Ecosystem Accounting: a Reprise

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- Purpose of Ecosystem Accounting
- Ecosystem Services (insert types of services)
- Ecosystem Account components
- Policy applications
- Challenges and Opportunities
- Conclusions

What is ecosystem accounting ?

- An accounting approach consistent with System for National Accounts, focussed on analysing ecosystem services, both in physical and monetary terms
- In this way, changes in ecosystem assets (capital) can be measured (i.e. sustainability), and the contribution of ecosystems to economic activity can be specified.
- Ecosystem accounting comprises a spatial approach, where ecosystem services and other ecosystem properties are mapped.
- It links the accounting and the ecosystem services communities (TEEB, MA)

Policy applications

Ecosystem Accounting can be used for:

- Monitoring sustainability
- Understanding linkages between ecosystems and the economy
- Identifying opportunities for PES and/or green economic development
- Land Use Planning
- Identifying hotspots for ecosystem services supply or areas with (a lack of) sustainability
- Analysing the the benefits of (new) protected areas

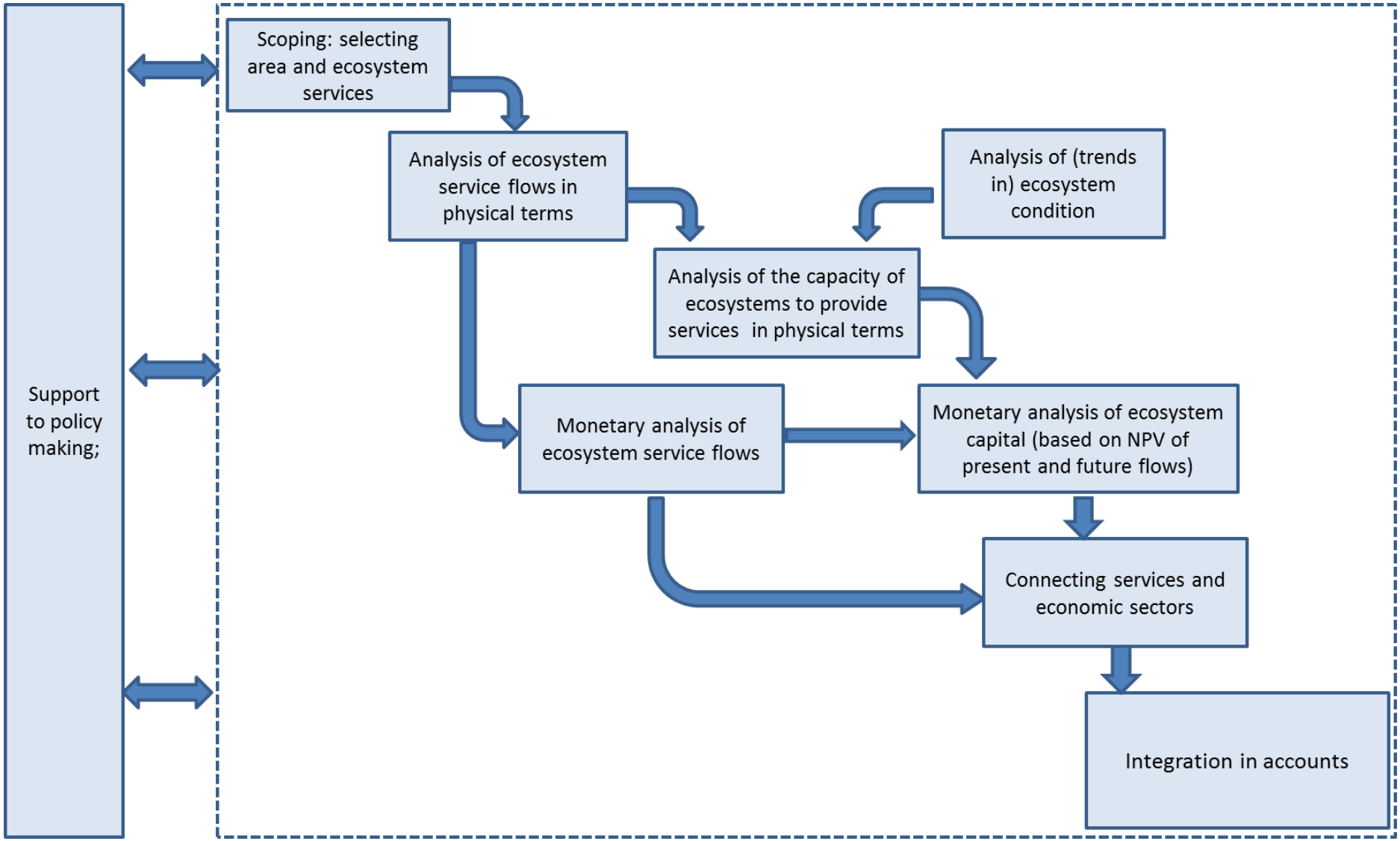
Ecosystem accounting and the GDP/NDP

- Note that many ecosystem services are already included in national accounts – directly or indirectly
  - Provisioning services (including home consumption)
  - Most of the regulating services (exception: carbon sequestration)
- Ecosystem accounting makes the contribution of ecosystems clear (also spatially) and shows implications of degradation and rehabilitation
- Ecosystem accounting allows monitoring capacity and thereby sustainability

Ecosystem accounting versus the Central Framework for environmental economic accounting

- Central Framework has been adopted as a standard
- Compartmental approach simpler, but leads to exclusion of many types of ecosystem services
- Central framework does not require spatial analysis
- Ecosystem accounting allows for more comprehensive understanding of sustainability trends

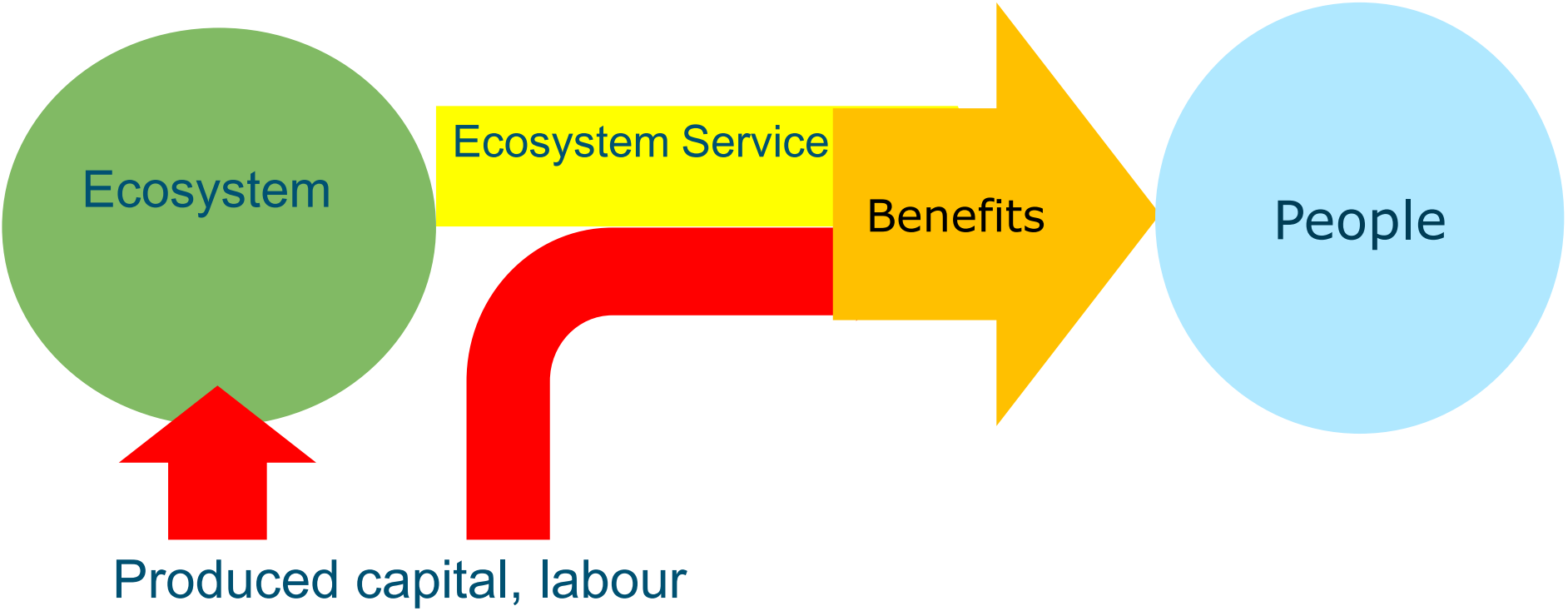
ES in ecosystem accounts



Biophysical and Monetary indicators

	Biophysical	Monetary
Ecosystem condition	X	
Ecosystem service flows	X	X
Ecosystem service capacity	X	X

