

Integrated Ecosystem Capital Accounts of Europe 2000-2010

Accounts in physical units and in ECU

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Ecosystem capital accounting in Europe

- The objective of ecosystem capital accounts is to measure the ecosystem resources that are accessible without degradation, the actual intensity of use of this accessible resource and the change in the capability of ecosystems to deliver their services over time.
- These accounts are based on currently available data from nature observation collected by satellite or in situ and on socioeconomic statistics.
- They cover all ecosystems types (forests, wetlands, agricultural and urban systems, sea ...).
- The results are aggregated by watersheds or administrative regions, but most data are collected or disaggregated according to the European standard grid of 1 km x 1 km.
- Accounts are intended to be updated annually in order to match the policy process.
- Simplified accounts are firstly implemented top-down for the European Union 27 countries. Based on the model, national accounts are planned to be developed with more specific focuses.

Purpose of ecosystem capital accounting, ... measuring capital maintenance

- The degradation of ecosystems' capability to deliver ecosystem services such as biomass, freshwater and natural cycle's regulation or socio-cultural services is not recorded in companies' accounting books and national accounts.
- Therefore depreciation is not charged in the price of our consumption.
- Consuming ecosystem capital without paying is equivalent to create ecological debts that are transmitted to others, to our present and future generations or to those countries from which we import products produced under unsustainable conditions.
- Ecological debts (and credits in case of improvement) can be measured using a composite physical unit reflecting ecosystem productivity and condition and recorded in an appropriate balance sheets.
- Ecological debts measured in physical units can be converted into money on the basis of remediation costs of degradation; its is an estimation of ecosystem capital depreciation.

Purpose of ecosystem capital accounting, continued, ... measuring ecosystem services

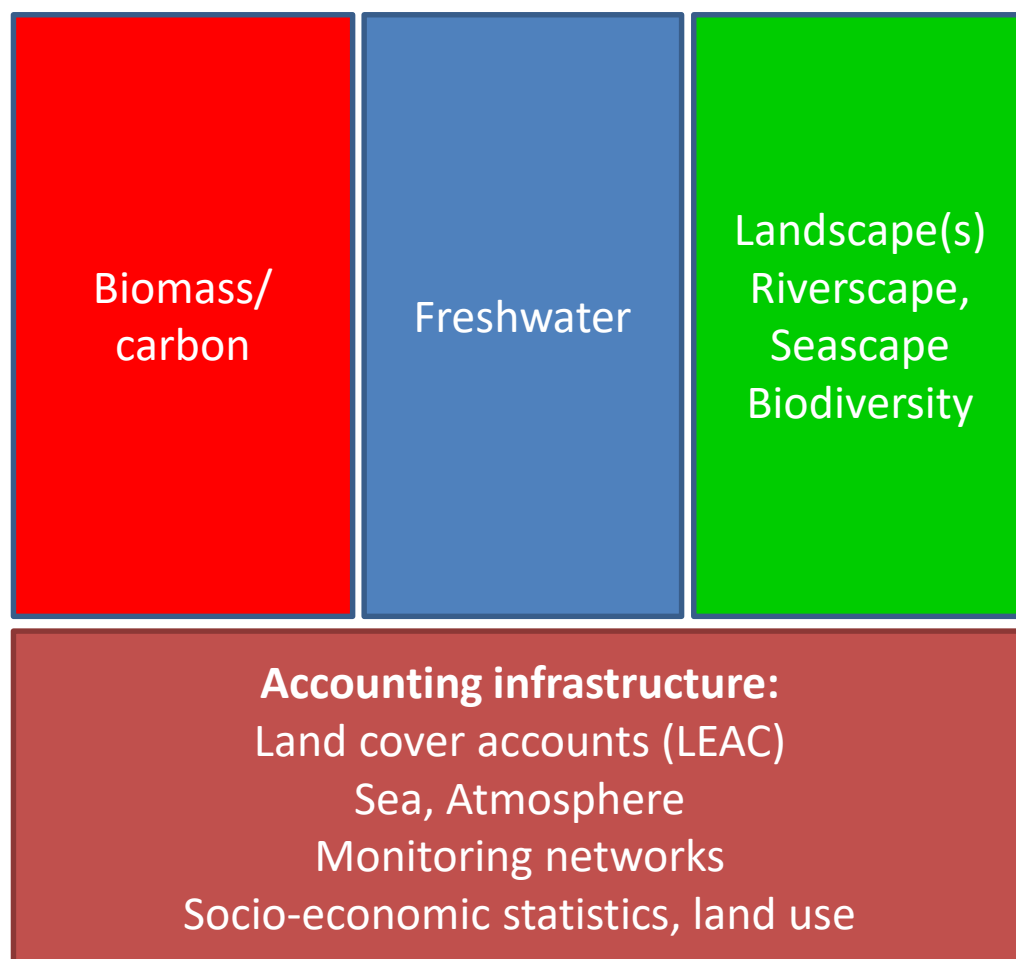
- Ecosystem services are measured in physical units for the purpose of assessing trade offs in the use of ecosystem's multiple functions and ecosystem intensity of use.
- Some ecosystem services which are input to production of commodities are given a value by the market. This value is in several aspects underestimated because of unpaid capital depreciation or because of inappropriate price used for the production of food and housing services for self account. Ecosystem capital accounts aim at putting these prices right.
- Other services of importance are part of market values but they are entangled into commodities and assets values. When useful and possible, their economic importance will be measured either as isolated rent component or regarding the total value added that they induce.

