



Land Monitoring

Copernicus land monitoring

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Current EEA - Eionet roles in Copernicus 2014-2020

**1. Coordination
of in situ data
component
across services**

**2. Implementation
European and local
land monitoring**

**FULL, FREE AND OPEN
ACCESS TO DATA**



-  ATMOSPHERE MONITORING
-  MARINE ENVIRONMENT MONITORING
-  LAND MONITORING
-  CLIMATE CHANGE
-  EMERGENCY MANAGEMENT
-  SECURITY

**3. Key user
MAWP 2014-2020**


opernicus
Europe's eyes on Earth

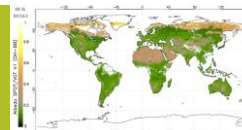


Land
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Copernicus Land Monitoring Service (CLMS)



Systematic Biophysical Monitoring



Land Cover & Land Use mapping



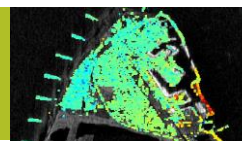
Thematic hotspot mapping



Reference data



Ground Motion service





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Portfolio overview

HR images
(20m pixels)



VHR images
(2.5m pixels)



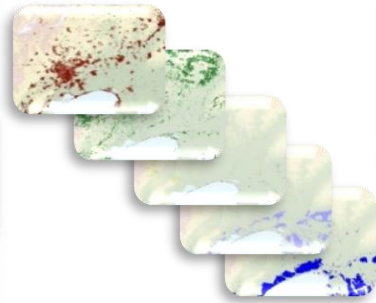
SAR + ...
(SRTM, S1, Aster GDEM)



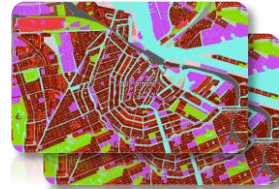
CLC & CLCC
1990-2000-06-12-18



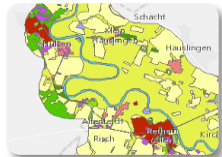
HRLs
2006-09-12-15-18



UA
2006-12-18



RZ
2012-18



N2K
2006-12



EU-Hydro
2012



EU-DEM
2012

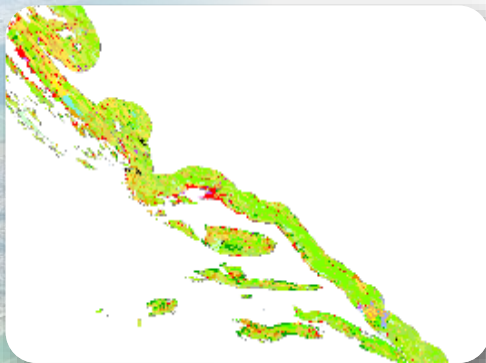




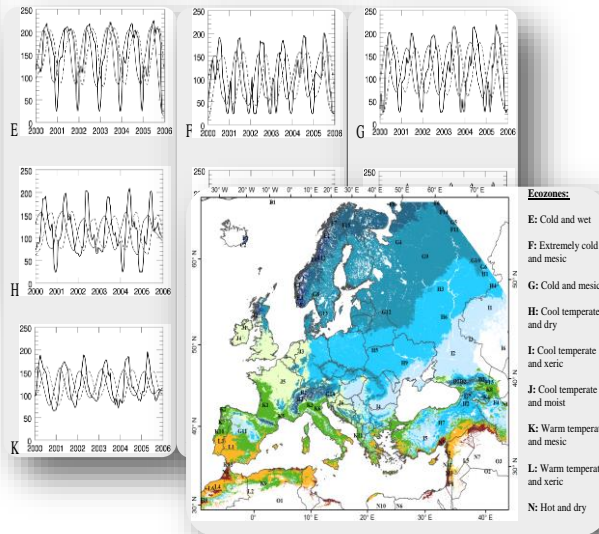
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Products in preparation of production

Coastal Zones



HR phenology



Snow & ice





Land Monitoring

Increased uptake of Copernicus information products

EEA Report | No 102016

Mapping and assessing the condition of Europe's ecosystems: progress and challenges
EEA contribution to the implementation of the EU Biodiversity Strategy to 2020

