Workshop on Environment Statistics and Information for Sustainable Development in the Arab Region| 12-16 November 2018 | Beirut

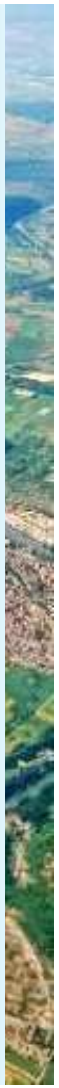
Land Monitoring

Copernicus overview
- role of EEA
- core services
- land monitoring

hans.dufourmont@eea.europa.eu

Copernicus Europe's eyes on Earth

European Commission



Land Monitoring

European programme for monitoring the Earth

Combines satellite observation data with data from sensor networks on the Earth's surface to build a comprehensive picture of our planet and its environment

Three components :

- Space
- Services (six areas: land, marine, atmosphere, climate change, emergency management and security)
- In Situ

Managed by the European Commission, implemented by MS, ESA, European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), European Centre for Medium-Range Weather Forecasts (ECMWF), EU Agencies and Mercator Océan.

EEA coordinates the Copernicus Land Monitoring Service (CLMS) and the Copernicus In Situ Component (under a Delegation Agreement with the European Commission).

Information services **freely and openly** accessible to all users

European Commission | eurostat

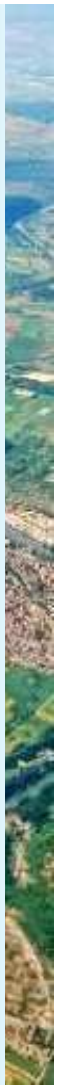
European Commission | Copernicus Europe's eyes on Earth

Current EEA - Eionet roles in Copernicus 2014-2020

Source: http://www.eea.europa.eu/themes/air/air-quality-index/index

Land Monitoring

Core environment services



Land Monitoring

Copernicus Emergency Service (CES)

Emergency response

Natural disasters

anthropogenic emergency situations

Humanitarian crises

Activities wrt preparedness, protection and reconstruction

European Commission | Copernicus Europe's eyes on Earth

Land Monitoring

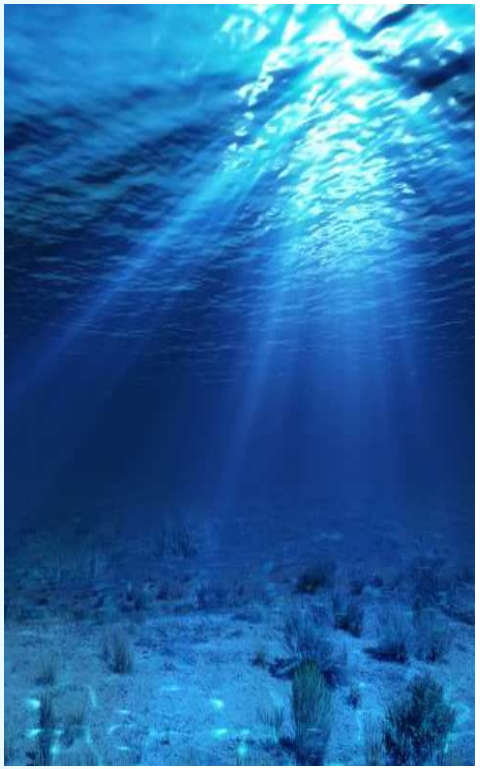
Copernicus Atmosphere Monitoring Service(CAMS)

- Air quality and atmospheric composition 
- Variables of climate forcing 
- Ozone layer & UV 
- Solar Radiation 
- Emissions and surface fluxes 

European Commission | Copernicus Europe's eyes on Earth

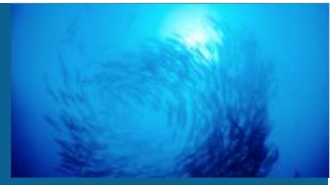
Land Monitoring

Copernicus Marine Environment Monitoring Service (CMEMS)



Maritime security

Marine ressources



Coastal and marine environnement

Meteorologie, seasonal predictions and climatology

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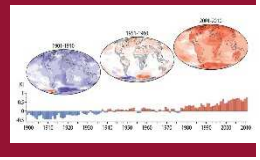
Land Monitoring

Copernicus Climate Change Service (C3S)

Estimation of essential climat variables (ECVs)

Global and regional re-analyses



Seasonal predictions and climate projections

Support to mitigation and adaptation strategies

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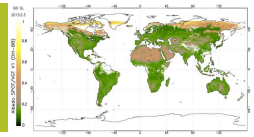
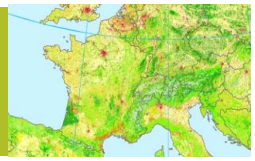
Land Monitoring

Copernicus Land Monitoring Service (CLMS)

Systematic Biophysical Monitoring



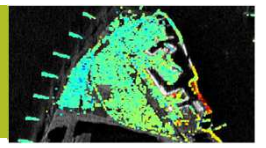
Land Cover & Land Use mapping



Thematic hotspot mapping

Reference data

Ground Motion service

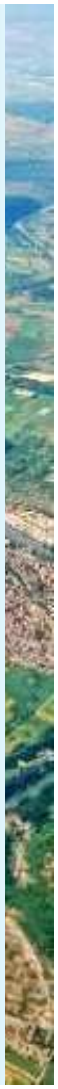


European Commission | Copernicus Europe's eyes on Earth

Land Monitoring

Core Land Monitoring Service

- global
- pan-European (mosaics, CLC, HRLs
- hotspot monitoring (Urban Atlas, Riparian Zones, N2K)
- Reference data (EU-DEM, EU-hydro)
- Upcoming products (coastal, HR-phenology, Snow & ice

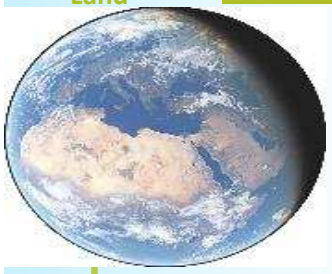


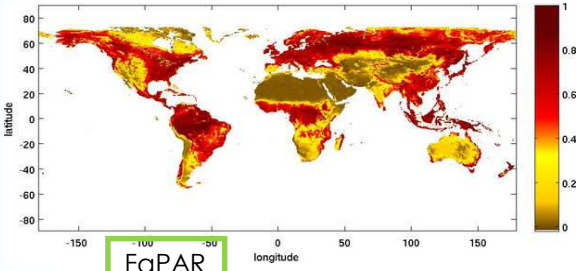
Copernicus Europe's eyes on Earth

European Commission

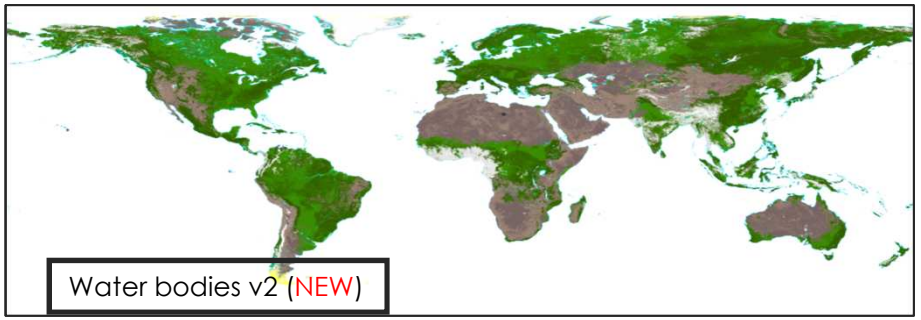
Global Land Monitoring Service (GLMS): Global vegetation, water & energy parameters

Land

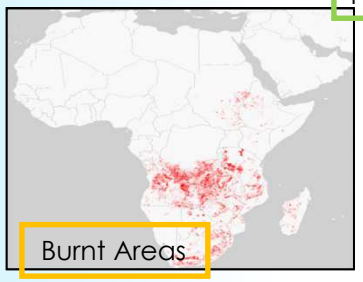




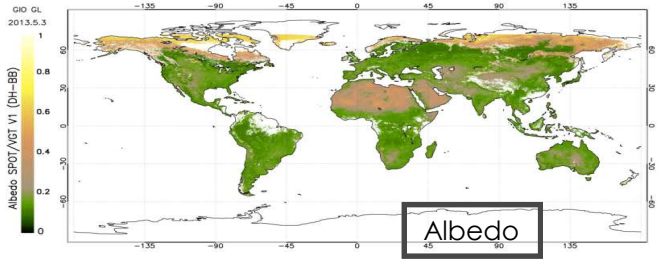
FaPAR



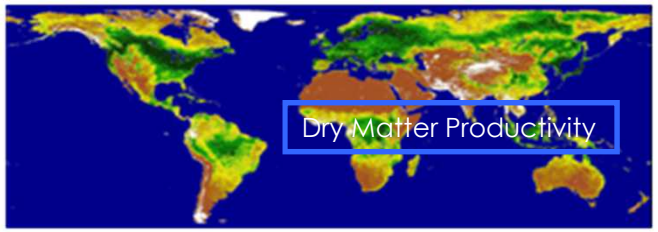
Water bodies v2 (NEW)



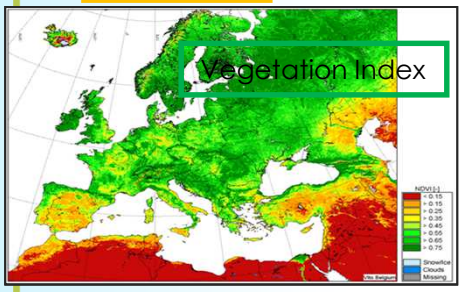
Burnt Areas



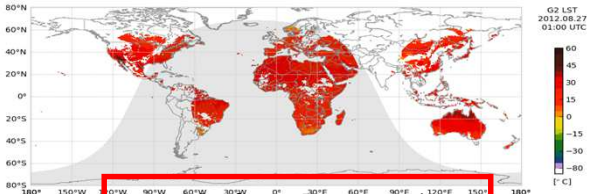
Albedo



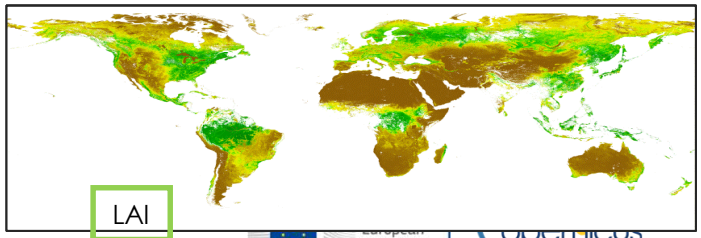
Dry Matter Productivity



Vegetation Index



Land Surface Temperature



LAI

JRC
EUROPEAN COMMISSION

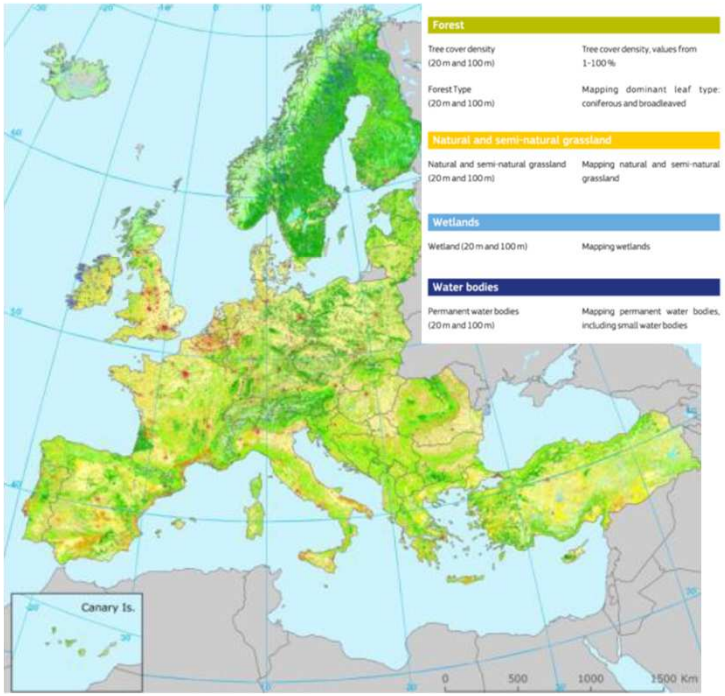
European Commission

Copernicus
Europe's eyes on Earth

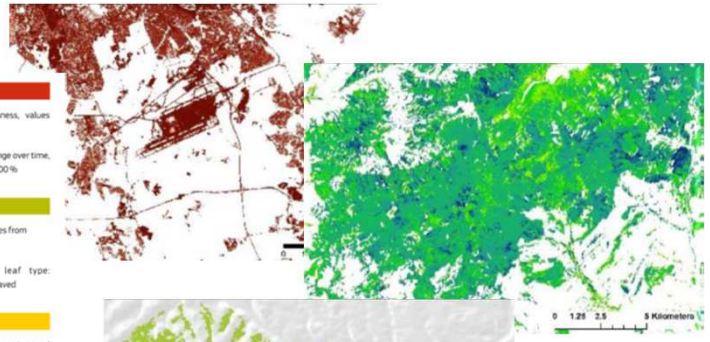
Land Monitoring

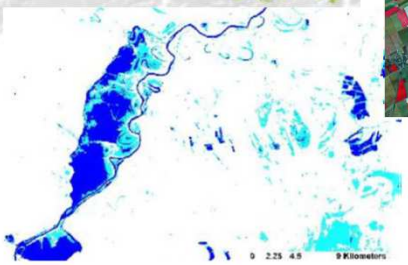
Copernicus Land Monitoring Core Services

