London Group
on Environmental and Economic Accounting
18th Meeting
Statistics Canada
Ottawa, 2-4 October 2012

Simplified Ecosystem Capital Accounts:

Progress of work at the EEA

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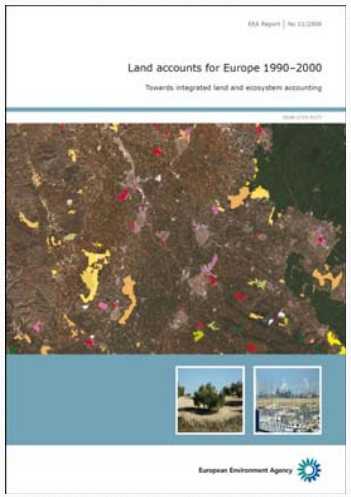
EEA's involvement in ecosystem accounting



Land cover accounts for Europe 1990-2000 (26 countries), 2006

Updated for year 2006 (34 countries), next update: for year 2012

Ecosystem accounting and the cost of biodiversity losses — the case of coastal Mediterranean wetlands, 2010, a report for TEEB

Activities within thematic processes:
UNEP/water
JRC/ES mapping
WB/WAVES
…

Activities within SEEA revision process

Fast Track implementation of ecosystem capital accounts, 2010-2012 (with Eurostat)

An experimental framework for ecosystem capital accounting in Europe
EEA Technical report No 13/2011

http://www.eea.europa.eu/publications/an-experimental-framework-for-ecosystem

CICES
Towards a Common International Classification of Ecosystem Services
European Environment Agency
Discussion hosted on behalf of the EEA

www.cices.eu

Summary of Discussion up to 1st December 2009
Roy Haines-Young and Marion Potschin (e-forum moderators)

The “fast track implementation of simplified ecosystem capital accounts in Europe”

- Based on:
  - European experience
  - Current development of ecosystem accounts in the UN SEEA revision
- Objectives:
  - Meet the policy demand (What, Beyond GDP?)
  - Accounts for 27 EU countries
  - Use of existing data
  - Best use of geographical information (e.g. when possible, 1 km x 1km grid)
  - Use of official statistics for socio-economic data (e.g. harvests…)
  - Annual accounts 2000-2010
  - Physical accounts first, by 2012, followed by monetary accounts

➔ make it relevant but simple (feasible, transparent, verifiable…)

The narrative behind simplified ecosystem capital accounts (SECA)

Ecosystems reproduce life on Earth and are resources for humankind (they deliver services...)

Ecosystems are altogether appropriable assets and public goods.

- As appropriated assets, they are owned and managed in view of benefits.
- As public good, they are "non-exclusive, non-rival": everyone has the same right to use them ("*we are all participants in the ecosystem*" – Richard Mount, 2012).

➔ When an economic agent degrades ecosystems by its activity, it degrades public good functions and creates debts to victimized communities, to future generations or to those countries from which commodities produced under unsustainable conditions are imported.

➔Debts (or credits, when improvement) can be measured in physical units and used as financial instruments..

The narrative behind simplified ecosystem capital accounts (SECA)

The monetary value of degradation and debts can be assessed on the basis of remediation costs (costs of restoration works or opportunity cost of avoiding degradation).

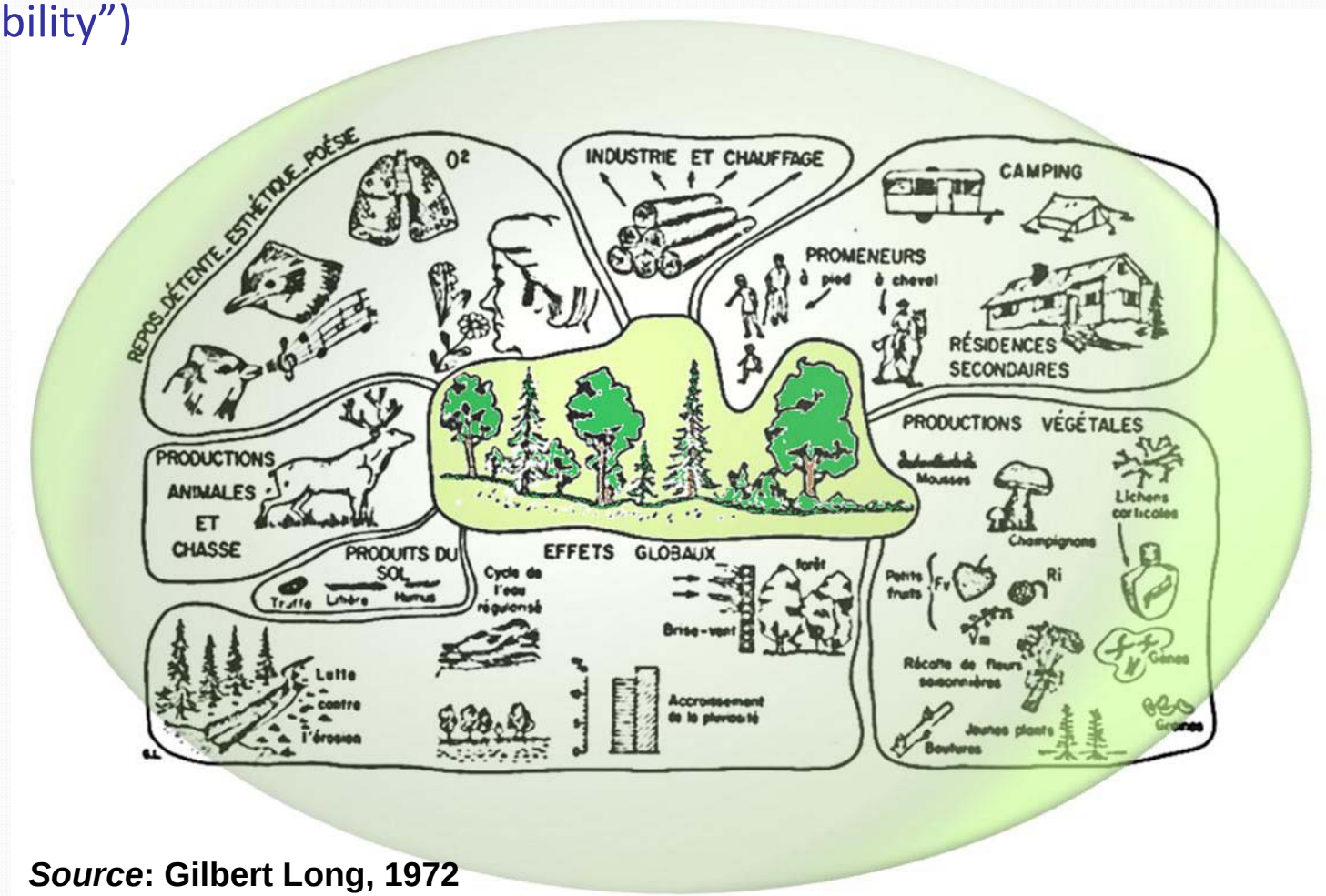
➔The monetary value of ecosystem degradation is a measurement of consumption of ecosystem capital which can be used for adjusting SNA aggregates: final demand at full cost (the "fair trade" paradigm) or Net Domestic Product.

Balancing the adjustment with debts forwarded to future instead of current (past) costs allows escaping the GreenStamp type criticism that the adjustment should lead to re-write the past…

Ecosystem services are measured on an ad hoc basis and can be valued if appropriate. The ecosystem capital is not measured from the NPV of ecosystem services.

Ecosystems have the capacity to deliver **multiple services** altogether

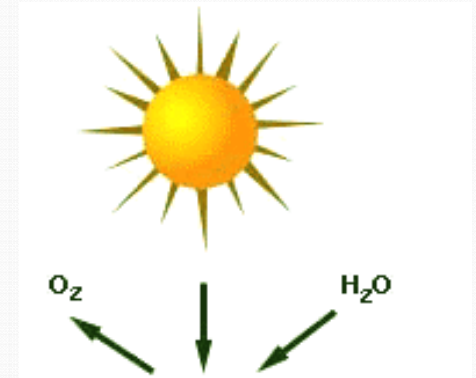
The primary focus of ecosystem capital accounts is to measure the performance and health of the ecosystem, its capacity to deliver (whatever) service without being degraded (its “capability”)



***Source*: Gilbert Long, 1972**

A propos du diagnostic écologique appliqué au milieu de vie de l'homme.
Options Méditerranéennes, 13 , CHIEAM, Montpellier, Juin 1972

Nature produces firstly for itself: only a **surplus** is **accessible** for human use



Ecoproduct (of cycling and reproductive systems/ capital) are produced by means of other ecoproducts. The ecosystem production function includes a surplus ecoproduct that can be used by the economy. (from Anthony Friend 2004)

Non-basic eco-product

Basic eco-product

Photosynthesis

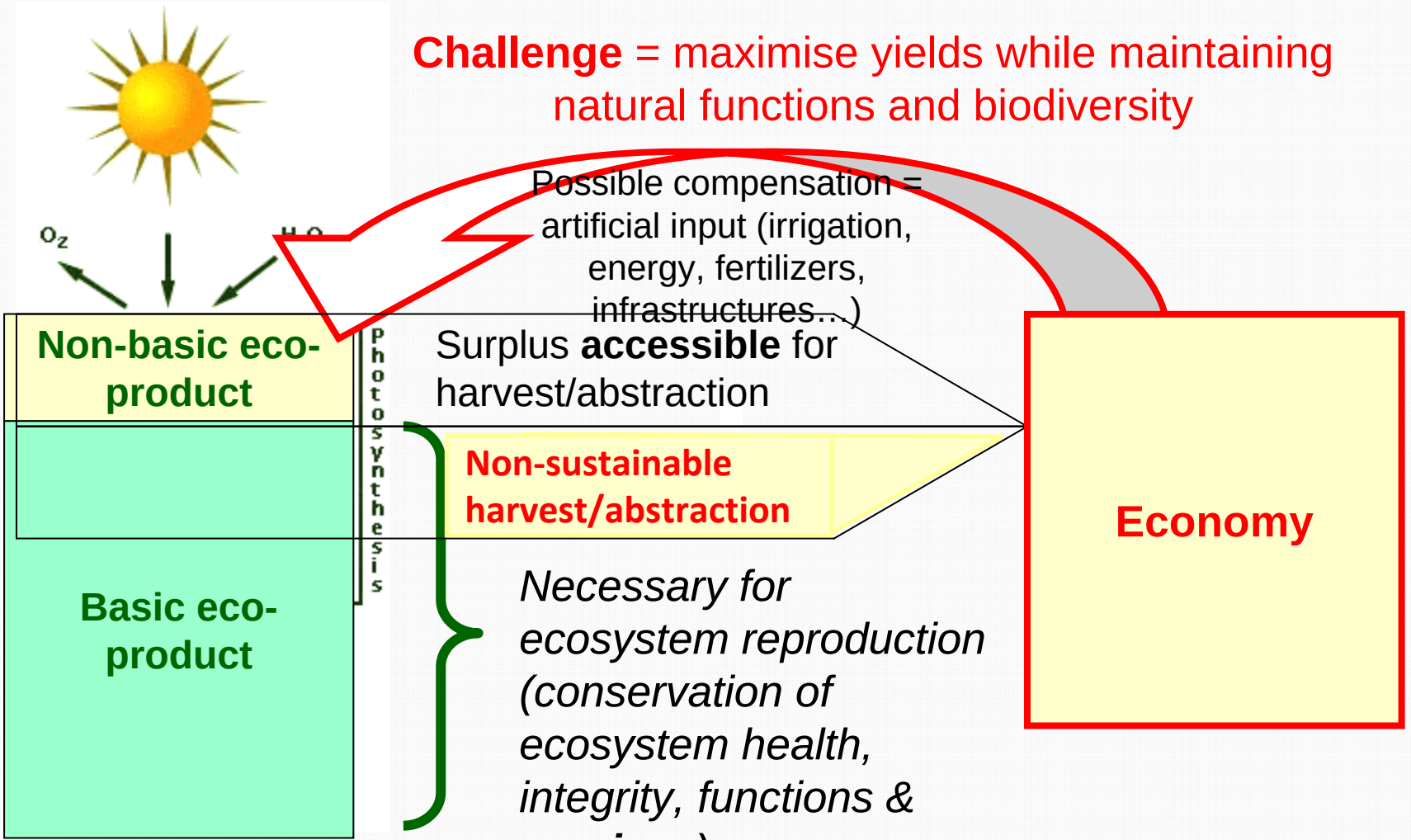
Surplus **accessible** for harvest/abstraction

*Necessary for ecosystem reproduction (conservation of ecosystem health, integrity, functions & **services**)*

Economy

Sources: Kling/U Michigan_2005 & Friend/ISEE_2004

Nature produces firstly for itself: only a **surplus** is **accessible** for human use



Sources: Kling/U Michigan_2005 & Friend/ISEE_2004

About ecosystem resource: availability vs. accessibility

Available resource: the total resource (actual stocks and flows) which can be used in principle.

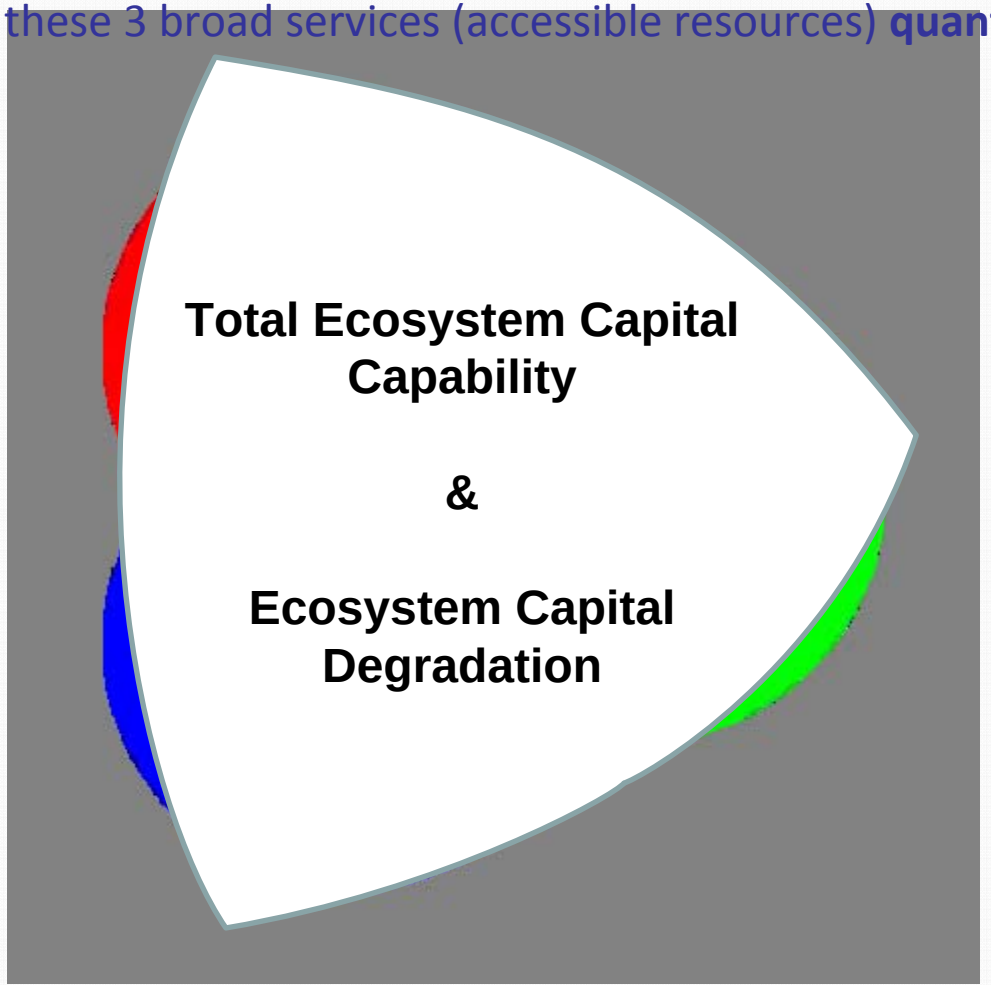
Accessible resource: the surplus (actual stocks and flows) which can be used considering

1. physical constraints (timeliness and location, cyclical risks, bio-chemical quality)
2. the amount to be left to nature for ecosystem reproduction
3. side or indirect impacts on ecosystem health (biodiversity, resilience, dependency from artificial inputs…)

Ecosystem capital accounts refer to intensity of use of accessible resources (ecological sustainability)

The simplified model

As a capital, ecosystems produce altogether 3 broad types of services between which there is little possible compensation or tradeoff: **biomass/carbon** AND **freshwater** (which can be extracted) AND intangible **systemic services** (accessible in function of the characteristics, extent and health of the ecosystem).
Ecosystem capital capability (& degradation/improvement) can be measured by combining measurements of these 3 broad services (accessible resources) **quantity and quality.**



The measurement of the quantity/quality of ecosystem capability requires defining a unit playing the role of a "currency".

Economic value vs. Ecological value

- Economic value = quantity x price

Financial & national accounts: values are established by the market; quantities and prices are decided by the transactors, they related to production costs, the capacity for the seller to make profit, the quality for the buyer, its capacity to negotiate discount…

- Ecological value = quantity x "price"

Ecosystem capital accounts: values need to be calculated, knowing quantities and defining an overall composite "quality" index equivalent to a market price

➔ ***General equivalence, measurement of stores of various ecosystem capabilities and changes (degradation, improvement), transactions between ecosystems (e.g. transfers of degradation between neighboring EAU or between scales)***

➔ ***Conventional but transparent and verifiable measurement and recording of ecological debts***

Ecosystem Capability Unit (ECU): a composite currency to measure ecosystem capability, degradation and improvement, ecological debts and credits…

In physical accounts, measurements are made in basic units (tons, joules, m^3 or ha) which cannot be aggregated. These measurements are converted to a special composite currency named ECU for 'Ecosystem Capability Unit'.

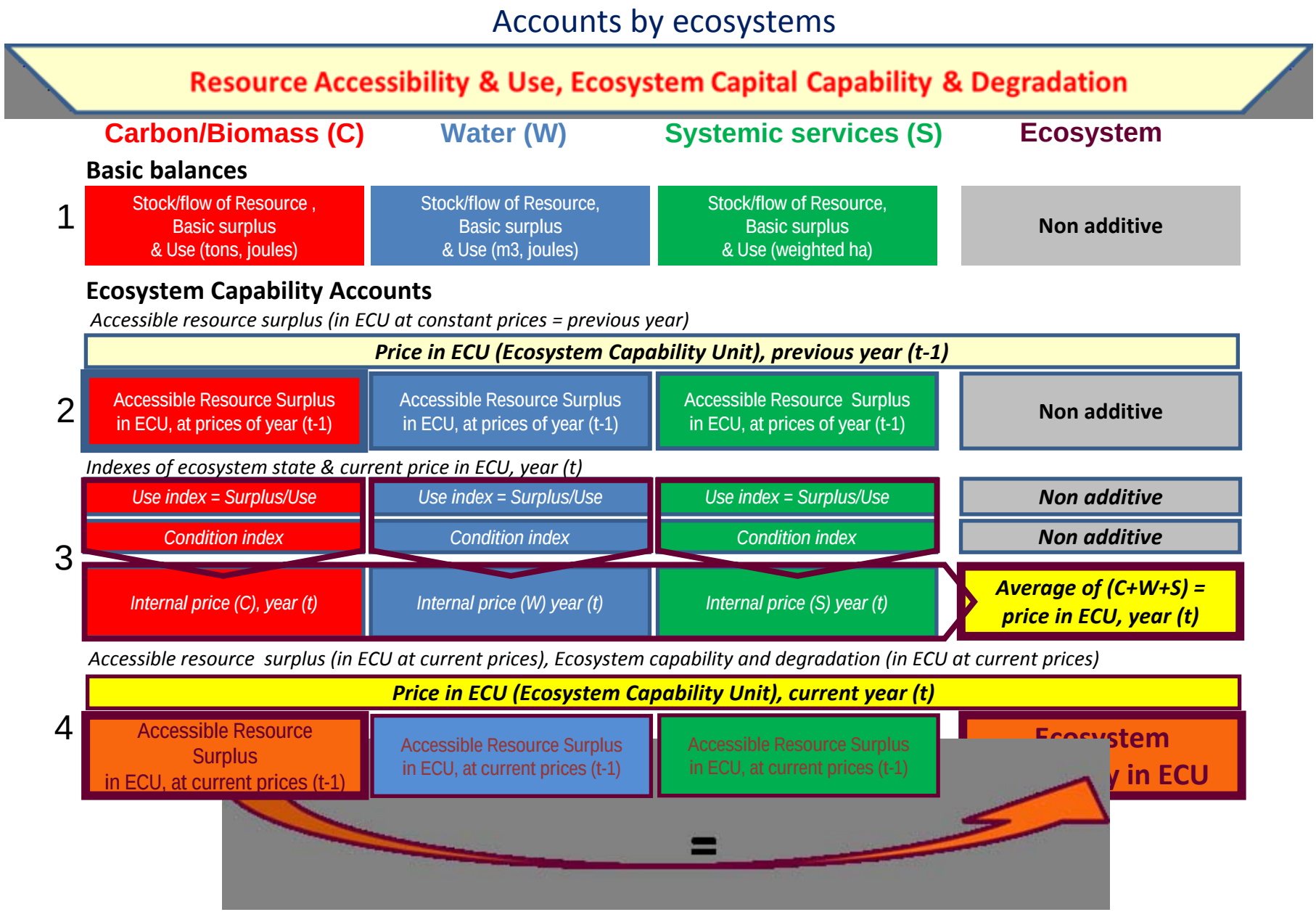
The price of one physical unit (e.g. 1 ton of biomass) in ECU expresses at the same time the intensity of use of the resource in terms of maximum sustainable yield and the direct and indirect impacts on ecosystem condition (e.g. contamination or biodiversity loss). Loss of ecosystem capability resulting from human activity is a measurement of ecological debt (in ECU).

