



Land Monitoring

Offer and use cases of the Copernicus Land Monitoring Service (CLMS) Pan-European and hotspot components

Copernicus for future cities workshop
09.11.2018

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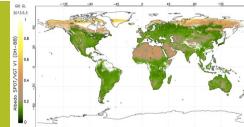


Land
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Copernicus Land Monitoring Service (CLMS)



Systematic Biophysical Monitoring



Land Cover & Land Use mapping



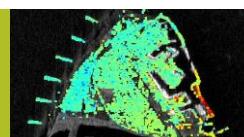
Thematic hotspot mapping



Imagery & Reference data



Ground Motion service

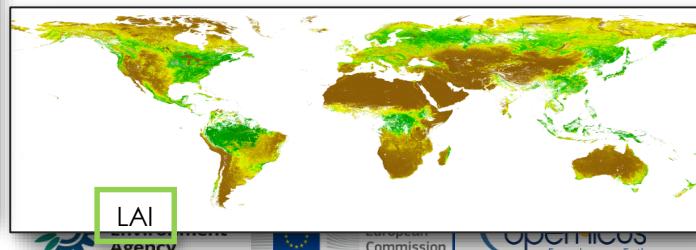
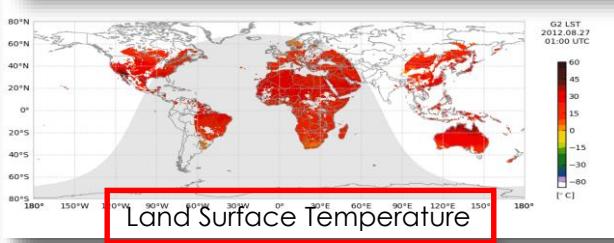
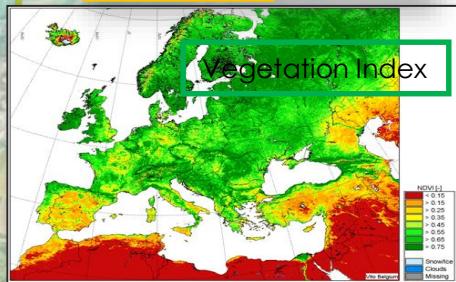
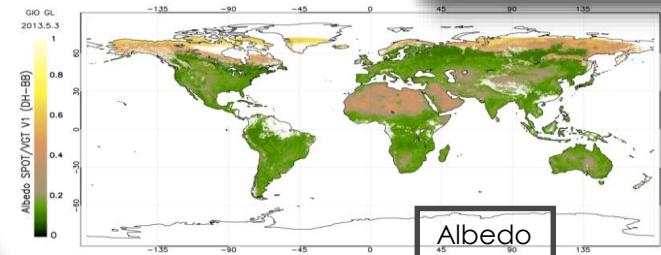
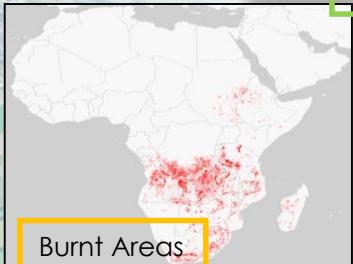
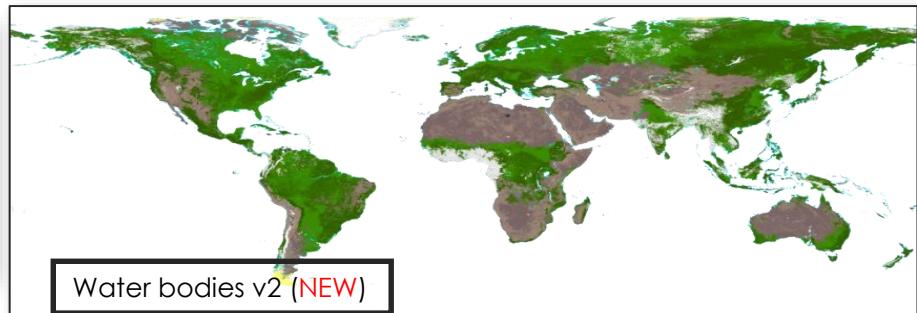
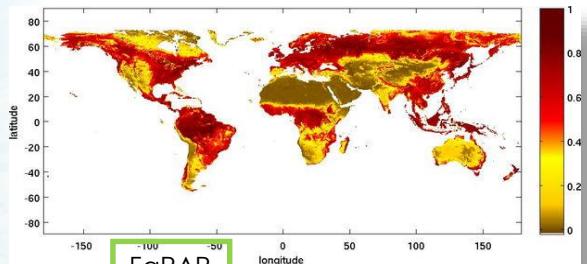


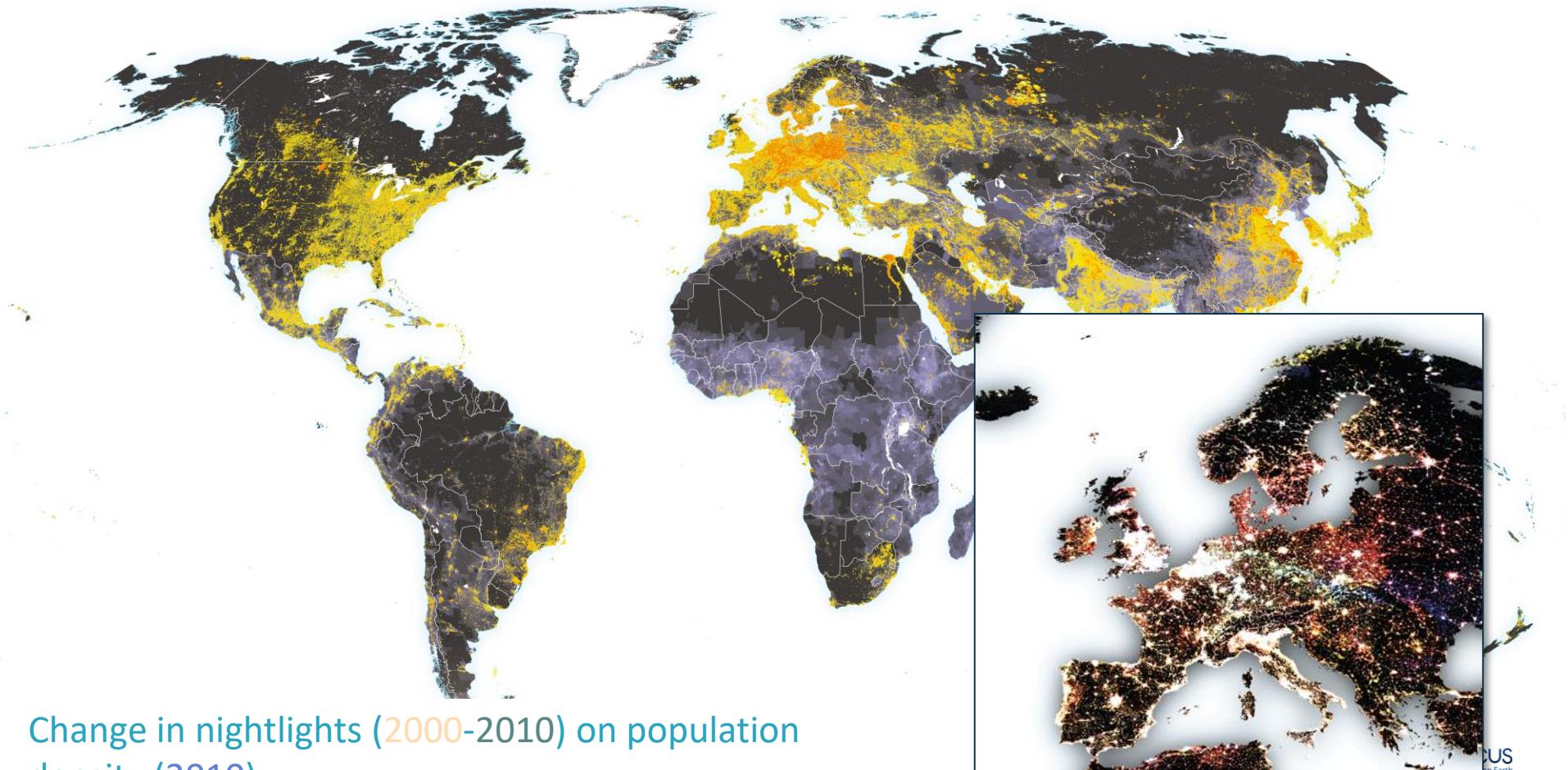


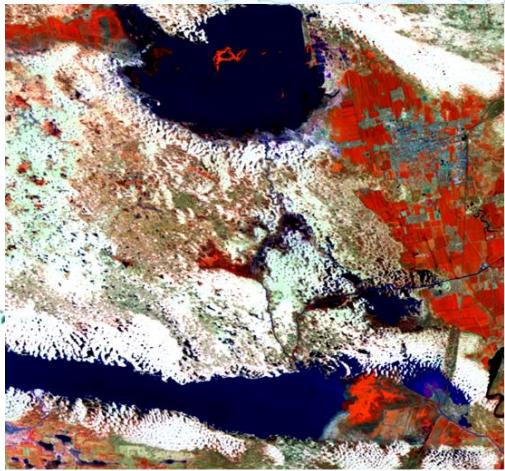
Land



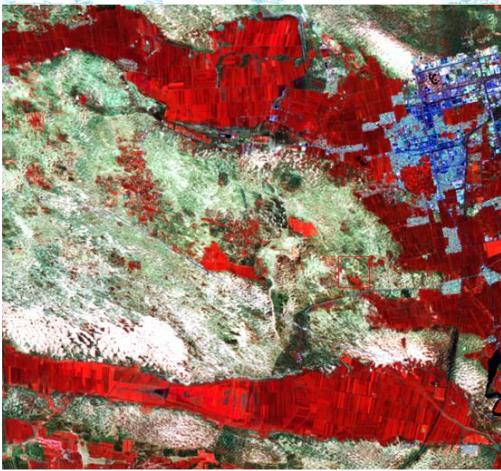
Global Land Monitoring Service (GLMS): Global vegetation, water & energy parameters





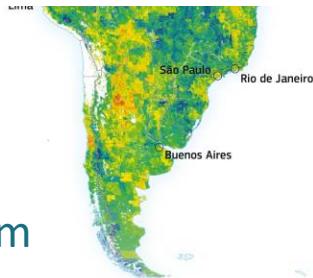


1987 08 11



2013 09 03

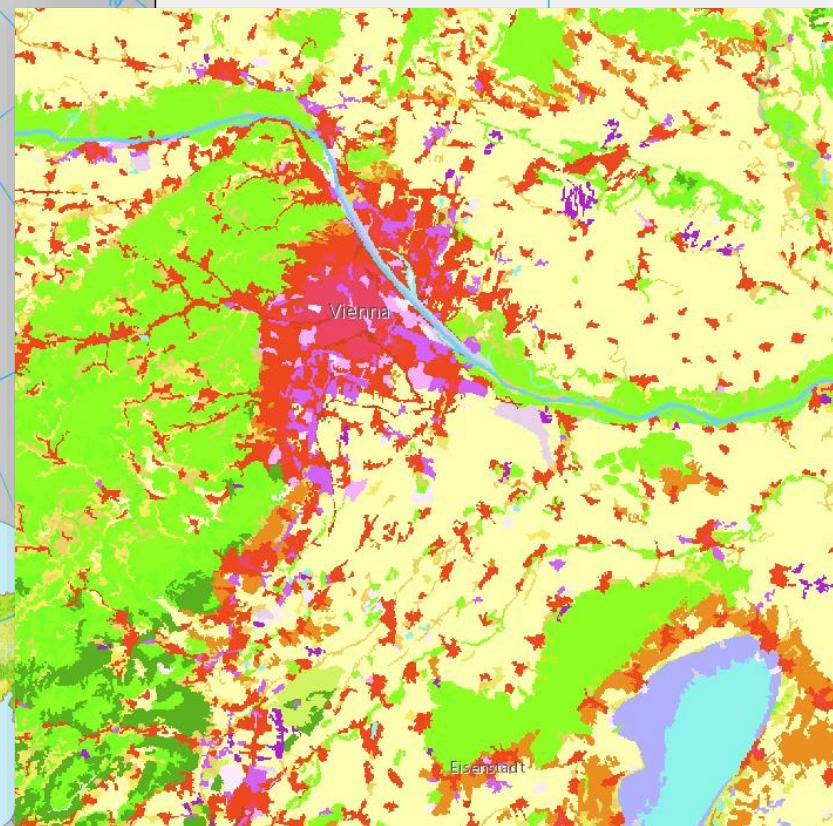
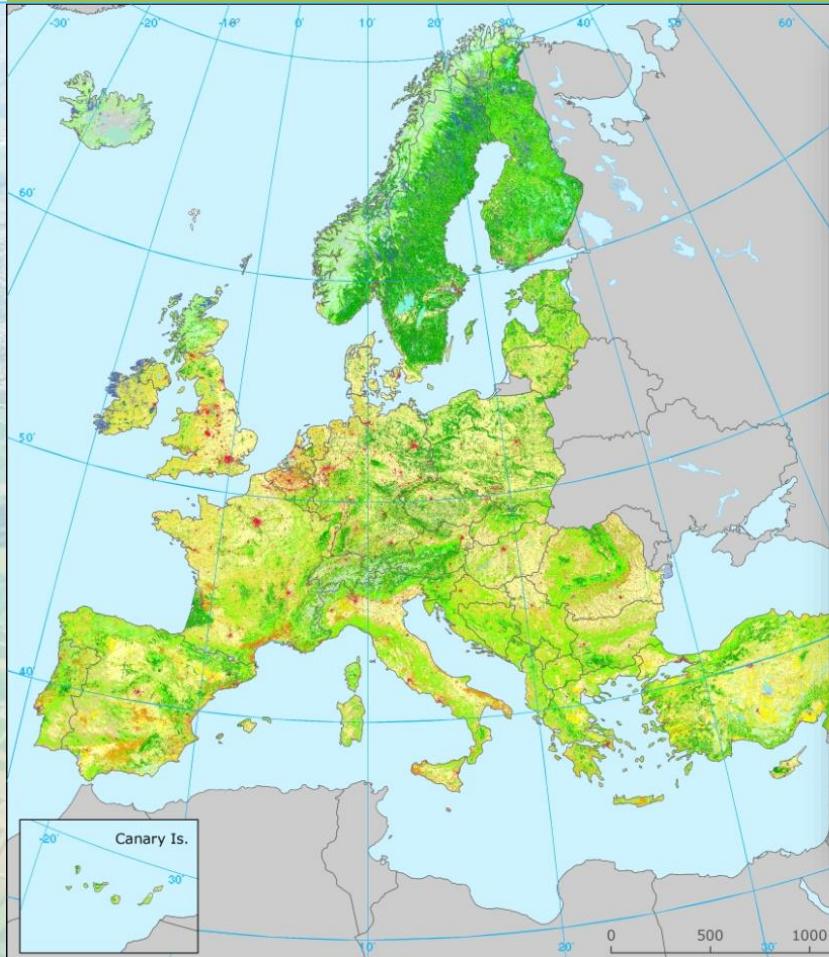
Agriculture
expansion
Calls for trade offs
for use of ecosystem
services