Experimental accounts 2000-2010

- Preliminary results in physical units, based on existing monitoring and statistics, annual, 2000 to 2010
- By ecosystem types, rivers basins, administrative regions...
- For each ecosystem 4 accounts:
 - Land cover
 - Biomass/carbon: stocks and flows, harvest and returns from artificial systems (manure, sludge...)
 - Water: accessible freshwater, quantity and quality
 - Landscape (LEP) and rivers integrity, species biodiversity
- Basic resource accounts and ecosystem capability accounts

Sustainable capability: not flows, not stocks...

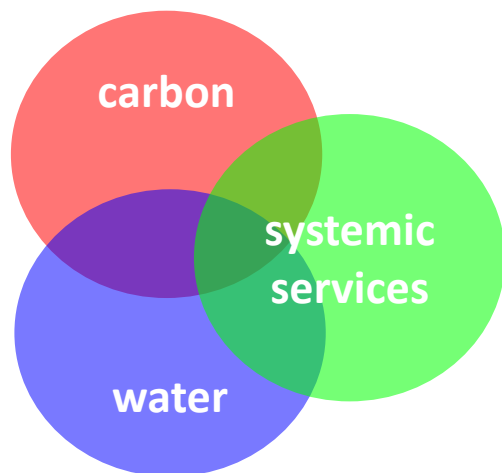
➔ flows and stocks accessible without degrading the ecosystem



The framework of Simplified Ecosystem Capital Accounts:

→ Ecosystem capital capability (& degradation) can be measured by combining the measurements of 3 broad ecosystem services:

biomass/carbon, **freshwater** and **systemic services**



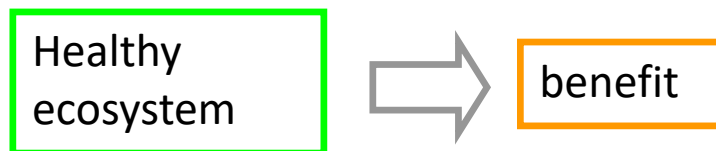
there is little or **no compensation or tradeoff** between them; the use of one should not reduce the use of the others

biomass/carbon, **freshwater** are firstly recorded as conventional balances

systemic services (regulating, socio-cultural...) are measured indirectly in relation to ecosystem integrity.

→ The simplified ecosystem capital accounting circuit

Calculating economic aggregate



Ecosystem capital depreciation
Ecological debts



Ecosystem degradation

European Environment Agency

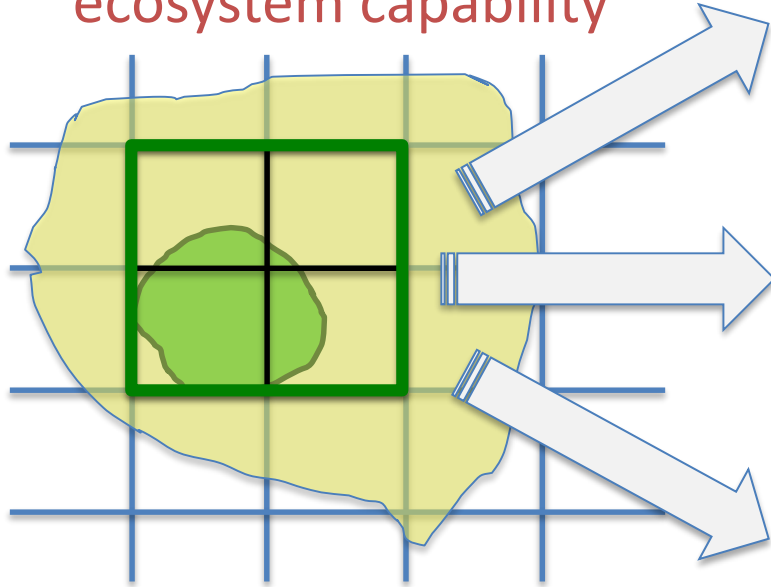


Adapted from

Aoyama Yukiko, Oguro Michio, and Yano Tohru,

Tohoku University, Sendai, Japan, November 2011

Land cover, landscape units, 1km² grids and calculation of ecosystem capability



6	5
10	8

Accessible
Carbon
“+”