François 1st (1515-1547), Ecu d'or au soleil du Dauphiné, Source : Münzen & Medaillen GmbH (DE)

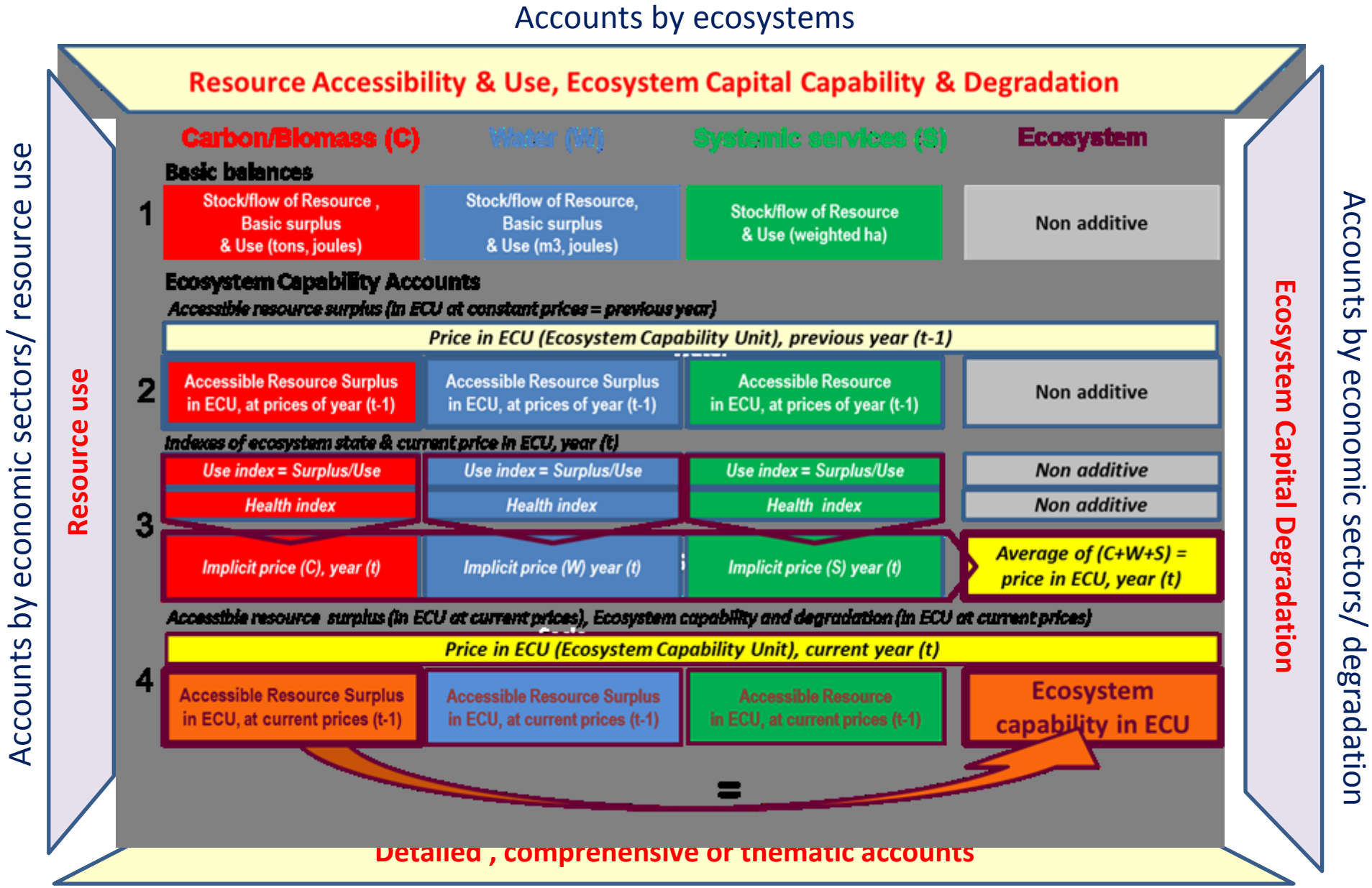
1 ECU = 1 unit of accessible ecosystem resource

There is no exchange rate between ECU and $ or €.

Calculation of ecological values in ECU



Calculation of ecological values in ECU



From ecosystem physical degradation to the measurement of sustainability of the benefits obtained from ecosystem services and unpaid maintenance costs

Consumption of ecosystem capital (unpaid costs)

Economic statistics & national accounts

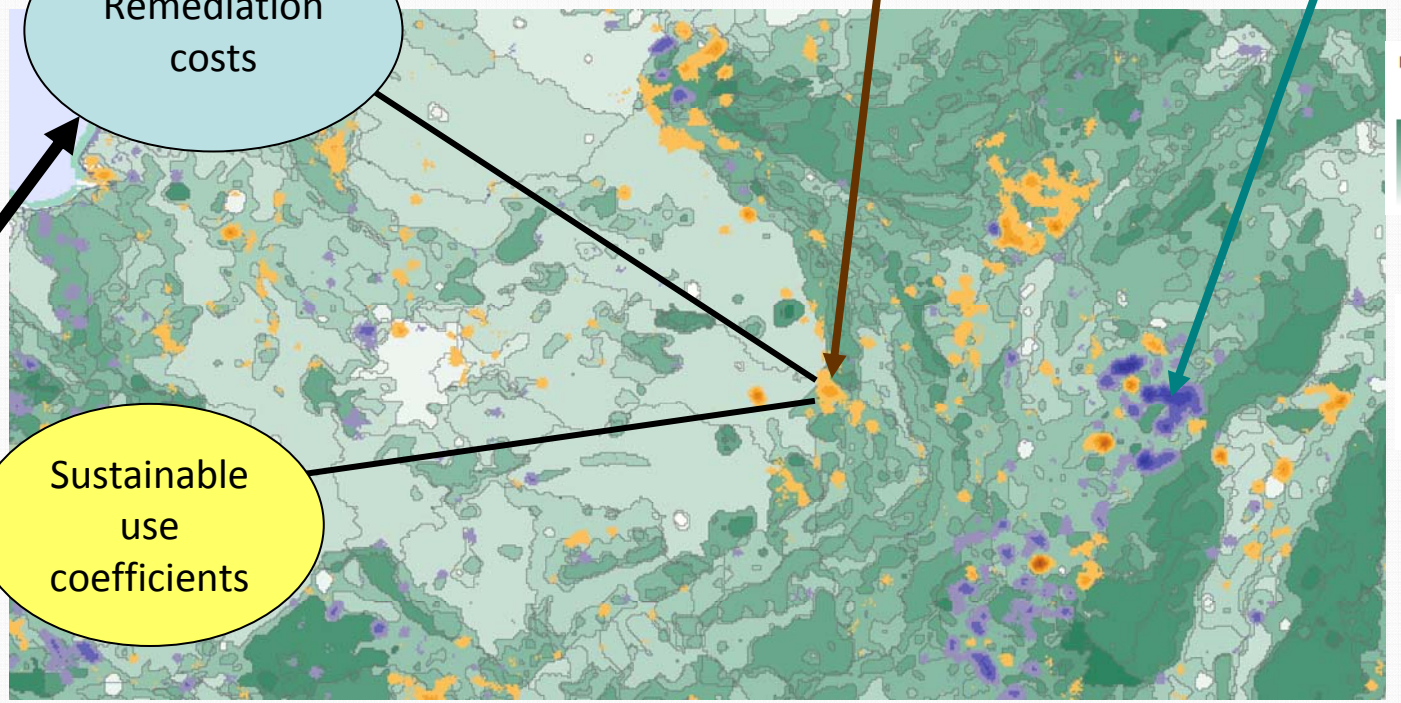
Ecological sustainability of **Value Added supported by ecosystem services**

Remediation costs

Sustainable use coefficients

Degradation

Improvement

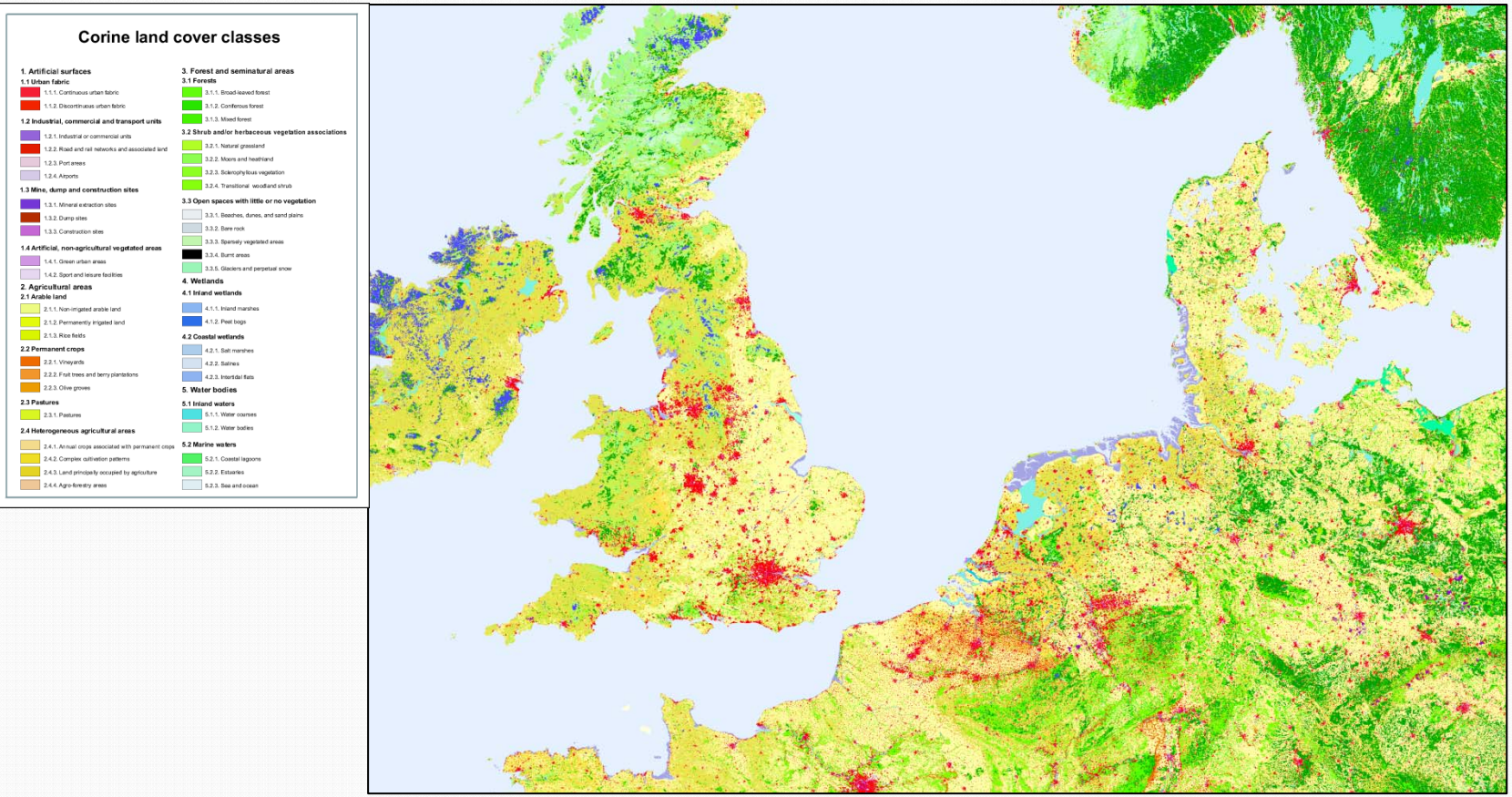


Landscape Ecological Potential change 1990-2006, by ecosystem landscape units

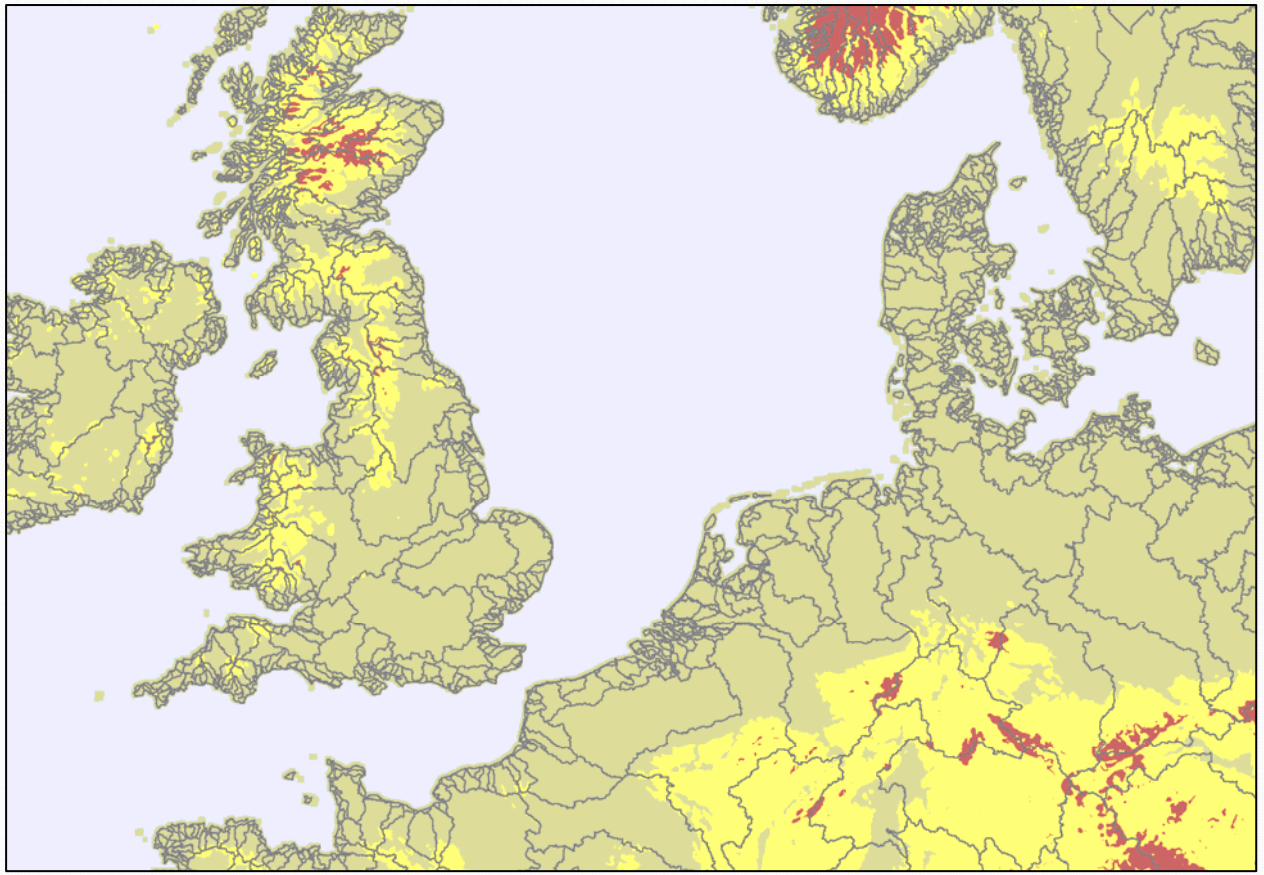
(J-L Weber and E. Ivanov, 2011)

First results of simplified ecosystem capital accounts in Europe

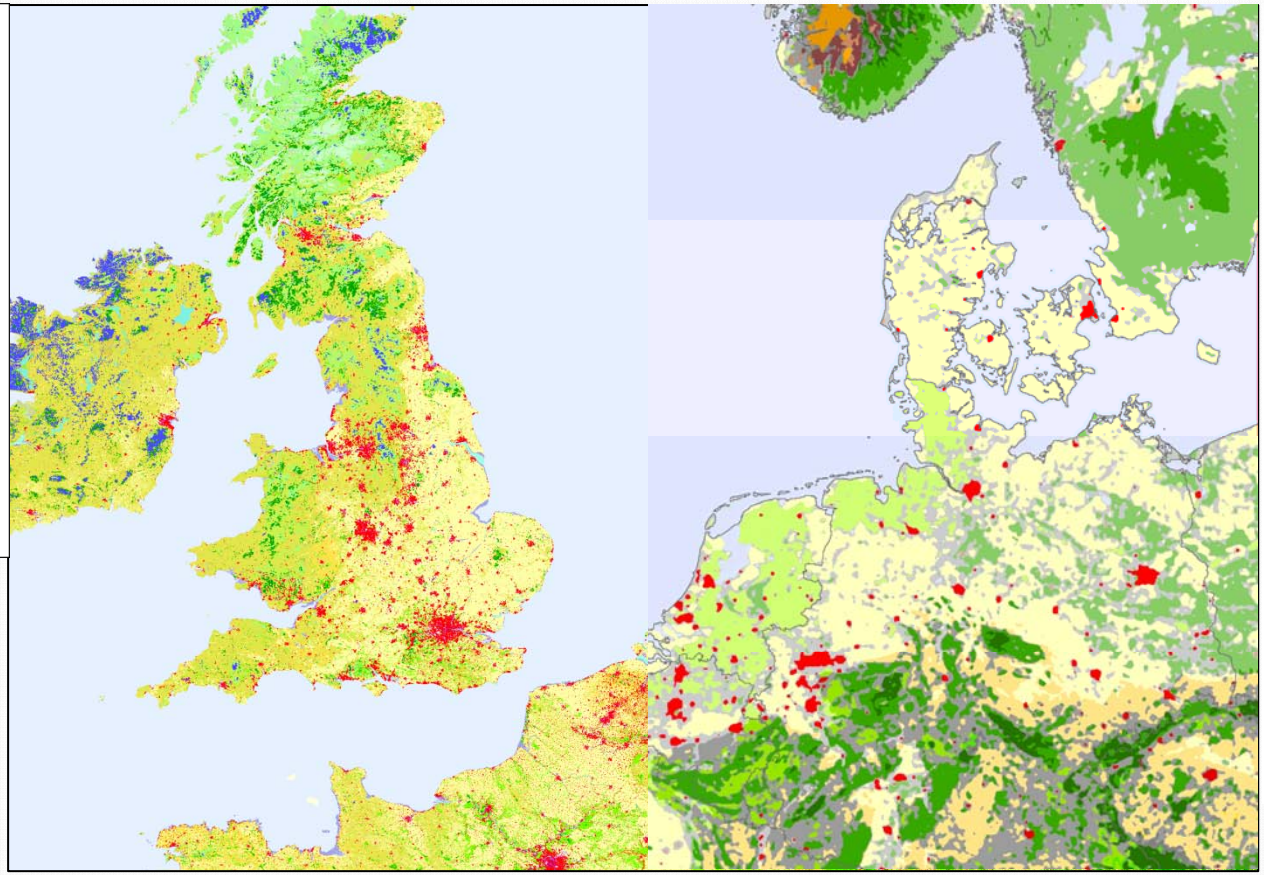
- Defining ecosystem accounting units
- C/biomass account
- Water account
- Ecosystem integrity/systemic services account



