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Approach to Simplified Ecosystem Capital Accounts

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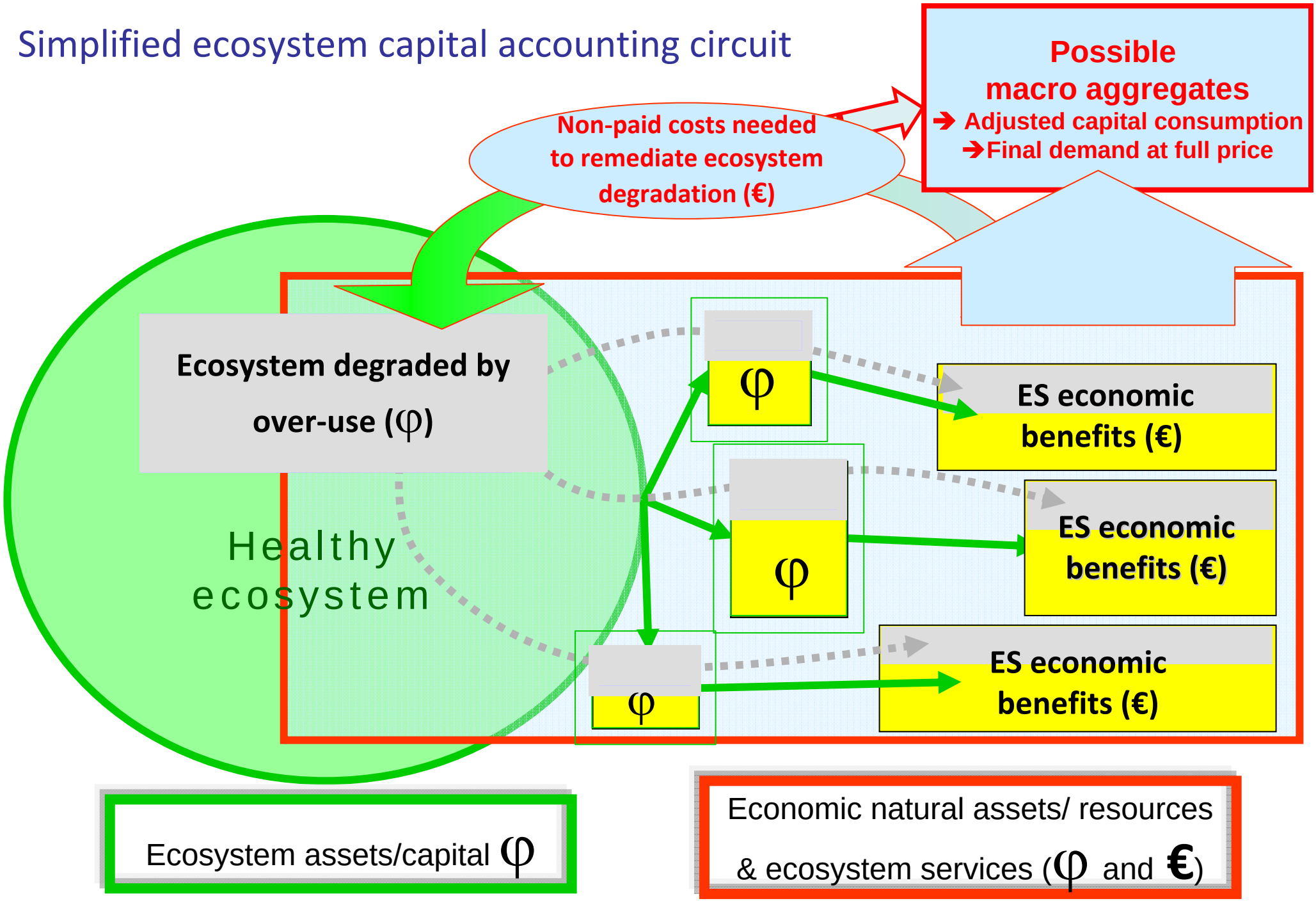
Simplified ecosystem capital accounts

- Make it feasible NOW – keep it simple
- Don’t miss important issues: need a good checklist
- All ecosystems: land/sea/atmosphere, and for land: urban, agriculture, forest, other natural and soil.
- 6 accounts/indexes for 1 diagnosis:
  - 1-Land // 2-Biomass-Carbon // 3-Water // 4-Biodiversity // 5-Dependency // 6-Disease prevalence
  - Diagnosis (instead of mere additions) and quantification: the “ecosystem distress syndrome” approach combined with basic balances of land, carbon, water…
- Physical accounts first, followed by valuation of selected flows and of ecosystem depreciation (on the basis of physical degradation and restoration costs – no valuation of stocks)

Characteristics of ecosystem capital accounts

- Top-down approach: accounts compiled at the European scale first, then country level applications (national and local)
- Starting from physical accounts of ecosystem assets and degradation (comprehensive) and of selected ecosystem services
- From physical accounts are derived macro-economic aggregates: sustainable benefits supported by ecosystem services & consumption of ecosystem capital
- Meet the policy demand: annual updates for t – 1
- Deep rooted in the best available datasets:
  - Socio-economic statistics
  - Monitoring by satellites (land use, biomass, climate variables…)
  - Best available in situ monitoring data
- Additional estimations need to be transparent and reproducible
- Relevance matter more than accuracy

Simplified ecosystem capital accounting circuit



Ecosystem physical degradation, sustainable benefits from ecosystem services and non-paid maintenance costs

Consumption of ecosystem capital (non-paid costs)

Economic statistics & national accounts

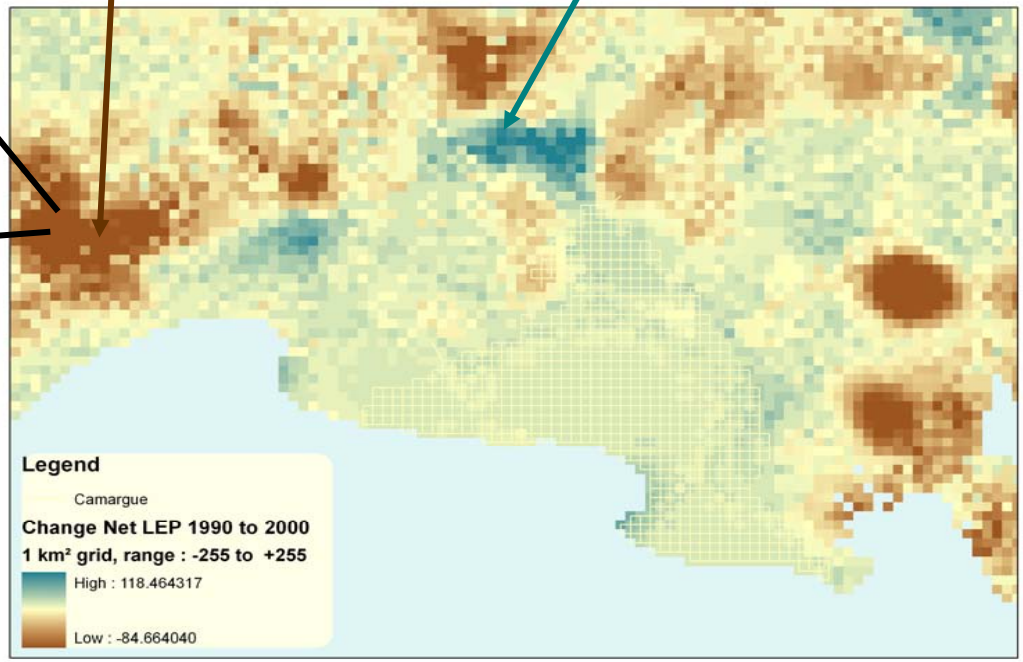
Sustainable benefits (income from key ecosystem services)

Mean restoration prices

Sustainable use coefficients

Degradation of Ecosystem capital

Improvement



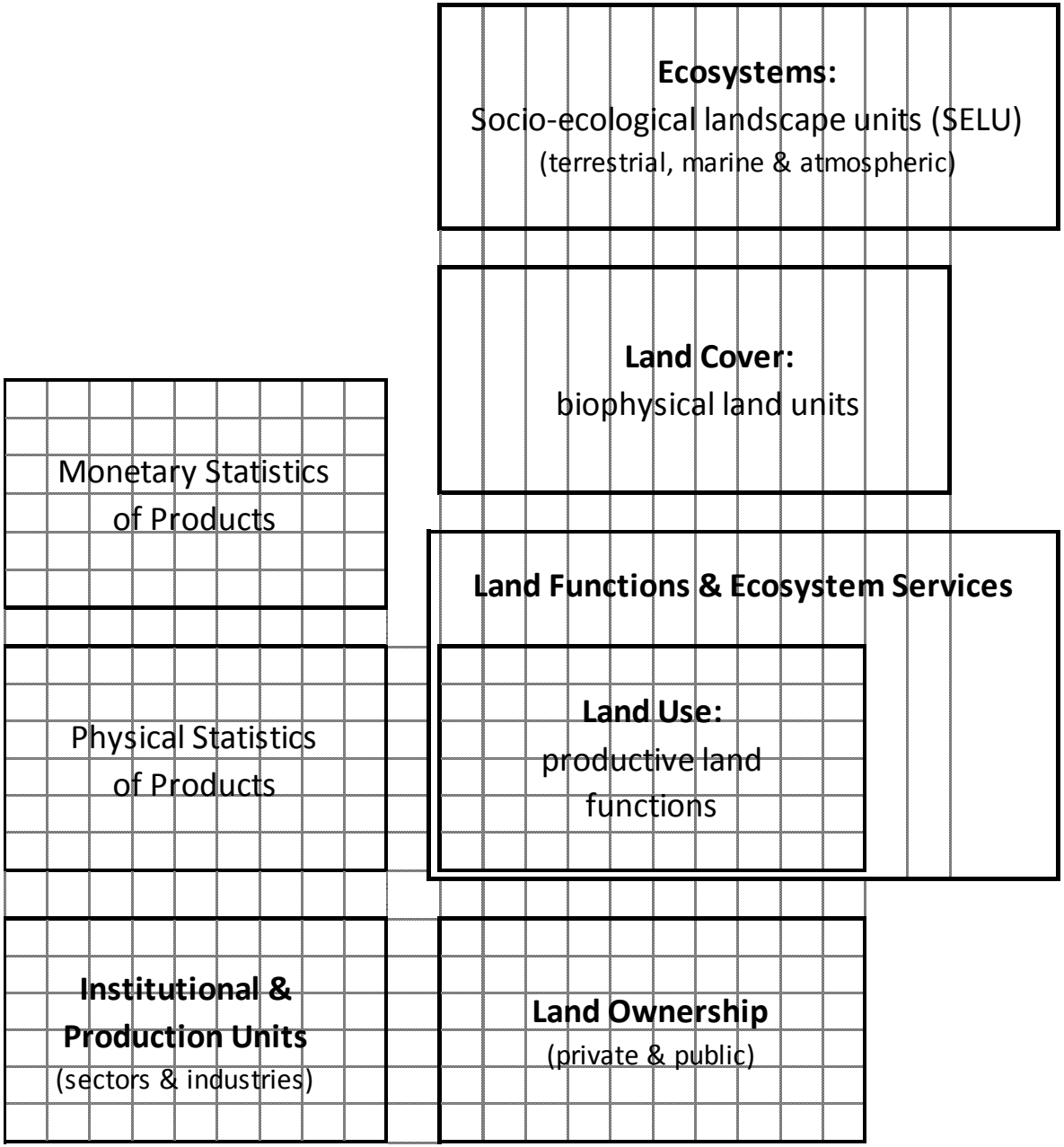
From theory to statistics and accounts

Theoretical background (very incomplete…):