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

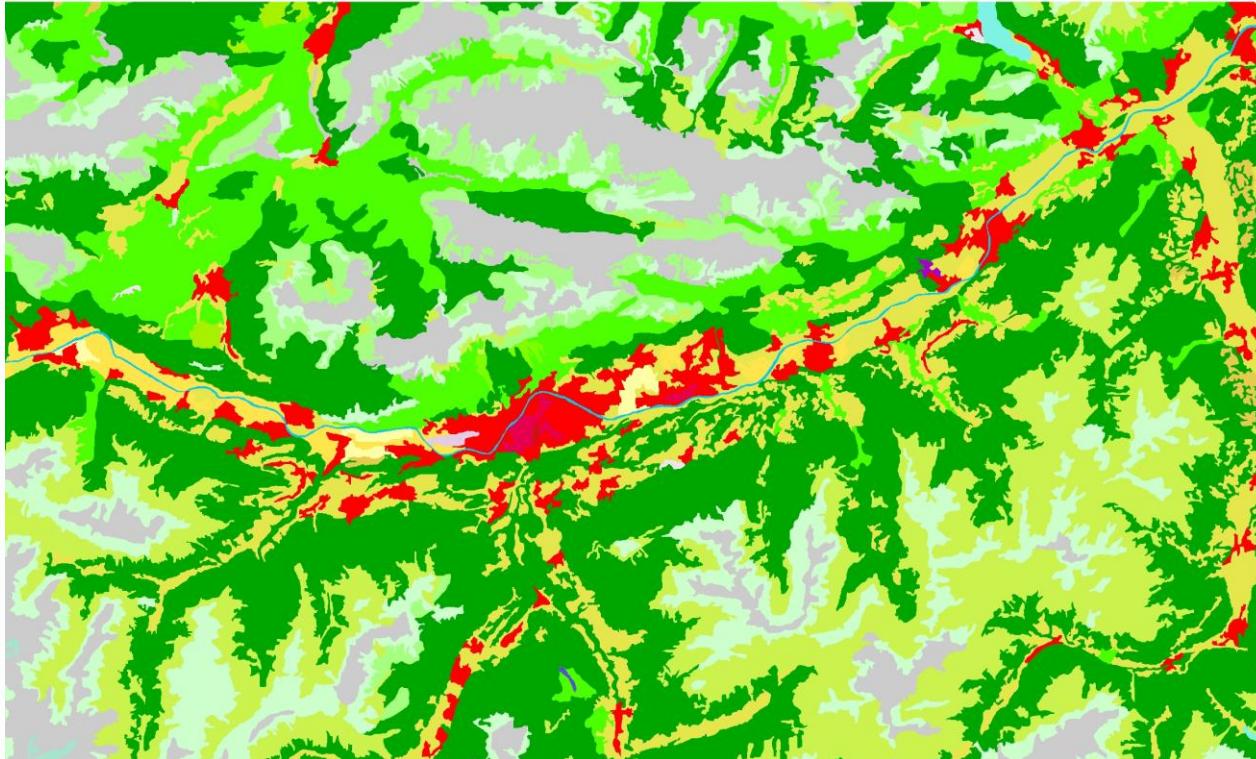




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Urban Atlas 2006 – 2018 (Innsbruck, AT)

CLC 1990





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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

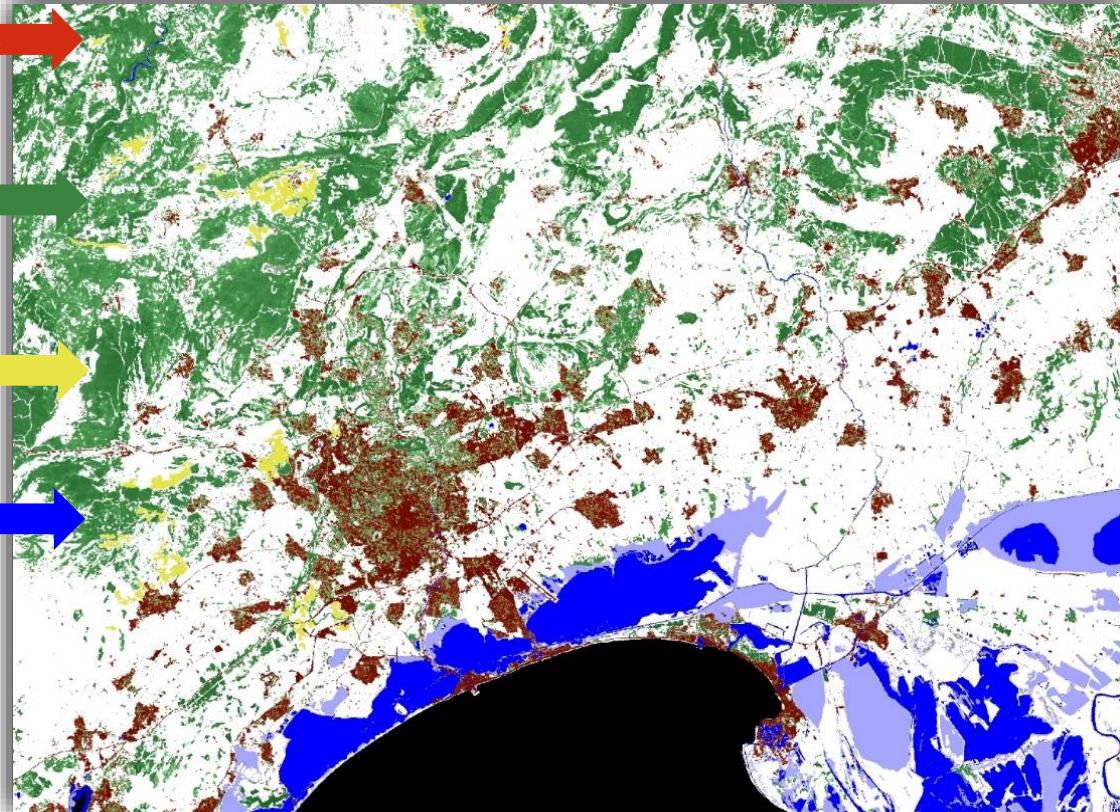
- Grassland (binary)
- 2012
- 20 m and 100 m

Water and Wetness

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

Small Woody Features

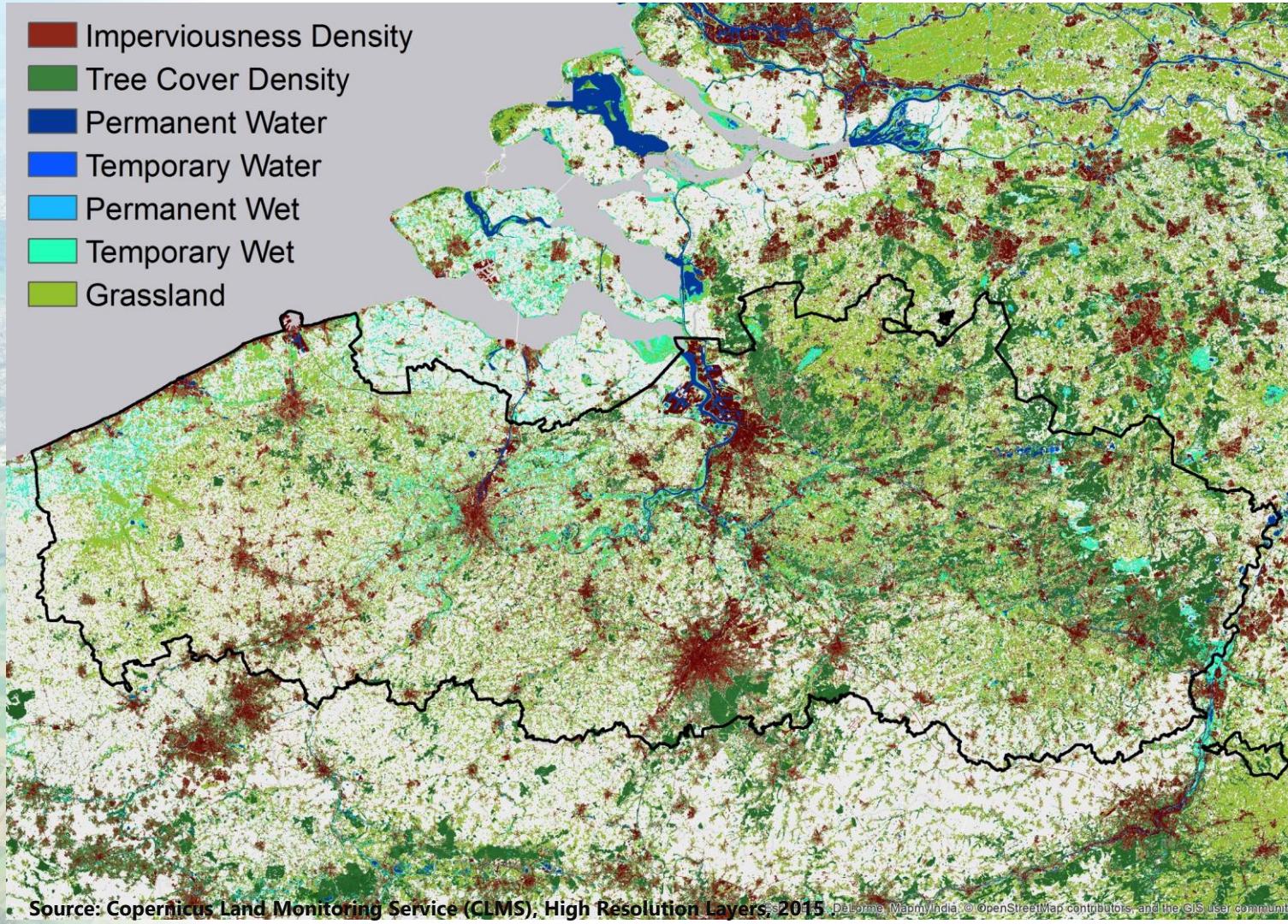
- Linear and patchy structures (binary)
- 2015





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- Imperviousness Density
- Tree Cover Density
- Permanent Water
- Temporary Water
- Permanent Wet
- Temporary Wet
- Grassland

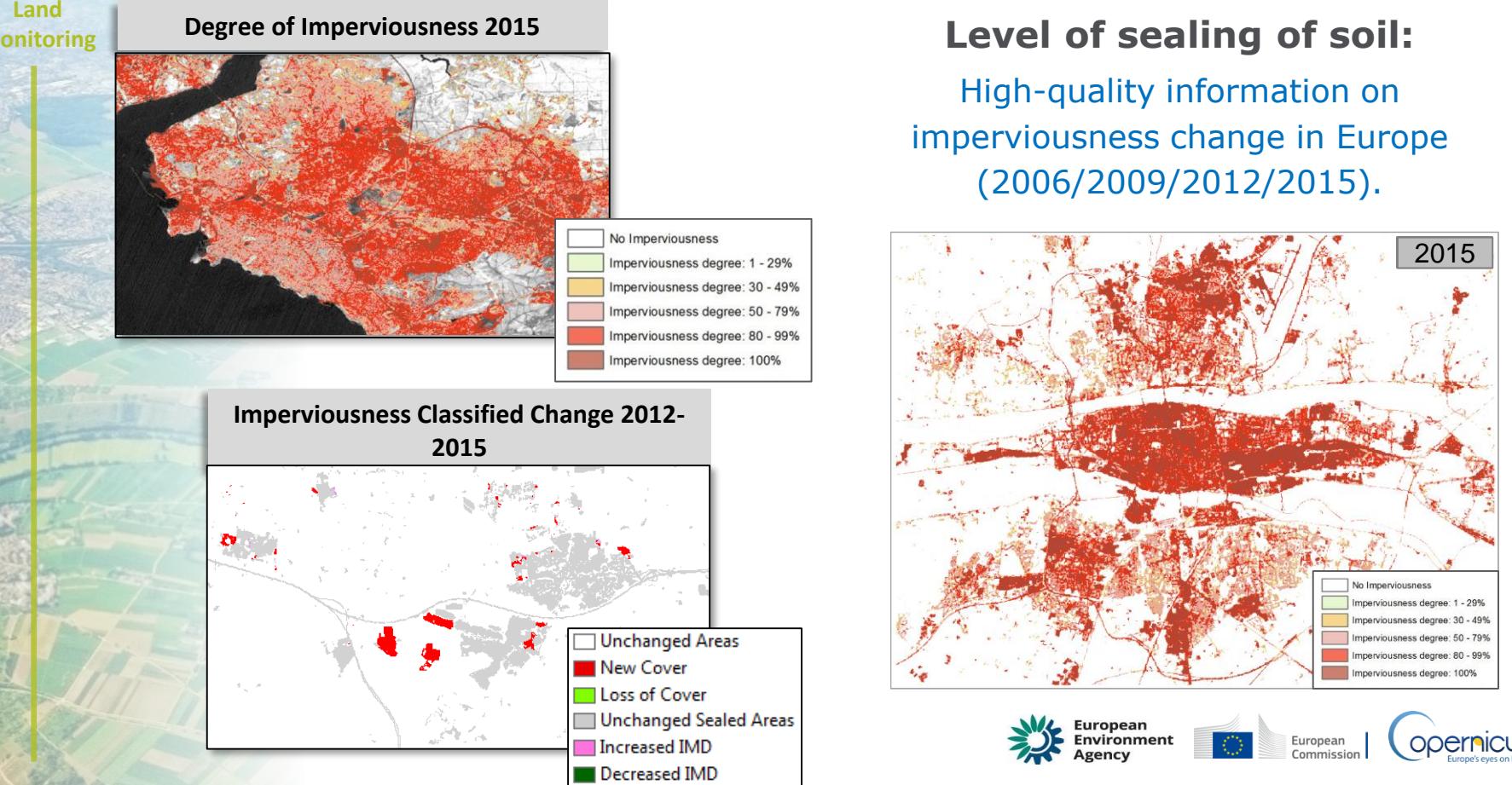


Source: Copernicus Land Monitoring Service (CLMS), High Resolution Layers, 2015. Delorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

