Ecosystem accounting concepts

Developed by: Lars Hein
Date: February 2015

WAVES

Wealth Accounting and the Valuation of Ecosystem Services
www.wavespartnership.org

WORLD BANK GROUP

Contents

1. Key concepts and units
2. Ecosystem condition
3. Ecosystem services
4. Ecosystem asset
5. Monetary value
6. Exercise (in groups of two)

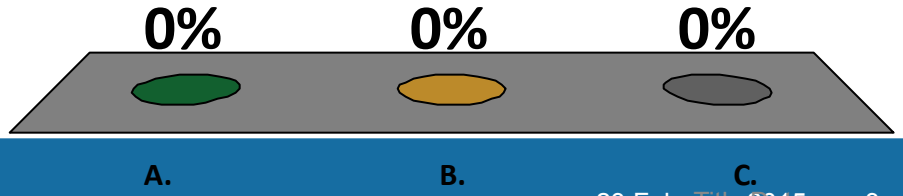
What is Ecosystem accounting?

Which of the following statements is <u>not</u> true?

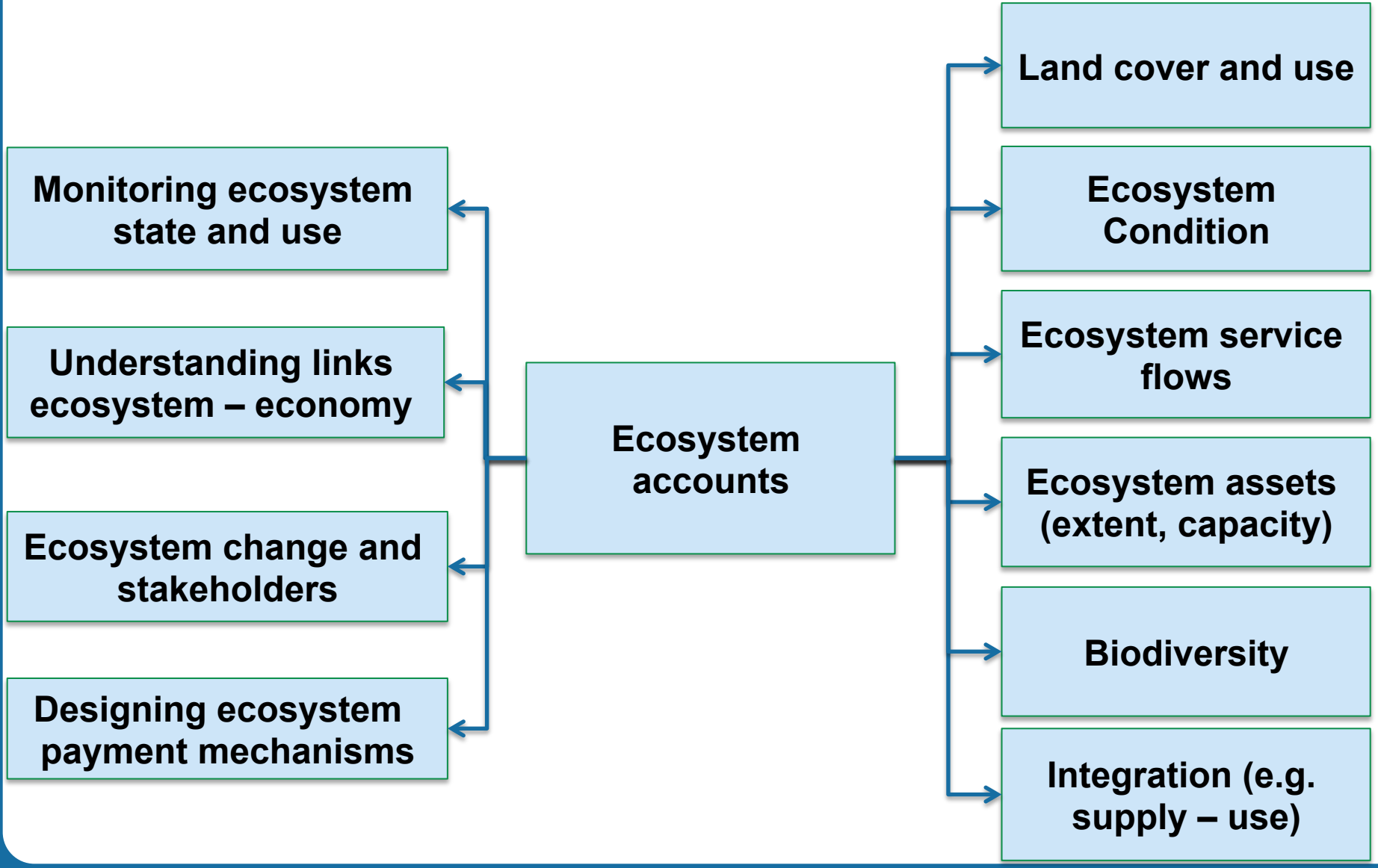
A. Ecosystem accounting is a tool to understand and monitor the contributions of economic activity to ecosystems.