Ecosystems and Ecosystem Services



Benefit versus service

Three types of Ecosystem Services

- Provisioning services

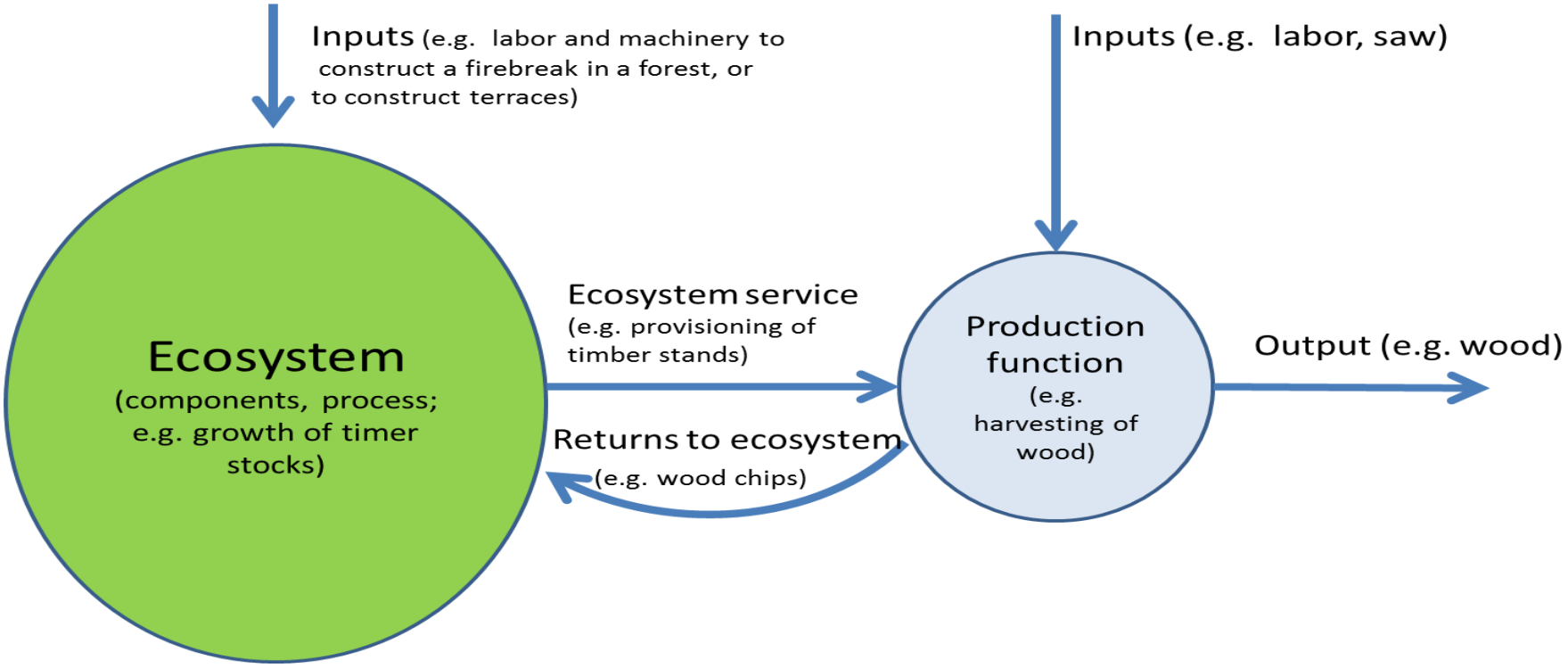
- Regulating services

- Cultural services

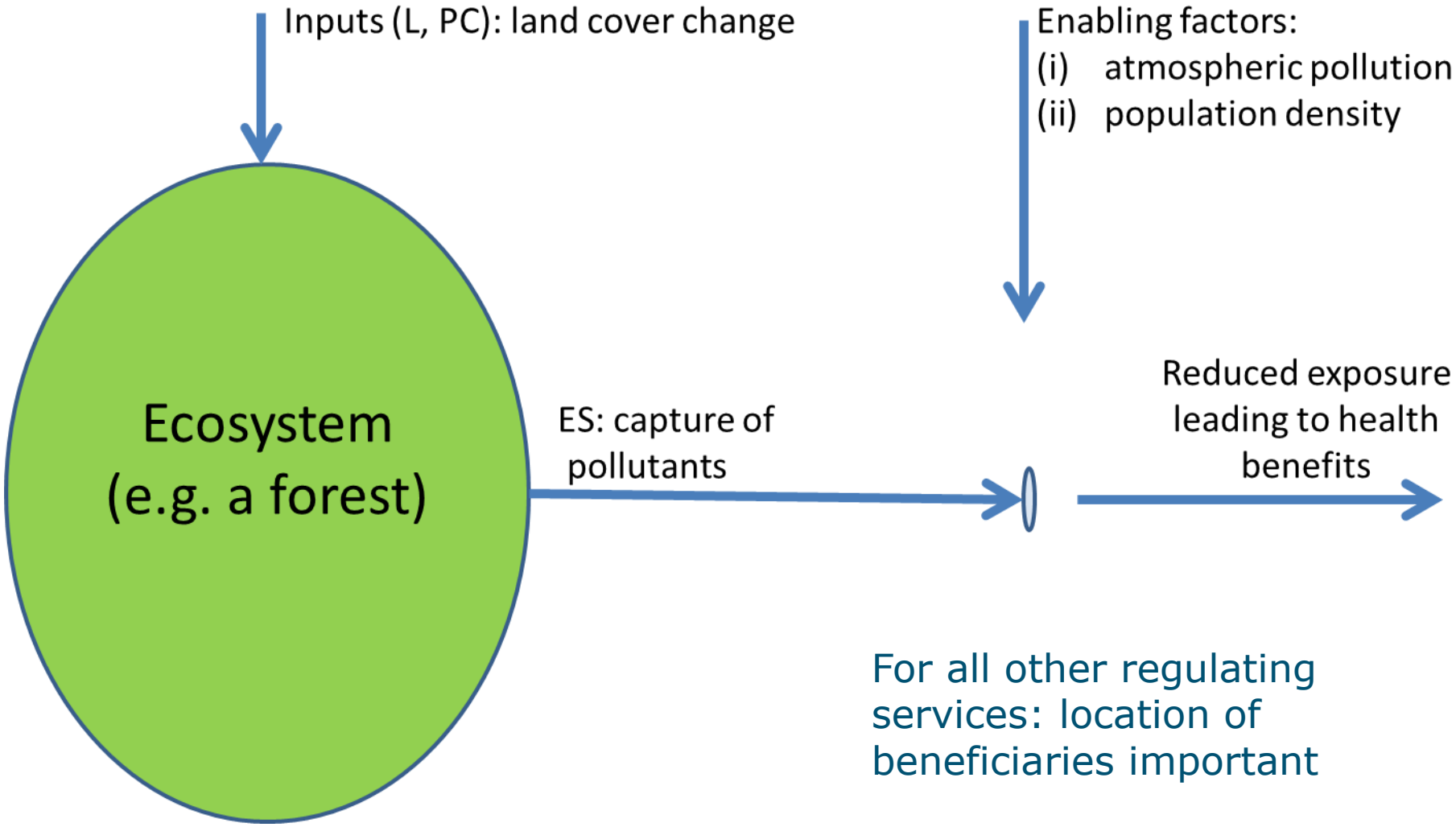
How to define capacity ?

	Ecosystem service capacity	Ecosystem service flows
Provisioning services	Capacity to provide the products (overharvesting may occur)	Amount of products extracted / harvested
Regulating services	Regulating impact of ecosystems on physical environment	Regulating impacts on people
Cultural services	Depend on service	Depend on service

Ecosystem services in accounting



Air filtration



For all other regulating services: location of beneficiaries important

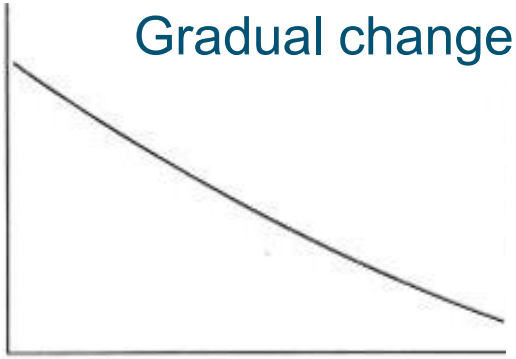
Capacity versus condition

- SEEA Vol 2 (2.33): capacity involves analysing the expected basket of ecosystem services
- Forward looking: expected view of ecosystem services considering current ecosystem use/management and sustainable harvest levels (for provisioning services)
- Capacity depends on ecosystem condition, and may be influenced by climate variability and change, and stochastic events (e.g. fire).
- The ecosystem may respond in an abrupt way to overharvesting or stress...