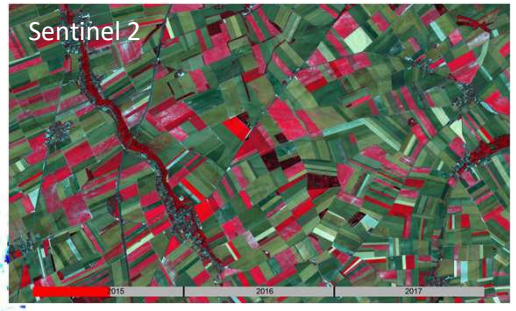
wall-to-wall coverage



Imperviousness	
Degree of Imperviousness 2012 (20 m and 100 m)	Degree of imperviousness, values from 1-100 %
Imperviousness density change 2009-2012 (100 m)	Mapping degree of change over time, values from -100 to +100 %
Forest	
Tree cover density (20 m and 100 m)	Tree cover density, values from 1-100 %
Forest Type (20 m and 100 m)	Mapping dominant leaf type: coniferous and broadleaved
Natural and semi-natural grassland	
Natural and semi-natural grassland (20 m and 100 m)	Mapping natural and semi-natural grassland
Wetlands	
Wetland (20 m and 100 m)	Mapping wetlands
Water bodies	
Permanent water bodies (20 m and 100 m)	Mapping permanent water bodies, including small water bodies







information services at local, national, European level

Long-term time series change monitoring

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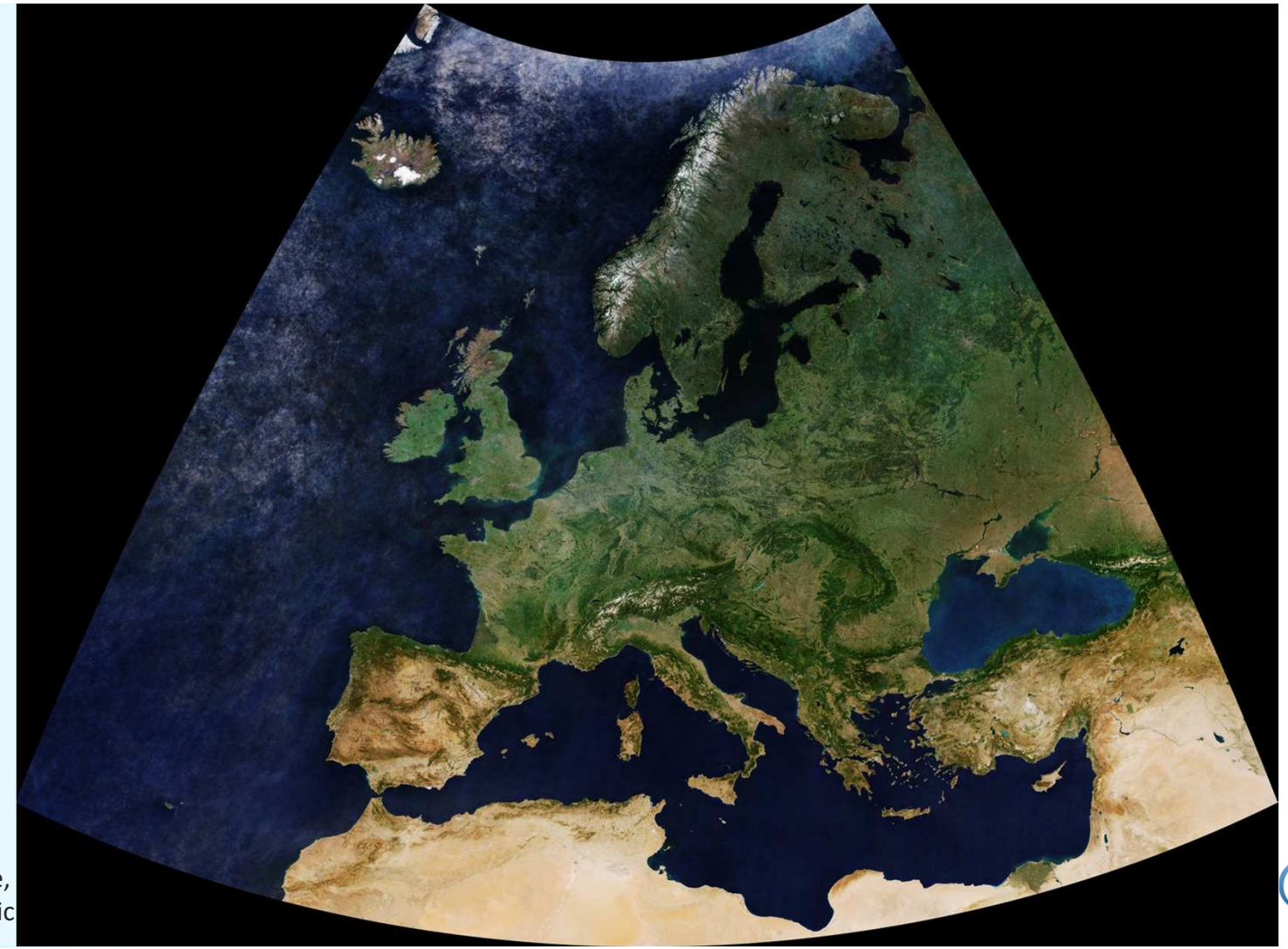
Land Monitoring



Source: Sinergise, S3 mosaic

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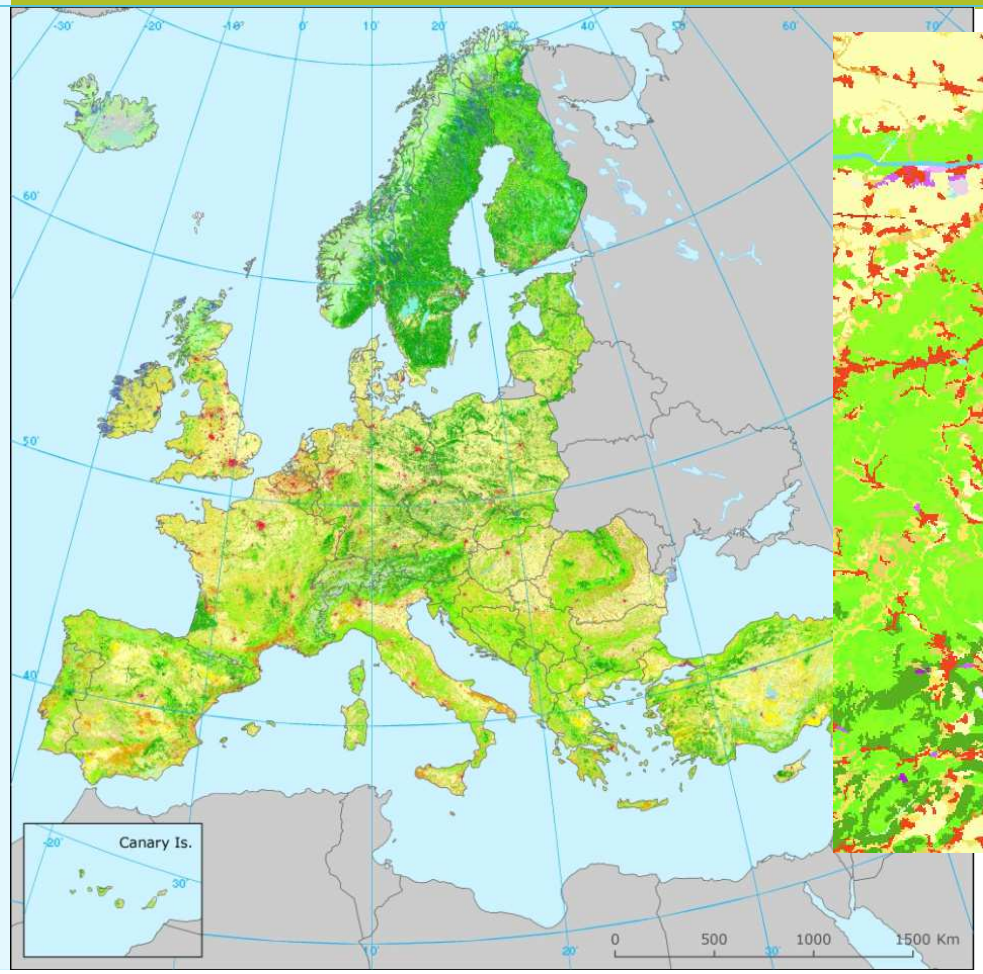
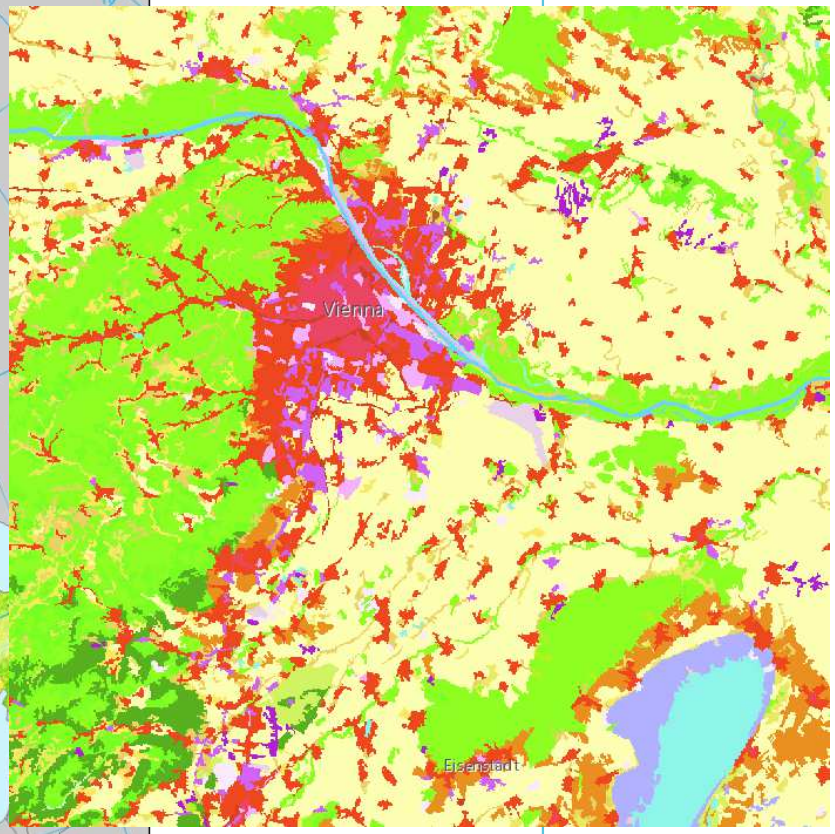
Europe's eyes on Earth