10 messages for 2010 Agricultural ecosystems

EEA Report | No 102017

Climate change, impacts and vulnerability in Europe 2016
An indicator based report

European Environment Agency

European Environment Agency

EEA Report | No 102017

Landscapes in transition
An account of 25 years of land cover change in Europe

EEA Report | No 102018

Urban sprawl in Europe
Joint EEA-FOEN report

European Commission

Working Papers

Regional Working Paper 2015

Measuring access to public transport in European cities

Hugo Poelman and Lewis Digheles

European Commission

Working Papers

A WALK TO THE PARK?

ASSESSING ACCESS TO GREEN AREAS IN EUROPE'S CITIES
UPDATE USING COMPLETED COPERNICUS URBAN ATLAS DATA

Hugo Poelman

European Air Quality Index

European Commission

Working Papers

A WALK TO THE PARK?

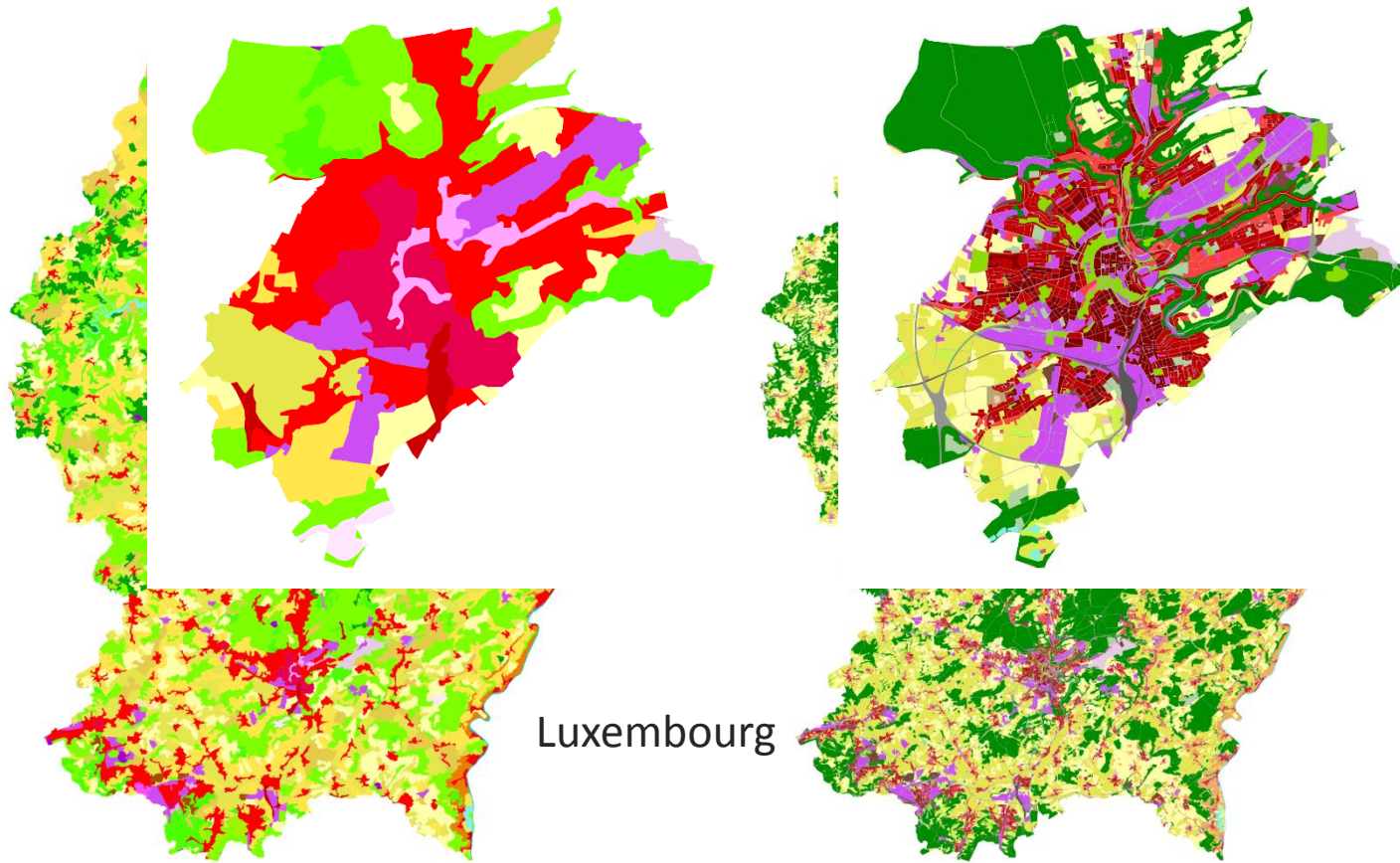
ASSESSING ACCESS TO GREEN AREAS IN EUROPE'S CITIES
UPDATE USING COMPLETED COPERNICUS URBAN ATLAS DATA