Land cover functional units: example of Europe

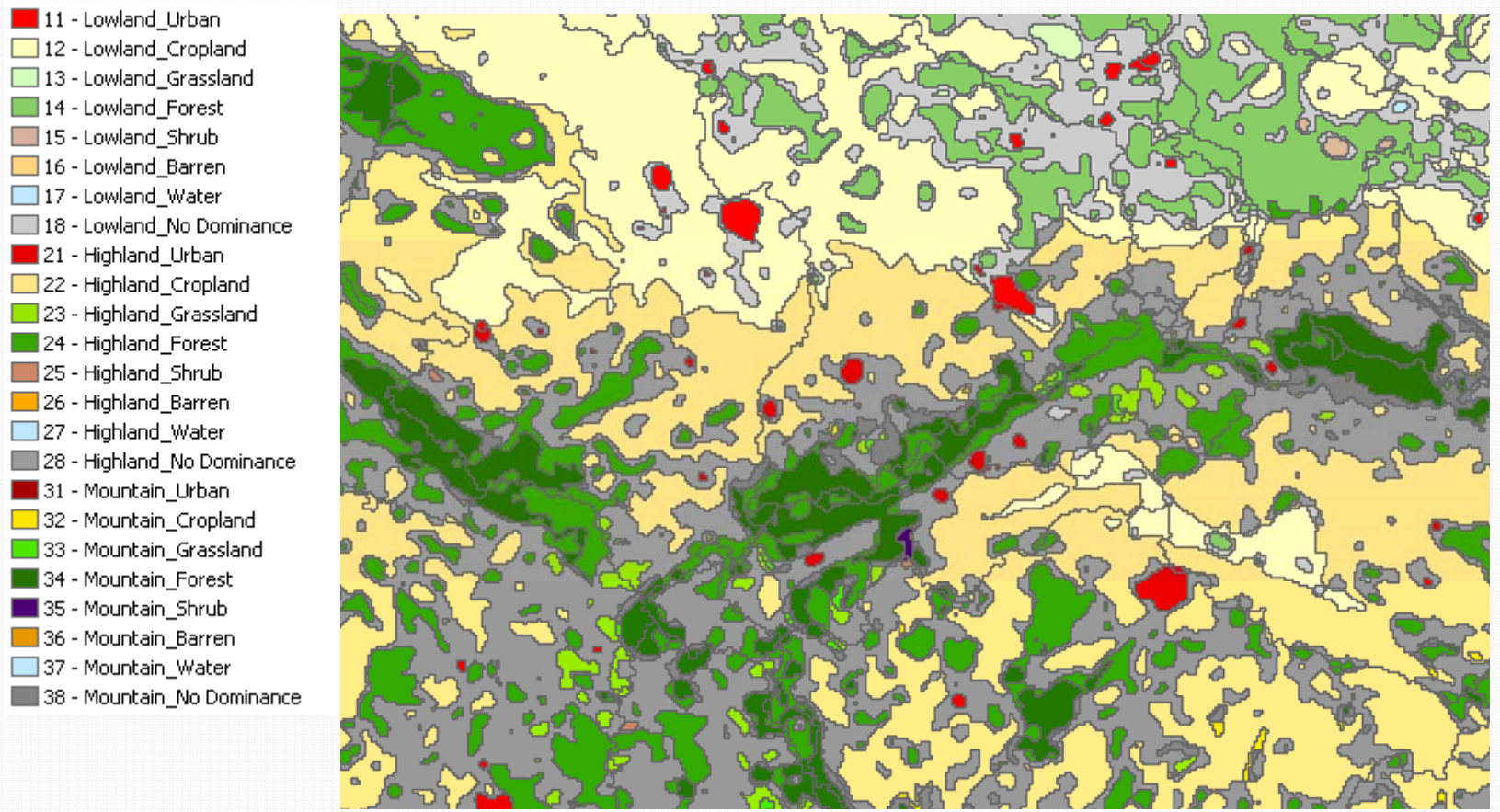


Relief and river basins limits

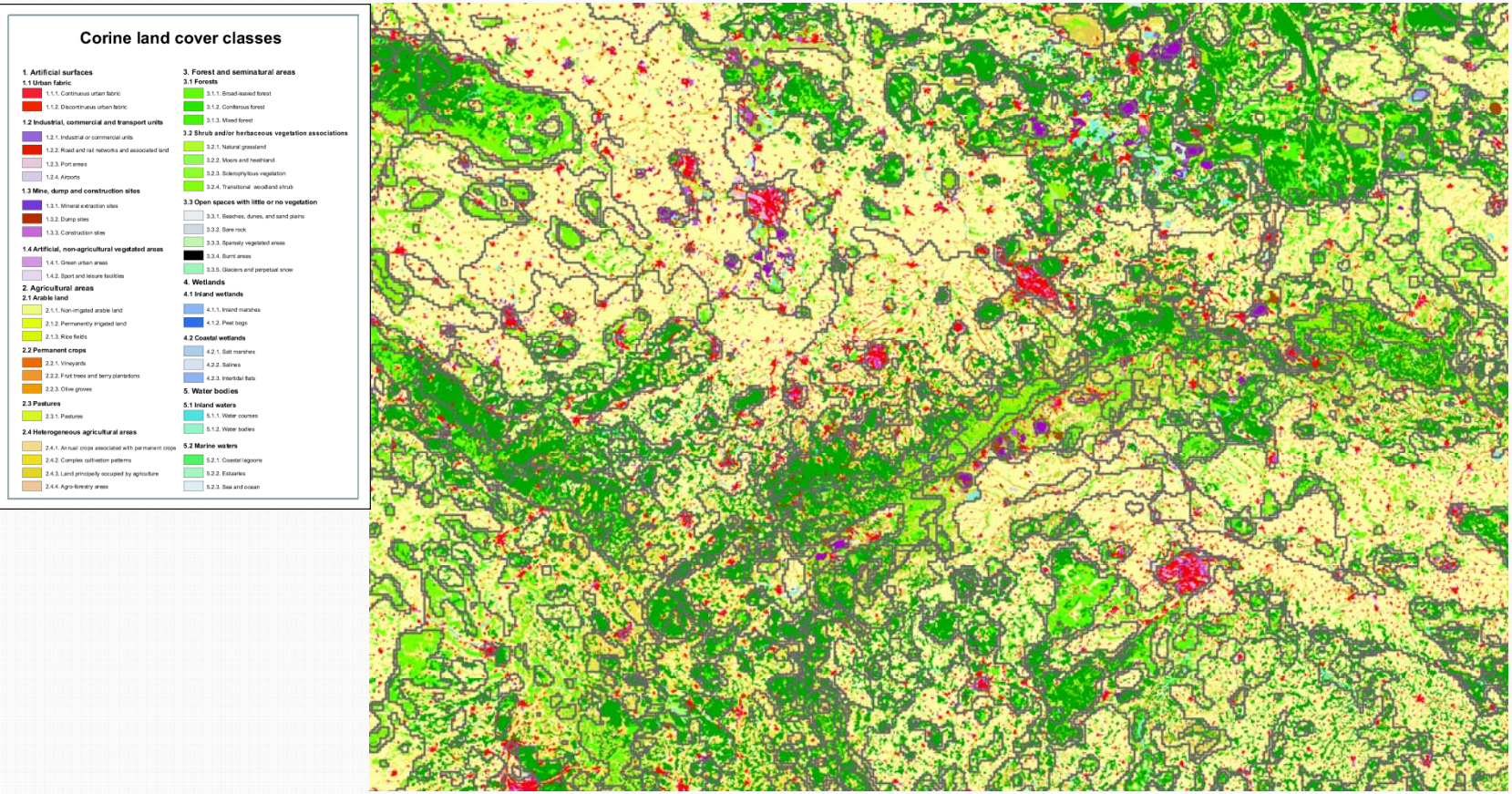


From land cover units to ecosystem accounting units

(SELU: socio-ecological landscape units)

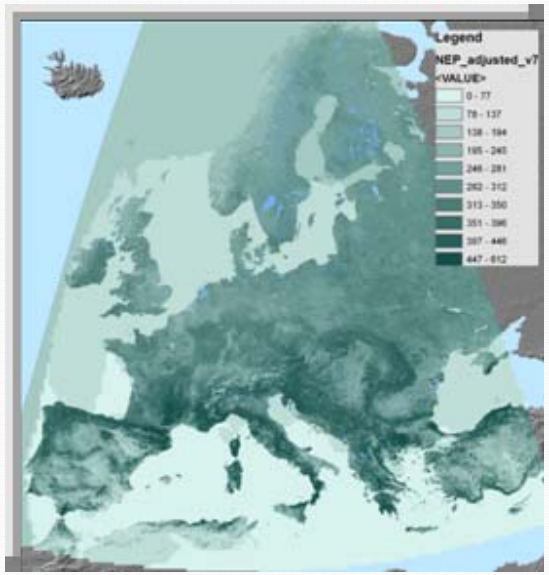


ZOOM: EAU/SELU in Central Europe



ZOOM: Land cover functional units by EAU/SELU

The carbon/biomass account



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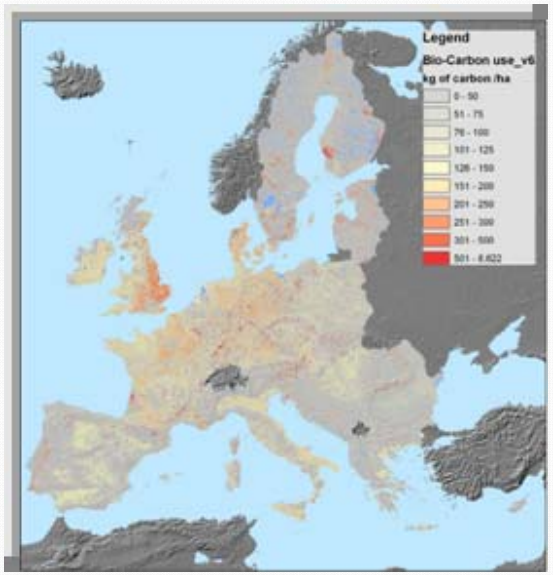

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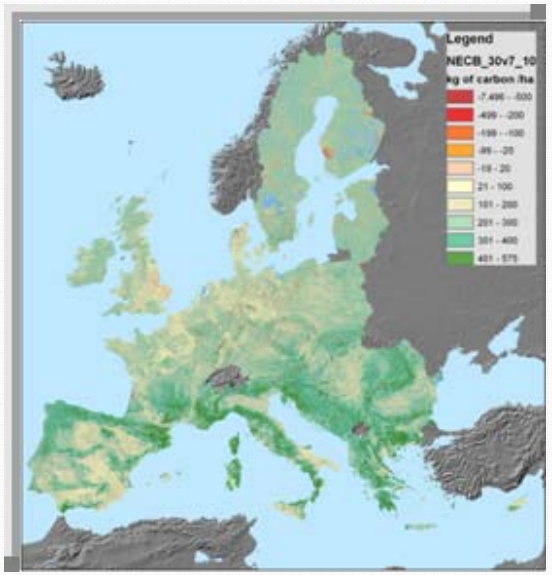


NPP/NEP:
satellite images (NDVI) and modeling, accessible bio-C surplus

Uses:
agriculture and forestry statistics by regions/countries resampled to 1km2 grid f(land cover, NDVI)

Net Ecosystem Carbon Balance:
soil and vegetation (trees, shrubs, grass)

The Net Ecosystem Carbon Balance 2000 (provisional results – 5 June 2012)

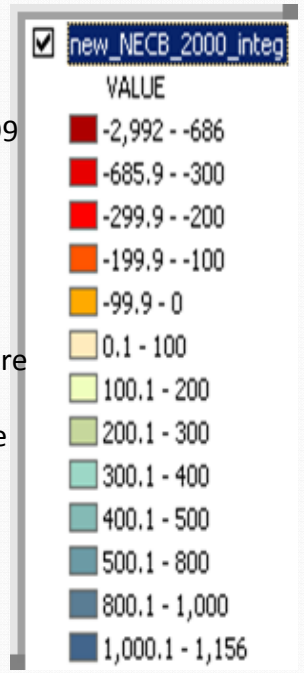
Tree felling, 1999 Xmas storm

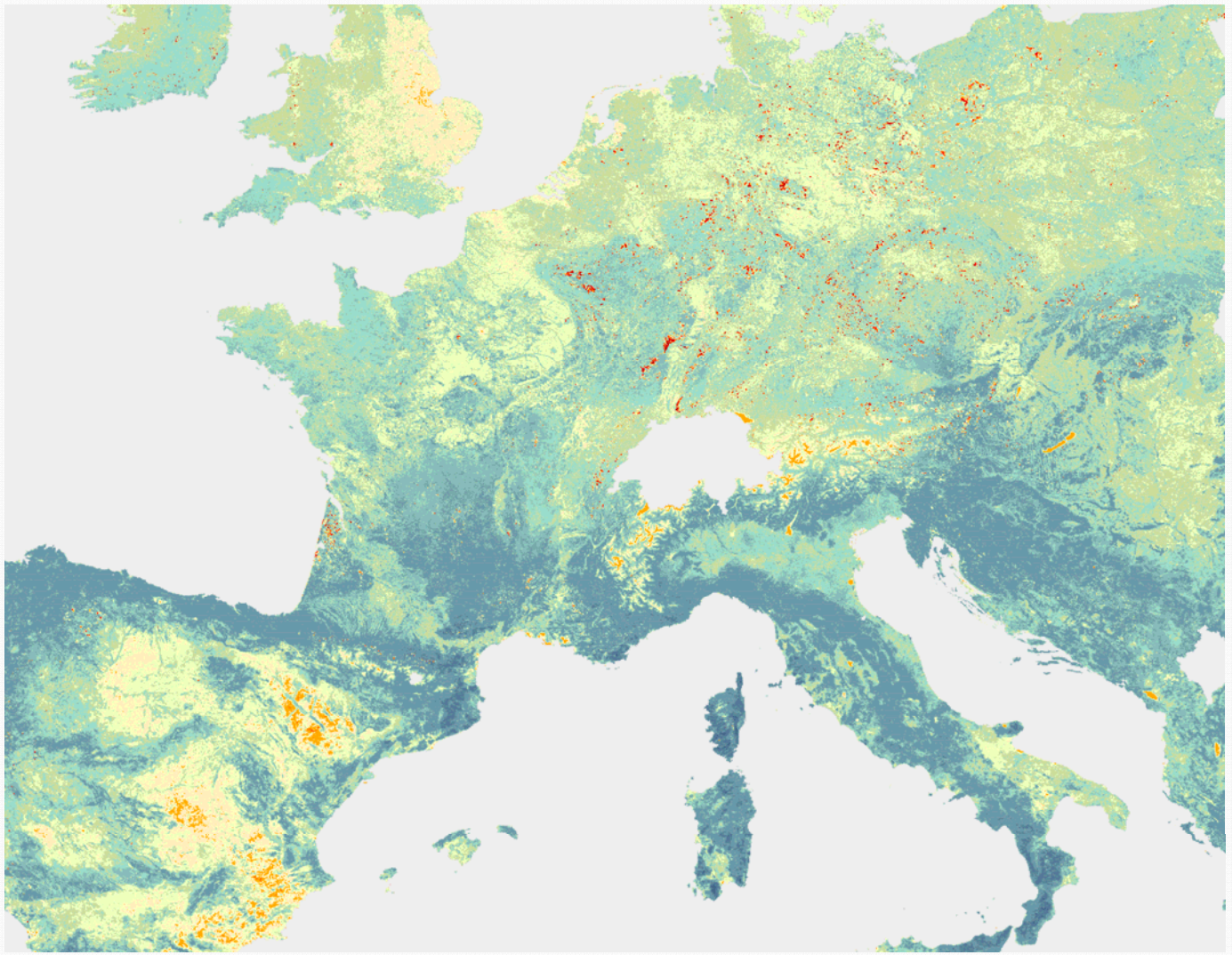
Greenhouses, plastic sheets

Intensive agriculture

Mixed agriculture

Forest





NB: over-estimation of NPP in the South

The water account

- By river sub-basins, based on monthly data (or more frequent)
- Basic balances (SEEAW+accessible surplus)
- First integration of quantity*quality

Water Accessibility by river catchments: taking into account limiting factors

Conventional water balances adjusted from various limiting factors ➔ calculation of resource accessibility & use intensity on the basis of what can be safely used without degrading ecosystems

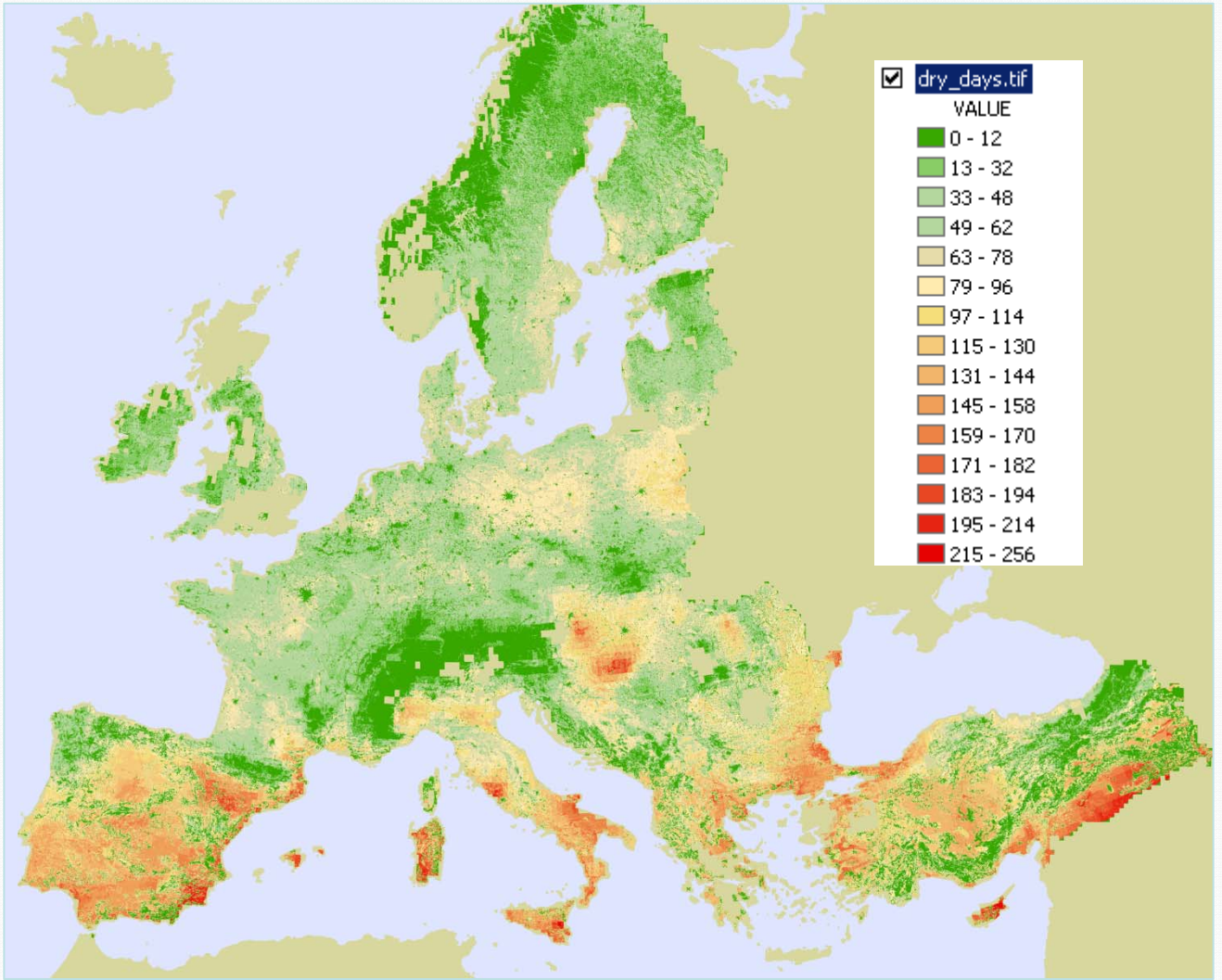
Water/ Rivers Stress Indexes

		Chemical status		Ecological status		Dry days					Change in River Green Ecotones 2000-2006
		Chemical Status Index		Ecological Status Index							
SB	level3	bad =("3"/tot)*5	good =("2"/tot)*5	bad =("4"+("5"*2))/tot	good =("1"+"2")/tot)	Mean number of dry days 2001-2010	Standard deviation	Dry days relative stress 2000 (2000/((mean+(STD/2)))	Dry days relative stress 2006 (2006/((mean+(STD/2)))	Dry days relative stress 2010 (2010/((mean+(STD/2)))	
WSB0000165	Guadalquivir main - Upper - Guadiana meno	100.00	105.00	98.70	100.33	214.6	35.8	0.83	0.97	0.64	0.64
WSB0000166	Guadiana coastal catchments	100.00	100.00	100.00	100.00	215.7	34.1	0.73	0.85	0.77	-0.30
WSB0000167	Guadiana main - Lower - Ardilla	100.00	100.00	100.00	100.00	217.1	31.4	0.77	0.88	0.74	-0.14
WSB0000168	Guadiana main - Medium - Zujar	99.60	100.84	99.97	100.37	219.5	34.2	0.82	0.94	0.71	-0.10
WSB0000169	Guadiana main - Upper - Zancara	100.00	105.00	98.61	100.00	192.8	32.0	0.85	0.97	0.67	-0.22
WSB0000170	Gulf of Finland coastal catchments and smal	100.00	100.00	100.00	100.00	93.1	16.3	0.79	1.13	0.94	-0.17
WSB0000172	Havel	99.90	100.00	99.99	100.00	135.1	17.5	0.84	1.05	0.76	0.02
WSB0000173	Henares	100.00	104.99	100.00	100.00	172.2	23.5	1.03	0.90	0.87	-0.04
WSB0000174	Humber	100.00	100.00	100.00	100.00	108.6	18.6	0.80	0.84	0.95	0.03
WSB0000176	Ialomita	100.00	100.00	100.00	100.00	160.1	23.0	0.95	1.05	0.86	0.04
WSB0000178	Iijoki coastal catchments	100.00	100.00	100.00	100.00	92.7	13.8	0.84	1.08	0.82	0.55
WSB0000179	Iijoki main - Lower	100.00	100.00	100.00	100.00	92.2	14.4	0.83	1.05	0.85	-0.03
WSB0000180	Iijoki main - Medium	100.00	100.00	100.00	100.00	82.1	14.3	0.85	1.04	0.89	0.05
WSB0000181	Iijoki main - Upper	100.00	100.00	100.00	100.00	69.0	14.0	0.93	1.06	0.92	0.03
WSB0000185	Indals main - Lower	95.24	100.00	99.05	100.00	109.1	29.7	0.44	0.98	0.63	0.05
WSB0000186	Indals main - Medium	100.00	100.00	100.00	100.00	87.9	34.2	0.34	1.02	0.49	0.03
WSB0000187	Indals main - Upper	100.00	100.00	100.00	100.00	44.4	17.0	0.27	1.07	0.50	0.04
WSB0000188	Inn	100.00	105.00	100.00	100.00	51.4	8.5	0.78	1.01	0.85	-0.05
WSB0000189	Internal Basins of Catalonia	100.00	104.98	99.99	100.72	186.9	31.8	0.87	1.03	0.74	-0.24
WSB0000191	Isere	95.00	100.00	99.95	100.00	83.4	14.4	0.71	0.99	0.85	-0.01

