

Expert Group Meeting on the Revision of the
Framework 29 April 2011
for the Development of Environment Statistics
(FDES)
New York, 4-6 May 2011

Geospatial developments relevant to environment statistics

Jean-Louis Weber
Special Adviser Economic Environmental Accounting
European Environment Agency
jean-louis.weber@eea.europa.eu

- - classifications: land use, land cover, ecosystems...
 - statistical and geographical units: administrative units (regions, municipalities, protected areas..) vs physical units (mountains, river basins, coasts...)
 - the scale issue, specific scales, stratification and sampling, downscaling statistics, upscaling local data...
 - open access datasets
 - existing open source tools for handling geo-statistical data

- The environment is about interactions of economic actors, people and Nature.
 - Human settlements and economic activities are not distributed evenly over land and therefore their pressure on Nature
 - The capacity of Nature to support population and economy and to resist pressures varies as well other space
 - Economy, population and Nature have all their specific space and mobility constraints.



People, Economy and Land

Services	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5
	<i>Food</i>	<i>Materials</i>	<i>Forest trees-related</i>	<i>Plant-related</i>	<i>Physical support</i>	<i>Amenity</i>	<i>Identity</i>	<i>Didactic</i>	<i>Cycling</i>	<i>Sink</i>	<i>Prevention</i>	<i>Refugium</i>	<i>Breeding</i>
<i>Land cover types</i>													
Artificial surfaces/ Urban													
Arable land & permanent crops													
Grassland & mixed farmland													
Forests & woodland shrub													
Heathland, sclerophyllous veg.													
Open space with little/ no vegetation													
Wetlands													
Water bodies													



Geography and statistics

- In the past (until the late 1970's):
 - Micro-data (individual questionnaires, administrative reports or observations) were generalised according to the purpose of their collection
 - ...then, stored in statistical offices' cellars for legal obligations
 - ...and very rarely reused
- Development of databases → deep change in the collect and processing and dissemination of statistics



IT in the Brazilian 2010 Census

New Technologies in Population and Housing Censuses: Country experiences

Eduardo Pereira Nunes – President of IBGE

eduardo.nunes@ibge.gov.br

UNSC, New York, 21 February 2011

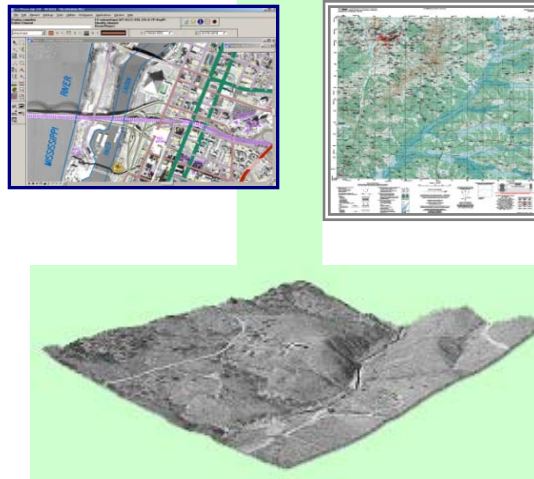
2010 Census Mapping

- **Building of an integrated Territorial Database to support 2010 Census, from the planning to the collection and dissemination steps:**
 - Associate the “National Address File for Statistical Purposes – CNEFE” file to the blocks and block-face urban enumeration areas;
 - Geometrical adjustment of urban and rural limits for each Municipality
- **SISMAP – Brazilian System for Census Mapping**
 - IT tool developed for municipal mapping in a single continuous spatial database;
 - Input data from several sources of vector and imagery data, like GIS, GPS, satellite imagery, digital and aerial photography

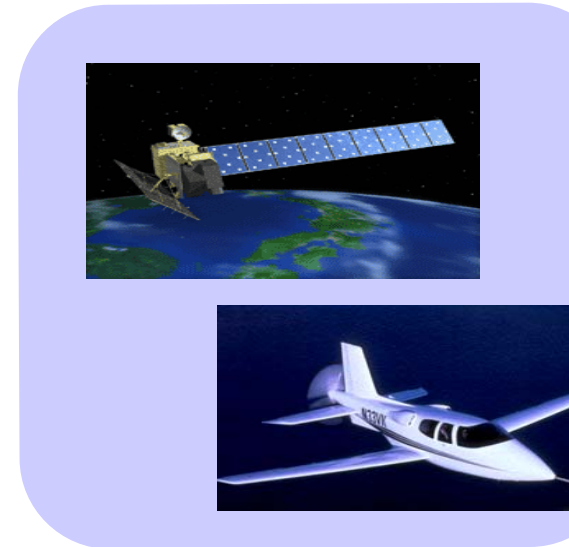
Handheld Devices (PDA)



GIS/Web



Low Cost Images



Growing Application at IBGE for both Cartography and Statistics

Brazilian Geospatial Statistics

Geography and statistics

- In the past, geography and statistics were fairly separated disciplines – and still today, how many geography and statistics institutes in the world? Brazil, Mexico...
 - Geographical dimension of statistics = breakdown of statistical tables by pre-existing zonings (typically: administrative regions)
 - Statistical dimension of geography = maps of statistics by pre-existing zonings (typically: administrative regions)
 - Geo-statistical analysis limited by the most detailed level of information (typically: municipalities)



Geography and statistics

- Today:
 - Micro-data are stored in databases with their time and space characteristics and remain individually accessible
 - ...they can be (re)used for multiple purposes: consultation and control, sampling, modeling...
 - ...they are shared and frequently disseminated via local statistics databases and reach broader publics
 - ... they can be analysed with cloud computing systems (no need for holding data and complex softwares packages)
 - They can be updated by crowd computing
 - **They are backed by remote sensing programmes for land, oceans and meteo**
 - **They are managed in geographical information systems**



Geo data are abundant and more and more often free

- Just a few examples...

ESA, NASA, JAXA, INPE, FAO..., and the Group on Earth Observation

Earth observation programmes are numerous and deliver abundant data on land over and biomass, as well as many climate change variables. In Europe, ESA and GMES are an important source of data for land & ecosystem accounting.

GEO is coordinated at the global level by the **GEO Secretariat** in which participate 81 countries (of which 18 African countries) and the European Commission.



The GlobCorine project of ESA is aimed at supporting land cover accounting

GEO Biodiversity Observation Network

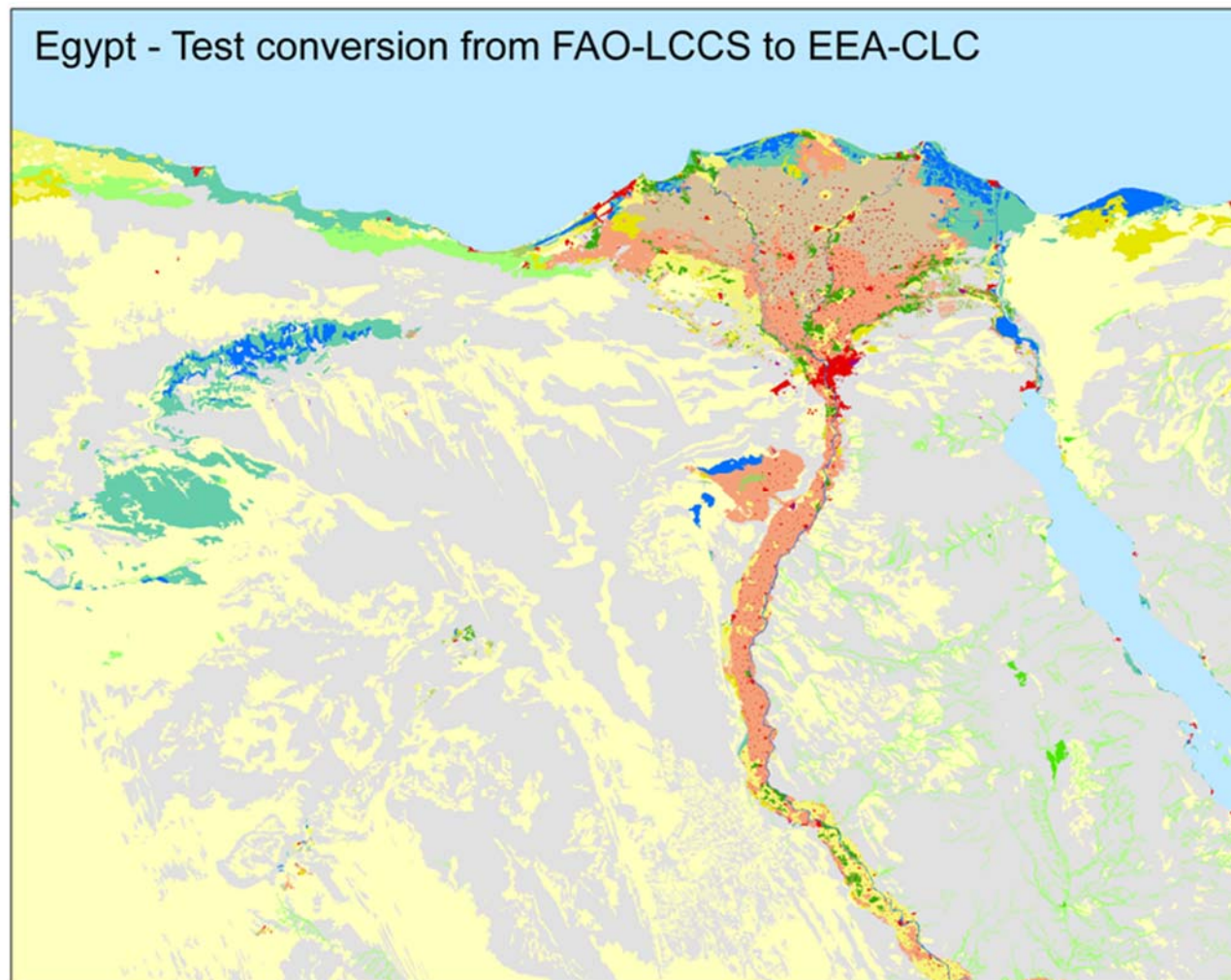
The Group on Earth Observations Biodiversity Observation Network – **GEO BON** – is the biodiversity arm of the Global Earth Observation System of Systems (GEOSS). Some 100 governmental and non-governmental organizations are collaborating through GEO BON.