Hugo Poelman



Land
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Pan-European and local CLMS: some strenghts



Luxembourg



Harmonized Legend

CLC corresponding classes	Harmonized	UA corresponding classes
111	111 Continuous urban fabric (S.L. >80%)	11100
112	112 Discontinuous Urban Fabric (S.L. 10-80%)	11210, 11220, 11230, 11240, 1300
121	121 Industrial, commercial, public, military and private units	12100
122	122 Road and rail network and associated land	12210, 12220, 12230
123	123 Port areas	12300
	124 Airports	12400
131, 132	131 Mineral extraction and dump sites	13100,
133	133 Construction sites	13300, 13400
141	141 Green urban areas	14100
142	142 Sport and leisure facilities	14200
211, 212, 213	210 Arable land (annual crops)	21000
221, 222, 223	220 Permanent crops (vineyards, fruit trees, olive groves)	22000
231	230 Pastures	23000
241, 242, 243, 244	240 Complex and mixed cultivation patterns	24000
311, 312, 313	310 Grasslands	31000
321, 322, 323, 324	320 Herbaceous vegetation associations (natural grassland, moors...)	32000
331, 332, 333, 334, 335	330 Open spaces with little or no little vegetation	33000
411, 412, 421, 422, 423	400 Wetlands	40000
511, 512, 521, 522, 523	500 Water	50000

