4th European Conference on Ecological Modelling

29 September 2004

Spatial assessments of Europe's environment

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Executive Director

The EEA mission

What is our mandate?

- To help the Community and member countries make informed decisions about improving the environment, integrating environmental considerations into economic policies and moving towards sustainability
- To coordinate the European environment information and observation network (Eionet)

The EEA is...

- An independent information provider
- An analyst and assessor
- Building bridges between science and policy
- Dependent upon strong networks to carry out its work

➢ ...to support policy processes and inform the public


ICELAND
NORWAY
SWEDEN
FINLAND
ESTONIA
LATVIA
LITHUANIA
IRELAND
UNITED KINGDOM
DENMARK
NETHERLANDS
BELGIUM
GERMANY
POLAND
LUXEN-BOURG
CZECH REPUBLIC
FRANCE
SLOVAKIA
SWITZER-LAND
AUSTRIA
HUNGARY
SLOVENIA
CROATIA
ROMANIA
BOSNIA-HERZEGOVINA
SERBIA & MONTENEGRO
BULGARIA
FYR OF MACEDONIA
ALBANIA
PORTUGAL
SPAIN
ITALY
GREECE
TURKEY
MALTA
CYPRUS
Member countries
Collaborating countries

Ecological Dynamics
Basic questions

How do we

- characterise and quantify dynamics and spatial structures?
- deal with large quantity of data, I.e. data compression?
- identify characteristic length scales?
- extract information from data?
- detect change over different time scales?

Artificial ecologies:structure and computation

SPATIO- TEMPORAL DYNAMICS

- discrete space & states
- thermodynamic limits
- characterisation of spatial structure
- Data analysis e.g. SVD

MODELS

Space, time and state	Treatment	Model
Continuous	Homogeneously mixed	ODE‘s mappings pde‘s, reaction-diffusion CML‘s
Discrete	Individual-based	Probabilistic cellular automata, interacting particle systems , artficial ecologies

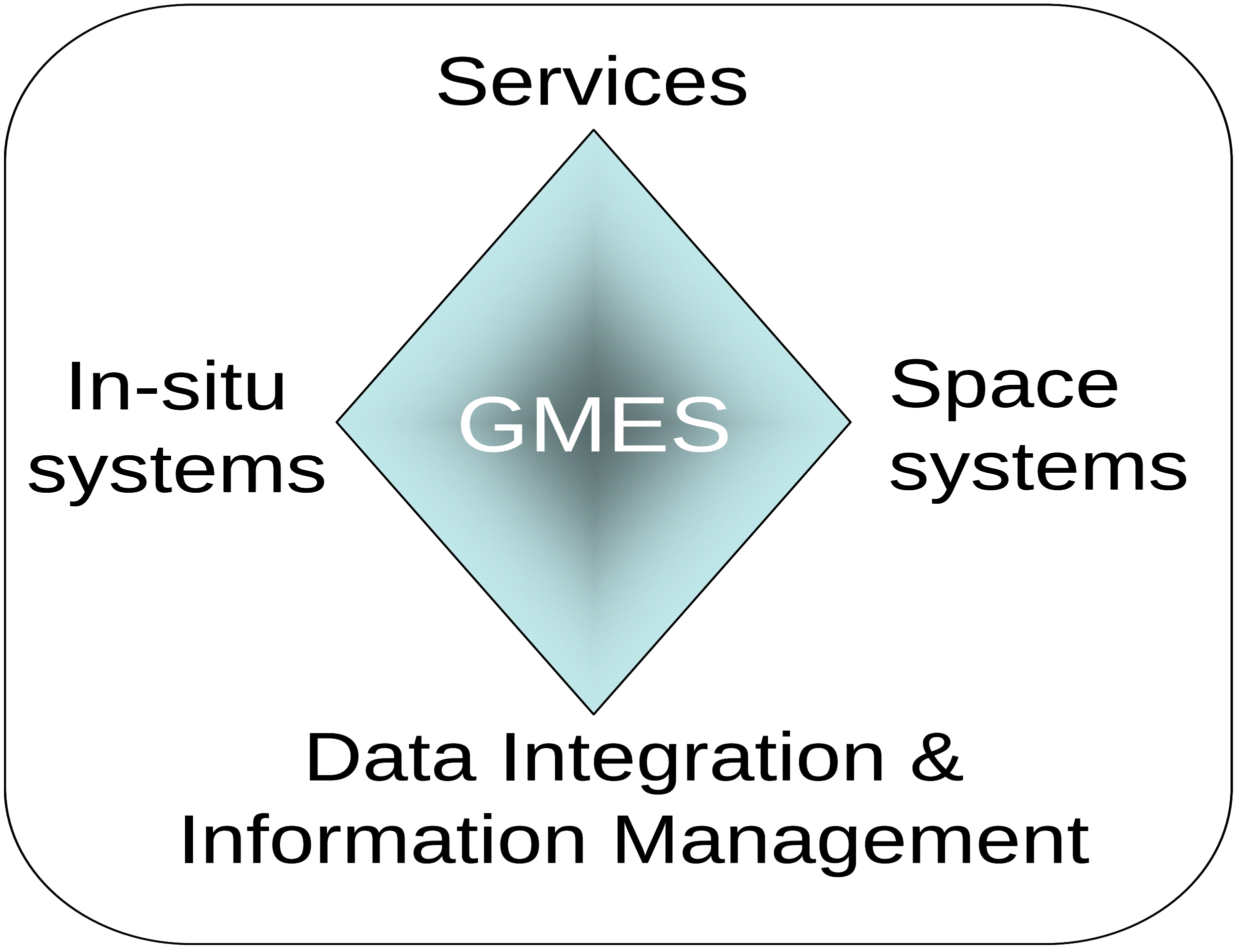
Lobster kelp sea- urchin system

- Lobsters take cover in the kelp
- Kelp grows naturally and abundantly
- Sea-urchins prey on the kelp by eating the stipe and thereby weakening the kelp to physical wave action
- Lobsters eat sea-urchins as 10% of their diet
- A fatal sea-urchin virus exists that is triggered by a rise in sea temperature

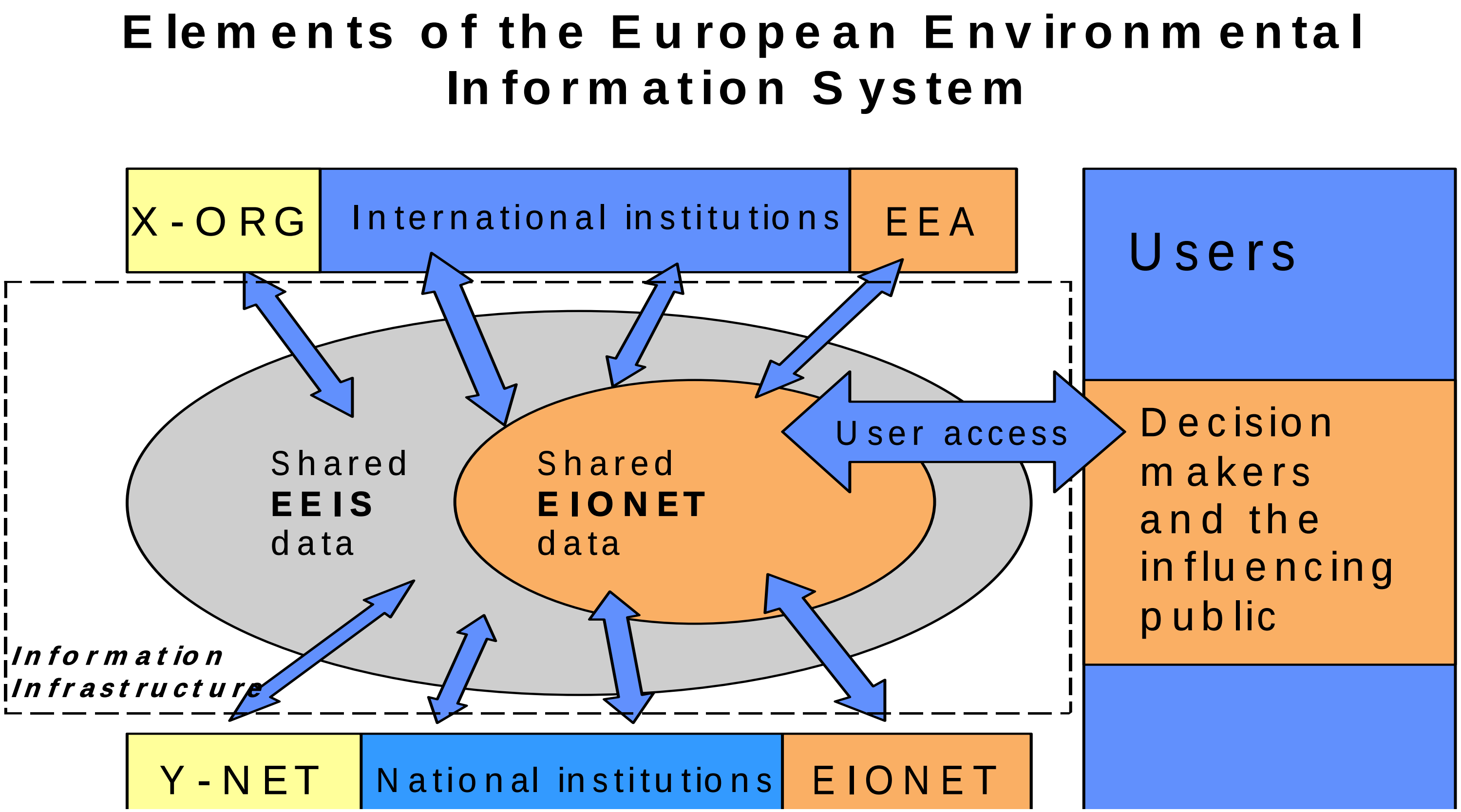
Monitoring, in-situ measurements and space-borne observation data: modelling for spatial analysis

European Environment Agency

The GMES "diamond" as in COM(2004) 65 final



EIONET: in situ monitoring in Europe for the environment, ~ 400 organisations…



…10 years of development

Enhancing EIONET role: EU Council meeting – Environment, 28 June 2004

- Calls on EEA to strengthen EIONET as a **key operating infrastructure to streamline monitoring and reporting**, and develop its information system in line with the Inspire and GMES initiatives

- Calls on the Commission to identify and examine new and innovative means of securing adequate funding for the operation of the Agency.

Main GMES 2004-2008 actions (excerpts)

Management tasks where EEA/EIONET involvement is foreseen in COM (2004) 65 final

N°	Implementation actions	Actors	Instrument	Timing
3	Prepare the in-situ component (implementation plan, upgrade)	EC, EEA, Member States	6th FP, EU stakeholder programmes	2004 2005-2008
5	Establish a data policy framework	EC, ESA, EEA, MS	INSPIRE, MOU	2004-2005
8	Improve data integration and information management	EC, ESA, EEA, MS and service providers (e.g. EUMETSAT)	6th FP, 7th FP INSPIRE	2004-2008

The GMES debate on DATA INTEGRATION

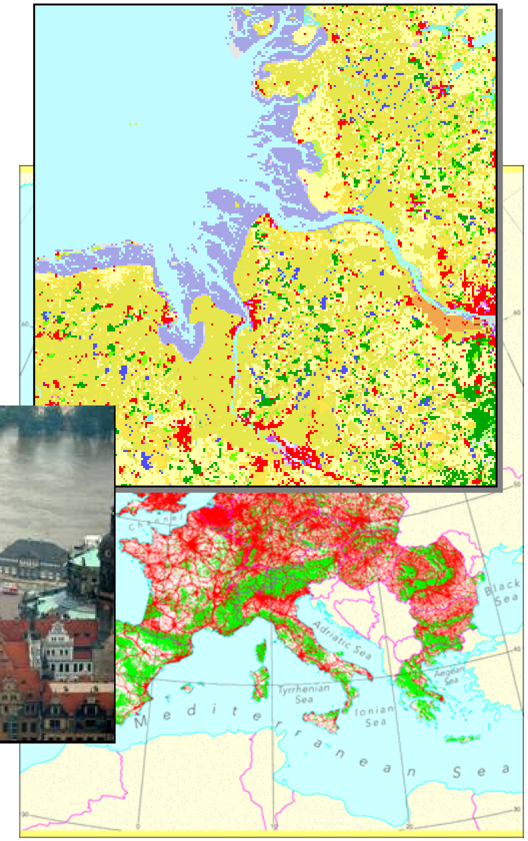
- **Space vs. In Situ monitoring**: no substitution, not a simple overlay, both to be integrated as sources in modelling
- **Integration of In Situ networks**: avoid as much as possible creation from the scratch, make use and upgrade existing monitoring networks (avoiding duplications, making the environmental actors feel owners of GMES)
- **Monitoring/ Data Collection/ Data Assimilation/ Modelling/ Assessments/ Services**
  - **Thematic integration** (assimilation, modelling…): avoid stand alone services, spatial integration (e.g. land use, water & biodiversity), integrated assessments needed for policy making
  - **Data policy**: towards a European Shared Information System (or Service?), the European Spatial Data Infrastructure (INSPIRE) as a first step

Prioritise support to new EU initiatives

Development/improvement of monitoring, assessment and information management tools for e.g.:

- Soil Thematic Strategy
- Urban environment Thematic Strategy
- Environment and Planning
- European Spatial Data Infrastructure (INSPIRE)

…



Knowledge-base perspectives for decision making?

- **Time perspective**: past and future trends, models, scenarios, visions
- **Spatial perspective**: commonalities and differences between situations (regions, river basins, areas…), comparisons
- **Governance perspective**: policy elaboration, policy implementation, policy assessment
- **Citizen perspective**: responsibility, equity, solidarity

Conditions:

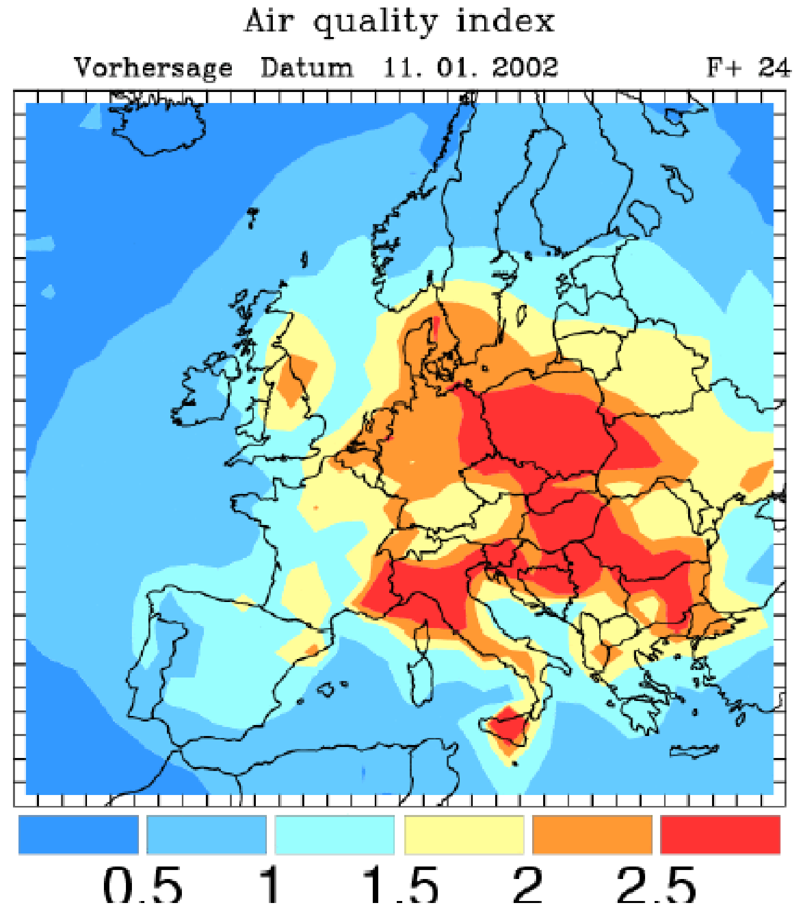
➔Open access to information

➔Understanding interactions and mechanisms: modelling

E.g. Improve Air Quality Monitoring and Forecasting

Tropospheric aerosol and chemical concentrations derived from satellite data for monitoring purposes

Near-surface estimates & forecasts of pollutant concentrations based on assimilated satellite & ground data



Courtesy PROMOTE

Scope for redesigning monitoring…

E.g. EC Dangerous Substances in Water Directive:

→ Case of England and Wales 1998-2002:

- For 85% of 215,000 samples: no concentrations found

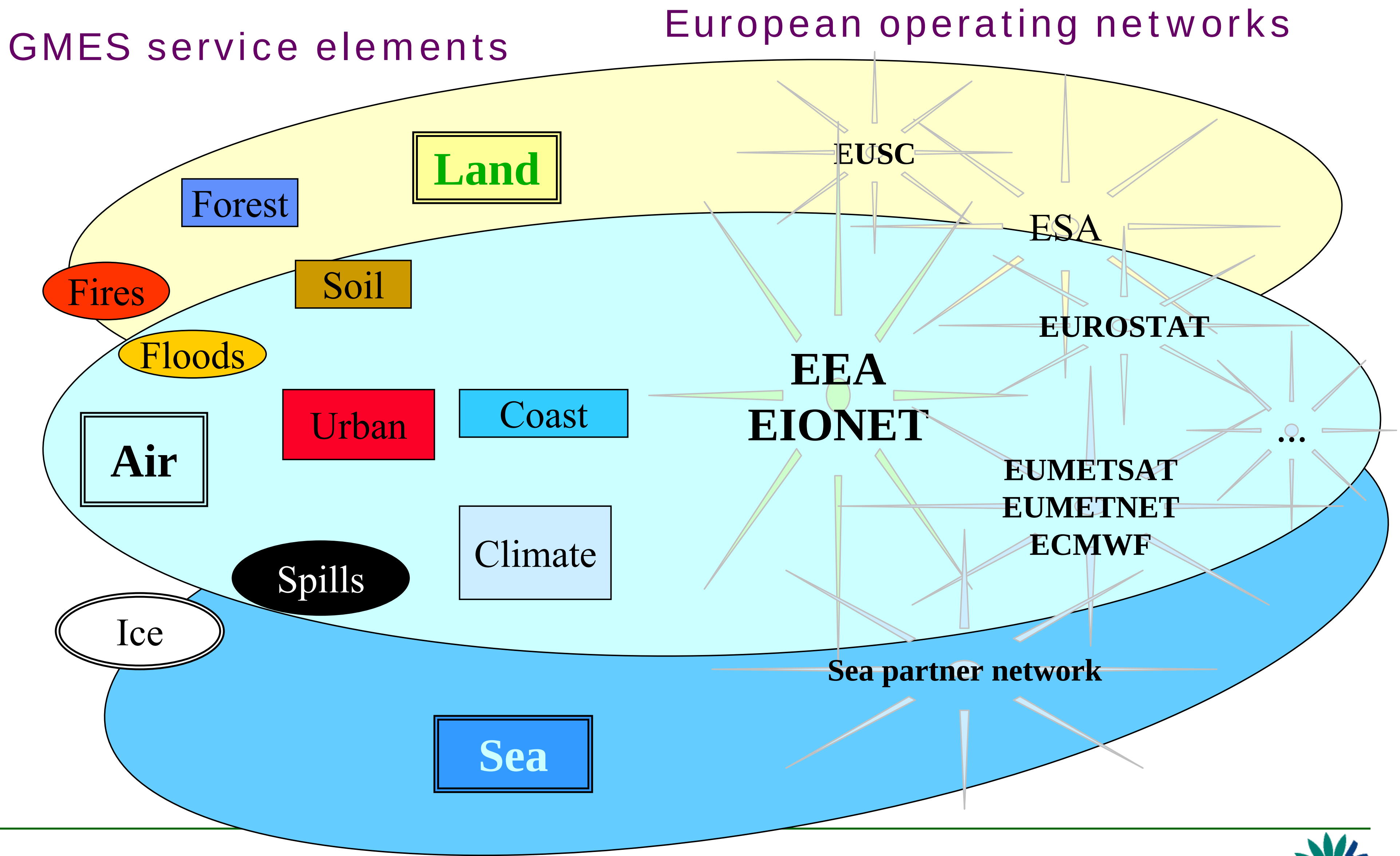
- Costs of non-risked-based monitoring under WFD **~ €15 million/year**

- Through streamlined, risk-based monitoring of ecological status **~ €6 million/yr**

From objectives to actions

- Retain the best monitoring networks and data
- Fill gaps in existing monitoring systems e.g. for ’ecosystems/habitats/species’
- Create partnerships between institutions for:
  - space-borne observation (ESA, EUMETSAT…),
  - environmental in-situ networks (EEA/EIONET, Environmental agencies, EUMETNET),
  - modelling and research programmes (GOOS, LUCC, MERSEA, GSEs…)