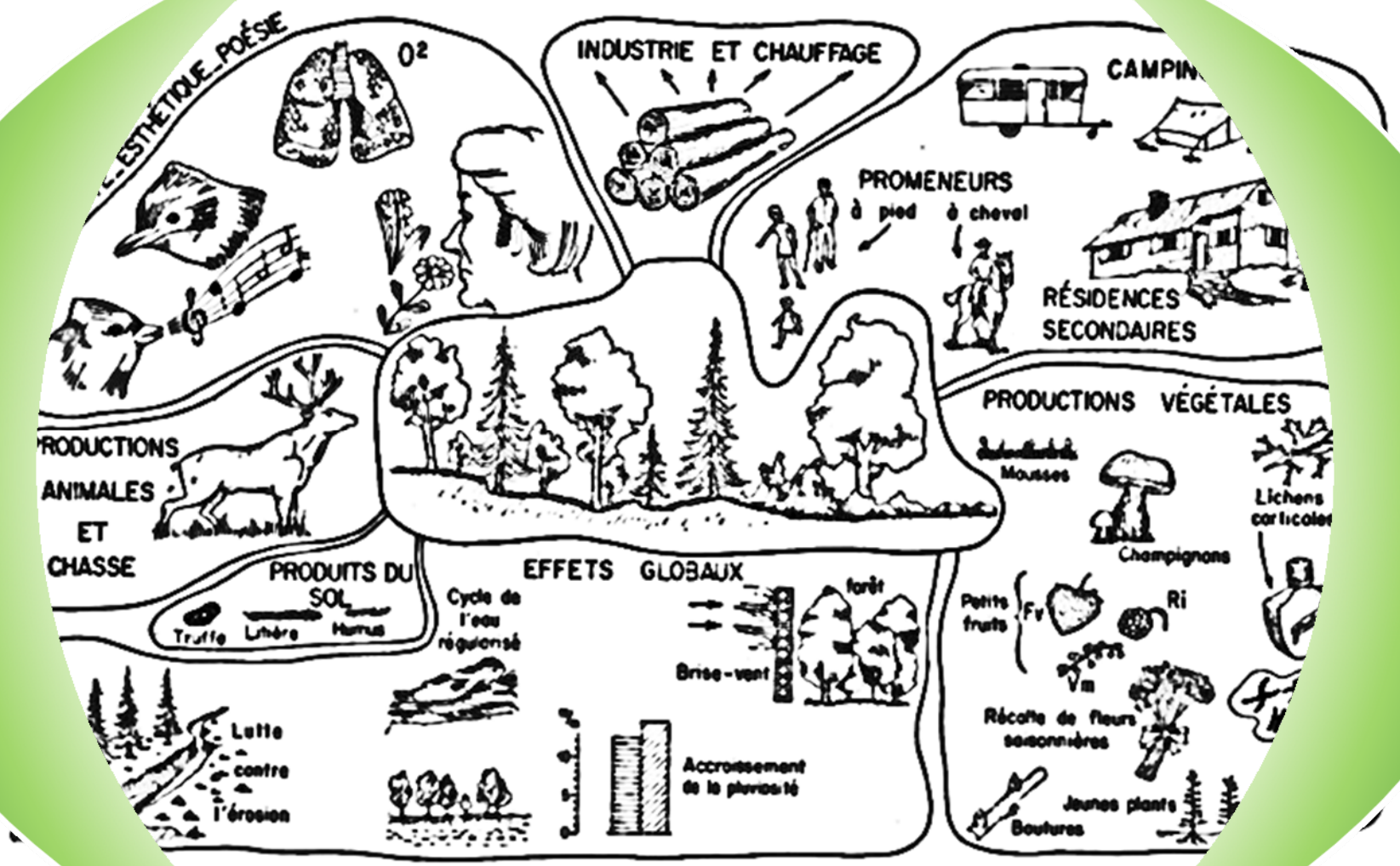
- *Georgescu-Roegen (The Entropy Law and the Economic Process* (1971), Odum (emergy), Hollin (panarchy,interaction between scales)
- Co-evolving systems (Norgaard)
- Ecosystem services: Long (1972), Costanza and De Groot, Millennium Ecosystem Assessment (2003)
- Landscape ecology (UK)
- Ecosystem units: socio-ecological systems (Gallopin, Carpenter, Rockström, Stockholm Resilience Centre, MA2003…)
- Ecosystem health (D. Rapport), resilience (the Resilience Alliance)

➔from economic-ecological theory to statistical practice and accounts : statistical units and classifications

Main relations between classifications & accounting units



Ecosystem services



Source: Gilbert Long, 1972

Common International Classification of Ecosystem Services (draft)

Theme	Class	Group
Provisioning	Nutrition	Terrestrial plant and animal foodstuffs
		Freshwater plant and animal foodstuffs
		Marine plant and animal foodstuffs
		Potable water
	Materials	Biotic materials
		Abiotic materials
	Energy	Renewable biofuels
		Renewable abiotic energy sources
Regulation and Maintenance	Regulation of wastes	Bioremediation
		Dilution and sequestration
	Flow regulation	Air flow regulation
		Water flow regulation
		Mass flow regulation
	Regulation of physical environment	Atmospheric regulation
		Water quality regulation
		Pedogenesis and soil quality regulation
	Regulation of biotic environment	Lifecycle maintenance & habitat protection
		Pest and disease control
		Gene pool protection
Cultural	Symbolic	Aesthetic, Heritage
		Religious and spiritual
	Intellectual and Experiential	Recreation and community activities
		Information & knowledge

CICES: Table E.2: Proposed Thematic, Class and Group Structure – source: EEA & Roy Haines-Young

Land cover classification based on FAO LCCS3

Land Cover Types

A	Herbaceous crop
A1	*Herbaceous crop/ Small size fields rainfed (< 2 ha)*
A2	*Herbaceous crop/ Medium to large size fields rainfed*
A3	*Herbaceous crop/ Medium to large size fields irrigated*
B	Tree or shrub crop
C	Multiple or layered crop
D	Tree covered area
E	Shrub covered area
F	Herb covered area
G	Sparse natura l vegetation (terrestrial/aquatic/regularly flooded)
H	Aquatic or regularly flooded tree covered area
I	Aquatic or regularly flooded shrub or herb covered area
J	Bare areas (terrestrial or regularly flooded)
K	Artificial surfaces and associated areas
L	Inland water bodies
M	Glacier and perennial snow

sampling

mapping

and derived Land Cover Functional Units

01	Urban and associated developed areas
02	Medium to large fields rainfed herbaceous cropland
03	Medium to large fields irrigated herbaceous cropland
04	Permanent crops, agriculture plantations
05	Agriculture associations and mosaics
06	Pastures and natural grassland
07	Forest tree cover
08	Shrubland, bushland, heathland
09	Sparsely vegetated areas
10	Natural vegetation associations and mosaics
11	Barren land
12	Permanent snow and glaciers
13	Open wetlands
14	Inland water bodies
15	Coastal water bodies
16	Sea (per memory)

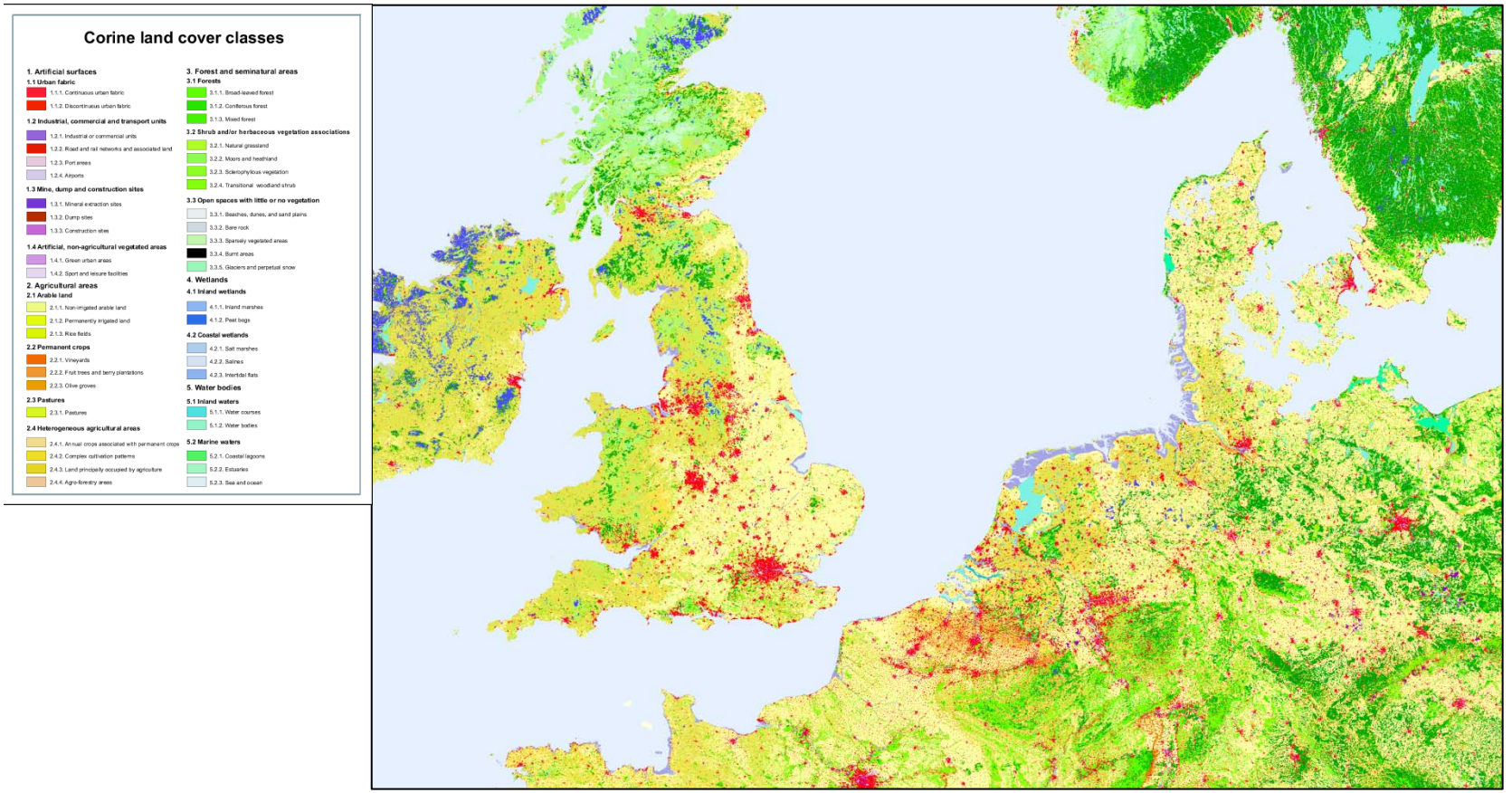
Ecosystem accounting and statistical units

SNA statistical units don't record ecosystem degradation ➔ need for other units…

Theoretical units vs. observation units (proxies for collecting data)

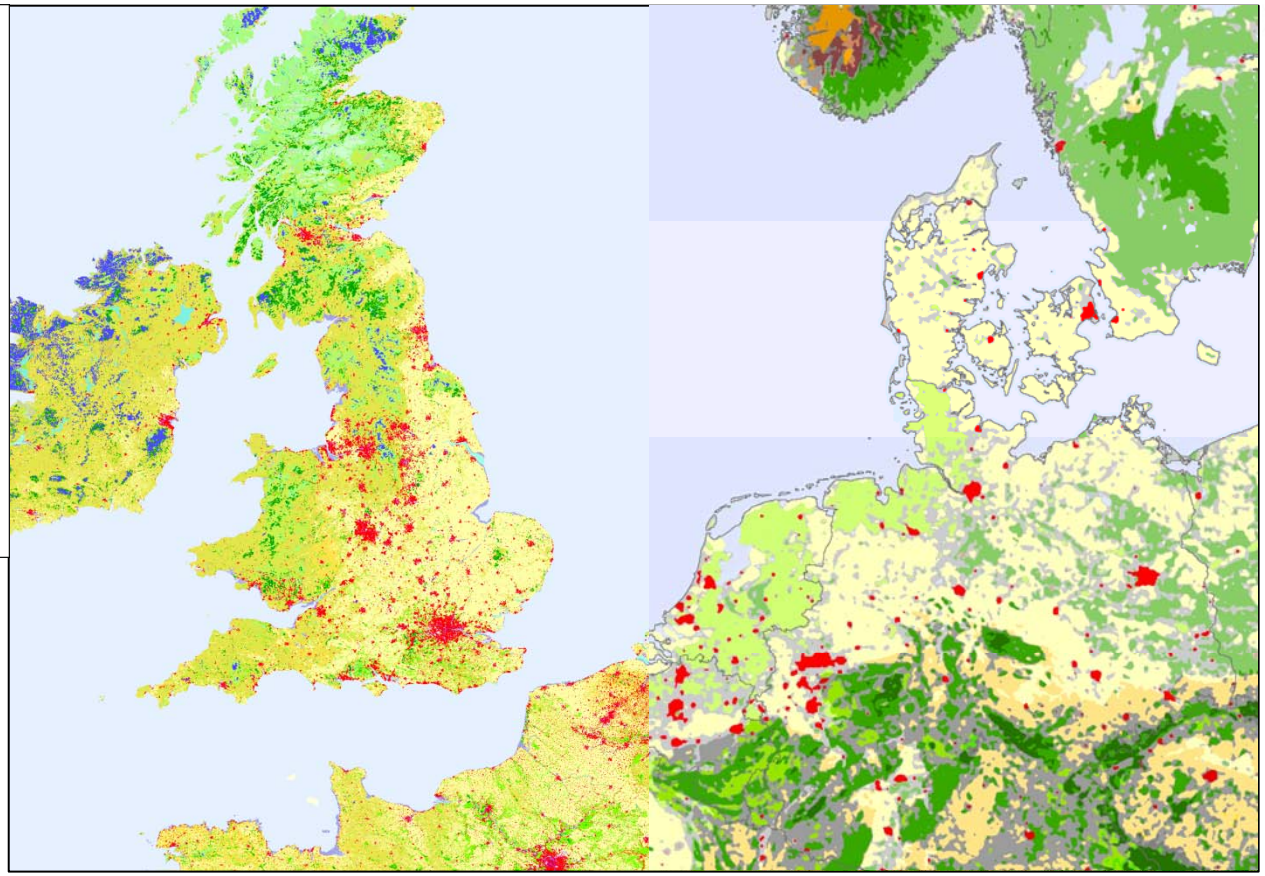
- **Theoretical units**: characteristic systems into which natural and socioeconomic elements interact to transform ecosystem functions into goods and services:
  - Functional units producing elementary services
  - "Socio-ecological systems", "socio ecosystems" or "Socio-ecological production landscapes" (the Japanese satoyama and satoumi) ➔
- **Observation units**:
  - For which we can collect data in a systematic way
  - Mostly surface units: "geo-systems", land cover units, functional administrative units, ownership units…

Japan *Satoyama Satoumi* Assessment, 2010. *Satoyama-Satoumi* Ecosystems and Human Well-being: Socio-ecological Production Landscapes of Japan – Summary for Decision Makers. United Nations University, Tokyo, Japan.