URBAN ATLAS

	111	112	121	122	123	124	131	133	141	142	210	220	230	240	310	320	330	400	500	Total
111	41,2%	19,7%	14,1%	16,5%	0,1%	0,0%	0,1%	1,0%	3,0%	1,3%	1,0%	0,2%	0,4%	0,0%	0,1%	0,5%	0,2%	0,0%	0,5%	100,0%
112	7,8%	51,4%	9,9%	9,5%	0,0%	0,0%	0,2%	1,2%	3,6%	2,5%	4,7%	0,2%	5,4%	0,0%	2,5%	0,6%	0,0%	0,0%	0,4%	100,0%
121	1,6%	4,7%	59,7%	8,8%	2,2%	0,4%	1,5%	2,6%	1,9%	1,6%	5,4%	0,2%	4,6%	0,0%	2,6%	1,2%	0,2%	0,1%	0,9%	100,0%
122	0,8%	2,5%	10,3%	48,2%	0,4%	0,1%	0,9%	3,2%	1,5%	1,0%	11,0%	0,4%	8,7%	0,0%	7,0%	3,0%	0,2%	0,1%	0,6%	100,0%
123	1,5%	1,4%	13,9%	8,9%	52,3%	0,1%	0,8%	2,8%	1,0%	3,5%	1,9%	0,1%	2,5%	0,0%	0,6%	0,8%	0,5%	0,2%	7,2%	100,0%
124	0,0%	0,6%	6,2%	1,6%	0,1%	76,4%	0,3%	1,1%	0,3%	1,7%	4,2%	0,1%	3,8%	0,1%	2,2%	0,8%	0,3%	0,0%	0,2%	100,0%
131	0,1%	0,8%	5,6%	1,6%	0,1%	0,1%	55,9%	1,1%	0,4%	0,4%	9,2%	0,3%	7,4%	0,0%	5,7%	3,6%	0,4%	0,3%	6,9%	100,0%
133	1,4%	5,2%	8,6%	8,0%	1,0%	0,5%	7,1%	31,3%	1,2%	40,1%	1,7%	13,2%	8,0%	0,1%	2,2%	8,0%	0,3%	0,3%	0,9%	100,0%
141	0,5%	7,0%	6,7%	5,0%	0,1%	0,0%	0,3%	1,2%	40,1%	9,2%	4,4%	0,1%	8,0%	0,0%	13,1%	1,3%	0,1%	0,2%	2,6%	100,0%
142	0,4%	9,7%	4,2%	3,4%	0,0%	0,3%	0,3%	0,6%	8,4%	44,7%	4,6%	0,1%	9,5%	0,0%	9,1%	1,8%	0,3%	0,2%	2,1%	100,0%
210	0,1%	2,2%	1,0%	1,5%	0,0%	0,0%	0,1%	0,1%	0,1%	0,2%	69,7%	0,4%	20,6%	0,0%	2,7%	0,9%	0,0%	0,0%	0,2%	100,0%
220	0,0%	4,1%	1,1%	2,1%	0,0%	0,0%	0,1%	0,1%	0,1%	0,4%	16,3%	45,8%	18,4%	0,6%	4,3%	5,2%	0,0%	0,0%	0,1%	100,0%
230	0,0%	3,7%	1,4%	1,8%	0,0%	0,0%	0,2%	0,1%	0,2%	0,5%	15,0%	0,2%	66,1%	0,0%	7,3%	2,0%	0,1%	0,3%	0,7%	100,0%
240	0,2%	8,8%	1,9%	2,5%	0,0%	0,0%	0,2%	0,2%	0,3%	0,5%	28,5%	1,7%	32,8%	0,3%	14,2%	6,4%	0,1%	0,2%	0,8%	100,0%
310	0,0%	0,8%	0,3%	0,9%	0,0%	0,0%	0,1%	0,0%	0,2%	0,1%	3,1%	0,1%	2,9%	0,0%	87,2%	3,0%	0,1%	0,3%	0,6%	100,0%
320	0,0%	0,7%	1,0%	0,8%	0,0%	0,0%	0,3%	0,1%	0,1%	0,1%	8,2%	0,4%	10,0%	0,1%	28,2%	39,2%	9,0%	0,6%	0,5%	100,0%
330	0,0%	0,2%	0,2%	0,2%	0,0%	0,0%	0,2%	0,0%	0,0%	0,1%	1,5%	0,1%	2,1%	0,0%	2,3%	25,9%	64,8%	0,3%	1,2%	100,0%
400	0,0%	0,2%	0,2%	0,3%	0,0%	0,0%	0,1%	0,0%	0,1%	0,1%	10,9%	0,1%	10,0%	0,0%	9,4%	32,3%	4,7%	24,5%	6,6%	100,0%
500	0,0%	0,3%	0,2%	0,3%	0,2%	0,0%	0,2%	0,0%	0,2%	0,3%	1,9%	0,0%	1,8%	0,0%	3,7%	0,4%	0,4%	1,4%	88,4%	100,0%
Total	0,8%	6,2%	2,6%	2,2%	0,1%	0,2%	0,4%	0,3%	0,6%	0,7%	28,5%	1,3%	18,7%	0,1%	27,9%	5,1%	1,5%	0,5%	2,4%	100,0%