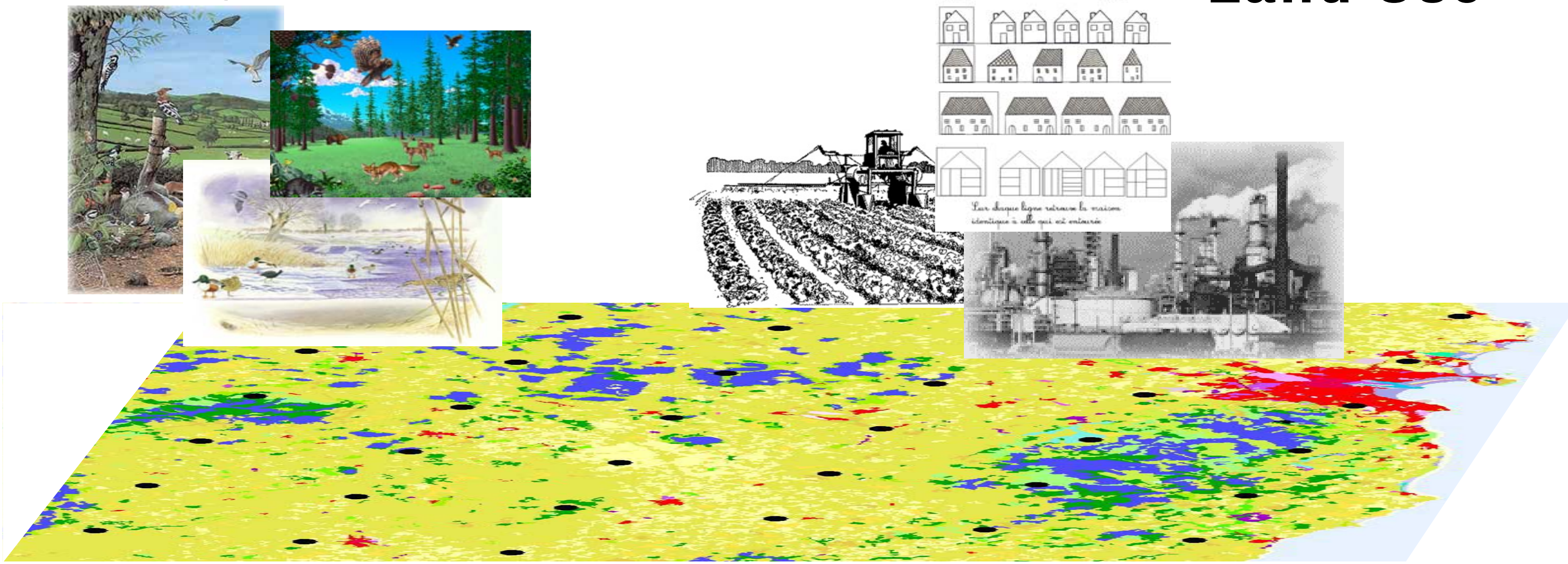
Communicate with all GMES Partners



Integrating monitoring data in a spatial assessment perspective

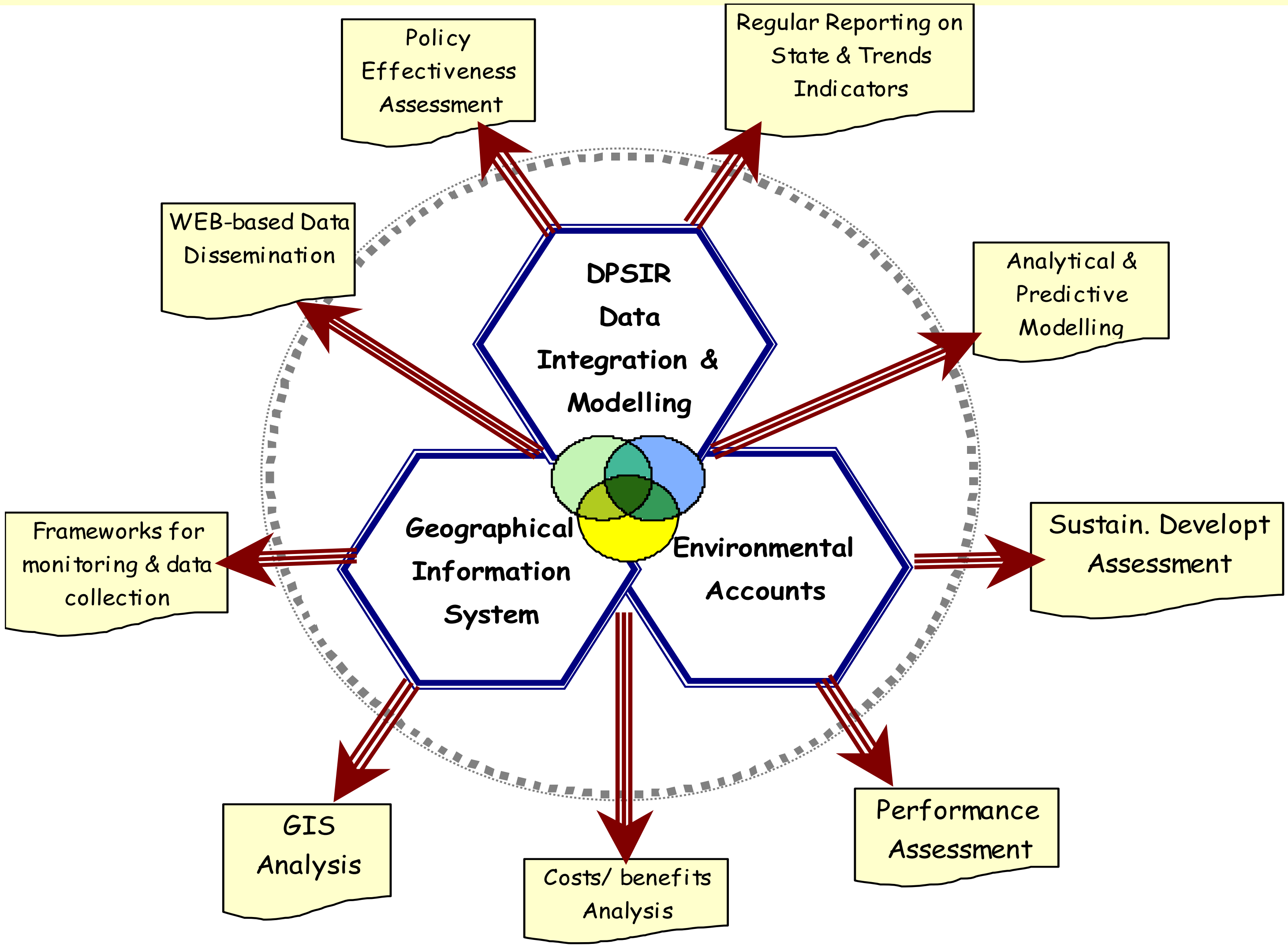
Ecosystems

Land Use



➔ **Land Cover is used for structuring the assessment of ecosystems in relation to human activities**

Platform for Integrated Spatial Assessment : GIS, Accounting & DPSIR Modelling



Typical outcomes from the integrated platform

I. Land cover and land use accounts

II. Ecosystem accounts and biodiversity assessments

III. Water accounts, sampling and modelling

IV. Assimilation & Integration of in situ and space-borne data

V. Common method to analyse statistics in their spatial dimension

I. Land and ecosystem accounts (LEAC)

- Land cover accounts as a starting point
- Land use accounts linking to social and economic functions (housing, transport, food production, industry & trade, recreation and tourism, nature conservation)
- Ecosystem accounts
  - stock, state, as dimension x health
  - health: diagnosis of distress syndrome (nutrient cycling, species composition, destabilisation of substrate)
  - natural perturbation and anthropogenic stress as explicative factors of distress (physical restructuring, over-harvesting, discharge of waste material, introduction of species)
  - input and output analysis (material, energy, services)
  - valuation of services and of assets (market price if any, restoration costs when possible, option values)

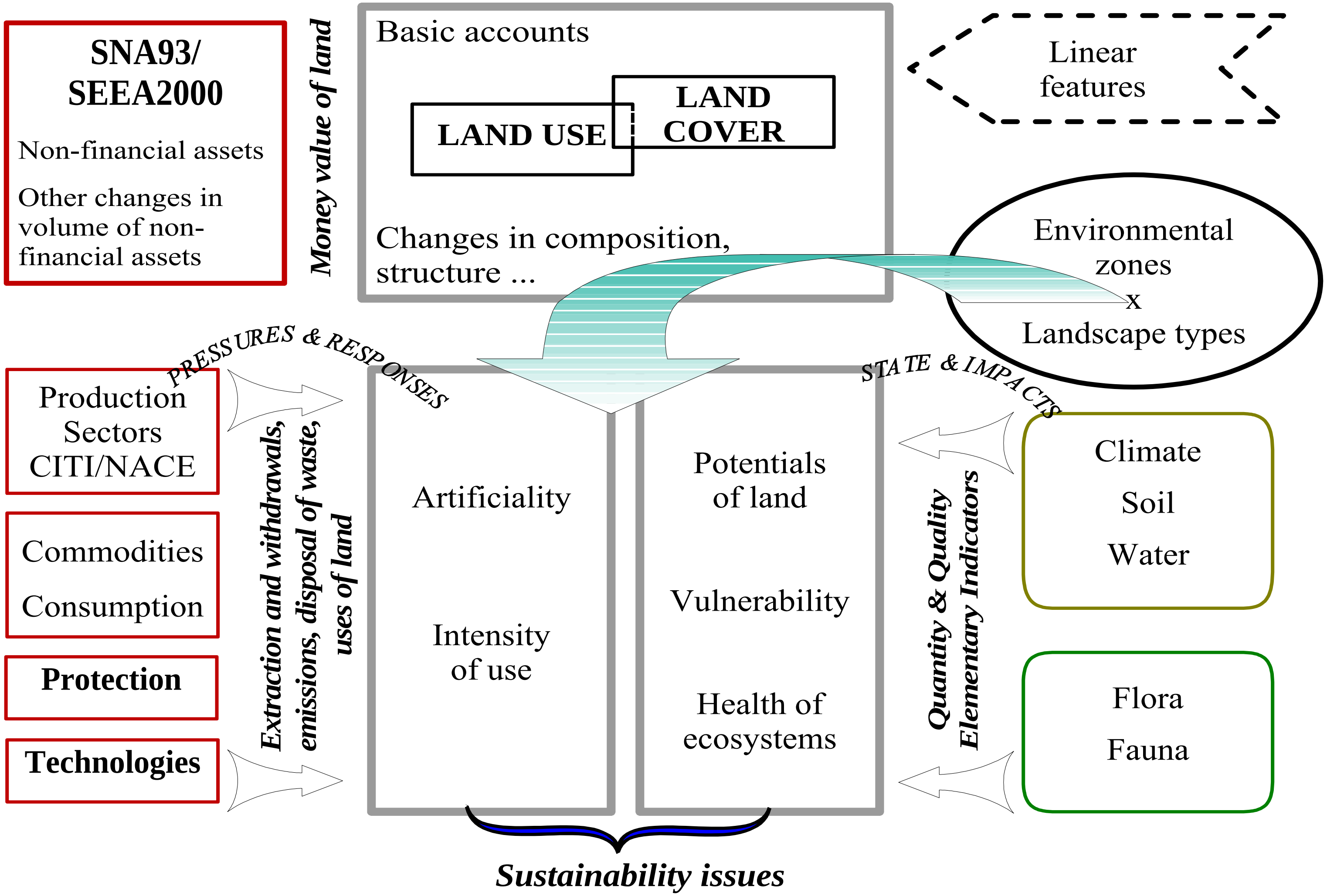
Why accounting for Land**?**

- Synthetic assessments, improved comparisons, keeping track of geographic differences

- Analysis of interactions between changes of land cover, land use and ecosystems, *in physical and monetary terms (the Natural Capital)*

- Development of spatially explicit models and scenarios

Land and ecosystems accounts overall framework



Land and Ecosystems Accounts – present outcomes

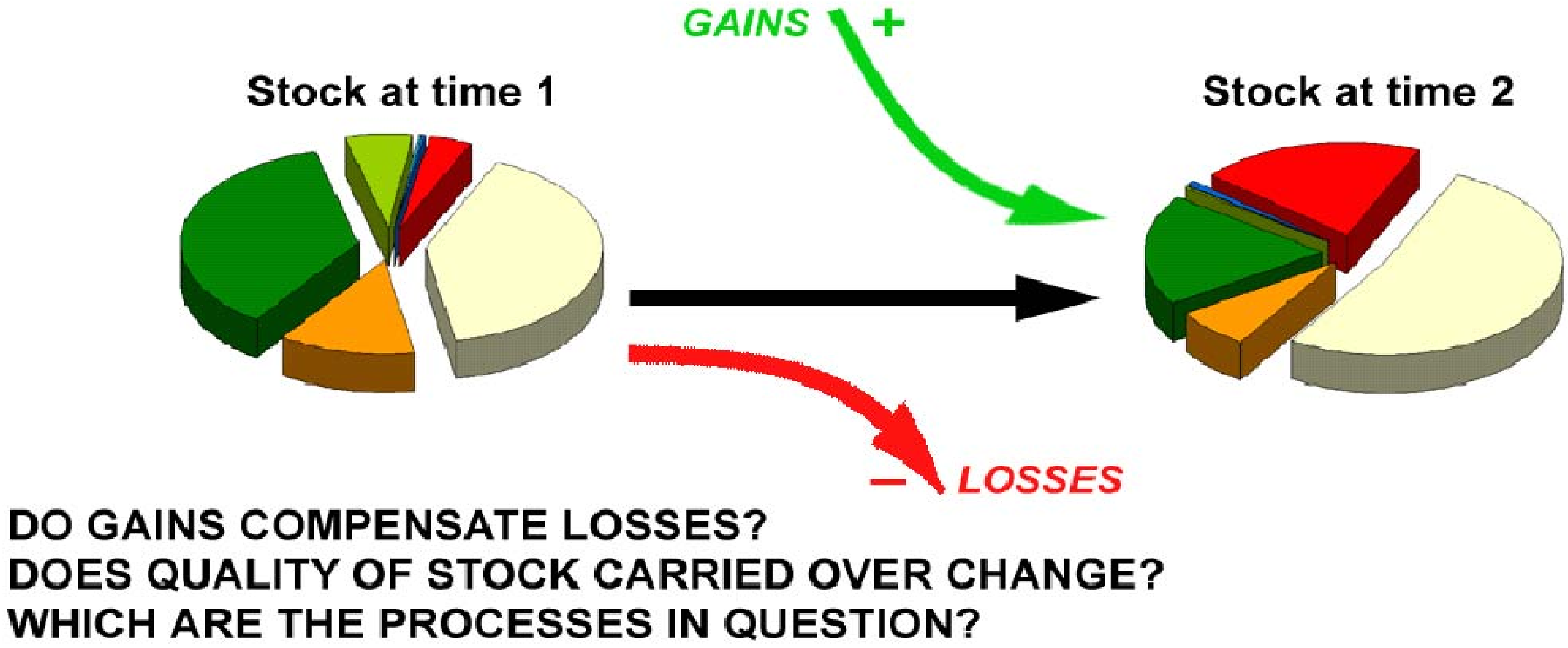
- Definition and test of accounting **methodology**:
  - Land cover stocks
  - Land cover changes (from CLC*y* to CLC*z)*
  - Land cover flows (grouping changes into processes)

- Stratification of the territory into **accounting units**:
  - Administrative units
  - Physical, ecological zones
  - Dominant landscape types

- Reports, Posters and test Database and Query Tool available at the Library of:

http://eea.eionet.eu.int:8980/Public/irc/eionet-circle/leac/library

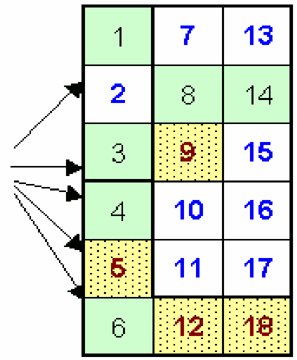
Accounting for Stocks & Flows



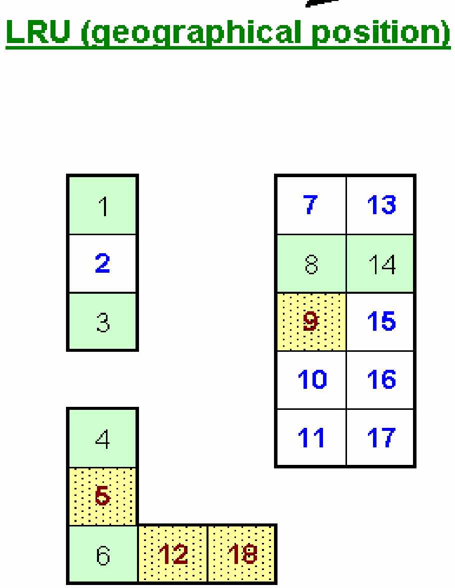
- Accounts can be compiled in monetary OR in physical units
- Changes in structure, patterns or quality are included in accounts
- Indicators can be easily derived from accounts

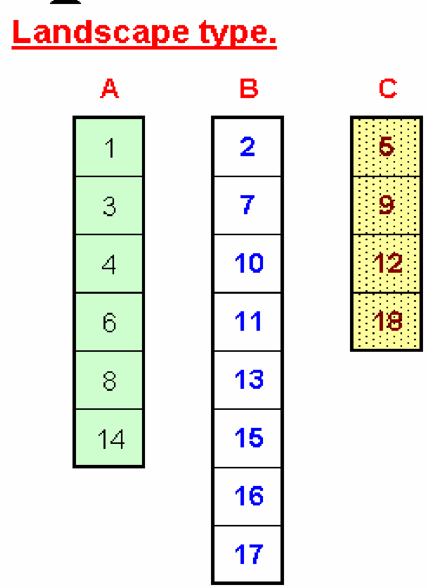
From many land cover units to Regions & to Landscape types

A territory can be subdivided in Land Units which reflect similar conditions. These Land Analytical Units (or LAU) can be pre-existing units (e.g. municipalities), cells of a regular grid or defined through analysis. They can be given a name or an idientifier as well as one or several attributes.



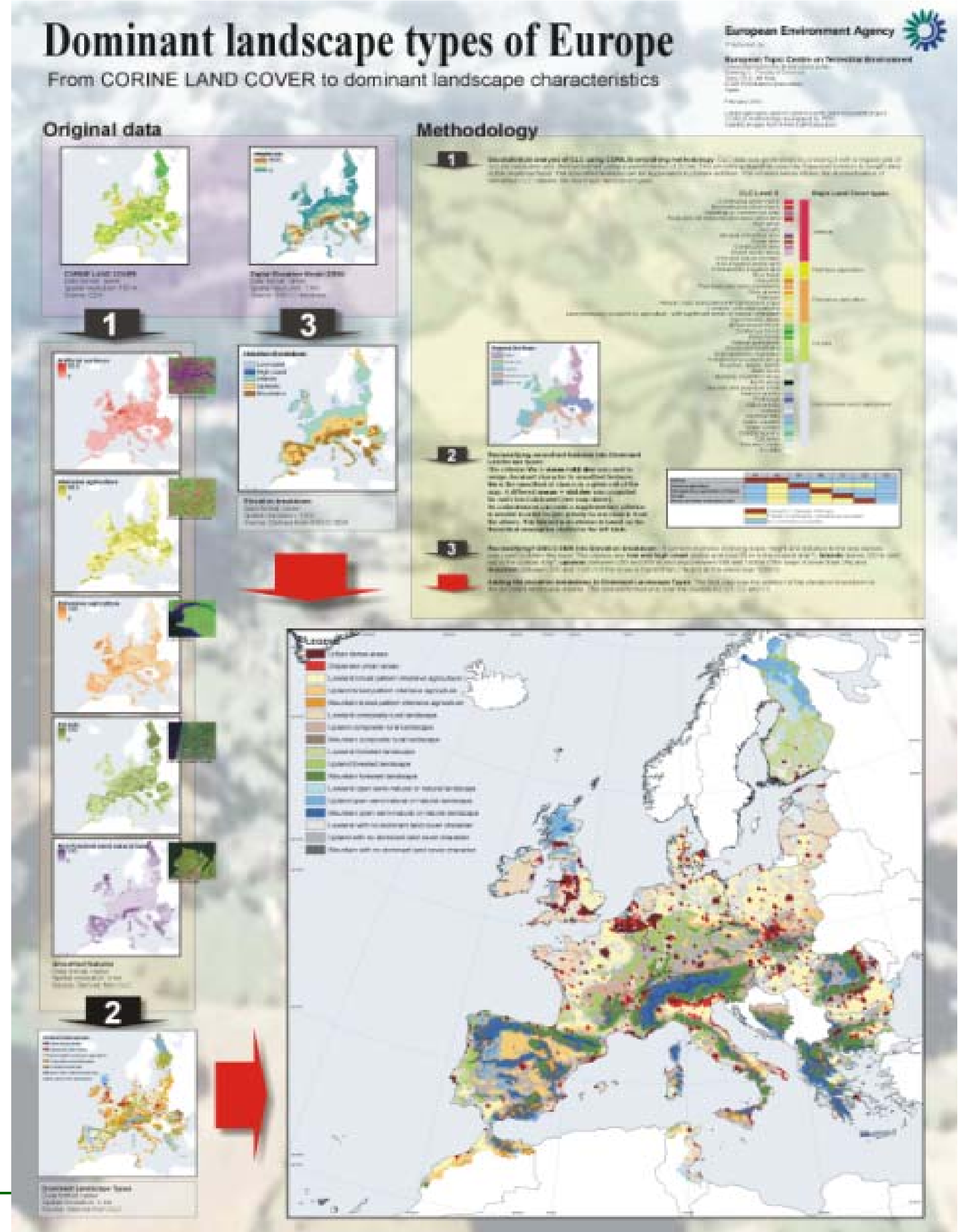
For analytical purpose as well as for synthesis and reporting, LAUs can be aggregated in Land Reporting Units (LRUs) or by Landscape types





Land accounting units

- Grids
- Administrative Units
- River basins
- Sea catchments
- Bio-geographical regions
- Coastal units
- Dominant Landscape Types ➔



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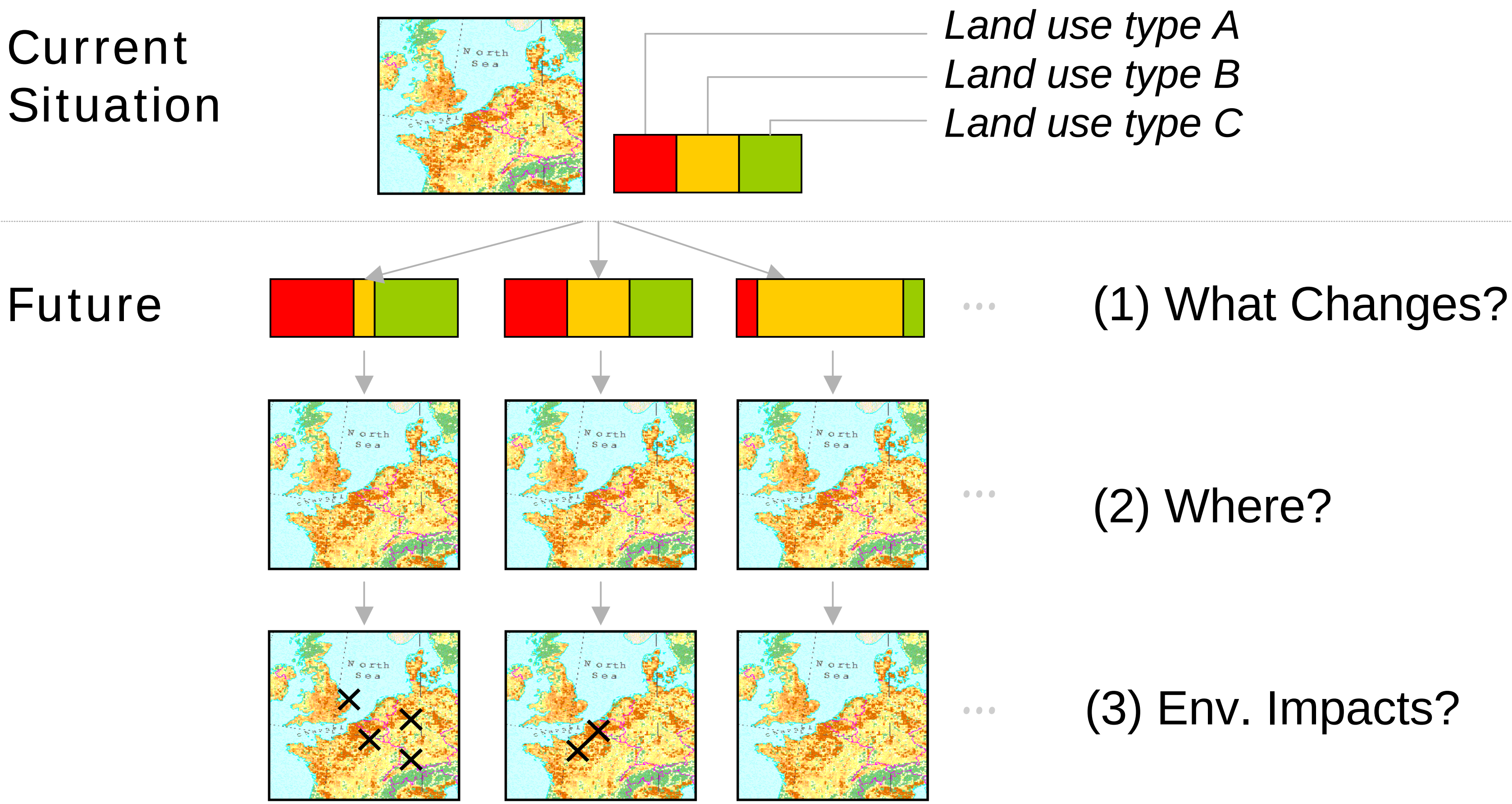
Possible scenario analysis based on LEAC

1. Overlay with existing land use scenario: CAP, TEN/TINA, Urban Polycentric development (ESPON/CRPM) … and calculate impact
2. Assess zones at risk of… by physical modelling of geographic characteristics (e.g. farmland abandonment)
3. Combine « local » models with the LEAC infrastructure (Landscape types, Stock & Flow accounts), in order to have a basis for extrapolation.