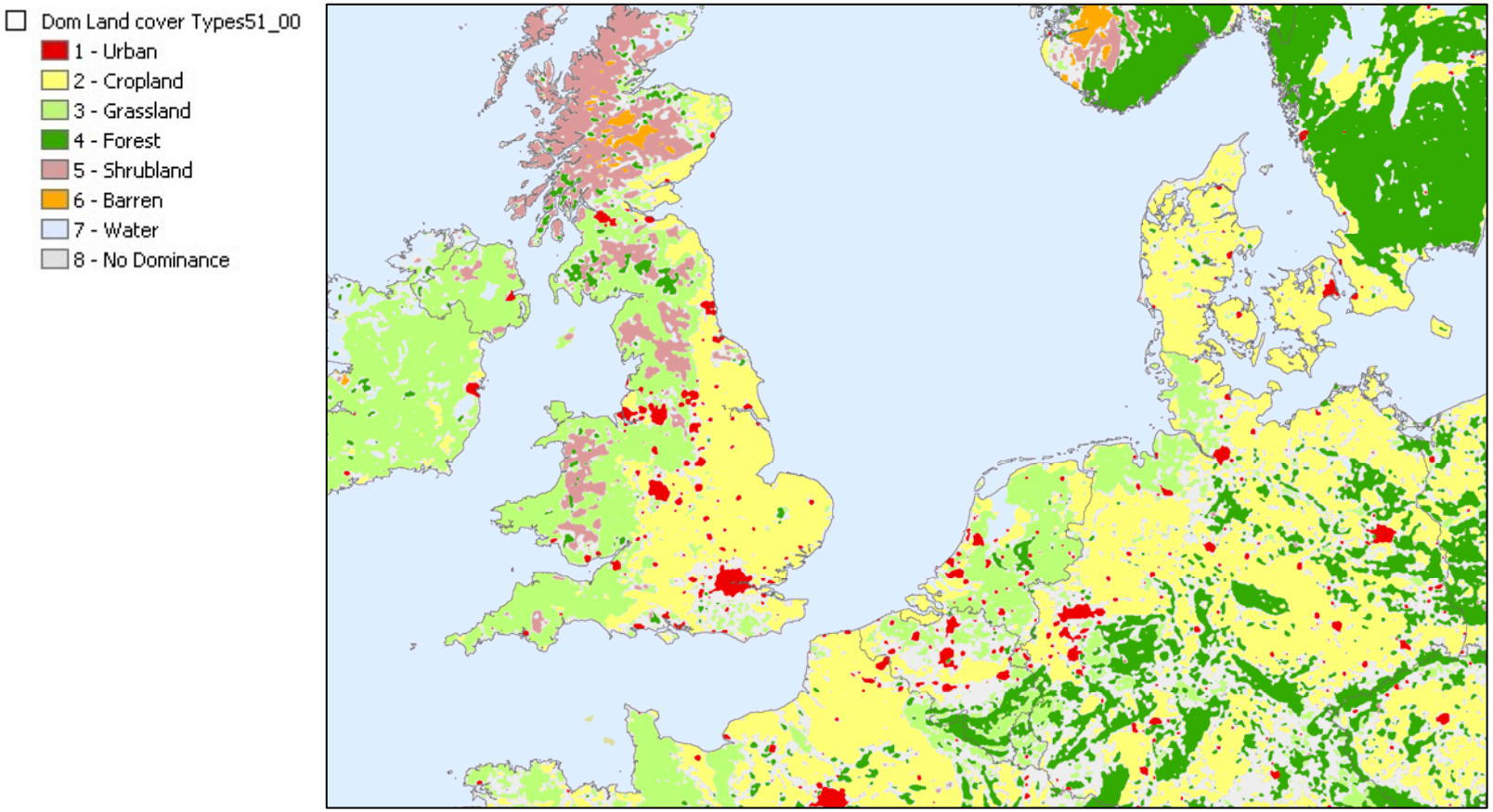


Land cover functional units: example of Europe

Land cover units are homogenous considering production of ecosystem services: crops, timber, water…

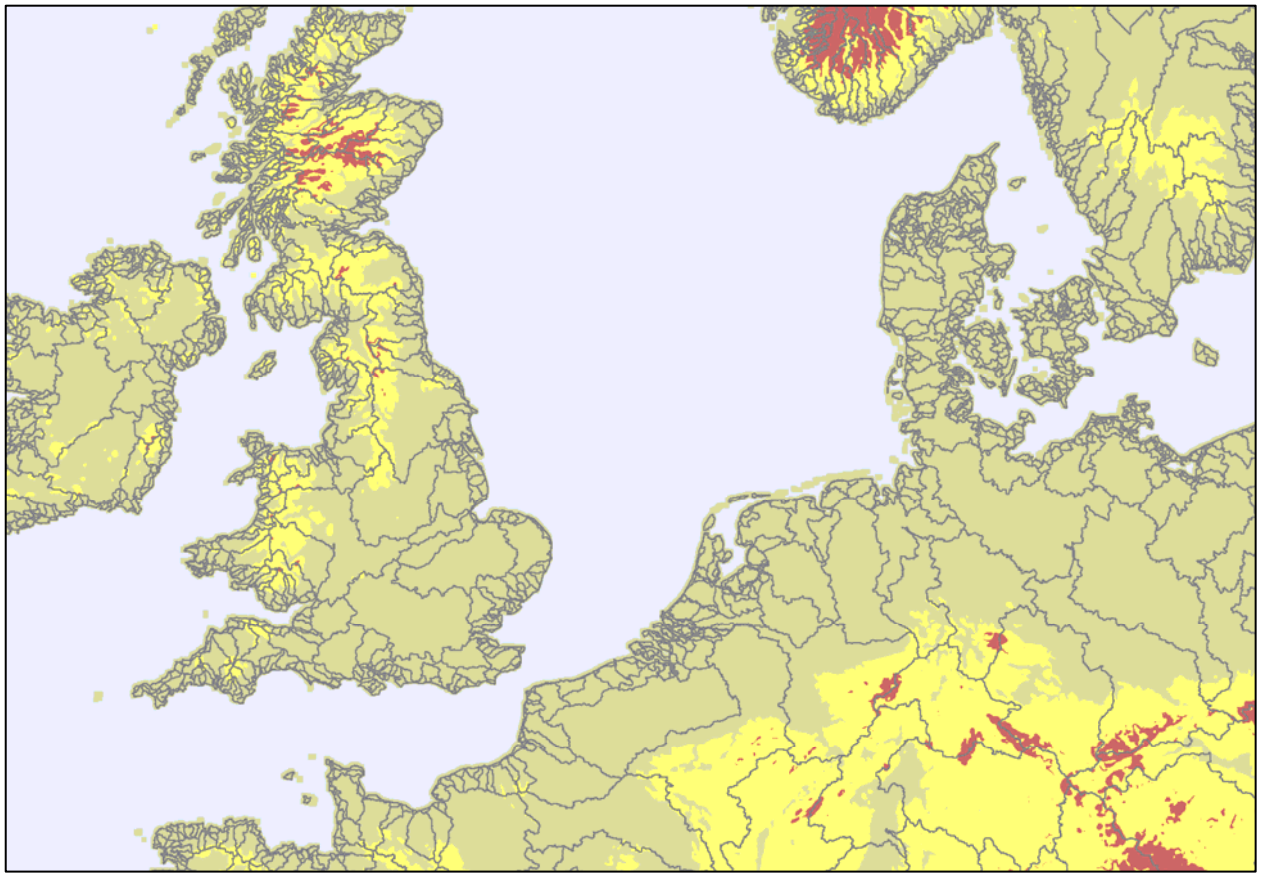


From land cover units to ecosystem landscape units

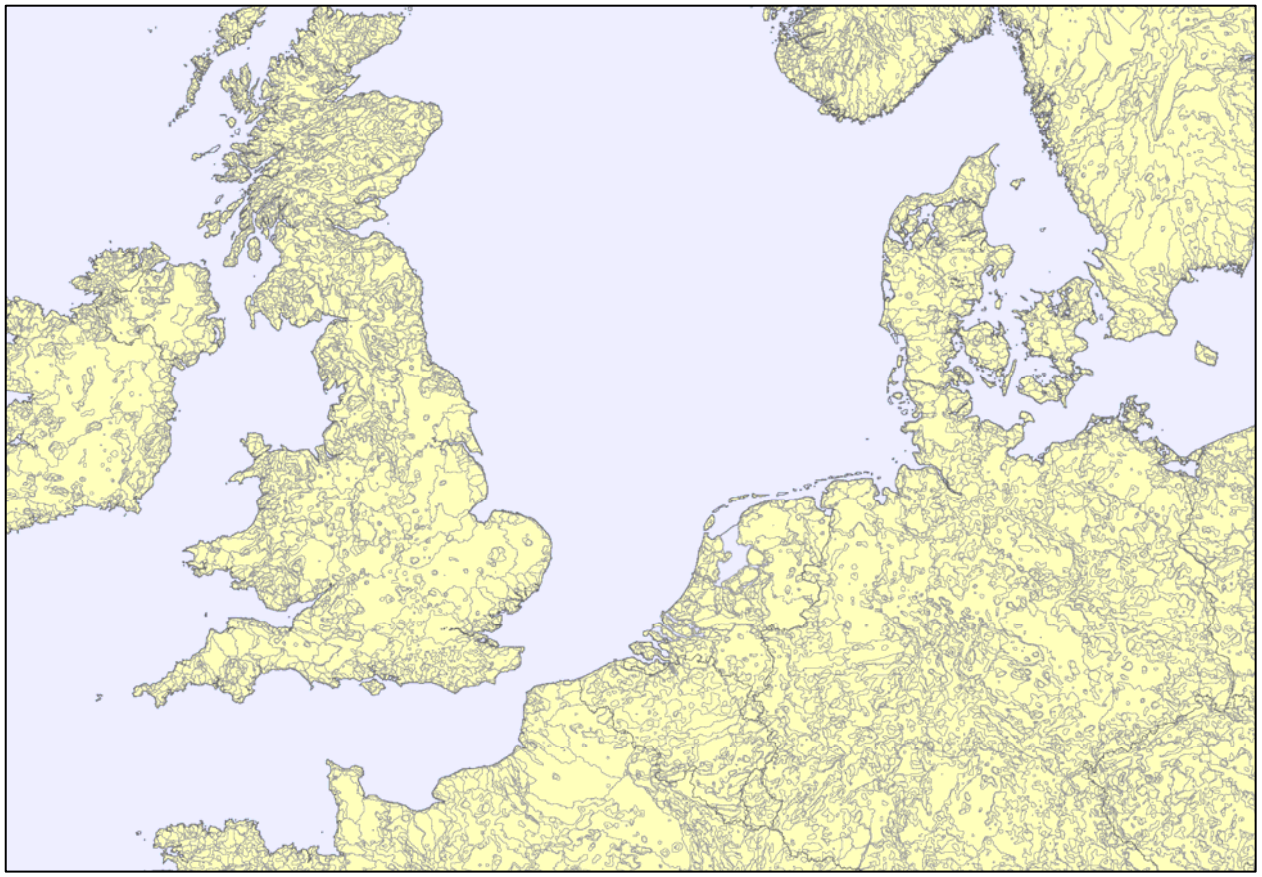


Dominant land cover types (more than 50% criteria)