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.



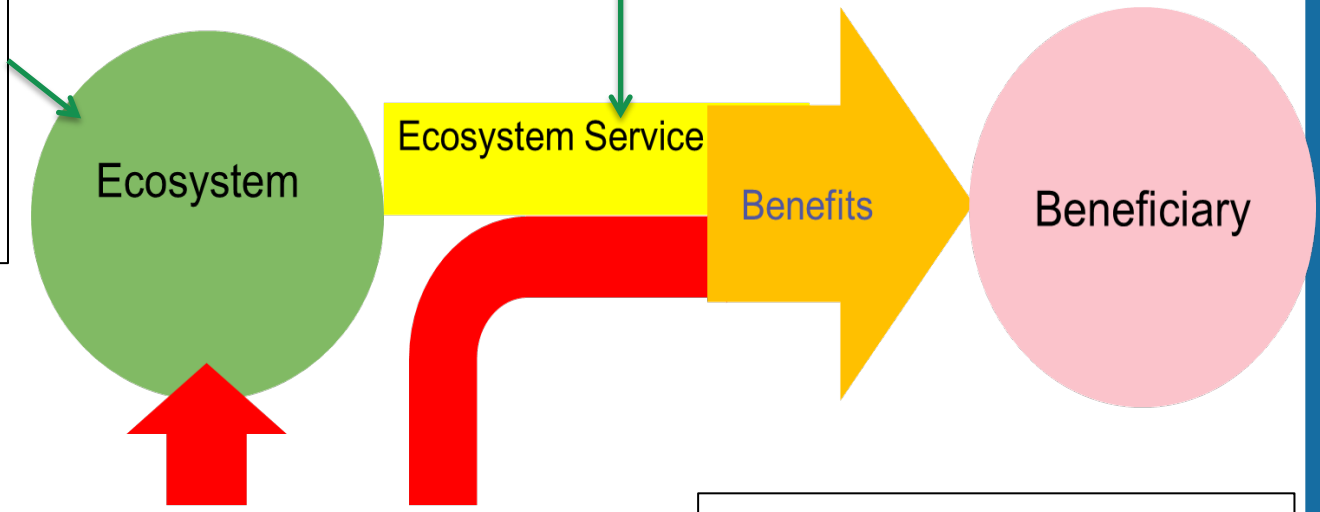
Key concepts and links to policy



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



System of National Accounts

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

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

Scale

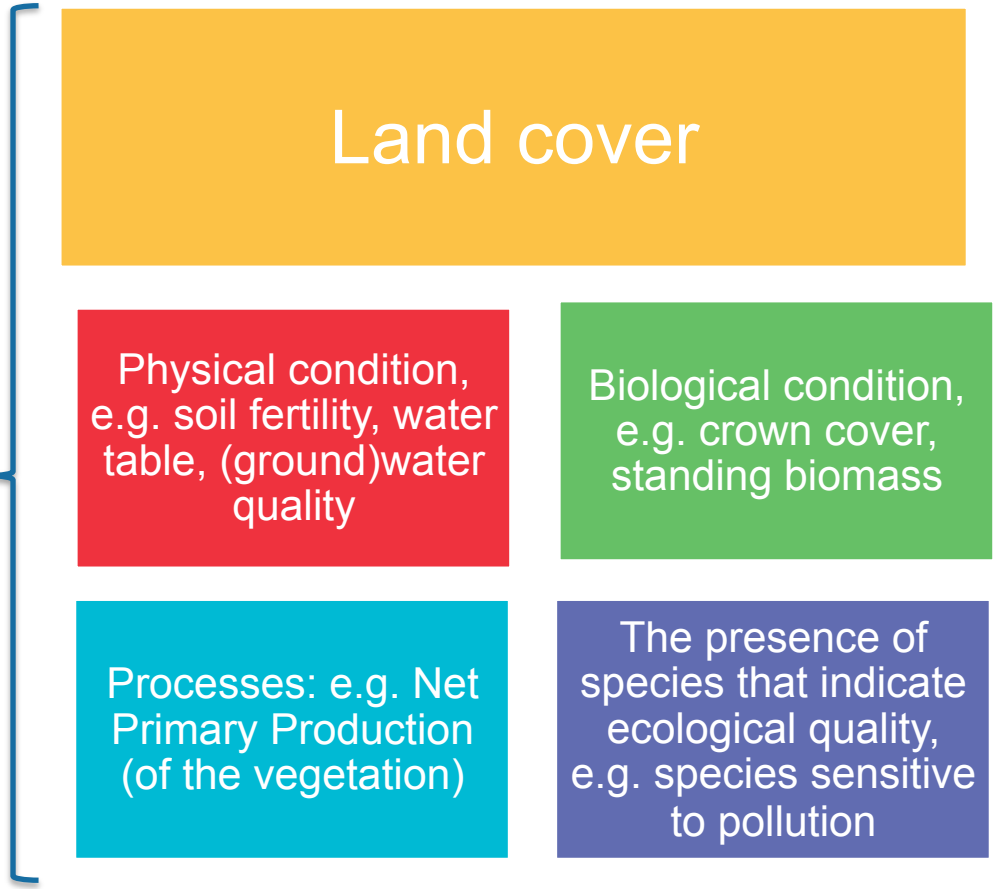
Pine forest

Deciduous forest