PRELUDE: an approach to modelling at the EEA

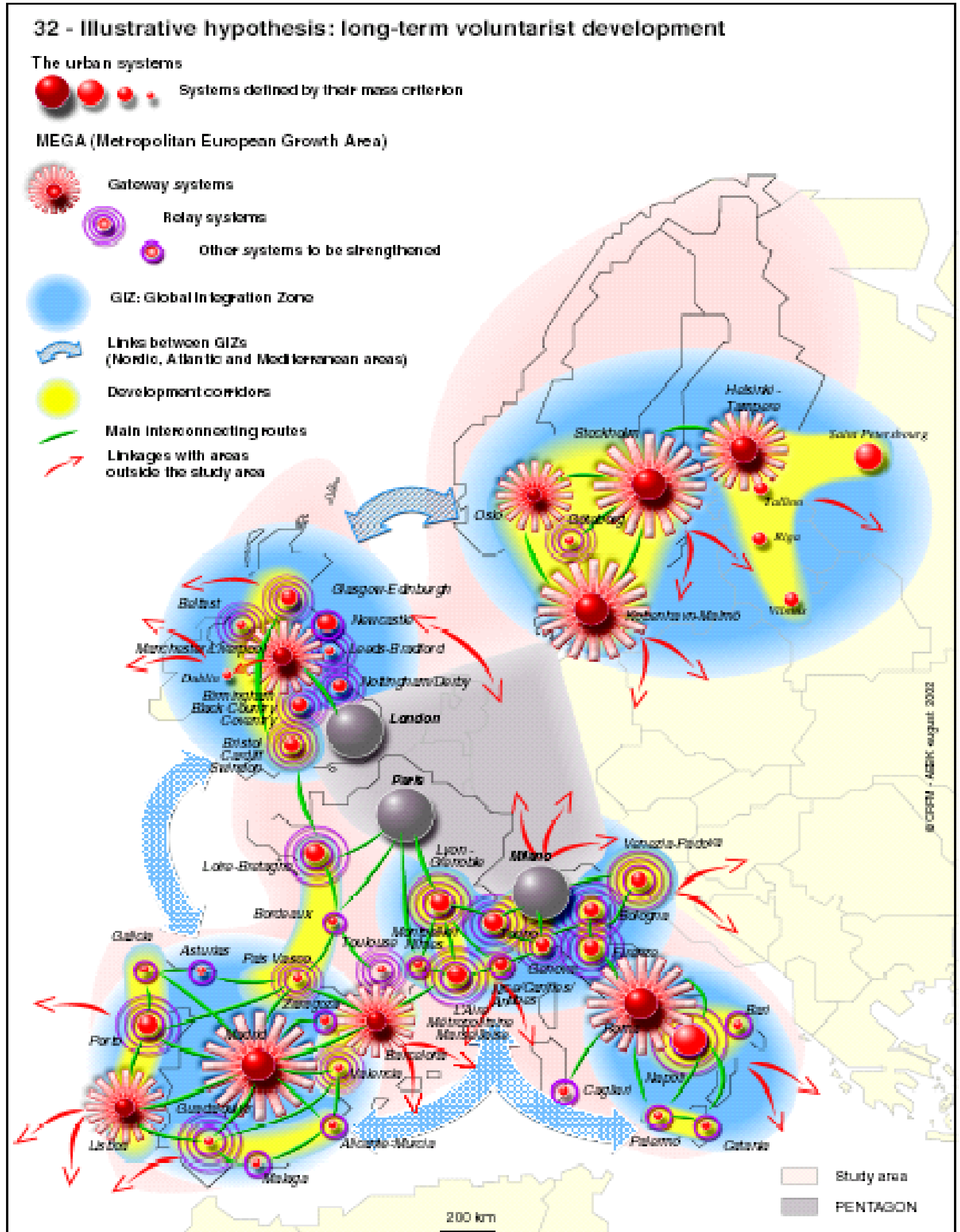


E.g. 1) What about the popular model of Europe's polycentric development?

The model suggests a more efficient and equitable organisation of the EU territory

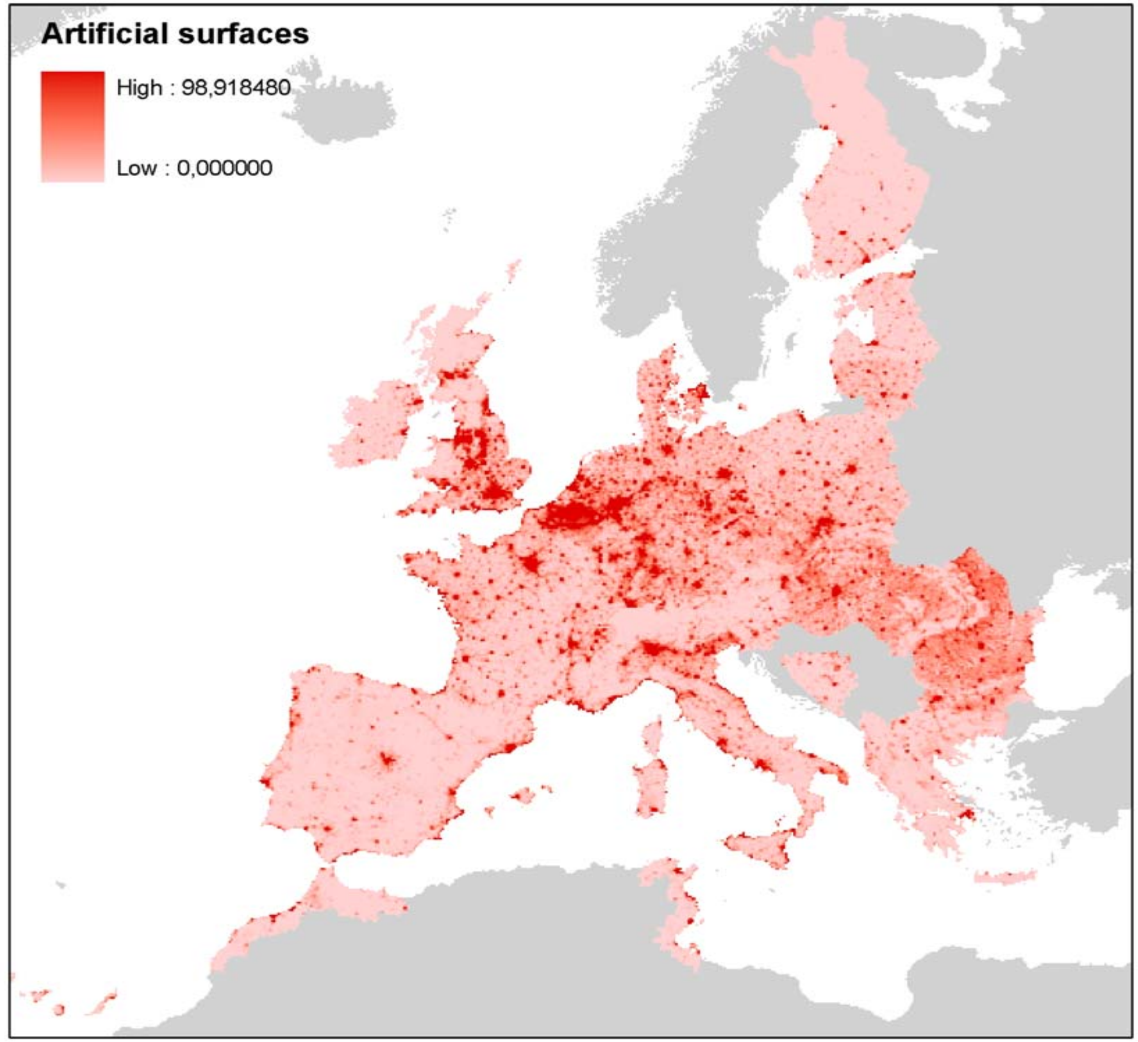
Questions:

- What about the environment?
- Is this scenario better than others?
- Why? Which impacts? How to monitor and model impacts?

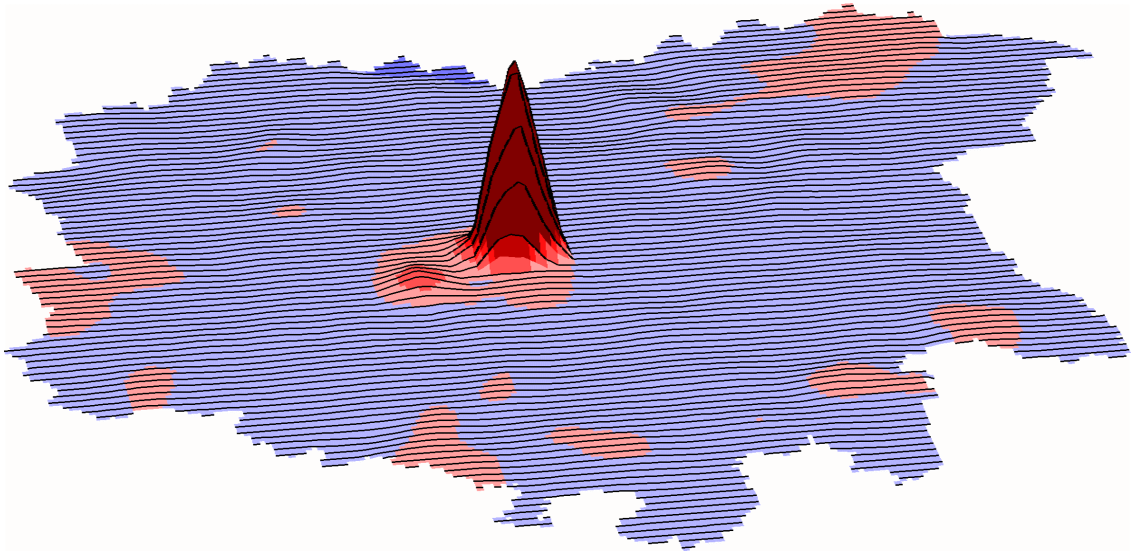


The baseline: processing, analysing and modelling images

Possible to highlight aspects of landscapes, e.g. where are located key features such as urban and other artificial areas



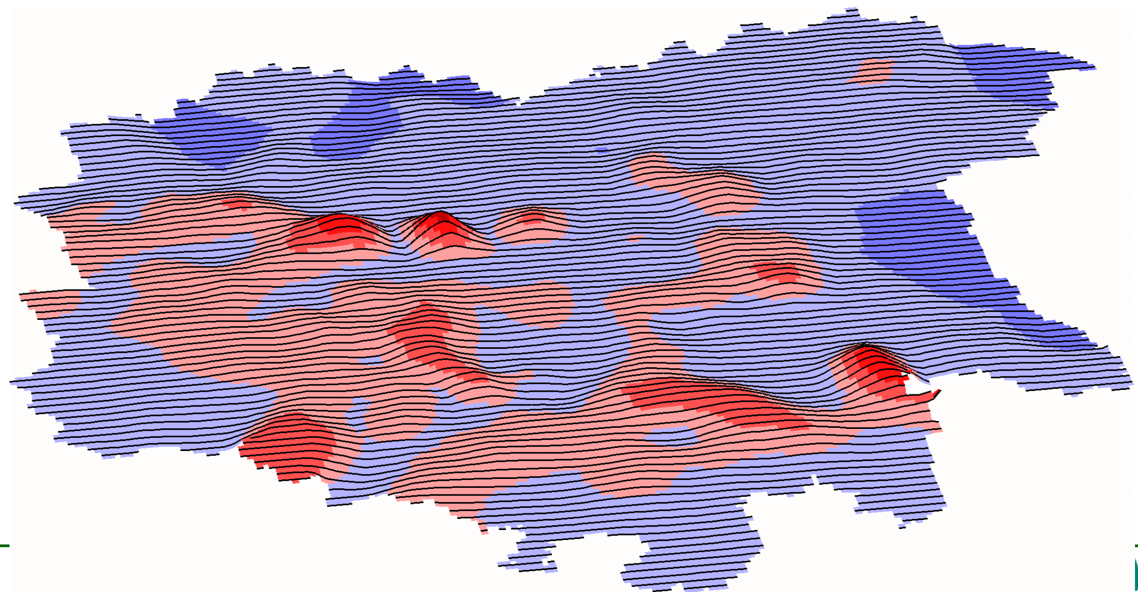
Compact City Scenario



🡐 Which quality of life ?

or

Polycentric Scenario

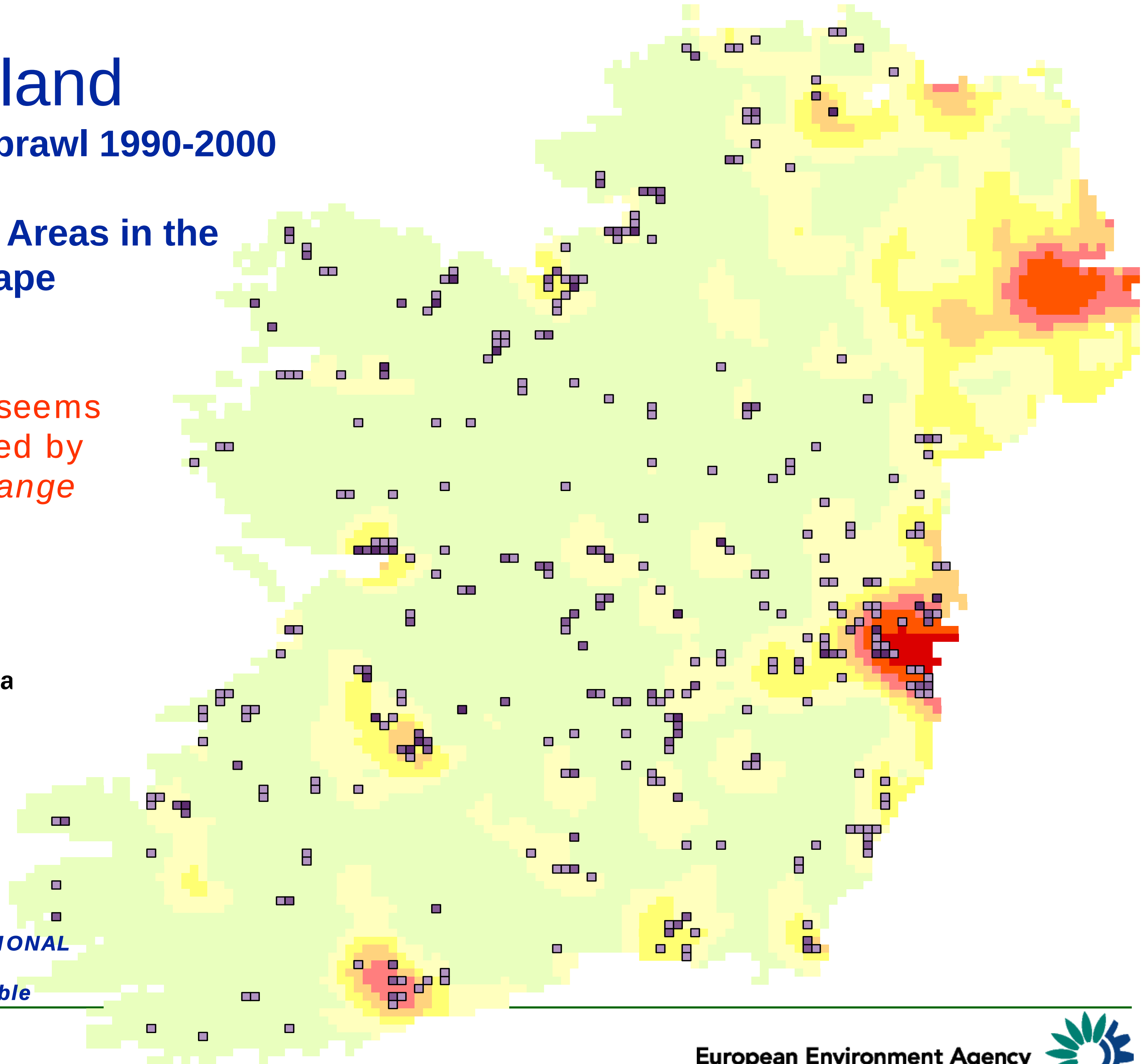


Which impact of land use on ecosystems ? 🡒

e.g. Ireland

Urban Residential Sprawl 1990-2000
&
Density of Urban Areas in the Landscape

Residential sprawl seems moderately attracted by towns *(in red to orange on the image)*



Urban Residential Sprawl

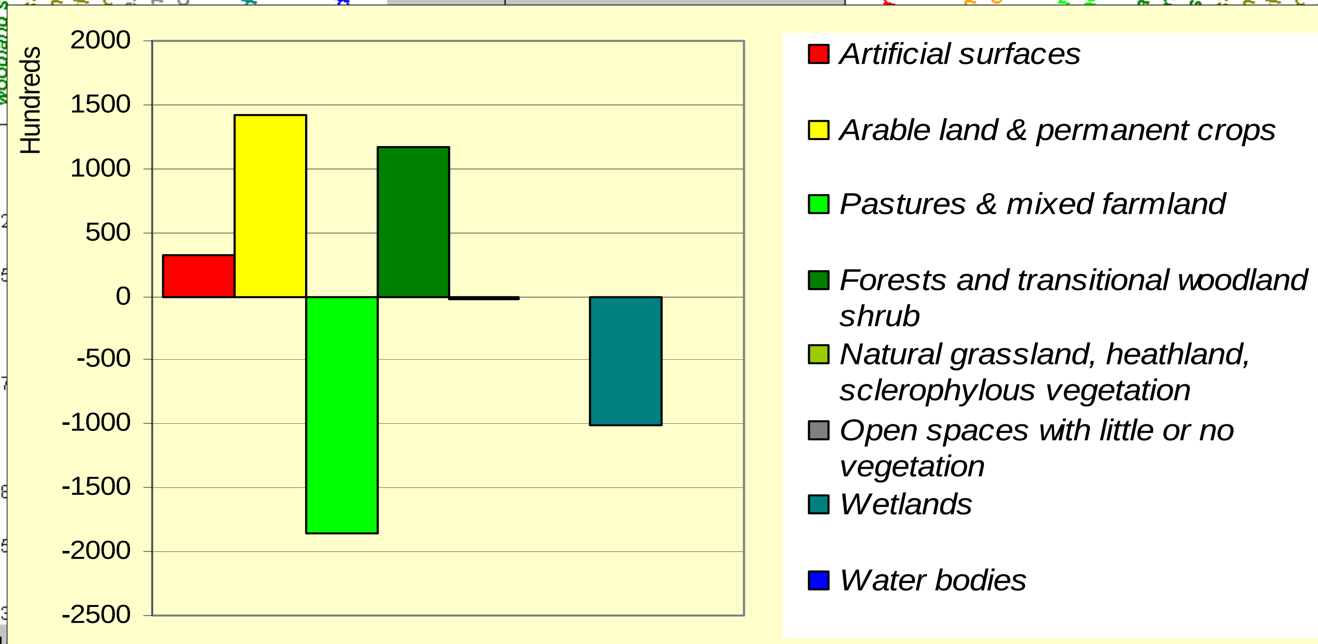
Hectares per grid cell of 900 ha

0 - 5
6 - 29
30 - 65
66 - 150

source:
CORINE Land Cover 2000 PROVISIONAL RESULTS
Northern Ireland 2000 Non Available

Ireland, Summary land cover account, 1986-2000, hectares

Consumption of Land Cover: 1 Artificial surfaces	2A Arable land & permanent crops	2B Pastures & mixed farmland	3A Forests and transitional woodland shrub	Formation of Land Cover: 3C … little or no vegetation	4 Wetlands	5 Water bodies	TOTAL
1641	42	849					2532
	1870	13408	22				15544
26	3656	11279	15				15549
	65024	237690					302714
1		1787	57				4858
	223	16188		0	2		16410
0			9888	0			200728
0	0	0	5	0		58	58
0	0	16	13	90	59	100	2157
1668	**70815**	**281218**	**10001**	**90**	**61**	**158**	**560551**