New global **high resolution** land cover maps initiatives :
China, USA, Japan (forest cover), Europe



Multi-lateral cooperation – e.g. FAO Africover

- Legend**
- 2.4.3. Mosaics agriculture nature
 - 2.4.1. Associated annual & permanent cropland
 - 3.2.1. Natural grassland/2.3.1. Pastures
 - 3.3.3. Sparsely vegetated areas
 - 3.2.3. Sclerophyllous vegetation
 - 4.2.0. Maritime wetlands
 - 1.2.4. Airports
 - 1.5.0. Archeological sites
 - 1.2.1. Industrial or commercial units
 - 1.2.3. Port areas
 - 1.1.1. Continuous urban fabric
 - 1.1.2. Discontinuous urban fabric
 - 1.4.0. Artificial, vegetated urban areas
 - 3.3.1. Beaches, dunes, and sand plains
 - 3.3.2. Bare rock
 - 4.1.0. Inland wetlands
 - 5.1.2. Water bodies
 - 5.1.1. Water courses
 - 2.1.3. Rice fields
 - 2.1.2. Permanently irrigated land
 - 2.1.1. Non-irrigated arable land
 - 2.2.1. Vineyards
 - 2.2.2. Fruit trees and berry plantations
 - 2.2.3. Olive groves & Date Palm



Multi-lateral cooperation – e.g. Corine land cover

www.eea.europa.eu/themes/landuse/interactive/clc-viewer

SOE 2010
The European environment – state and outlook 2010

Land use

- Menu
- Data centre
 - Land accounts data viewer 2000-2006
 - Data centre overview
 - Interactive maps and data viewers
 - LUCAS viewer with
 - ground-level pictures
 - Changing face of Europe – explore the land resources
 - Land and
 - Ecosystem Accounting (LEAC)
 - Data and maps
 - Countries data reporting
 - GIS applications API
 - Document library
 - About the land use data centre
 - Access to national data

Changing face of Europe – explore the land resources

Corine Land Cover interactive map viewer

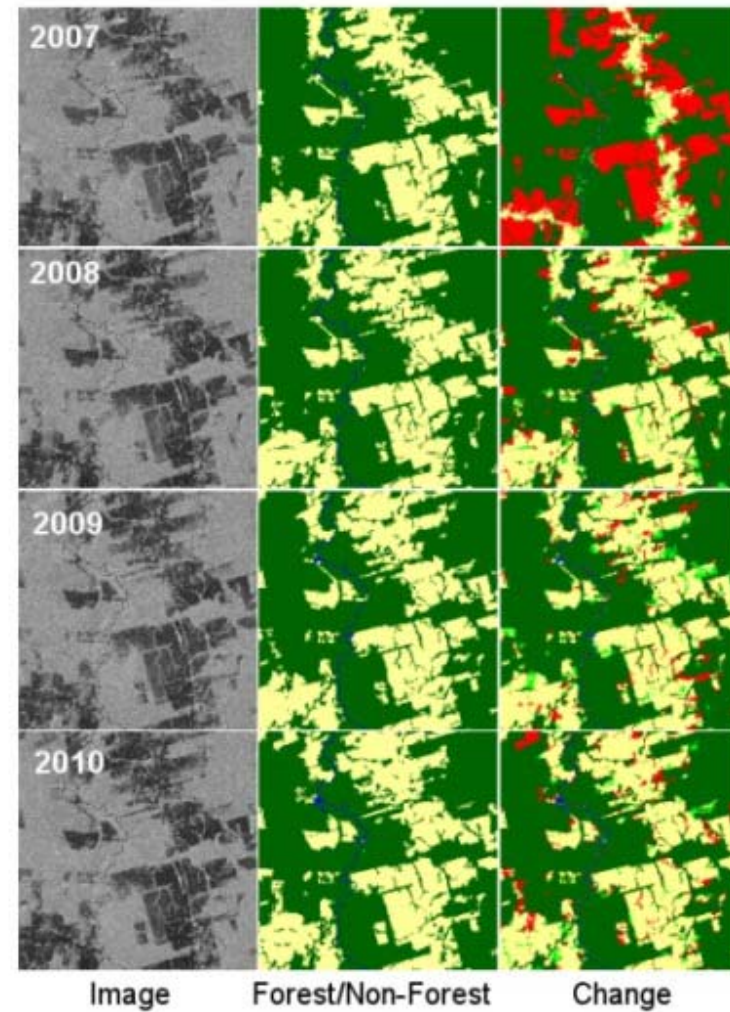
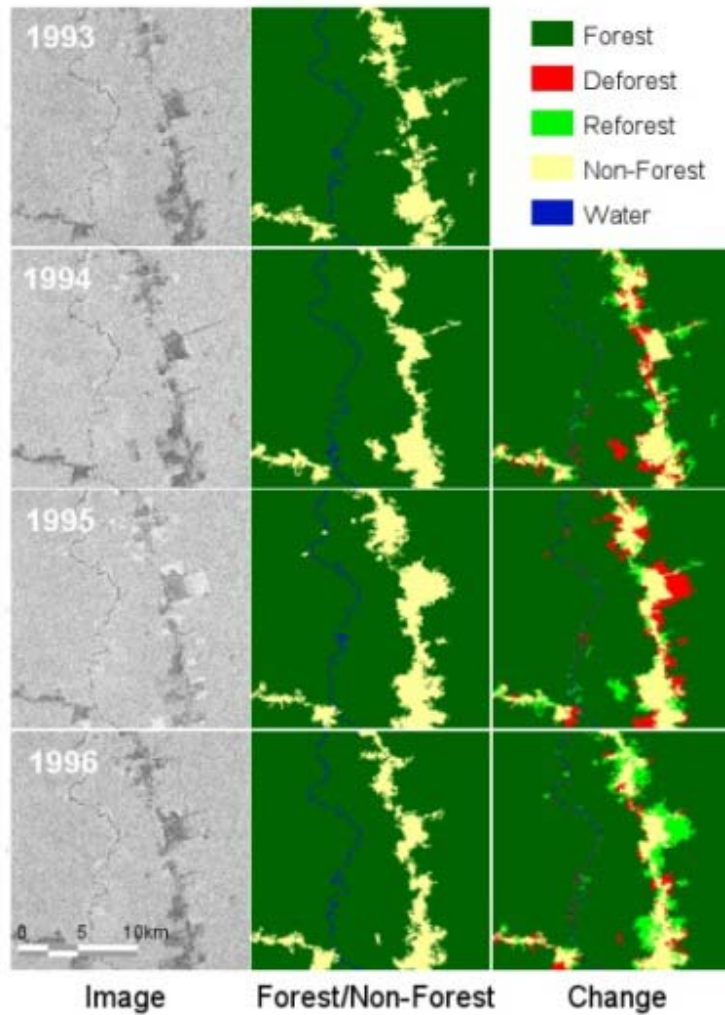
Find location...