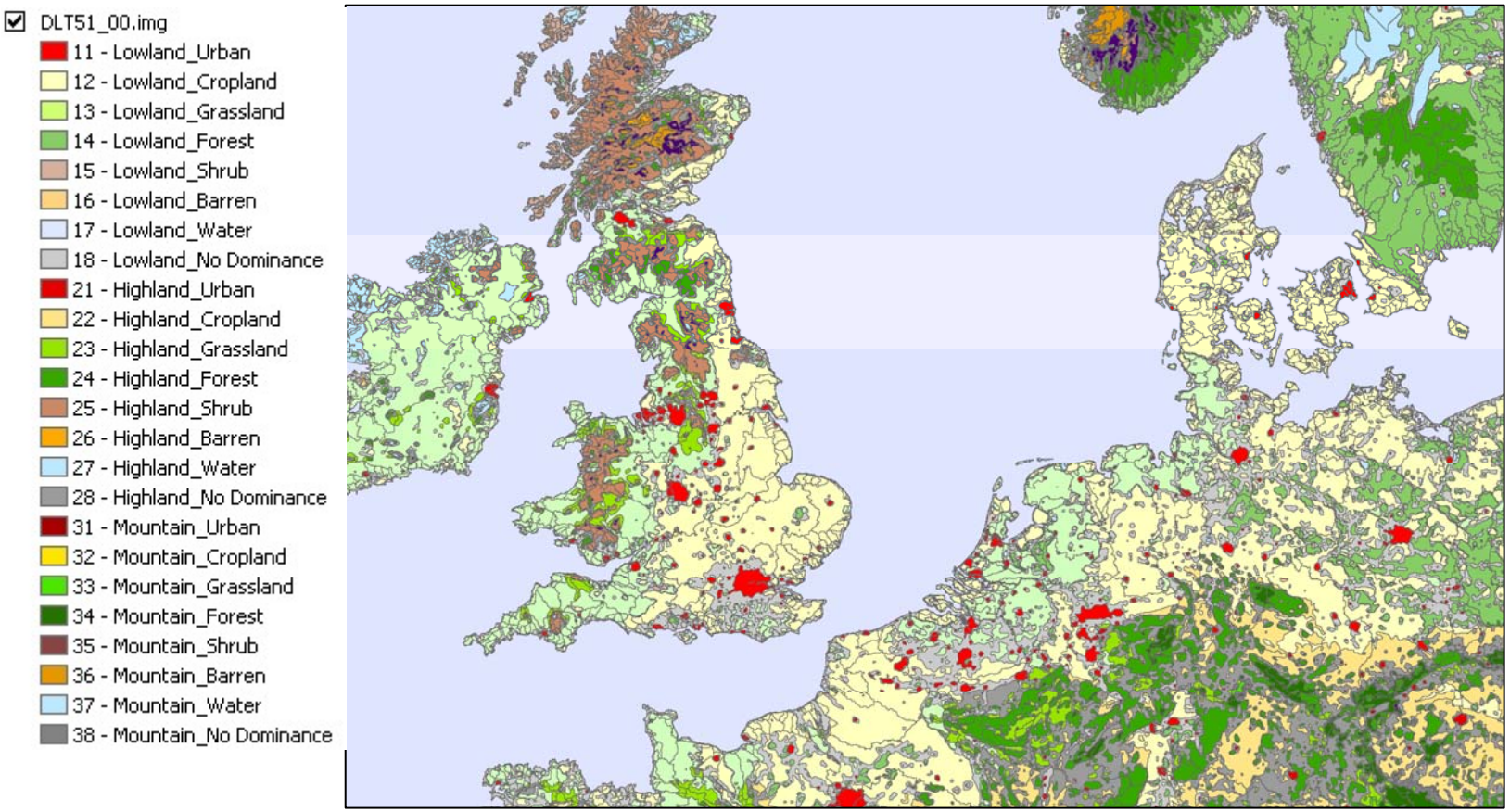
In grey are areas where **no** land cover type is dominant