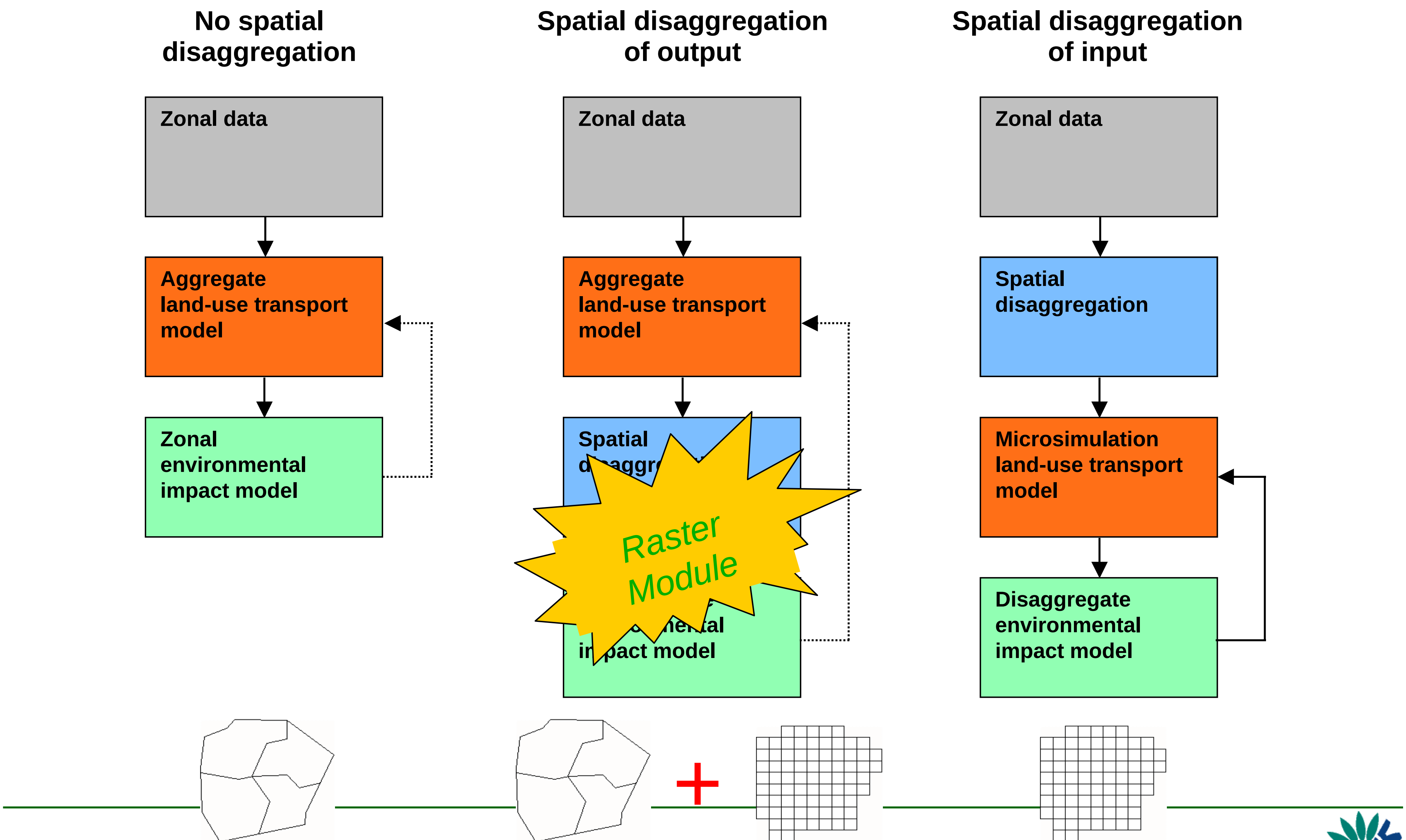
Net Change in Land Cover during the period - ha

	1	2A	2B	3A	3B	3C	4	5	TOTAL
Land Cover 1990, ha	102275	402069	4351059	515012	153137	50855	1300423	687739	**7562571**
Consumption of initial land cover	1668	70815	281218	100015	3532	221	101474	1609	**560551**
Formation of new land cover	33625	212218	95602	216915	1882	90	61	158	**560551**
Net Formation of Land Cover	*31957*	*141403*	*-185616*	*116900*	*-1649*	*-131*	*-101413*	*-1451*	***0***
Land cover 2000, ha	134233	543472	4165443	631912	151488	50724	1199010	686288	**7562571**

(source: CORINE Land Cover 2000 – PROVISIONAL RESULTS)

European Environment Agency

E.g. 2) How to Add Environment to Land Use Transport?

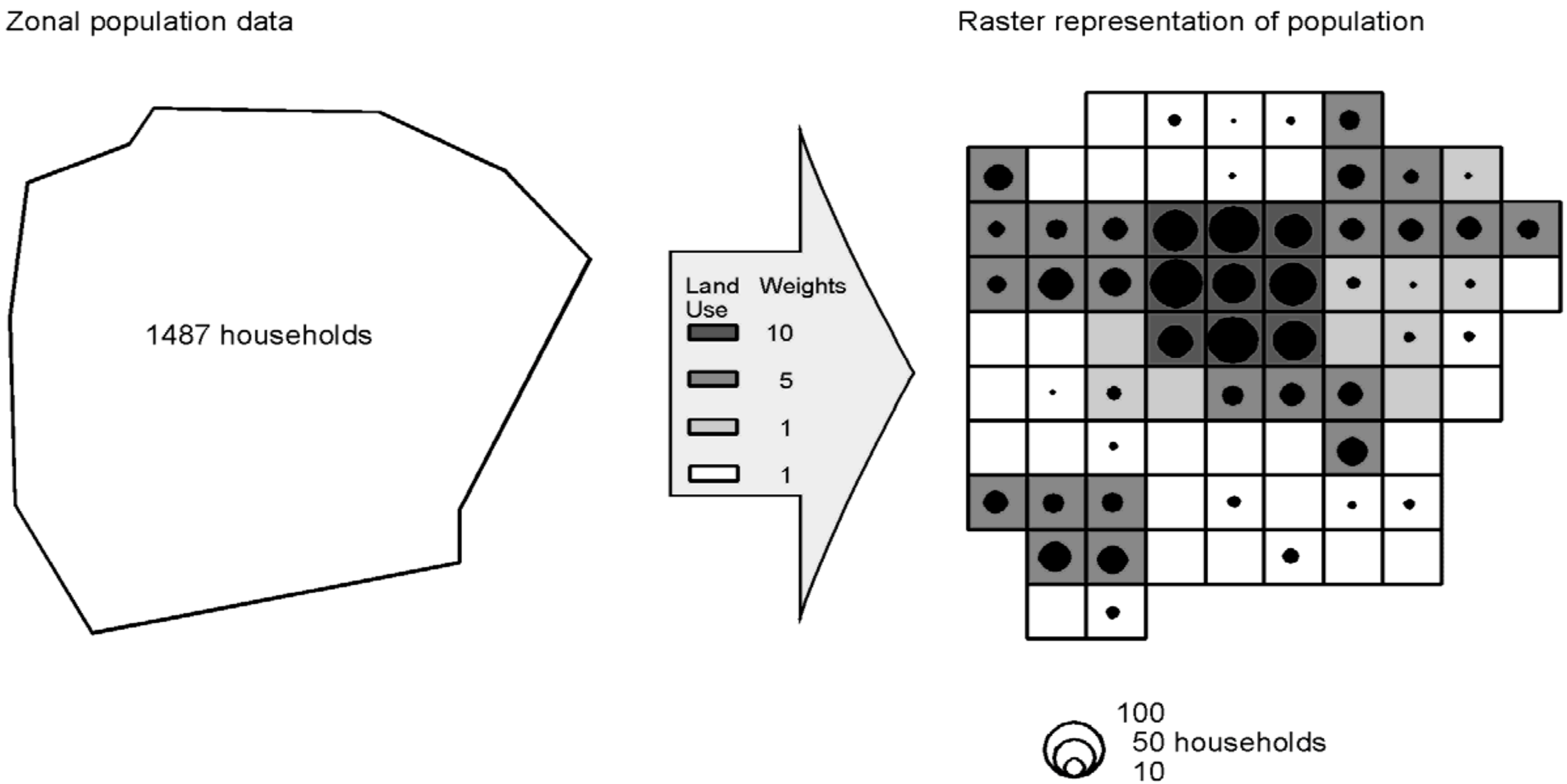


Raster Module: Methodology

- Post-processing of land use transport model output when higher spatial resolution is required
- Second spatial reference system: physical micro-locations
  - maintaining the zonal organisation
  - adding a disaggregate raster-based representation of space
- Disaggregation of zonal and network attributes to raster space
- Calculation of local envionmental and social impacts of land use and transport policies
- Re-aggregation to indicators

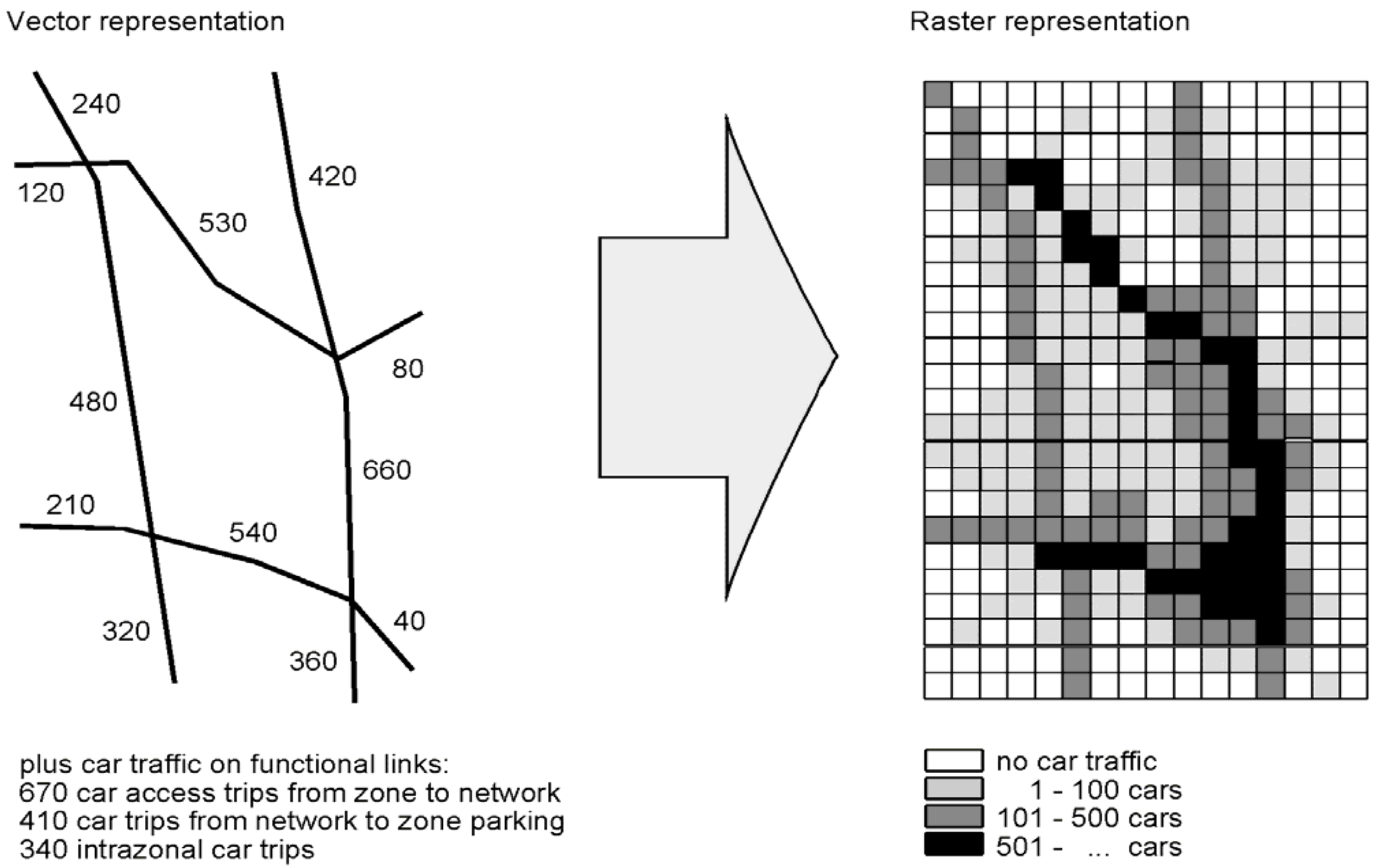
Spatial Disaggregation: Methodology

- **(1) Allocation of zonal data to raster cells**

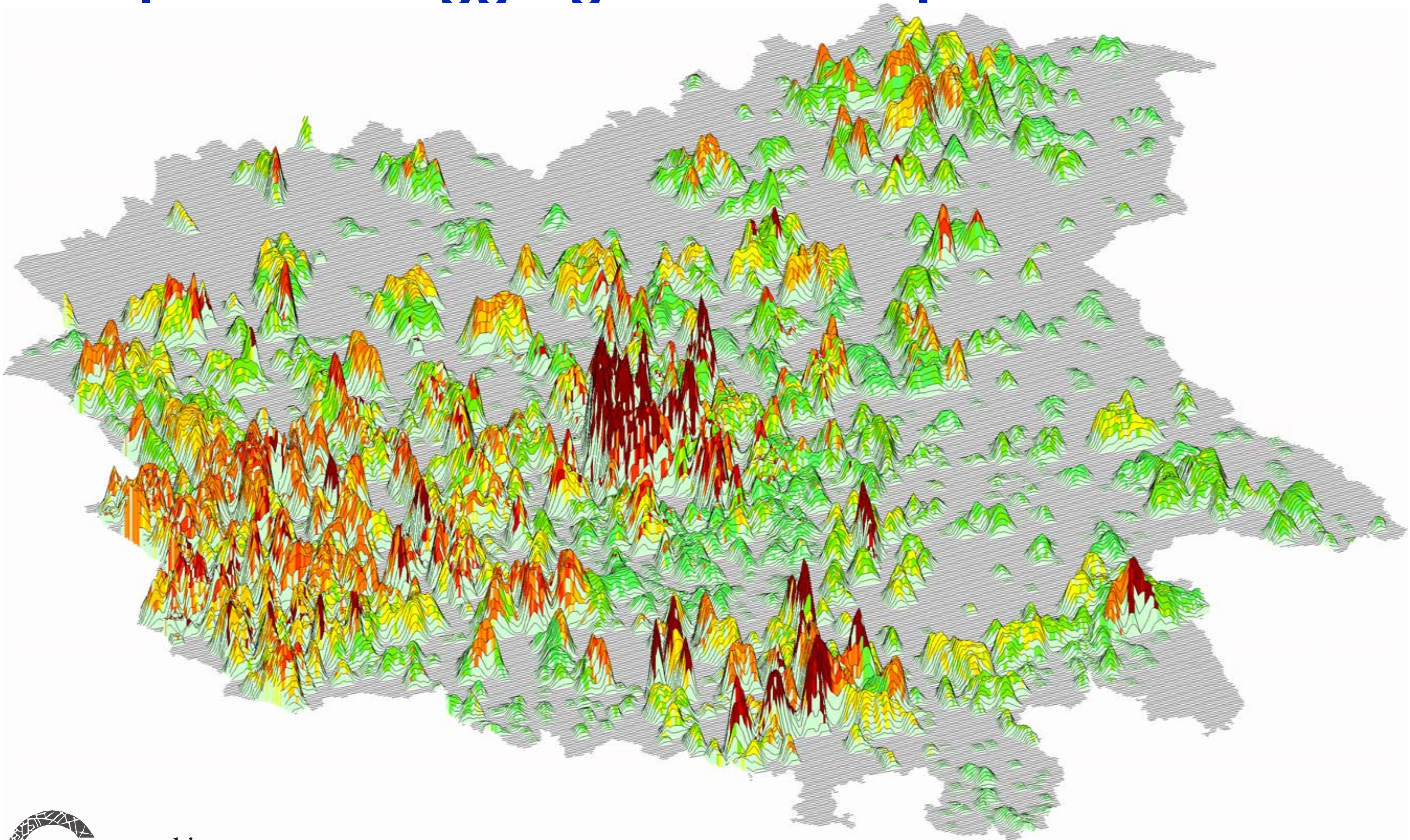


Spatial Disaggregation: Methodology (2)