Share with others

<http://www.eea.europa.eu/themes/landuse/interactive/clc-viewer>



Bilateral cooperation



(C)JAXA, METI analyzed by JAXA

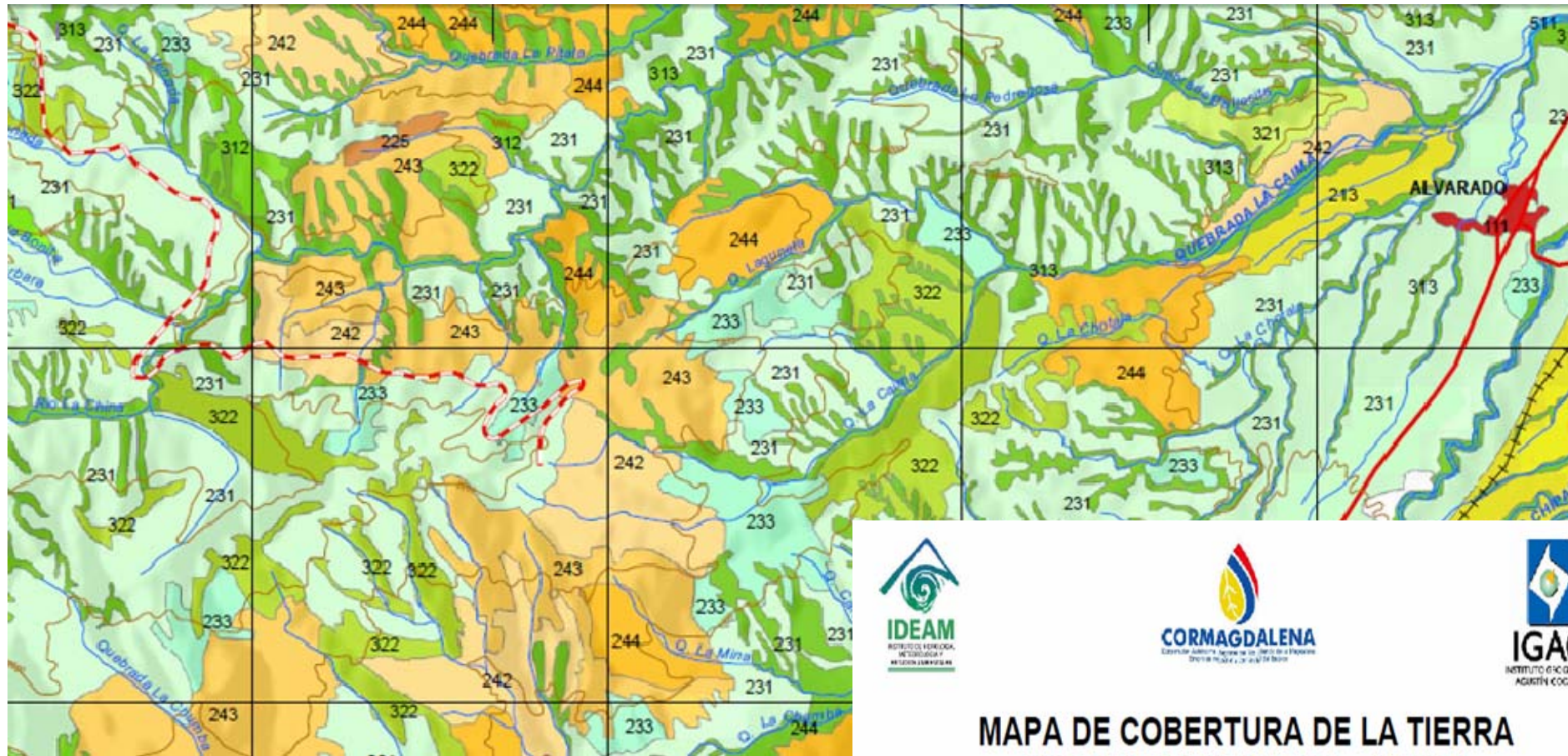
Cooperation JAXA-IBGE

Forestry change over time in the State of Para, Amazon
between 1993 and 2010 ©JAXA