Land Monitoring

CORINE Land Cover time series: 1990 – 2000 – 2006 – 2012 - 2018





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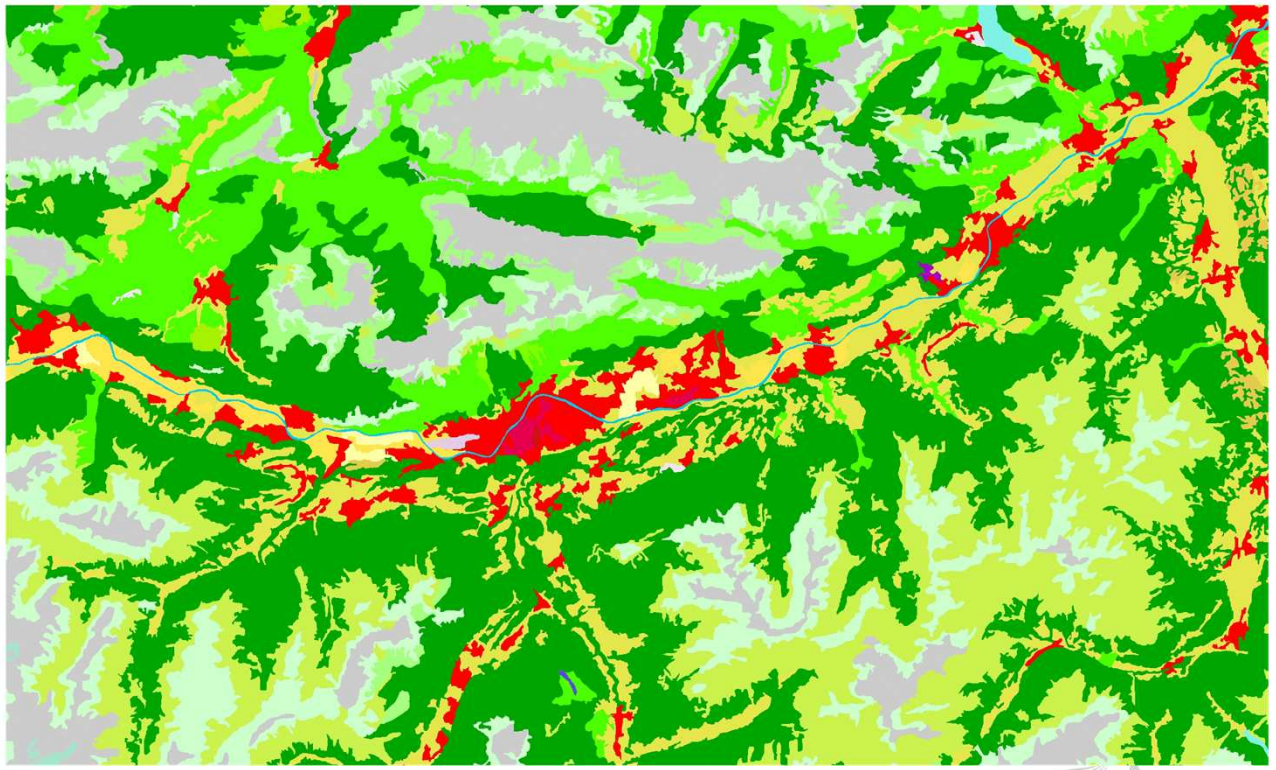
Land Monitoring

Urban Atlas 2006 – 2018 (Innsbruck, AT)

CLC 1990



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Land Monitoring

pan-European component – High Resolution Layers (HRL's)

Imperviousness and imperviousness change products

- Degree of Imperviousness and Imperviousness Change (0-100%)
- 2006-2009-2012-2015
- 20 m and 100 m

Forest

- Tree Cover Density (0-100%)
- Dominant Leaf Type
- 2012-2015
- 20 m and 100 m

Grassland

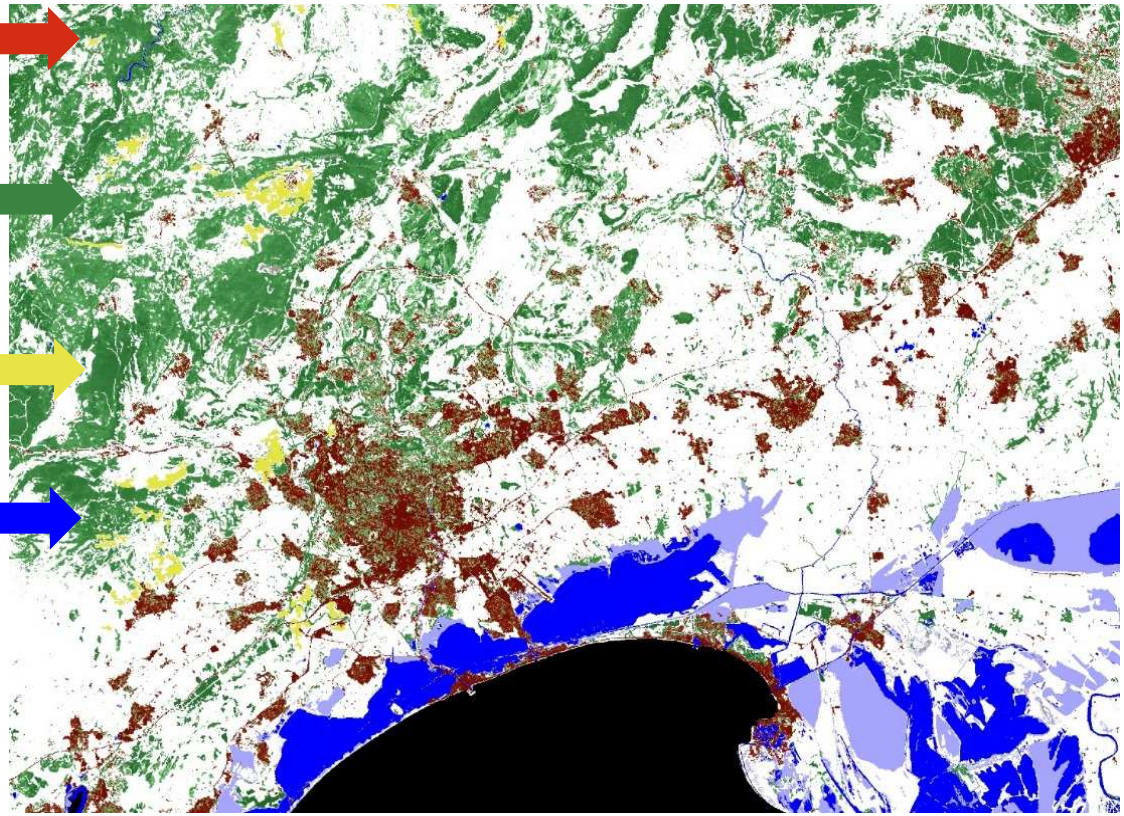
- Grassland (binary)
- 2012
- 20 m and 100 m

Water and Wetness

- Permanent/Temporary Water
- Permanent/Temporary Wetness
- Based on 2009-2016 time series

Small Woody Features

- Linear and patchy structures (binary)
- 2015



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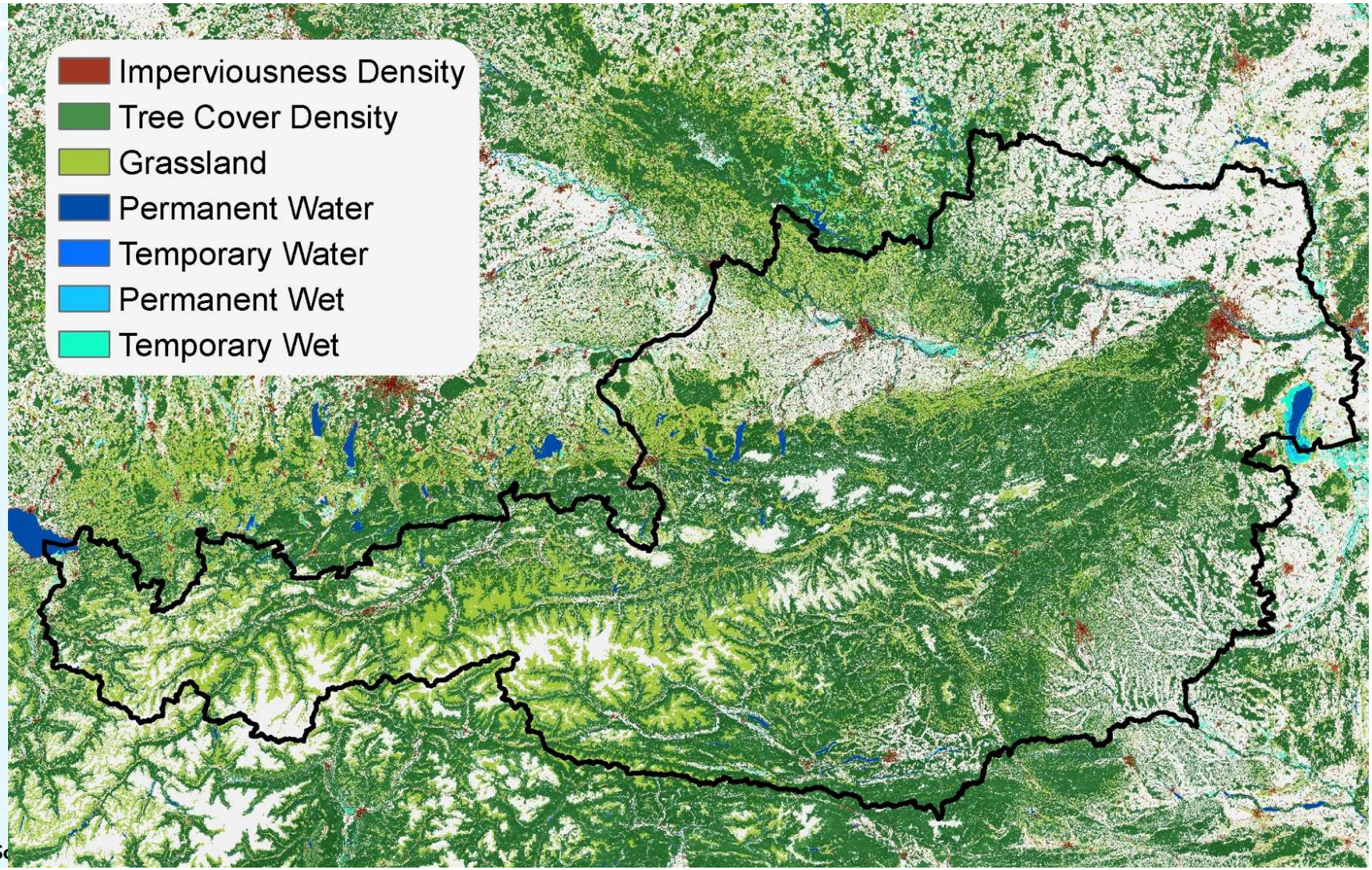
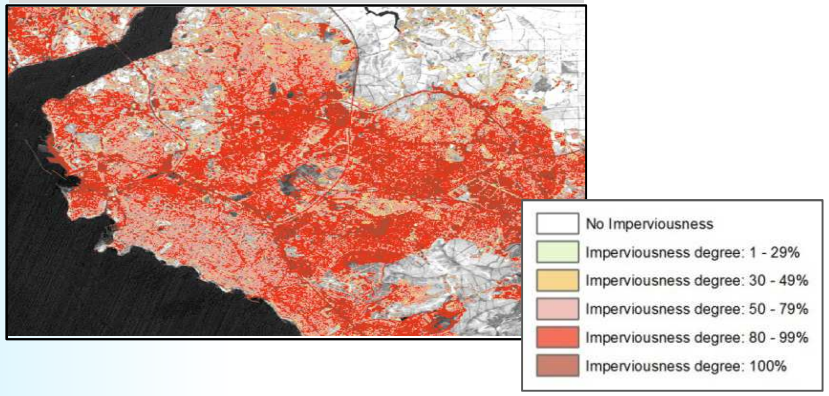
Land Monitoring