- **(2) Spatial disaggregation of network data**



Spatial Disaggregation of Population – 3Ds



propolis

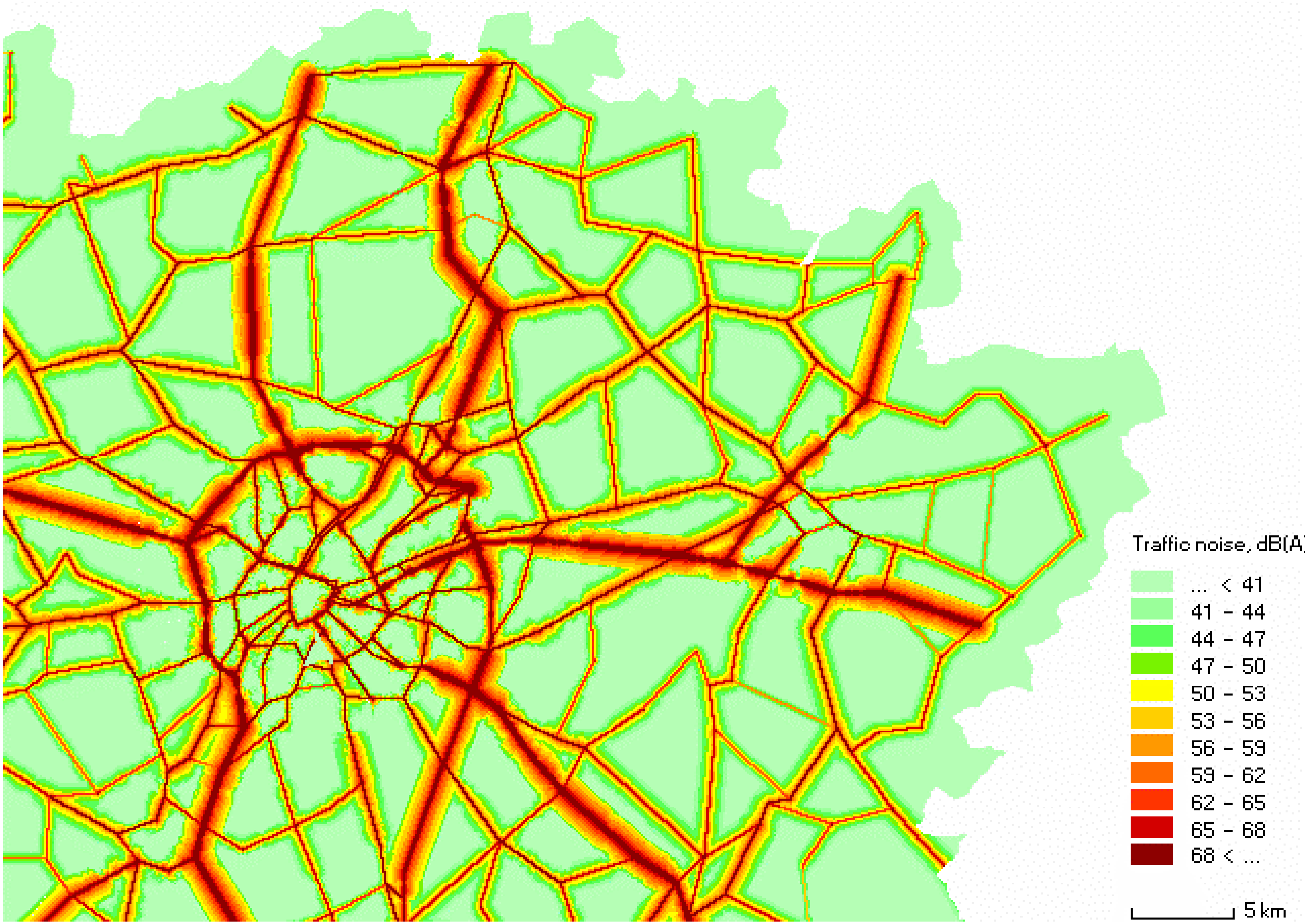
European Environment Agency

Population in Raster Cells and Transport Network

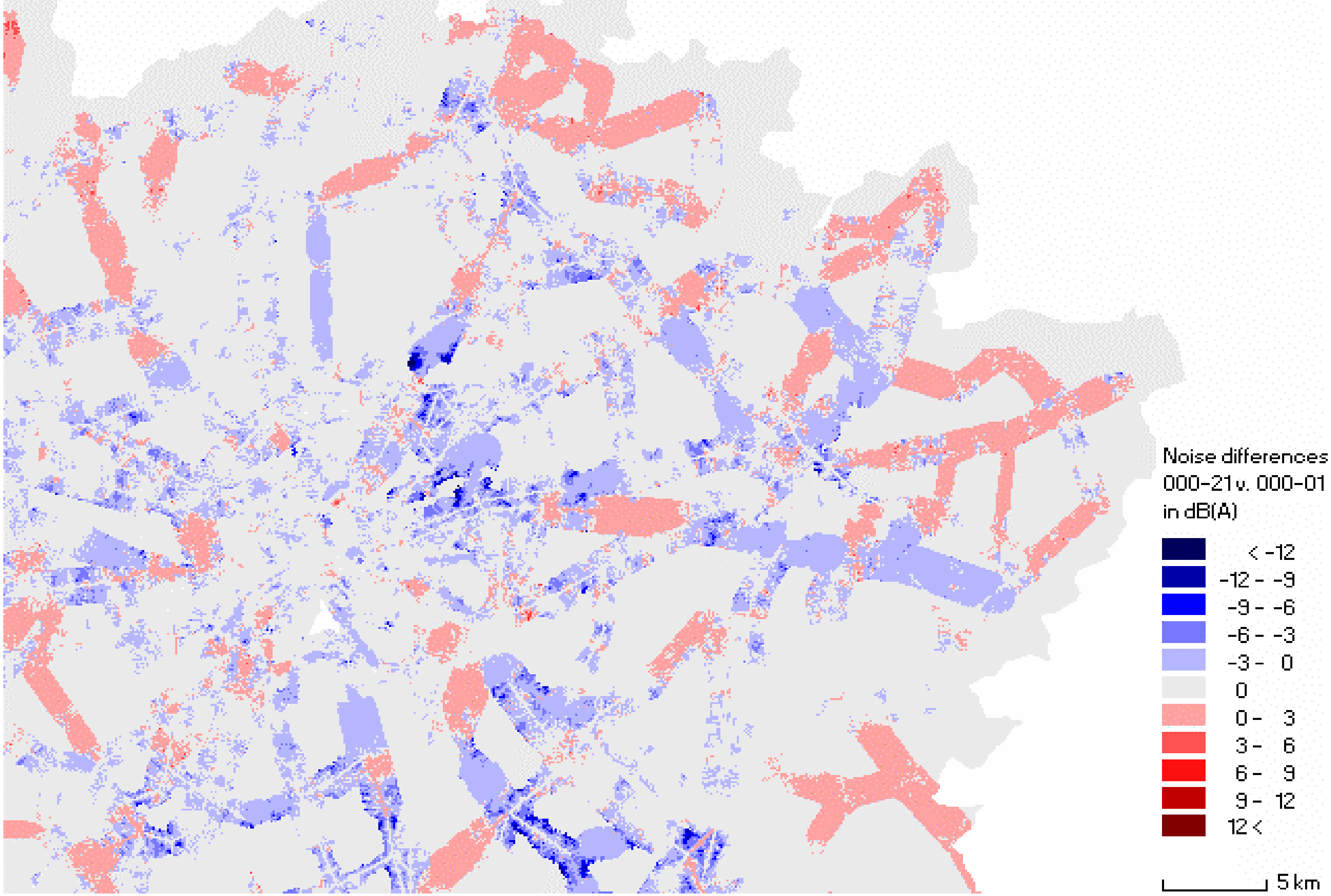
Exposure to air pollution

Exposure to traffic noise

Traffic Noise in Base Year -2001

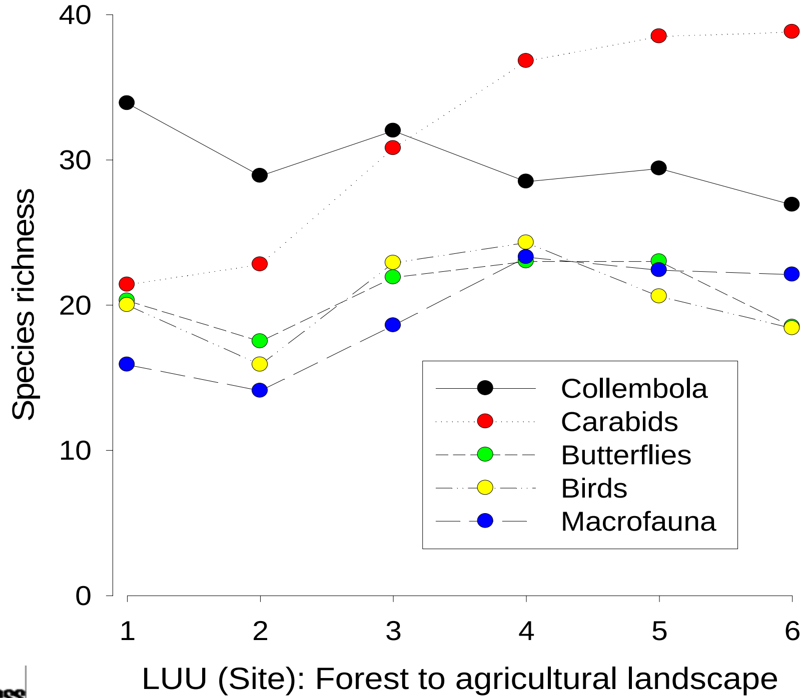


Scenario analysis: Traffic Noise Difference 2021 v. 2001



II. Ecosystem accounts and biodiversity assessments

Impact of land use on biodiversity

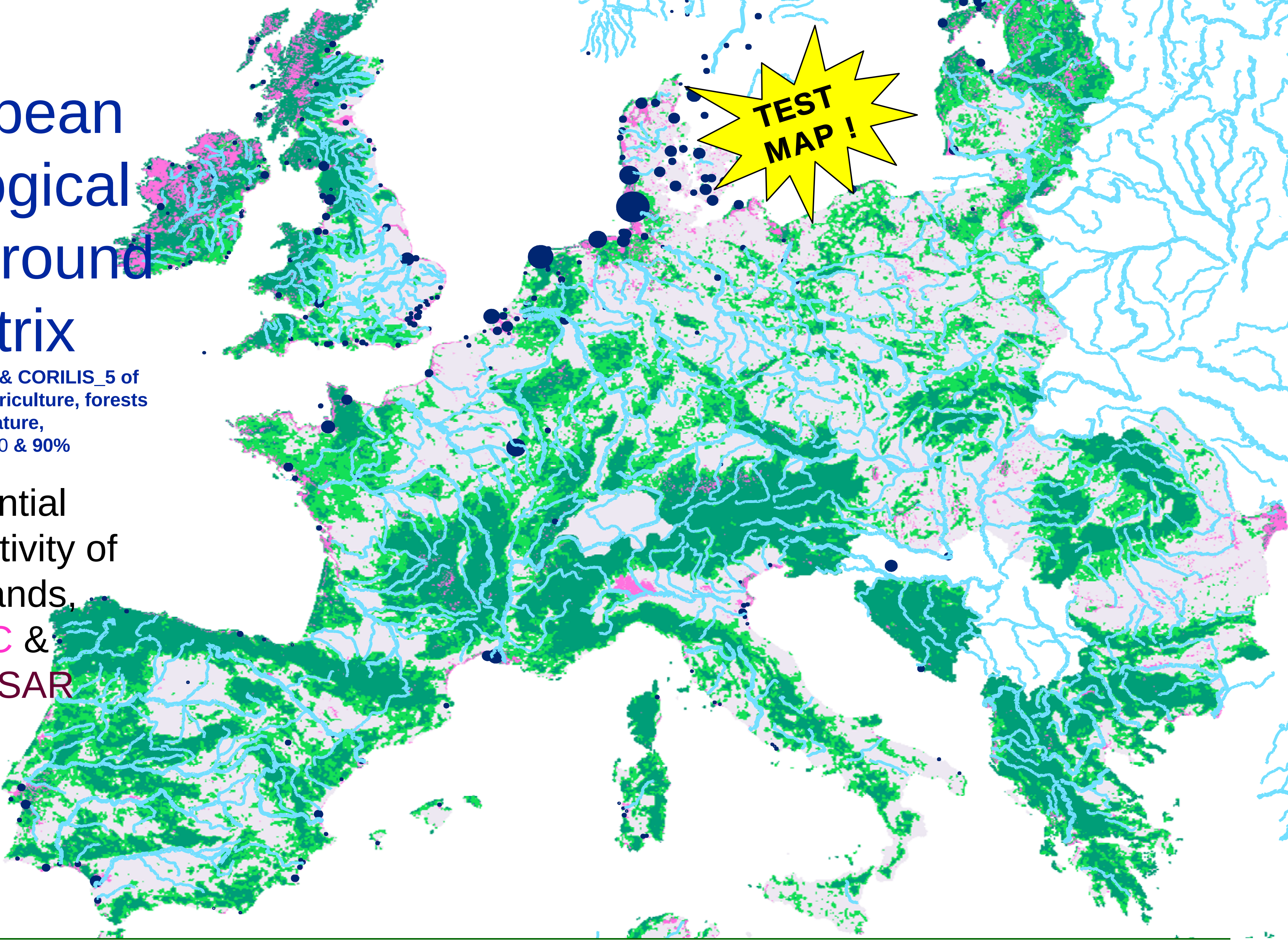


Courtesy Allan Watt

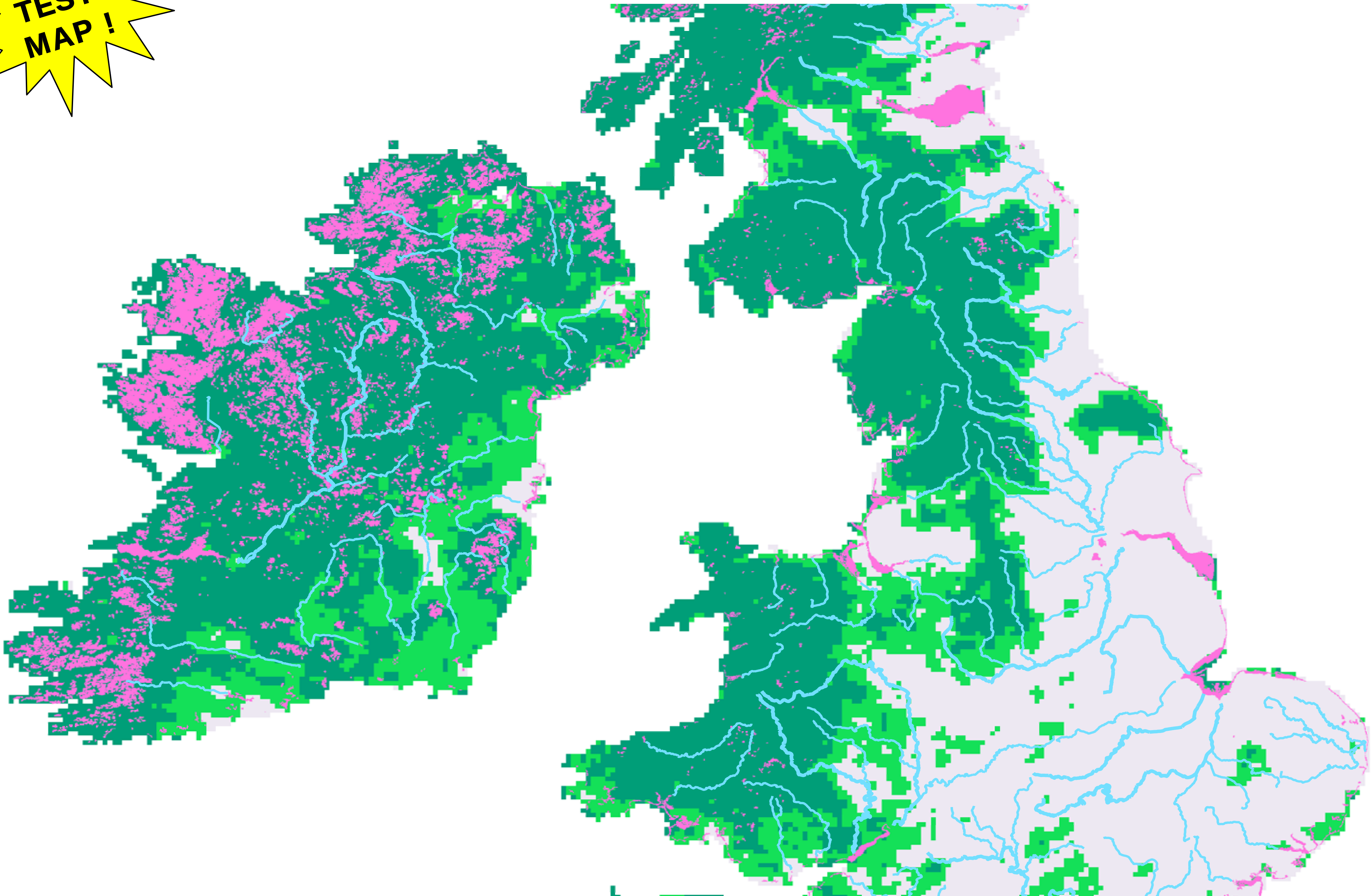
European Ecological Background Matrix

based on Rivers & CORILIS_5 of pasture, mixed agriculture, forests and nature, index > 60 & 90%

Potential Connectivity of Wetlands, CLC & RAMSAR



Potential connectivity of wetlands



Ecosystems as a natural capital

- **Capital:**
  - present services
  - future services
  - maintenance, reconstitution, surplus
  - stock and system
  - value
- **System:**
  - size, quantity: counts, surface, volume, frequency
  - state, quality: composition, pattern, integrity, resistance, resilience, **health**

Health of ecosystems: the EDS simplified model *(from D.J. Rapport et. al.)*

- Ecosystem Distress Syndrome is common to most types of ecosystems and stress conditions
- Limited number of symptoms of distress:
  - **Disruption of the pattern of nutrient cycling** from vertical direction (e.g. between biota and substrate) to horizontal direction
  - **Adaptative strategies by opportunistic or introduced species** (characterized by high reproductive rates, short life cycles and small size)
  - **Destabilization of substrates** (Loss of keystone habitats, changes in pattern and connectivity of habitat patches, loss of structural complexity, alteration of hydrologic patterns…)
- Possible application to managed ecosystems
  - Self-sustaining without subsidies, input; economically viable
  - Able to sustain healthy human communities

Ecosystem Distress Counts

Purpose: assess the vulnerability of ecosystems via weighting factors based on health diagnosis

Ecosystem distress diagnosis		Reference	Trend	Thresholds	Change in the period	Diagnosis		
						A	B	C
Nutrient cycling								
	Primary productivity							
	Secondary productivity							
	Exceedance of nutrient loads							
	Eutrophication							
	,,,							
Species composition								
	Endemic							
	Migratory							
	Introduced or invasive							
	,,,							
Destabilisation of substrates								
	Partitionning of wetlands							
	Internal fragmentation of wetlands							
	Accumulation of toxic substances							
	Instability of Water System							
	,,,							
Overall assessment								

(e.g. for wetlands)

A = Resistant/Resilient B = Changing/Vulnerable C = Critical state

Ecosystems Distress diagnosis

- **Levels**
  - Complete check-up
  - Summary check-up
  - Diagnosis based on Expert Knowledge

- **Scales**
  - Individual ecosystems (observation, monitoring)
  - Regional diagnosis (statistical indices)
  - Diagnosis by types of ecosystems (statistical indices)

- **Need to keep track of the pedigree of the information used (for modelling and assessment)**

The Pressure side of Ecosystems Distress symptoms

- **Natural disturbances vs. anthropogenic stress**

- **4 main groups of anthropogenic stresses**
  - Physical restructuring (e.g. resulting from land use, dams...)
  - Introduction of exotic species
  - Discharge of waste and toxic substances
  - Overharvesting

Ecosystem Stress (or Pressure) Counts

Purpose: identify and quantify the causes of ecosystem distress

Ecosystem stress investigation	Reference	Trend	Thresholds	Change in the period	Evaluation		
					X	Y	Z
Natural disturbance							
Floods							
Droughts							
Sedimentation							
,,,							
Anthropogenic stress							
Physical restructuring							
Drainage of wetlands							
Cultivation of marginal land							
Soil sealing							
Development of transport infrastructure							
Overharvesting							
Management of dams							
Seasonnal over-use of water							
Discharge of waste residuals							
Polluting emissions from river basins							
Use of pesticides							
Air deposition/ eutrophication							
Introduction of exotic species							
Intentional (cultivation, breeding)							
Non-intentional							
Overall assessment							

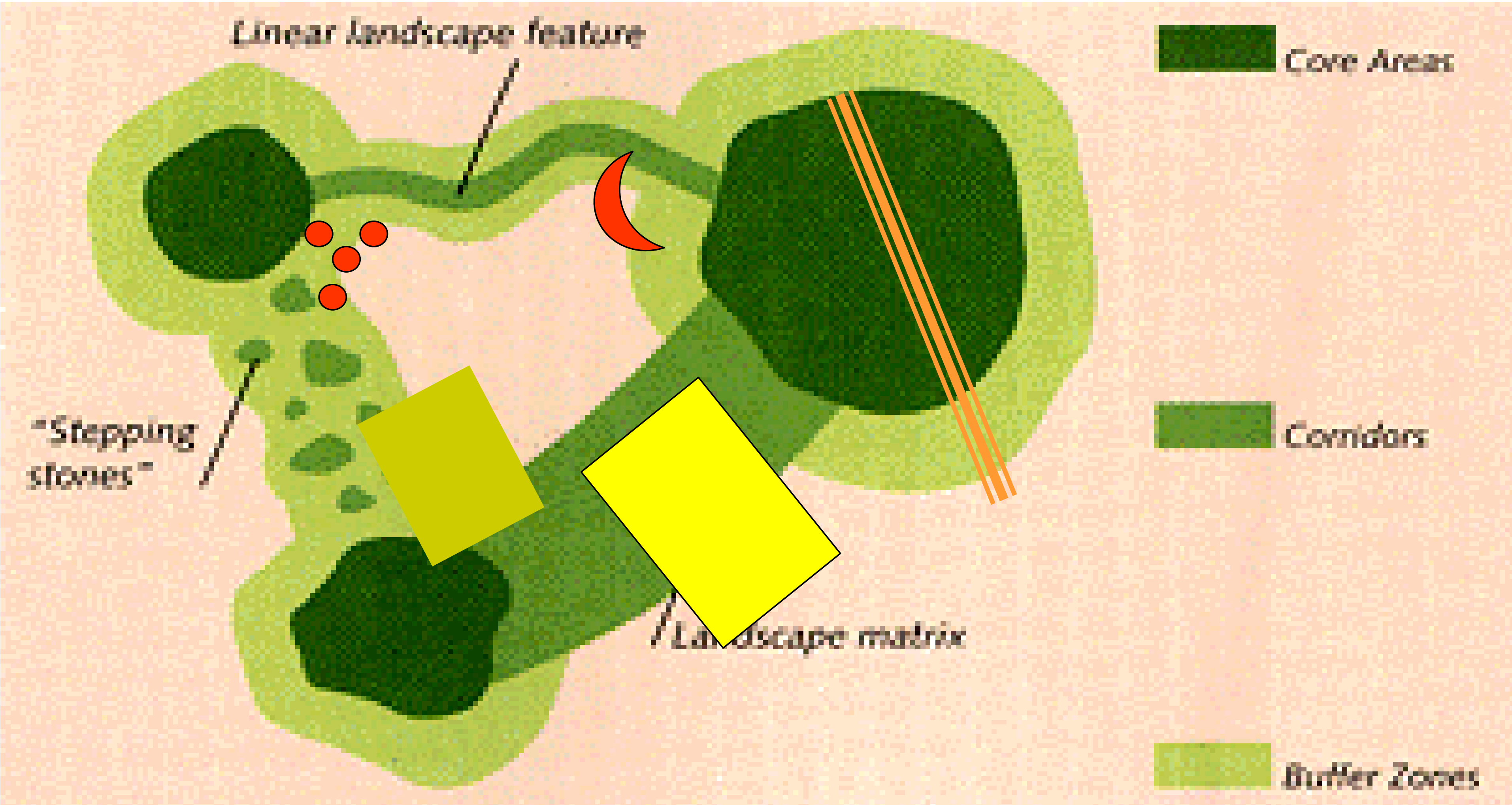
(e.g. for wetlands)

X = negligible, Y = moderate, Z = heavy

Ecosystem Stress investigation

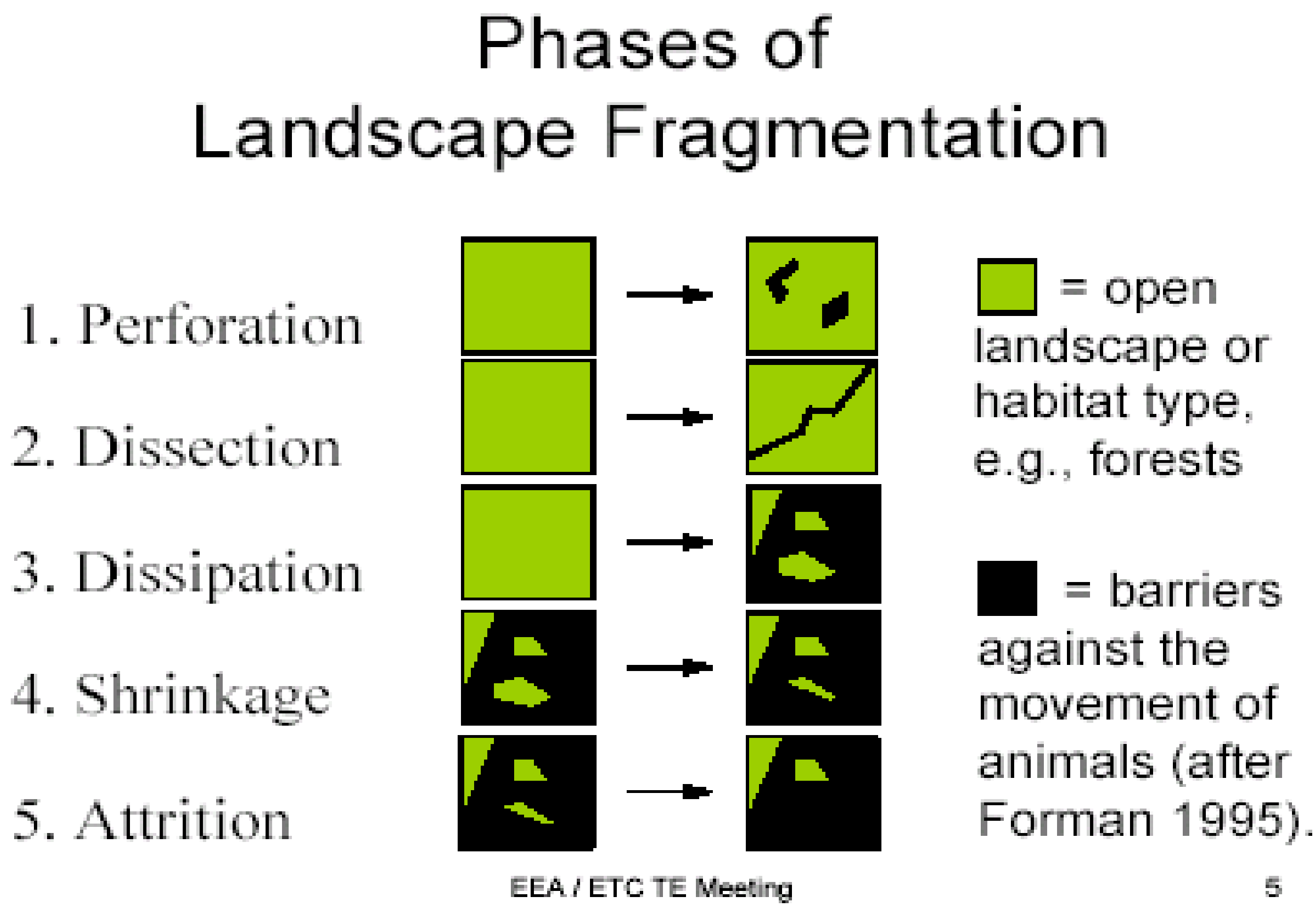
- **Levels:**
  - Complete investigation
  - Summary investigation
  - Expert knowledge based investigation
- **Scales:**
  - Individual ecosystems (monitoring)
  - Individual pressure (monitoring)
  - Regional investigation (statistics)
  - Investigation by types of ecosystems and type of pressure (statistics)
- Stress often results from **interaction** of various pressure
- Accounts to be compiled for the main pressures (linkage to driving forces)
- Need to keep track of the pedigree of the information used (for modelling and assessment)