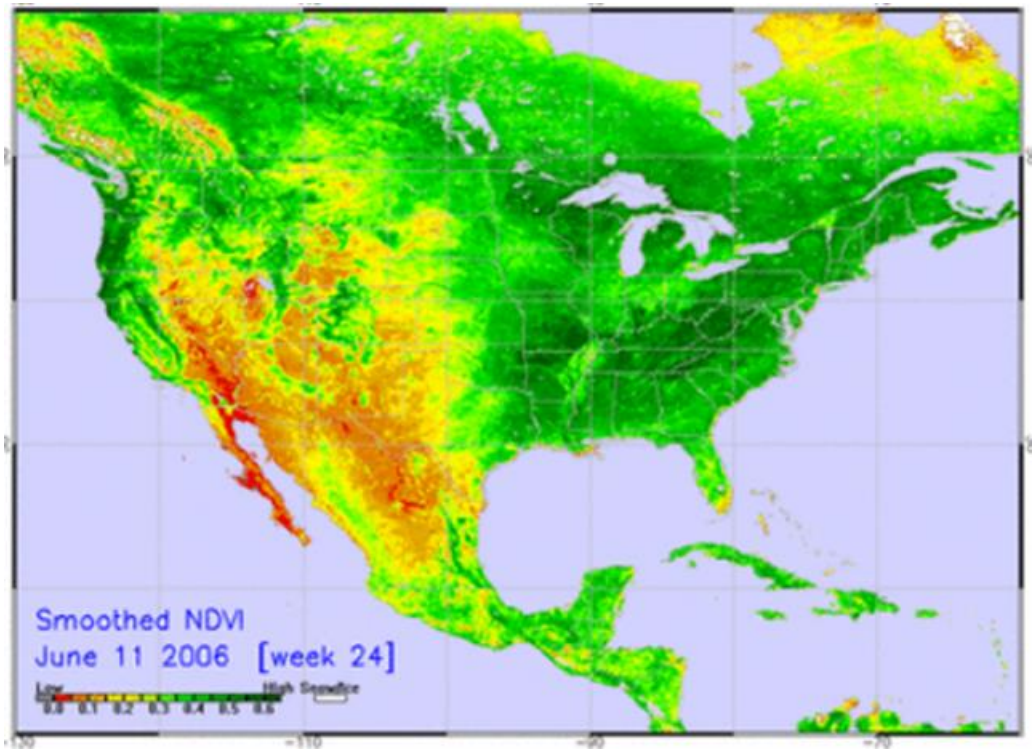
- Ecosystem Accounting Unit (EAU) = a country, province or watershed for which the account is developed
- Land cover/ecosystem functional unit (LCEU) = e.g. Deciduous forest
- BSU = (can be) a pixel

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



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

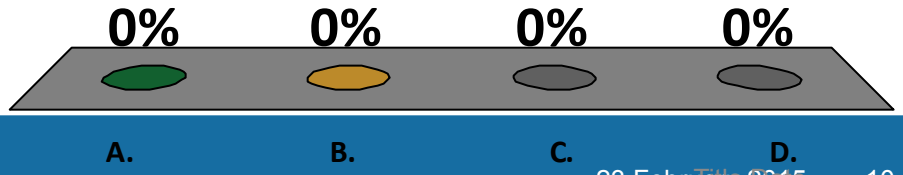
Which indicator is not expressing ecosystem condition ?