Copernicus
Europe's eyes on Earth



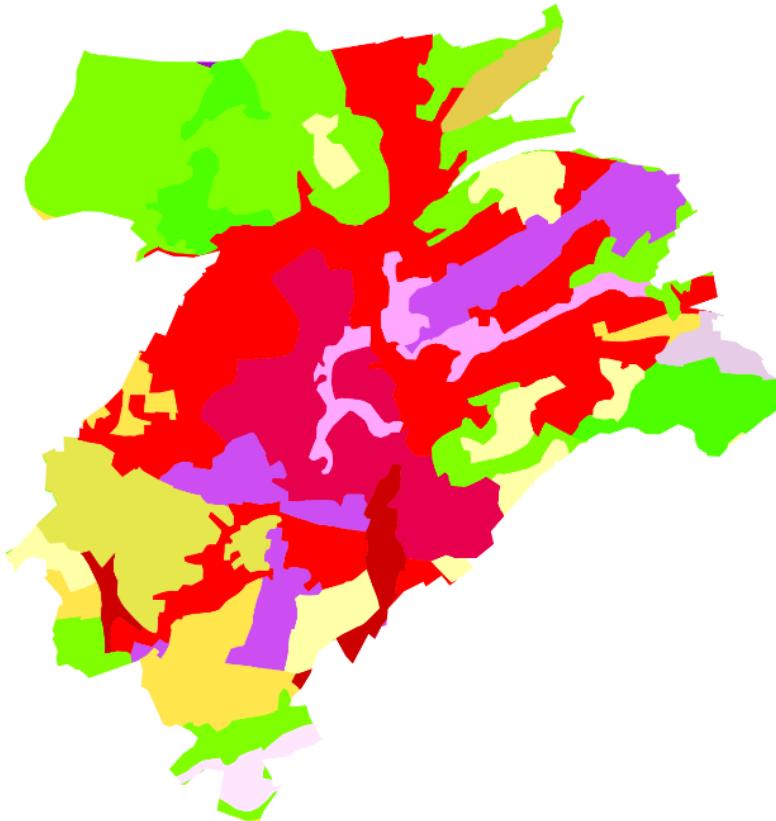
HRL Imperviousness (IMP)



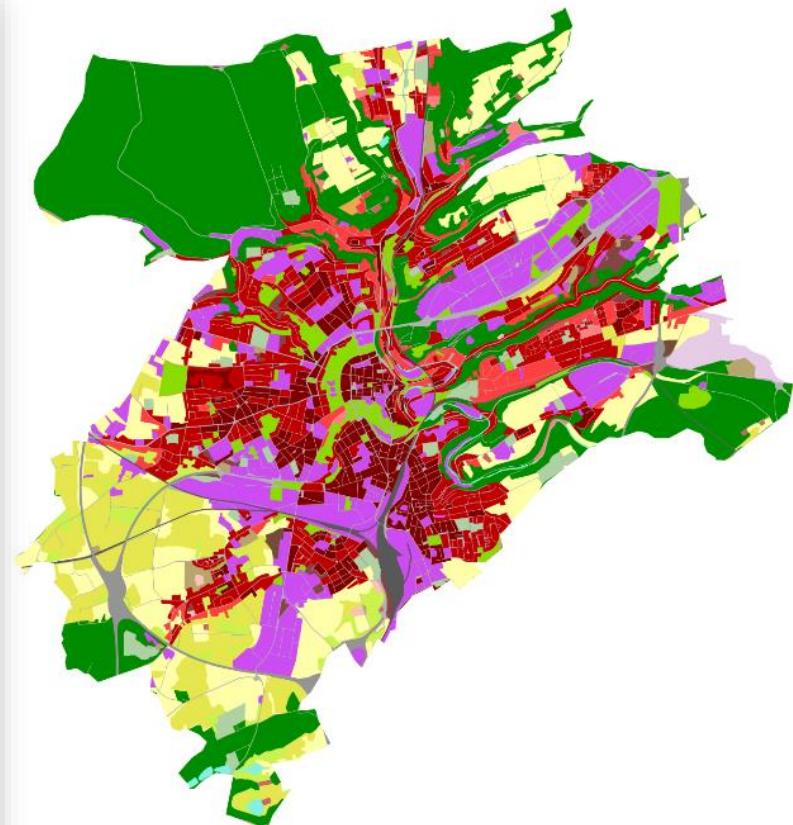


Land
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From pan-European (CLC) to hotspot (Urban Atlas) mapping



Luxembourg





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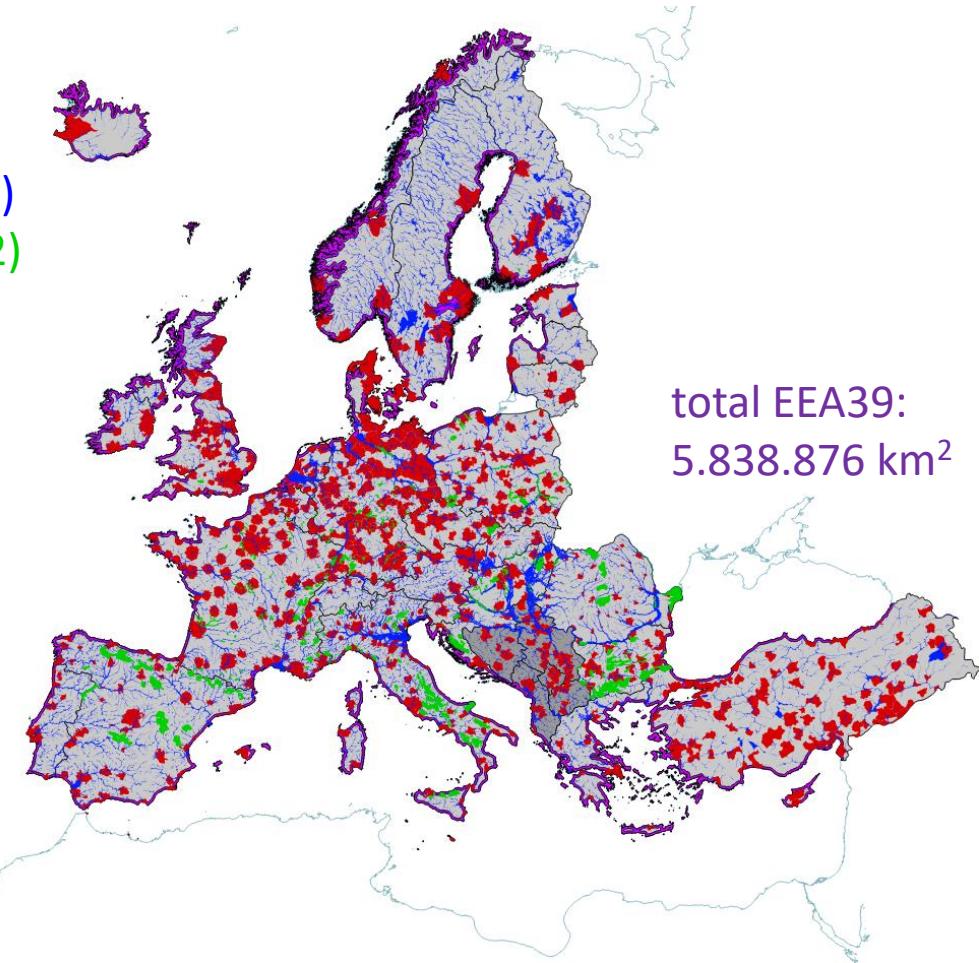
Hotspot monitoring products

Existing coverage:

- 1,1 M km² Urban Atlas (2006-12)
- 0,55 M km² Riparian Zones (2012)
- 0,52 M km² Natura2000 (2006-12)

In preparation: Coastal Zones:

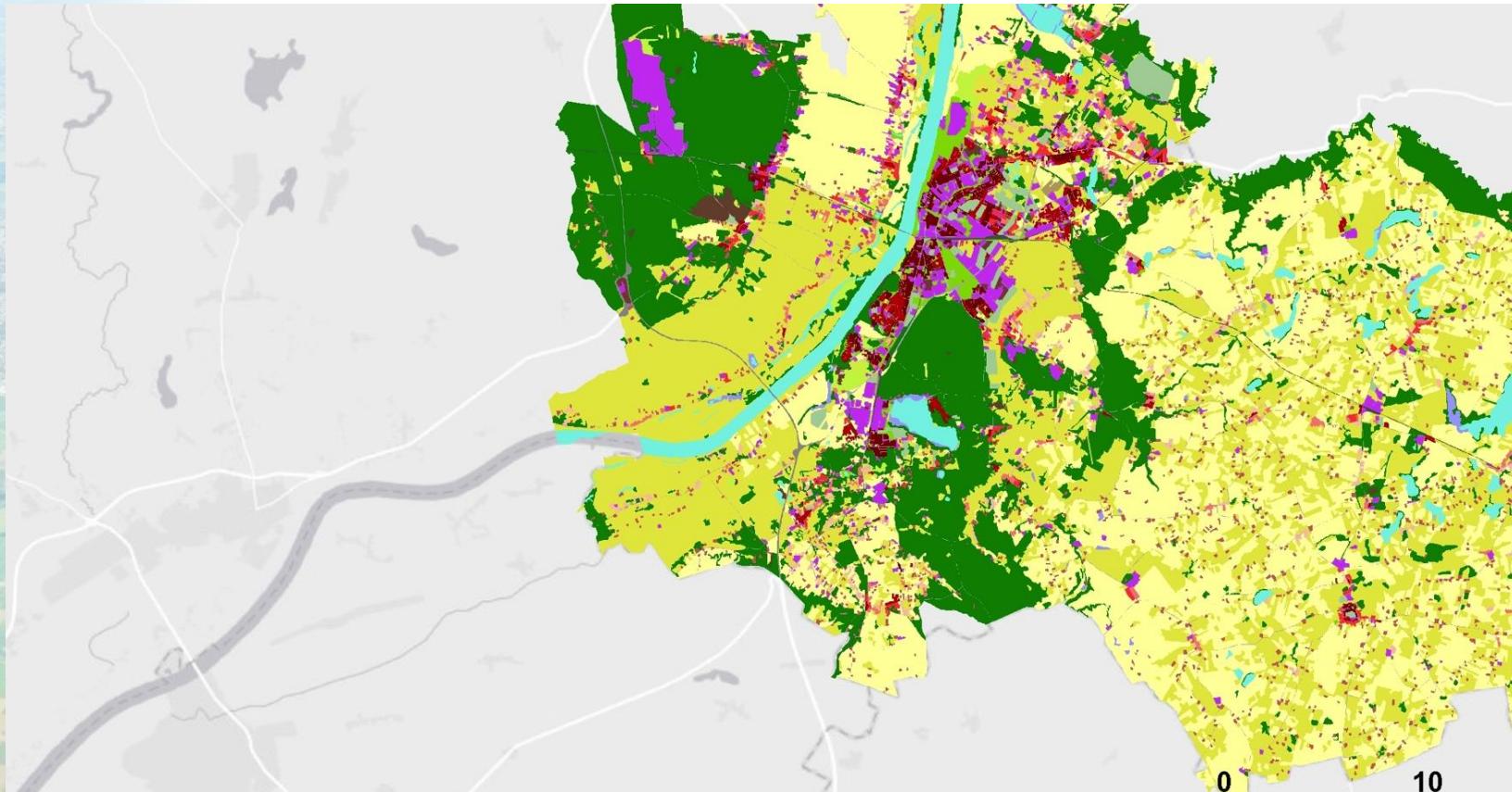
- 10 km inland buffer
- 0,64 M km² (2018)
- MMU: from 0,25ha to 1ha
- Adapted nomenclature
- Vector products





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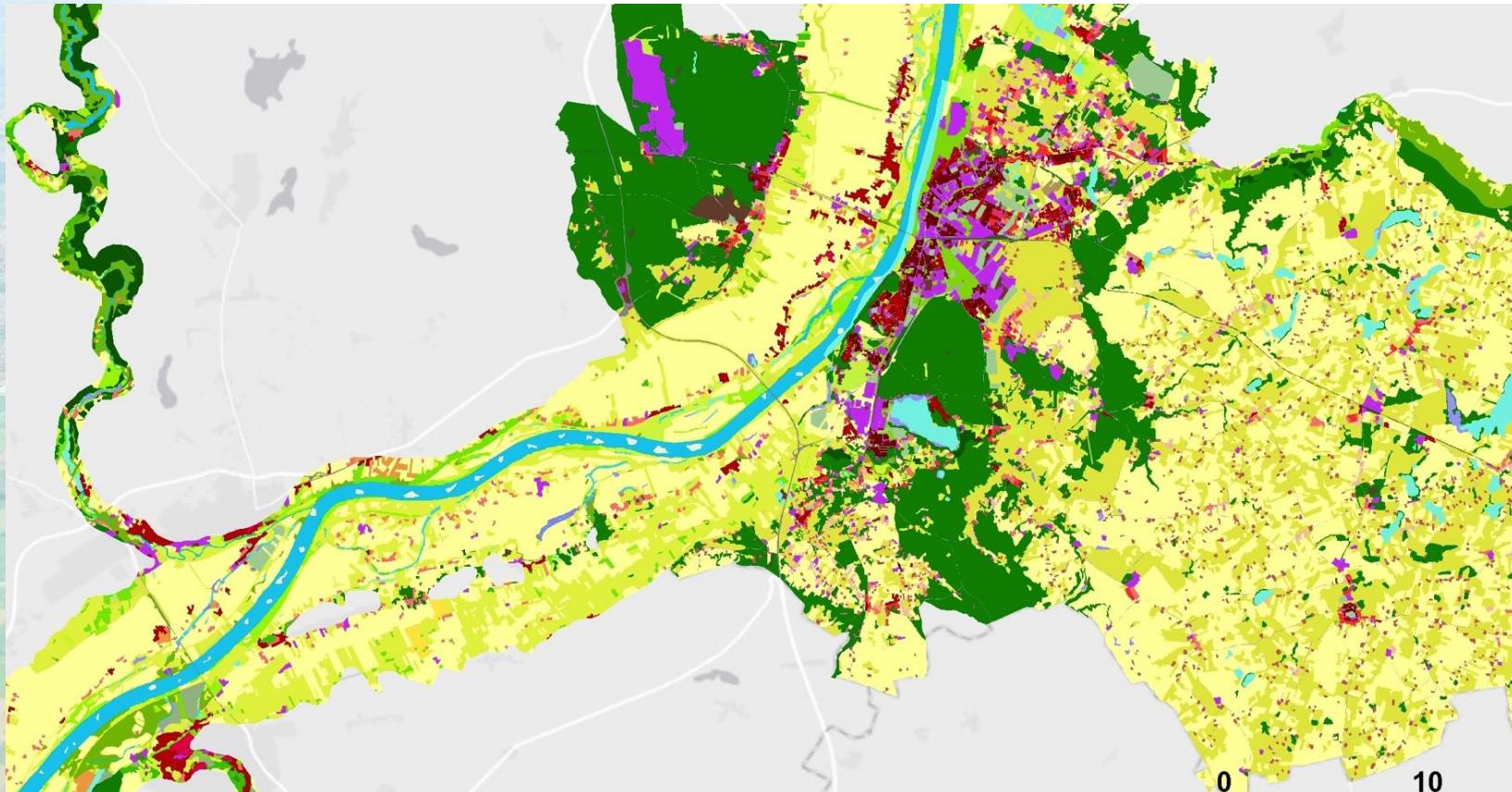
Urban Atlas (Grudziadz, PL)