CORINE

Inconsistencies: example 1

COMPLEX & MIXED CULTIVATION PATTERNS

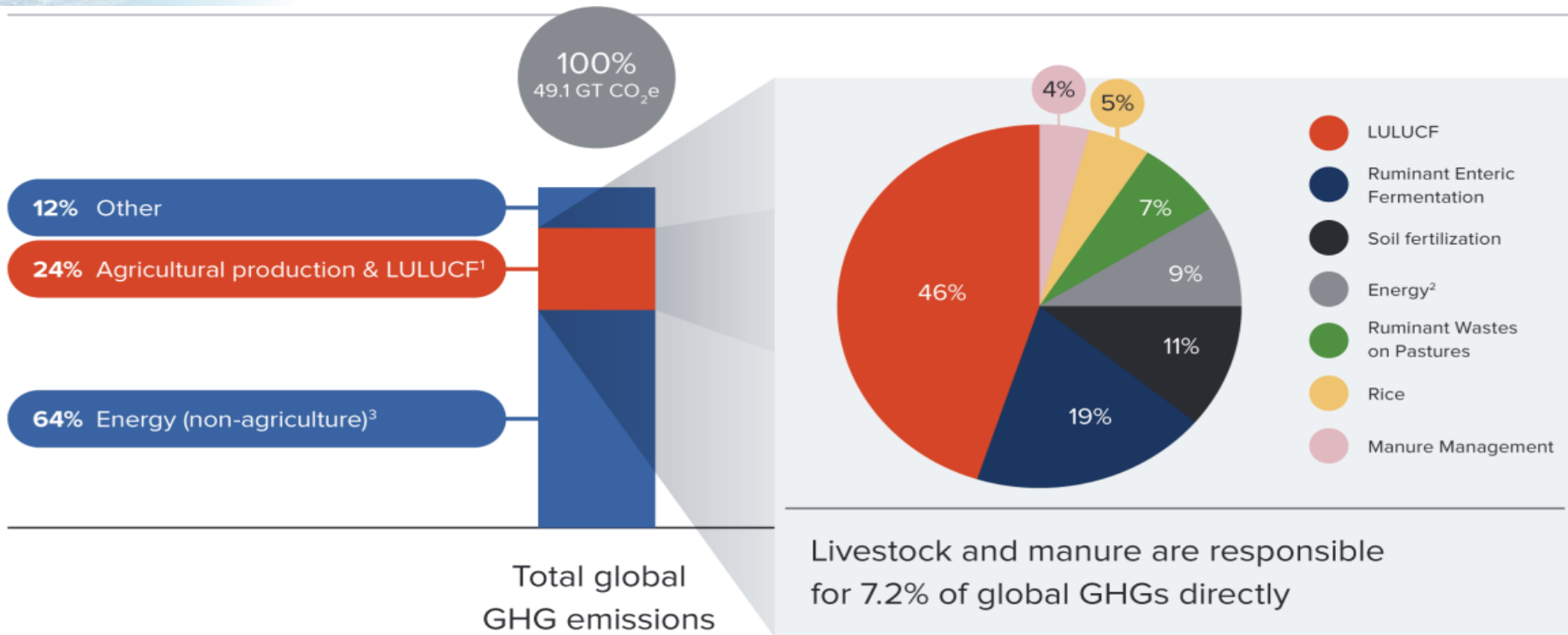
Inconsistencies: example 2

WETLANDS



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AGRICULTURE, FORESTS AND OTHER LAND USE (AFOLU): A QUARTER OF GLOBAL GHG EMISSIONS





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POLICY CONTEXT: NATURAL CAPITAL

Biodiversity strategy

Halt loss of biodiversity and degradation of ecosystem services and 15% restoration.



Water policy

WFD, good ecological status



Forest strategy

Focus on ecosystem services delivered by forests



Natural capital

Climate policy

Climate adaptation



Regional policy

Green Infrastructure



Agricultural policy

Greening the CAP measures



Marine policy

MSFD, good environmental status





Land Monitoring

SUSTAINABLE DEVELOPMENT GOALS



SUSTAINABLE DEVELOPMENT GOALS



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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)