A. Normalized difference vegetation index (NDVI)

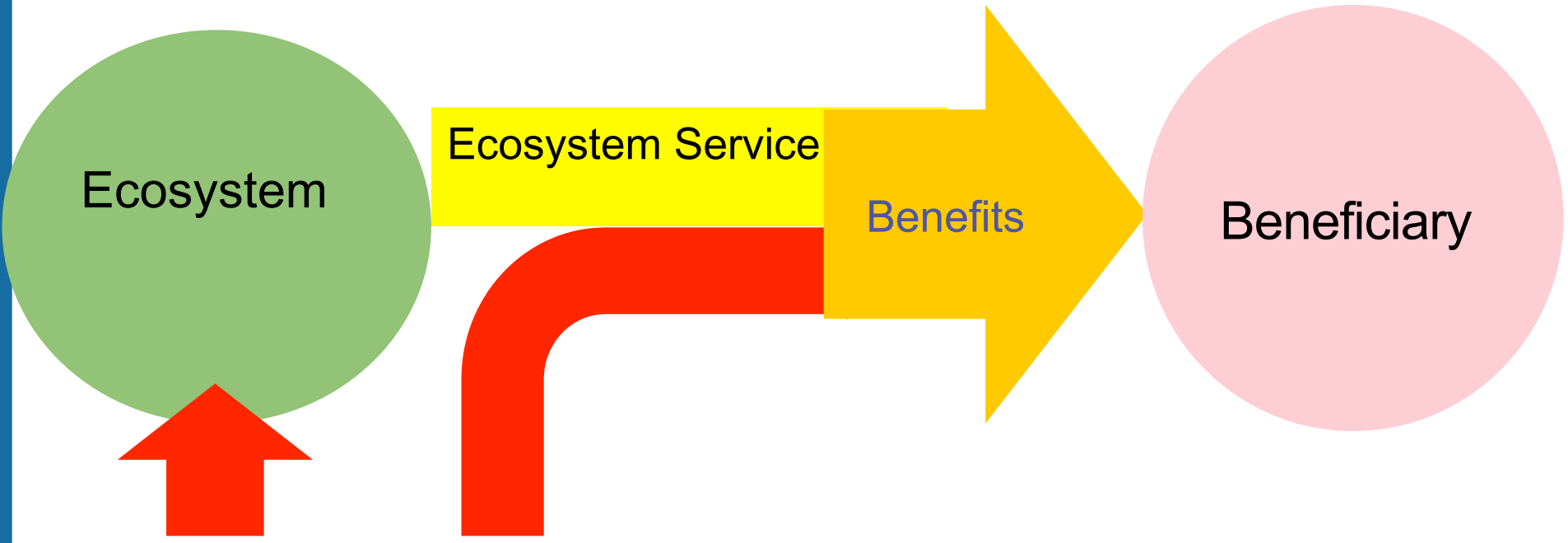
B. Soil fertility (in % organic matter in topsoil)

C. Groundwater depth

D. Timber harvest (in m3/hectare/ year)



Ecosystem services (versus benefit)