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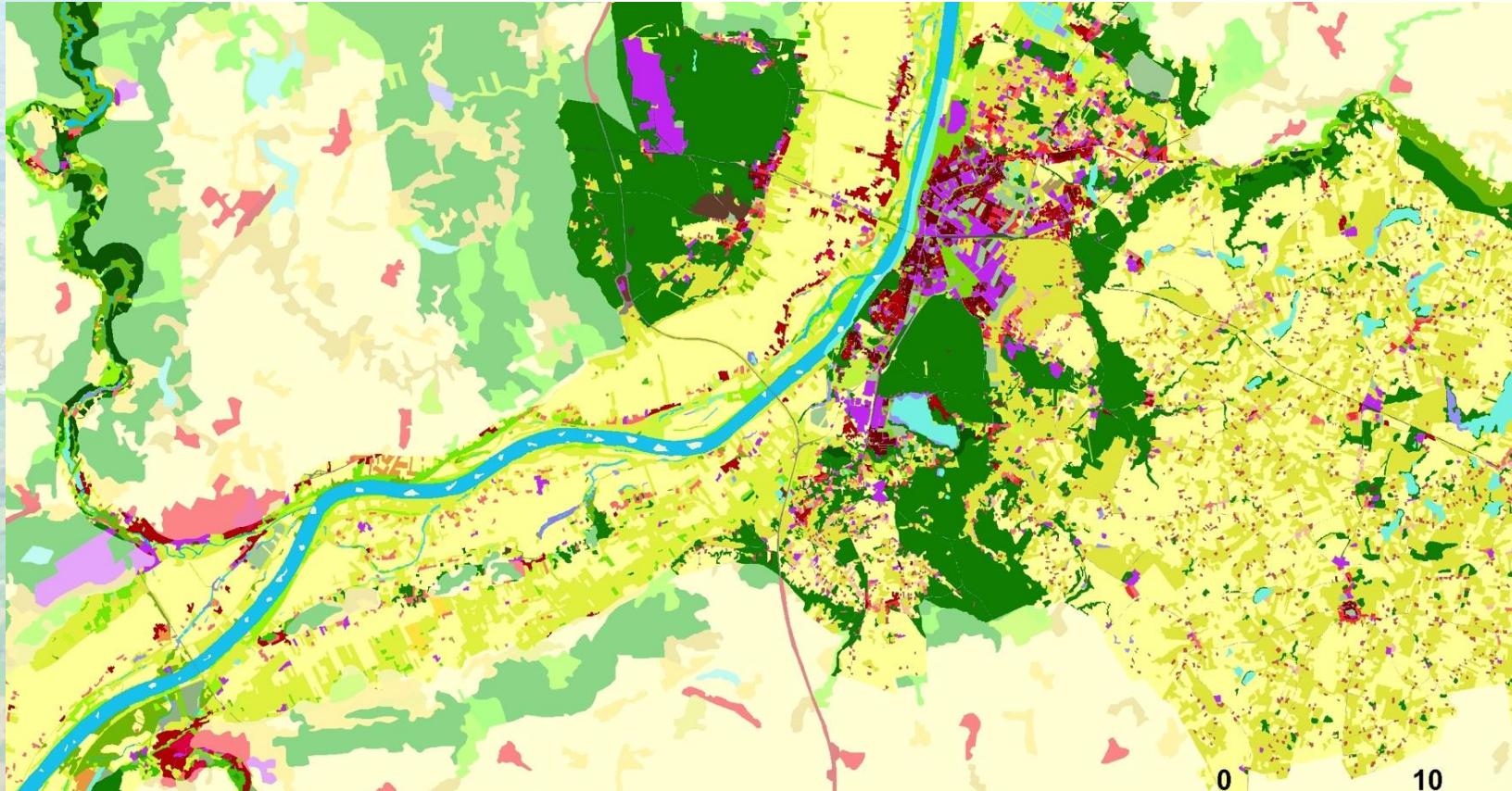
Urban Atlas + Riparian Zones (Grudziadz, PL)





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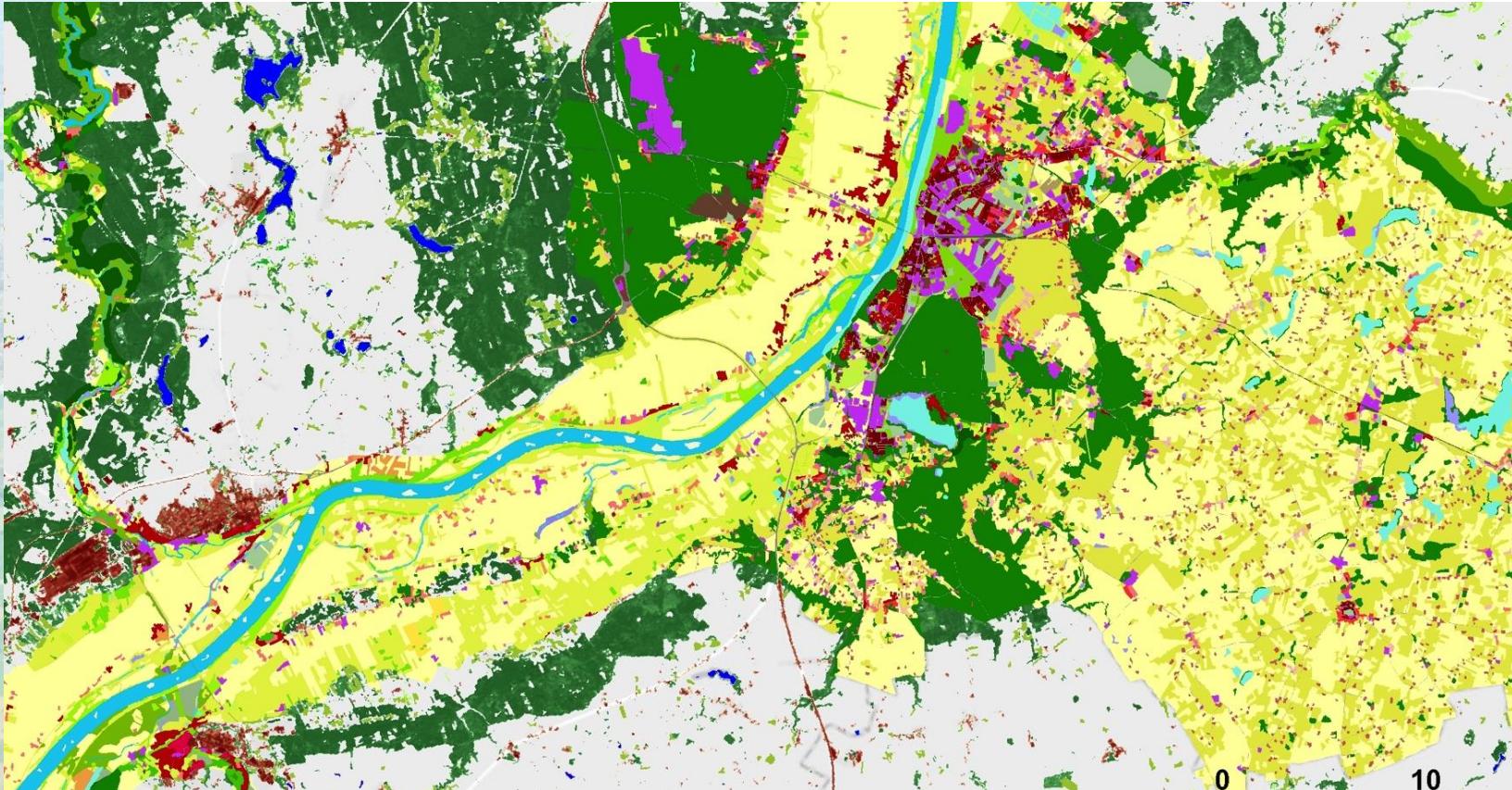
Urban Atlas + Riparian Zones + CLC (Grudziadz, PL)





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Urban Atlas + Riparian Zones + HRLs (Grudziadz, PL)