For part based on continuous monitoring (e.g. dry days with no water for vegetation…)

Accessible water adjustment for risks of water stress (« dry days index »)

based on the number of days when no water was available for plants in 2001, 1 km² grid



Source: Blaz Kurnik, EEA, 2011

Fast track implementation of ecosystem capital accounts in Europe

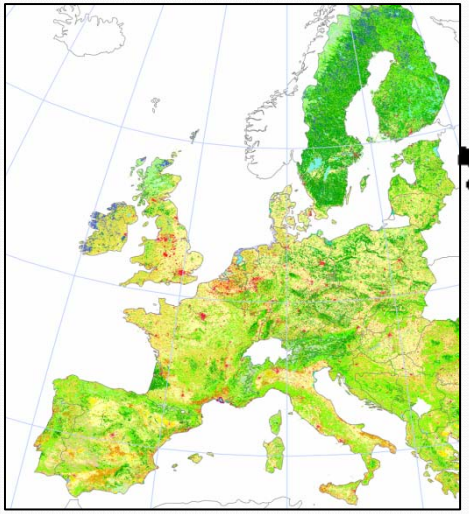
Landscape/biodiversity capacity accounts

preliminary results 2000-2006-2010,
version 2

Jean-Louis Weber, Emil D. Ivanov,
Rania Syropoulou, Oscar G. Prieto

4 June 2012

Landscape Integrity & Systemic Services: Landscape Ecological Potential (v1)

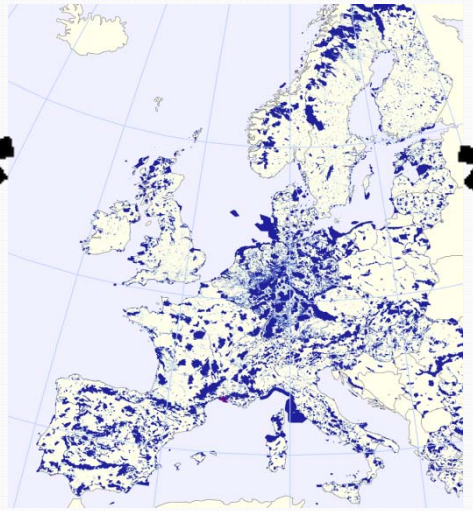


Corine land cover map *(CLC is derived from satellite images)*

*

Green Landscape Index *(derived from CLC)*

*



Nature Value (*Naturilis, derived from Natura2000 designated areas)*

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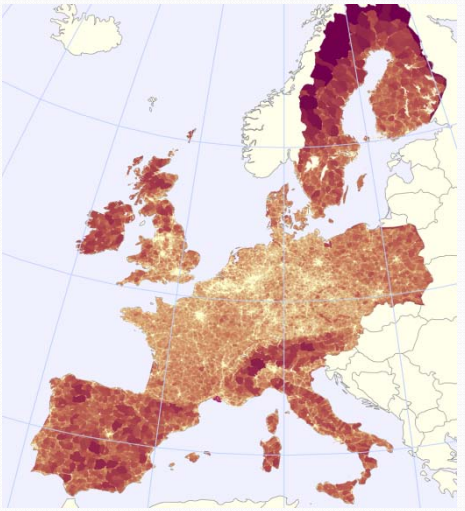
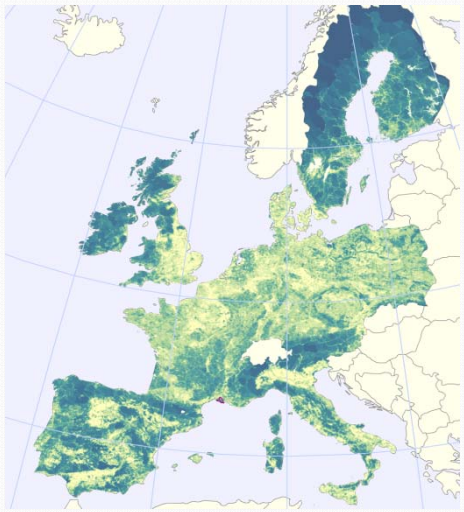


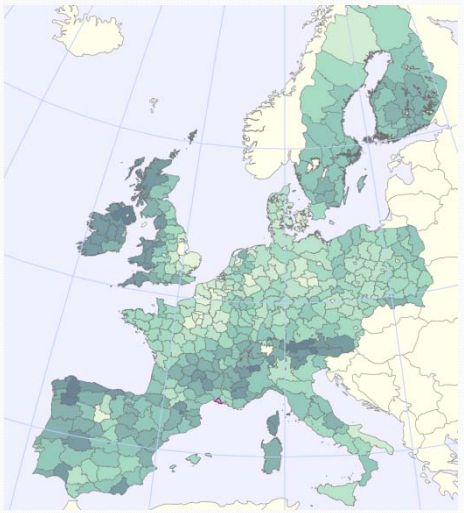
Fragmentation (*Effective Mesh Size (MEFF) derived from TeleAtlas Roads and CLC)*

➔



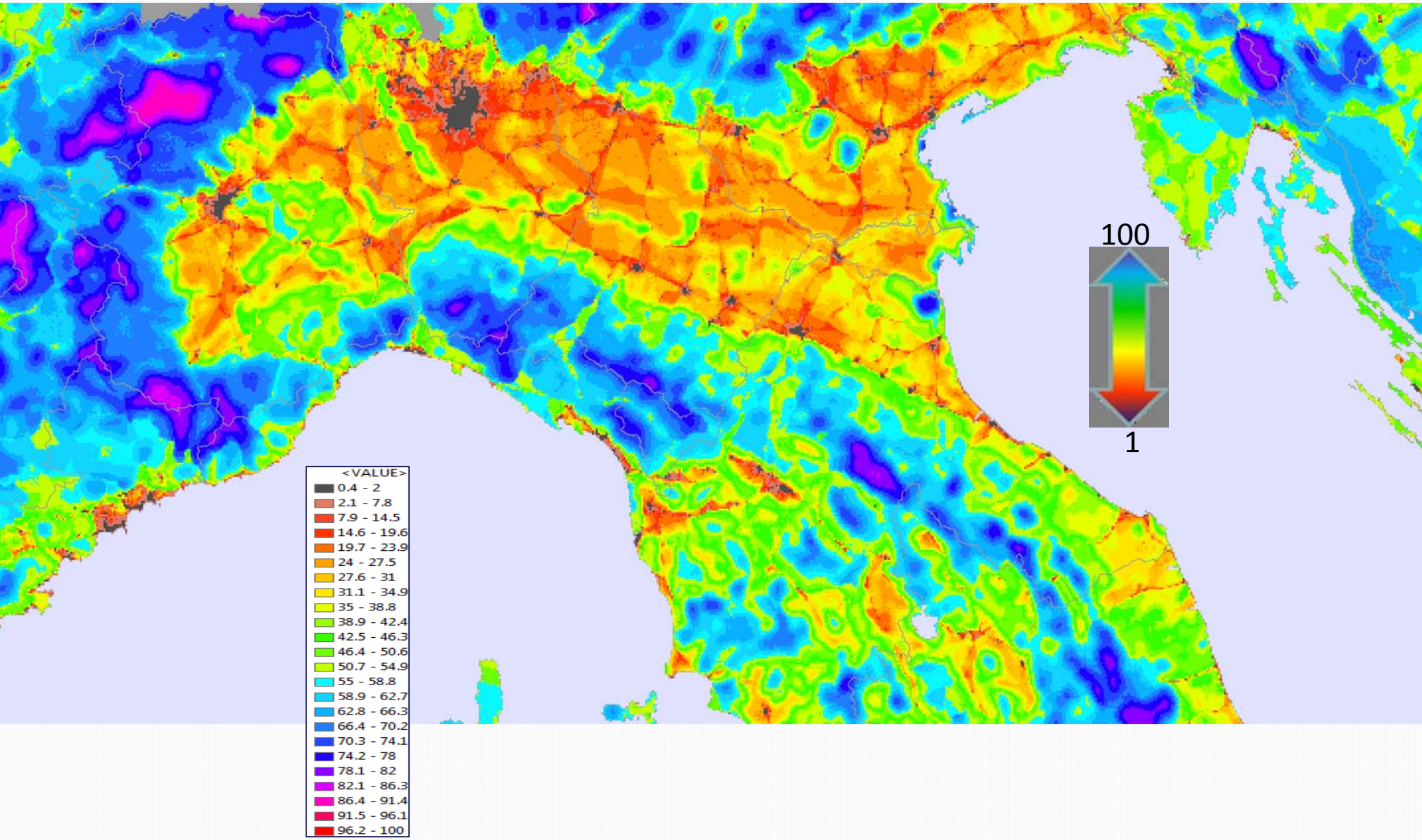
Landscape Ecological Potential (LEP) 2000, by 1km² grid cell

and

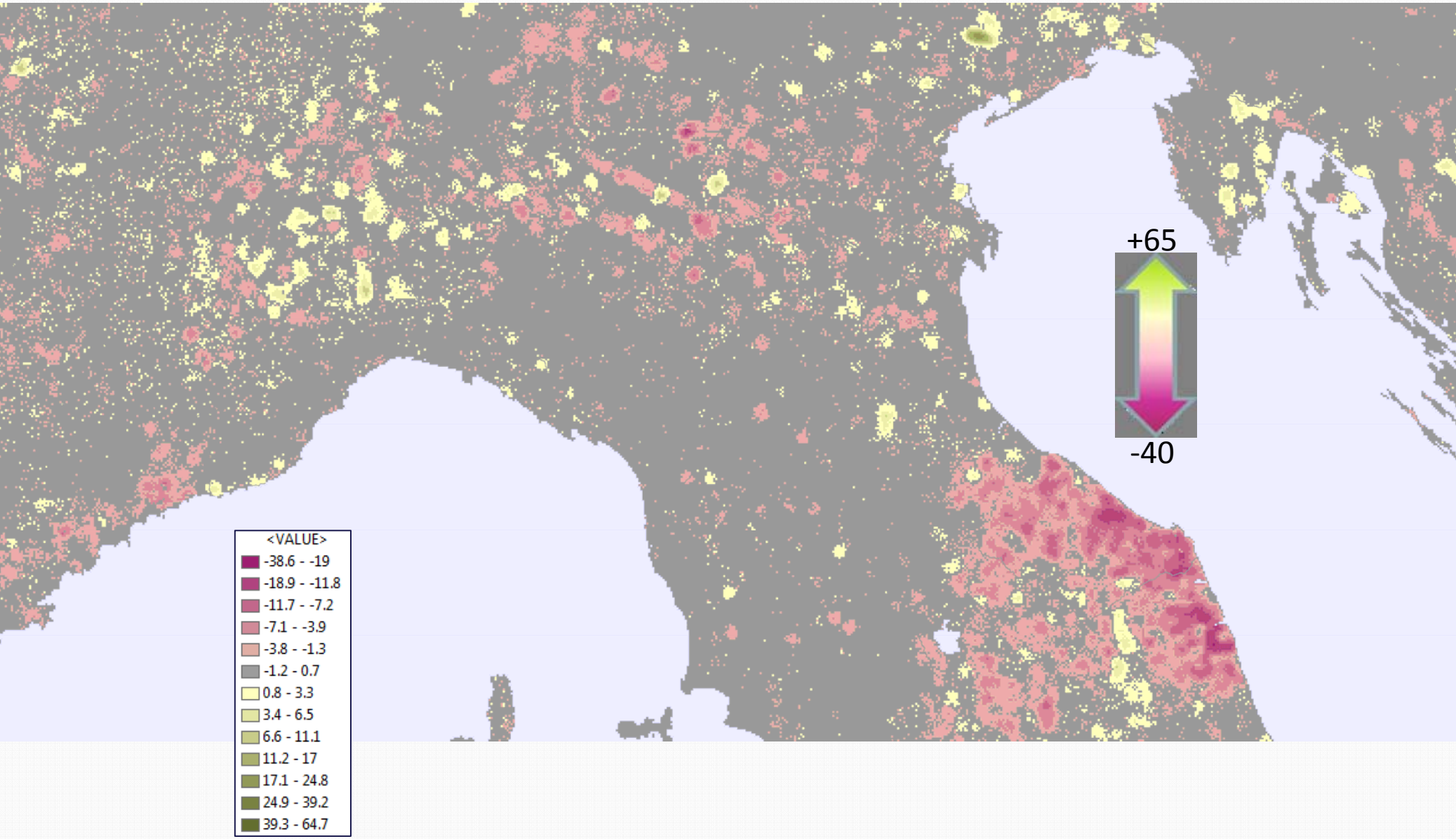


LEP 2000 by NUTS 2/3

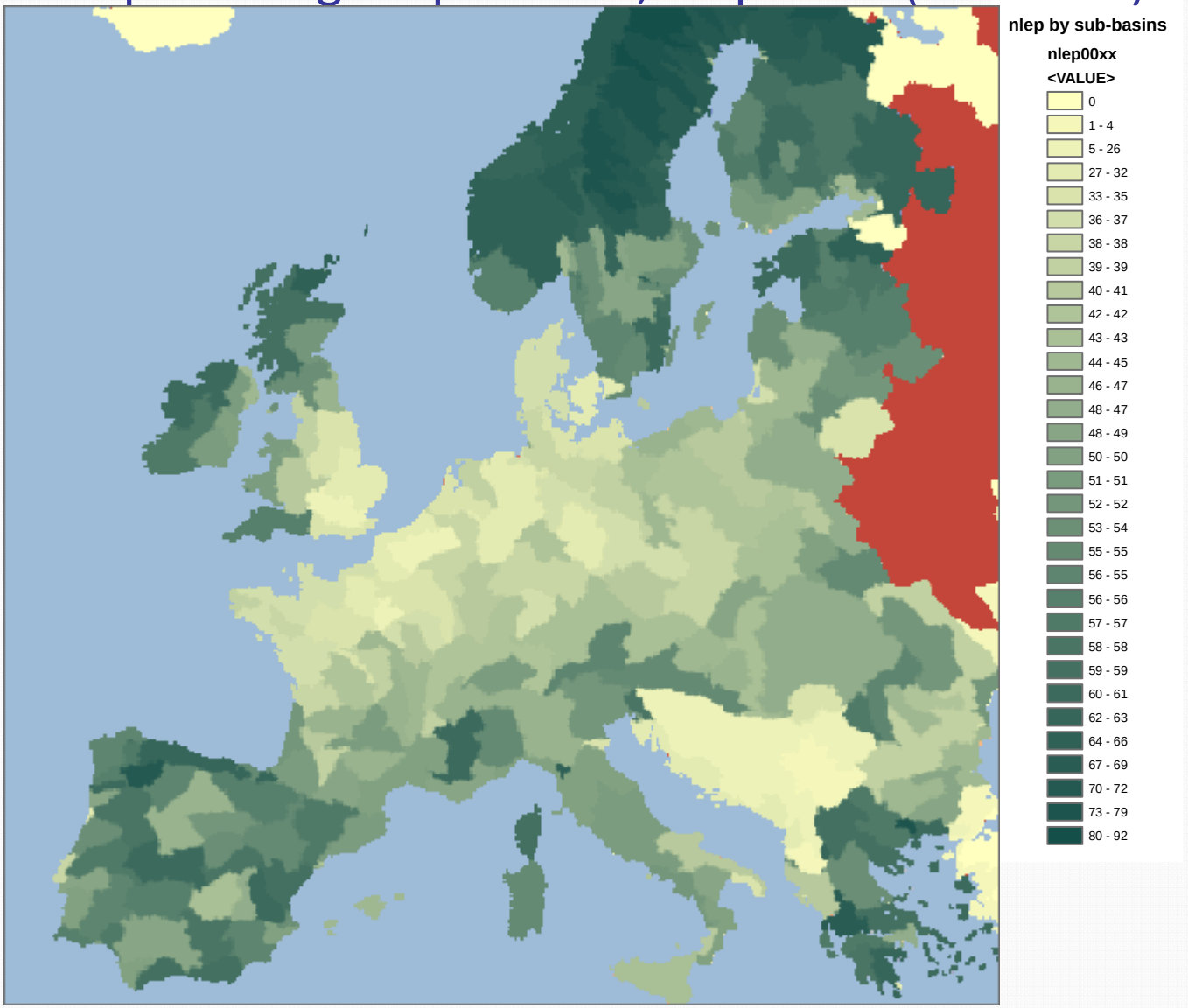
Landscape ecosystem potential (integrity): the EEA nlep indicator – 2000

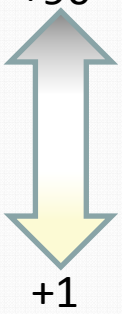


Change in nlep, 2000 – 2010, 0-100 scale

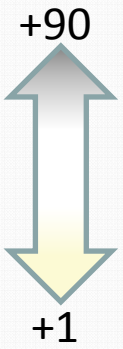


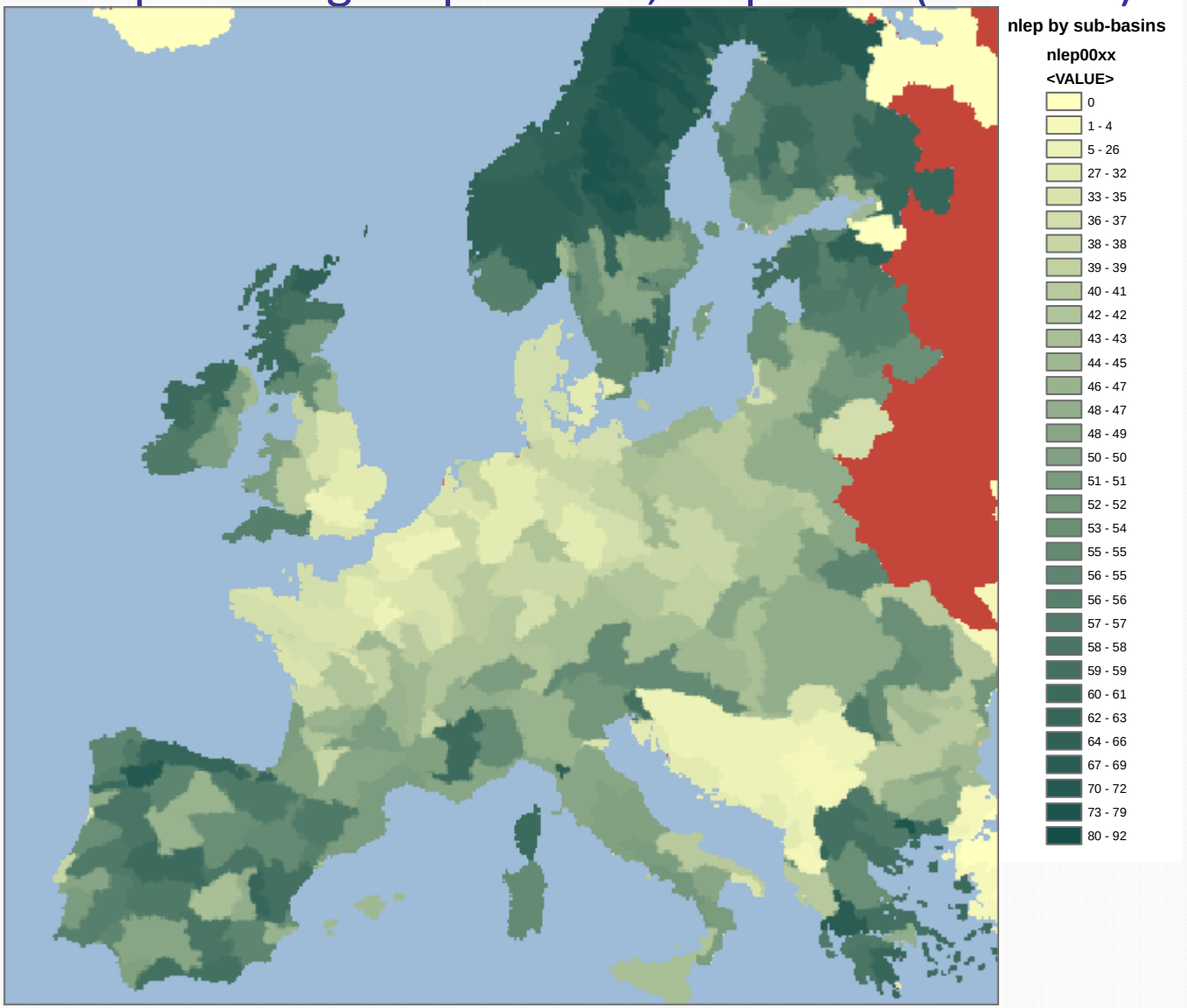
Net landscape ecological potential, nlep 2000 (observed)