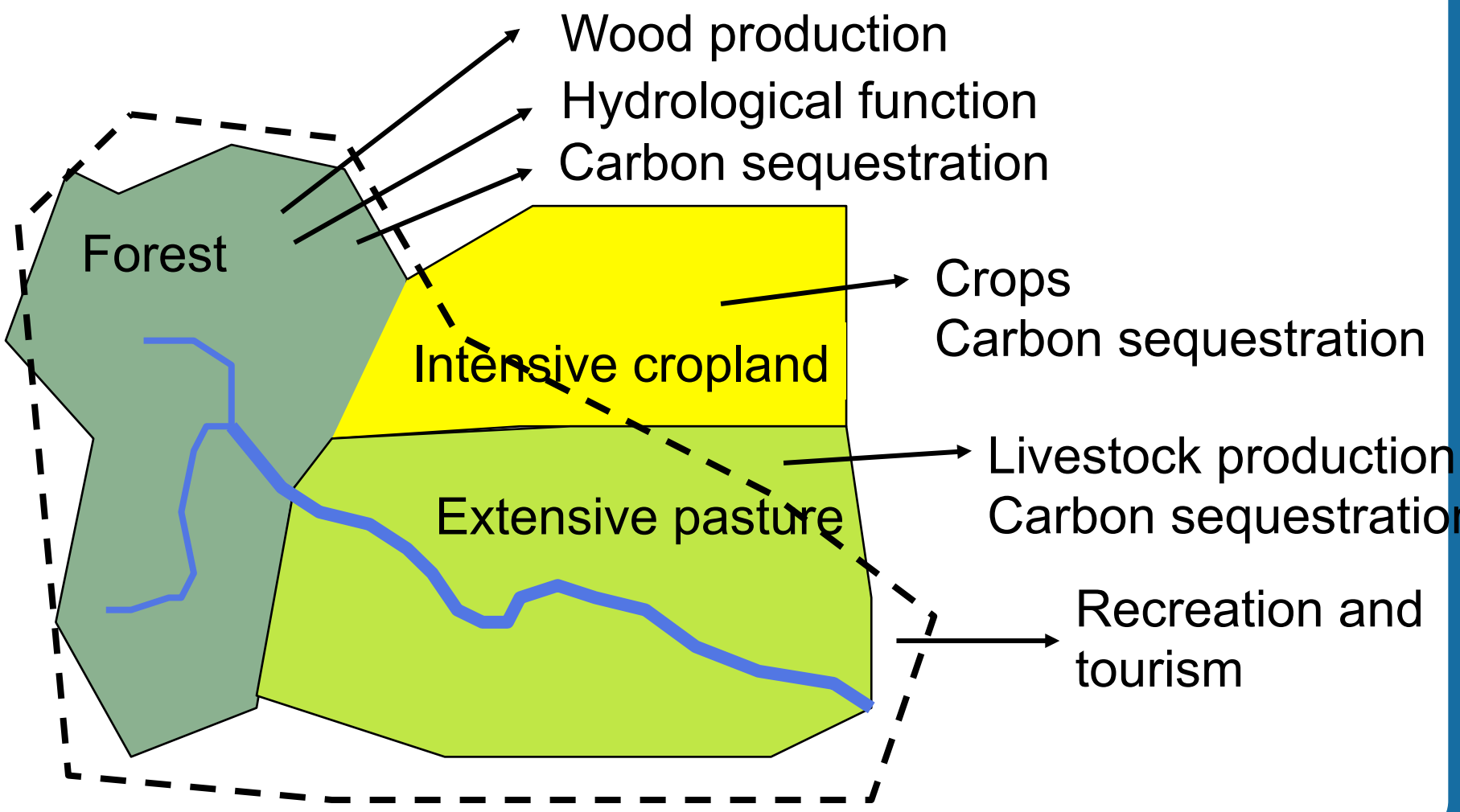


An ecosystem service is the contribution (by the ecosystem) to a benefit (for people)

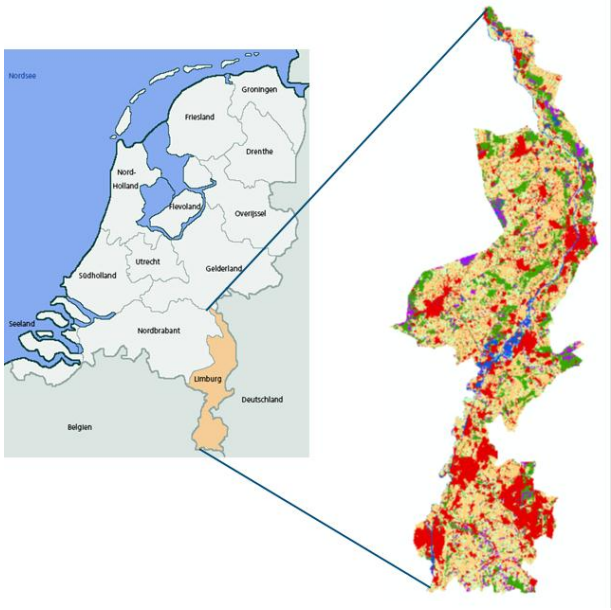
Types of ecosystem services

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

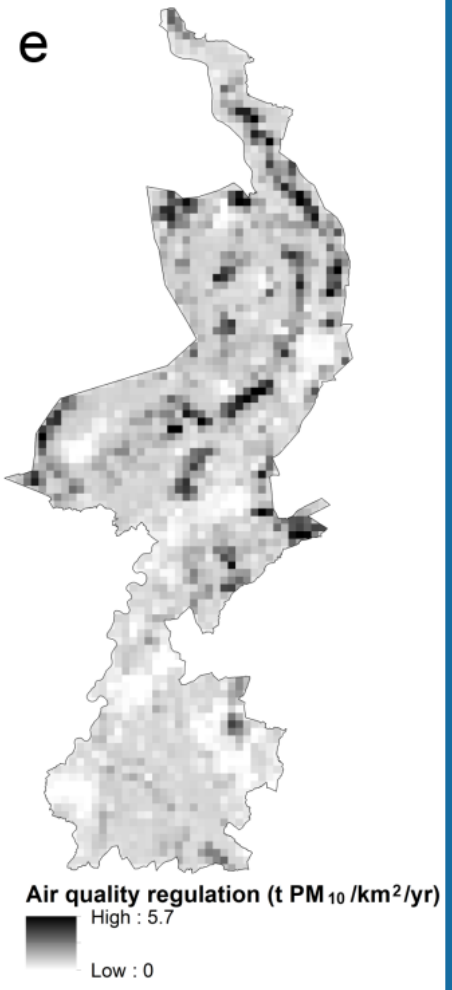


Ecosystem services in an account (example)



Source: Remme et al., 2014

- Ecosystem service account developed for Limburg Province, the Netherlands
- 2200 km^2, 1.1 million inhabitants
- Analysis of 7 ecosystem services



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

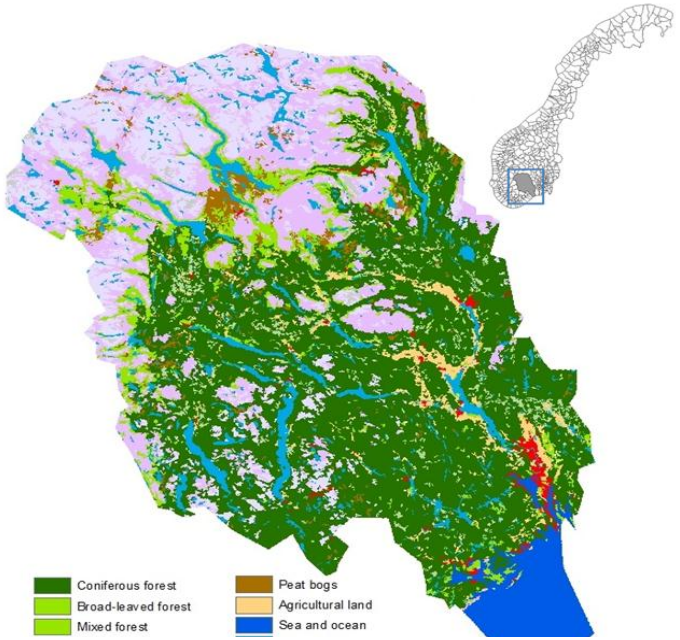
- Extent, condition and the capacity of ecosystems to generate services.
- Can be broken done into individual assets (e.g. land, water, carbon, biodiversity) depending upon policy needs
- Physical (e.g. ha, litres, t) or monetary (e.g. $) terms

