation to fill data gaps.
3. To support additional policy uses (e.g. land use planning)
Land cover / key units in Ecosystem Accounts

Ecosystem Accounting Unit (EAU) = a country, province or watershed for which the account is developed

Land cover/eco-system functional unit (LCEU) = e.g. Deciduous forest

BSU = (can be) a pixel

Scale

- Pine forest
- Deciduous forest
Ecosystem condition

- Contains indicators that reflect the condition
- Indicators are specific to countries and ecosystems but may include such aspects as:
- Information is provided in maps and synthesised in tables

Land cover

Physical condition, e.g. soil fertility, water table, (ground)water quality

Biological condition, e.g. crown cover, standing biomass

Processes: e.g. Net Primary Production (of the vegetation)

The presence of species that indicate ecological quality, e.g. species sensitive to pollution
Example condition indicator: NDVI

NOAA normalized difference vegetation index (NDVI)

NDVI reflects biomass growth

Source: NOAA Star

http://www.star.nesdis.noaa.gov/smcd/emb/vci/images/usa_8km/animation_usa_GVIX_NN_G08_C07_SMN_Y2006.gif
Quiz : question 1

Which indicator is not expressing ecosystem condition ?

A. Normalized difference vegetation index (NDVI)
B. Soil fertility (in % organic matter in topsoil)
C. Groundwater depth
D. Timber harvest (in m3/hectare/year)
Ecosystem services (versus benefit)

An ecosystem service is the contribution (by the ecosystem) to a benefit (for people)
Types of ecosystem services

**Provisioning services**
- = goods that can be harvested from, or extracted from ecosystems
- Example: providing fish for fisheries, or providing wood for timber harvest

**Regulating services**
- = the regulation of climate, hydrological, ecological and soil processes
- Example: pollination, carbon sequestration, flood control

**Cultural services**
- = the non-material benefits provided by ecosystems
- Example: recreation, tourism, providing a setting for cultural or religious practices
Ecosystem services and maps

- Wood production
- Hydrological function
- Carbon sequestration
- Forest
- Intensive cropland
- Carbon sequestration
- Extensive pasture
- Crops
- Carbon sequestration
- Livestock production
- Carbon sequestration
- Recreation and tourism
Ecosystem services in an account (example)

- Ecosystem service account developed for Limburg Province, the Netherlands
- 2200 km², 1.1 million inhabitants
- Analysis of 7 ecosystem services

Source: Remme et al., 2014
Quiz : question 2
Which are the main types of ecosystem services distinguished in Ecosystem accounting ?

1. Provisioning, regulating, cultural services
2. Provisioning, regulating, cultural, habitat services
3. Provisioning, regulating, cultural, supporting services
4. Provisioning, regulating, cultural, carrier services
Ecosystem asset

**Ecosystem asset**: spatial areas containing a combination of biotic and abiotic components and other characteristics that function together. Defined by

- **Extent**: size of an ecosystem asset, commonly in terms of spatial area
- **Condition**: characteristics of an ecosystem that are important for quality of the asset and/or supply of ecosystem services
- **Capacity**: Capacity of the ecosystem to generate ecosystem services (under current management)
Ecosystem Asset: key elements

- Extent, condition and the capacity of ecosystems to generate services.
- Can be broken down into individual assets (e.g. land, water, carbon, biodiversity) depending upon policy needs
- Physical (e.g. ha, litres, t) or monetary (e.g. $) terms

<table>
<thead>
<tr>
<th>Potential indicators</th>
<th>Ecosystem service Flow</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provisioning services</td>
<td>Actual harvest</td>
<td>Harvest level that would not deplete the ecosystem</td>
</tr>
<tr>
<td>Regulating service</td>
<td>Use of ecosystem processes</td>
<td>Capacity of ecosystem to regulate processes independent of use</td>
</tr>
<tr>
<td>Cultural service</td>
<td>Number of people involved in an activity</td>
<td>Same</td>
</tr>
</tbody>
</table>
Example of capacity

Capacity for ecosystem services use in Telemark County, Norway

Capacity to support ecosystem use was modelled, jointly with NINA Norway, by M. Schröter for Telemark County, Norway (15,000 km²)
Differences between capacity and flow

Source: Schröter et al., 2014
Integration: e.g. supply-use of ecosystem services

- The users of ecosystem services are identified where ecosystems enter the economy.
- The suppliers of the service are the land owners.
- Only a table can be prepared in view of the complex spatial interactions involved.
- An integration of the SNA with ecosystem assets and services.
Key monetary concepts

Importantly: national accounts, and ecosystem accounts, measure exchange values

Exchange values are the values for which goods and services are exchanged between willing sellers and buyers.

These values do not reflect the surplus that users may receive from using an ecosystem service (i.e. what they would be willing to pay in excess of what they pay)

Hence: the monetary values of flows and assets in the ecosystem accounts reflect ecosystem’s contribution to economic activity NOT to welfare.
Welfare versus exchange values

There may be a major difference between the exchange value and the welfare value of an ecosystem service.

For instance, drinking water may have a low exchange value but it may have a high welfare value (measured in terms of the shadow price of the drinking water).

For measuring changes in welfare, wealth accounting methods are under development (including the Inclusive and Comprehensive wealth accounting approaches).
Values of flows and stocks

Ecosystem service accounts record flows of ecosystem services, in both physical (e.g. ton/ha/year) and monetary (e.g. $/ha/year) units.

Ecosystem asset indicates the stock of ecosystem capital. In monetary terms, for instance, $/ha.

The value of the asset may be determined by the net present value of the expected flow of ecosystem services.

If the flow > capacity, depletion needs to be considered, and the future flow is likely to be lower than the present flow.
Example: values of ecosystem services flows

Timber provisioning service

- High: 58 euro/ha/year
- Low: 12 euro/ha/year

Work ongoing in Central Kalimantan, Indonesia shows the monetary value of 7 ecosystem services measured with an accounting approach at 100m resolution.

Source: Sumarga et al., in press
Exercise (in groups)

Describe for yourself the concepts of
- Ecosystem Condition
- Ecosystem Service
- Ecosystem Capacity

Select a watershed in your country that you know well. For this watershed, select two indicators each for:
- Ecosystem Condition
- Ecosystem Service
- Ecosystem Capacity

Prepare 1 ppt slide / 1 sheet with your indicators for presentation to the group. Reflect on data availability of the indicators.
Synthesis

Ecosystem accounting aims to integrate ecosystem services in a national accounting framework, in both physical and monetary terms.

Ecosystem accounting allows analysing changes in ecosystems in a way that is aligned with the economic statistics (such as GDP) generated by the national accounts.

Ecosystem accounting uses maps and has several other applications, including monitoring sustainability and land use planning.

Ecosystem accounting requires a distinction between flows of ecosystem services and stocks of ecosystem assets.