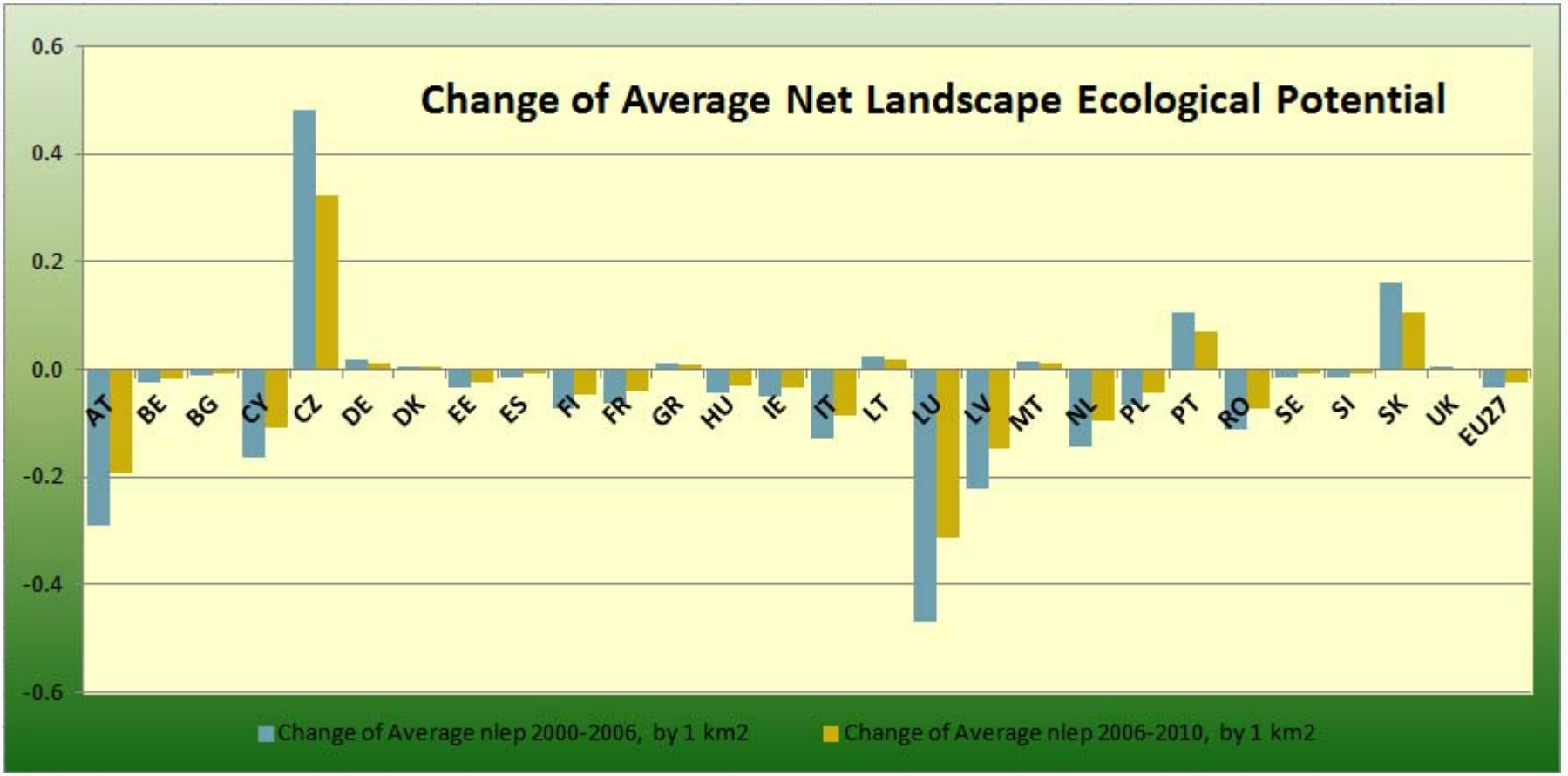
Net landscape ecological potential, nlep 2010 (nowcast)





Ecosystem Capital Accounts: Landscape/Biodiversity Capacity Account

Change in Net Landscape Ecological Potential 2000-2006 and 2006-2010



Species biodiversity: main questions before accounting

- Why to put species there anyway?
- What to expect from species indices ? (measuring stock impossible) What about changes e.g trends of population or trends in the number of present species?
- What to expect from full ecosystem capital accounts e.g. to explain trends, to identify policies, to measure progress?
- What kind of data on species could be used for testing our approach?

Data source: Article 17 of the EU “Habitats Directive”

- More than 1000 species protected in the EU, 25 countries (2006)
- Distribution maps by species (x countries x biomes)
- Standard set of judgments asked to country experts for each pair speciesxarea: change in area of distribution, range (use of this area), population and future prospect
- species attributed to their most preferred habitat / ecosystem (one specie can belong to more than one group): Forest, Agriculture, Grassland, Shrubland, Forest, Wetlands and water, Coasts
- Two ‘judgments’ selected
- Data on species mapped at 10kmx10km ➔ resampled one by one at 1kmx1km according to to land cover

➔ Population trends 2000-2006 (Increasing, Stable, Decreasing)

Index T1: no of species Increasing + Stable – Decreasing

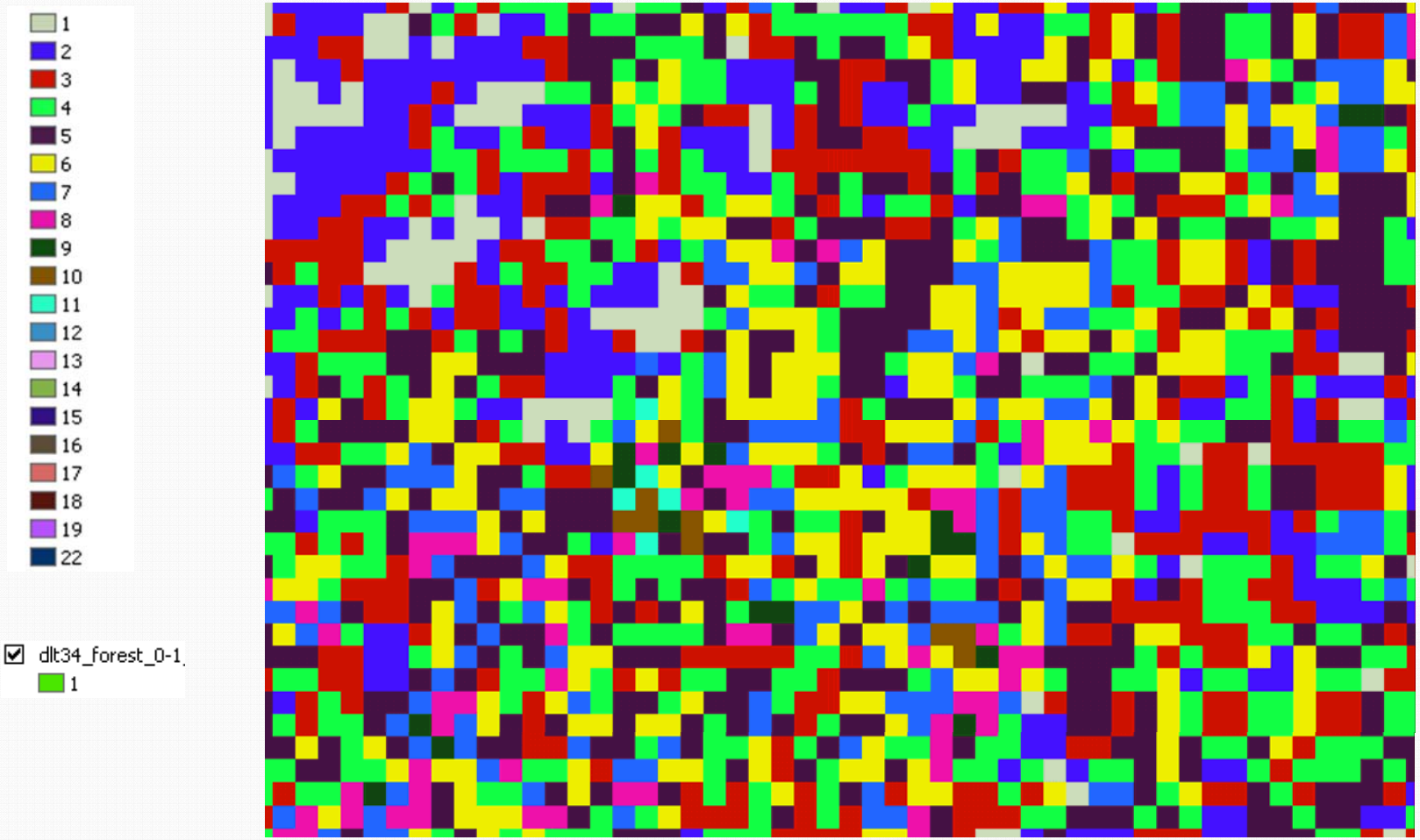
➔ Future prospects as seen in 2006 (good, poor, bad)

Index T2: no of species with good- poor- bad future prospects

Resampling (example)

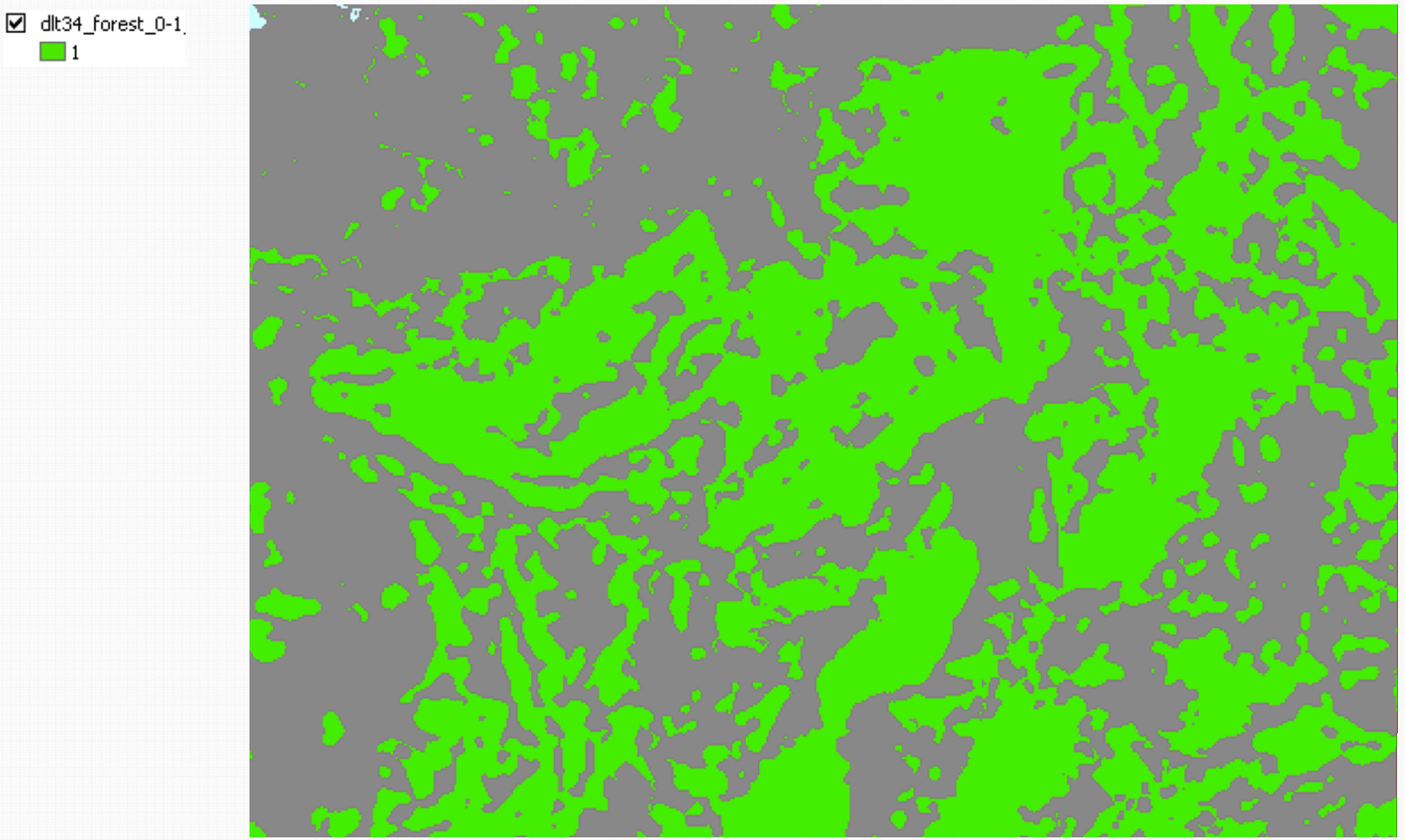
Input 1: Number of forest species reported with « future = bad or poor», 10kmx10km

(Note that several « forest » species can be found in other ecosystems as well)



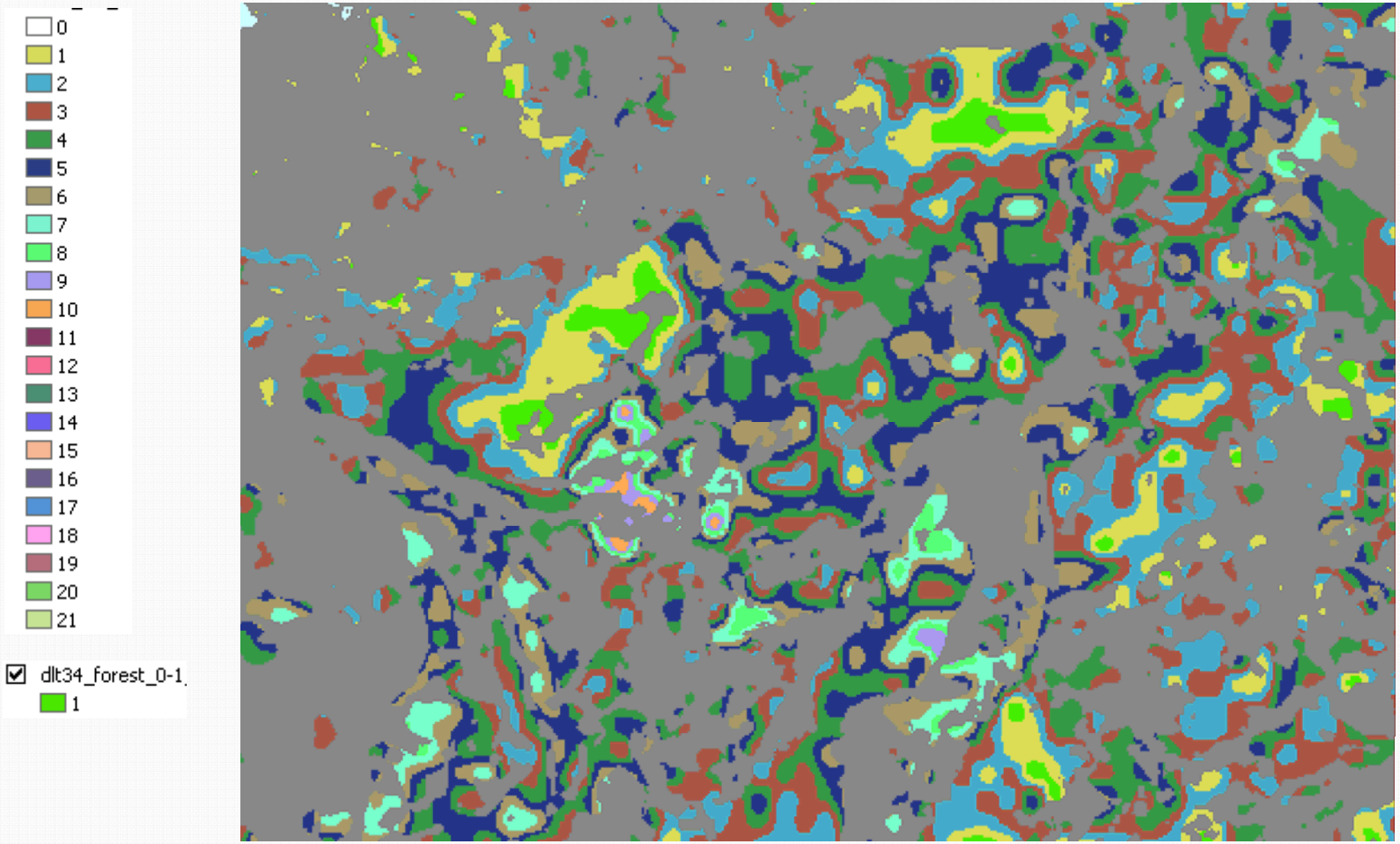
Resampling (example)

Input 2: Forest Dominant Land Cover Type « 34 » (more than 1/3 of the 1km2 grid cell)

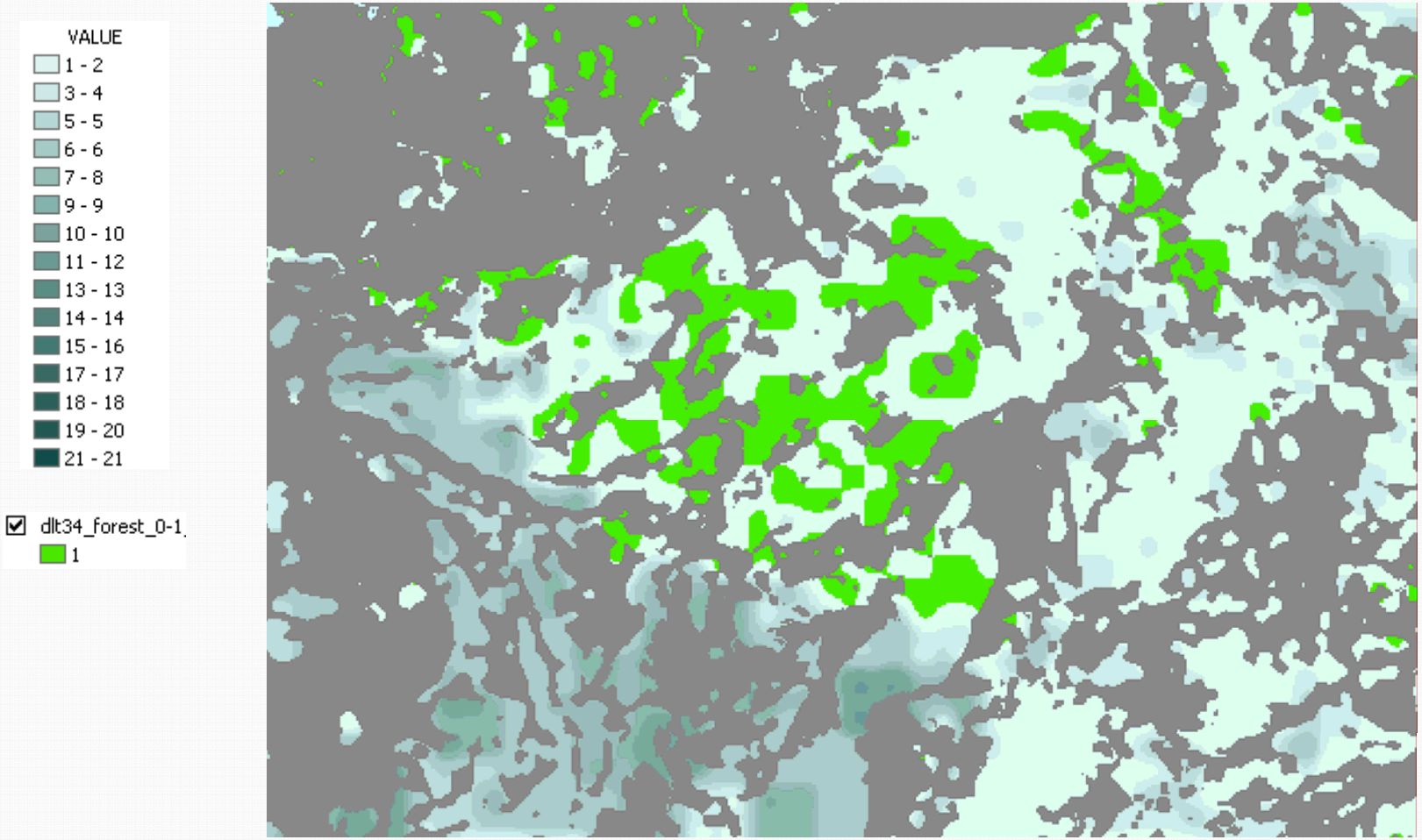


Resampling (example)