2	4
4	3

Accessible
Water
“+”

4	1
6	4

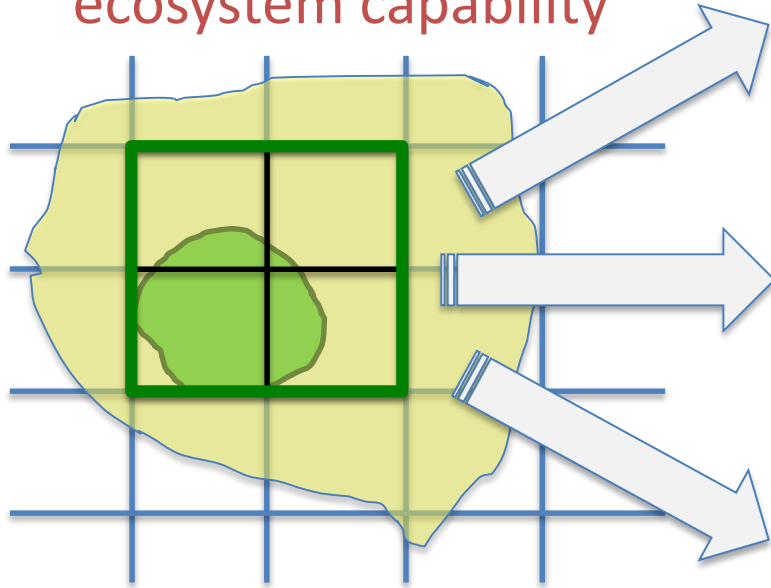
Landscape
integrity,
biodiversity

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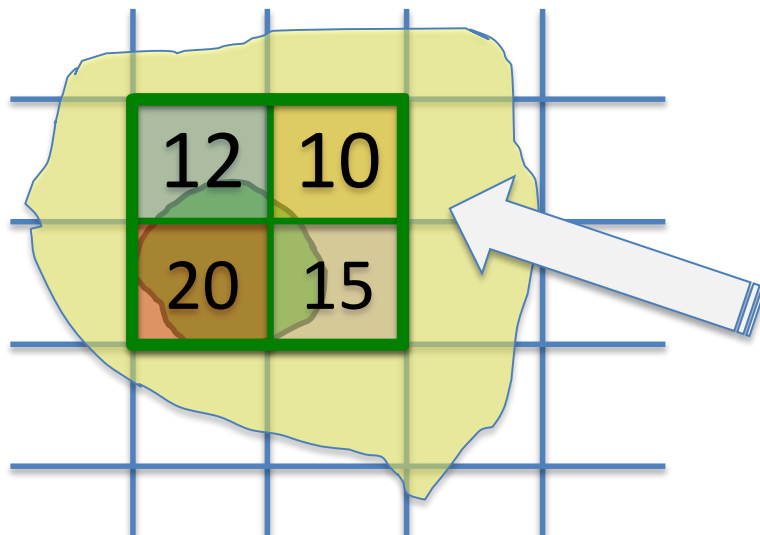
4	1
6	4

Landscape
integrity,
biodiversity

“=”

12	10
20	15

Total ecosystem
capital capability
(or potential)



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Capability1

12	10
20	15

Time 1

Capability2

9	11
12	12

Time 2

Development

-3	+1
-8	-3

Degradation

$\text{Capability2} - \text{Capability1} = \text{Change in capital}$



Need of a common accounting unit

- In physical accounts, measurements are made firstly in basic units (tons, joules, m³ or ha)
- They are then converted to a special composite currency named ECU for 'Ecosystem Capability Unit'.
- Loss of ecosystem capability in ECU is a measurement of ecological debt. To territorial debt, it should be added the consumption of non-paid ecosystem capital that is embedded in international transactions.
- The ecological debt in ECU (and symmetrically credits when improvements are verified) could be incorporated into portfolios of financial instruments.

ECU: Ecosystem Capability Unit



1 ECU = 1 unit of accessible ecosystem service

The price of one physical unit (e.g. 1 ton of biomass) in ECU expresses at the same time the intensity of use of the resource in terms of maximum sustainable yield and the direct and indirect impacts on ecosystem condition (e.g. contamination or biodiversity loss).