Partitioning of land

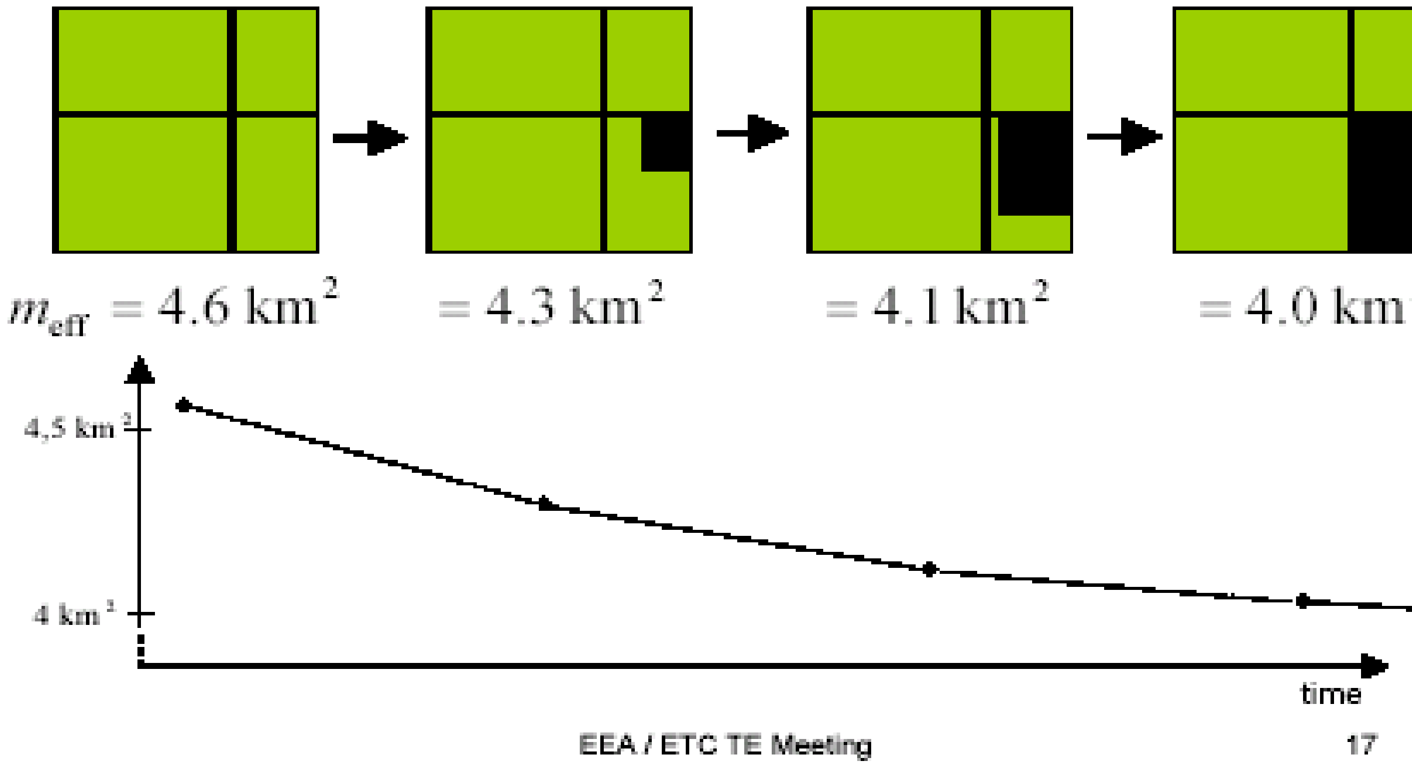


Source: G. Bennett, PEEN / COE

Landscape fragmentation or partitioning



Approach of fragmentation by mesh size



Effective Mesh Size = area * probability of 2 random points to be in the same patch : $m_{eff} = A_{total} * p$

By Jochen Jaeger, ETH Zurich for ETC TE

Integrating fragmentation and land accounts at the European scale

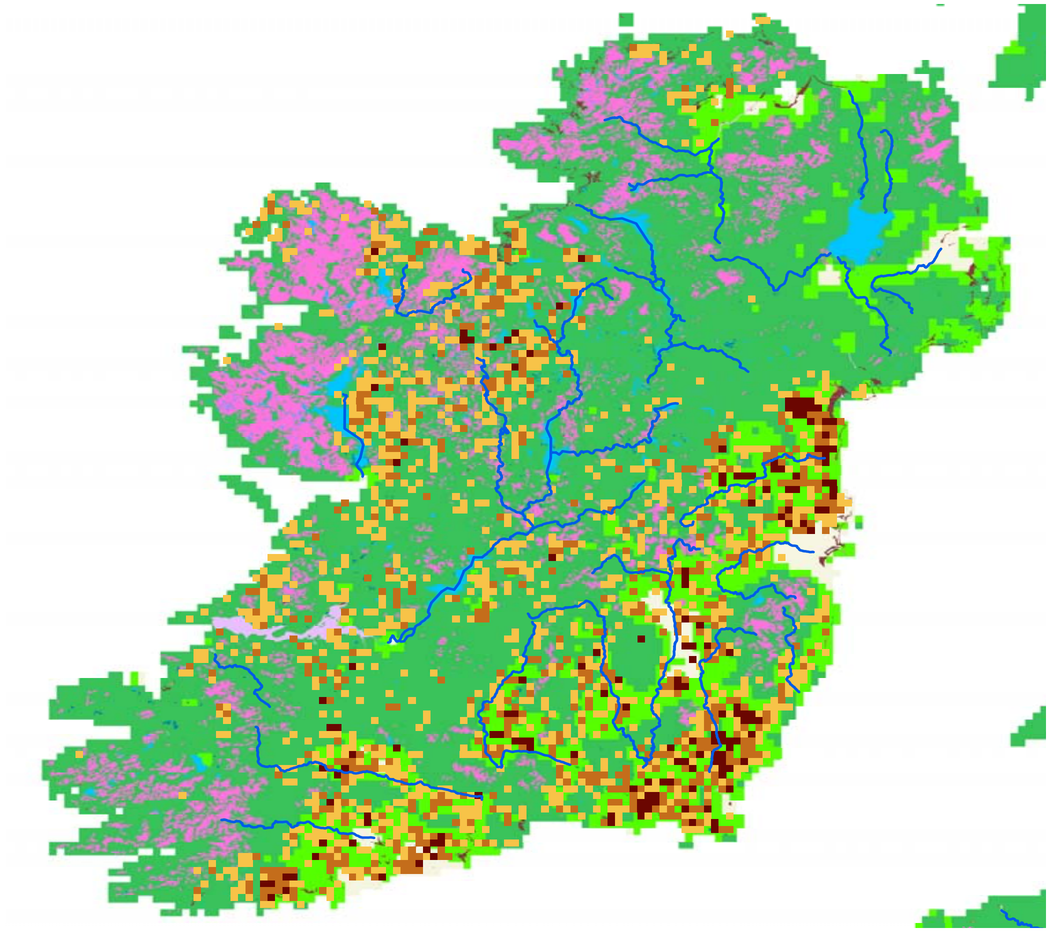
- **Objective is to integrate fragmentation/partitioning variables in the overall assessment framework**

- **Land & ecosystem accounts:**
  - Land cover accounts (surface, patterns)
  - Land use accounts: functions of land (e.g. transport), linkage to economy
  - Ecosystem accounts: « quantity » & health of ecosystems (species, nutriment cycling, fragmentation)

Assessment of the stress on ecosystems and biodiversity from land use

- E.g. : Conversion of pasture to arable land fragments the potential connectivity between wetlands

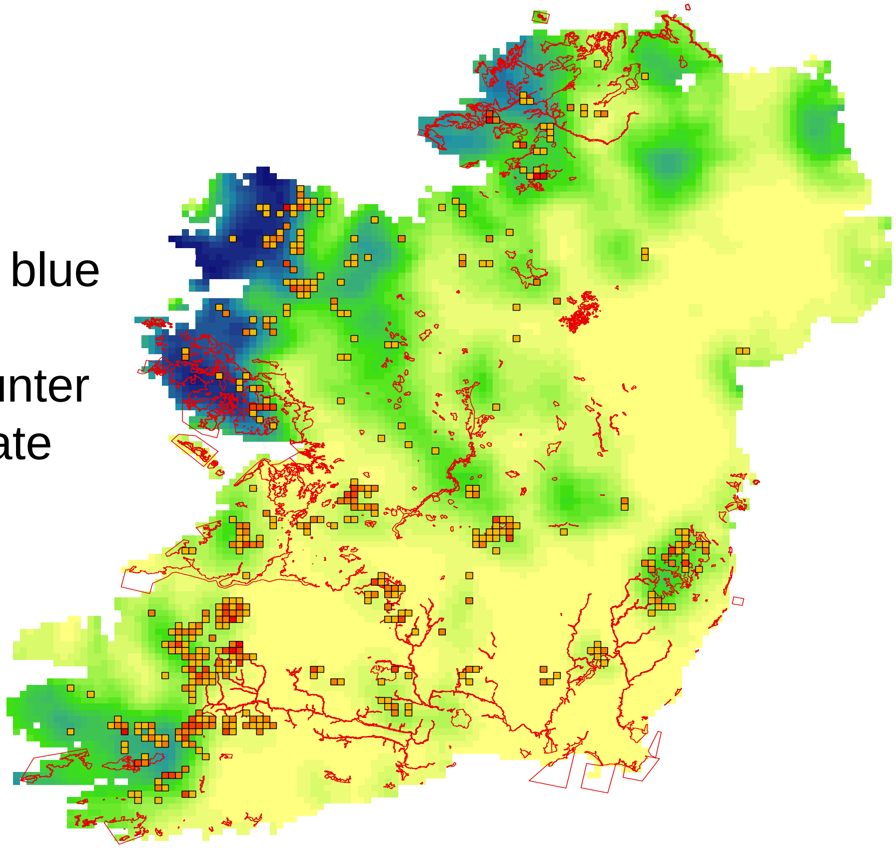
Wetlands are embedded in a matrix where pastures are the key component. Their conversion to arable land (orange and brown small squares) trends to some partitioning in the long run. Urban sprawl and roads construction contribute to increasing the same threat.



The Stress on ecosystems and biodiversity: Natura 2000 and land use change

Needs for Nature protection to be supported by sectoral policies

Distribution of Natura 2000 sites (in red) & Plantation of Coniferous 1990-2000 (small squares) over Wetlands (density from dark blue to light green). The map shows that the protection of natural sites alone cannot counter balance diffuse loss of biodiversity. Adequate sector policies are necessary as well.

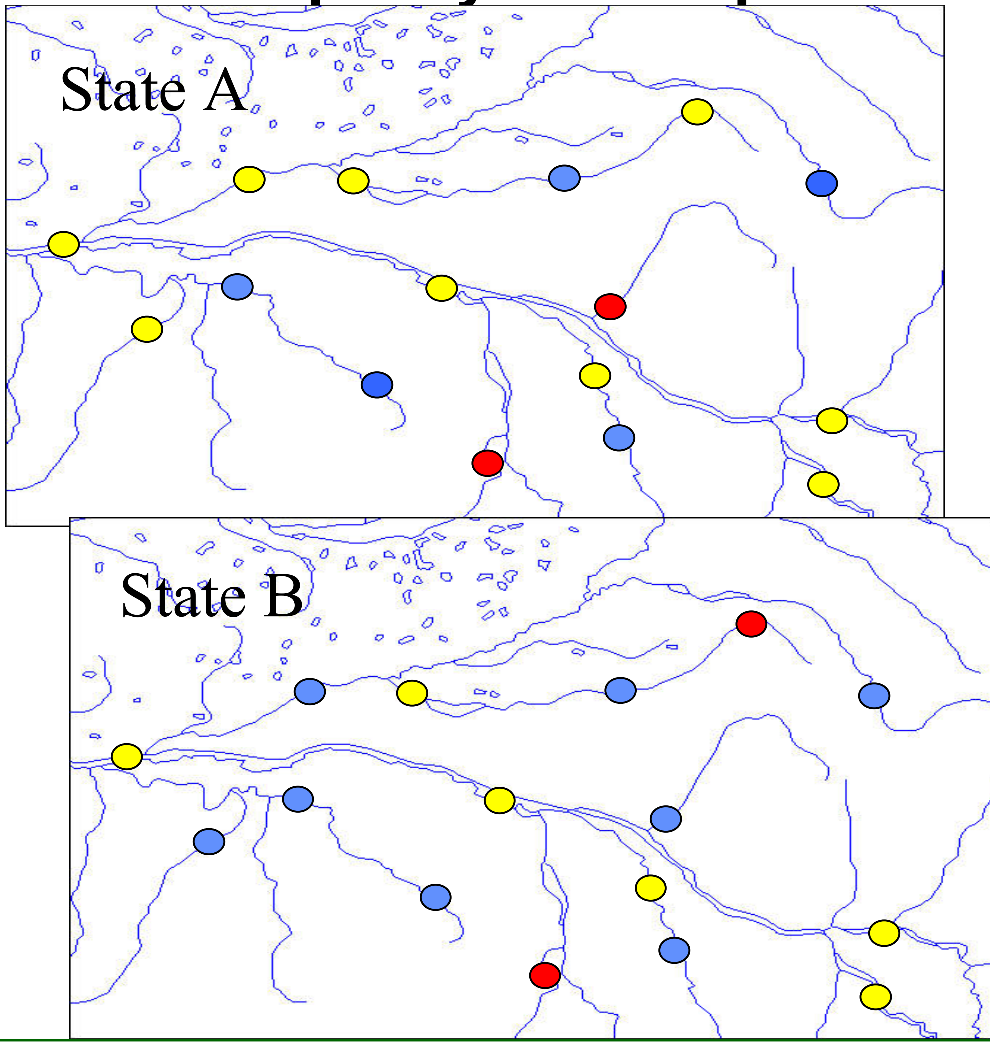


Next steps in spatial analysis and land accounting

- Integrating socio-economic statistics: land use accounts
- Integrating monitoring data (FF, rivers, coastal water…): ecosystems accounts
- Integrating time: scenarios & outlooks, PRELUDE as a first test
- Integrating scales: connection of land accounts & and the European landscape map at the meso/micro scale

III. Water accounts, sampling and modelling

River quality: actual presentation of monitoring data



Quality class	State A	State B	Δ
	12.5%	0.0%	-13%
	18.8%	50.0%	+31%
	56.2%	37.5%	-19%
	13.5%	13.5%	+0%
	100%	100%	0

Is it accurate??

As if…

Counting measurement points was conceptually equivalent to counting money like this =>

2

+

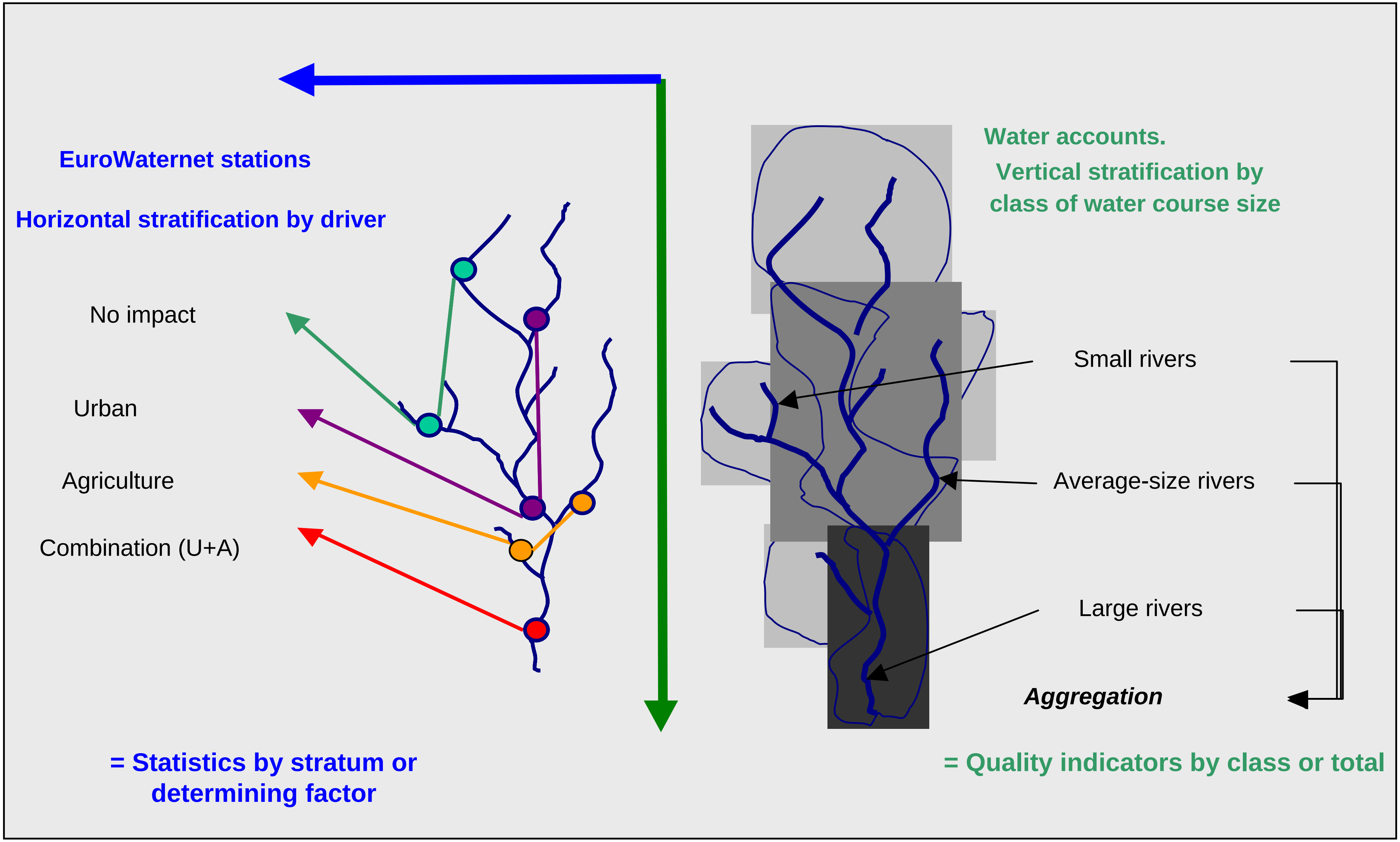
3

+

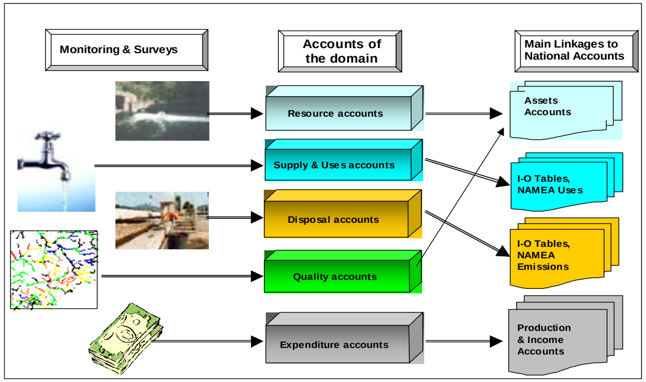
5

= 10 units !!!

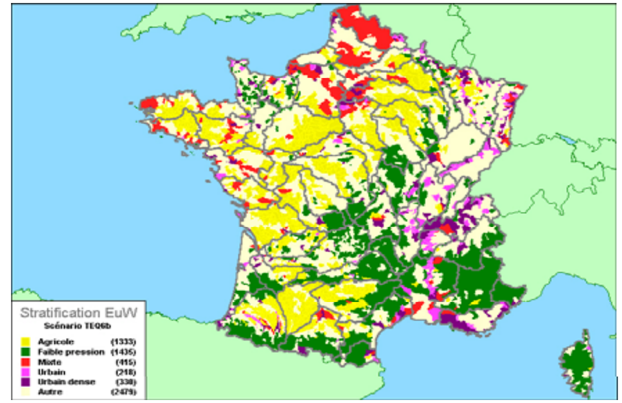
Taking account river courses



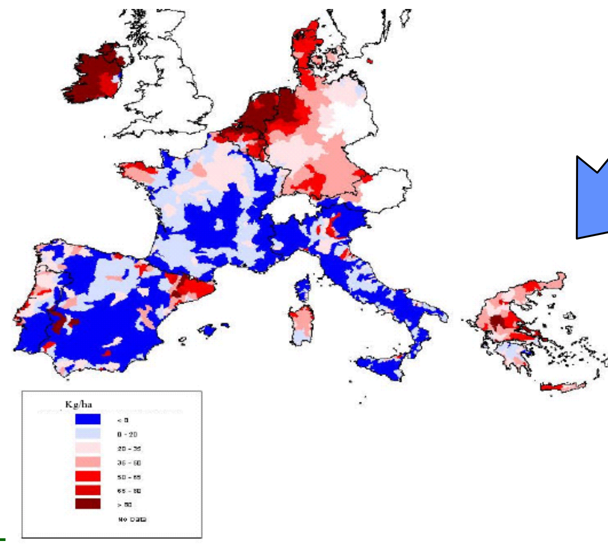
Water accounts, sampling and modelling…



Water accounts of the quantity and quality of the resource, of polluting emissions to water and economic costs



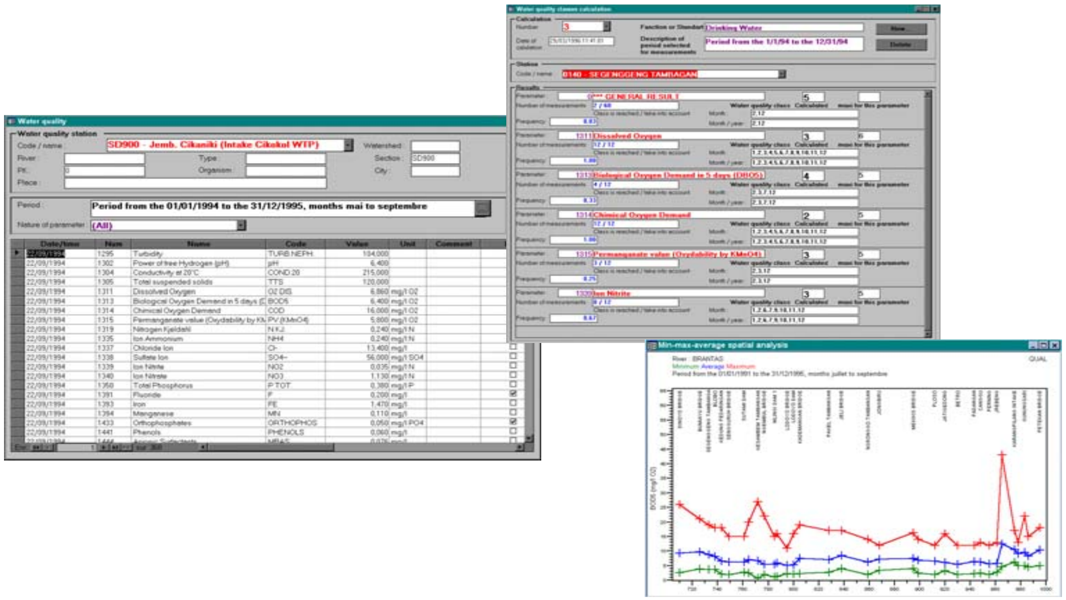
Eurowaternet sampling based on hydrological monitoring and CLC