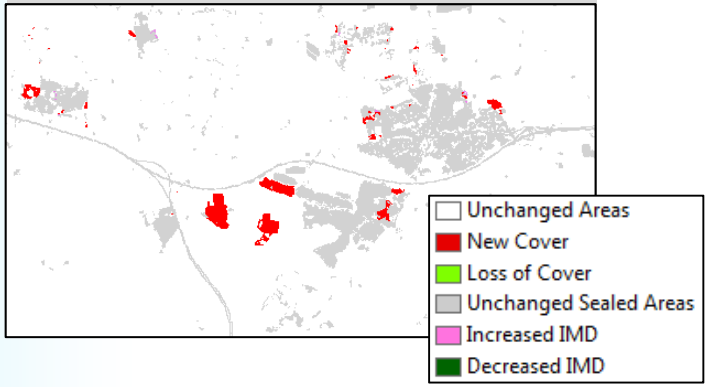
Land Monitoring

HRL Imperviousness (IMD)

Degree of Imperviousness 2015

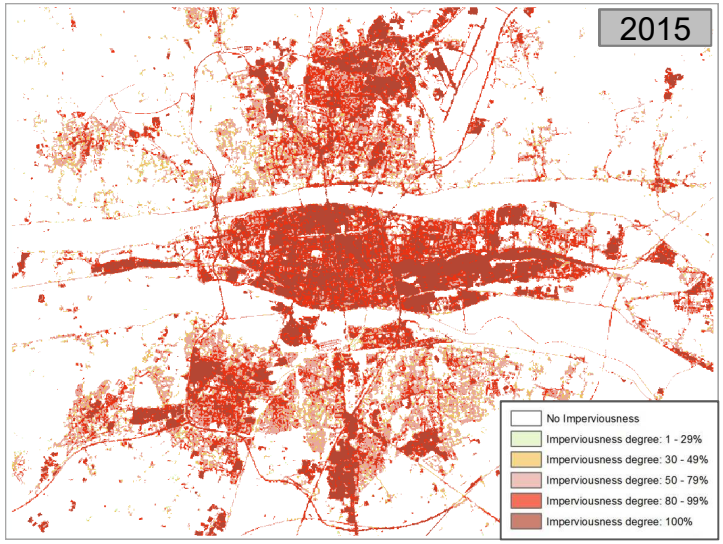


Imperviousness Classified Change 2012-2015



Level of sealing of soil:

High-quality information on imperviousness change in Europe (2006/2009/2012/2015).



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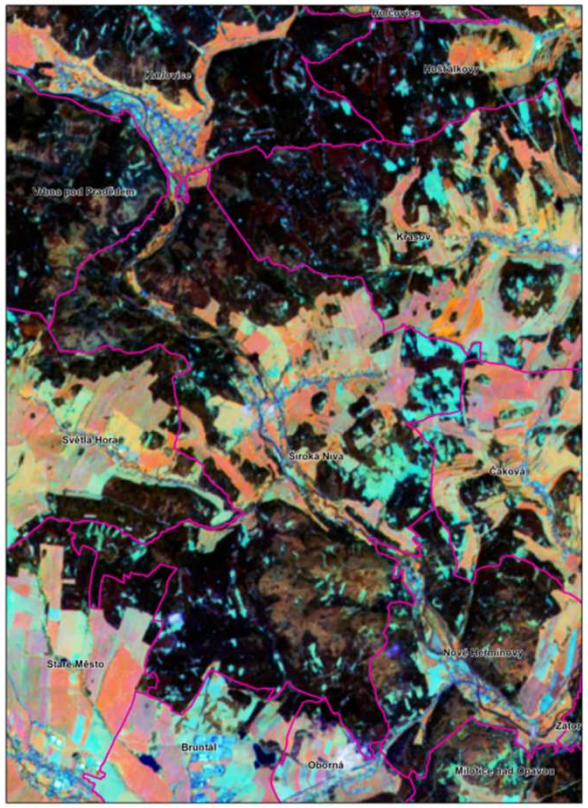
Land Monitoring

Monitoring Forest degradation in CZ (2011 – 2017)

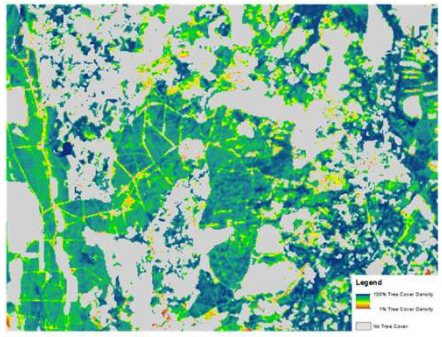
2011

květen 2011



Top: Bark beetle affecting forests

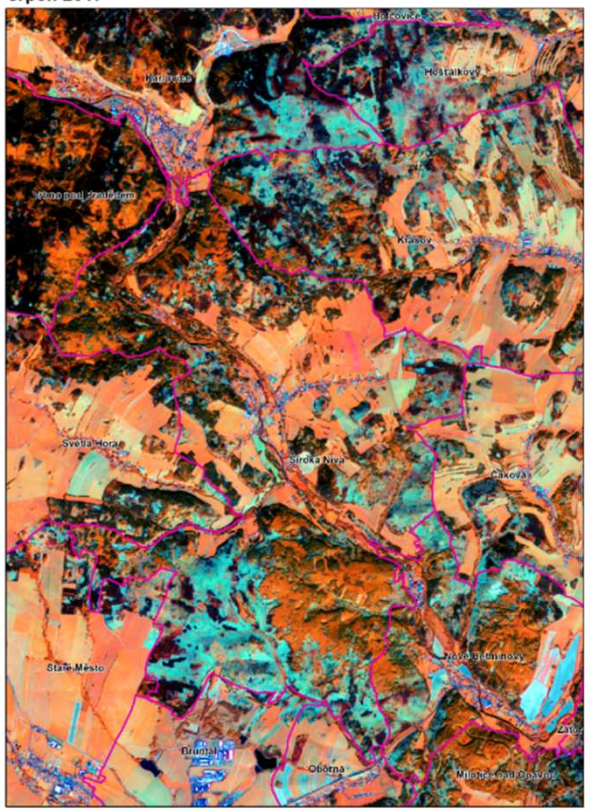
Bottom: Tree Cover Density Map



20m Tree Cover Density 2015. *Produced using modified Copernicus Sentinel data [2016]*

2017

srpen 2017



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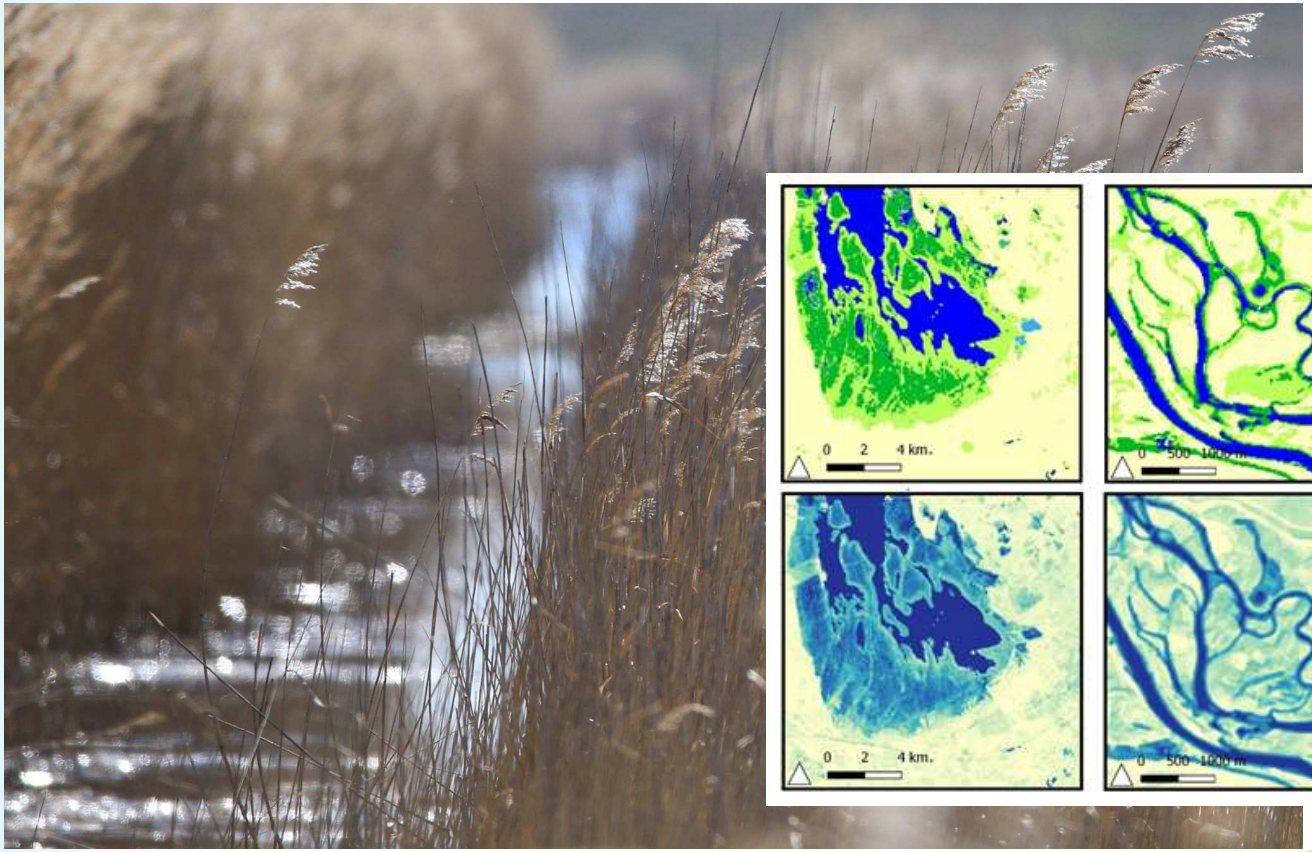
Land Monitoring

HRL wetness and water (WAW)



Water and Wetness

- Dry areas
- Permanent water
- Temporary water
- Permanent wet
- Temporary wet
- Unclassifiable

Water Wetness Probability Index (WWPI)

100 %

0 %

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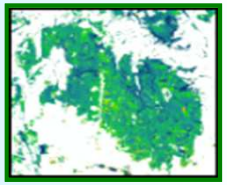
Land portfolio interdependencies: Hotspot Monitoring component: Riparian Zones example