European Environment Agency



Bilateral cooperation



MAPA DE COBERTURA DE LA TIERRA CUENCA MAGDALENA - CAUCA

METODOLOGIA CORINE LAND COVER ADAPTADA PARA COLOMBIA

Cooperation Colombia-France

European Environment Agency



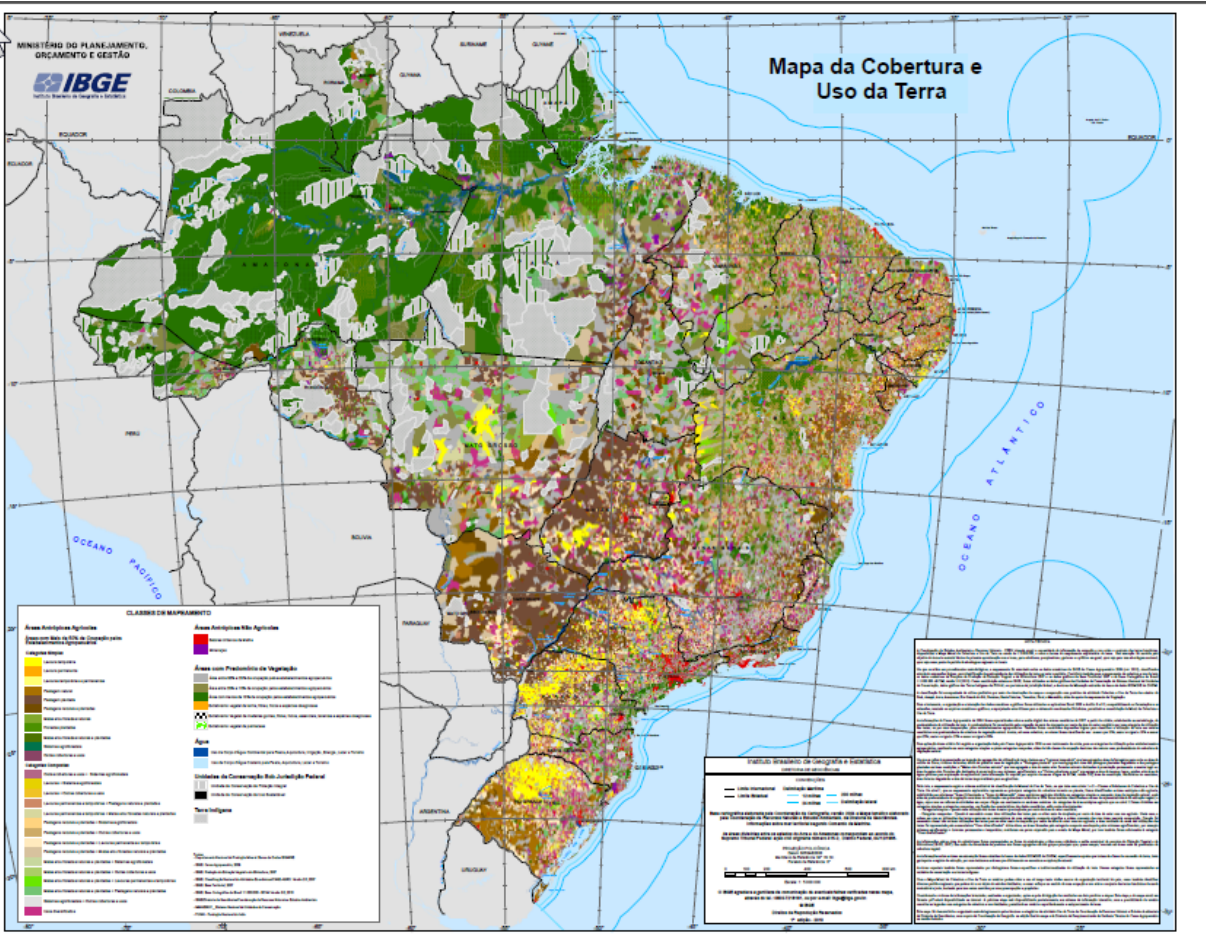
TerraNorte RLC Map for 2005



Source: Serguey Bartalev, IKI, Russian Academy of Science 2010

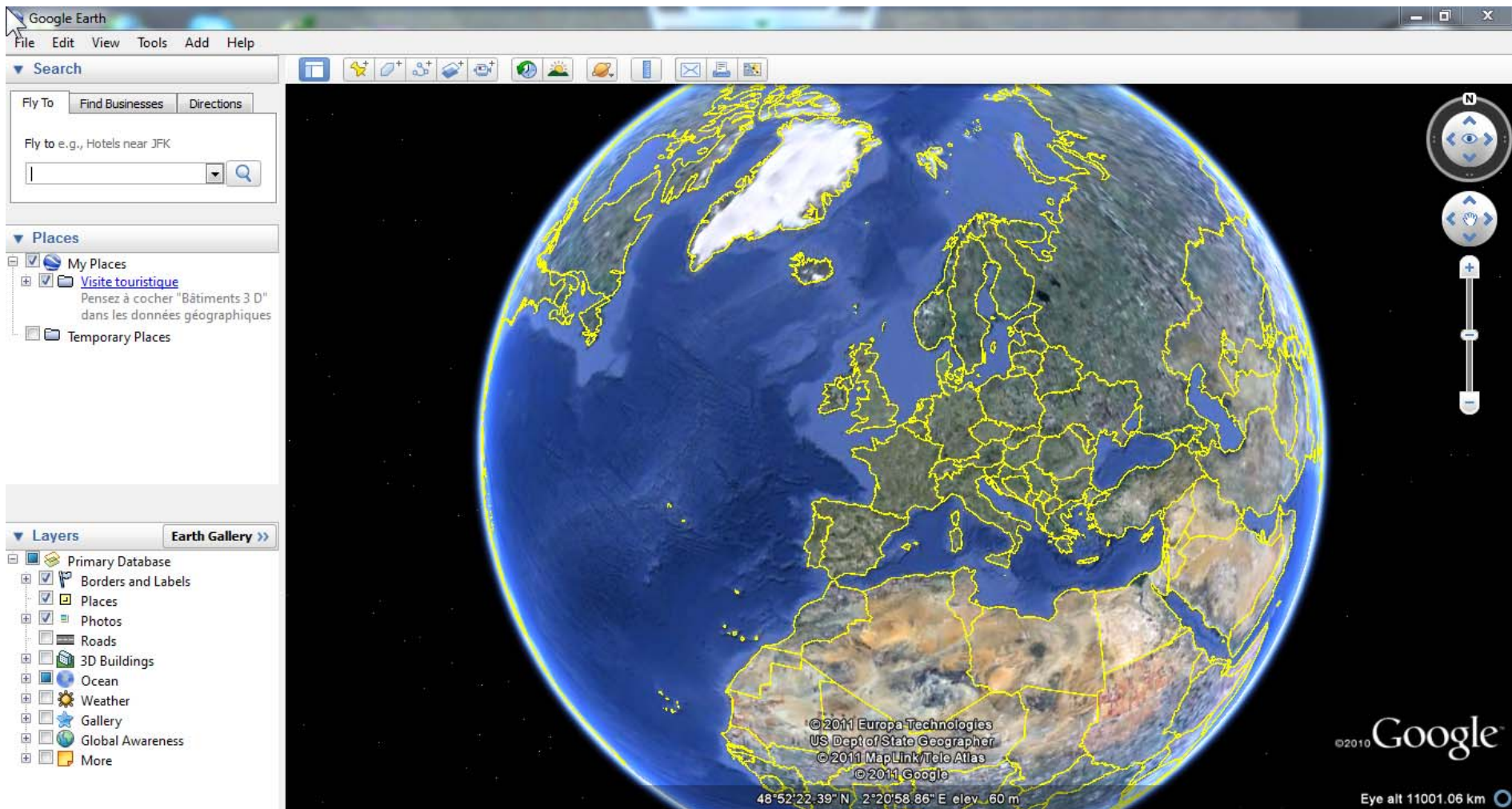


National programmes



ftp://geoftp.ibge.gov.br/mapas/tematicos/mapas_murais

Private initiatives

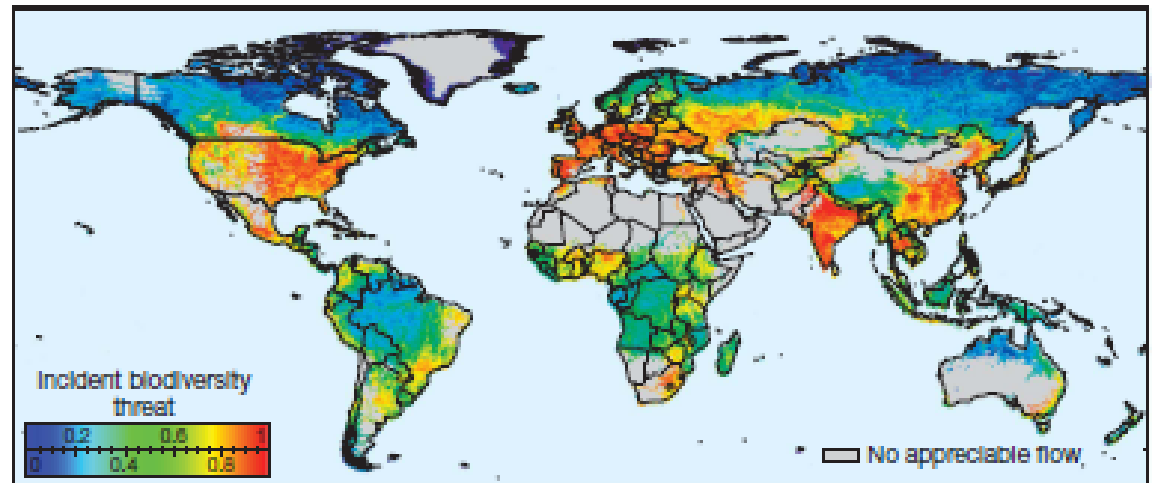
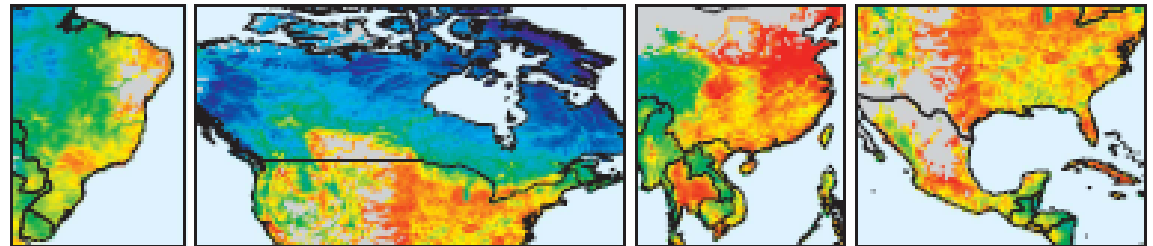
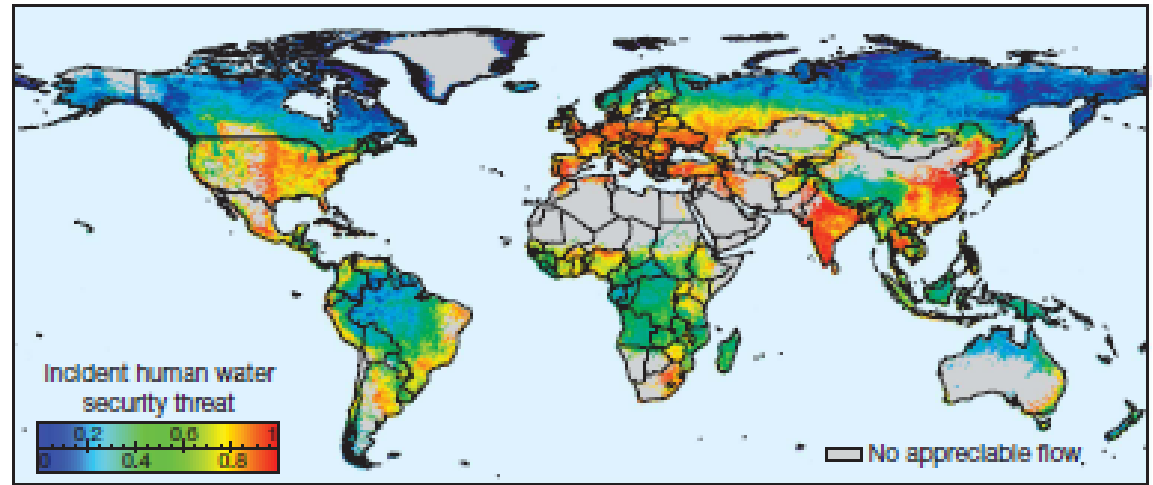


On GoogleEarth, you can introduce your own geodata

Not only land cover: e.g. geo data on Water quantity & quality data exist at the Global scale

Meteo data

+



Source: Global threats to human water security and river biodiversity, C. J. Vorosmarty, P. B. McIntyre et al., NATURE, Vol. 467, 30 Sept. 2010



UK Nature's calendar updates by "crowd sourcing"

The nature's calendar survey

WOODLAND TRUST

Home Get started Results **Maps** Wildlife About

Look out for the delicate pink dog rose flowering in woods and hedgerows - record your sightings

Map

bluebell - first flowering 2011

Select Map

- Get species information
- Get event information

MAP ZOOM
Click the magnifying glass to zoom in, then click on either map to navigate

RECORDINGS

55
0

19/02/11 19/02/11 02/05/11

Recordings: 0

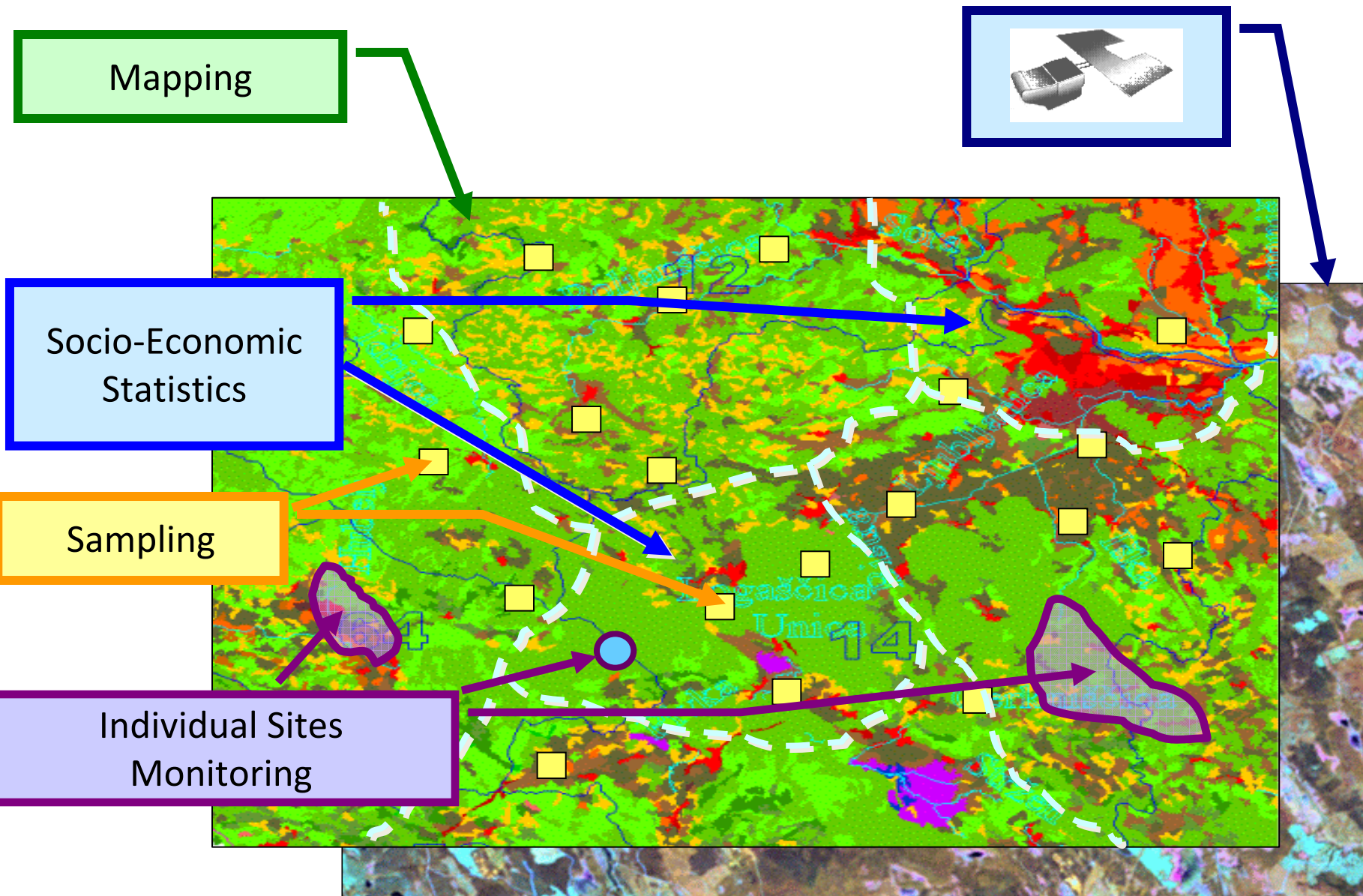


Integration of spatial data and statistics

- Multiple spatial units:
 - Administrative units: e.g. municipalities, districts, counties, regions
 - Management units: e.g. protected areas, river basin districts
 - Planning units: e.g. coastal zones, urban areas...
 - Legal property units: e.g. cadastral units
 - Analytical units: e.g. land cover units, socio-ecological landscape units, “satoyama”, “satoumi”, eco-complexes, geo-systems, ecozones...
- At various scales...
 - ➔ Integration = classification and assimilation