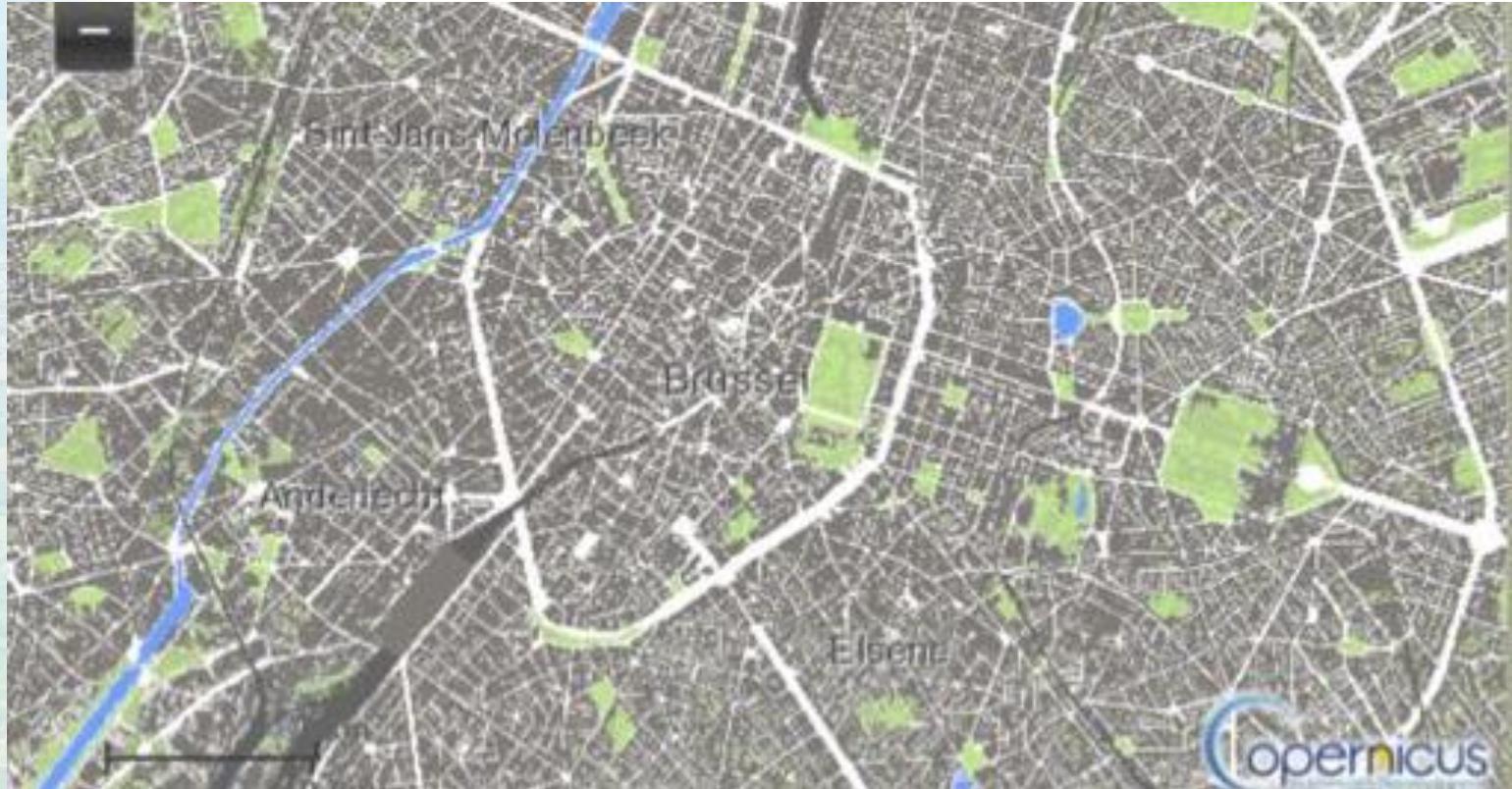
Land
Monitoring





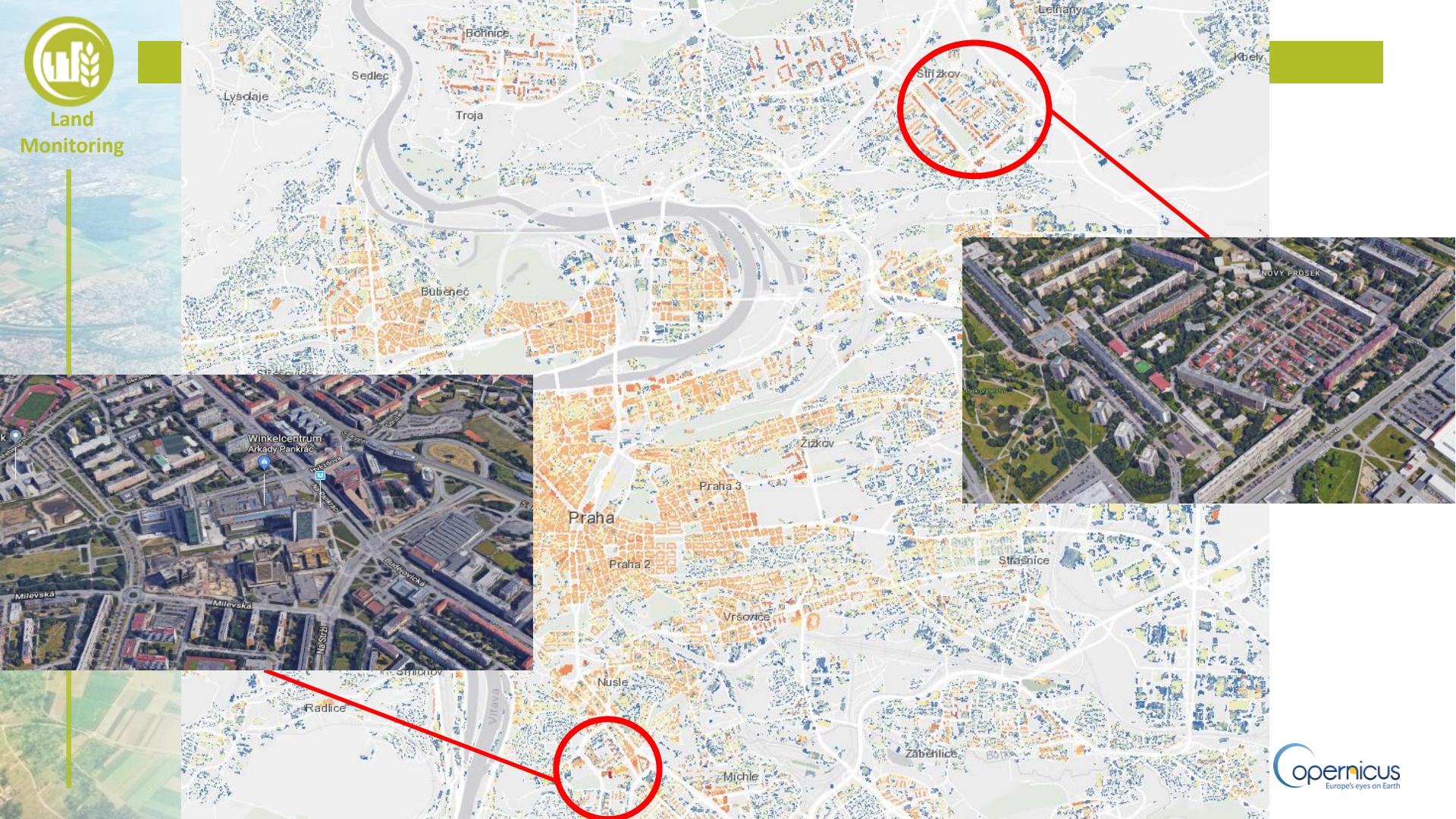
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EU settlement map to be included in HRL2018





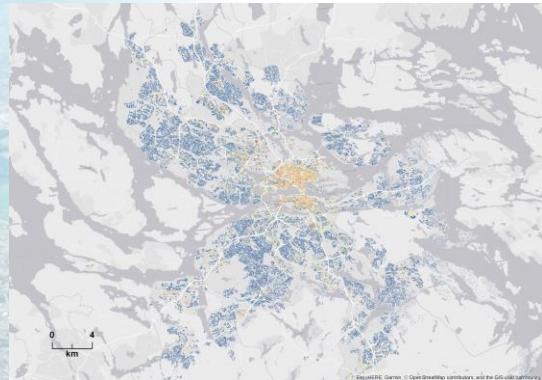
Land
Monitoring



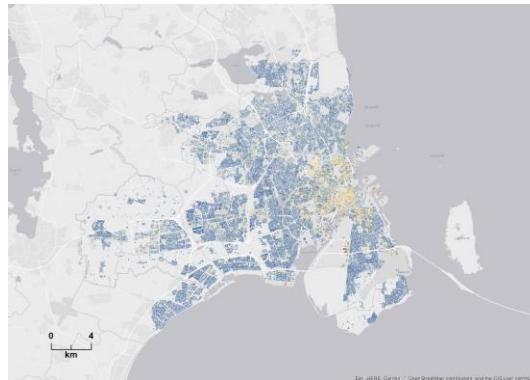


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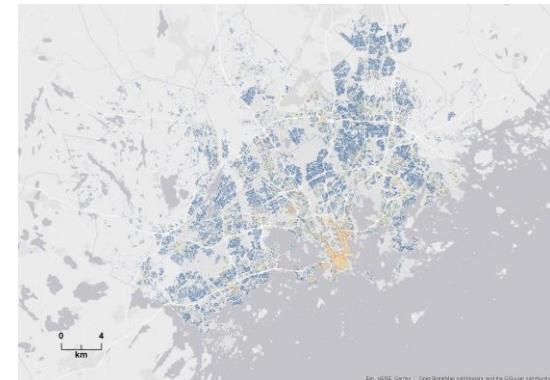
Building block height in EU28 capitals



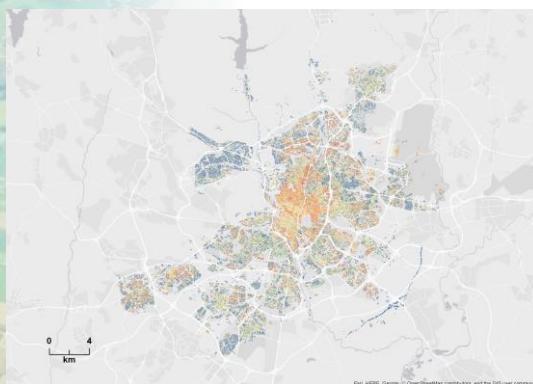
Stockholm



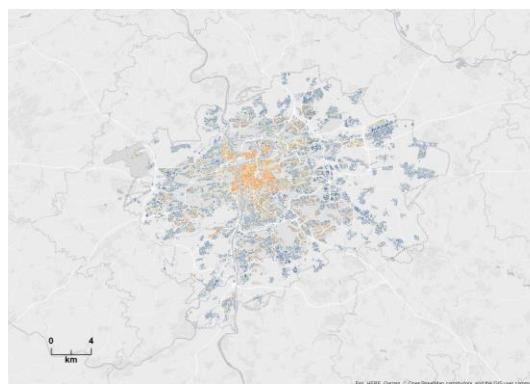
Copenhagen



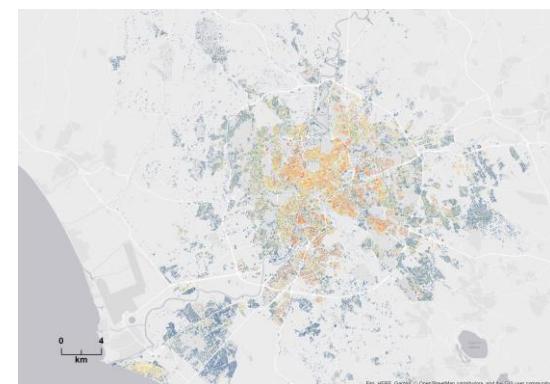
Helsinki



Madrid



Prague



Rome



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Requirements summary: New EU policies: driver for new concept: 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 & dynamic update cycle**
 - Pan-European coverage (EEA-39)
- Aspects of
 - Current CLC
 - Hotspot monitoring products
 - HRLs
 - EAGLE Group developments

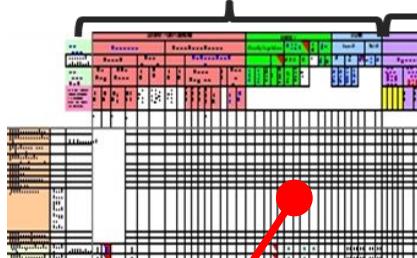




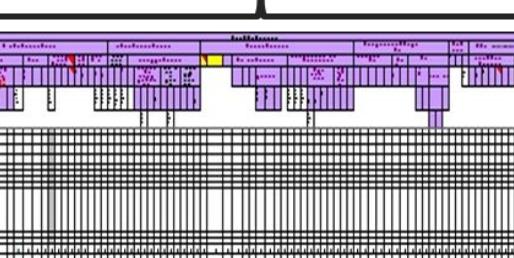
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CLC-Core GIS 101!

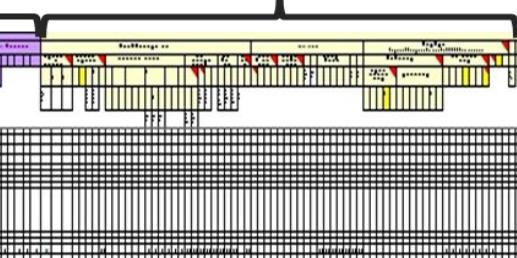
I. LCC block



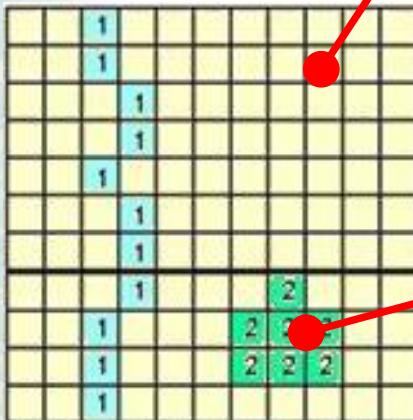
II. LUA block



III. CH block



- Grid GIS databases



Table

FID	Shape *	OBJECT	NAME	SUM_POP	SUM_DWELL2	SUM_POP19	Shape...
0	Polygon	1	Ajincourt North	22237	6352	20519	12392
1	Polygon	2	Ajincourt South-Malvern W	21770	6689	21154	15444
2	Polygon	3	Alderwood	12118	4599	12043	9146.8
3	Polygon	4	Annex	21117	12895	20969	6393.4
4	Polygon	5	Banbury-Don Mills	18083	7309	17908	16857
5	Polygon	6	Bathurst Manor	14027	5465	13908	12823
6	Polygon	7	Bay Street Corridor	9386	6127	8267	6897.8
7	Polygon	8	Bayview Village	12404	4458	12679	9510.6
8	Polygon	9	Bayview Woods-Steeles	13538	4687	13534	8263.6
9	Polygon	10	Bedford Park-Nortown	17293	7538	16070	10274
10	Polygon	11	Beechborough-Greenbrook	7231	2690	7067	6355.8
11	Polygon	12	Bendale	12578	4388	11157	9215.5
12	Polygon	13	Black Creek	24360	7513	24707	8901.5

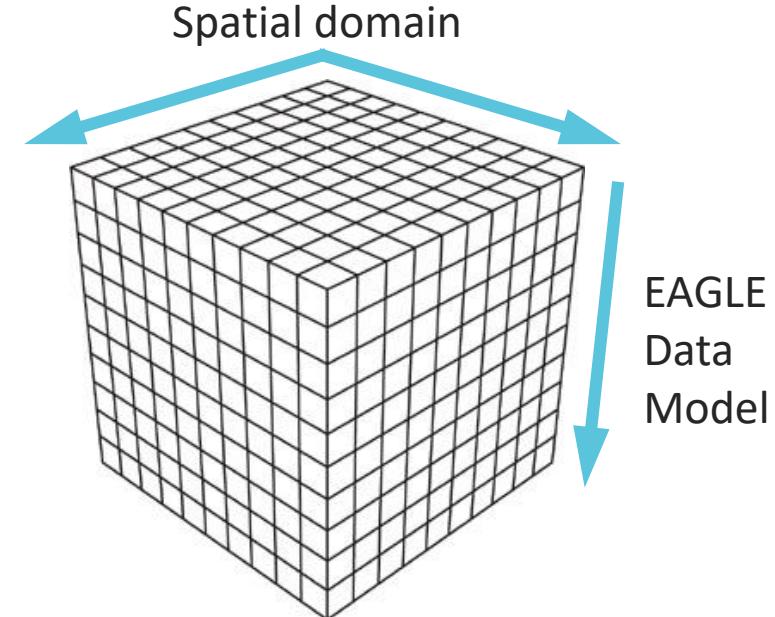
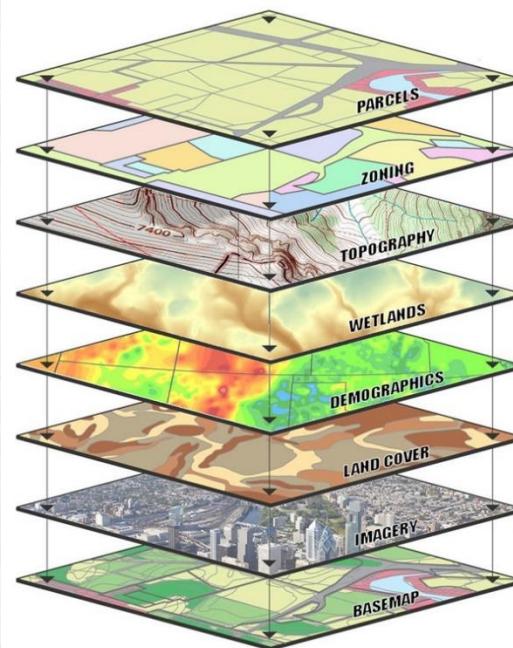


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CLC-Core Concept



- Database for storage and access to information.