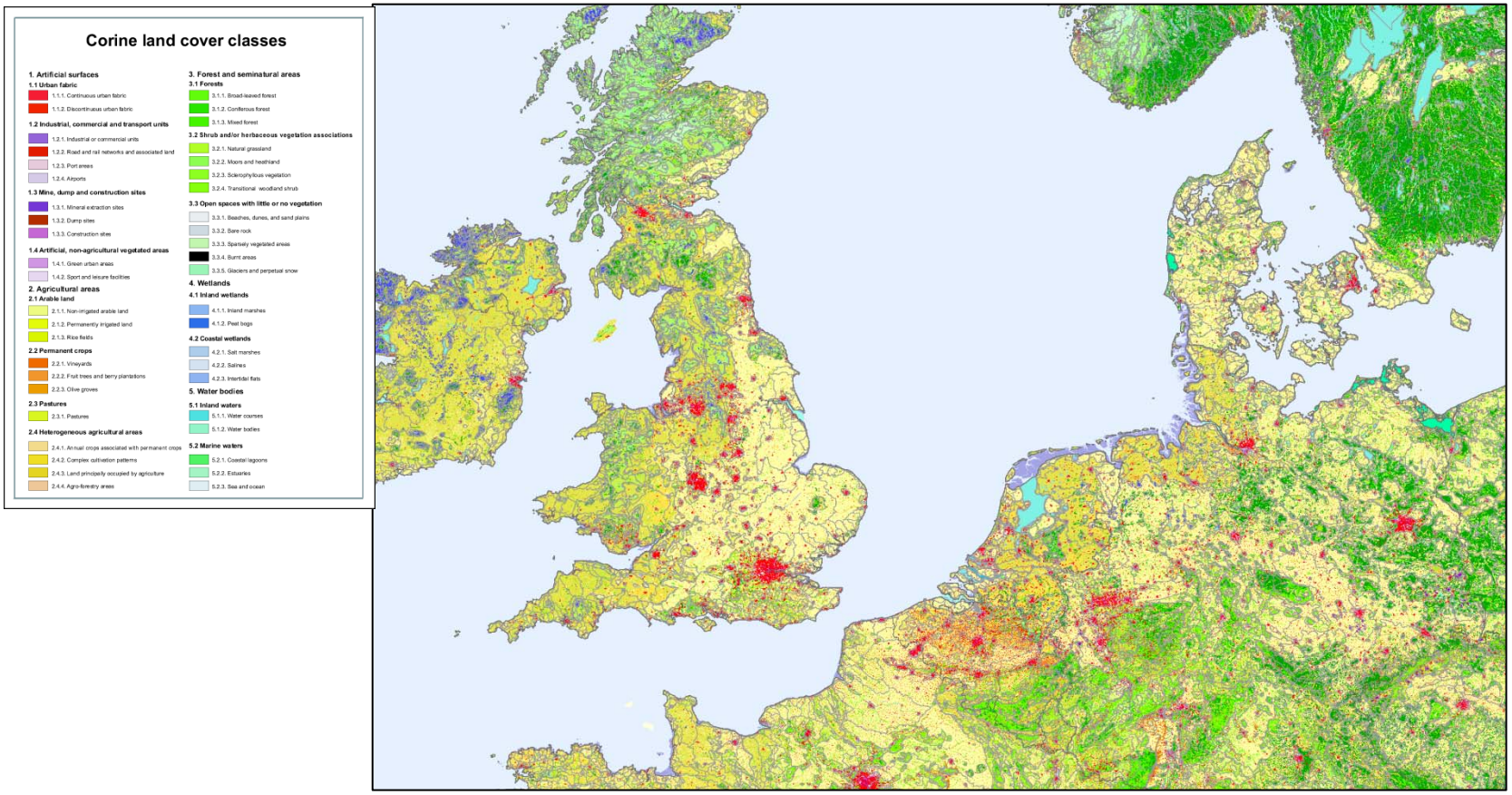
Relief and river basins limits



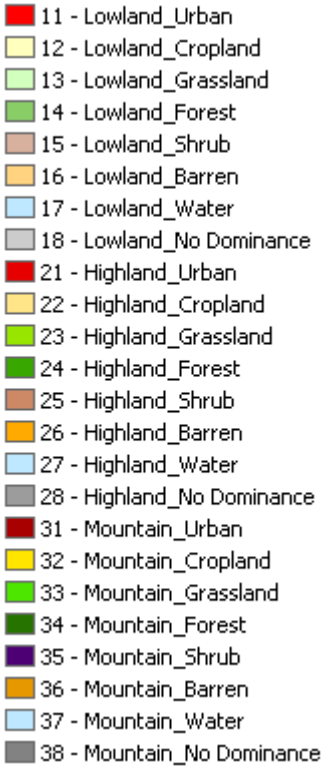
The SELU map/database

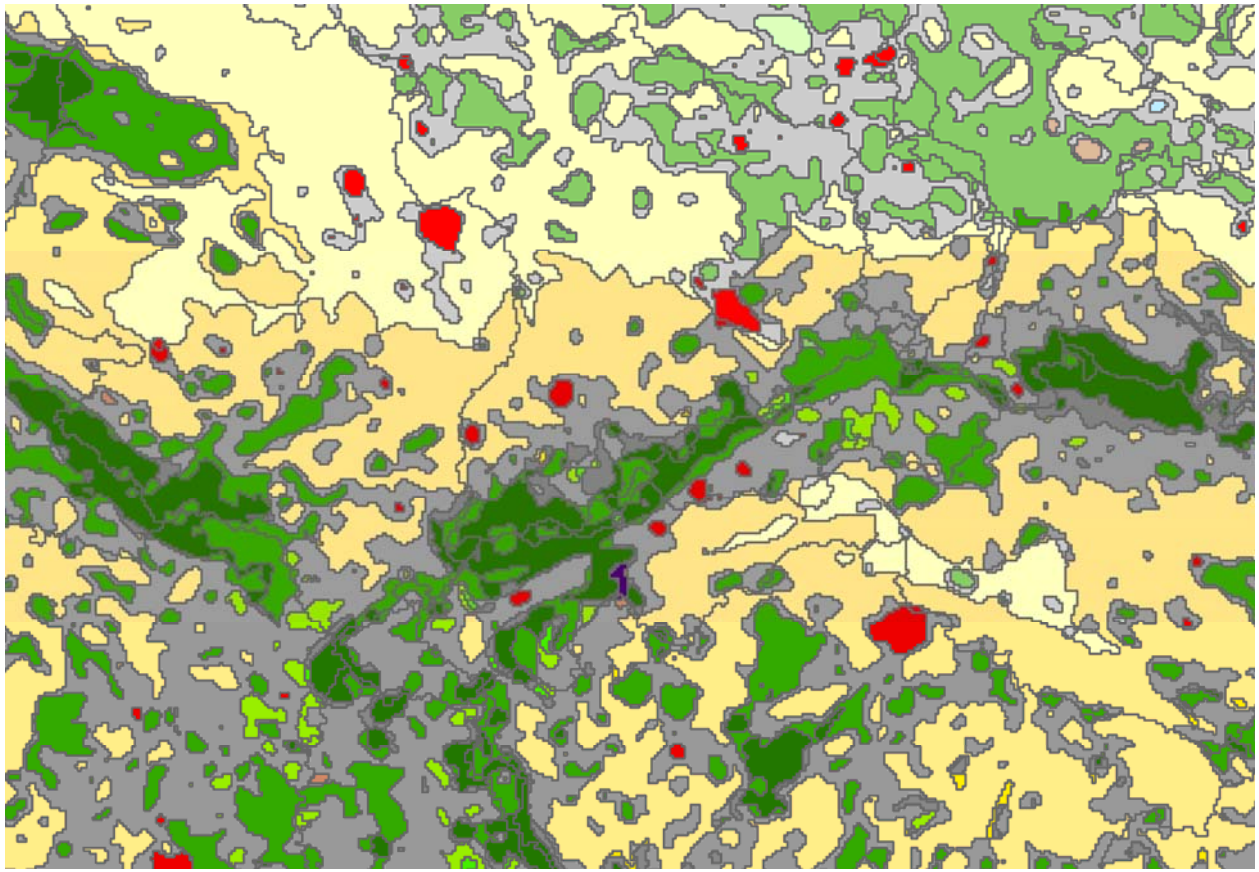


SELU classified by landscape types

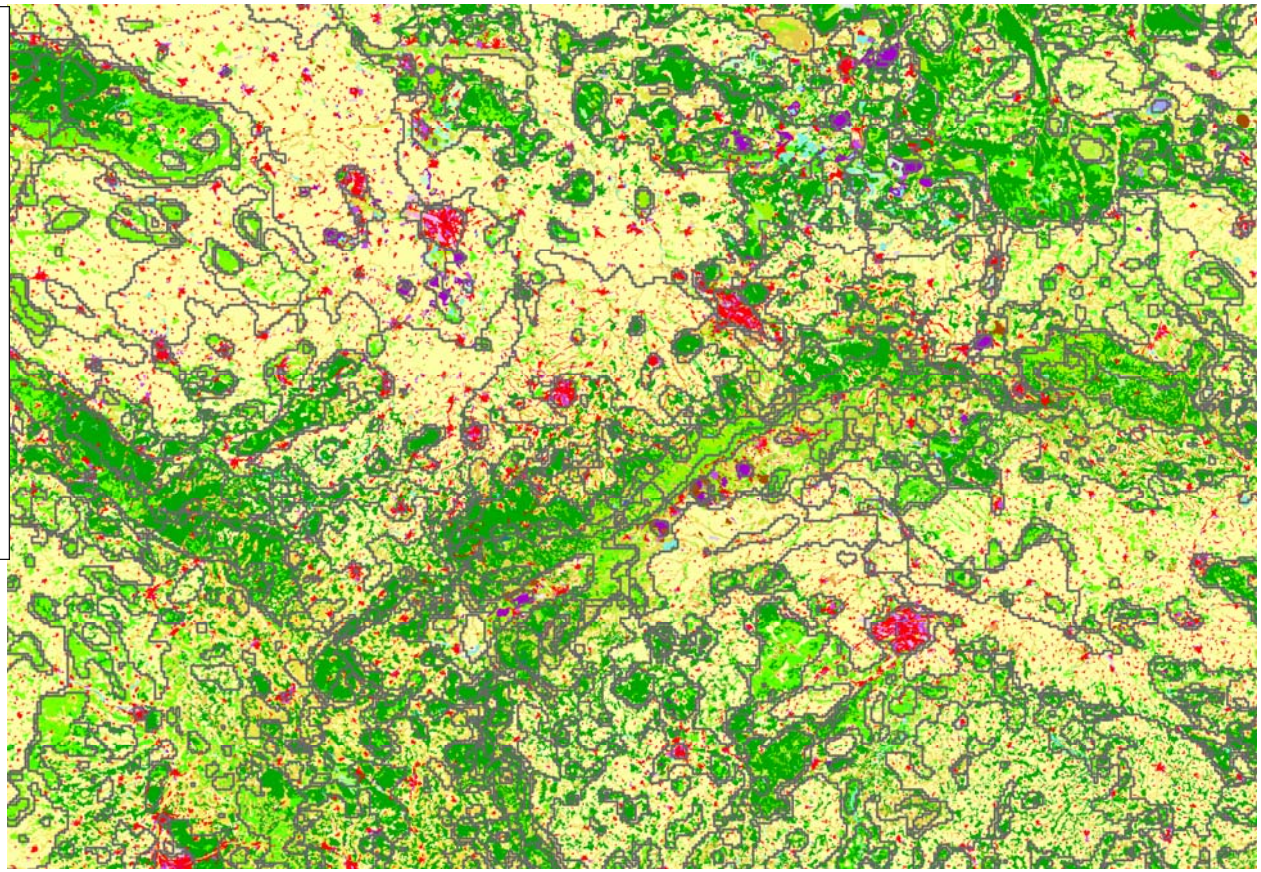


Land cover functional units mapped by SELU





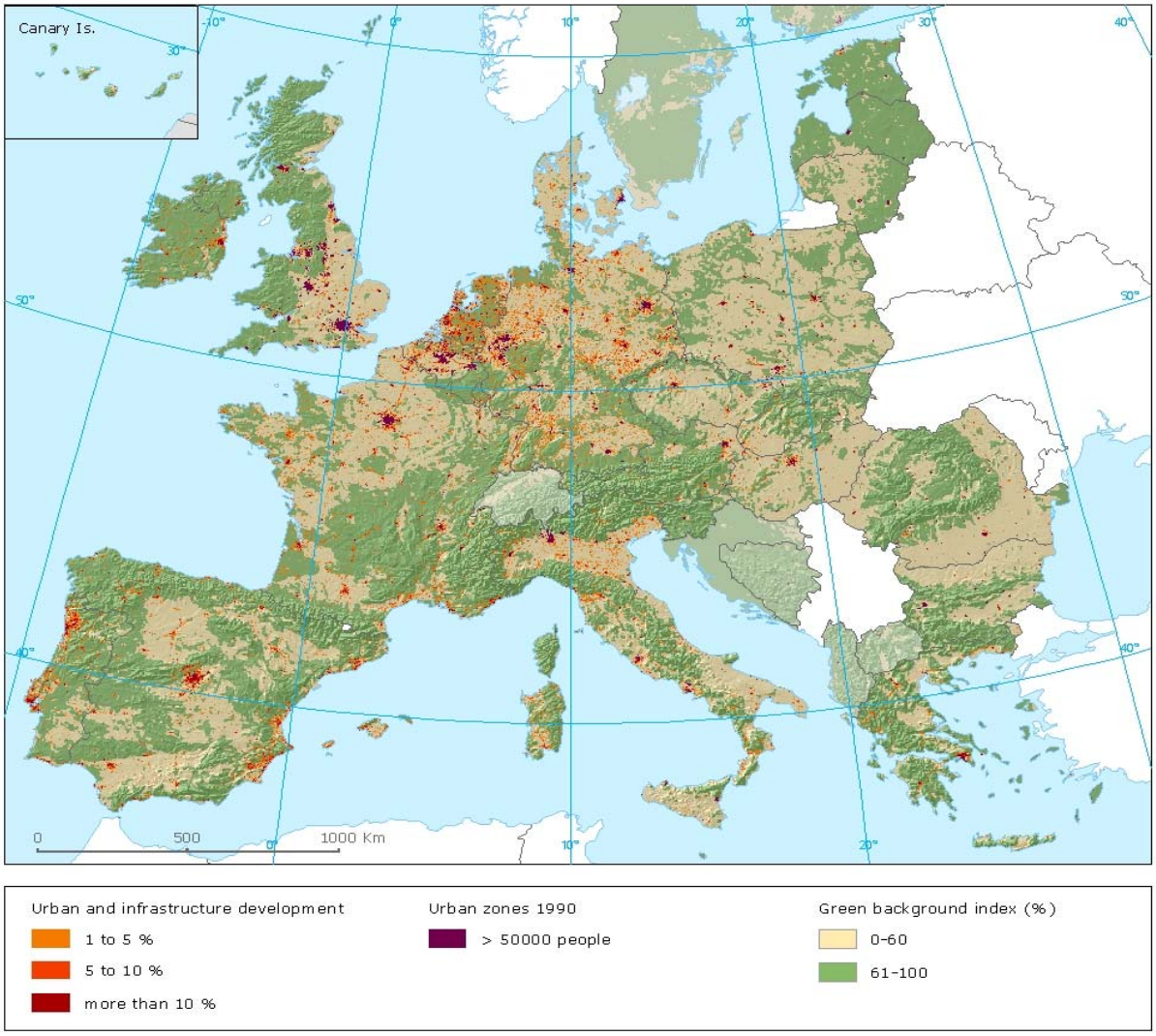
ZOOM: SELU in Central Europe

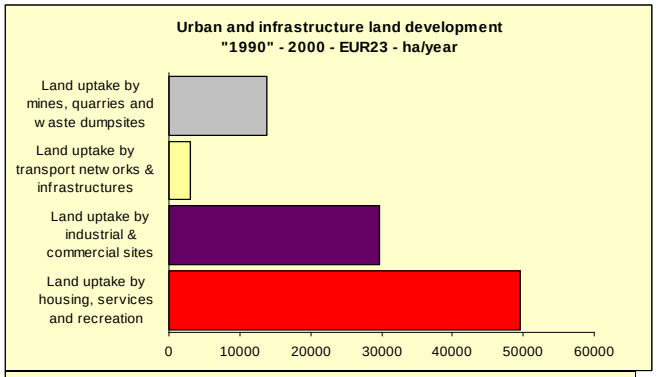


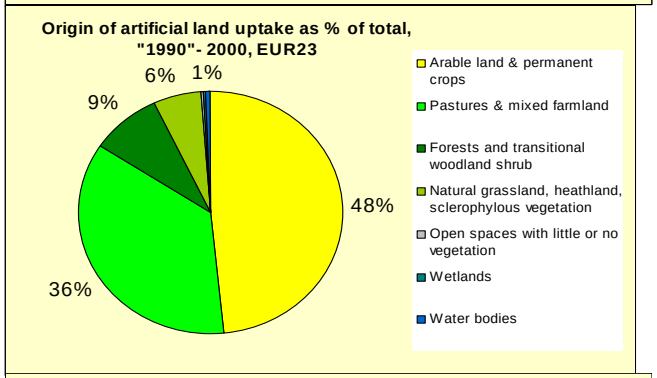
ZOOM: Land cover functional units by SELU