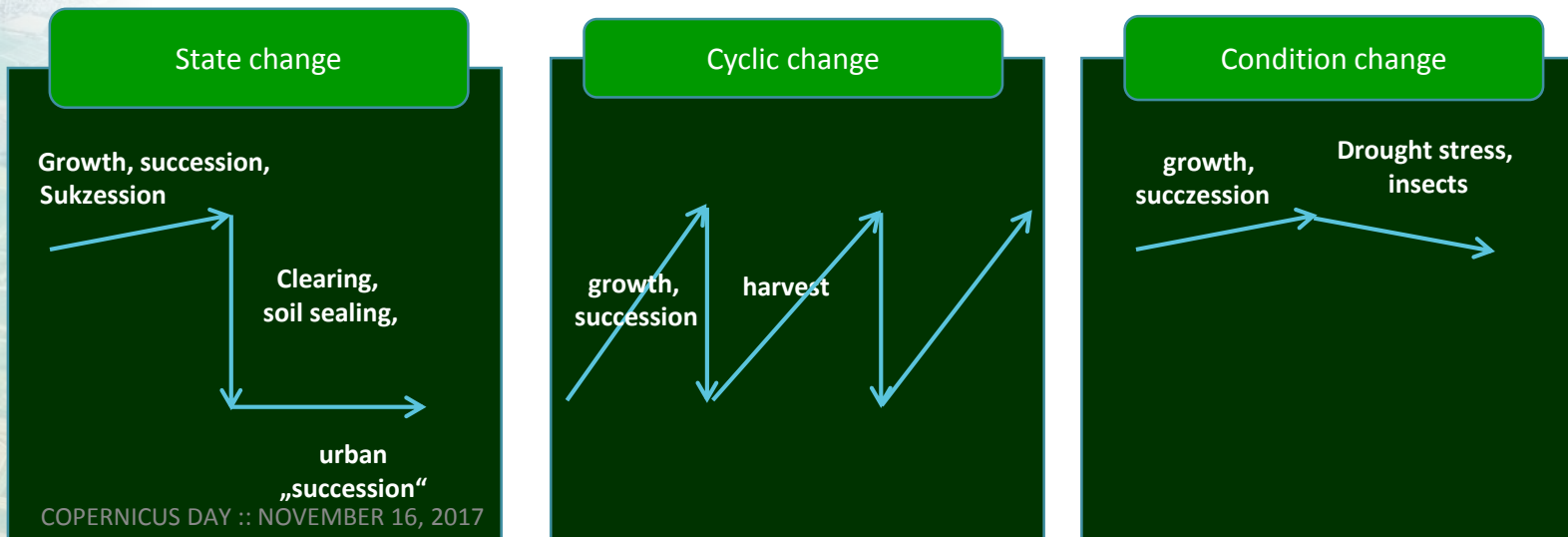
- need for LC/LU information:
- full EU28 / EEA39 coverage,
 - harmonised specifications
 - sufficient spatial detail
 - timely availability
 - regular updates (yearly)



Types of Changes in Land monitoring

- Change occurs all the time
 - Variable rates (in time) and magnitudes
- What matters is then the *process* of change
 - Create and label vectors (trajectories) to understand the process

© Wulder, Berlin, 2014, EARSeL





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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-Backbone

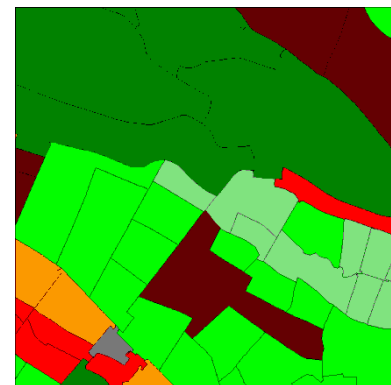
CLC-Backbone

CLC-Core

CLC+

CLC-Legacy

- Basic land cover inventory
- Wall-to-wall coverage (EEA-39)
- Complete the picture started by the LoCo which cover one third of EEA-39
- Spatially detailed, large scale
- Vector format
- Based on digital cartography and EO
- **Geometric backbone – high quality**
- **thematic detail – limited, but robust**
- Framework to build other products
- Foreseen for Industrial production in 2018 (tender)
- **Object – oriented !!**