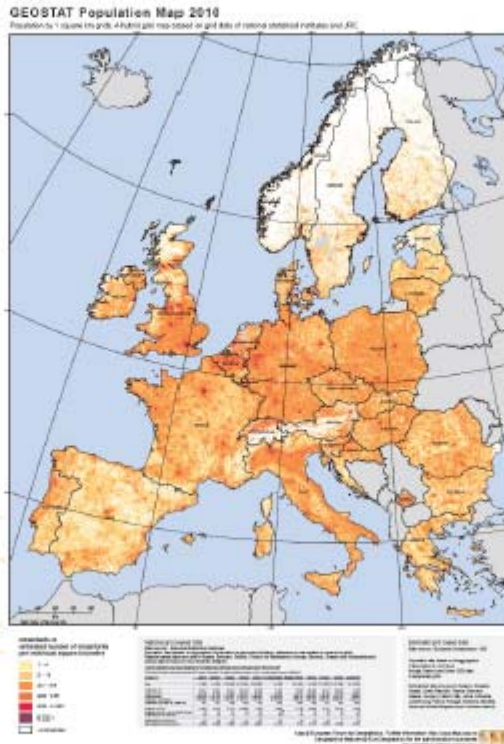
Spatial Integration of Environmental & Socio-Economic Data Collection



Assimilation of data

- Geo-referencing of micro data → use of GPS
- Choice of dominant geographical patterns
 - Relief, physical spatial patterns
 - Climate
 - Land cover
- **Assimilation of data into regular grids**

GEOSTAT - Geo-referencing data from the 2011 population and housing census

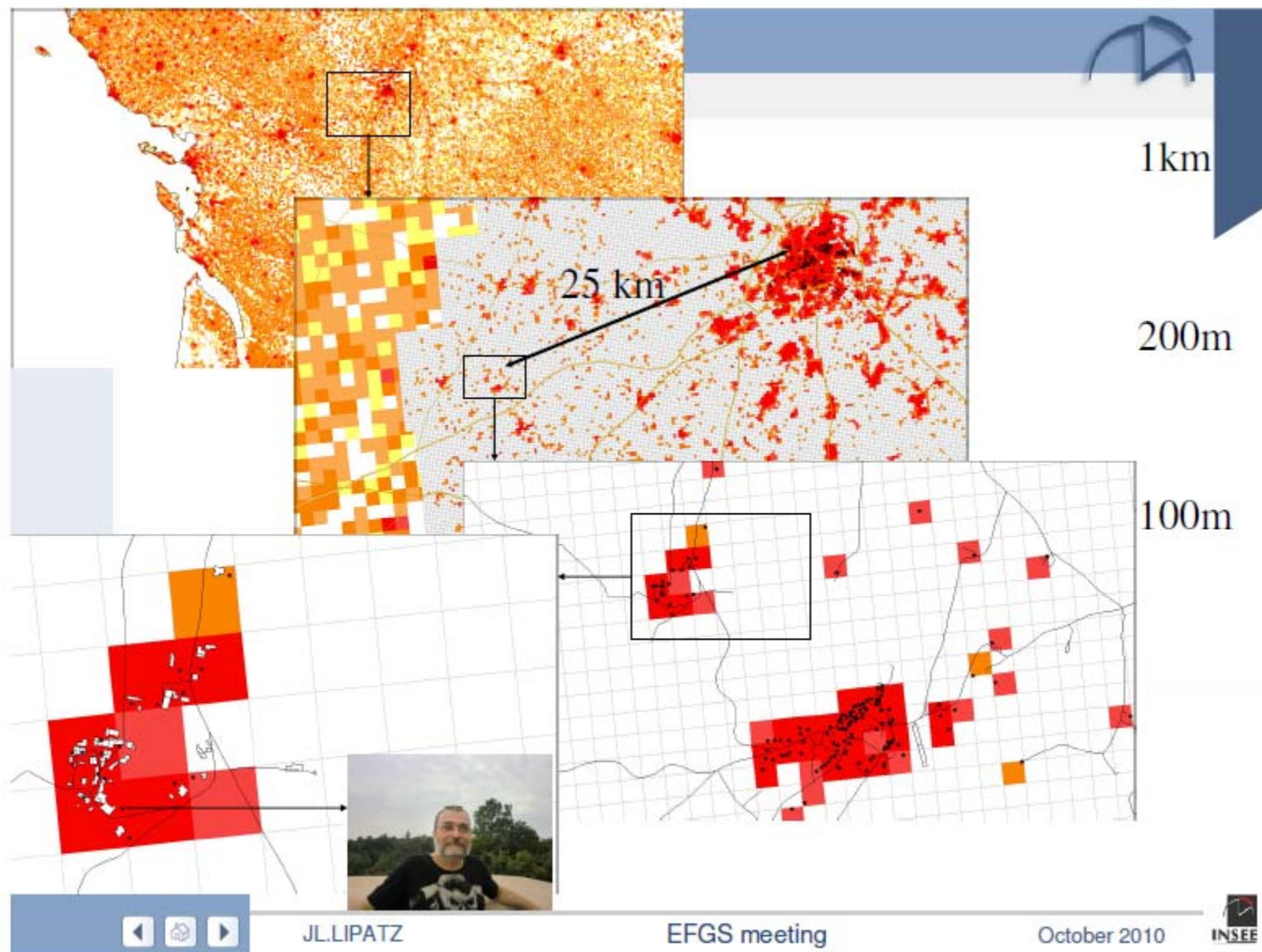


05-October-2010

EFGS conference 2010 in Tallinn



Assimilation of statistics into regular grids

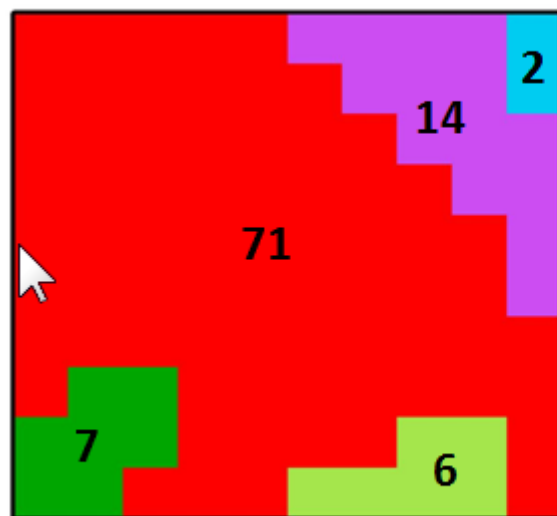


Statistics based on grid data

Land cover accounts for Europe
1990-2000 (26 countries)
2006 update (34 countries)

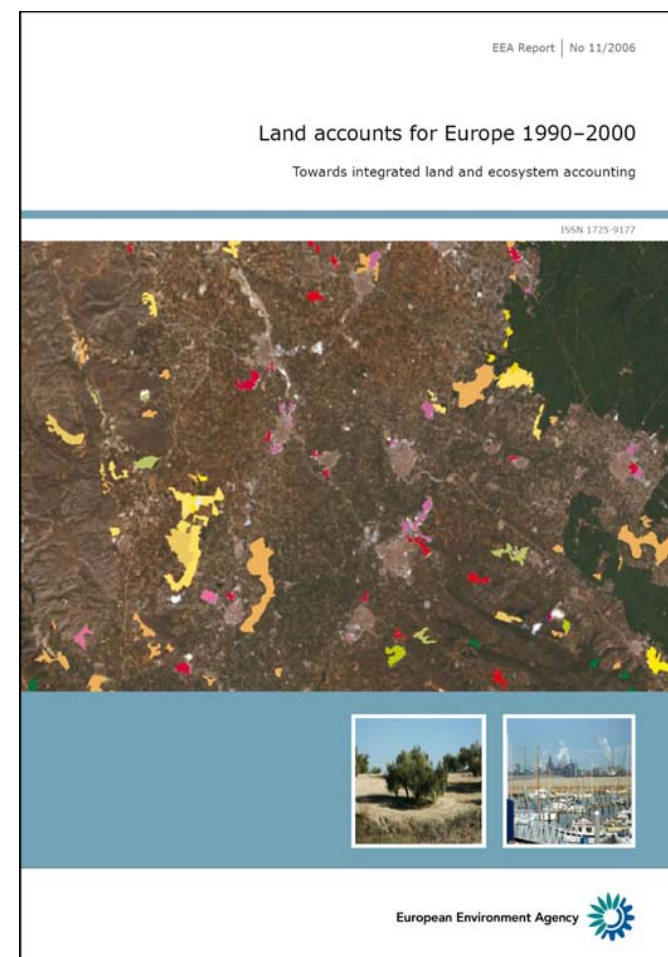
Land cover accounts are produced for
1 km² grid cells