Potential indicators	Ecosystem service Flow	Capacity
Provisioning services	Actual harvest	Harvest level that would not deplete the ecosystem
Regulating service	Use of ecosystem processes	Capacity of ecosystem to regulate processes independent of use
Cultural service	Number of people involved in an activity	Same

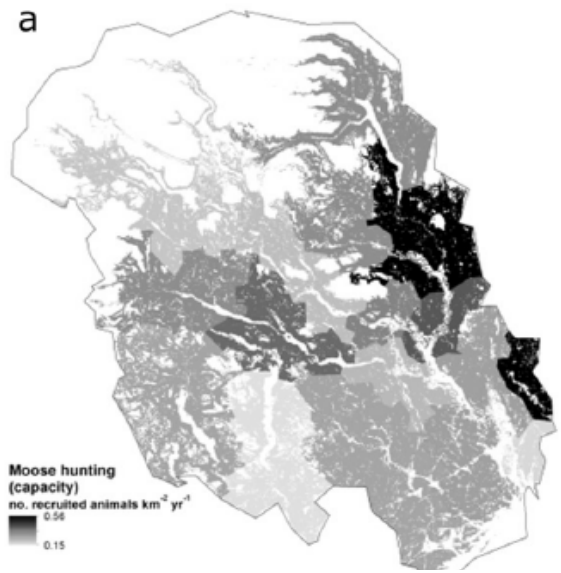
Example of capacity

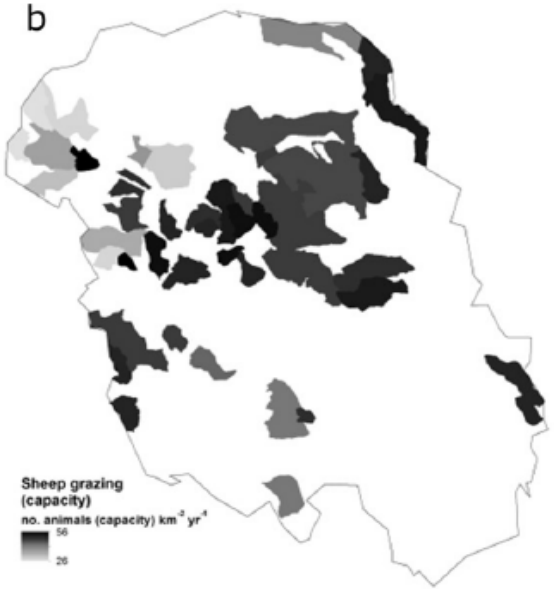
Capacity for ecosystem services use in Telemark County, Norway

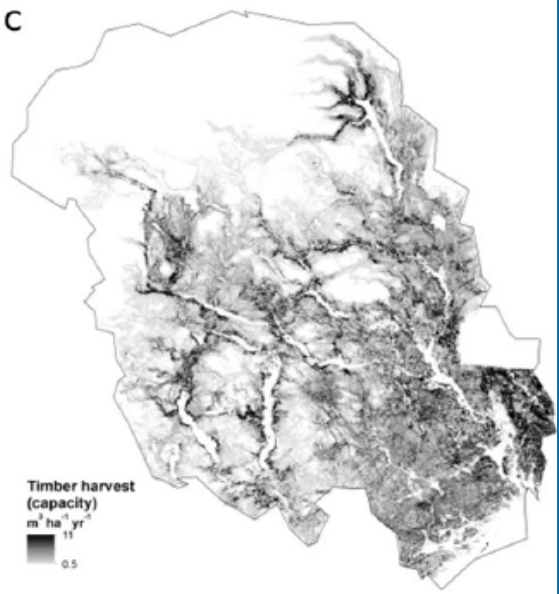
Capacity to support ecosystem use was modelled, jointly with NINA Norway, by M. Schröter for Telemark County, Norway (15.000 km2)