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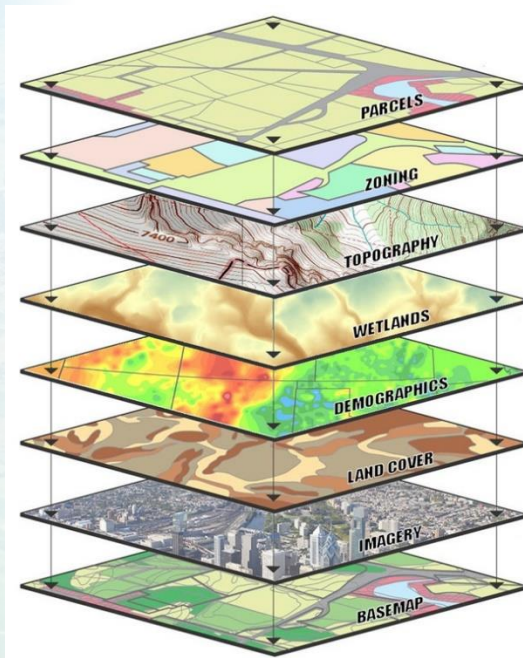
CLC-Core

CLC-Backbone

CLC-Core

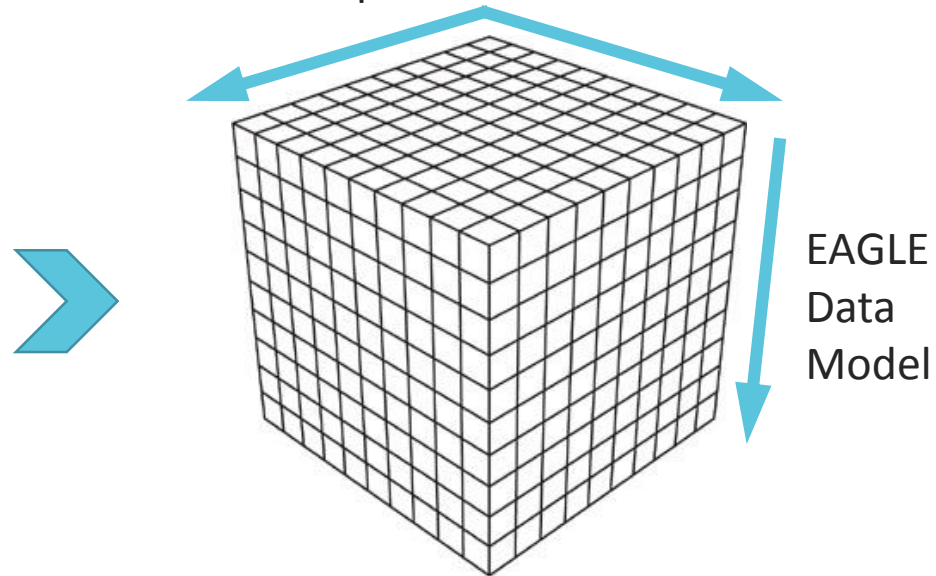
CLC+

CLC-Legacy



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

Spatial domain





Land
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CLC+

CLC-Backbone

CLC-Core

CLC+

CLC-Legacy

- Tailored instances:

- One potential end point for this exercise
- An improved LULC monitoring product relative to CLC
- Multi-functional geospatial dataset
- Addressing a broad range of requirements at European, national and regional scales
- Based on CLC-Core and CLC-Backbone, along with the local components and HRLs
- Expand the mapping philosophy away from single attribute thematic classification



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Pan-European and local component data

- land.copernicus.eu

Copernicus Land Monitoring Service
Europe's eyes on Earth

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Ask the service desk Search

Global Pan-European Local Reference data FAQ

Copernicus is an European system for monitoring the Earth. Data is collected by different sources, including Earth observation satellites and in-situ sensors. The data is processed and provides reliable and up-to-date information about six thematic areas: land, marine, atmosphere, climate change, emergency management and security. The land theme is divided into four main components:

- Global**
provides a series of bio-geophysical products on the status and evolution of the land surface at global scale at mid and low spatial resolution
- Pan-European**
provides information about the land cover and land use (LC/LU), land cover and land use changes and land cover characteristics
- Local**
focuses on different hotspots, i.e. areas that are prone to specific environmental challenges and problems
- Reference data**
All of the Copernicus services need access to in-situ data in order to ensure an efficient and effective use of Copernicus space-borne data



In situ

EEA's main cross-cutting activities



Maintain an overview of the Copernicus in situ component

Improve access to selected in situ data

Raise the awareness about the Copernicus in situ component



Examples of what we do ...