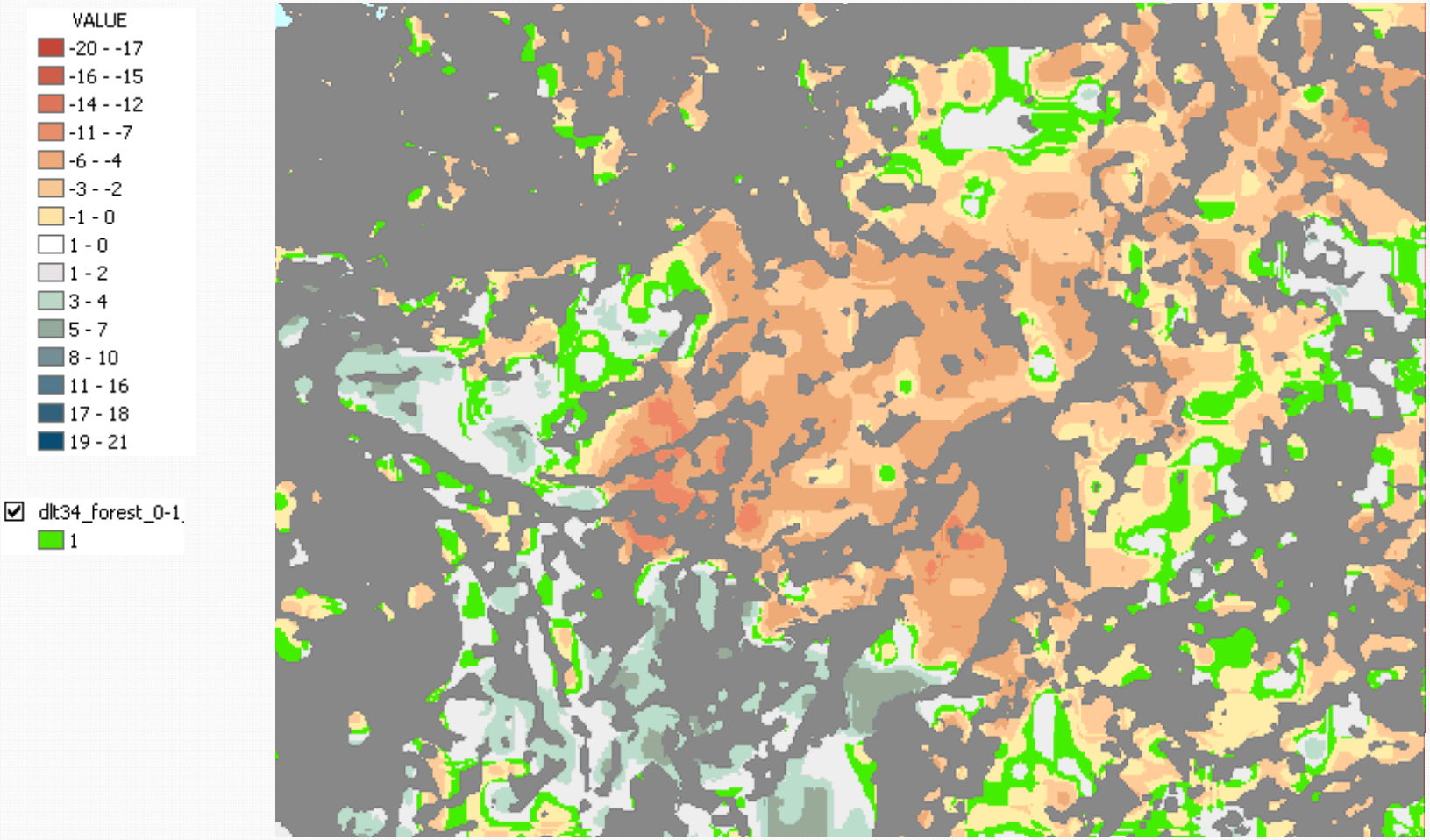
Filtering of data with the map of Forest Dominant Landscape Type 34 (1 km x 1 km), using cubic convolution



Example of result for Forest future prospect: number of species with « future = good »

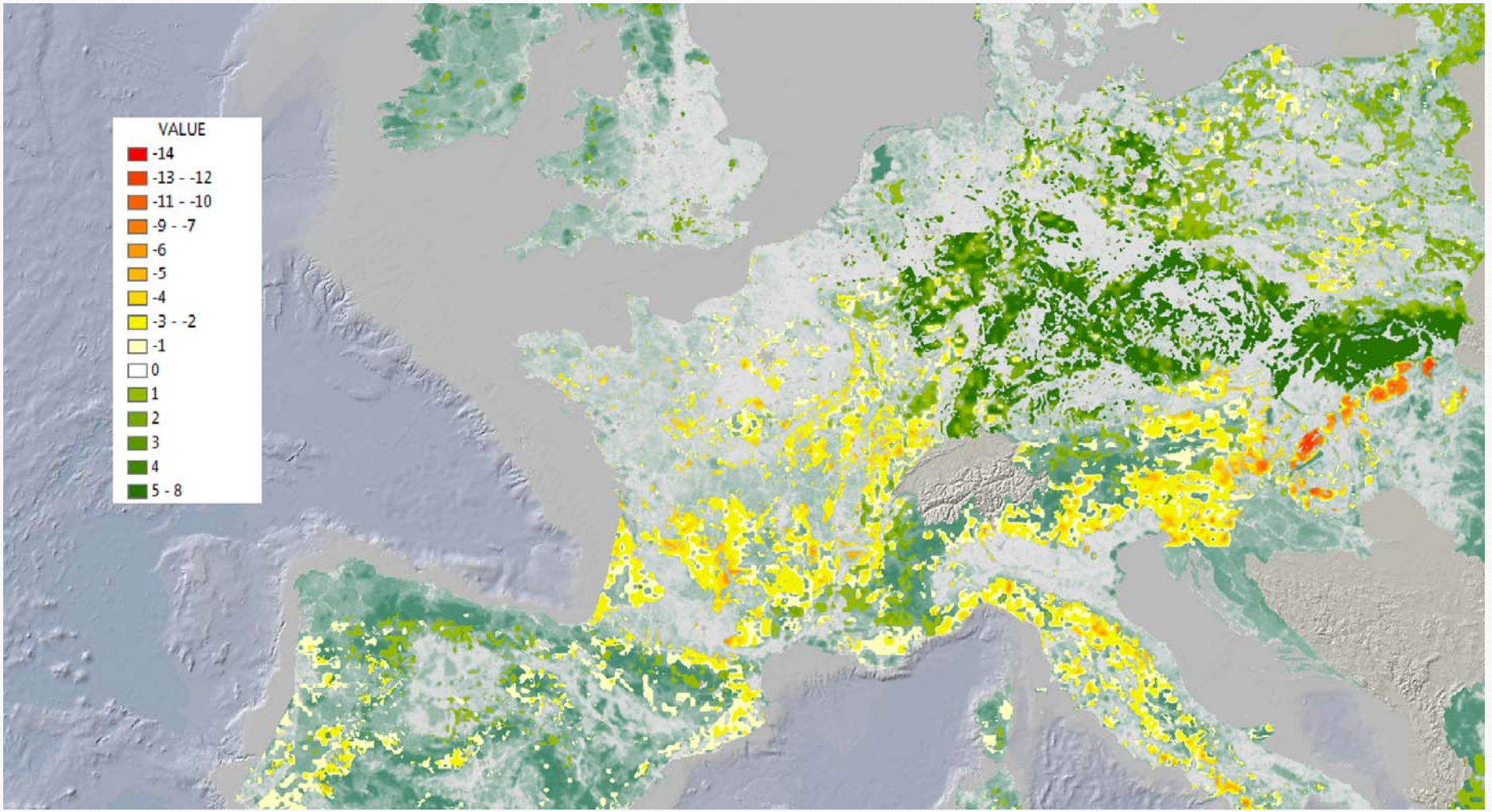


Example of result for Forest future prospect: :
Number of species with « future good minus future bad+poor »



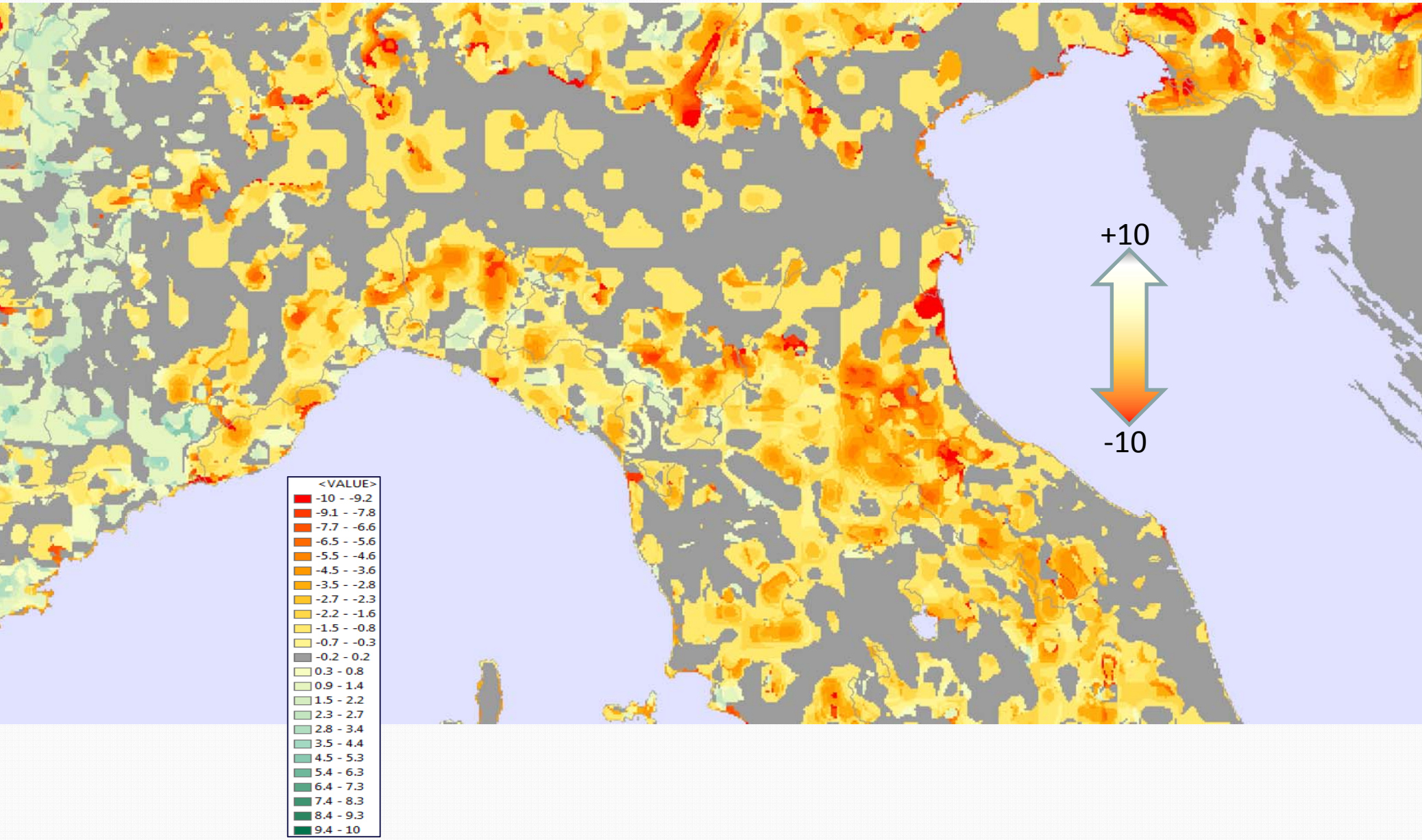
Jean-Louis Weber

Final index for forest species population:
Nb of species with population increase and stable minus nb of species with decrease

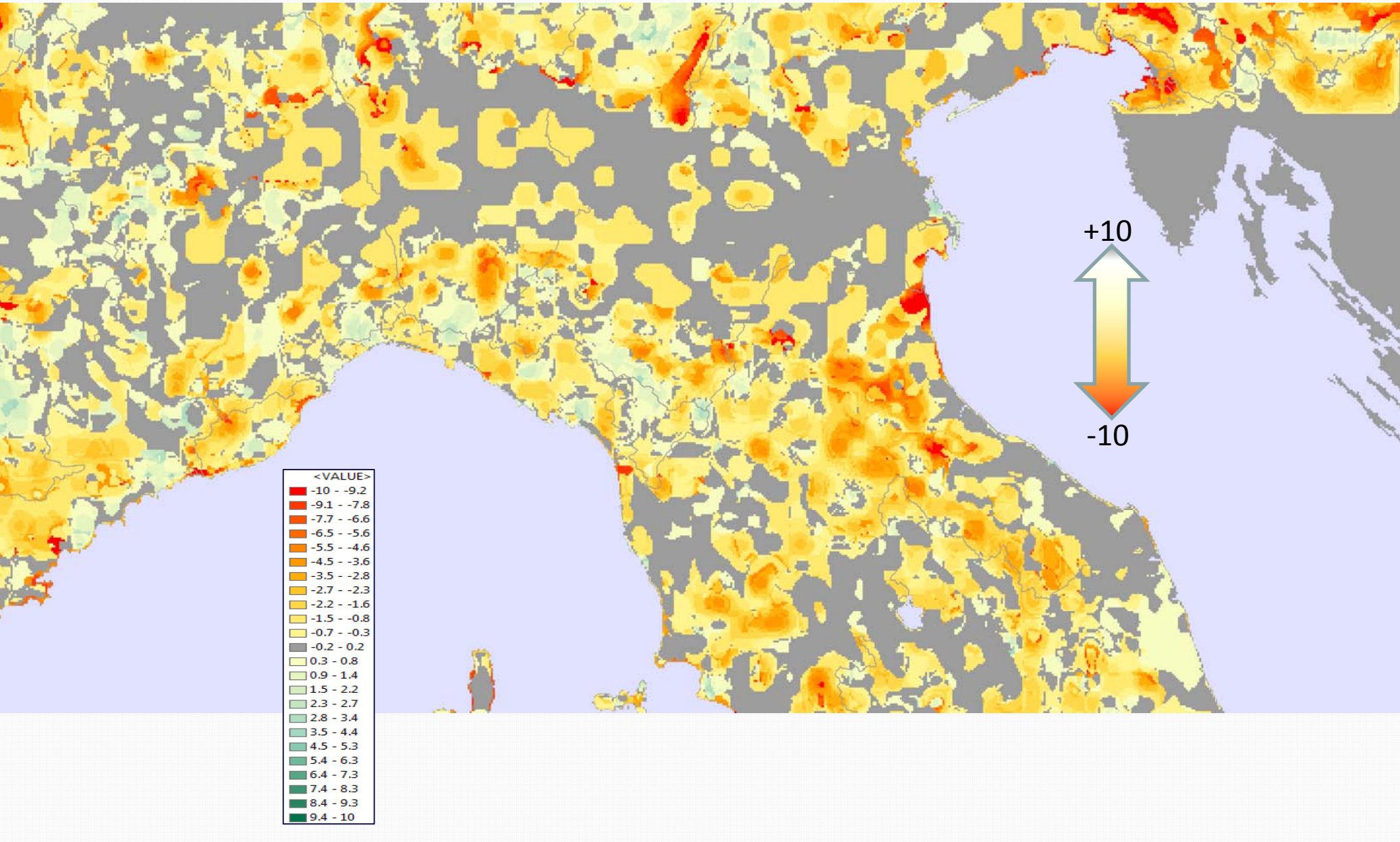


Jean-Louis Weber

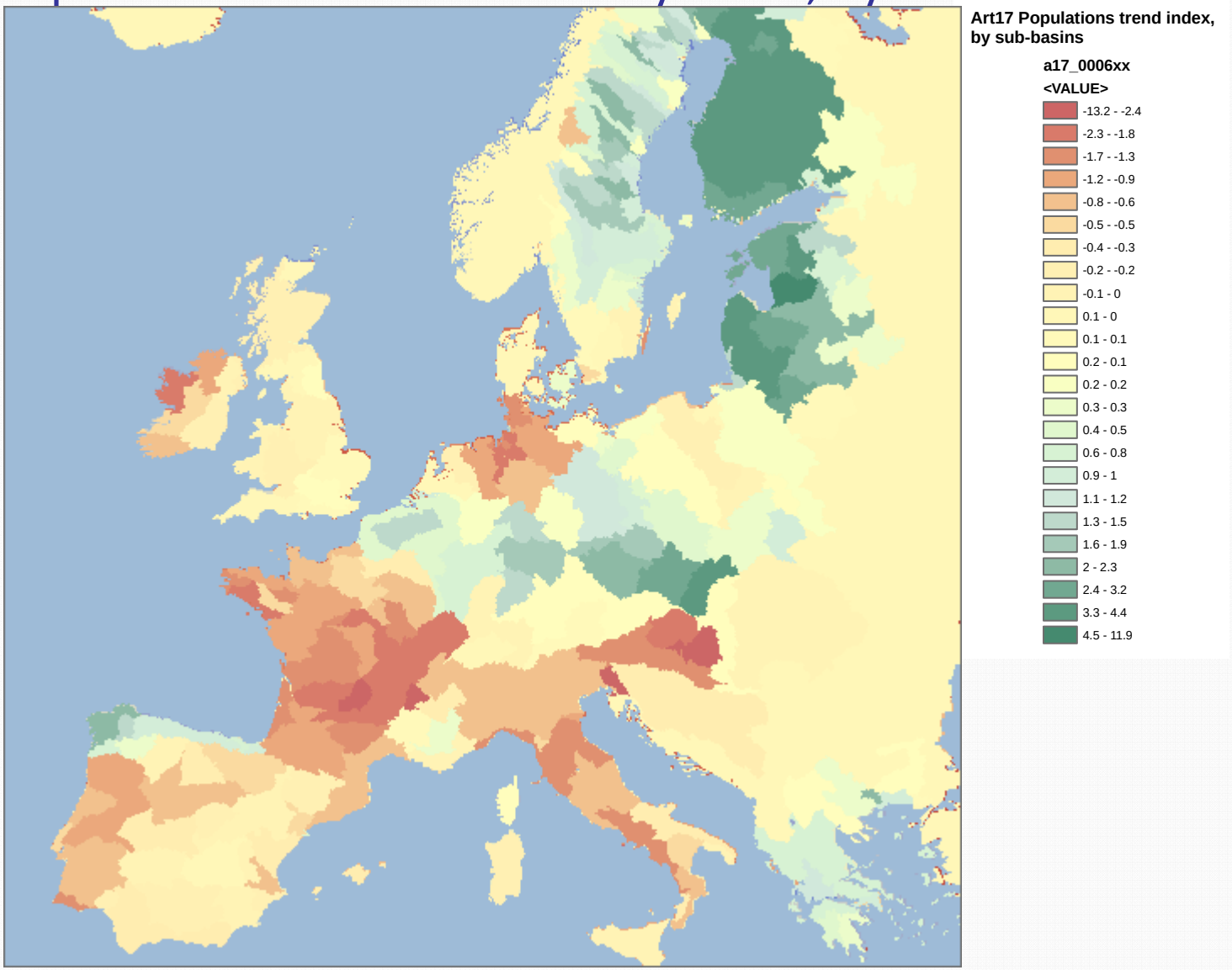
Species biodiversity index: “Art.17” reporting to the EC on Populations past/present trends (up to 2006)



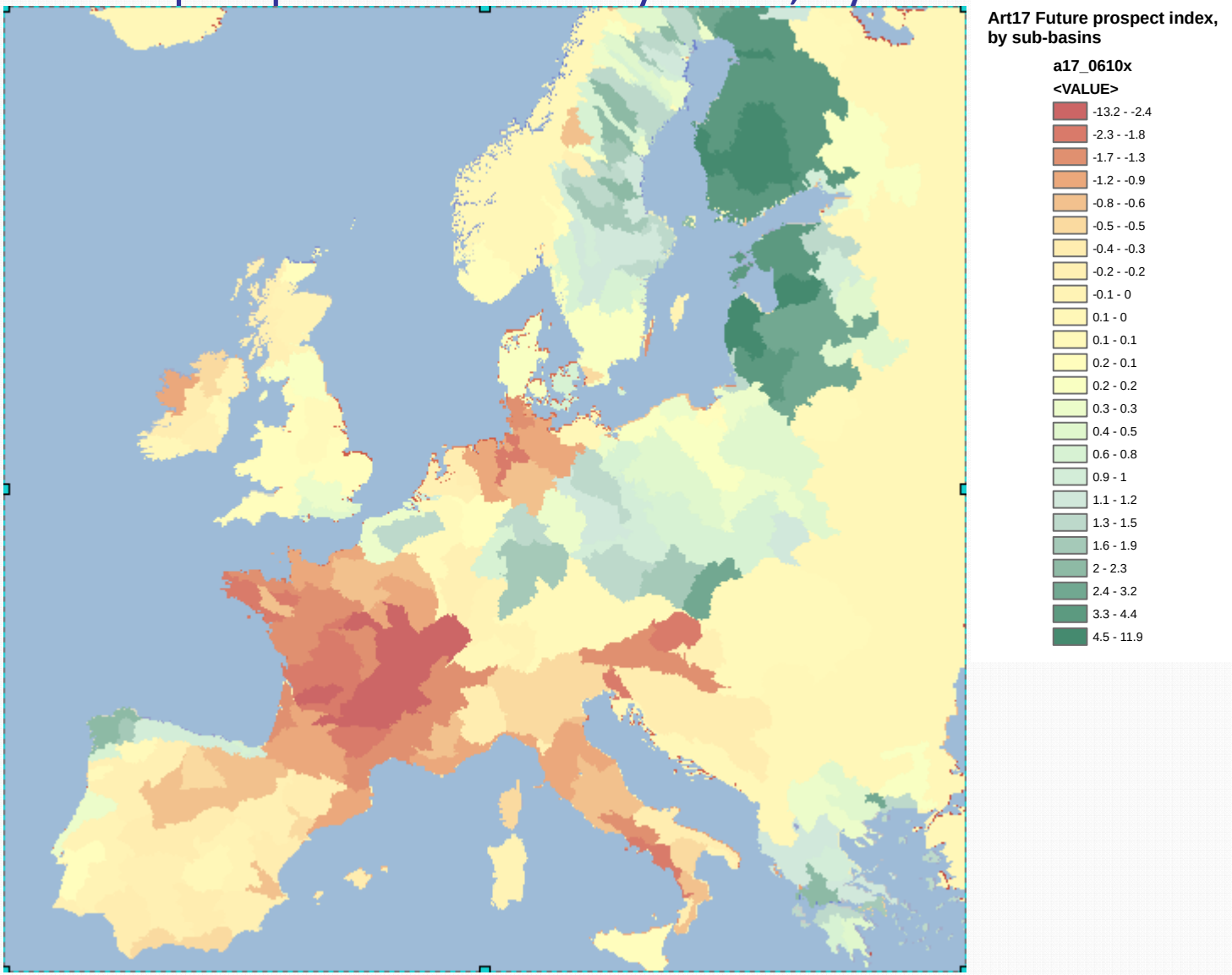
Species biodiversity index: “Art.17” reporting to the EC on Future prospects (after 2006)