Complex dynamics

State

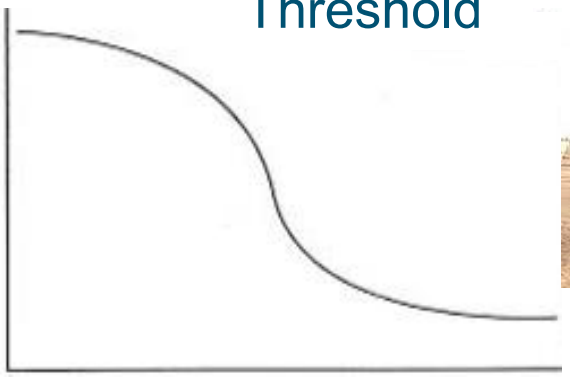
Gradual change



Pressure

State

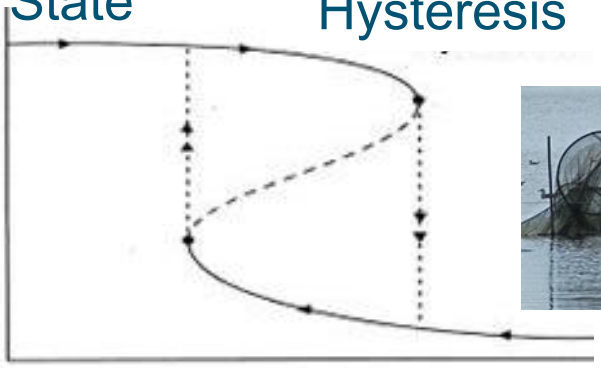
Threshold



Pressure

State

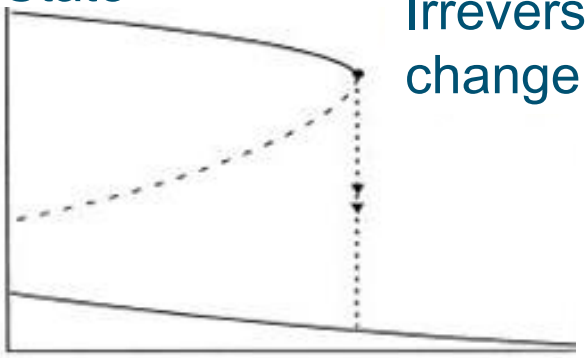
Hysteresis



Pressure

State

Irreversible change



Pressure

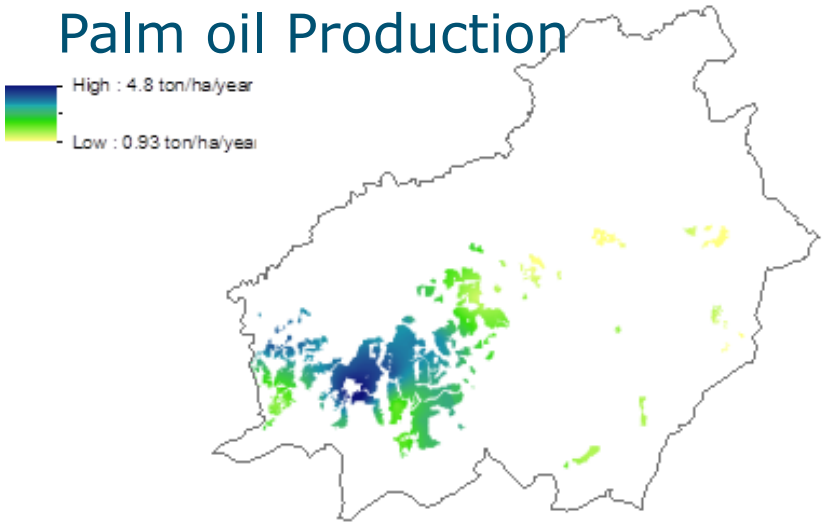
Spatial modelling

Spatial modelling involves combining spatial datasets (maps, remote sensing images), point data and statistical data for administrative units to estimate ecosystem services flow and capacity. It can be used:

