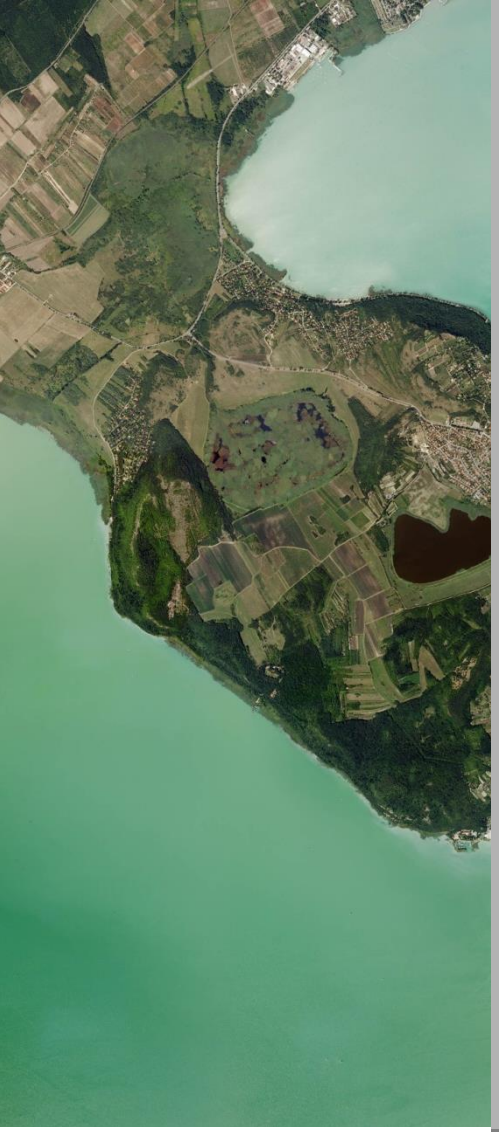


Mapping land take and soil sealing in the frames of Copernicus land monitoring

Gergely Maucha
head
Environmental Applications of Remote Sensing
Institute of Geodesy, Cartography and Remote Sensing (FÖMI)

National Seminar on PannEx / Land Degradation Neutrality
8. December 2016.

Institute of Geodesy, Cartography & Remote Sensing
1149 Budapest, Bosnyák tér 5. - Hungary
http://www.fomi.hu

Land take - context

'Land take' dominates in Europe, with artificial areas and agricultural intensification, resulting in land degradation, worsened by high fragmentation on 30% of land area. Conflicting demands on land impact significantly on the land's potential to supply key services.

Limiting 'land take' is already an important policy target at national or sub-national level. Balancing land-recycling, compact urban development, place-based management and green infrastructure will provide positive effects.

Addressing the issues raised, the European Union's (EU) 7th Environment Action Programme (7th EAP)[2] aims to ensure that by 2020 land is managed sustainably. This commitment requires coordinated governance and integration of environmental considerations into territorial planning decisions on land use. Land policy targets would also help achieve this goal, and the **7th EAP** specifically suggests a **target** of **'no net land take' by 2050**. This resonates with the UN Rio+20 Summit[3] call for a land-degradation-neutral world in the context of sustainable development, a goal to which the EU has subscribed.

SOER 2015 — The European environment — state and outlook 2015

Copernicus programme

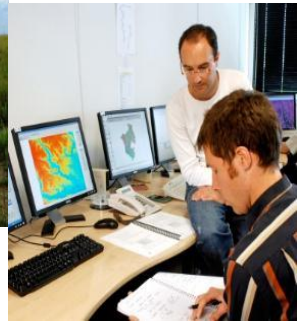
GMES (Global Monitoring for Environment & Security)

Copernicus is a joint initiative of the EC and ESA to develop a high-quality European Earth observation capacity. Its objective is to provide relevant information services to policy-makers and other users, particularly in relation to environment and security

Copernicus components

- Space segment (e.g Sentinel satellites)