K1000 E3666 N2073

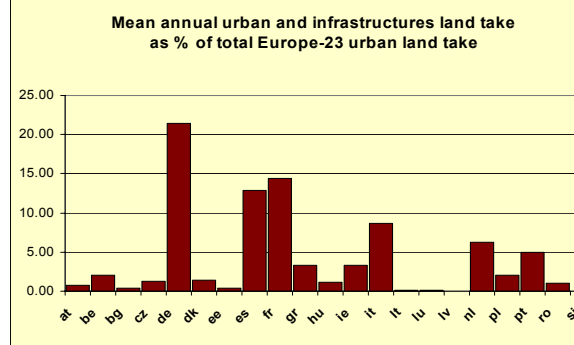
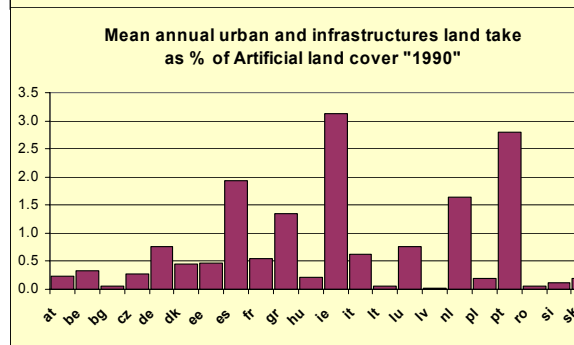
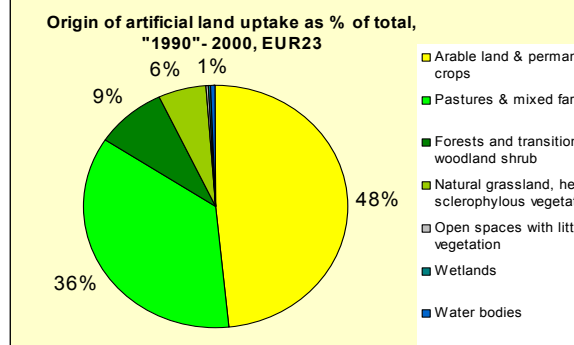
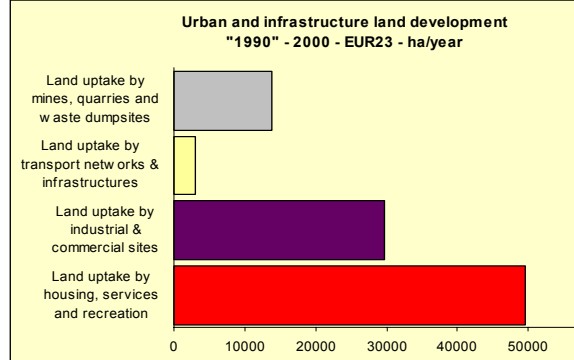
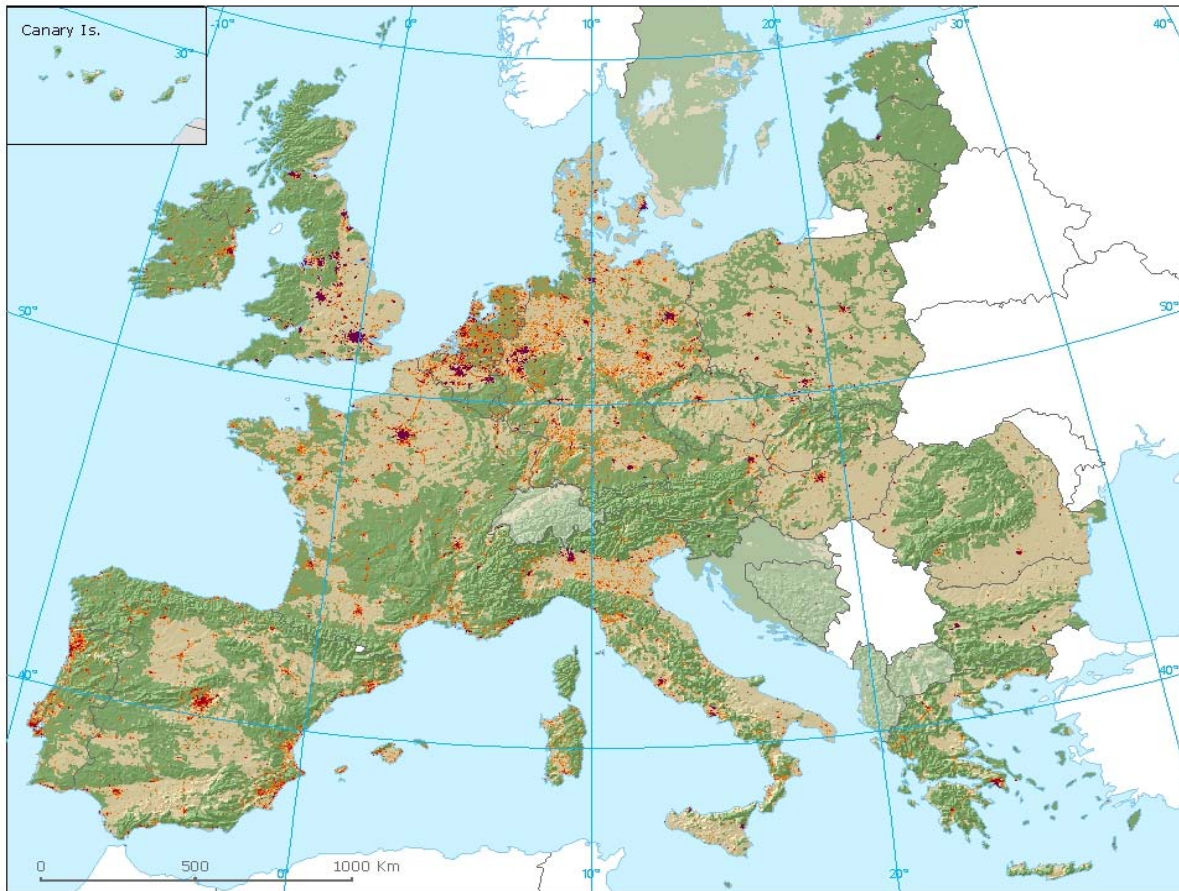


- Discontinuous urban fabric
- Industrial or commercial units
- Coniferous forest
- Sclerophyllous vegetation
- Water courses

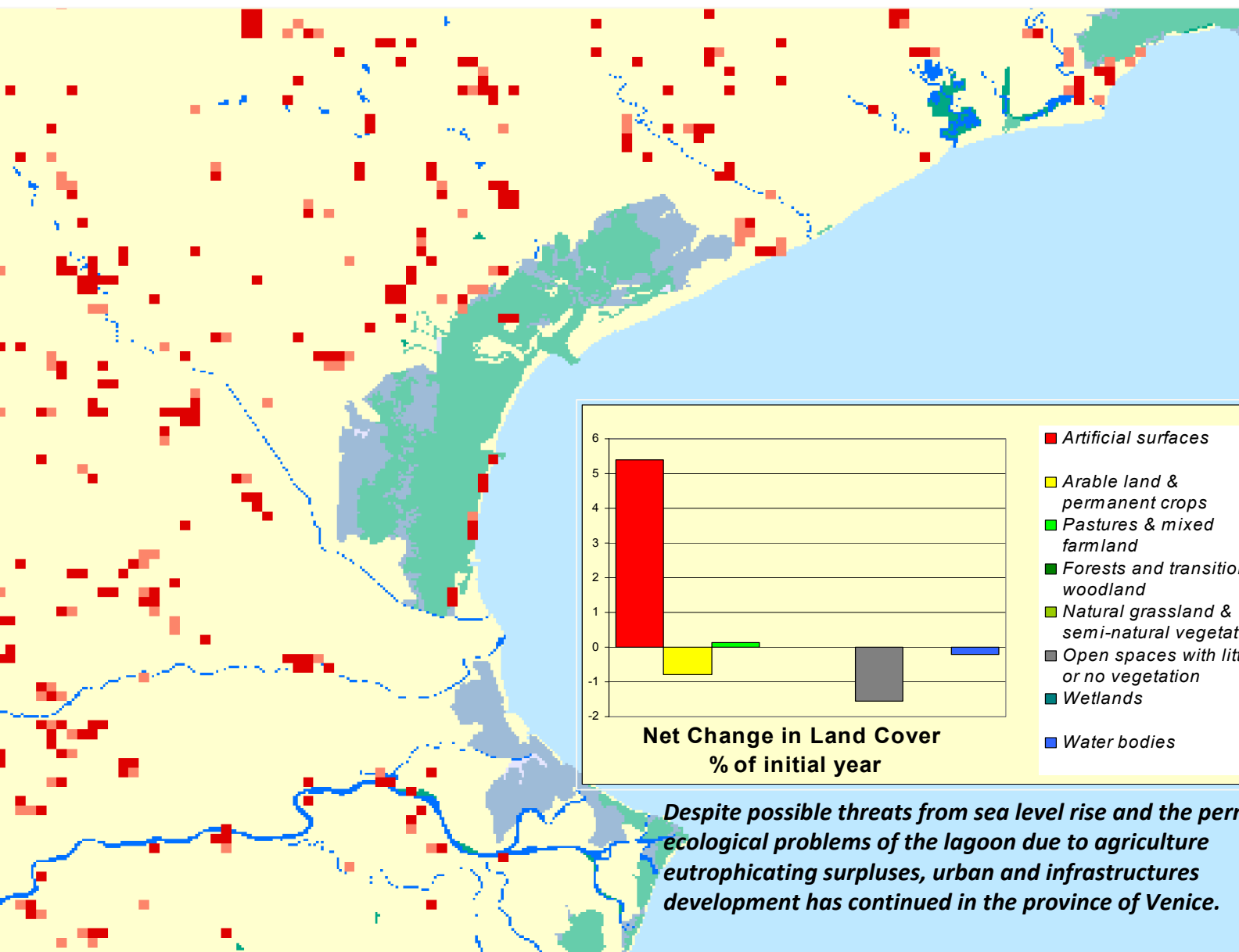
Total surface: 100 Ha



Sprawl of artificial areas 1990-2000



Urban sprawl in the province of Venice, 1990-2000, cells of 1 km², impact on wetlands