In situ



Preparing in situ data
State of Play reports
(covering all six
services)

Creating and populating
the Copernicus In Situ
Component Information
System (CIS²)

Creating Fact Sheets
for all Copernicus
Services' components

Managing partnership
agreements with
EuroGeographics and
EUMETNET

Managing access
agreements with
international partners

Maintaining and adding
content to the
Copernicus Geospatial
Reference Data Access
Portal

Developing and
maintaining the
Copernicus in situ
website

Producing news articles
and newsletters

Representing
Copernicus in situ
component at
conferences and
workshops



In situ

Find more information on

INSITU.COPELICUS.EU

EXPLORE THE COPERNICUS IN SITU COMPONENT

Discover the Copernicus Services

- Marine
- Atmosphere
- Land
- Security
- Emergency
- Climate

FEATURED

The Copernicus In Situ Component: State of Play Reports

The Copernicus Services depend on the availability of in situ data at the right quality and resolution. An essential element of the EEA's coordinating role is to maintain an overview of the availability of in situ data to meet the needs of Copernicus. Two reports on the State of Play for both Observations and Geospatial Reference Data have recently been released.

[Observations](#) [Spatial Data](#) [READ MORE...](#)

Operational use of in situ data at EUMETSAT: Interview with Bojan Bojkov

In situ data of various kinds is used operationally to verify satellite data products and calibrate satellite instruments. Dr. Bojkov, Head of the Remote Sensing and Products Division in the Department of Technical Support and Science at EUMETSAT, explained the close links between space and in situ data, and the importance of this relationship for operational satellite data provision.

[Observations](#) [Spatial Data](#) [Policy](#) [READ MORE...](#)

In situ data critical for the Copernicus Marine Service

The Copernicus Marine Environment Monitoring Service benefits from a range of in situ observations, drawn from a wide variety of platforms, including autonomous ocean-based observatories and sensors aboard ships. Almost 9000 platforms supply the service with data, which is critical for the production of the Copernicus Marine Service products.

[Observations](#) [Policy](#) [Marine](#) [READ MORE...](#)



FACT SHEET ON COPERNICUS IN SITU DATA REQUIREMENTS



COPERNICUS LAND MONITORING SERVICE GLOBAL COMPONENT

The Copernicus Services rely on a combination of satellite data and environmental measurements collected from ground-based, sea-borne or air-borne monitoring systems, as well as geospatial reference or ancillary data. These non-space data are collectively referred to as "in situ" data. This Fact Sheet is one of a series which summarises the in situ data requirements for the Copernicus Services at component level.

Products and Services

The Copernicus Land Monitoring Service (CLMS) provides geographical data and products based on satellite imagery and in situ data, supporting topics such as agriculture, food security, forest management and water management. The CLMS has three components: Global, Pan-European and Local.

The CLMS Global Component offers a series of bio-geophysical products to monitor the status and evolution of land surfaces at a global scale. Production and delivery of the parameters take place in a timely manner and are complemented by the generation of long-term time series. The products are used to monitor vegetation, the water cycle and the energy budget.



European view of Leaf Area Index from May/June 2014 overlaid (using shades of blue) with the water bodies product © Copernicus Global Land Service (2014). Distributed and produced by VITO NV, Belgium.

What in situ data is required for this component?

The CLMS Global Component requires the following Global and European in situ data:

- **Digital Elevation Models** – for modelling surface and subsurface features.
- **Land Cover Maps & Masks** – to define the land cover and ecological biomes.
- **Calibration and Validation Measurements** – Measurements of phenomena such as vegetation and irradiance for calibrating and validating satellite-derived products.
- **Hydrographical & Meteorological Data** – to assist in the definition of water bodies and correct for the effects of the atmospheric.