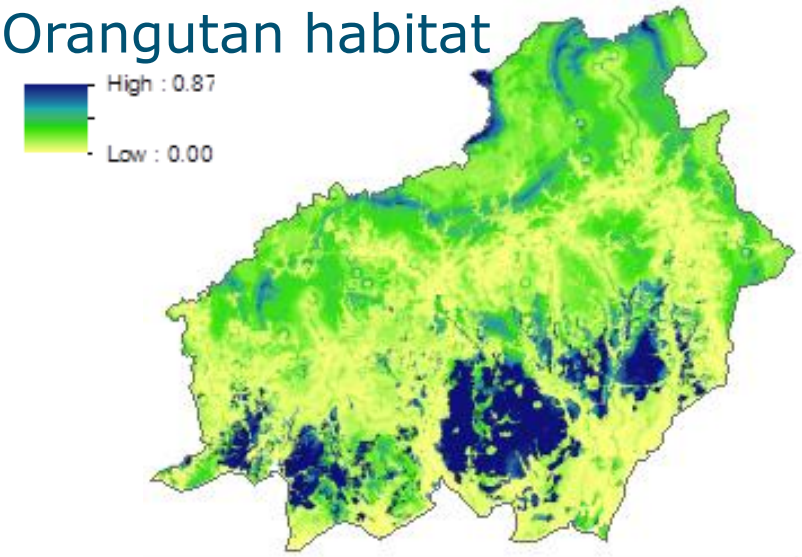
- For calculating flow and capacity of specific data points
  - Look-up tables
  - Geostatistical interpolation (e.g. kriging)
  - Statistical approaches
  - Process based modelling (e.g. USLE)
- For modelling spatial aspects of ecosystem services (in particular regulation services except carbon sequestration)
  - E.g. hydrological services, air filtration

Ecosystem services Central Kalimantan

Palm oil Production



Orangutan habitat



Information to be provided

Monetary value of ecosystem services

Provisioning services: resource rent

$RR = TR - (IC + LC + CC)$

where

RR = resource rent

TR = total revenue

IC = intermediate consumption

CE = labour costs

CC = consumption of fix capital

Valuing public goods, as per the SNA

Principle in SNA (2008): Public goods (e.g. education) are valued at cost. I.e. as the sum of:

- Intermediate consumption
- Compensation of employees
- Consumption of fixed capital
- Other taxes (less subsidies) on production

There are challenges in applying these valuation principles to ecosystem services..

Valuation of non-market goods in Ecosystem Accounting

- Production factor approaches: Production function approaches estimate the contribution of ecosystem services to production processes in terms of their contribution to the value of the final product being traded on the market (e.g. pollination).
- Replacement costs (not restoration costs !): In case an ES provides input into a whole range of different benefits (e.g. a coastal protection service). It is required that it can be reasonably be expected that society would indeed replace the service if it was lost.
    - Example: the value of coastal protection equals the costs of dykes ***if*** it can be expected that these dykes would indeed be constructed
- Avoided damage cost: This valuation approach may be applicable where replacement investments are not likely to be made.

Monetary value

Information to be provided

Monetary value of capacity

- Based on NPV: forward looking, requires estimating the expected flow of ecosystem services – under current management.
- This may include a reduction in future service supply as a function of ecosystem degradation for instance because of overharvesting

Examples of policy applications

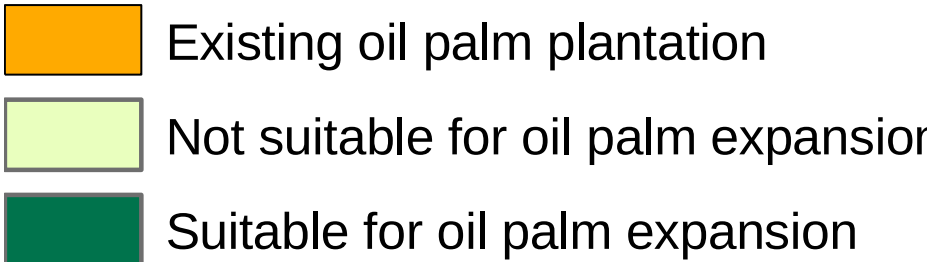
- Land use planning
- Payments for ecosystem services
- Sustainability analysis
- Analysing benefits of new natural parks

Stakeholders' development scenarios

Environmentally sustainable scenario

- Exclusion of orangutan habitat (suitability > 50%).
- Excluding areas where the current carbon storage in the vegetation exceeds the carbon storage in a mature oil palm plantation.
- Excluding peatlands. Exclusion of areas with high potential for nature recreation.
- Maintaining the supply of areas important for timber, rattan and paddy rice production.