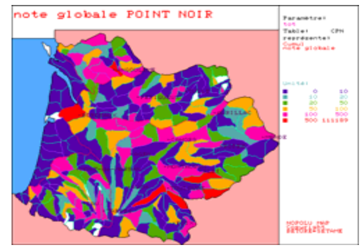


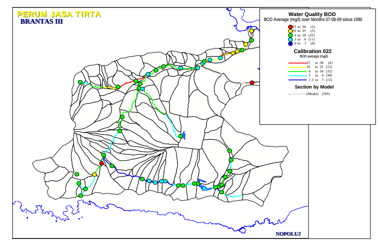
N – Balance in Kg/ha for Europe (EU 15) calculated at catchments level using the NUTS 3 census database and CLC (JRC with NOPOLU)

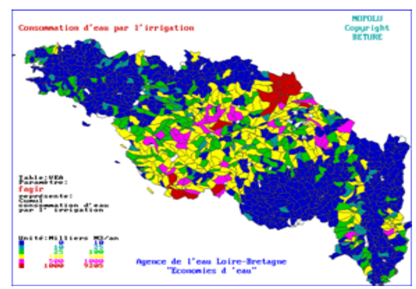
European Environment Agency

… are the basis for spatial integration of hydrological monitoring with land use and biodiversity assessments



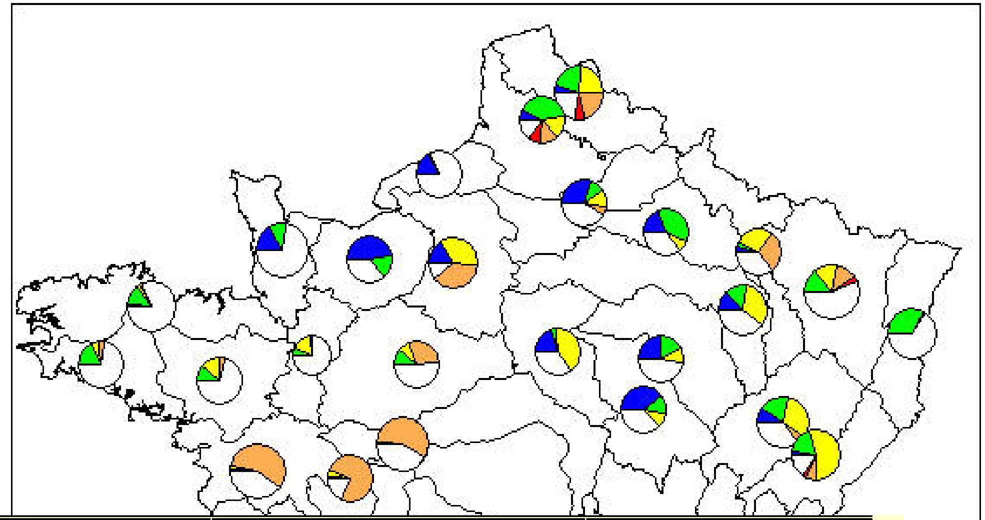






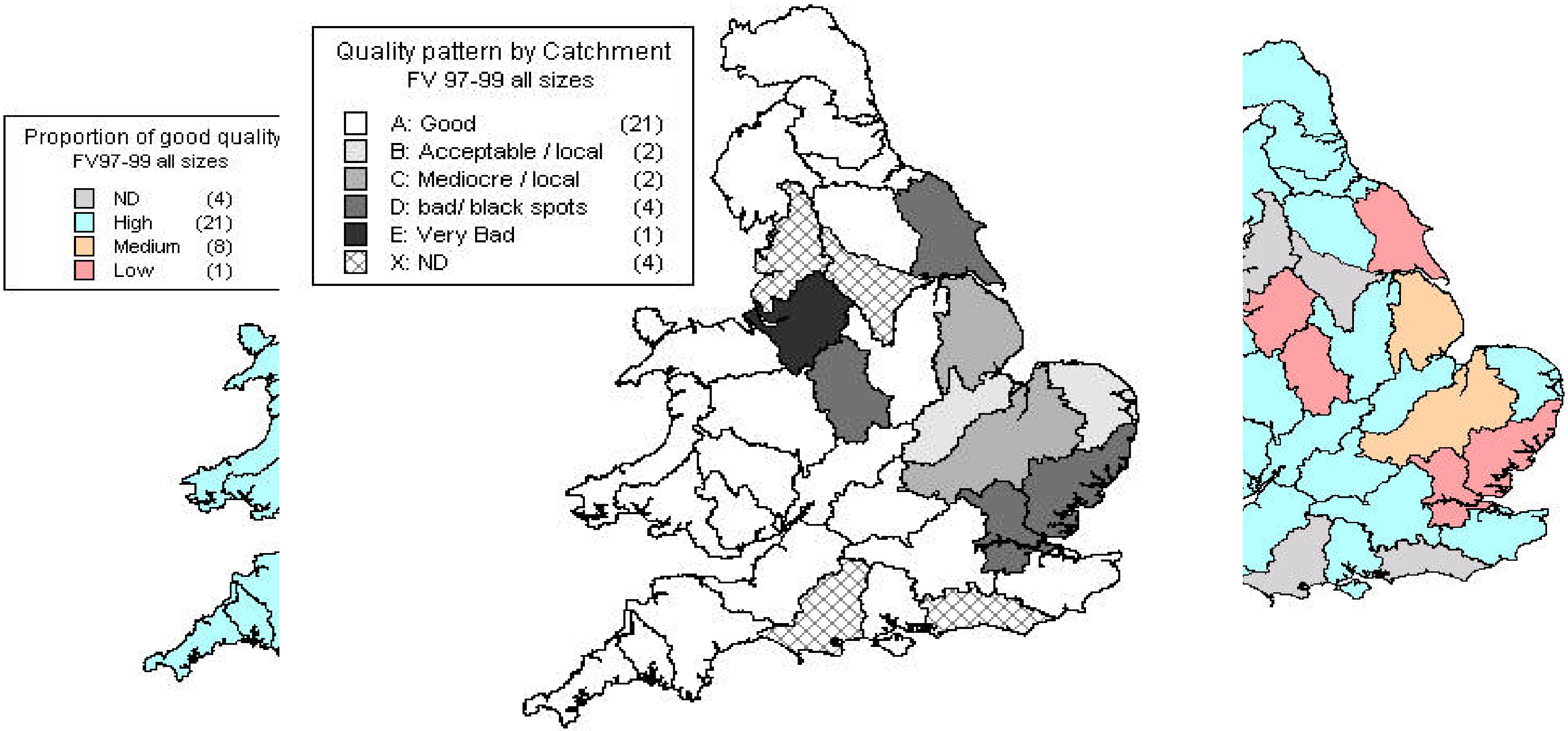
Fundamental results of water quality accounts

- Accounts, by default, give a "quantity of quality" that can be distributed by water sheds and be compared over time – e.g. 1994 / 1992 for France

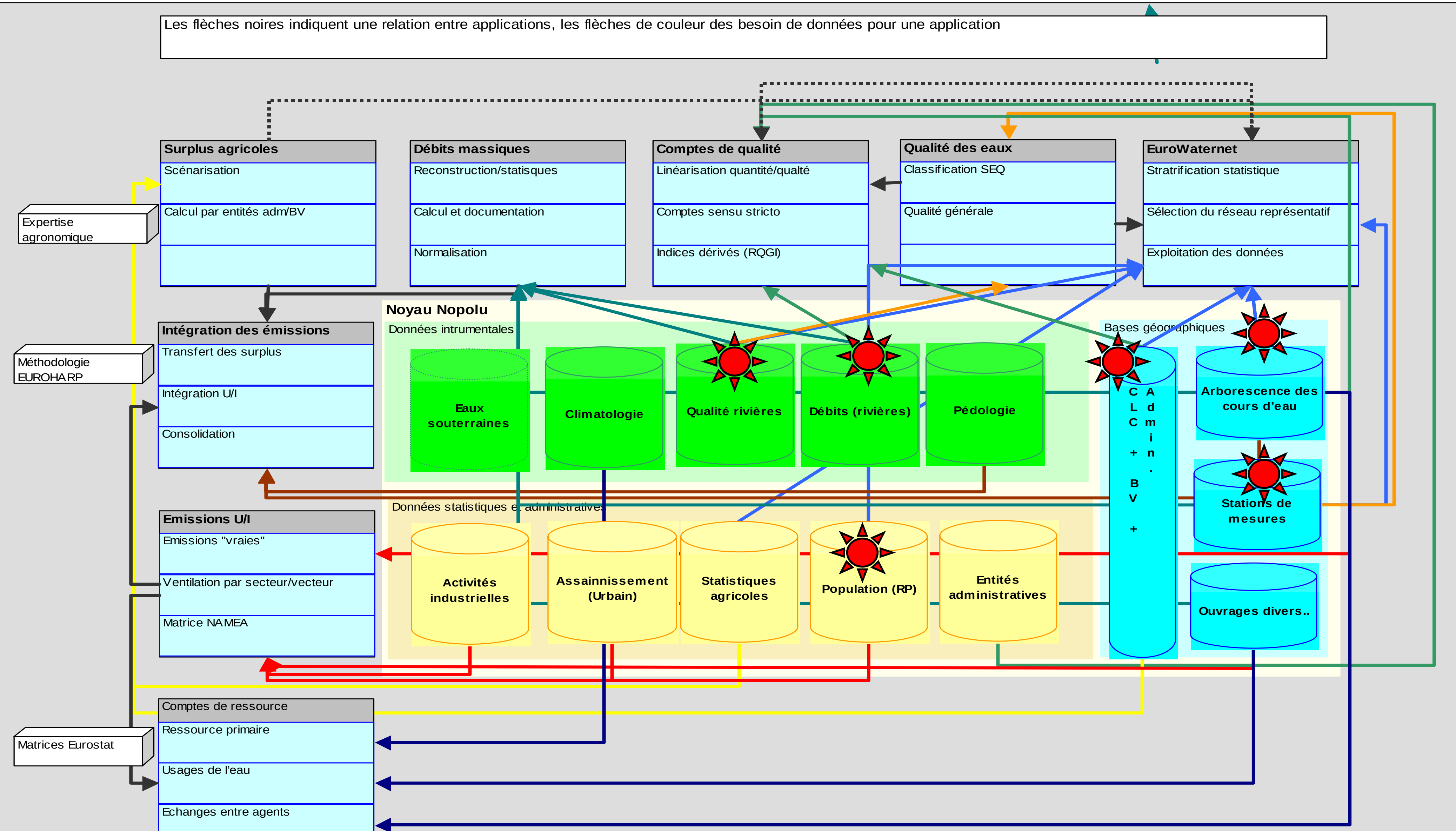


River size class	State 1992					Change 1994-1992					State 1994					Adjustment				
	1A	1B	2	3	HC	1A	1B	2	3	HC	1A	1B	2	3	HC	1A	1B	2	3	HC
Main rivers	5	1253	891	510	177	3	329	2	-152	-165	8	1583	893	358	12	*0*	*6*	*7*	*-32*	*0*
Main tributaries	309	1228	1194	336	50	16	464	-275	-182	-22	325	1691	919	154	28	*0*	*0*	*0*	*0*	*0*
Rivers	260	615	451	128	47	46	134	-129	-17	-28	306	749	322	110	18	*-1*	*-4*	*0*	*0*	*0*
Brooks	860	1464	690	243	95	-51	-170	227	15	-23	810	1295	917	258	72	*7*	*-6*	*1*	*0*	*0*

…or quality profiles, e.g. England & wales 1997-99



Model structure for accounts (under validation for Europe)



IV. Assimilation & Integration of in situ and space-borne data

- **Contribution of space systems to environmental monitoring…**

  •Time continuity, repetitiveness and fast delivery of Earth observation by satellite

  ✓ updating and "nowcasting" systems based on in situ monitoring

  ✓ intra-annual frequency data for **calibrating models** on river basins and ecosystems (phenology, soil humidity, temporary wetlands, turbidity of water)

  • Spatial continuity, exhaustive coverage, comparability of data

  ✓ stratification of sampling & optimisation of observation networks (e.g. monitoring of species, monitoring of urban air pollution, monitoring of exposure and risks…)

  ✓ improvement of the spatial distribution of present statistics

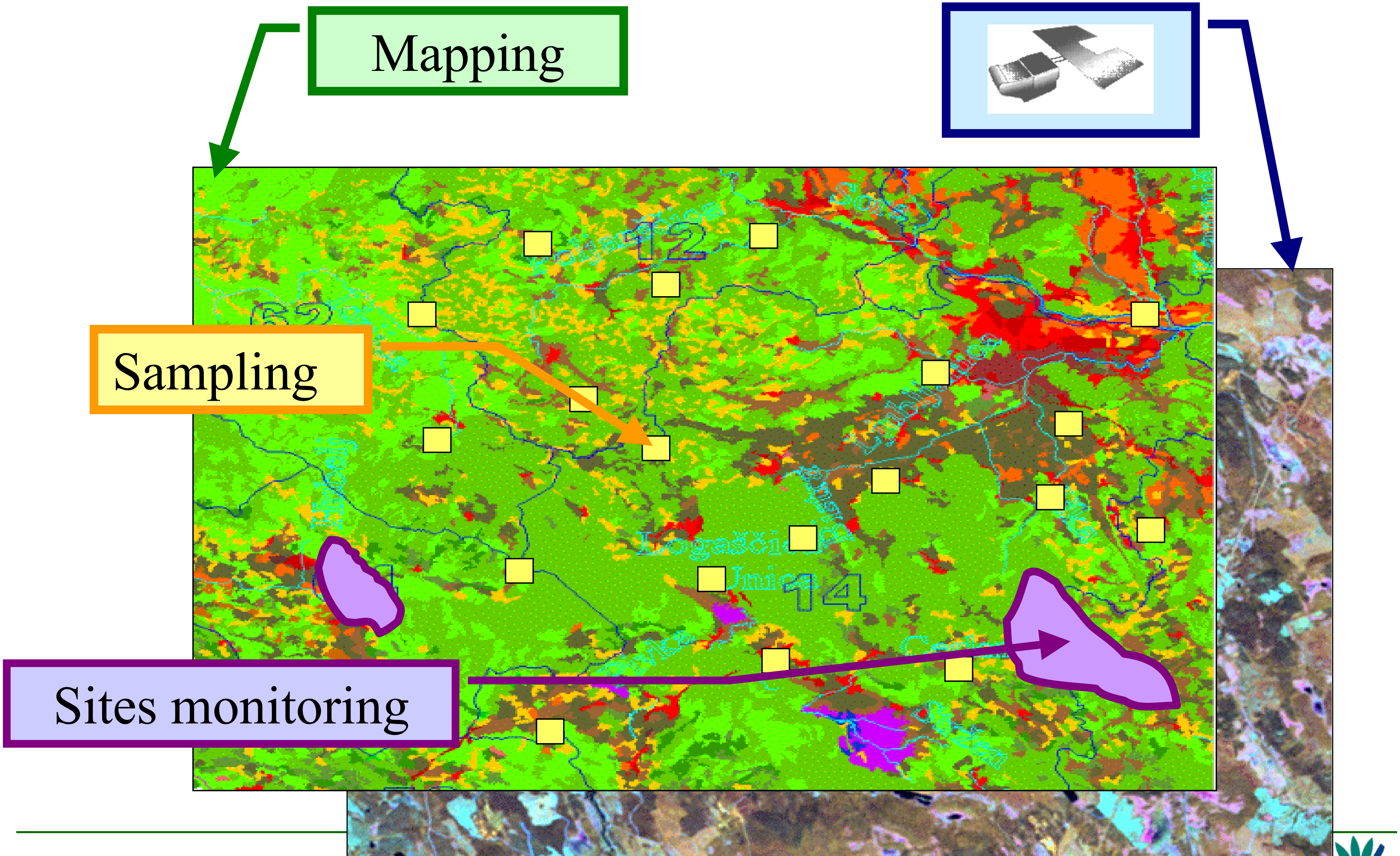
…an appropriate combination of science and of pragmatism (operationalization)

In practical terms, partnerships between institutions in charge of:

- space-borne observation (ESA, EUMETSAT…),
- environmental field networks (EEA/EIONET, Environmental agencies, EUMETNET),
- modellers and research programmes (GOOS, LUCC, MERSEA, GSEs…)

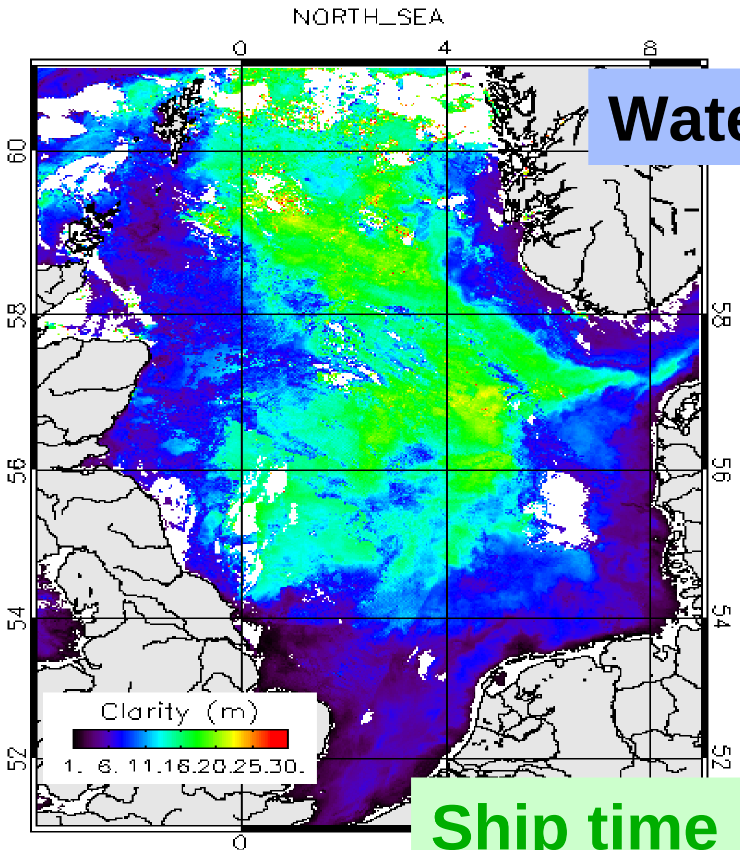
should establish partnerships for assessing potentials and needs (social needs as well as scientific developments to meet them), defining products, rules of cooperation and making the first steps in this novel way.

Earth Observation: part of a Monitoring Strategy

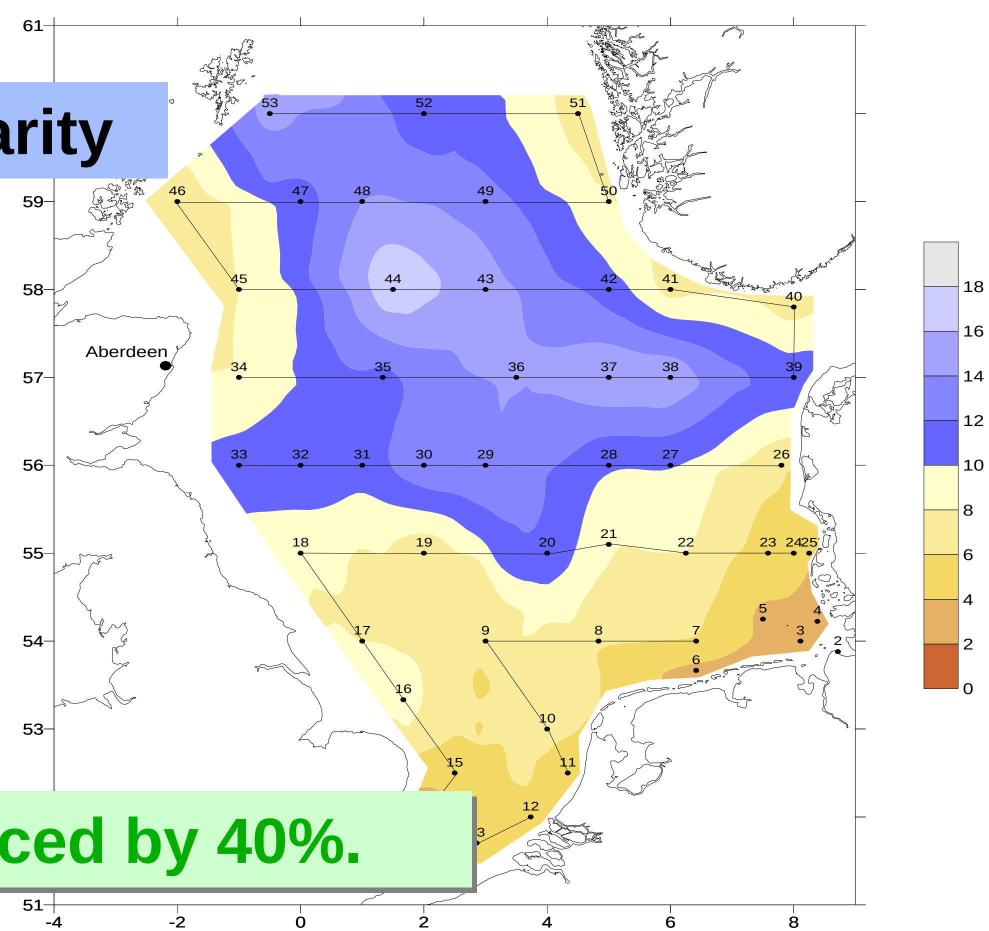


Integrating in situ and space-born monitoring to reduce costs

Courtesy COASTWATCH



Water clarity



Ship time reduced by 40%.