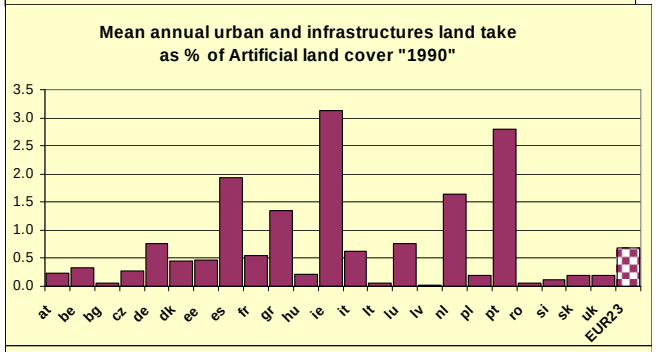
The land/ landscape account

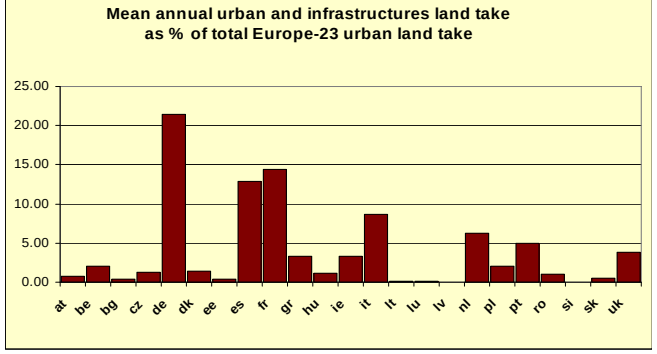
Sprawl of artificial areas 1990-2000

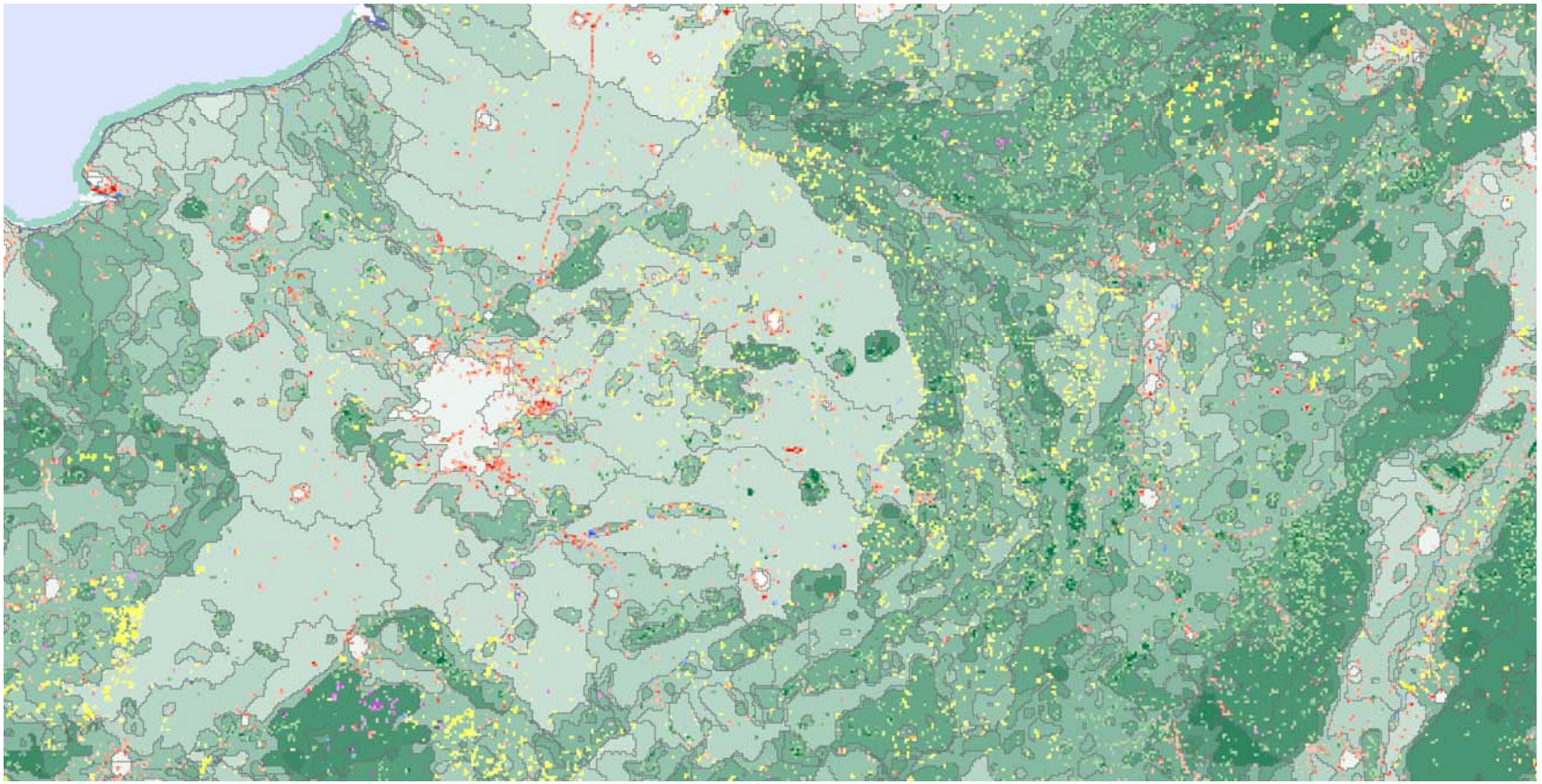






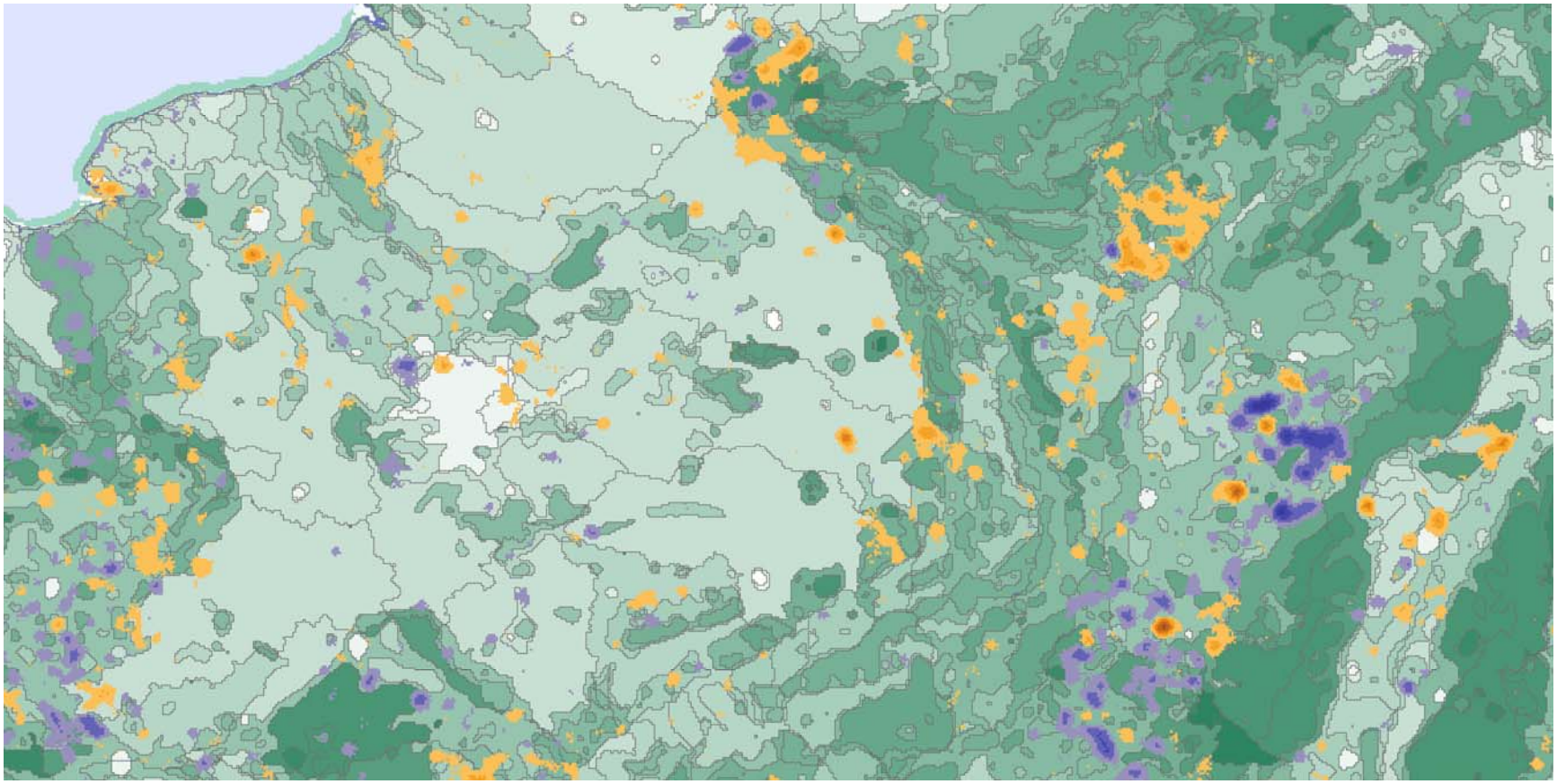






Land cover flows 1990-2006 and mean Landscape Ecosystem Potential (LEP) by ecosystem landscape unit

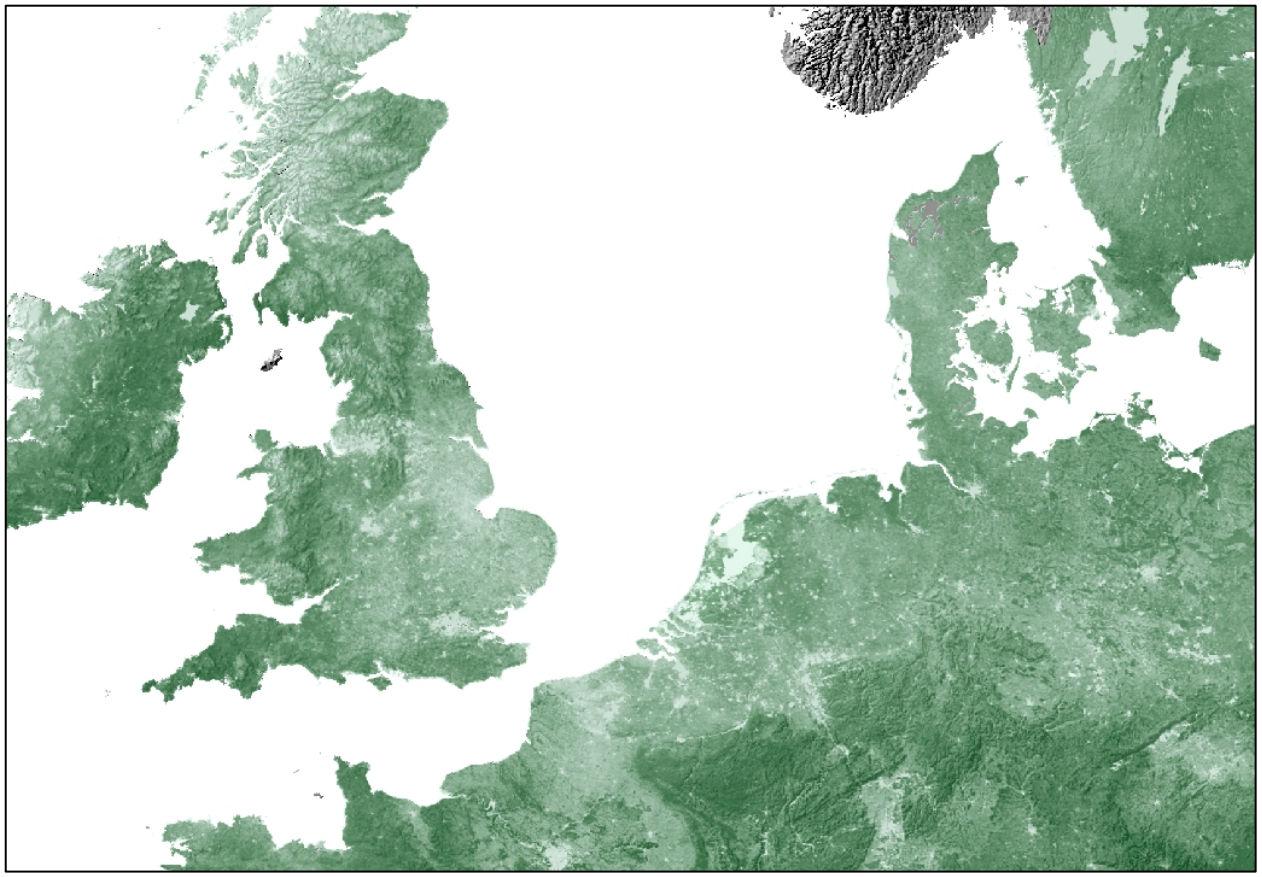
Land cover flows are measured according to the EEA LEAC methodology based on Corine land cover *(J-L Weber and E. Ivanov, 2011)*



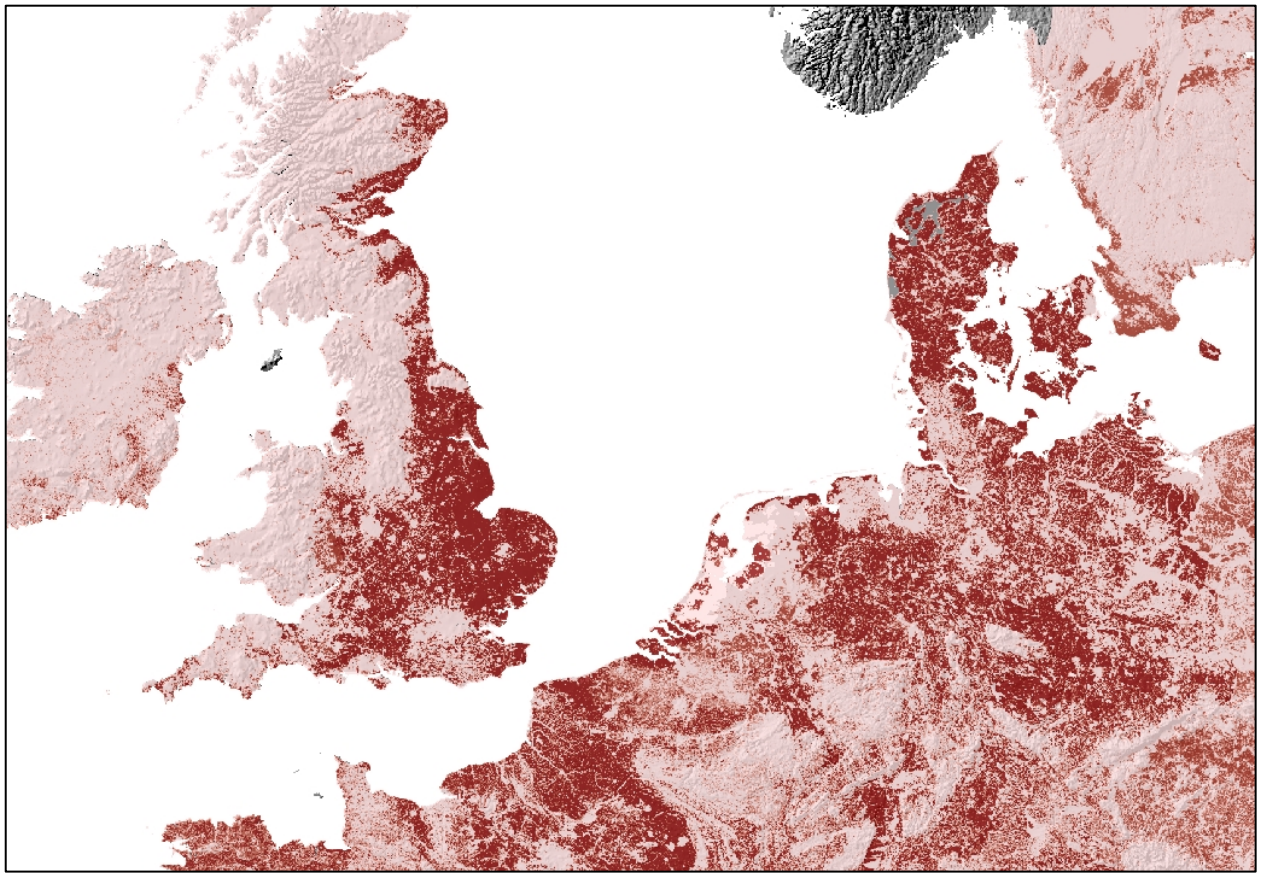
Landscape Ecological Potential change 1990-2006, by ecosystem landscape unit