ES mapping for Land Use Planning



Information to be provided

Payments for Ecosystem Services

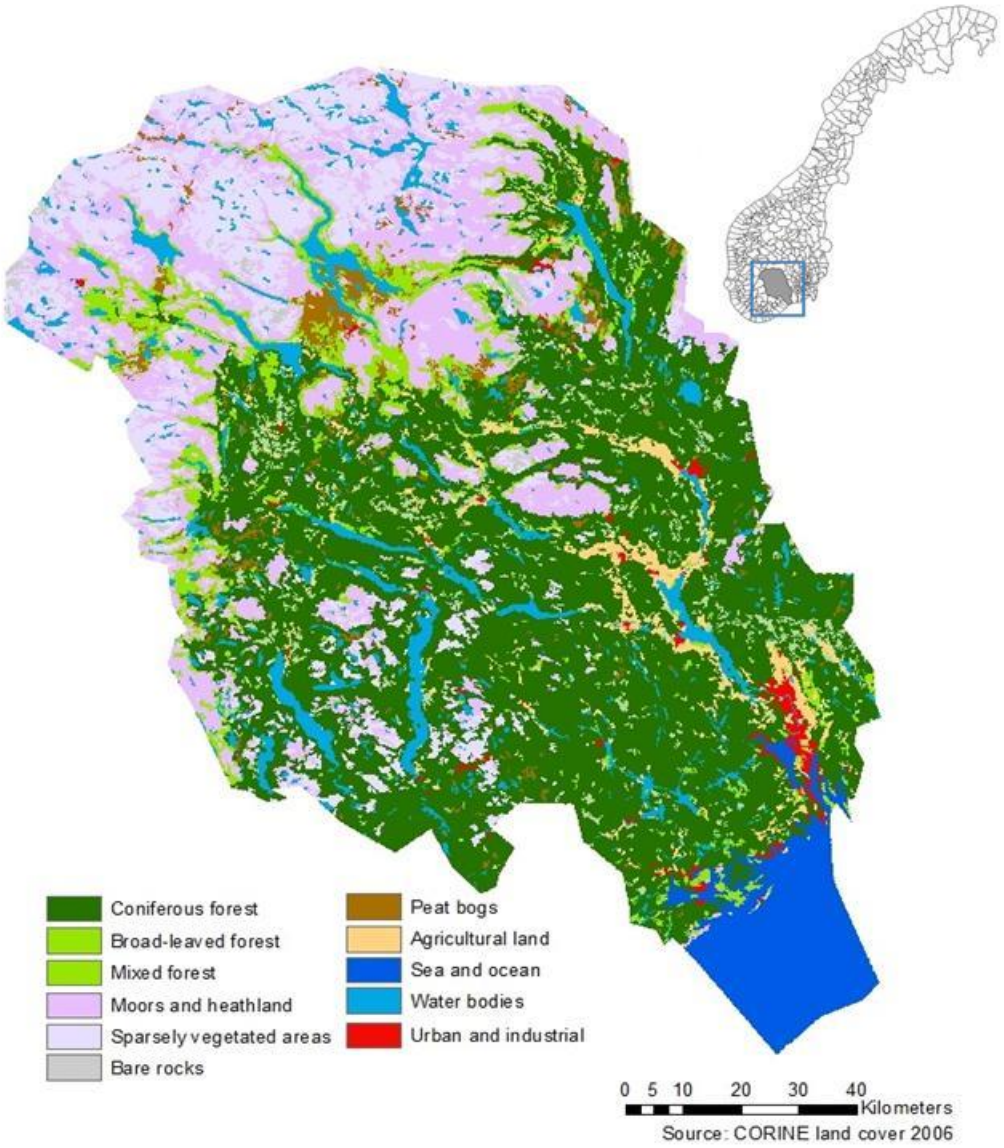
Market-related sources	Volume (US$ billion/year)
PES for watershed services	~ 6
REDD+ market	0.1
Voluntary biodiversity markets	<0.1
Green commodities	2.6
Ecotourism	0.7 – 1.3 for park management
US and Australian offset markets	~ 2 - 2.5
Other (e.g. bio-prospecting, direct ecosystem service and biodiversity fees)	0.2 – 0.3

Ecosystem services maps can:

- Identify areas suitable for developing PES
- Identify co-benefits

Source: adapted from Hein et al., 2012

Case Telemark, Norway



Mountainous, semi-boreal, low population density

Modelled services (8) include:

- Forestry
- Hunting
- Reindeer herding
- Carbon storage and sequestration
- Tourism