Land Monitoring

VHR imagery

Urban Atlas



HRL Forest

RZ LCLU

Extent RZ

GLEs

EU-hydro

EU-DEM

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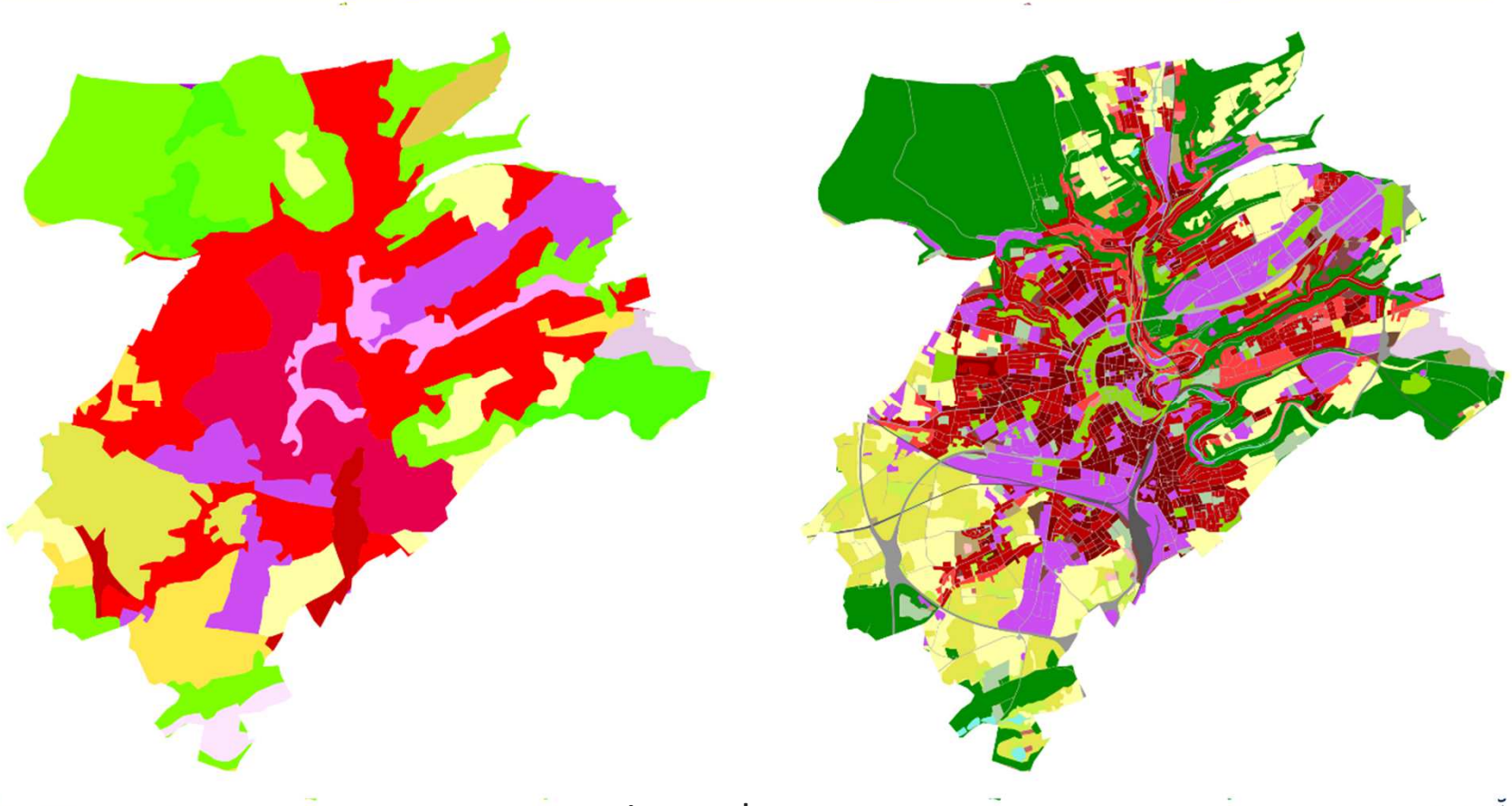
Land
Monitorir

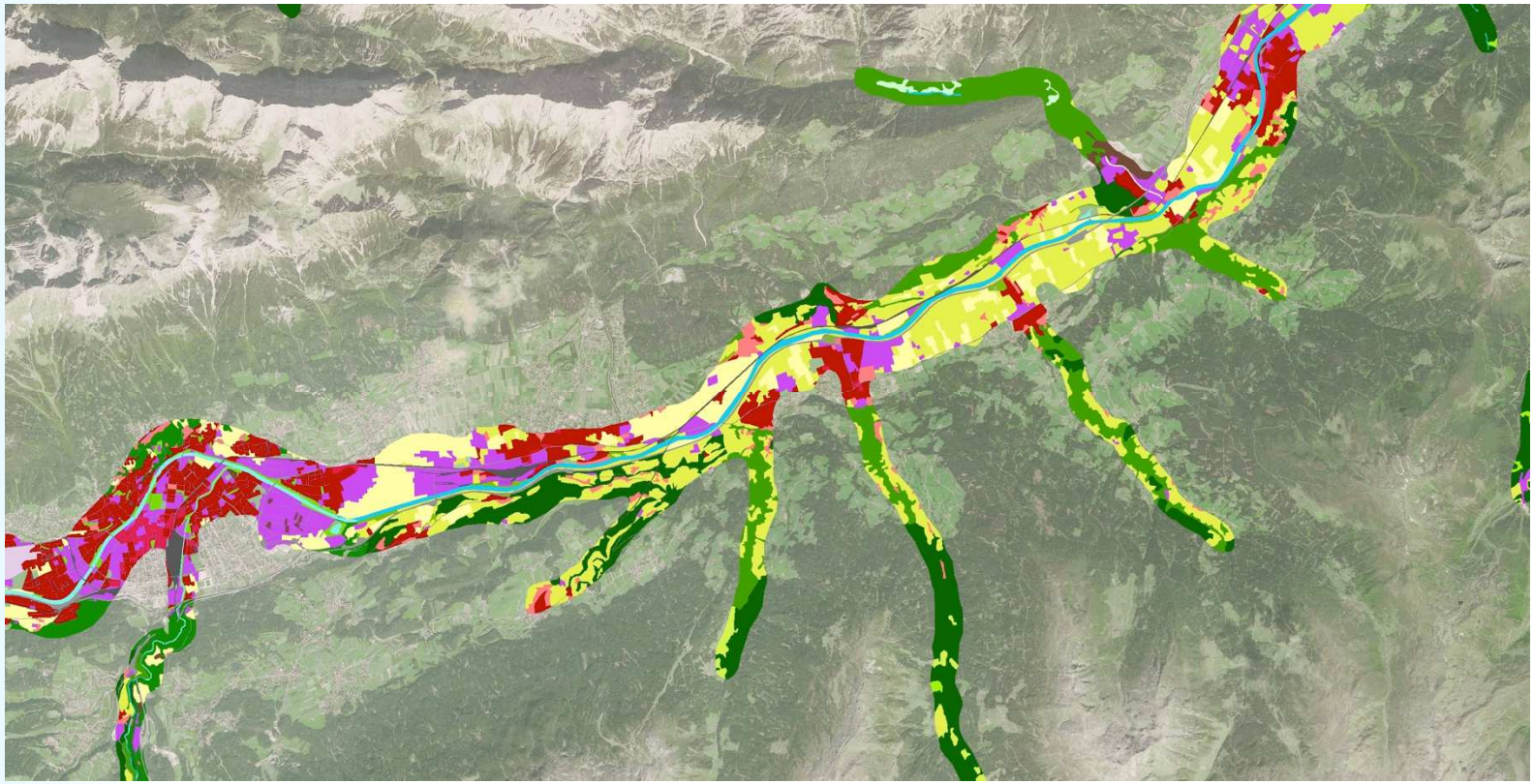
From pan-European (CLC) to hotspot (Urban Atlas) monitoring



Luxembourg

Land Monitoring

VHR + Riparian Zones



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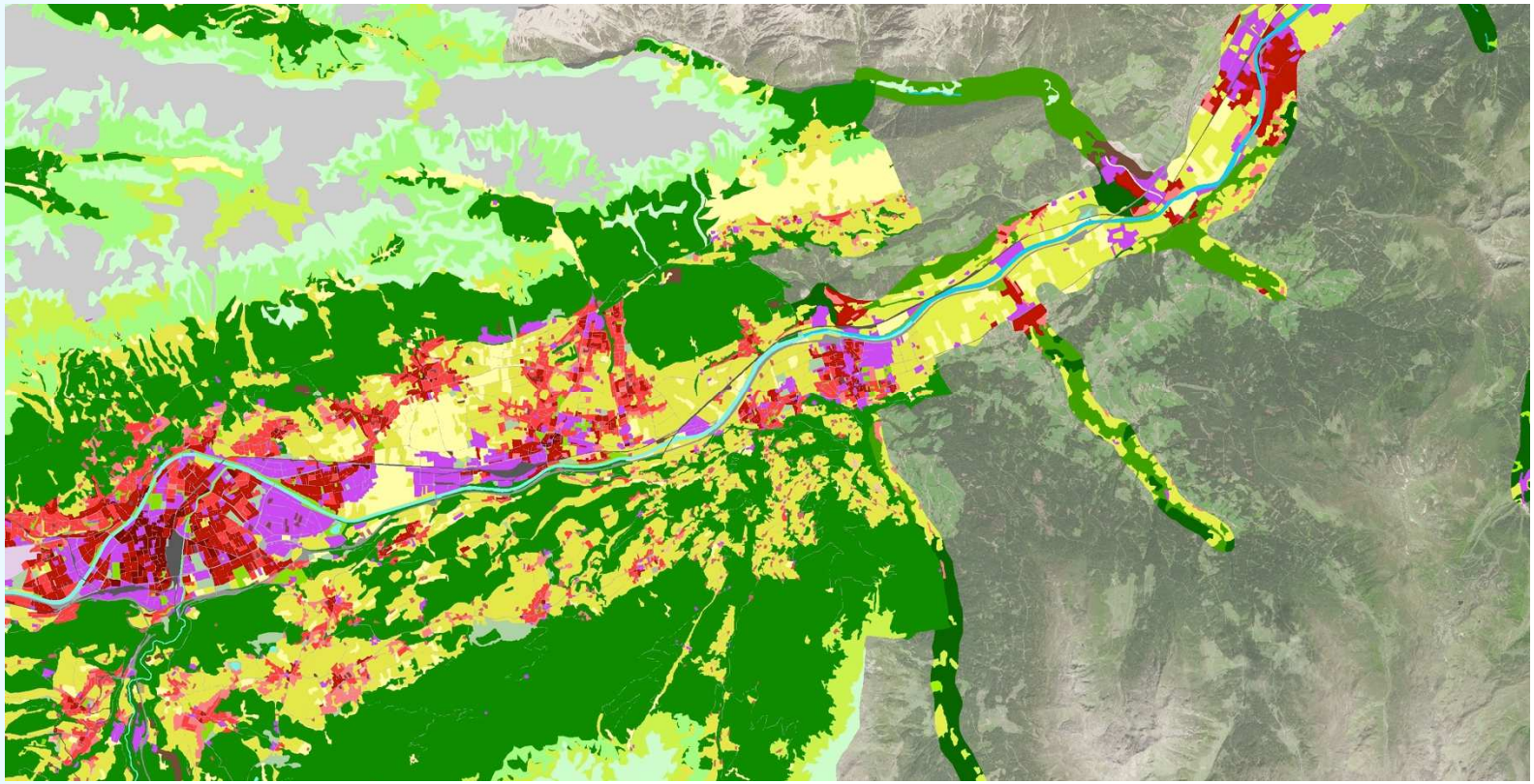
Land Monitoring