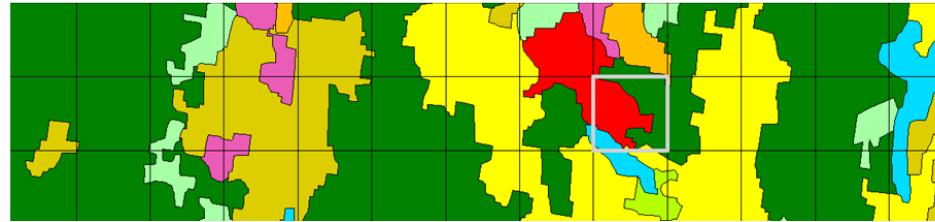


Source: CSU,
<http://heleneloyan.cikeys.com/update/gis-layers/>

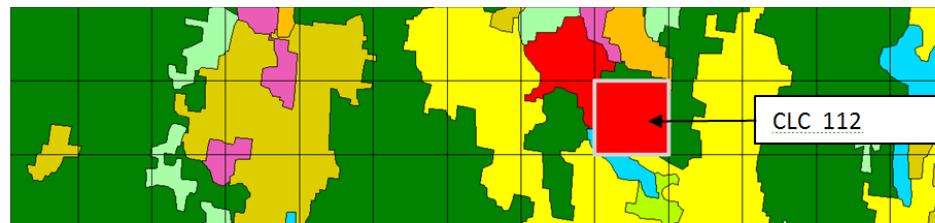


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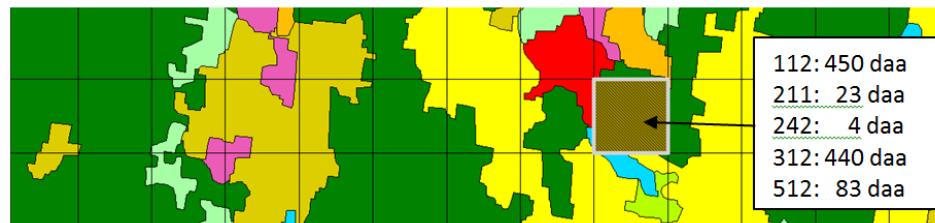
CLC-Core GIS 101 example



CLC with 1 km raster/grid superimposed



Raster representation: A single class is assigned to each pixel



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



Some city related use cases

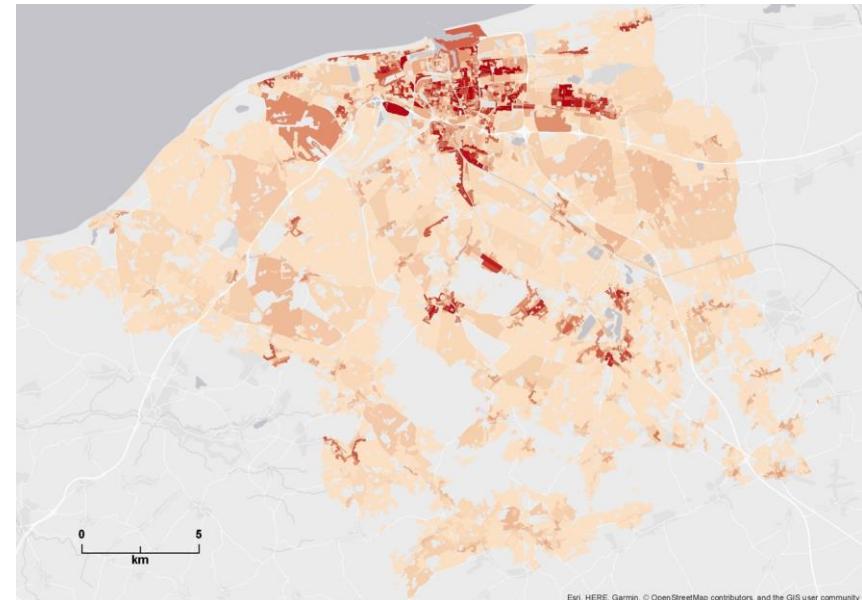
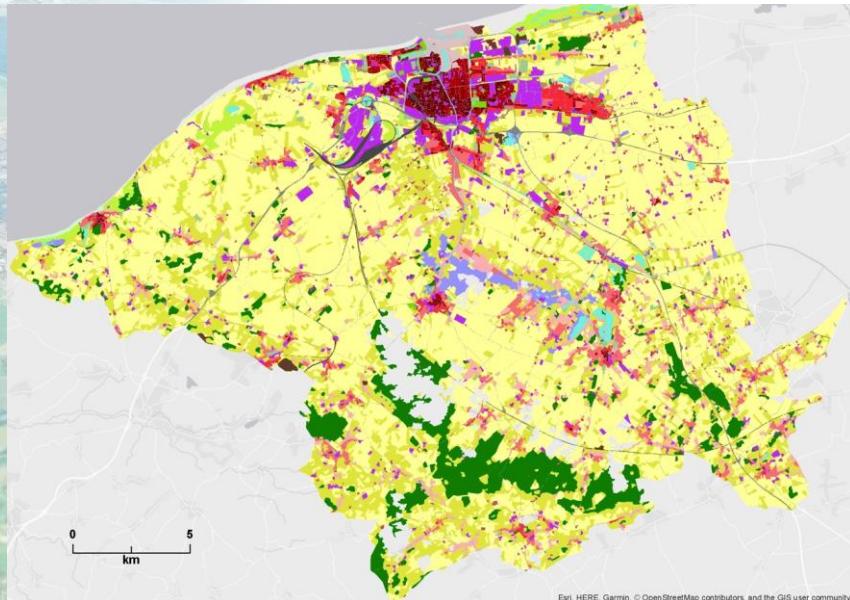




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Population density estimates based on UA

Calais (FR)

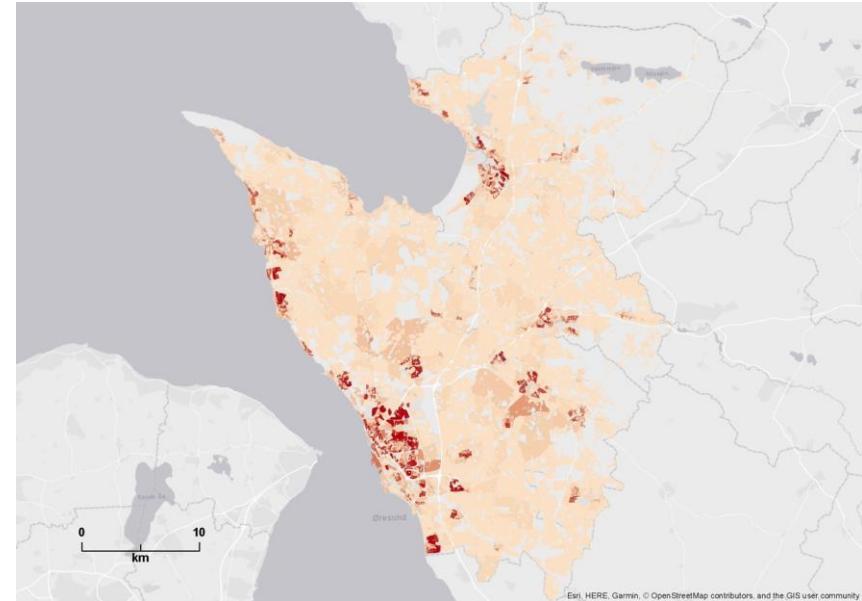
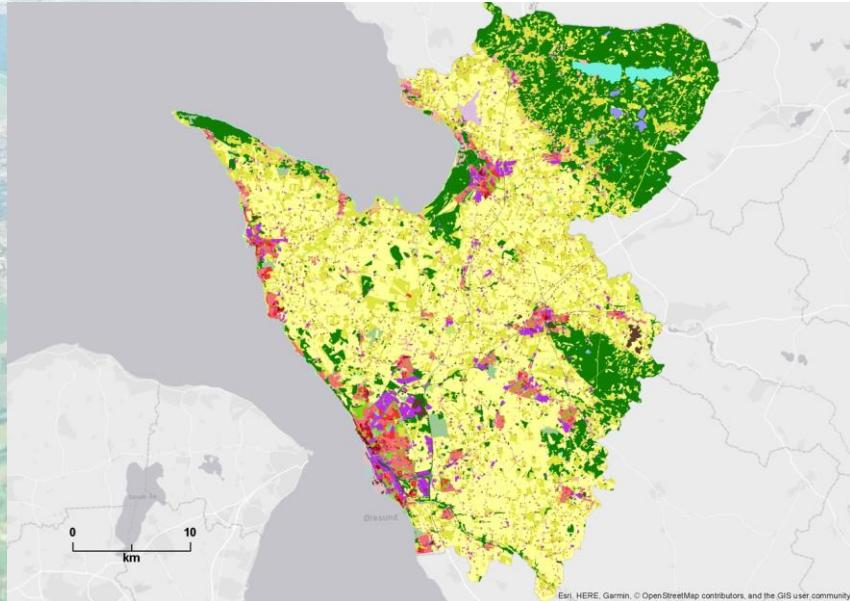




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Population density estimates based on UA

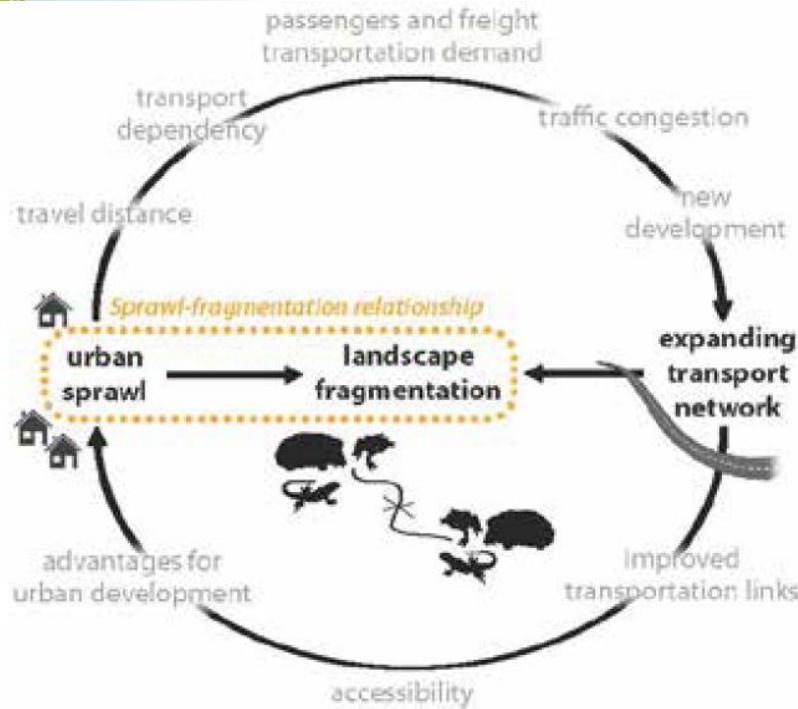
Helsingborg (SE)



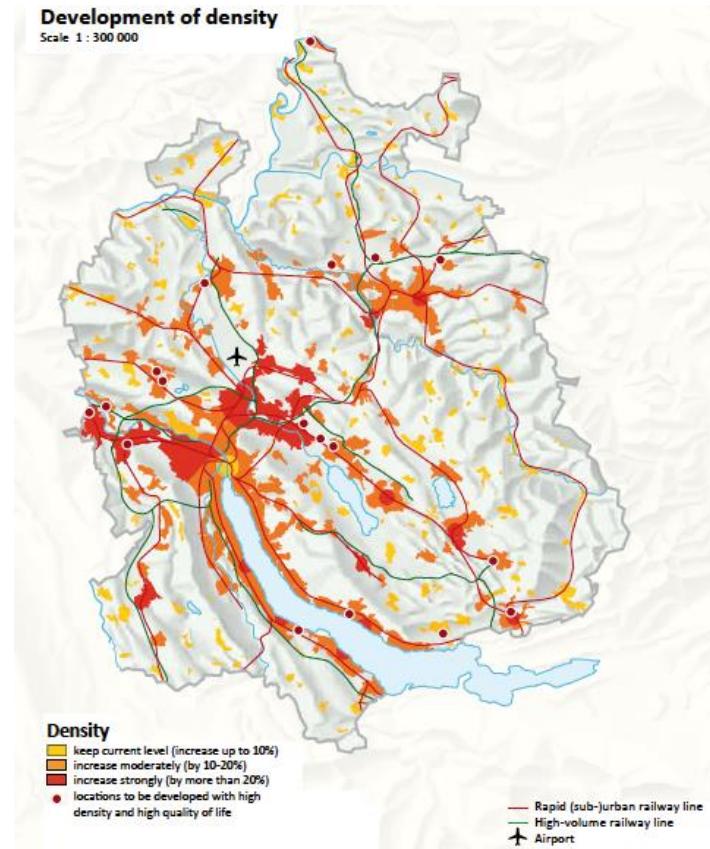


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Road network expansion, urban sprawl & lock-in



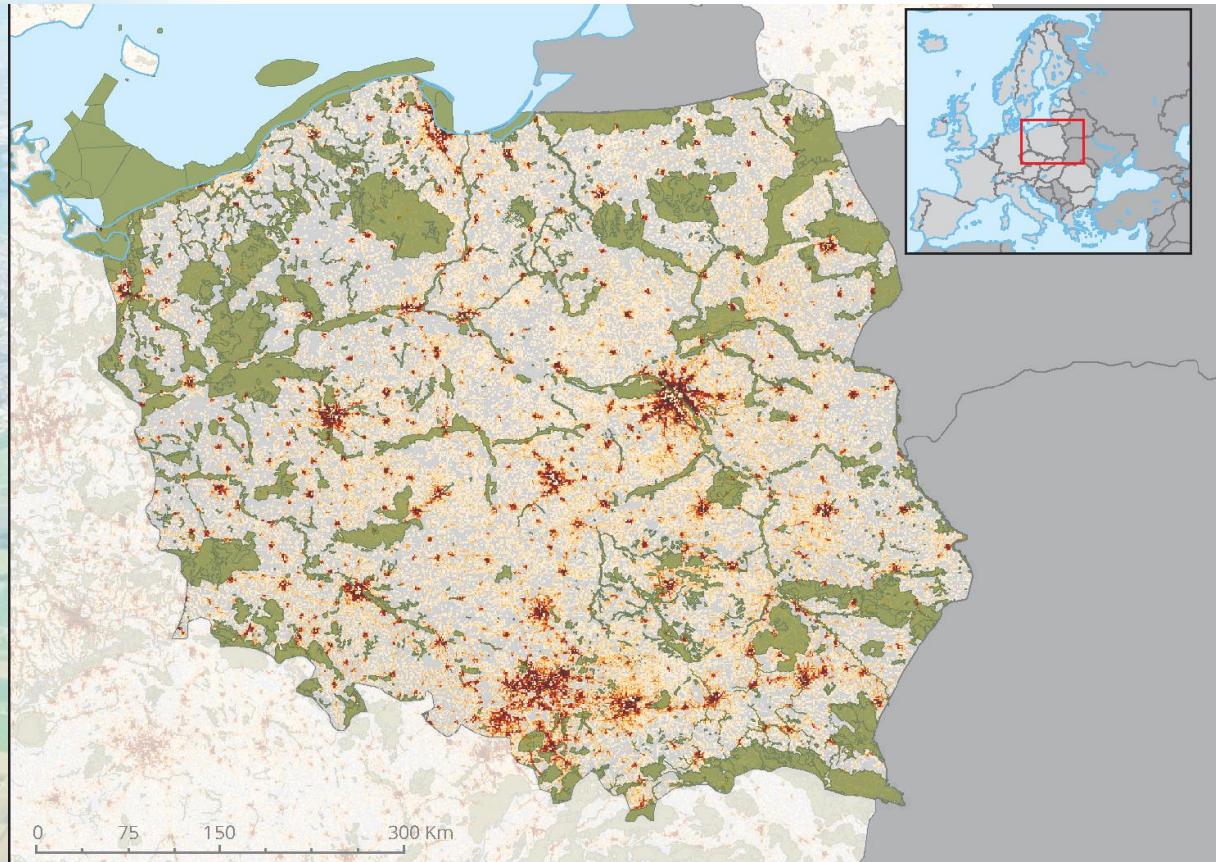
source: Torres 2016





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Overlay of N2K with urban sprawl (PL) (EEA & FOEN)