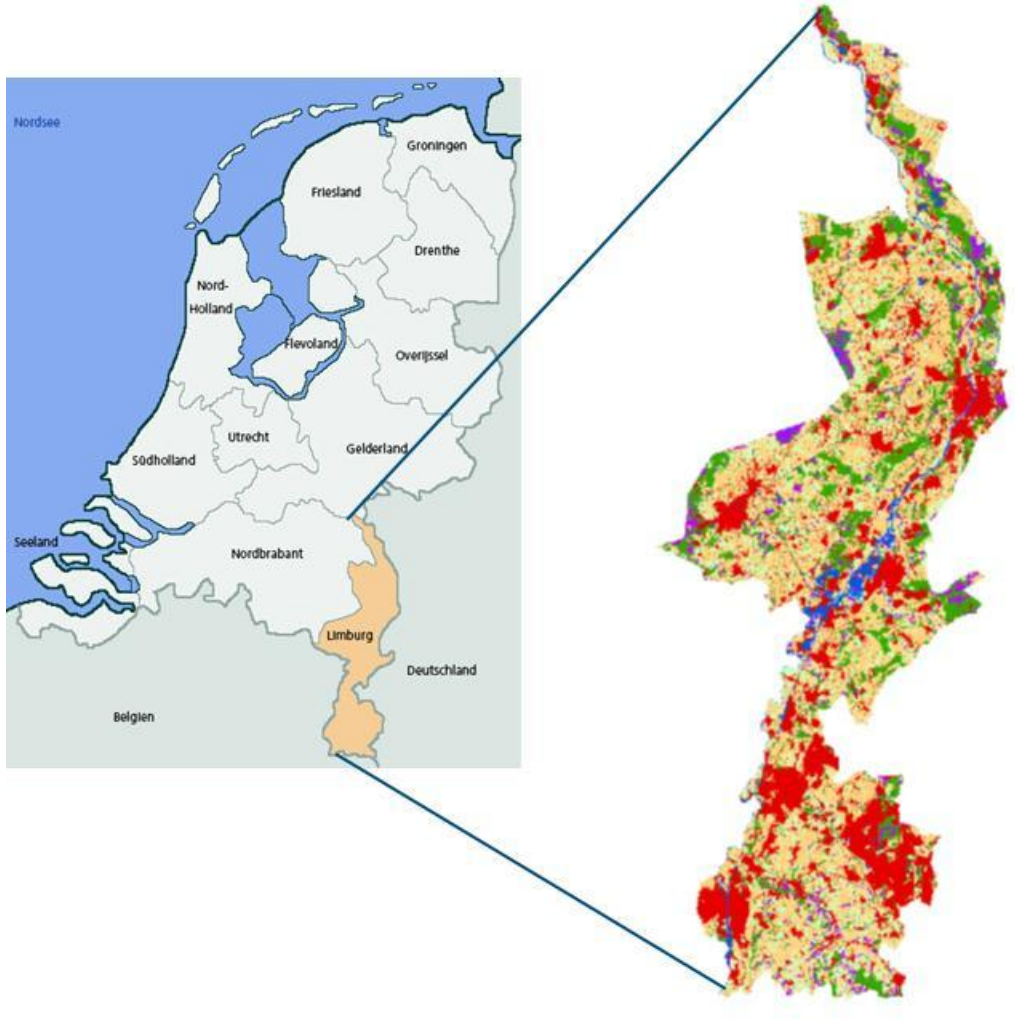
Specific aim: to test different methods to model services

Carbon sequestration

Information to be provided

Case Limburg, the Netherlands

- Analyse ecosystem services flows and ecosystem capital
- 8 ecosystem services
- Specific attention for biodiversity
- Analyse two management options under two scenario's



Ecosystem accounting table

Information to be provided

Policy application: comparing costs and co-benefits of new nature

Areas considered for expansion of protected area network

- Costs may include loss of crop production, costs of reduced urban expansion.
- Co-benefits may include increase in water supply, recreation, flood control.

Challenges in ecosystem accounting

- Data shortages, capacities, integration of disciplines
- Modelling condition and capacity
  - Depend on service type, complex for e.g. hydrological services
- Valuation
  - Valuation of provisioning services: Valuation of open-access common pool provisioning services,
  - Valuation of regulating and cultural services.
  - Selection of discount rate
- Integration with national accounts

Opportunities

- Critical mass of researchers, accountants, policy advisors, interested policy makers has been reached
- Wealth of knowledge and data from the ecosystem services literature can be integrated
- Spatial data (e.g. from remote sensing) is increasingly available
- Broad range of spatial models to build upon

Conclusions

- Ecosystem Accounting is grounded in SNA, but further conceptual work needed
- It is no panacea: e.g. long-term effects difficult to include
- Ecosystem accounting is a potentially highly useful new tool in support of policy making on natural resources
- It allows evaluating the sustainability of ecosystem use and the contribution of ecosystems to economic activities.
- It can support a broad range of decision making processes
- Ecosystem accounting requires significant resources and data (GIS, ecology, economics).