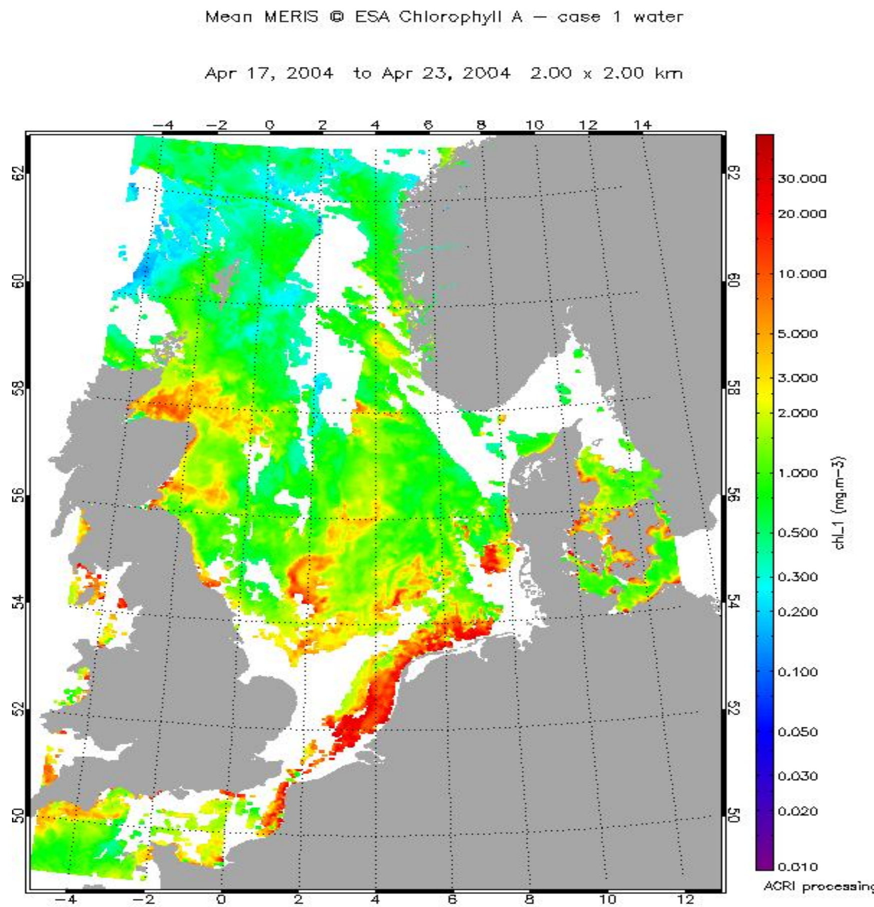
EO data capture the synoptic pattern of water clarity and enable identification of regions with strong clarity gradient where enhanced ship measurements are needed.

Real-time monitoring for real-time management

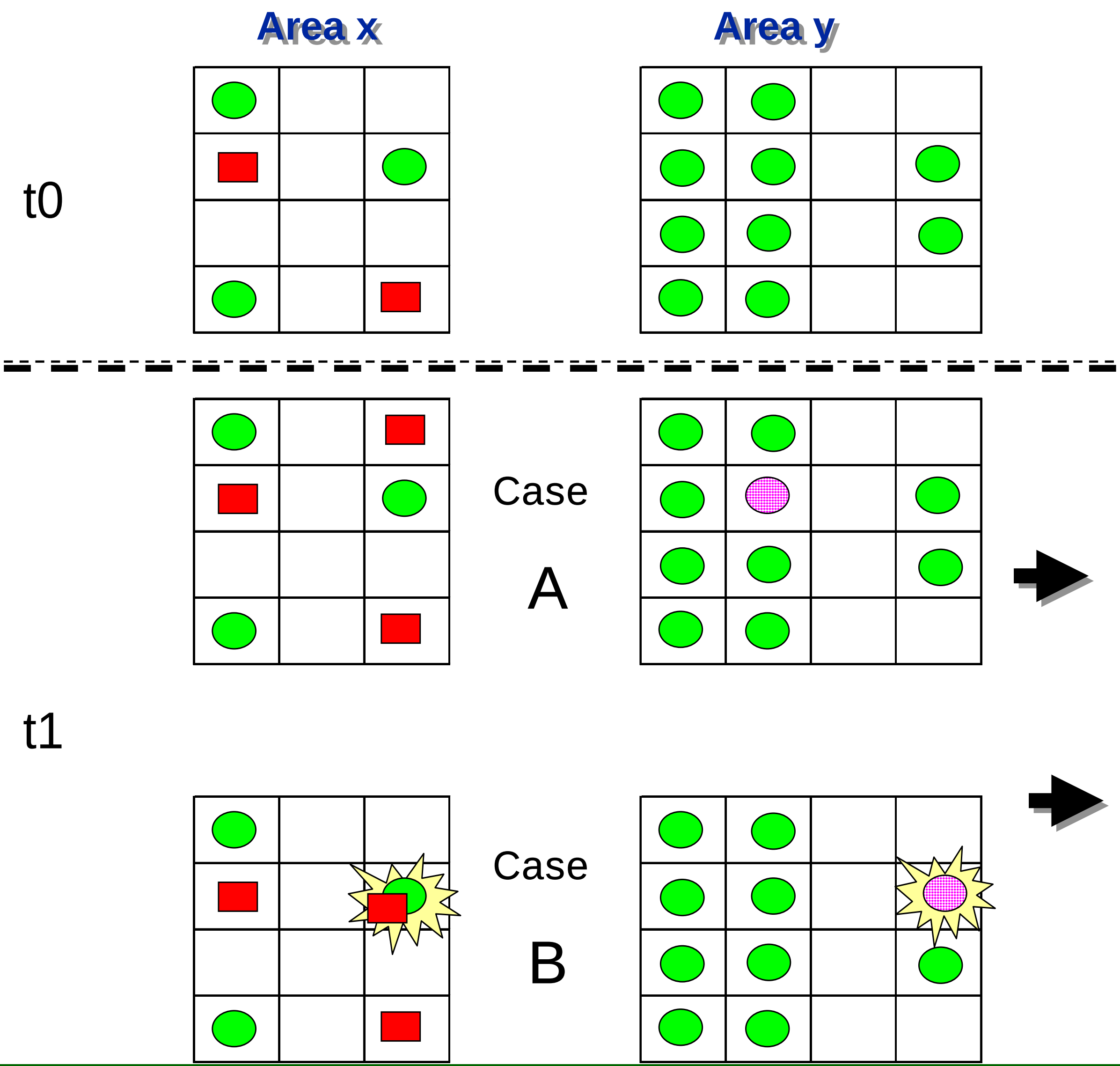
- In 2002 about 200 M€ loss of mussel cultures in the River Scheldt area.
- Predicting of risk based on EO-data chlorophyll and wave data.
- Decision support for closing dams to keep harmful algae blooms outside the estuary.

Courtesy COASTWATCH

algae bloom (17.04.2004)



V. Analysing statistics in their Spatial dimension



From t0 till t1,
total changes are

■ = +1 (+30%)

● = -1 (-10%)

no major problem is detected

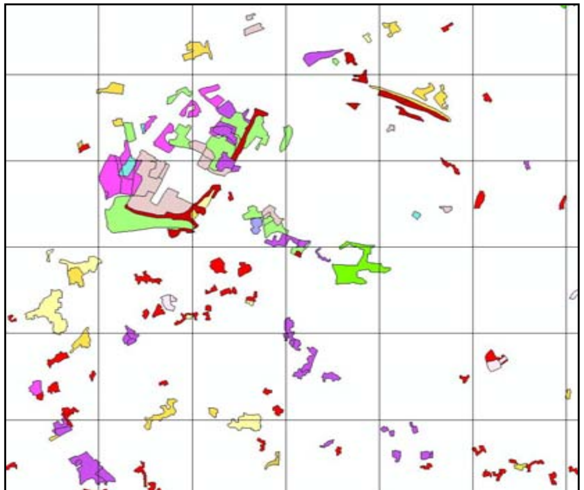
two problems:

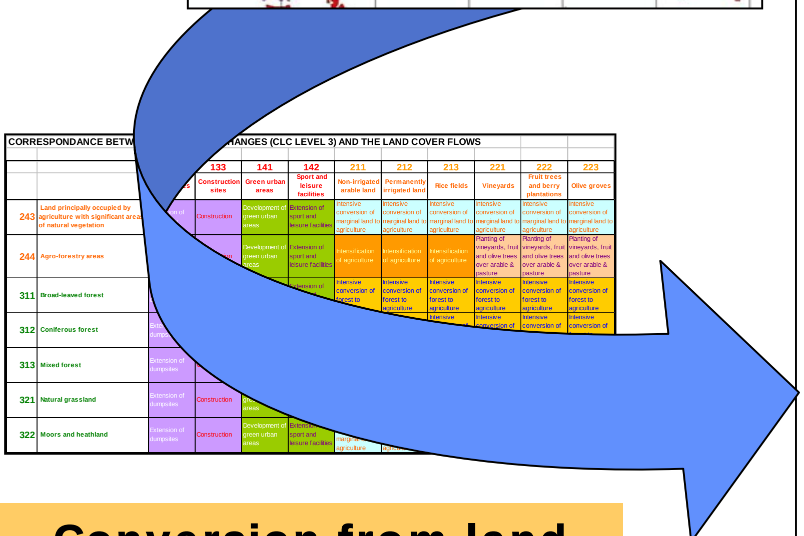
- conflict between ■ & ●

- loss of 50% of ● in the east part of the zone

Land cover accounts: from maps to statistics

Change
1990 - 2000





Conversion from land cover change to land cover flows

LCF1 Urban land management

LCF2 Urban residential sprawl

LCF3 Sprawl of economic sites and infrastructures

LCF4 Agriculture internal conversions

LCF5 Conversion from other land cover to agriculture

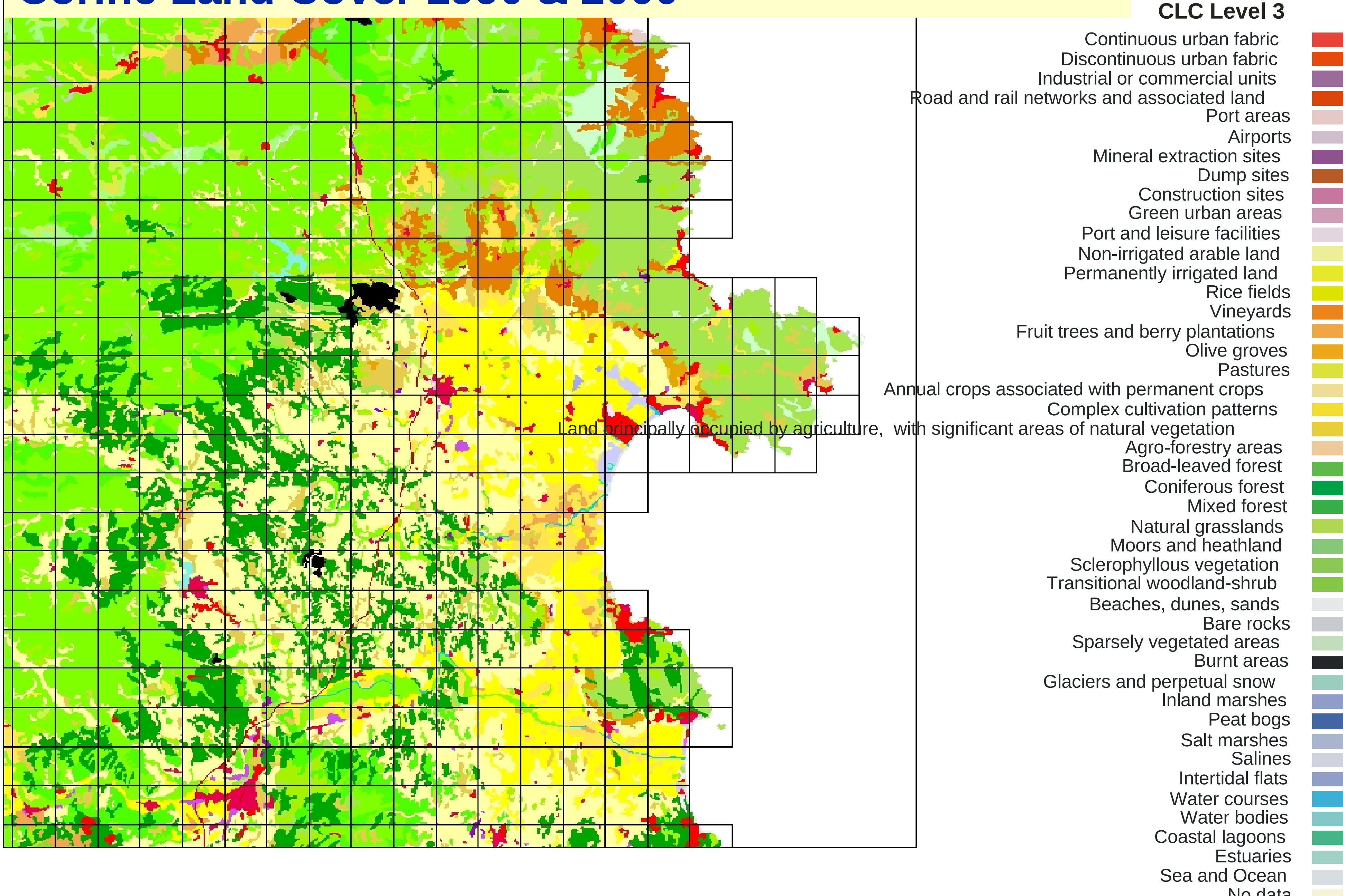
LCF6 Withdrawal of farming

LCF7 Forests creation and management

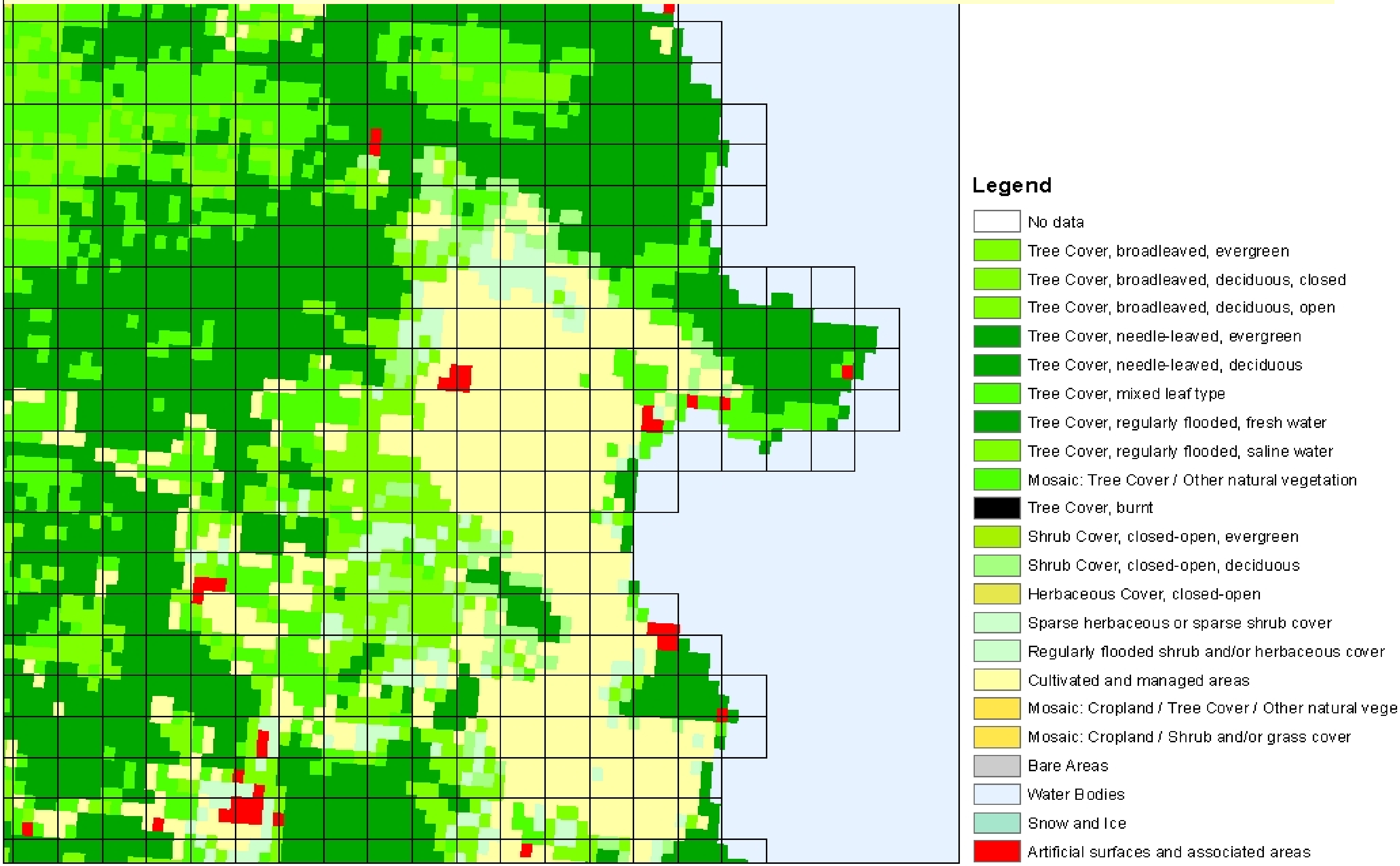
LCF8 Water bodies creation and management

LCF9 Changes of Land Cover due to natural and multiple causes

Land cover accounts are extracted from Corine Land Cover 1990 & 2000

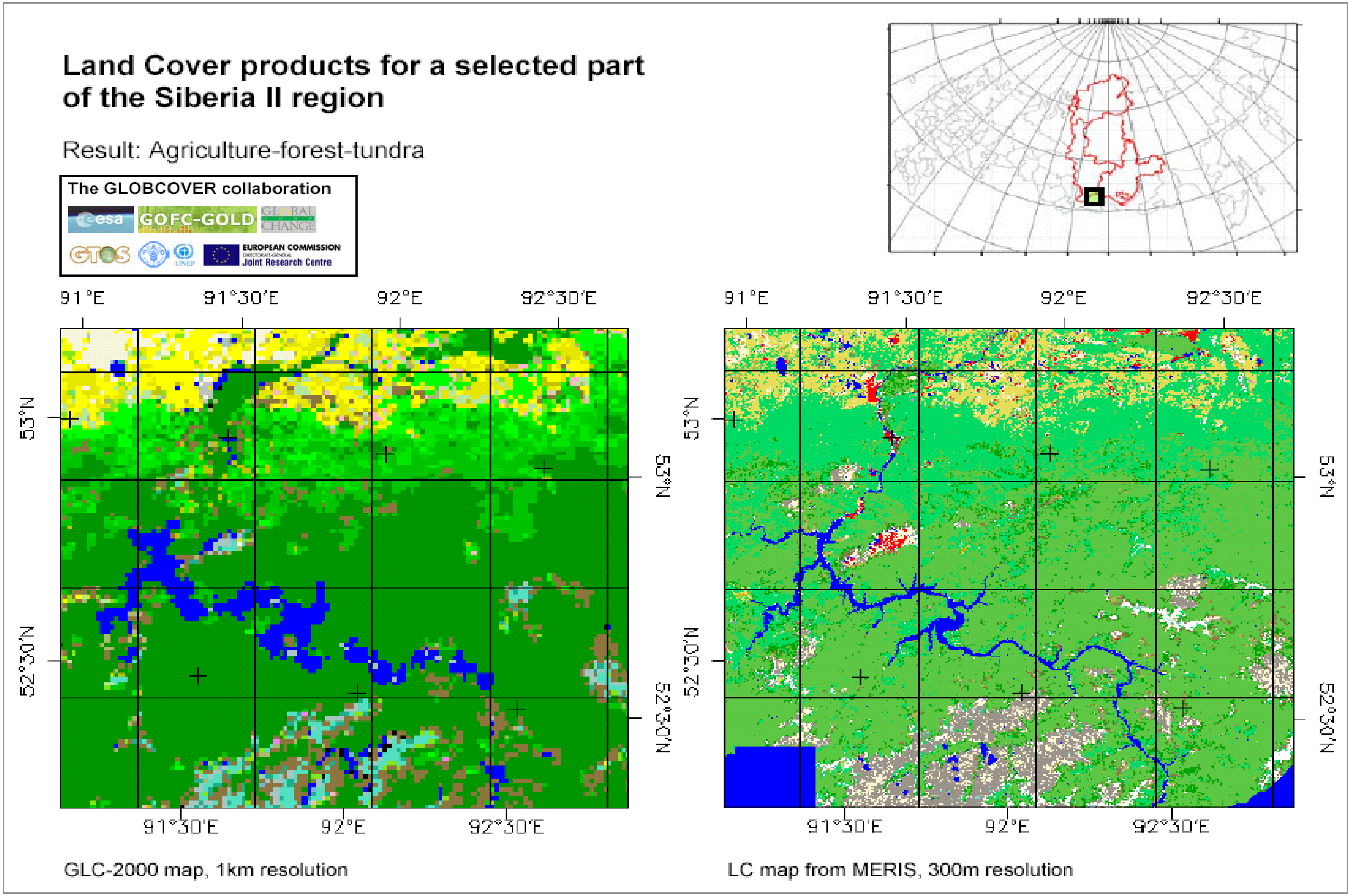


The Global Land Cover Map 2000 is not an appropriate data source for land cover accounting



MERIS and the Global Land Cover Map 2005 are a new opportunity for bridging the data gap

MERIS brings in resolution and density of information



Expected value-added by MERIS to land accounting

- Frequent updates (2 to 5 years), in between 2 CLC updates (10 years) are possible

- Additional information on temporary classes (e.g. mapping of temporary wetlands, not covered by CLC or improved distinction between arable land and pasture)

- Extension to EU partner countries (Pan-European process, Mediterranean cooperation, OECD, others…), using Globcover 2005 as a starting point

MERIS, CLC & Land accounts

- MERIS resolution doesn't match for mapping CLC:
  - minimum requirement for CLC = Landsat MSS, 80x80 m (France, Portugal, Czechia, Slovakia, Romania, Hungary)
  - MERIS = 300x300 m
  - CLC 25 ha mean ~40 MSS pixels and 3 MERIS pixels
- MERIS density of information may match land accounts requirements
  - Looking at the main flows only
  - First, matching CLC-based accounts with MERIS & then tracking change with MERIS, assessing directly the flows
  - Making use of multi-date capacities of MERIS (e.g. for distinction of crops from pasture)
  - Assessing bias in change measurement (e.g. for small changes) and adjusting the land accounts accordingly
- More details still needed for complex areas (urban, mosaics…), possible multi-scalar assessment

Possible multi-scalar assessment

- Implementation differentiated according to priorities
- Scales/details
  - Land cover map (e.g. 1/1M, 1/100000, 1/50000)
  - Land cover flows: level 1, level 2, level 3
- Classifications
  - Basic land cover (FAO and CLC level 1)
  - Detailed land cover accounts (CLC level 3)
  - FAO-LCCS tool for regional users

THAT YOU