(J-L Weber and E. Ivanov, 2011)

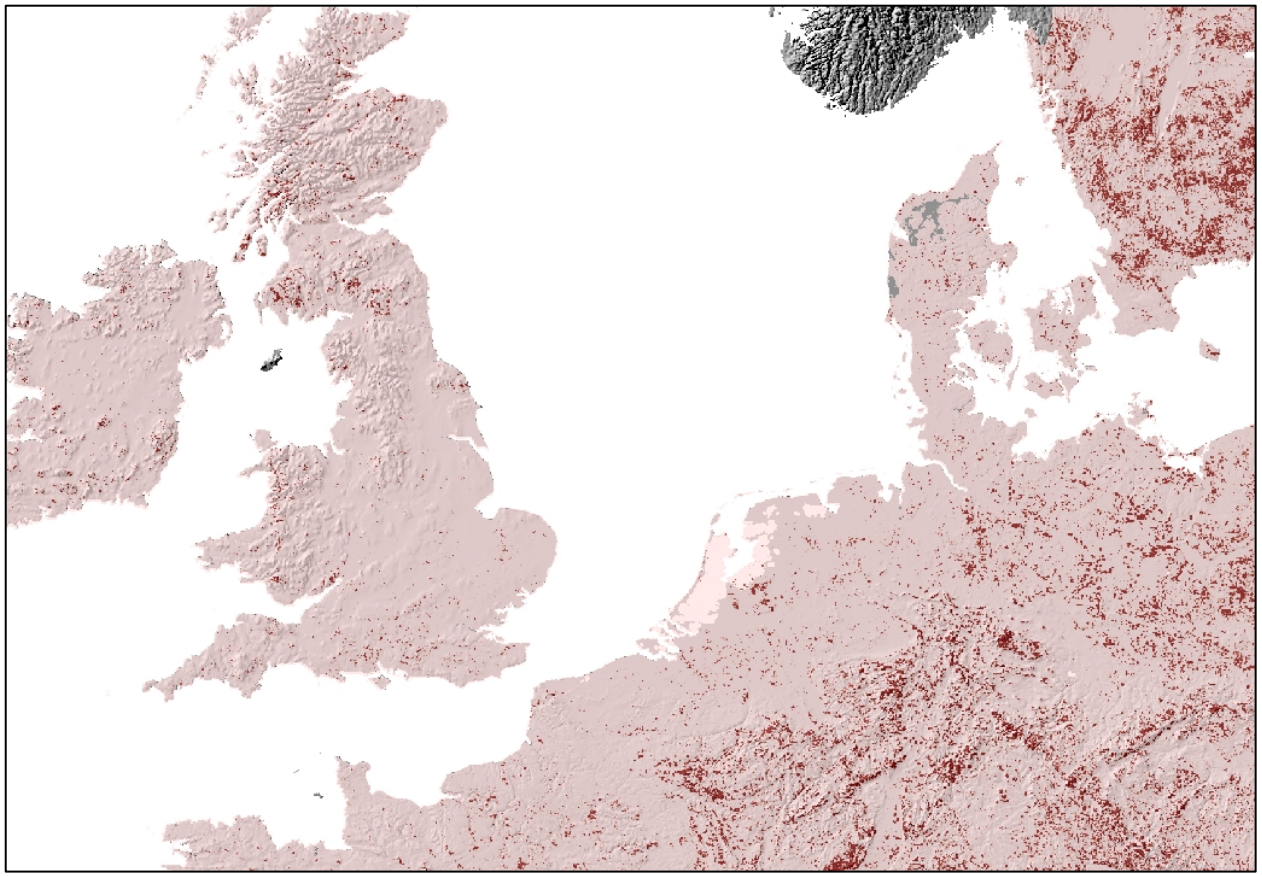
The biomass/carbon account



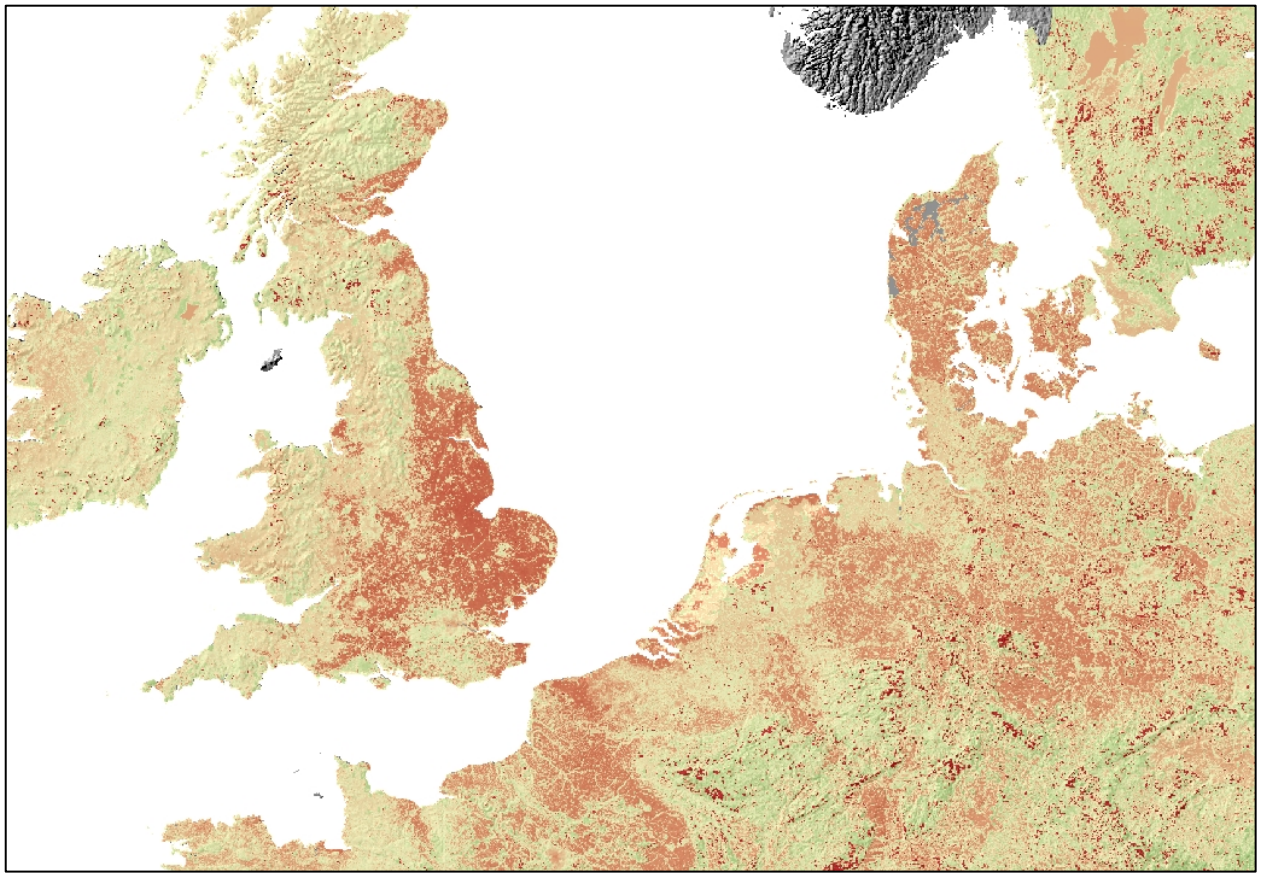
Net Primary Production of biomass/carbon
(2000, in tons of carbon)



Harvest of crops
(2000, in tons of carbon)



Harvest of timber
(2000, in tons of carbon)



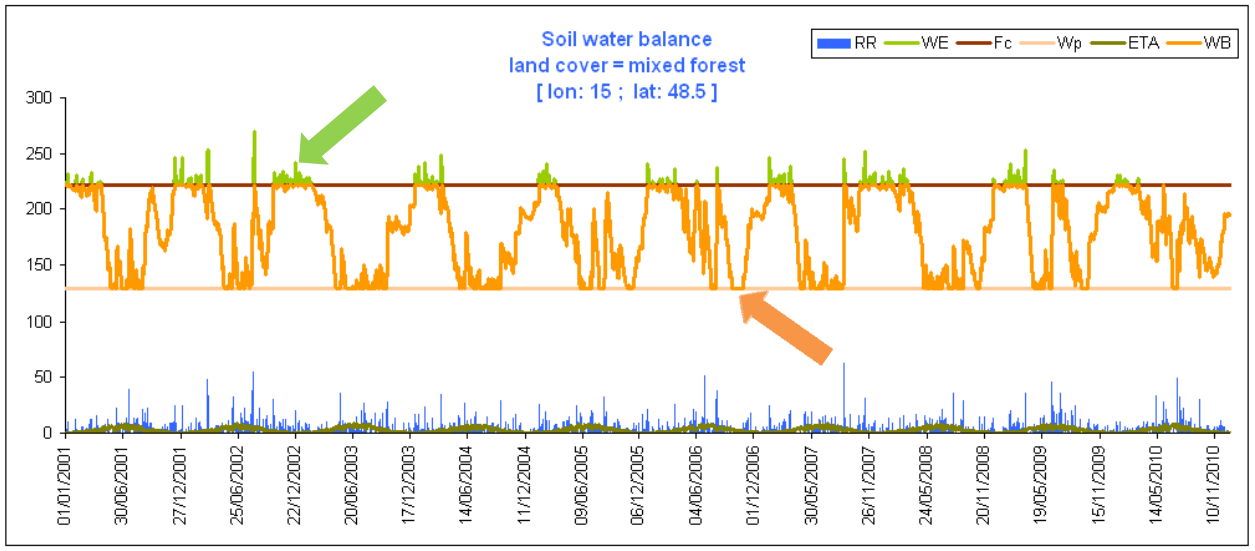
Net Ecosystem Carbon Balance (NECB)

(2000, in tons of carbon)

NECB = NPP – Harvest of crops and Timber + - minor flows (organic fertilization, erosion, emissions to air from decomposition…)

The water account (example of soil water)

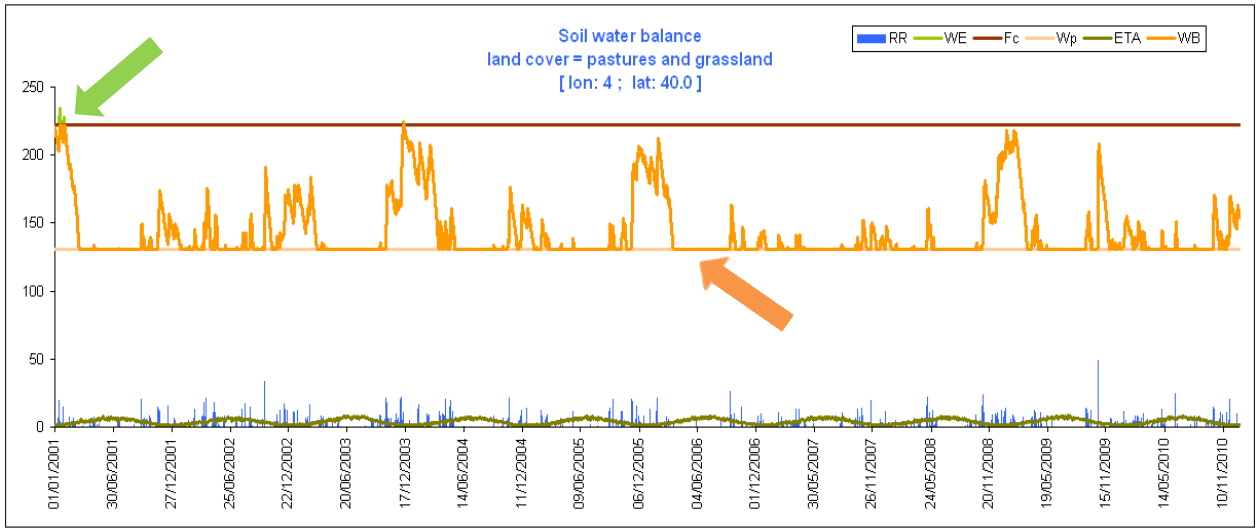
Soil water stress: % of days when no water is available for plants



One point in Germany

Surplus streaming to rivers or infiltrating to groundwater

No water available for plants below this point (Wilting point)