VHR + RZ + Urban Atlas



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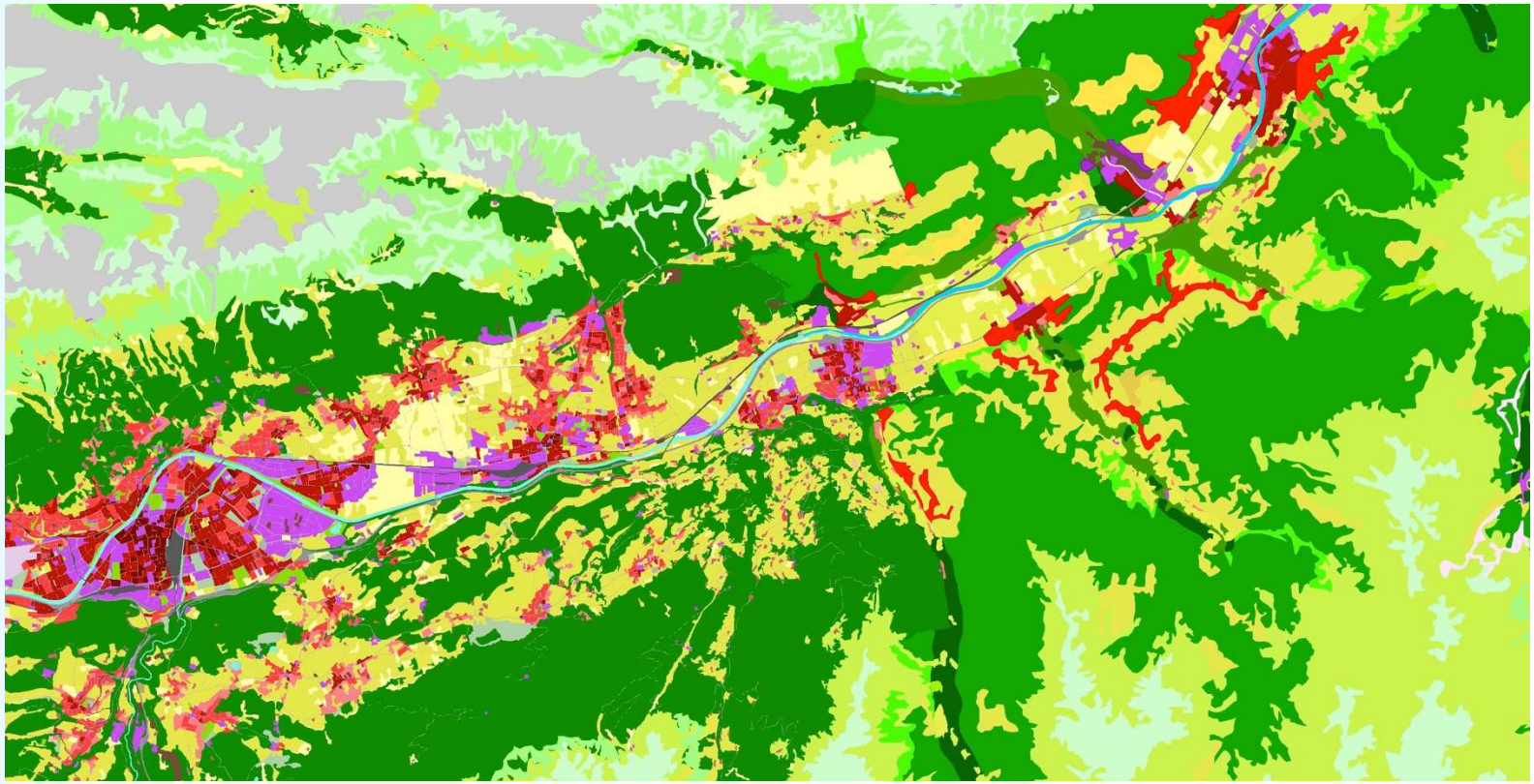
Land Monitoring

VHR + RZ + UA + CLC



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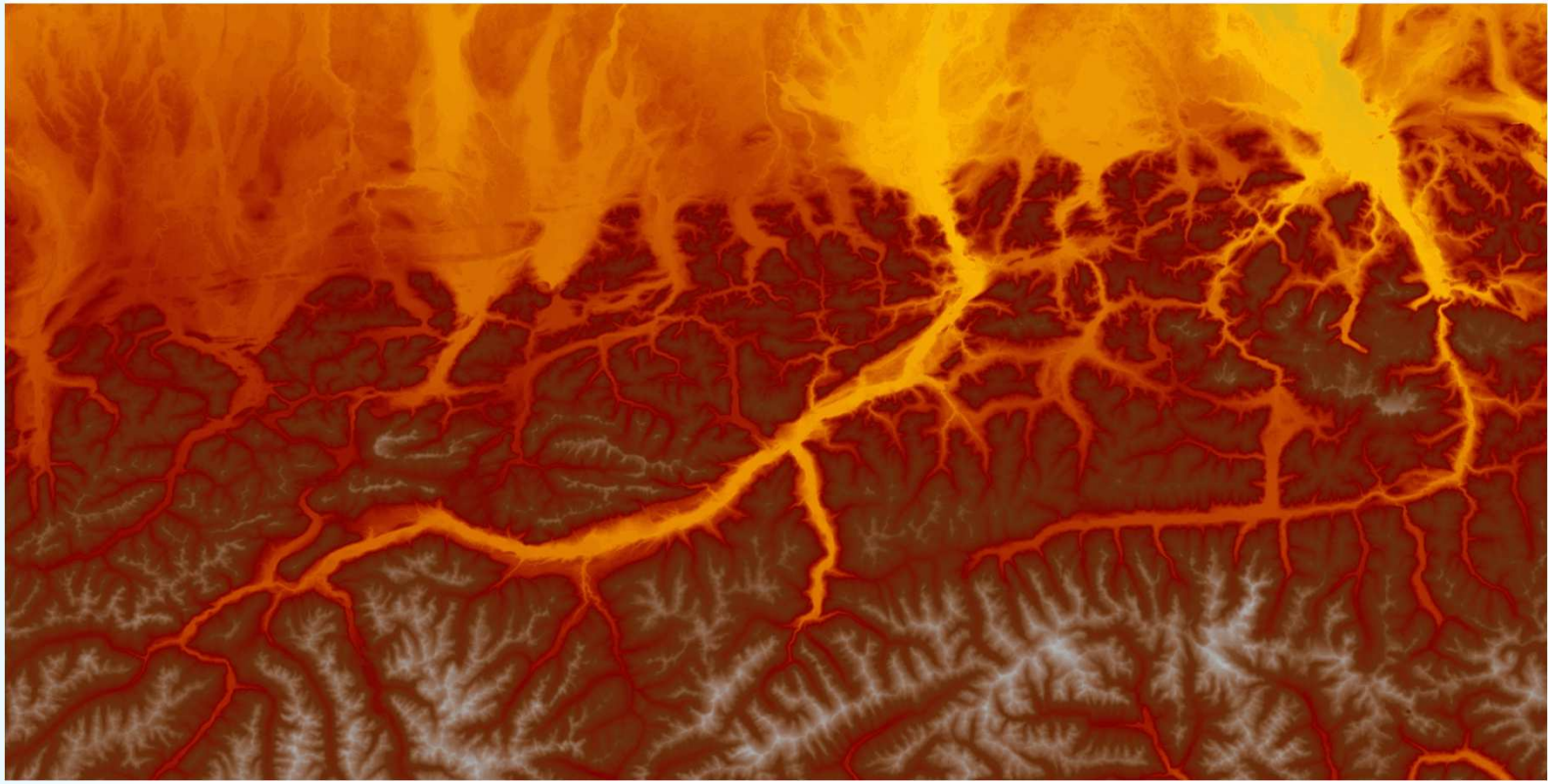
Land Monitoring

EU-DEM
(height, shaded relief, slope, aspect, hill-shade)



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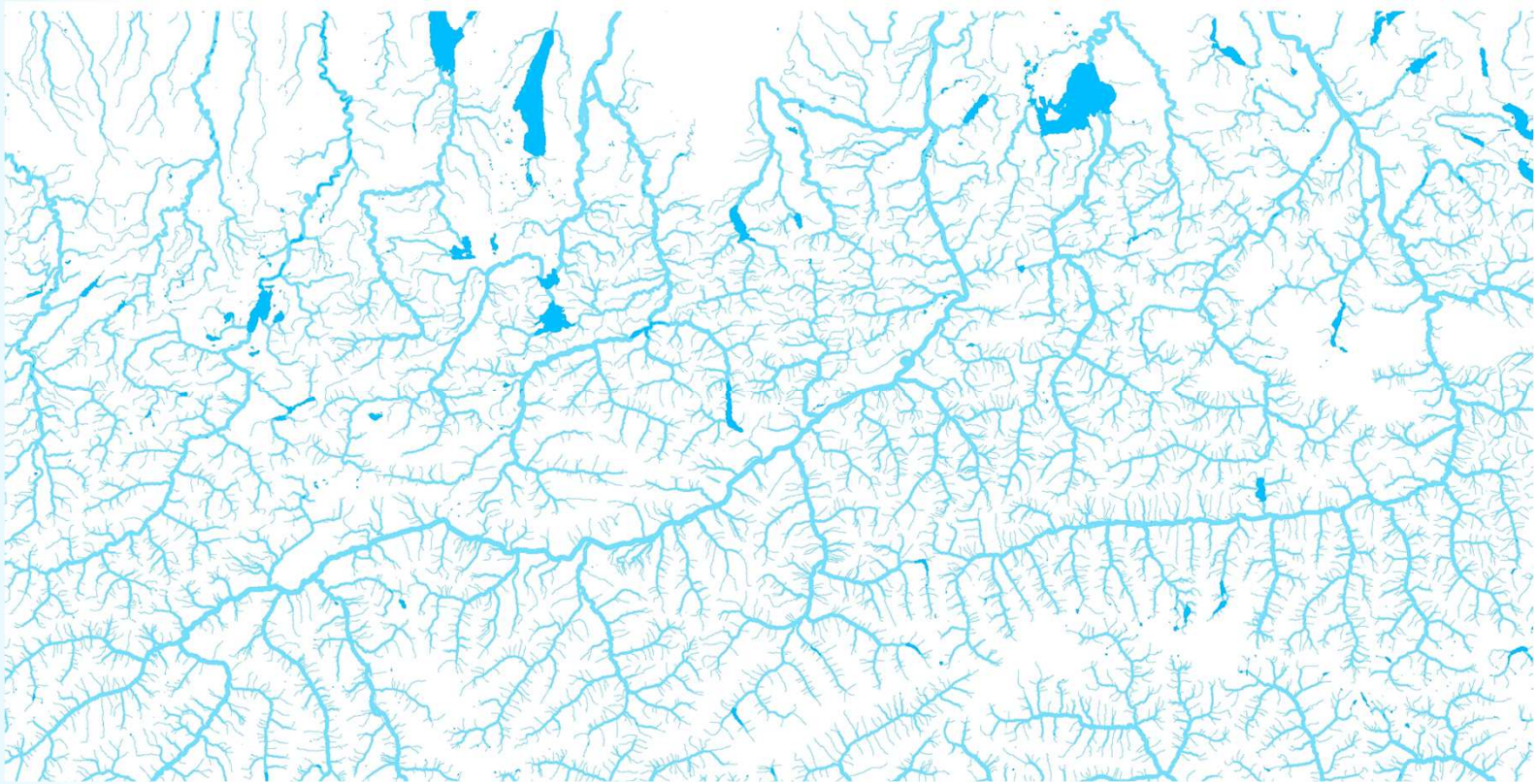
Land Monitoring

EU-DEM & EU-hydro



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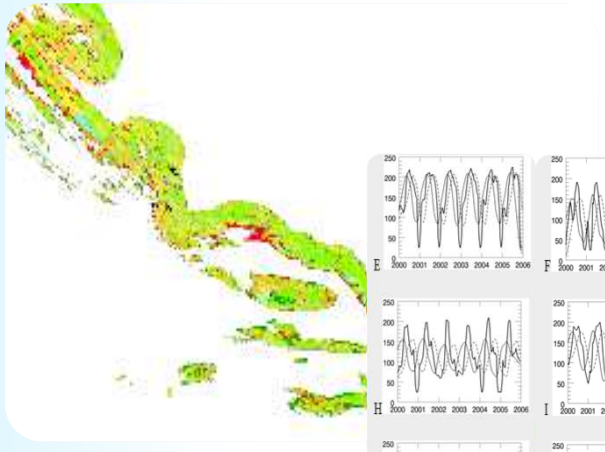
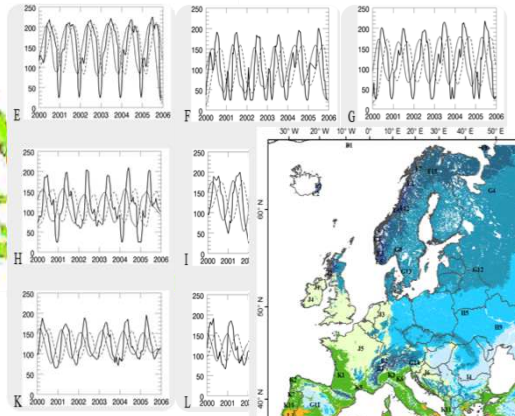
Land Monitoring