Legend

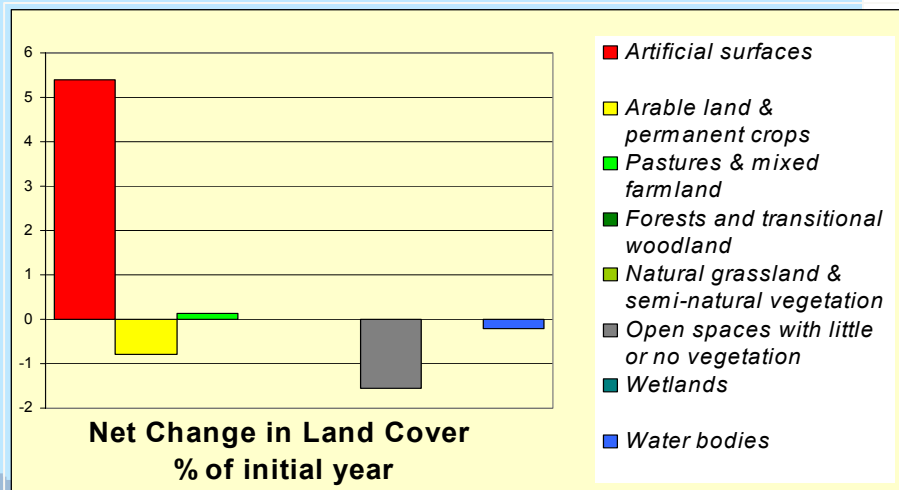
Land uptake by urban sprawl

Value

- 0 - 2
- 2 - 5
- 5 - 100

Wetlands

- Inland marshes
- Peat bogs
- Salt marshes
- Salines
- Intertidal flats
- Water courses
- Water bodies
- Coastal lagoons
- Estuaries



Despite possible threats from sea level rise and the permanent ecological problems of the lagoon due to agriculture eutrophication surpluses, urban and infrastructures development has continued in the province of Venice.

Definition of accounting and statistical units for ecosystem

UNA 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:

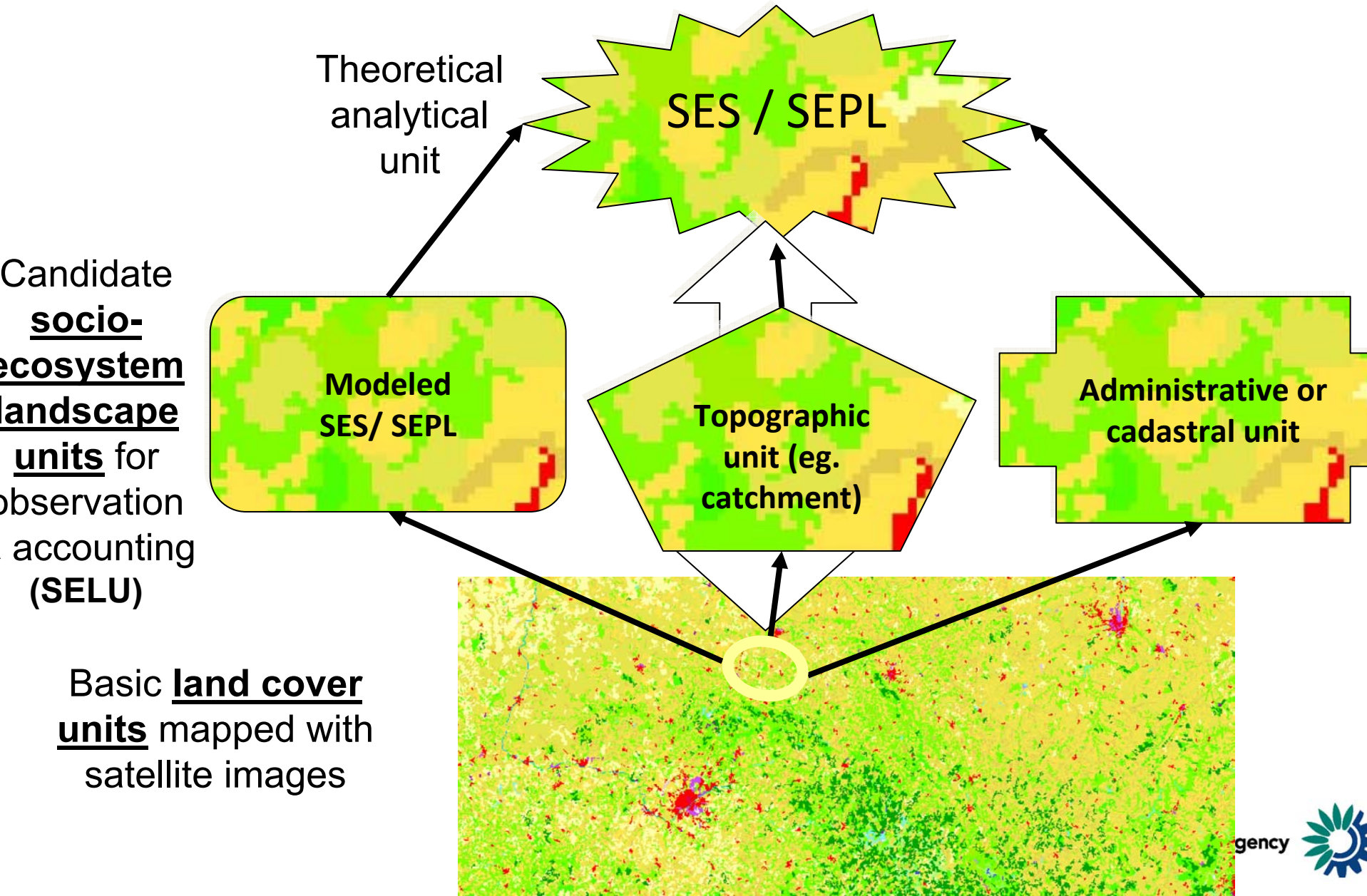
- For which we can collect data in a systematic way
- Mostly surface units: “geo-systems”, land cover units, functional administrative units, ownership units...



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.