Overlay of the Natura 2000 network with the urban sprawl results for Poland

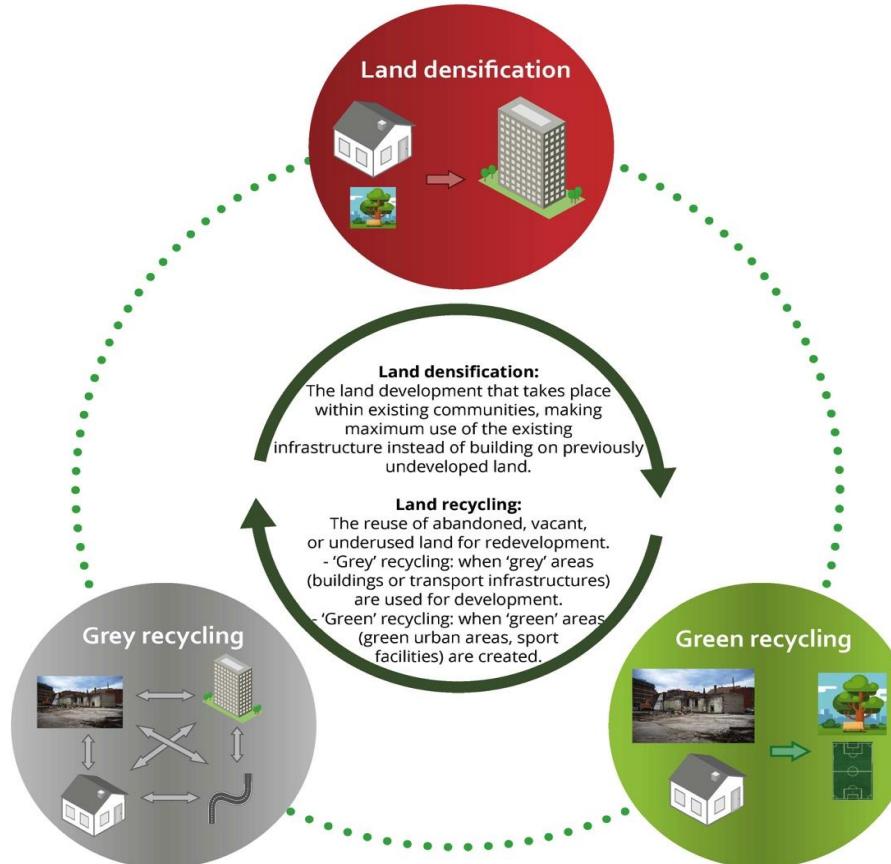
Urban permeation units per m²

- < 1
- 1-3
- 3-5
- 5-8
- 8-13
- 16-18
- 18-25
- 25-32
- 32-41
- > 41
- No built-up areas
- Natura 2000 sites
- Outside Poland
- Outside EEA member countries



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Land recycling as a concept



European
Commission

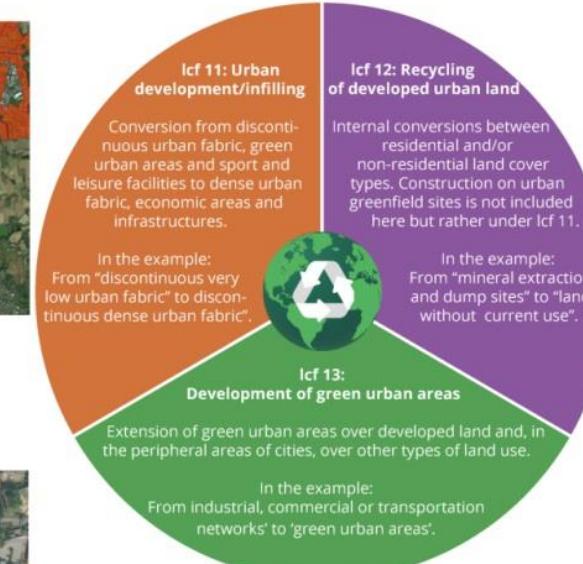
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Europe's eyes on Earth



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Land Cover flows in land recycling:

LAND RECYCLING



Lcf11 Urban development/infilling: conversion from discontinuous urban fabric, green urban areas and sport and leisure facilities to dense urban fabric, economic areas and infrastructures;

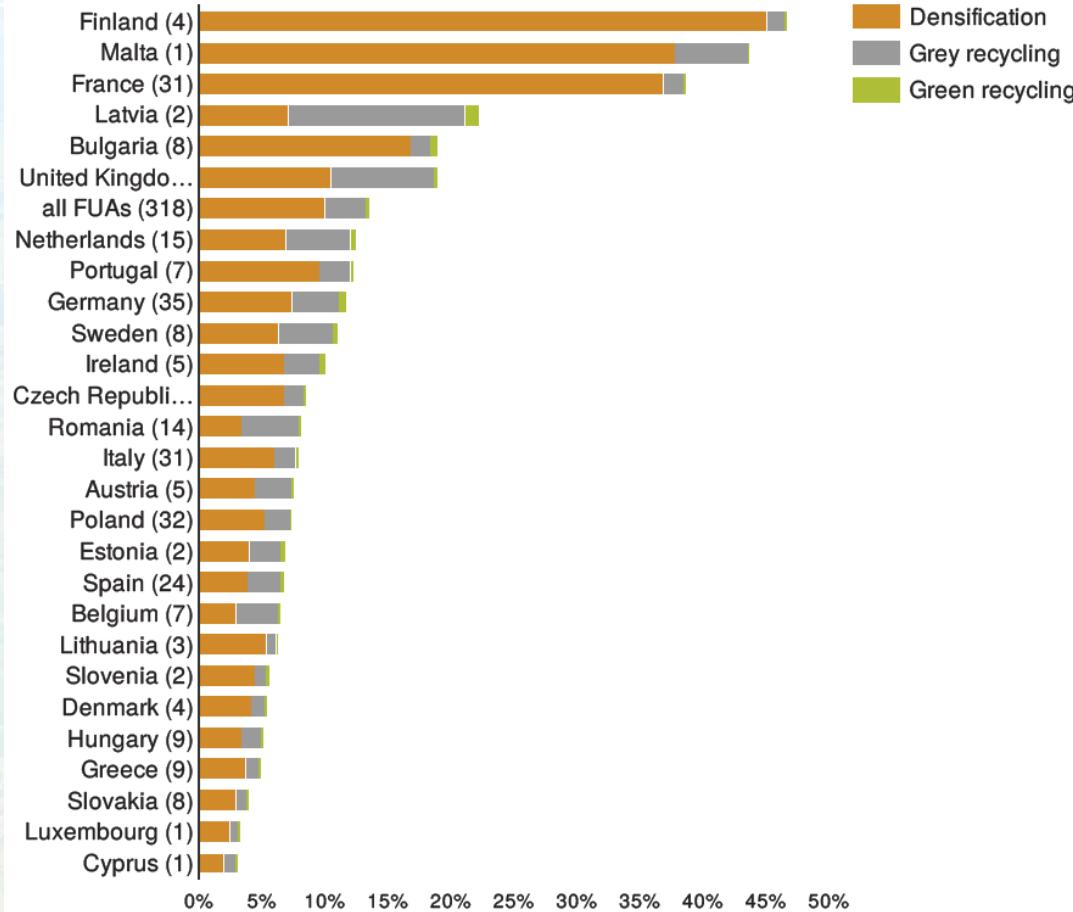
Lcf12 Recycling of developed urban land: internal conversions between residential and/or non-residential land cover types; construction on urban greenfield sites is not included here but rather under LCF11;

Lcf13 Development of green urban areas: extension of green urban areas over developed land and, in the peripheral areas of cities, over other types of land use;



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Components of land recycling: % of total land consumption



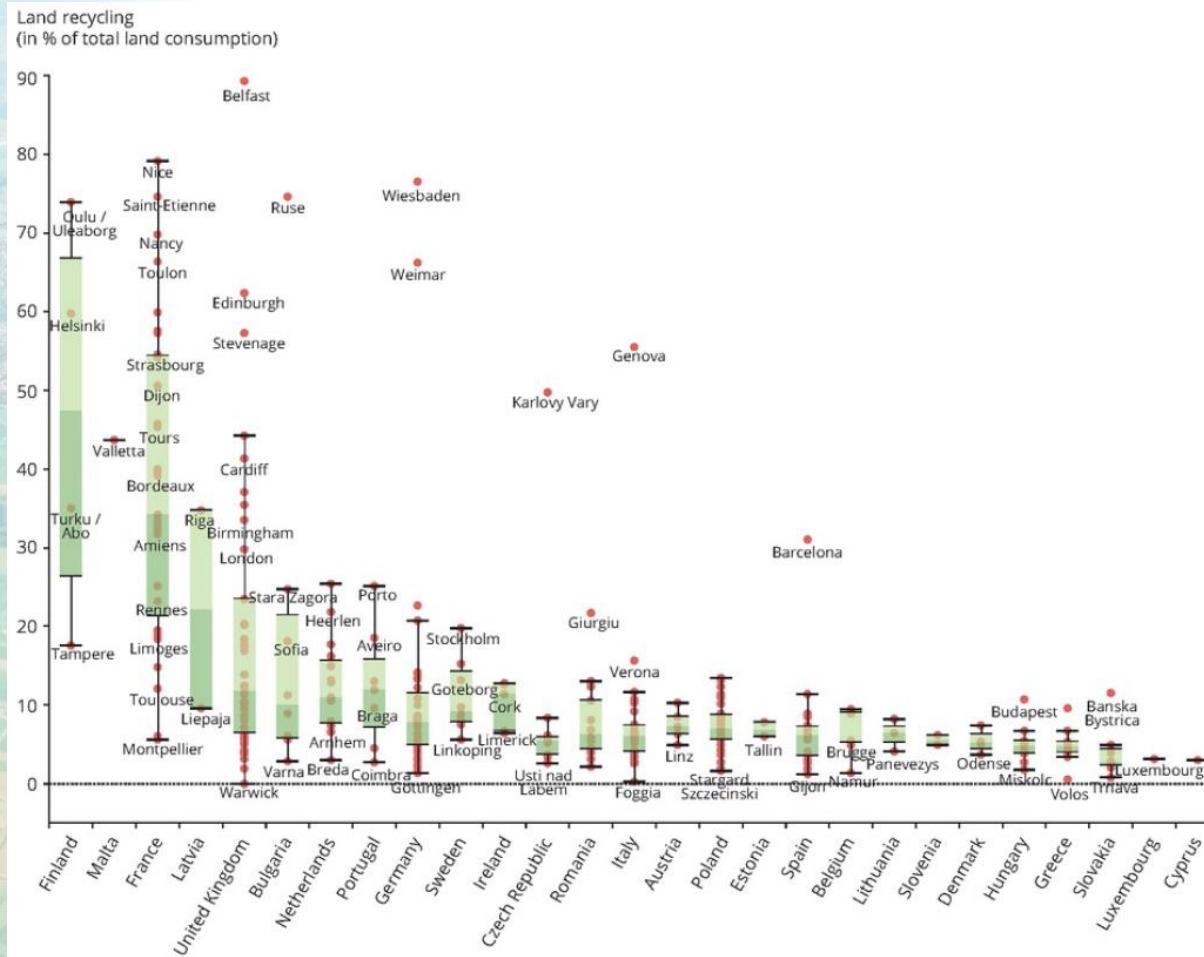
European
Commission

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Land recycling by FUA and country