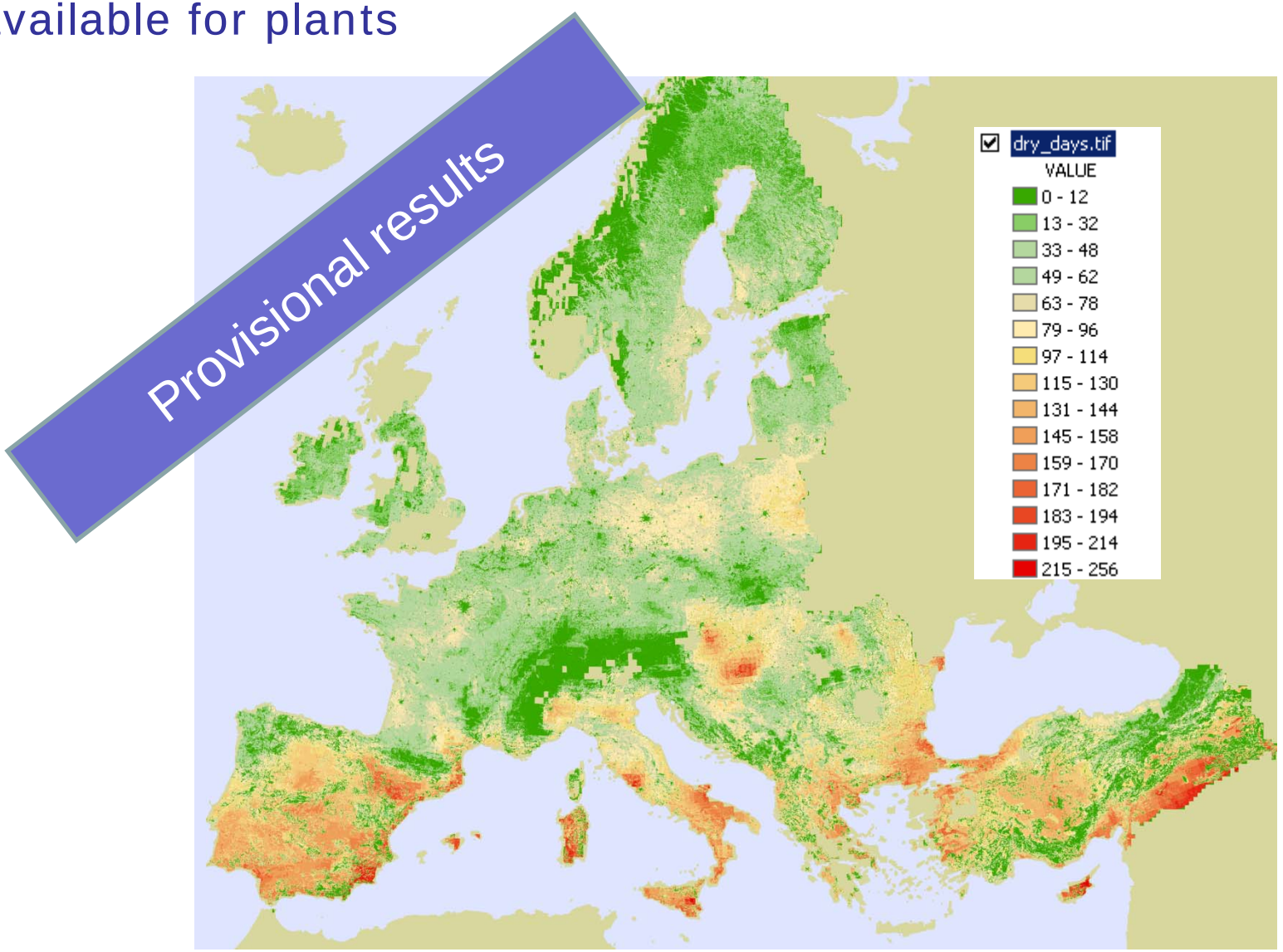
One point in Spain

Surplus streaming to rivers or infiltrating to groundwater

No water available for plants below this point (Wilting point)

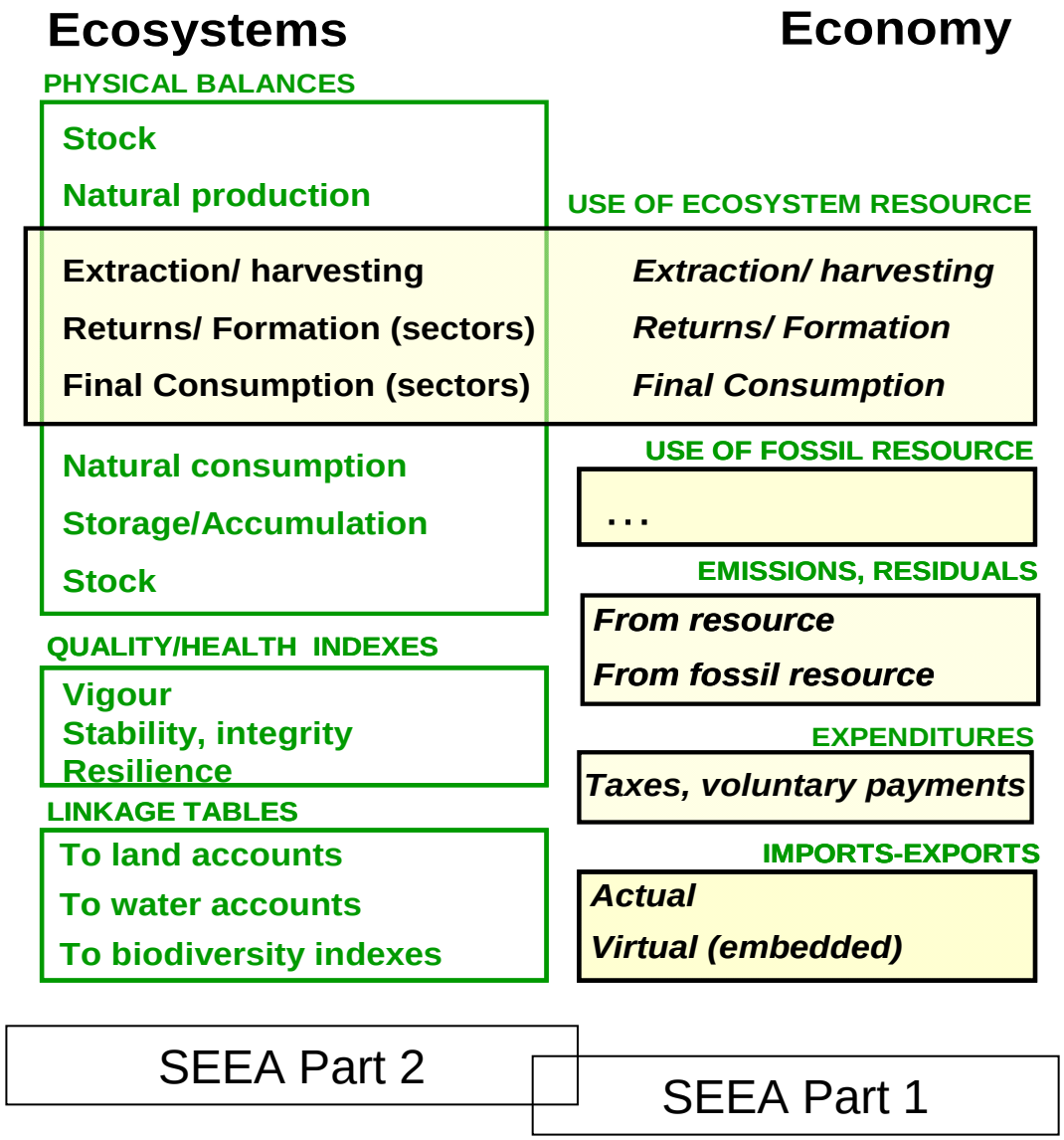
Source: Blaz Kurnik, EEA, 2011

Soil water stress in 2001: number of days when no water is available for plants



Source: Blaz Kurnik, EEA, 2011

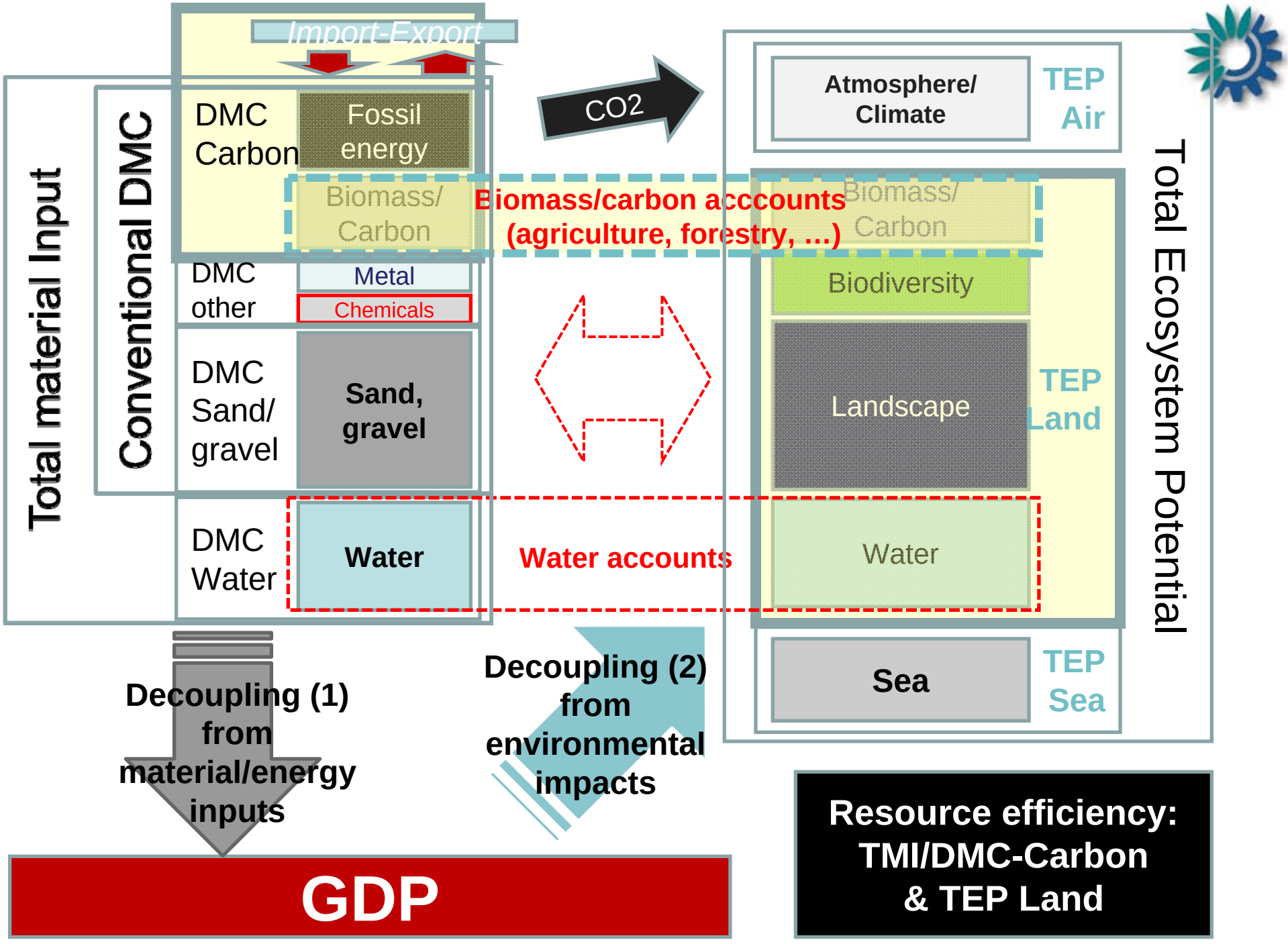
Ecosystem-Economy integrated accounts



SNA & SEEA: economic and ecosystem assets

Assets hold by ecosystem units (forests, agro-systems, wetlands…)	Assets hold by economic units (enterprises, government bodies, households…)									
	Produced assets					Non produced assets				
	Dwellings & other buildings and structures	Machinery and equipment	Cultivated biological resources	Inventories	Other products	Land	Mineral and energy reserves	Noncultivated biological resources	Water and other natural resources	Intangible assets (contracts, licences…)
Land			x			x				
Land cover systems	x		x			O		x	x	
Biomass/carbon			x	x			O	x	O	
Water								O	x	
Biodiversity			O			O		O	O	O
Self regulating capacity	O		O			O		O	O	
Health, overall regenerative capacity			N			N		N	N	

x	explicitly recorded as economic asset
O	partly or indirectly recorded as economic asset
N	not recorded, externality


Import-Export
Total material Input
Conventional DMC
DMC Carbon
Fossil energy
Biomass/ Carbon
DMC other
Metal
Chemicals
DMC Sand/ gravel
Sand, gravel
DMC Water
Water
CO2
Biomass/carbon acccounts (agriculture, forestry, …)
Water accounts
Atmosphere/ Climate
TEP Air
Biomass/ Carbon
Biodiversity
Landscape
TEP Land
Water
Sea
TEP Sea
Total Ecosystem Potential
Decoupling (1) from material/energy inputs
Decoupling (2) from environmental impacts
GDP
Resource efficiency: TMI/DMC-Carbon & TEP Land