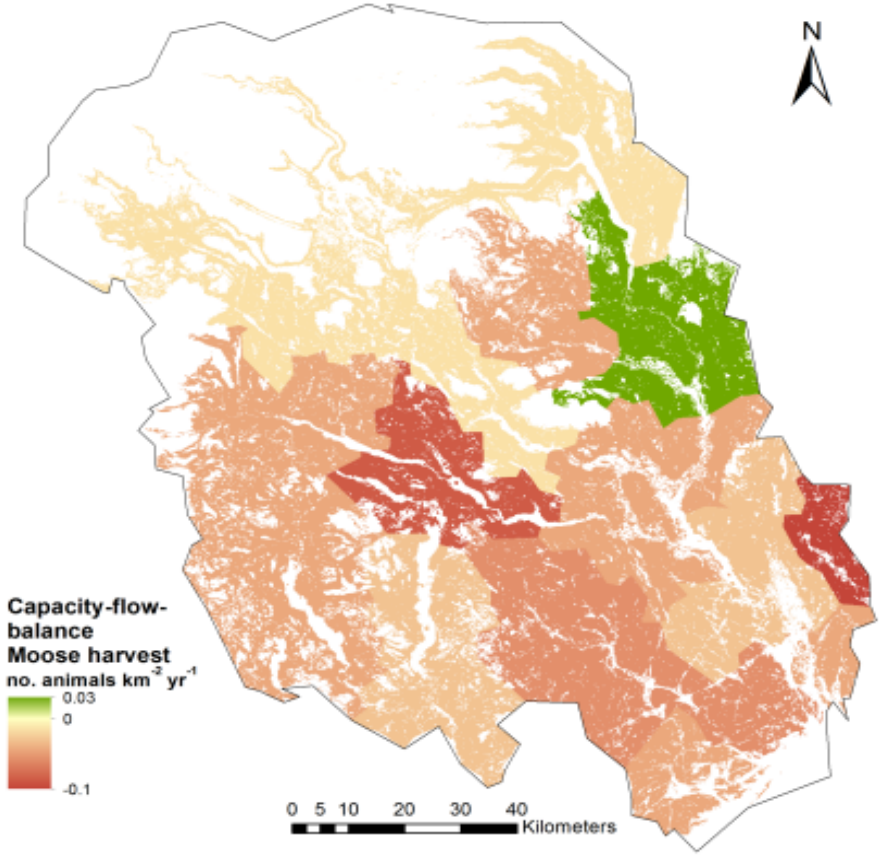
M. Schröter et al. / Ecological Indicators 36 (2014) 539–551