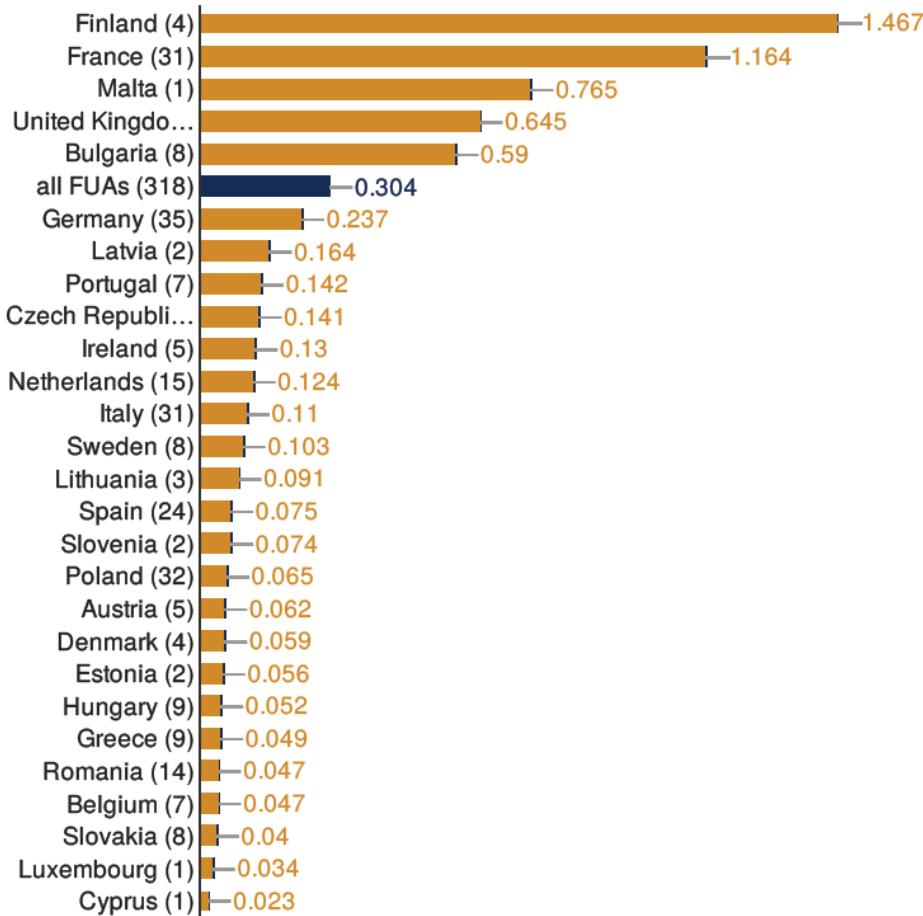
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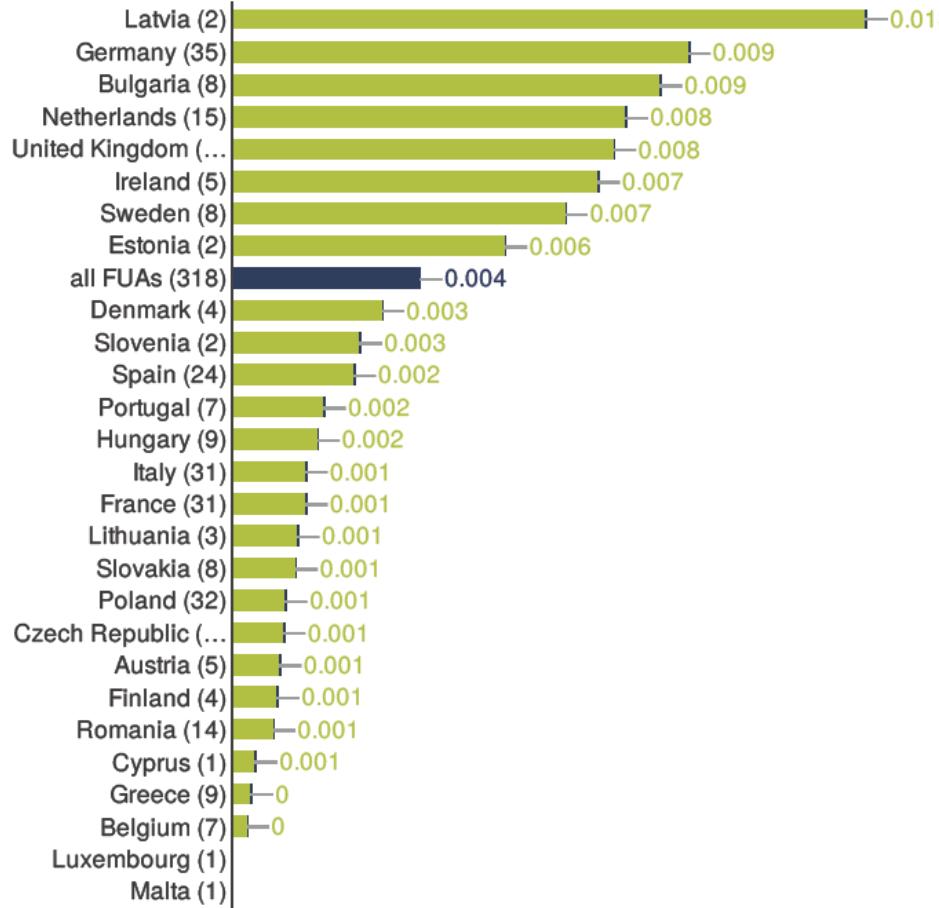
Ratio of densification to land take (average of all FUAs)



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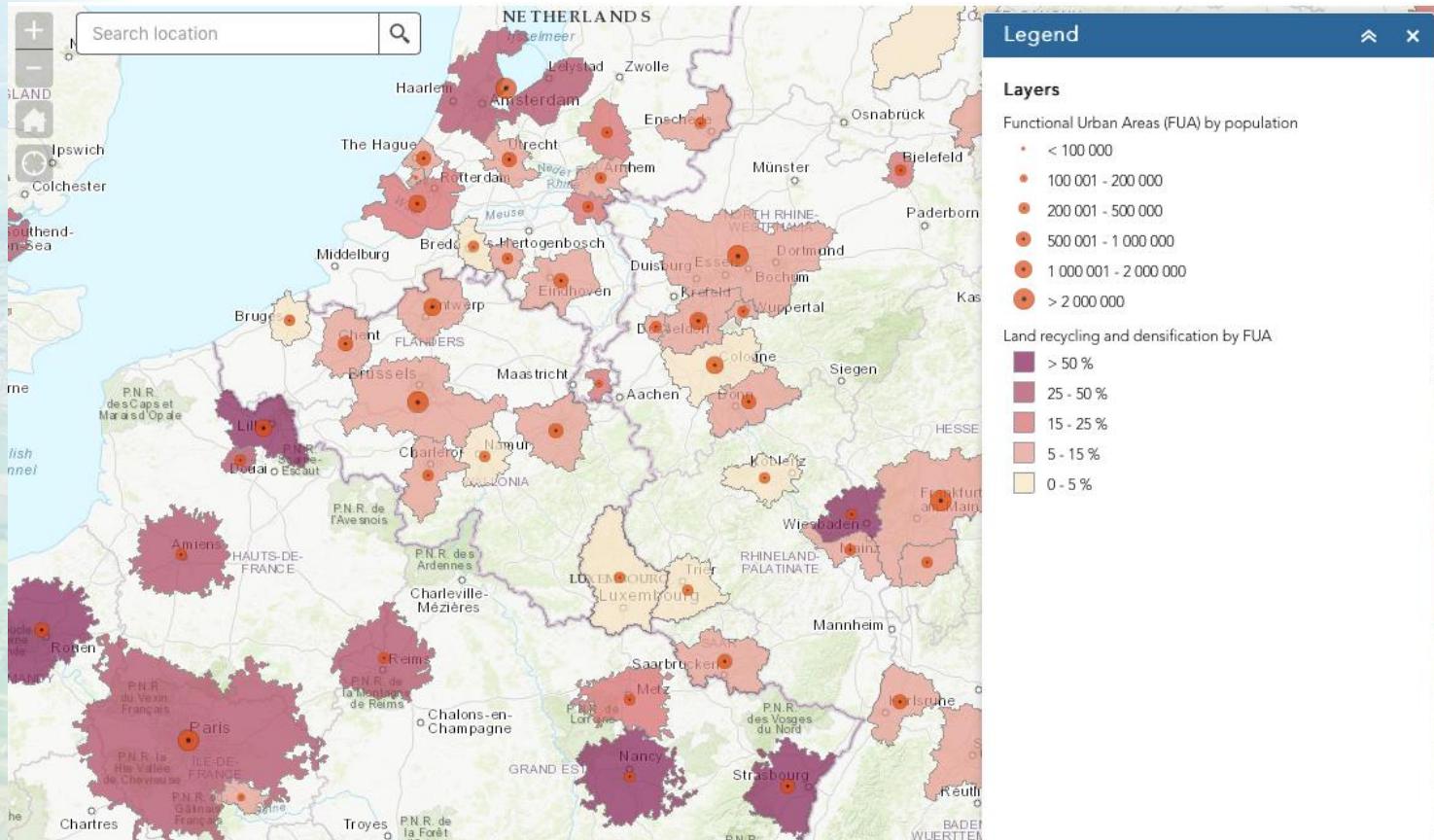
Ratio Green Recycling to Land Take (average of all FUAs)





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Interactive web map on land recycling & densification





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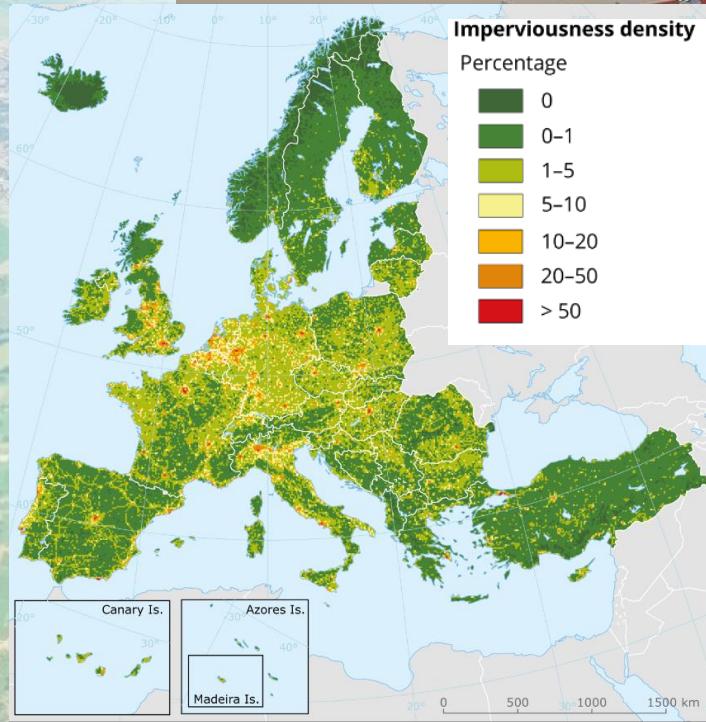
Key messages: land recycling & densification indicator

- Land recycling is still low in all European countries: on average, land recycling accounted for only 13.5 % of total land consumption in European cities in the 2006-2012 period.
- The land use densification process, i.e. when land development makes maximum use of existing infrastructure, accounts for the largest proportion of land recycling (10 % of total land consumption). However, in most countries, land take dominates over densification in total land management with the exception of Finland and France.
- Grey recycling, i.e. internal conversions between residential and/or non-residential land cover types, is secondary to densification, ranging from 14 % to less than 1 % of total land consumption. Land take predominates over grey recycling in total land management in all countries.
- Green recycling, i.e. the development of green urban areas using previously built-up areas, is an important trend that reverses soil sealing, but it is a marginal process in all countries and, on average, it accounts for only 0.2 % of total land consumption.

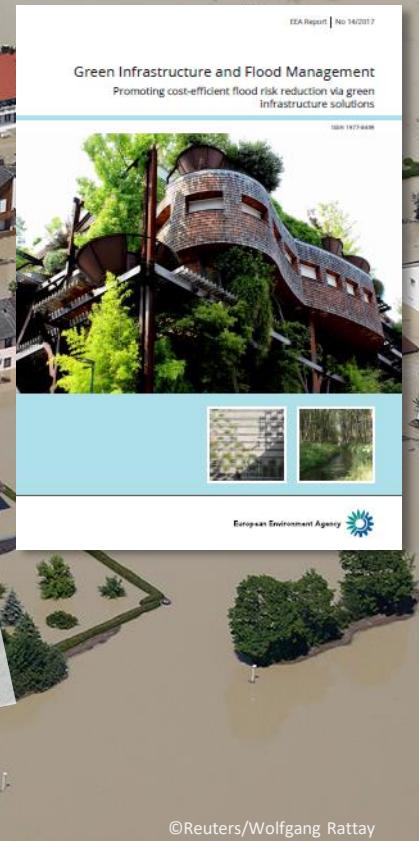


Land
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Safeguarding citizens from risks to health & well-being



Floods in Europe will
cause five times more
damage by 2050





Land
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Assessing flash flood risks

München ist die am stärksten versiegelte Stadt

SPIEGEL ONLINE SPIEGEL

Menü | Politik Meinung Wirtschaft Panorama Sport Kultur Netzwerk Wissenschaft mehr ▾

WIRTSCHAFT

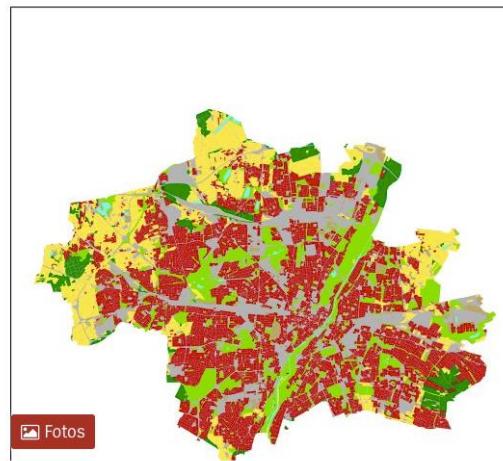
Schlagzeilen | DAX 11.466,39 | TV-Programm | Abo

Nachrichten > Wirtschaft > Verbraucher & Service > Stadtplanung > München: Von allen Städten am meisten bebaut und asphaltiert

Versiegelte Flächen

In diesen Städten ist Starkregen besonders gefährlich

Weil immer mehr Flächen versiegelt sind, drohen bei Starkregen Überschwemmungen. Eine Datenanalyse zeigt, wie viel Fläche deutsche Großstädte verbaut haben - und wer Beton-Spitzenreiter ist.



Versiegelungskarte München (Stadt)

Mittlerer Versiegelungsgrad: 46,61 %

Legende

- 11 - Städtische Bebauung
- 12 - Verkehrswege, öff./industr./gewerb. Nutzung
- 13 - Baustellen, Halden, Mineralförderung, ungenutztes Land
- 14 - Städtisches Grün
- 2 - Landwirtschaftliche Nutzung
- 3 - Wald, Vegetation, offene Flächen ohne Vegetation
- 4 - Auen
- 5 - Wasser
- 9 - keine Daten

Nutzung	Durchschnittliche Versiegelung in %	Flächenanteil in %
11	66,27	35,92
12	75,00	24,55
13	49,58	2,14
14	18,24	14,10
2	37,73	17,37
3	1,23	4,97
5	3,89	0,95

GDV

Gesamtranking: Versiegelungsgrad der 50 einwohnerstärksten Städte

Rang	Stadt	Versiegelungsgrad in %
1	München	46,6
2	Oberhausen	44,2
3	Hannover	42,6
4	Ludwigshafen am Rhein	42,3
5	Nürnberg	40,4
6	Mannheim	40,2
7	Gelsenkirchen	39,4
8	Berlin	39,0
9	Bochum	37,9
10	Duisburg	37,0
11	Frankfurt am Main	45
12	Essen	46
13	Oldenburg	47
14	Düsseldorf	48
15	Hamburg	49
...
45	Heidelberg	18,8
46	Saarbrücken	18,5
47	Münster	17,9
48	Hamm	17,8
49	Freiburg im Breisgau	17,6
50	Potsdam	12,7



Land
Monitoring



Thank you

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