Art17 “Populations trend” biodiversity index, by sub-basins

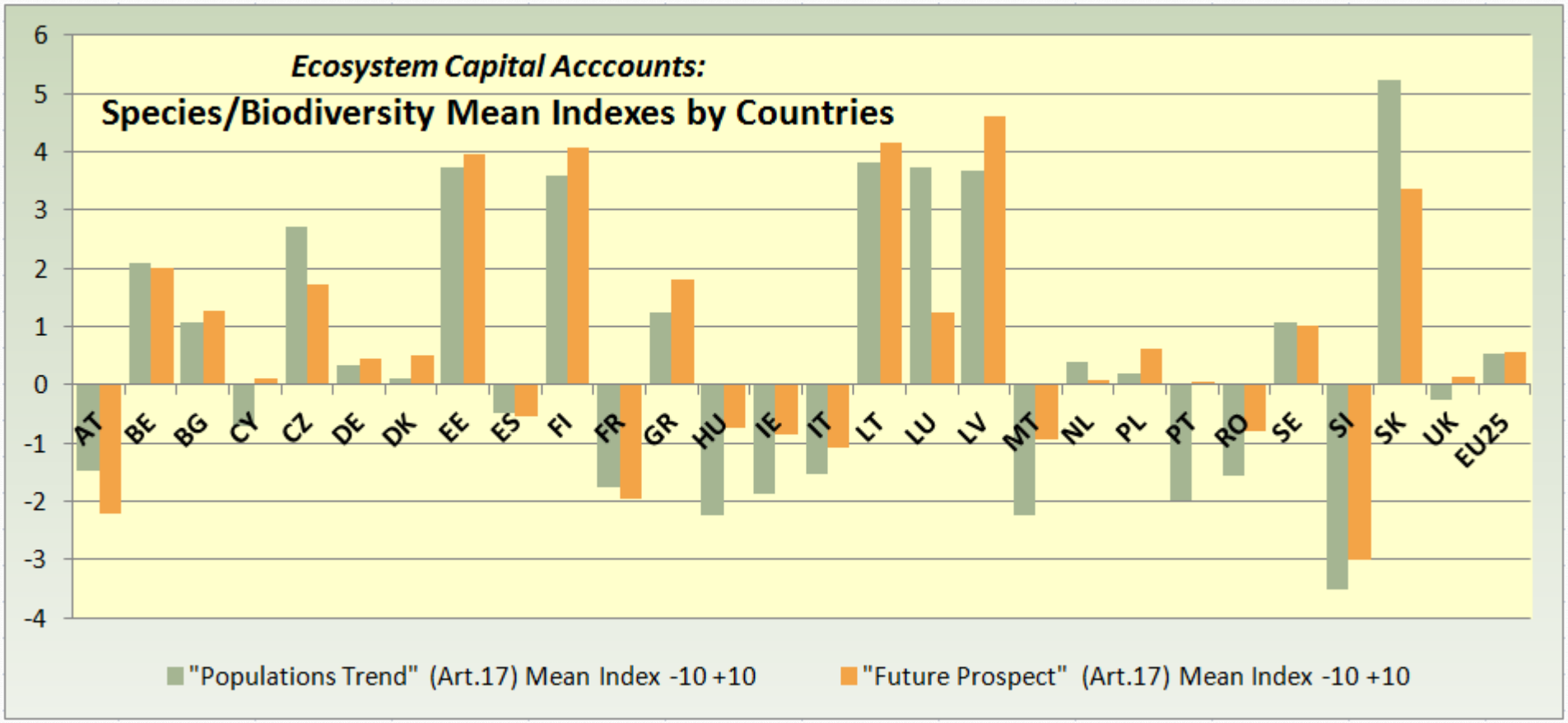


Art17 “Future prospect” biodiversity index, by sub-basins



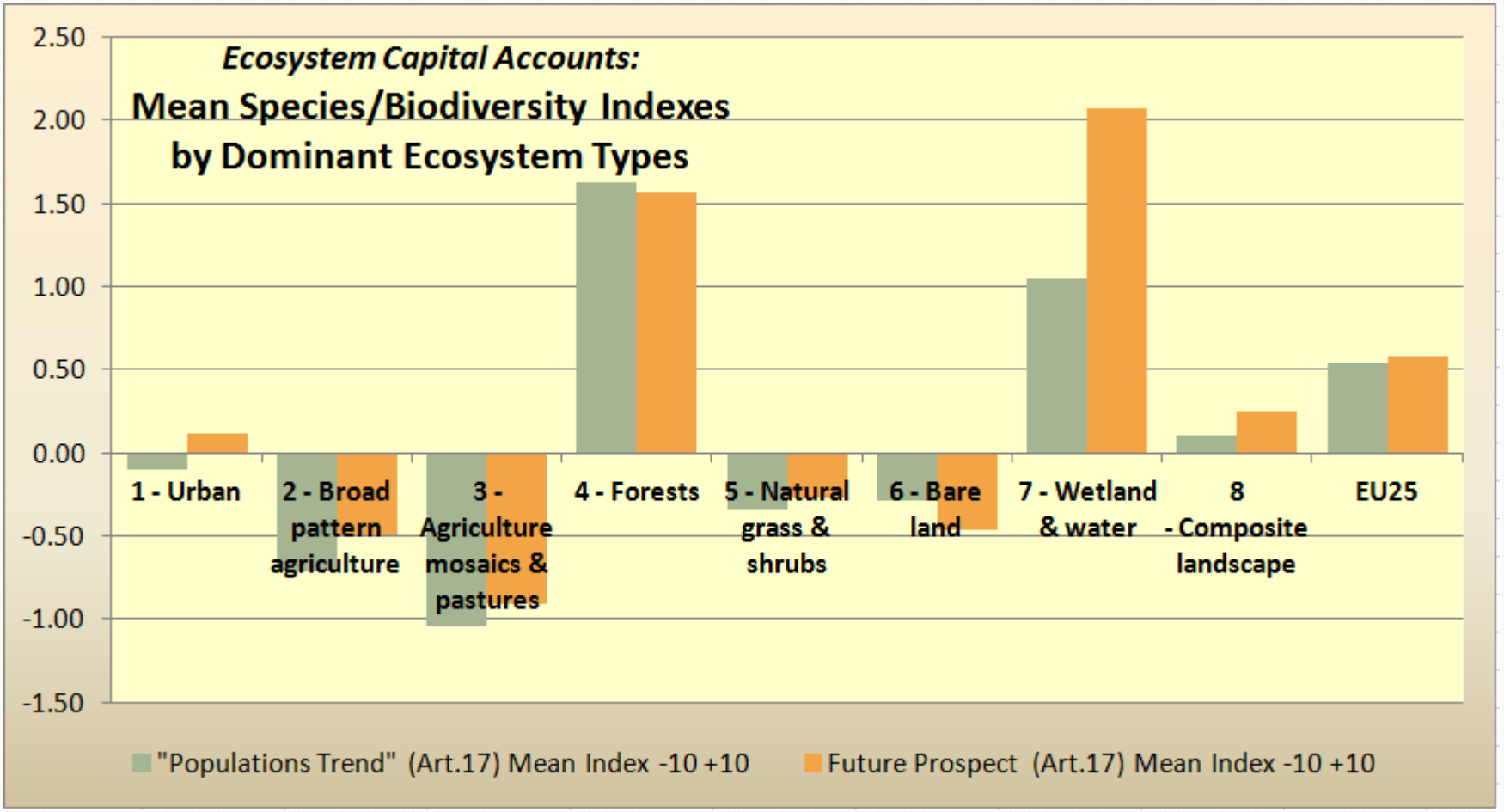
Ecosystem Capital Accounts: Landscape/Biodiversity Capacity Account

Species/biodiversity change mean indexes pre- and post 2006, by countries

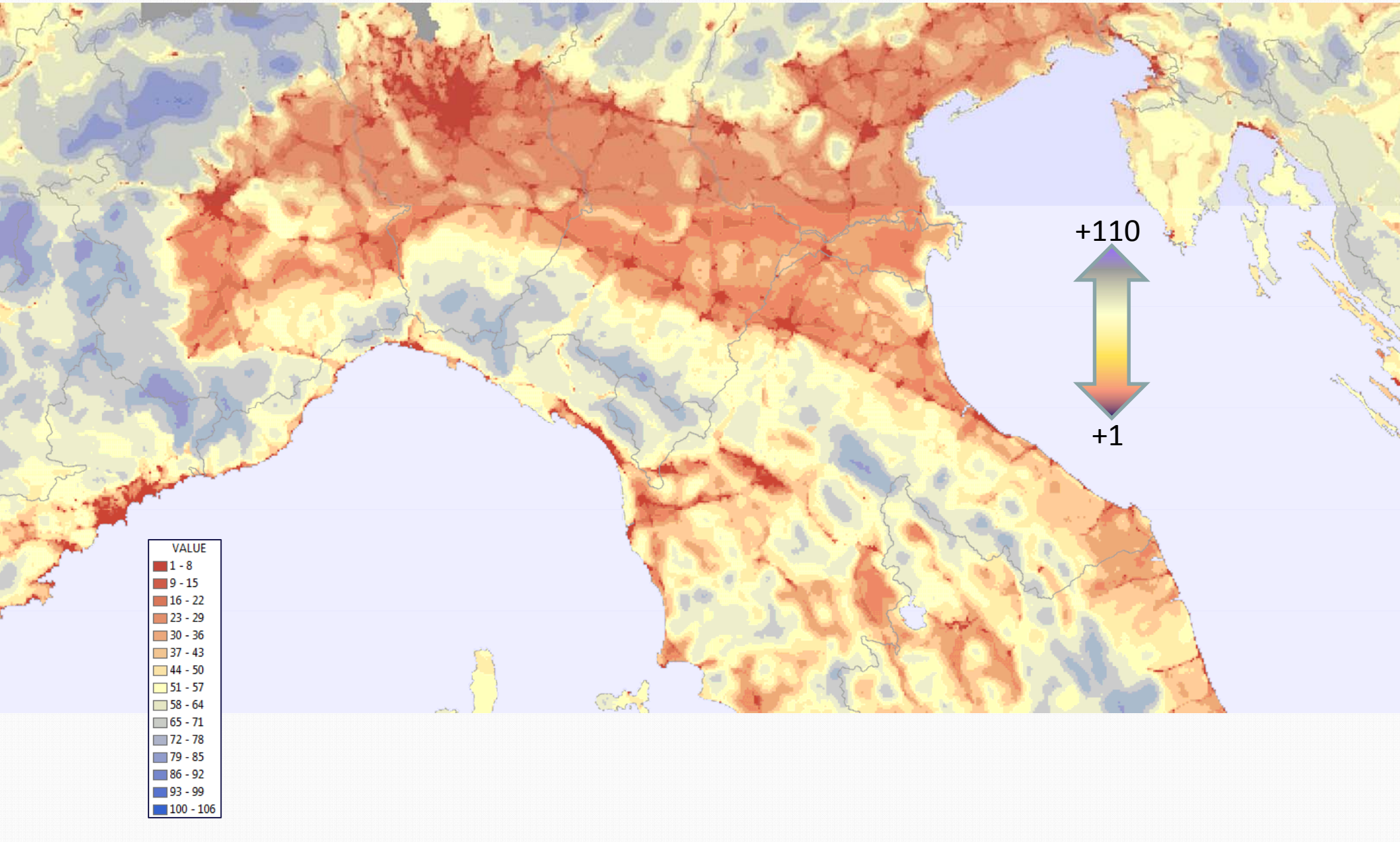


Ecosystem Capital Accounts: Landscape/Biodiversity Capacity Account

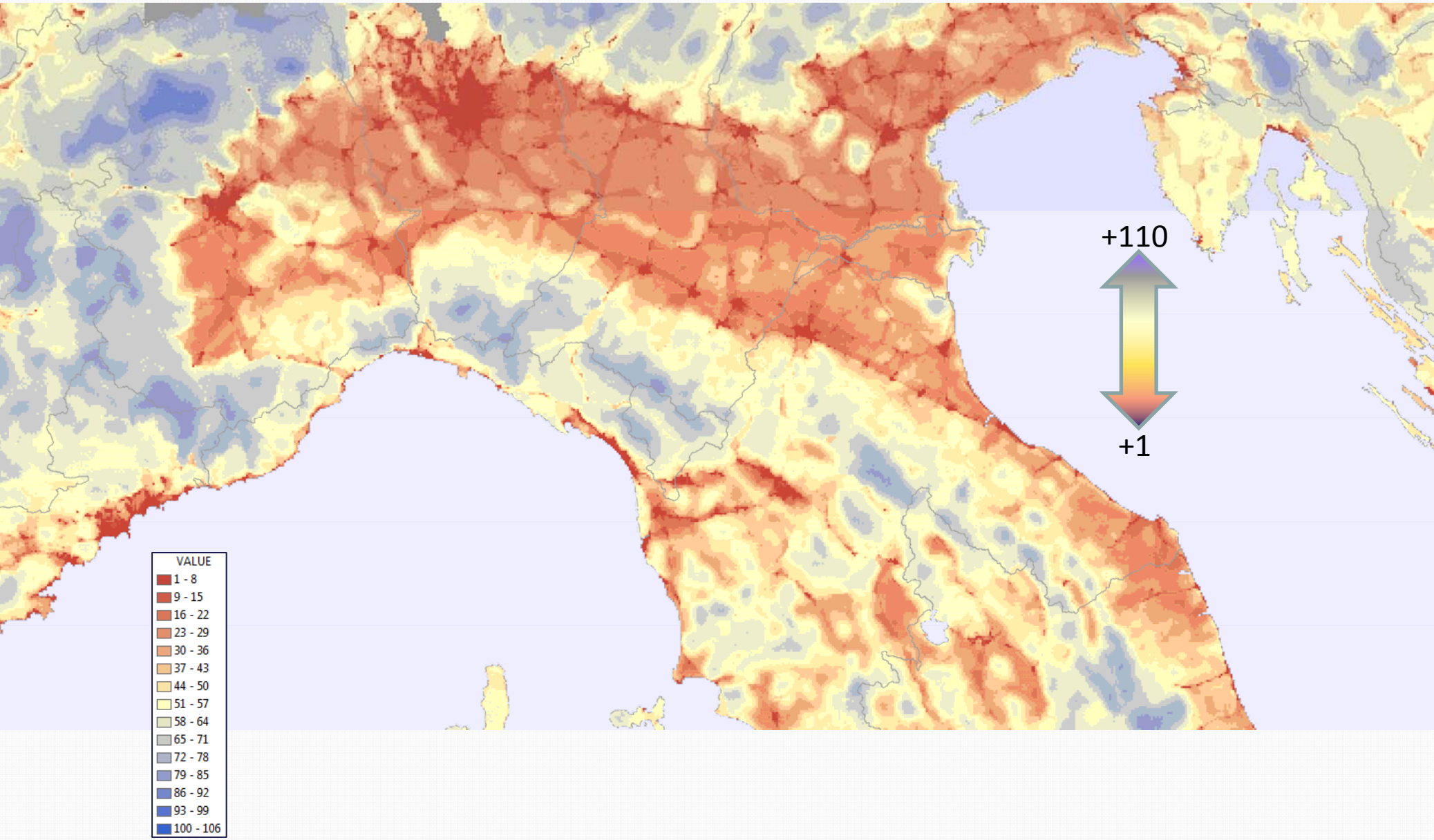
Species/biodiversity change mean indexes pre- and post 2006, by ecosystems



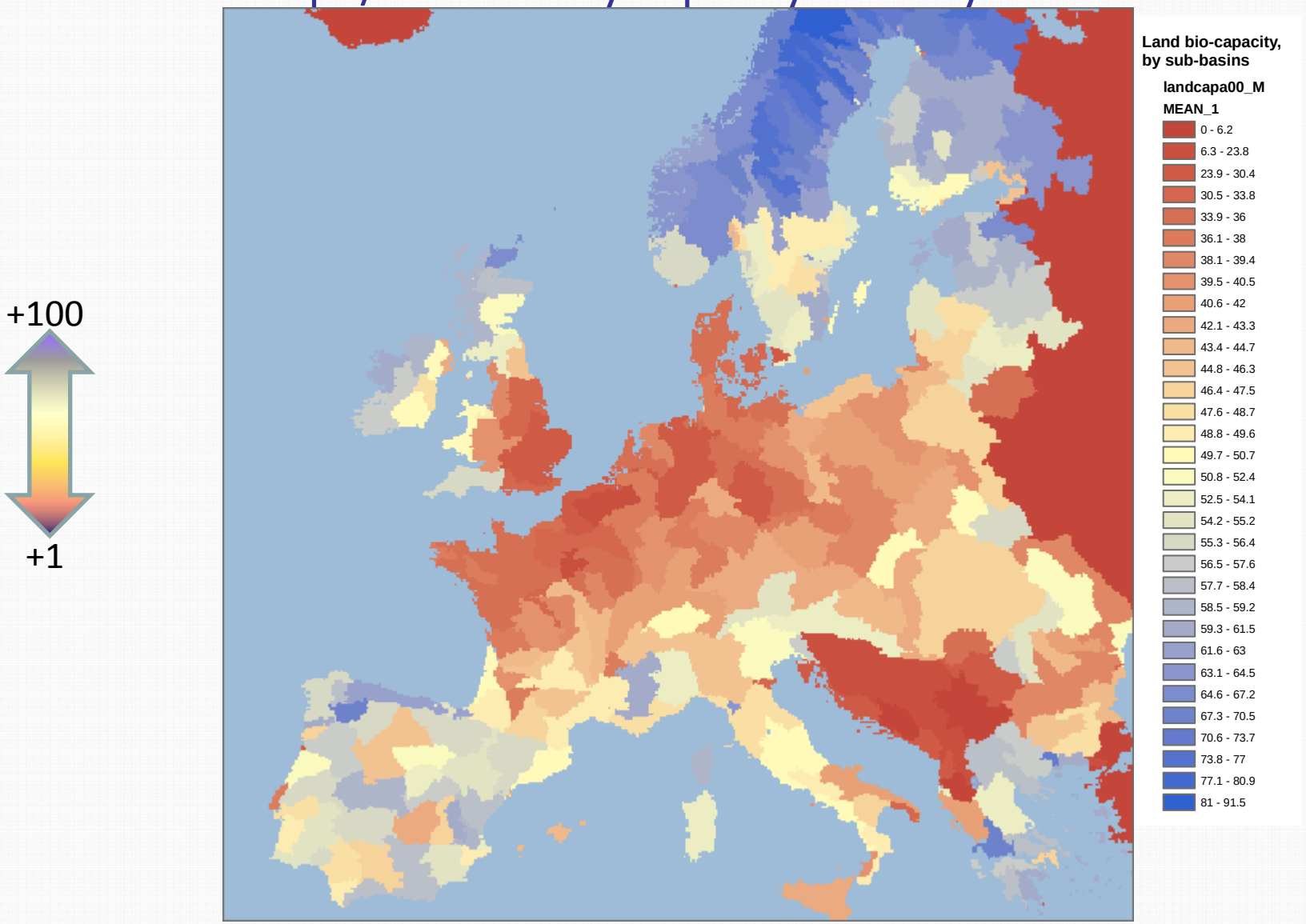
Landscape/biodiversity capacity 2000 by 1 x 1 km grid cells



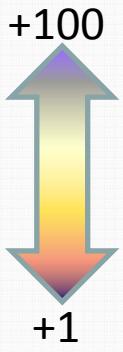
Landscape/biodiversity capacity 2010 by 1 x 1 km grid cells