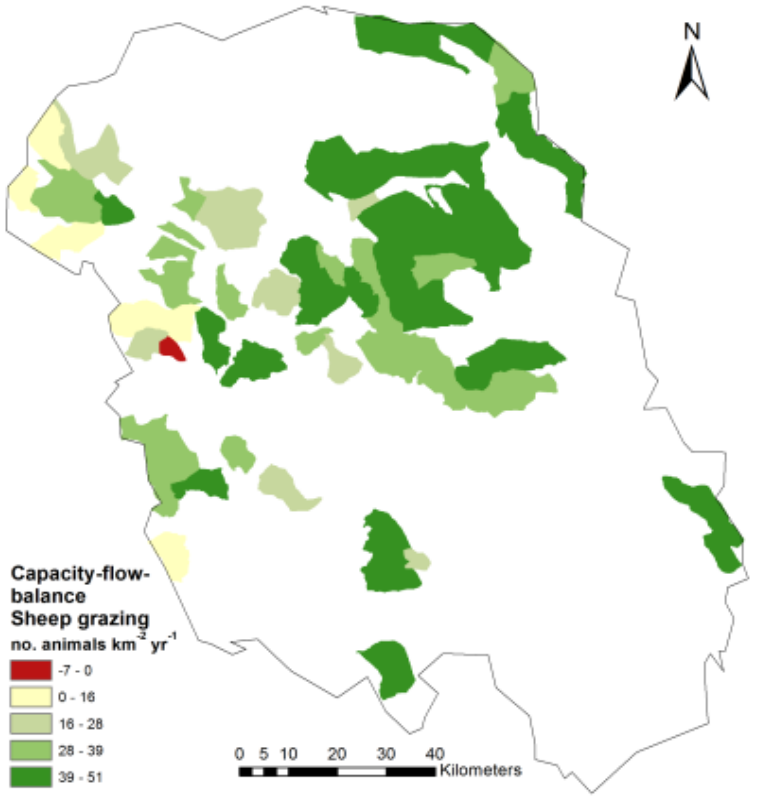






Differences between capacity and flow

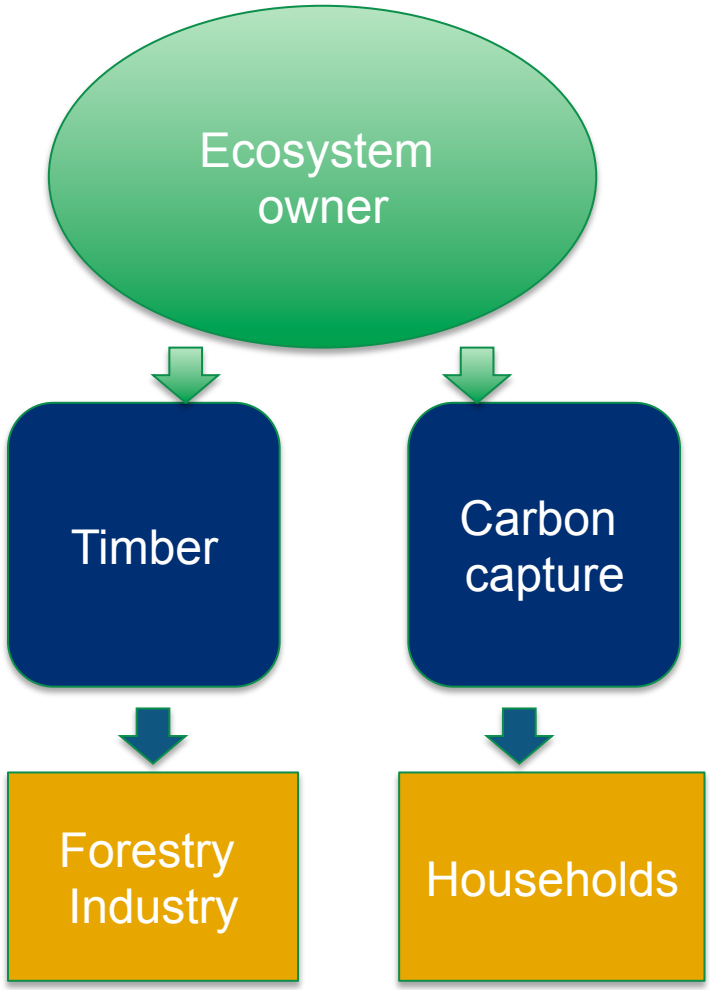




Source: Schröter et al., 2014

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

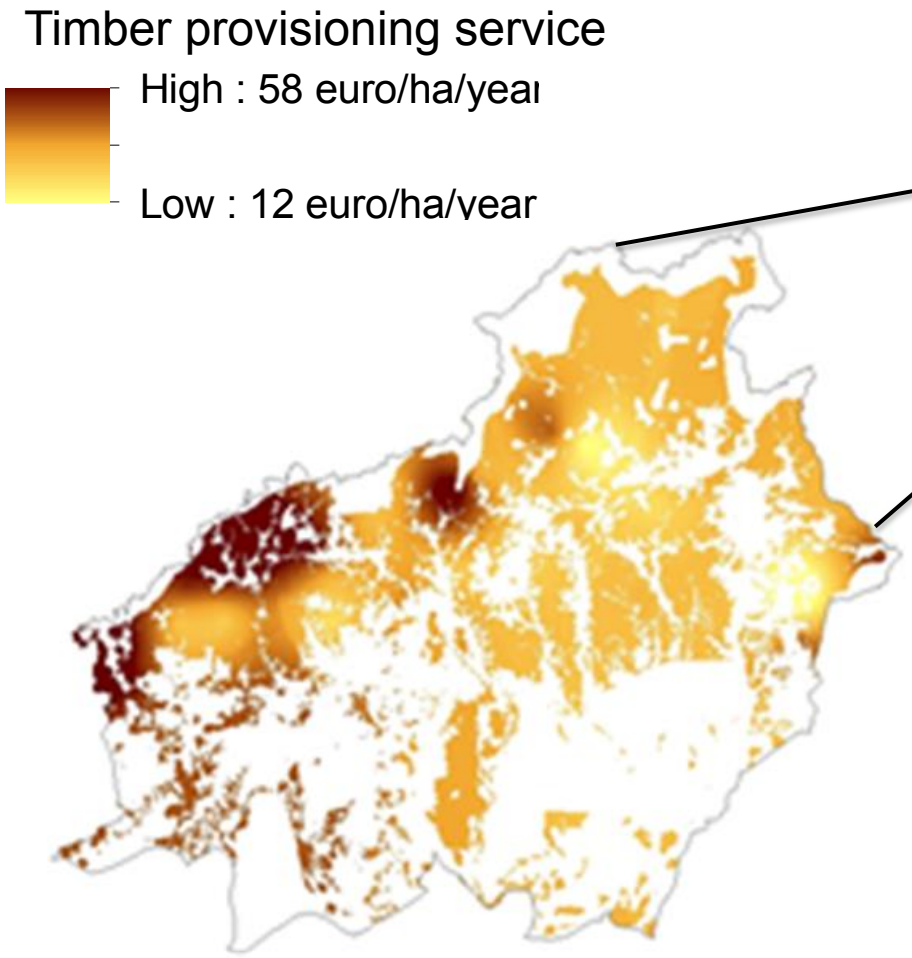
Ecosystem service accounts record flows of ecosystem services, in both physical (e.g. ton/ha/year) and monetary (e.g. $/ha/year) units.

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



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.