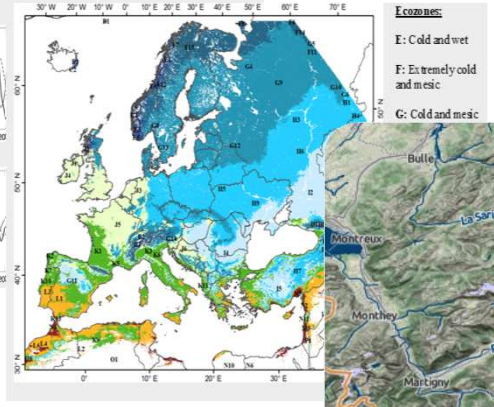
New products (CZ, HR-pheno, Snow & Ice)

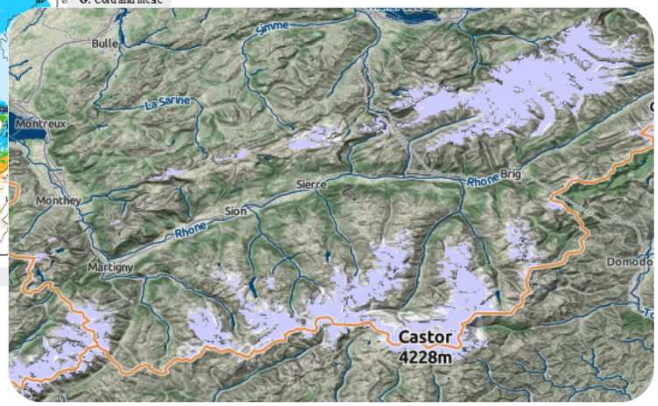


LC/LU status maps
Change maps



Phenology parameters (SOS, EOS, LOS)
Seasonal trajectories





Snow Cover
Fractional Snow Cover

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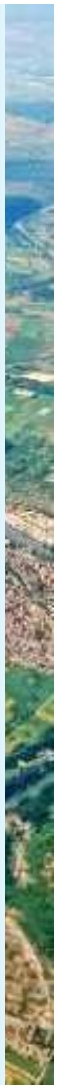
Land monitoring Dissemination

Land Monitoring

Copernicus
Europe's eyes on Earth

European Commission



Land Monitoring

European level dissemination activities: the Copernicus land portal

Focus on:

- Easy access to the products:
  - discover, view, WMS / download
- INSPIRE compliant metadata
- structural linkages with the open data initiatives on European and global level, in order to promote the use of the Copernicus Land products

EU Open Data Portal

GEOSS Portal

European Commission | eurostat

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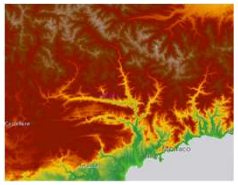
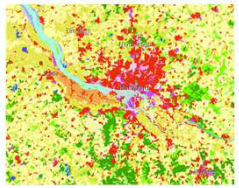
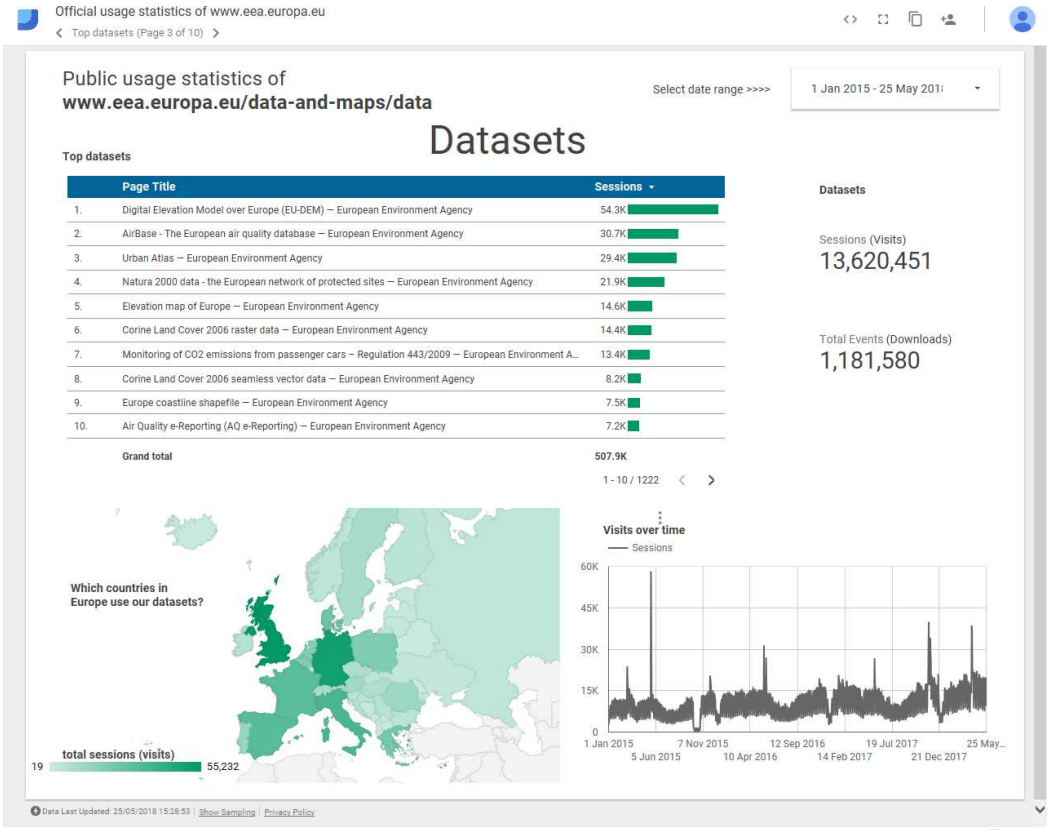
Land Monitoring

4 CLMS products in the top 10 of most used EEA data 2015-2018







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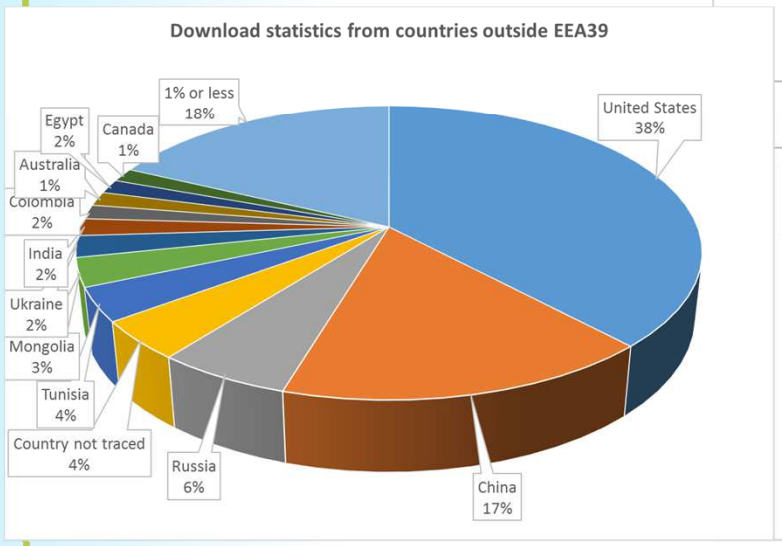
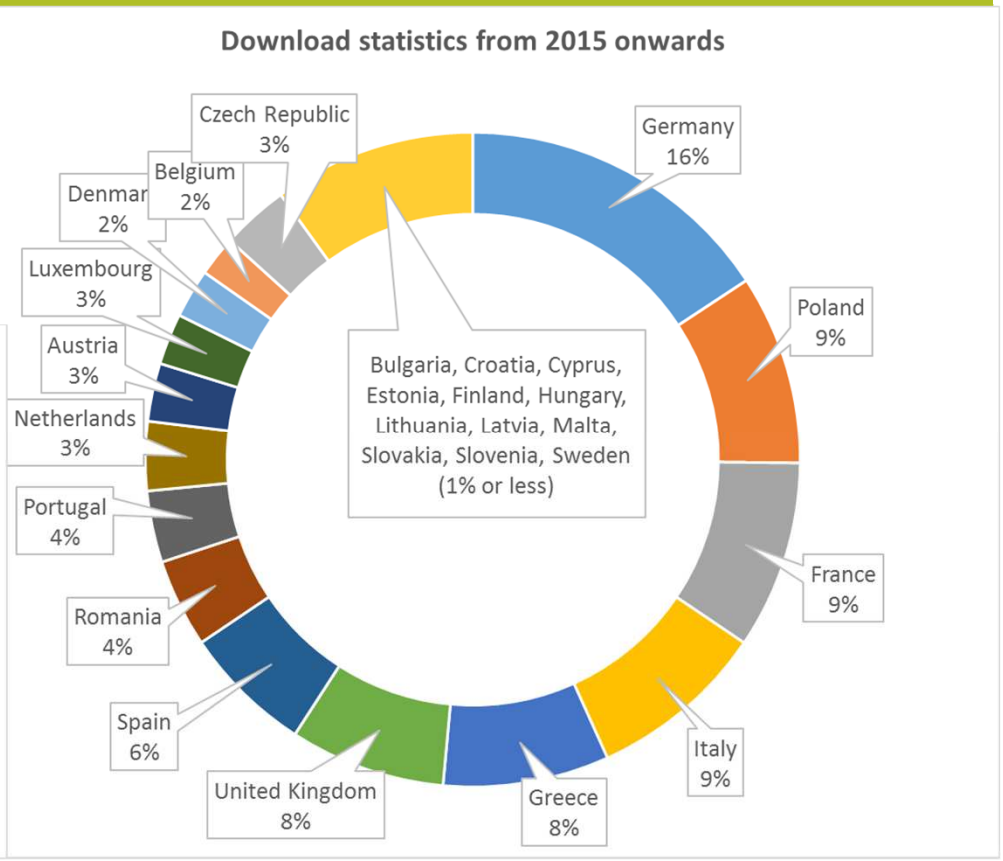
Geographical distribution of downloads in EEA39 (2015 – 2018)

EU Member States remain main users of Copernicus land products





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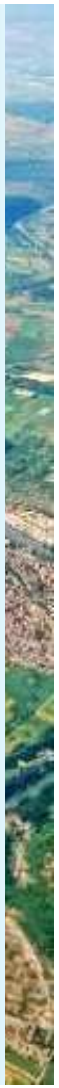
Land Monitoring

Evolution of the service: towards CLC+

- more demanding user needs from policy side
- more possibilities from technology side
- CLC+ to provide a solution, operational by 2021