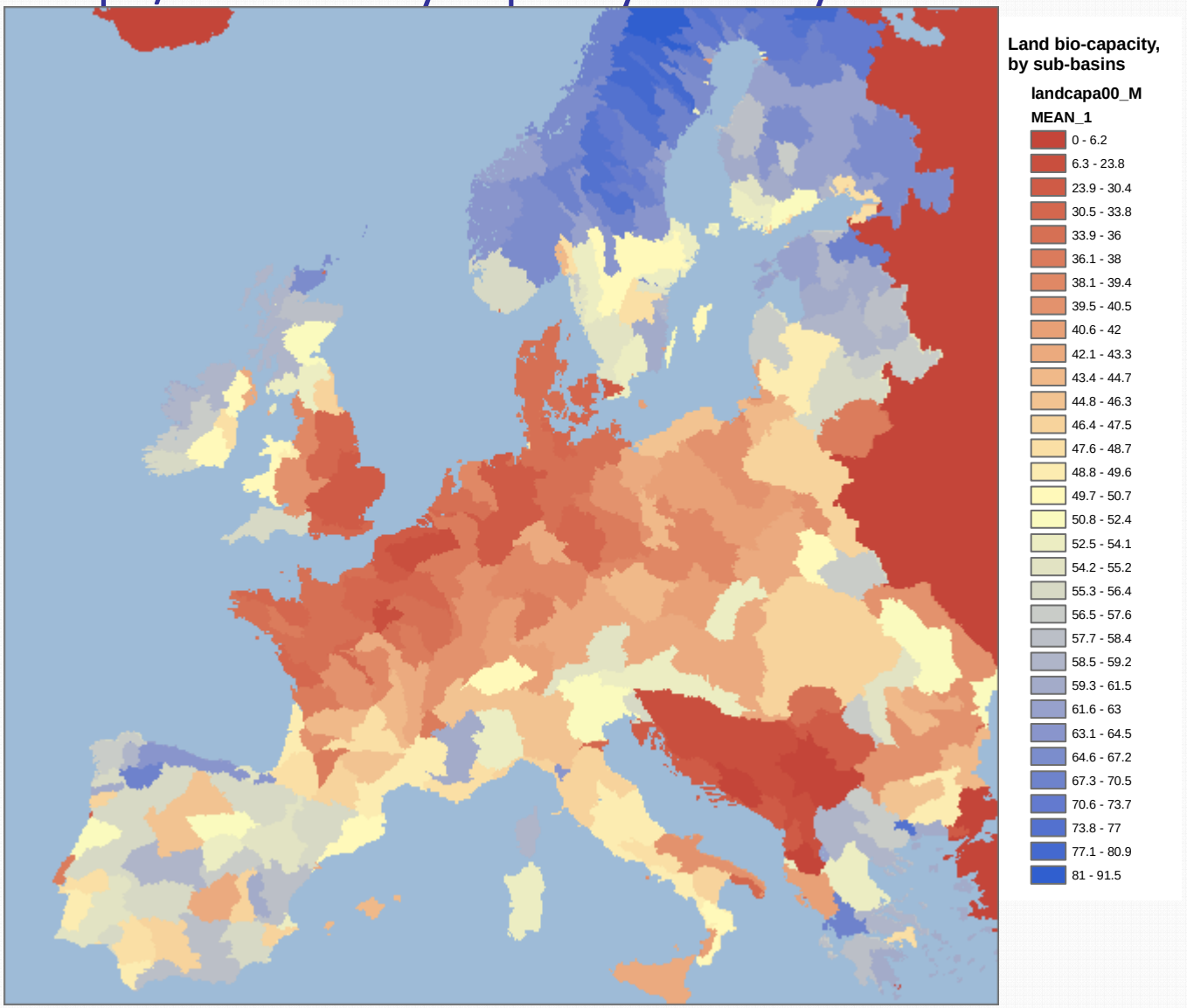


Landscape/biodiversity capacity 2000 by sub-basins



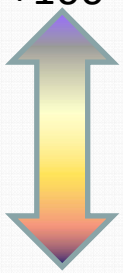
Landscape/biodiversity capacity 2006 by sub-basins



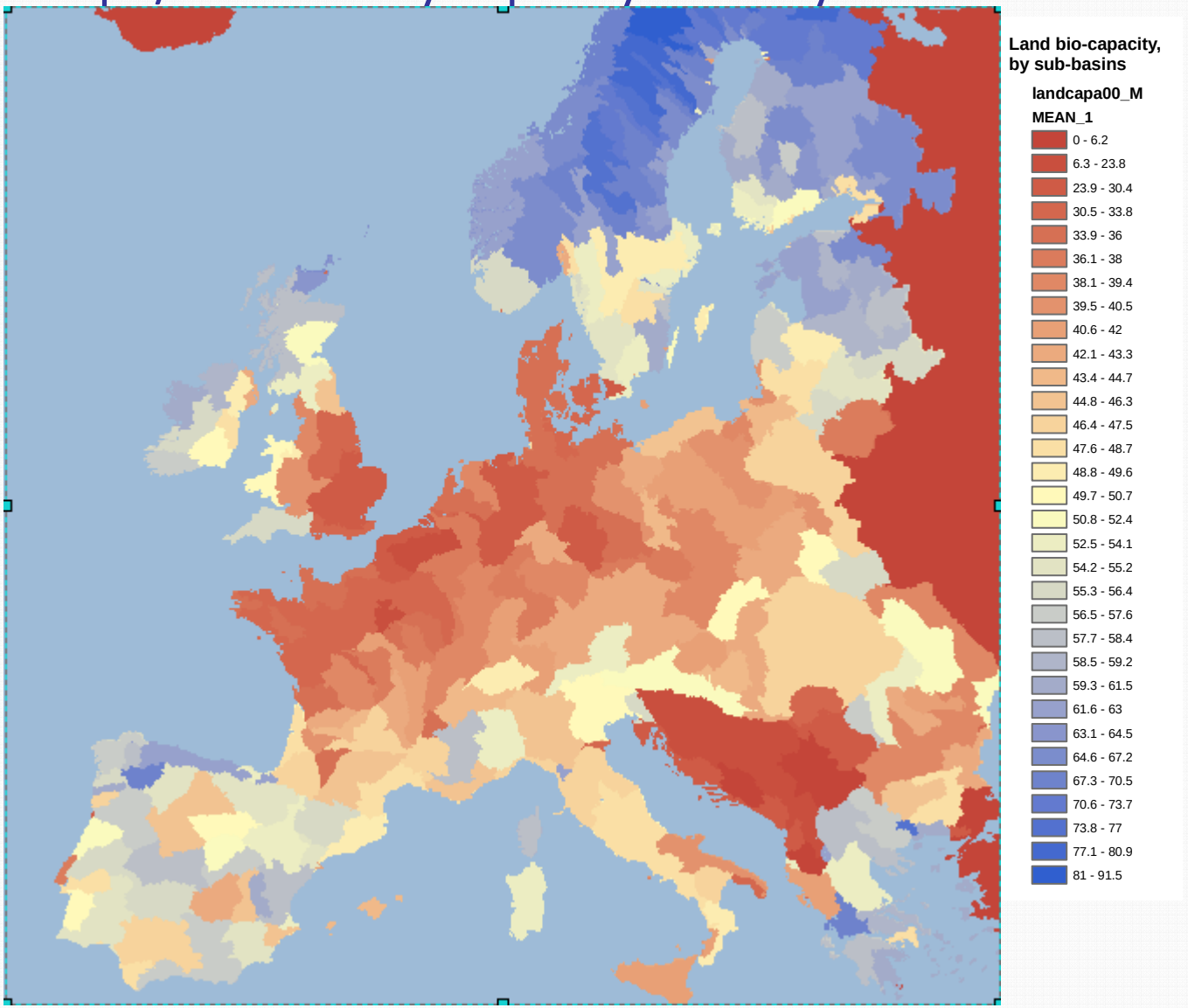


Landscape/biodiversity capacity 2010 by sub-basins

+100



+1

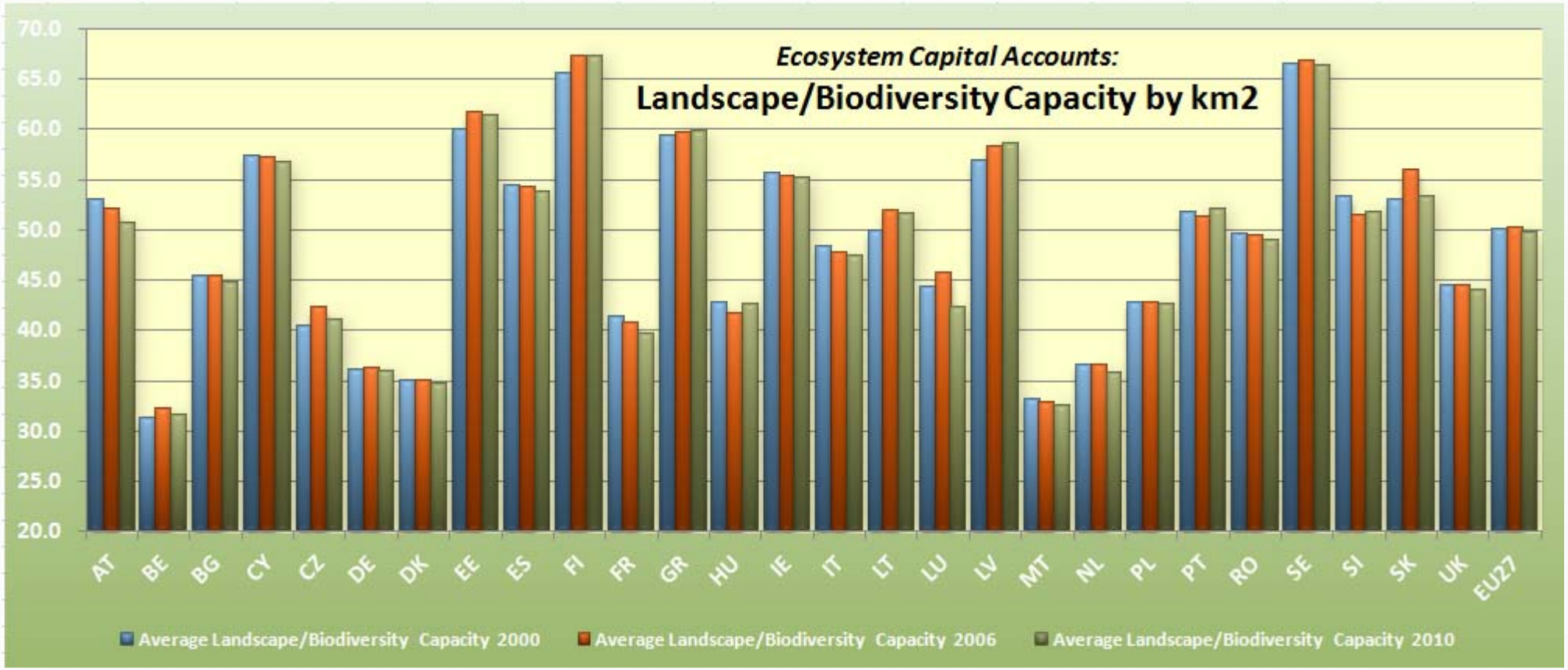


Ecosystem Capital Accounts: Landscape/Biodiversity Capacity Account

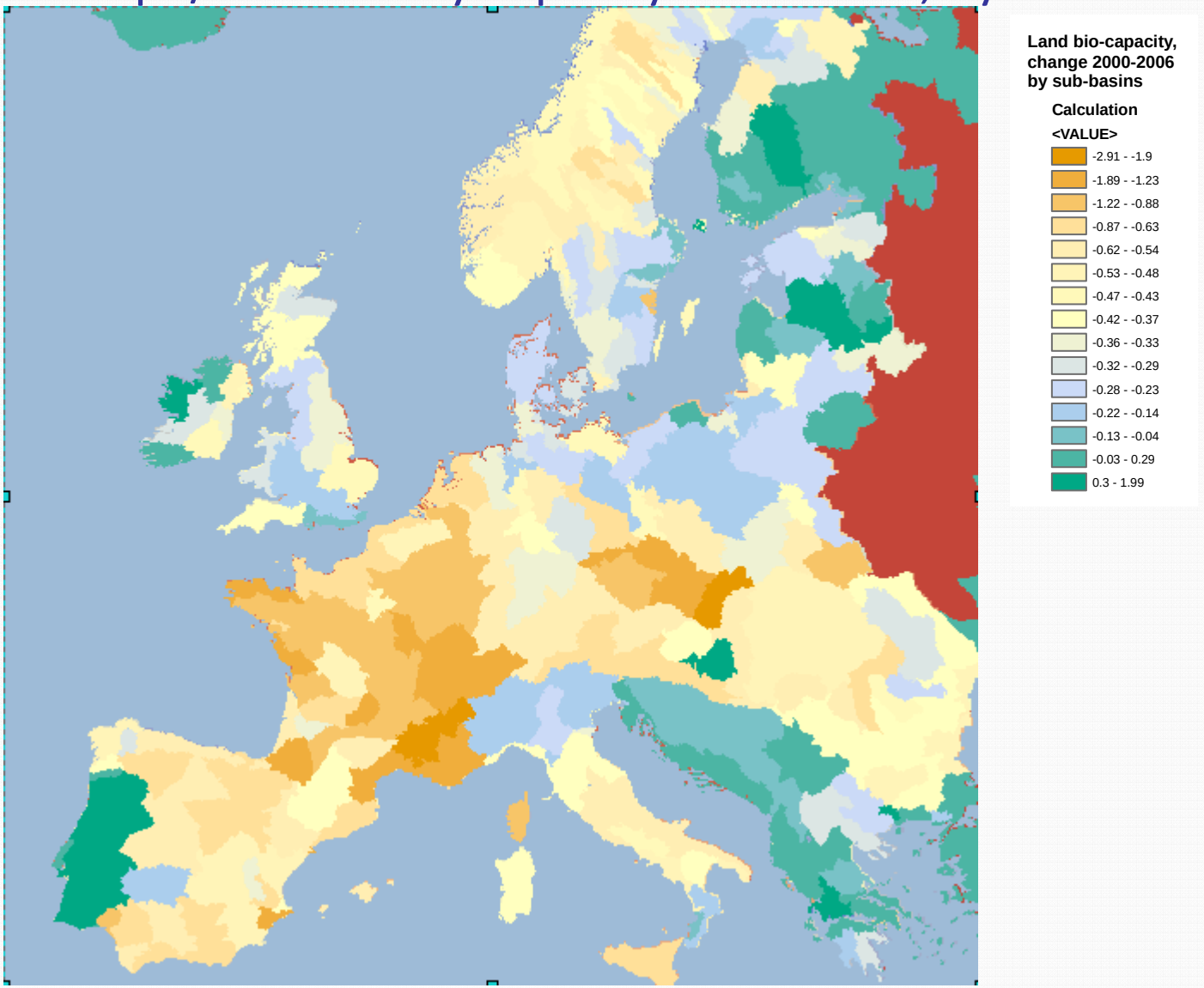
TABLE LBDV7: Landscape/Biodiversity Capacity 2000, 2006 & 2010, by Countries and River Sub-Basins

COUNTRY	RIVER SUB-BASIN (ECRINS Level 3)		Landscape /Biodiversity Capacity 2010 — *Dominant Ecosystem Type (as DLT51*)*								Total Landscape /Biodiversity Capacity 2010
			1 - Urban	2 - Broad pattern agricult.	3 - Agricult. mosaics & pastures	4 - Forests	5 - Natural grass & shrubs	6 - Bare land	7 - Wetland & water	8 - Composite landscape	
AT	WSB0000069	Danube main upper 1 - Altmuhl, Lech, Iller			762	25198	11929	11119		42265	91273
	WSB0000070	Danube main upper 2 - Naab, Regen, Isar				43051		9793		17342	70186
	WSB0000071	Danube main upper 3- Traun, Enns, Kamp	1277	155083	177549	653520	48135	12856		200844	1249264
	WSB0000101	Drau	509	5170	8674	756276	91036	82233		268854	1212752
	WSB0000188	Inn	77	2345	70631	348090	63552	202448		258231	9453[illegible]4
	WSB0000321	Morava		81671	5799	6020				21748	1152[illegible]
	WSB0000411	Raab	116	57842	26102	172932	901		14231	96361	368485
	WSB0000417	Rhine main - Upper - Ill	1		1350	49792	12149	10180	321	53326	127119
	WSB0000571	Vltava			13988	15977				10771	40736
AT Total			1980	302111	304855	2070856	227702	328629	14552	969742	4220427
BE	WSB0000138	Escaut / Schelde	4131	57108	62229	3587				170961	298016
	WSB0000304	Meuse	1278	26663	101209	189969	166		511	201926	521722
	WSB0000322	Moselle			19090	9551				5127	33768
	WSB0000362	Oise			649	1345				2194	4188
	WSB0000445	Scheldt coastal castchments and small basins (Somme,	1714	32634	42798	326				37233	114705
BE Total			7123	116405	225975	204778	166		511	417441	972399
BG	WSB0000037	Black Sea Basin District	123	204865		316847			3998	183388	709221
	WSB0000038	Black sea coastal and small river basins				12529			101	74	12704
	WSB0000066	Danube main lower 1 - Ogosta, Iskar, Vit, Osum, Yantra,	562	460294	5988	502230	1520	221	745	440070	1411630
	WSB0000067	Danube main lower 2 - final	5	193499		19117				57506	270127
	WSB0000068	Danube main - Medium - Timok		83668	965	40155				45714	170502

Ecosystem Capital Accounts: Landscape/Biodiversity Capacity Account

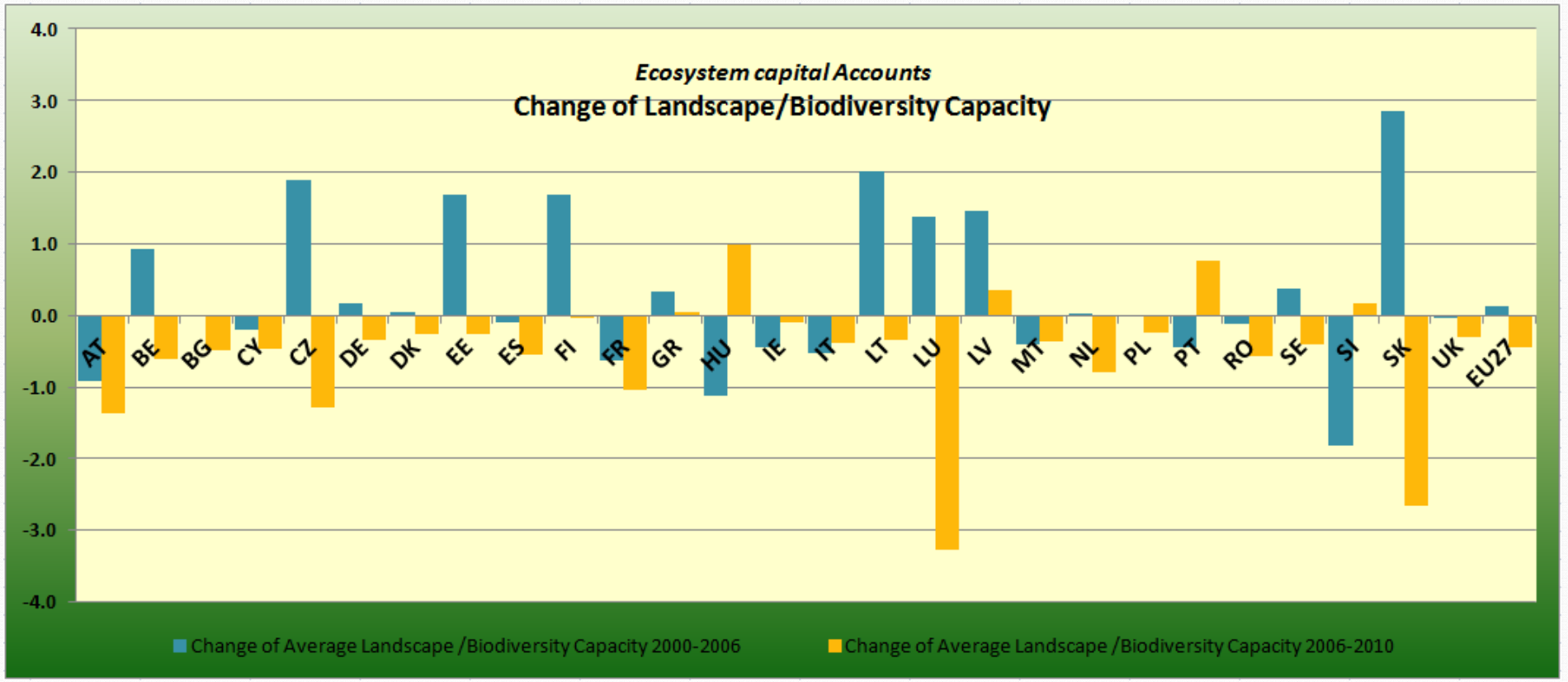


Change in landscape/biodiversity capacity 2000-2006, by sub-basins



Ecosystem Capital Accounts: Landscape/Biodiversity Capacity Account

Change in Landscape/Biodiversity Capacity 2000-2006 and 2006-2010



Next step

- From preliminary to first operational results:
  - Validation & improvements by EEA and ETCs
  - Open to review by EEA partners (JRC, Eurostat, DGENV…)
  - International review, SEEA revision context, tests with Australia…
  - We need EIONET's comments…

- Country applications:
  - On a case by case basis – e.g., Slovakia, Scotland, Turkey, Rhone-Alpes Region in France...
  - Starting from national or regional priorities: detailed, more accurate accounts under the umbrella of the EU broad picture for biomass/carbon/freshwater/landscape/biodiversity
  - According to existing data in countries…