A - Theoretical total resource: stocks and flows, in basic units (tons, joules, m³, hectares...)
(the resource of an individual economic agent, not that of a community or a country)

B - Theoretical available resource: previous accumulation to stocks and net annual flows, in basic units *(the maximum sustainable yield paradigm)*

C – Limitations to resource use: timeliness, location, quality, in basic units

D - Real available resource in basic units

E - Resource use in basic units

F - Resource use intensity (Index: D/E)

G - Ecosystem condition (Index)

H - Overall ecological price, in ECU ($F+G$)

I - Accessible resource in ECU ($B \times H$): Ecosystem Capability

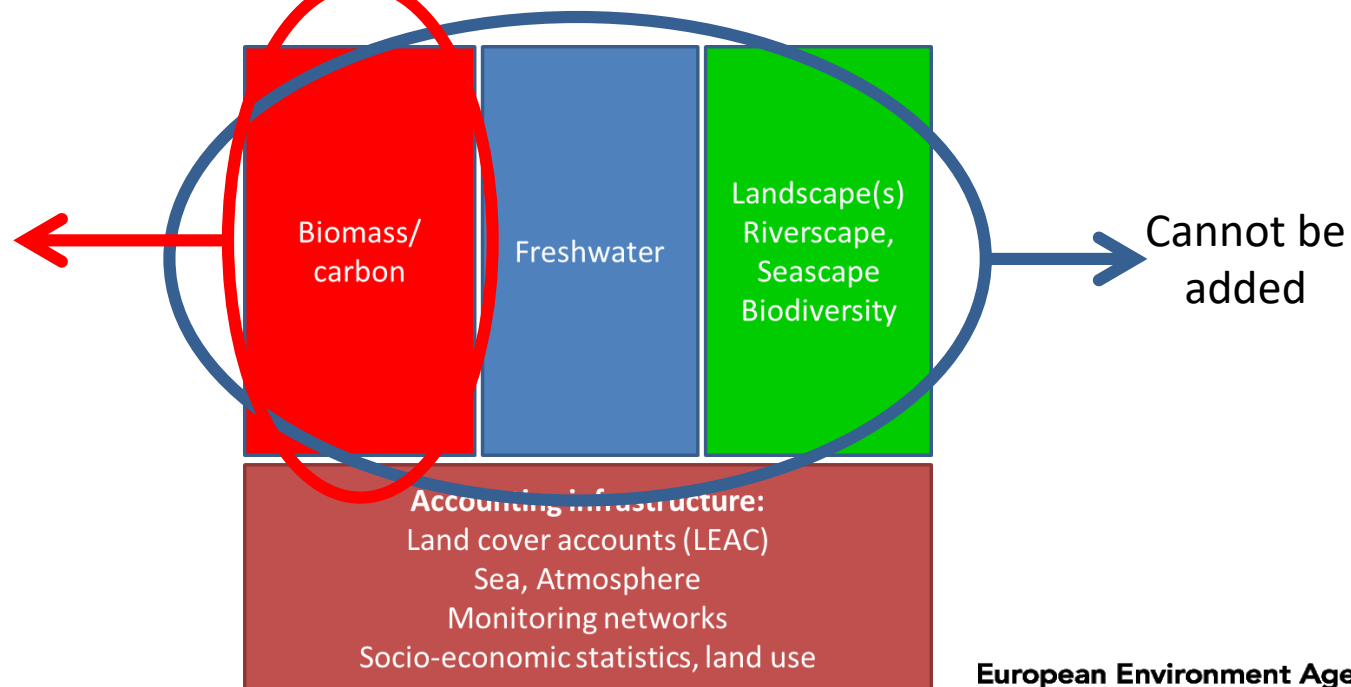
Change in Ecosystem Capability: degradation or development



Calculating prices in ECU

Calculation of resource prices in Ecosystem Capability Units (ECU)	Ecosystem accounting unit: e.g. forest, agro-system...			
	Biomass/ carbon	Water	Landscape biodiversity	Total Ecosystem Capability
<i>a</i> - Indexes of resource use sustainability [IF<100, = overuse, dilapidation; IF>100, accumulation]	110	98	98	Non applicable
<i>b</i> - Indexes of ecosystem condition [IF<100, = impoverishment; IF>100, improvement]	100	95	97	Non applicable
Combined indexes of ecosystem distress (implicit prices = $a+b-100$) & mean overall price in ECU	110	93	95	99.3
Resource price in ECU	99.3	99.3	99.3	99.3

Pivot account,
surrogate of
the whole
ecosystem



From degradation to depreciation (from ECU to EURO):
Estimation of ecosystem capital depreciation can be derived from physical degradation