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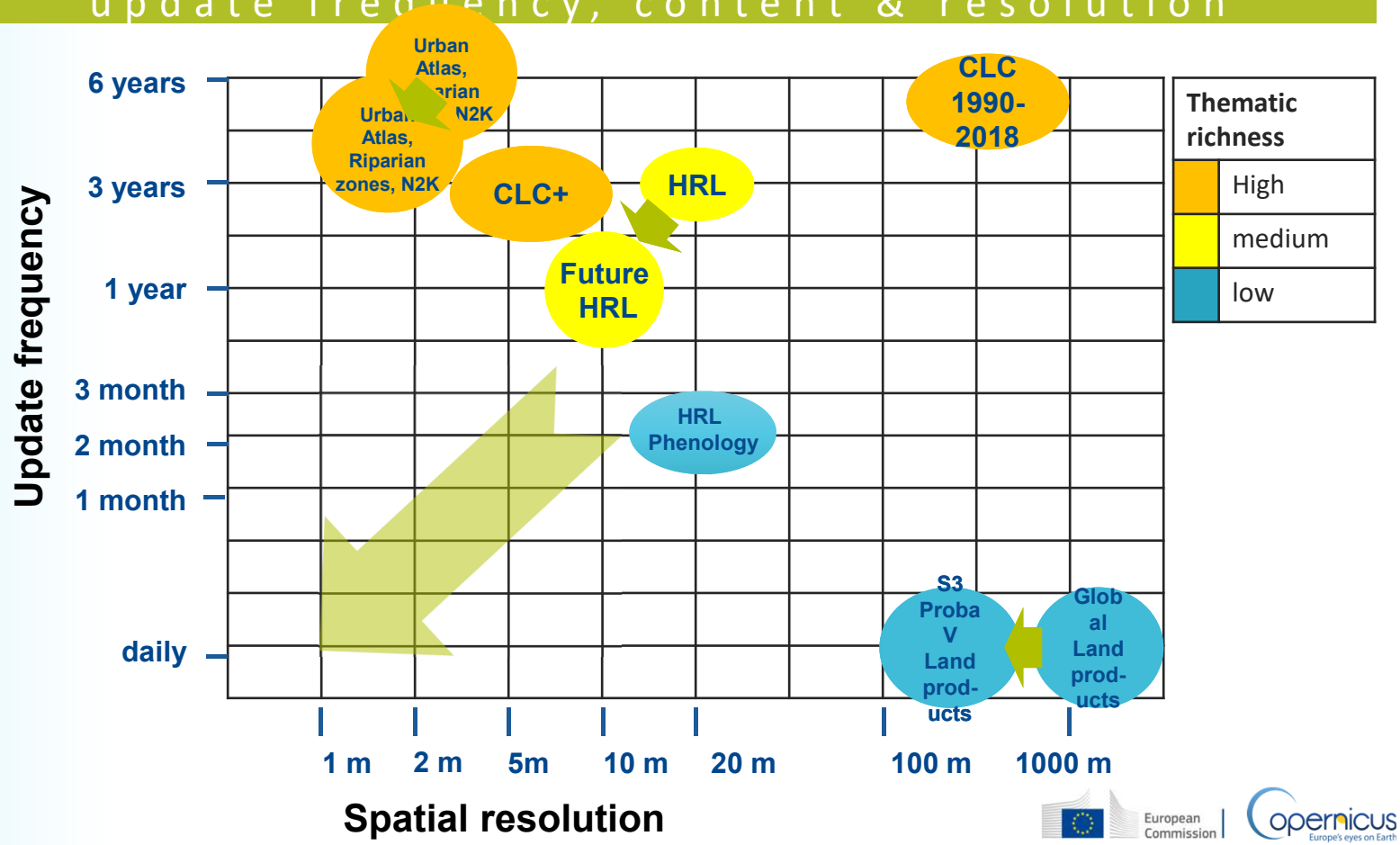
Copernicus land monitoring: update frequency, content & resolution



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Land Monitoring

More demanding needs for LC/LU information

- Continuity of land monitoring information over Europe
- Thematic considerations:
  - New or revised/updated Community legislation, (incl. new MS reporting):
    - Climate change
      - low carbon economy
      - circular economy
    - Energy Union
    - Greening the CAP
    - Forestry
    - Urban planning
    - Biodiversity strategy
      - natural capital
- Global policy: Sustainable Development Goals (SDGs)

need for LC/LU information:

- full EU28 / EEA39 coverage,
- harmonised specifications
- sufficient spatial detail
- timely availability
- regular updates (yearly)

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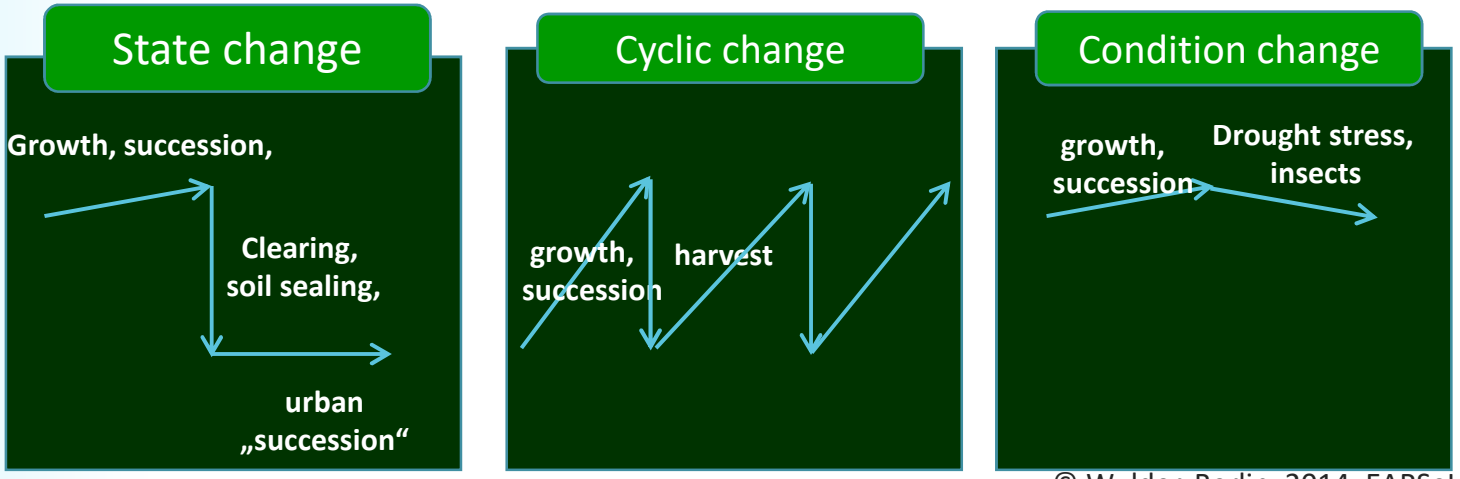
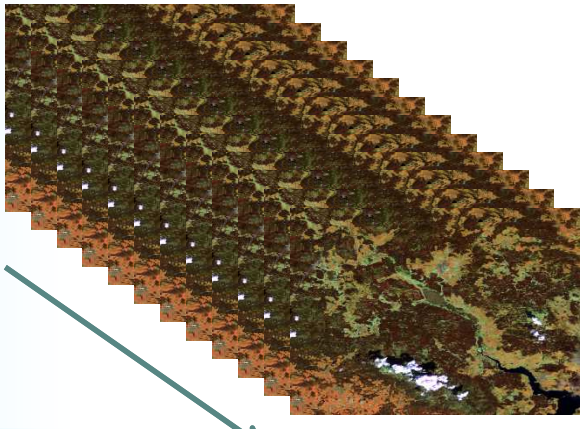
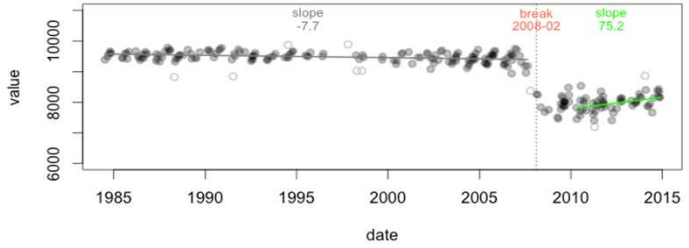
The challenge of Change Detection in Land monitoring





Time series analysis



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Land Monitoring

Requirements summary: driver for new concept for CLC+

- Summary of requirements review
  - MMU 0.5 to 5 ha, 0.5 to 1 ha for LULUCF
  - Change layer MMU = status layer MMU
  - Revised thematic content (more classes, increased characterisation)
  - 3 year to yearly update cycle
  - Pan-European coverage (EEA-39)
- Aspects of ….
  - Current CLC
  - Local Components
  - HRLs
  - EAGLE Group developments

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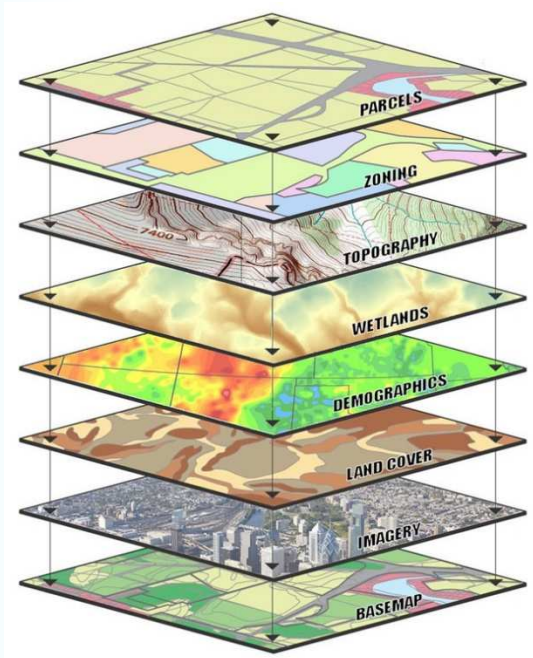
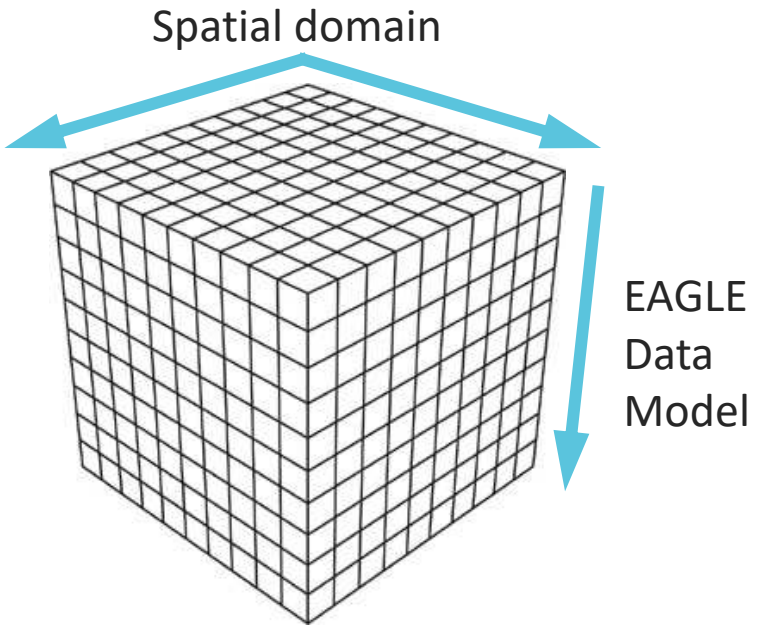
CLC+ a new concept in Land Cover / Land Use





Source: CSU,
http://heleneloyan.cikeys.com/update/gis-layers/

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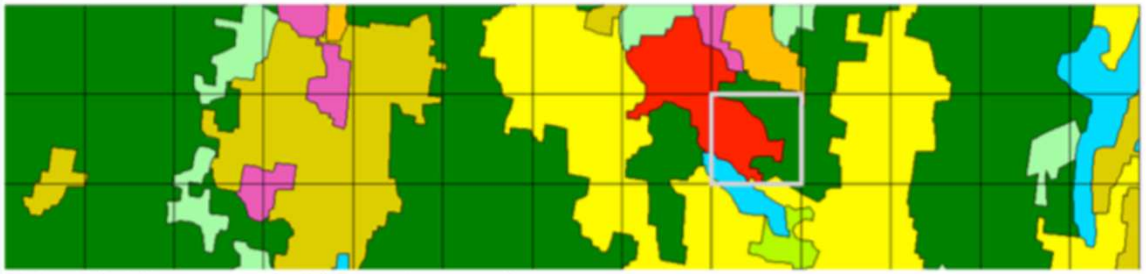
Vector, raster, grid cells



CLC with 1 km raster/grid superimposed

CLC vector

Raster representation: A single class is assigned to each pixel

Raster

Grid representation: The internal composition of the grid cell is kept as an attribute vector.

CLC-core grid, populated with thematic info

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