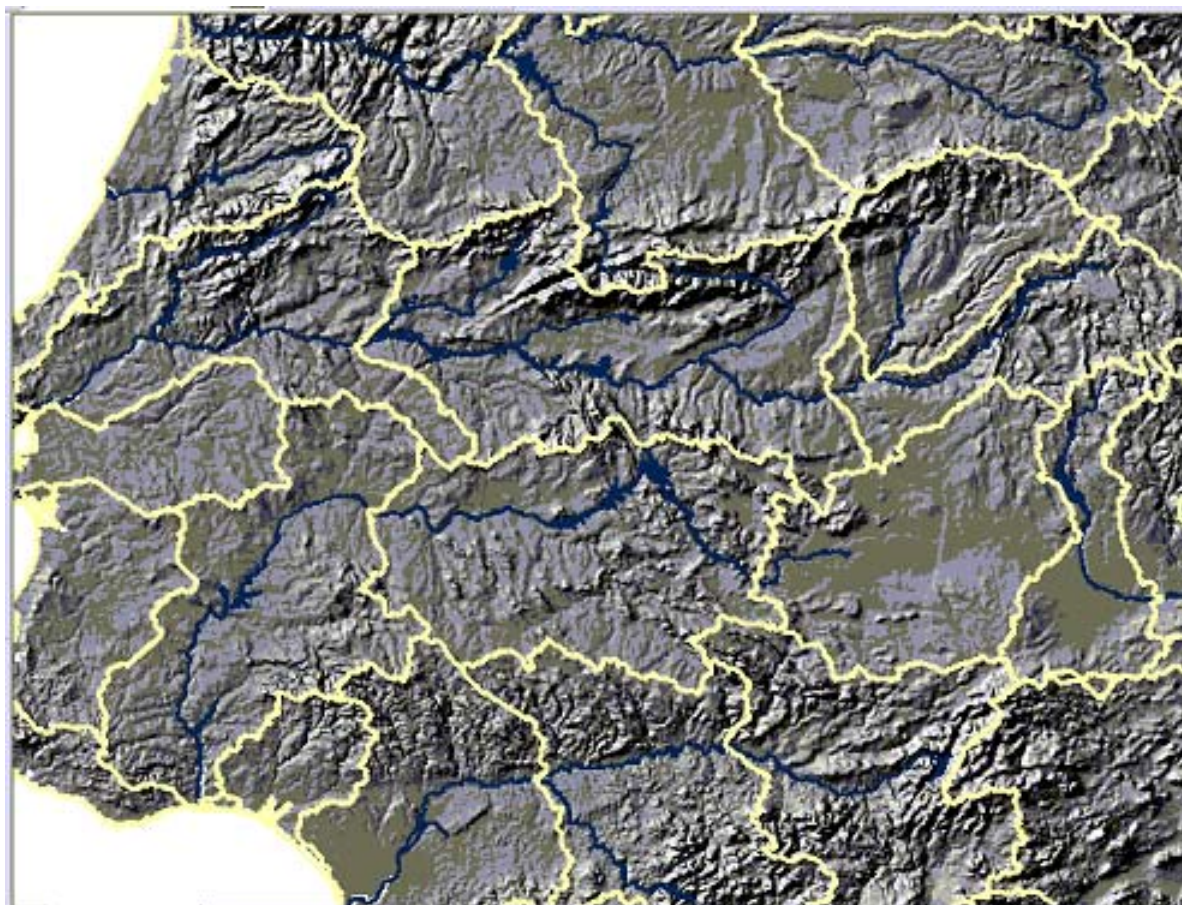


From theoretical to observation units



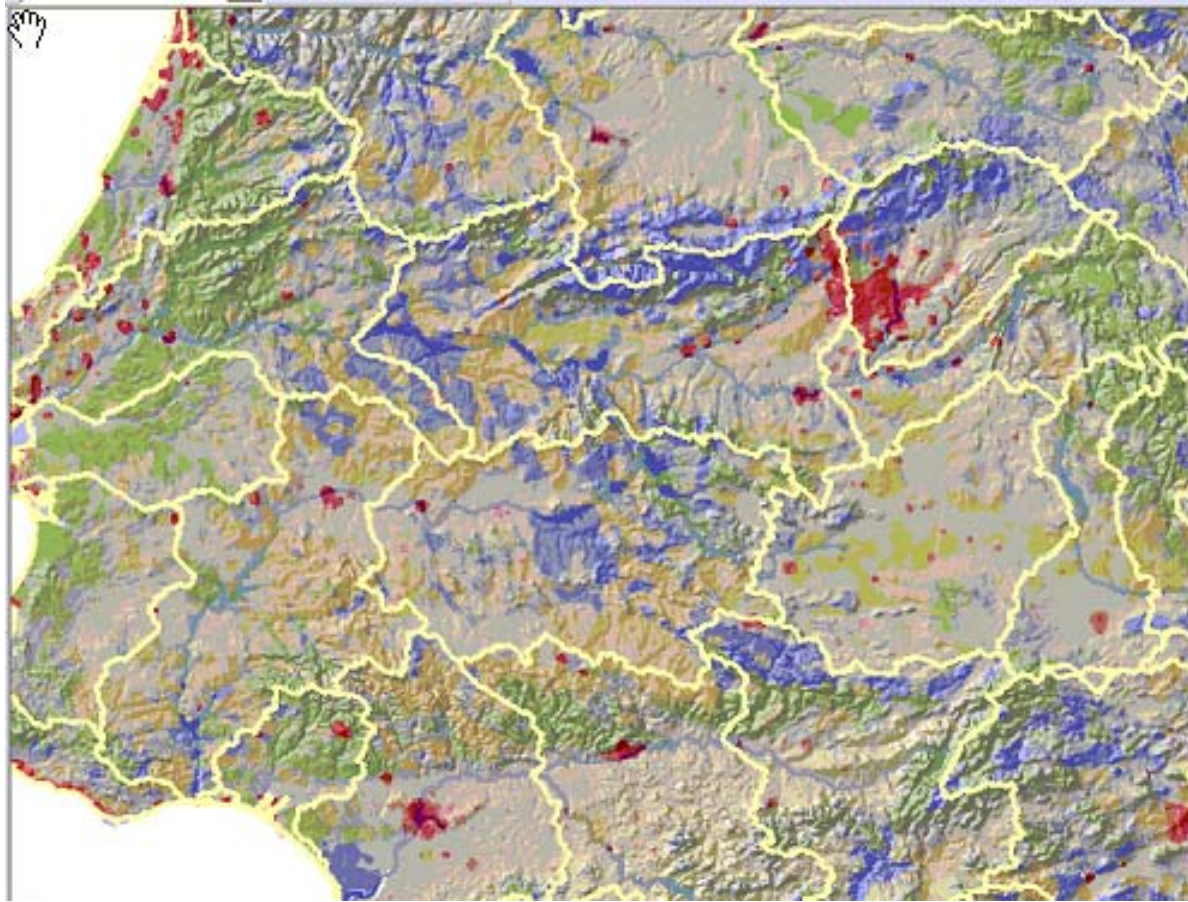
Mapping & classification of socio-ecological landscape units (SELU)

1- river basins and 2- relief



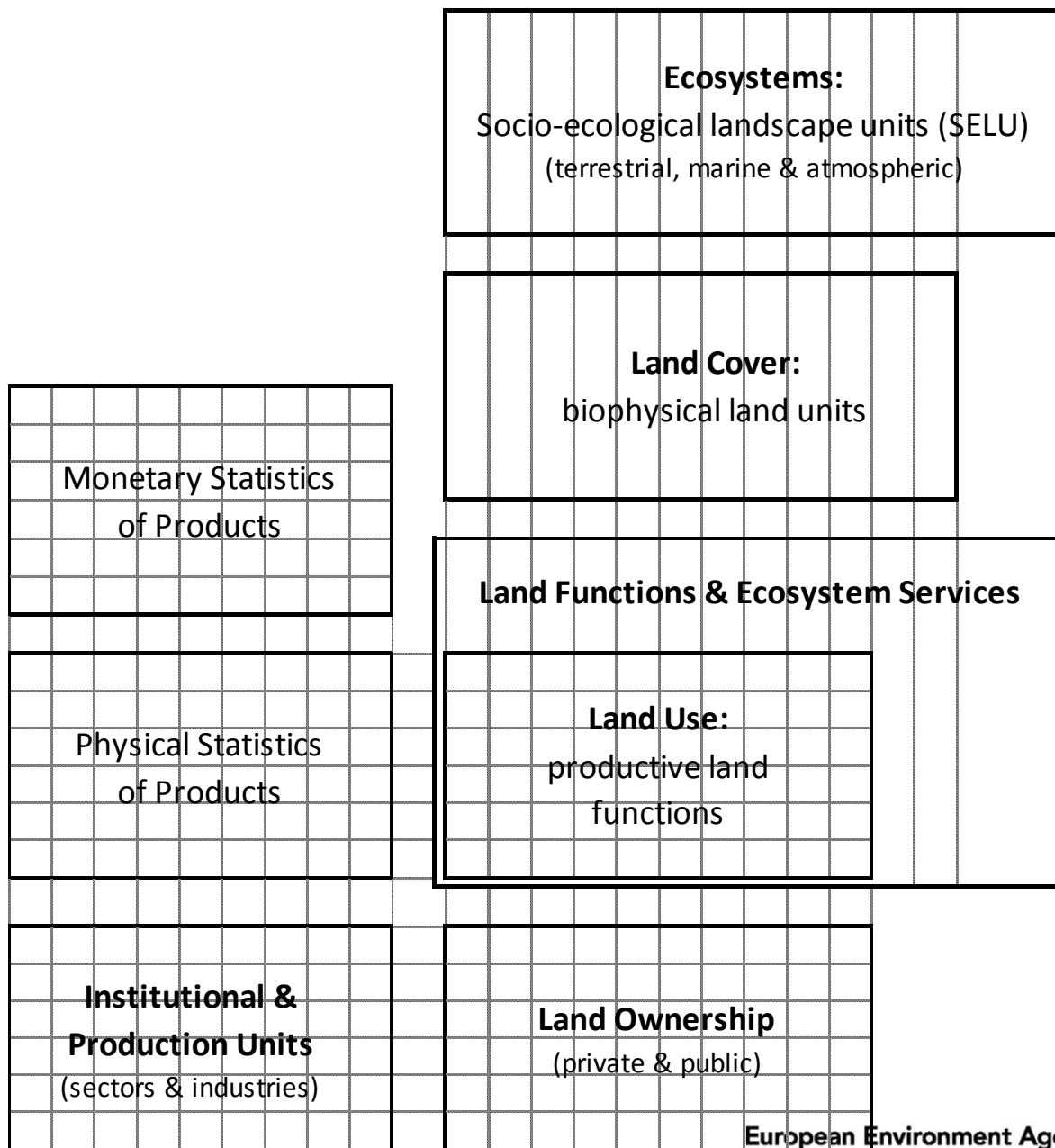
Courtesy Emil D. Ivanov, 2011

Mapping & classification of socio-ecological landscape units (SELU) 3- dominant landscape types (urban, intensive agriculture, mosaics, grassland, forests, other natural types and no-dominance)



Courtesy Emil D. Ivanov, 2011

Main relations between classifications & accounting units



Classification, the case of land cover

LCCS3 (FAO & UNEP) as international standard

- LCCS3 = a meta language

- Basic objects

- + characteristics

- + properties

- + spatial patterns

- ➔ Applications which are at the same time coherent and user defined

- LCCS3 = a software package

- LCCS3 = standard proposed for the SEEA land cover classification



Land cover types and derived land cover functional units

A	Herbaceous crop
A1	<i>Herbaceous crop/ Small size fields rainfed (< 2 ha)</i>
A2	<i>Herbaceous crop/ Medium to large size fields rainfed</i>
A3	<i>Herbaceous crop/ Medium to large size fields irrigated</i>
B	Tree or shrub crop
C	Multiple or layered crop
D	Tree covered area
E	Shrub covered area
F	Herb covered area
G	Sparse natural 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

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)



Open source tools to manage geo data and produce statistics

- Google Earth, MS Eye on Earth
- GRASS
- Quantum GIS
- SRING (INPE)
- HyperAtlas and OLAP Cube (EEA)