- In-situ observatations



- Information services

Source: EEA

Mapping land take and soil sealing in the frames of Copernicus land monitoring

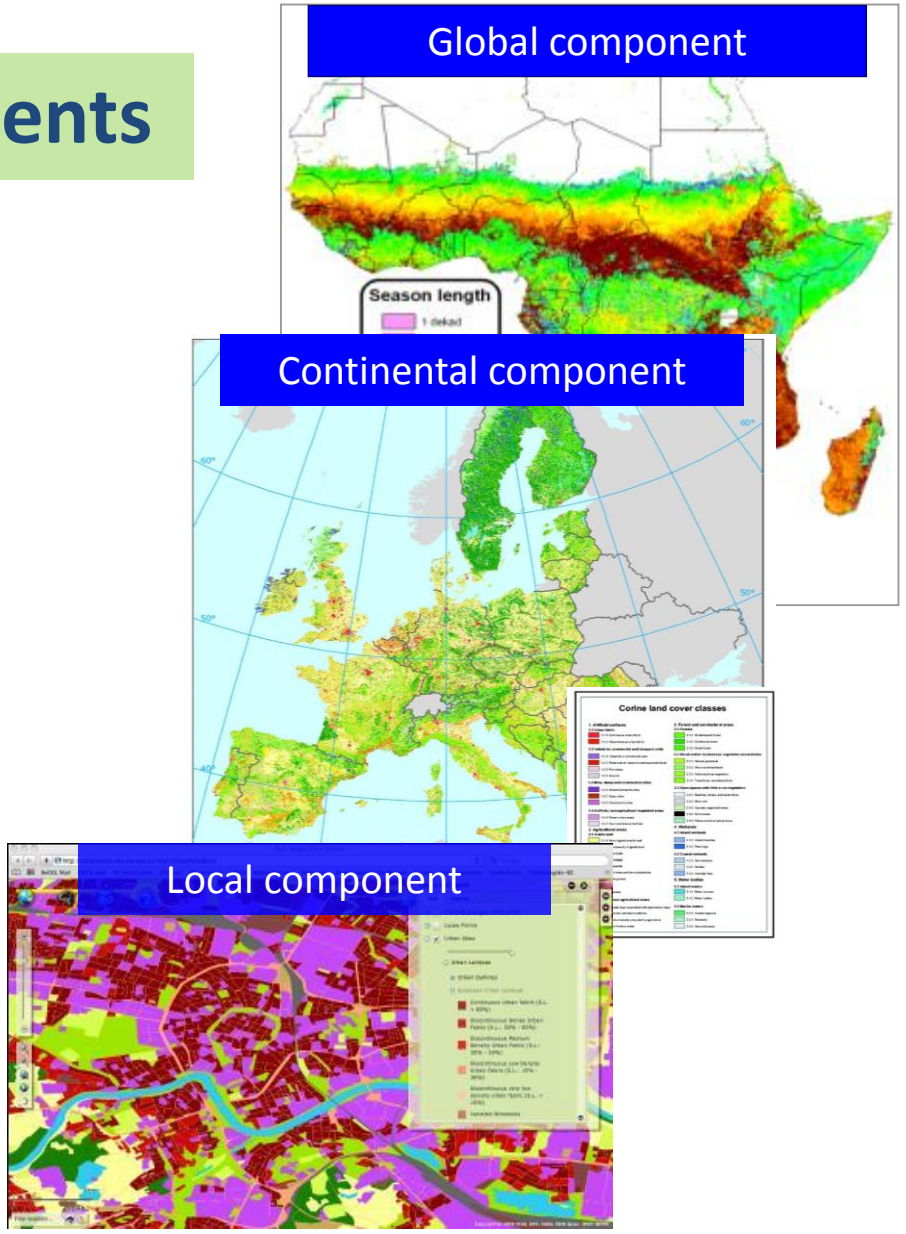
Copernicus land components

- **Global component**
  bio-physical parameters (Essential Climate Variables (ECVs), food security (Africa) etc.)

- **Pan-European component**
  Satellite image mosaics, CORINE land cover & changes, High Resolution layers (HRL)

- **Local component (hot spot mapping)**
  Urban Atlas + HR land cover for Riparian zones / Natura 2000 areas / Coastal zones

- **In-situ component**
  National ortho-photos, topo& thematic maps, cadastral maps, LPIS data, Eurostat LUCAS survey, …



Source: EEA

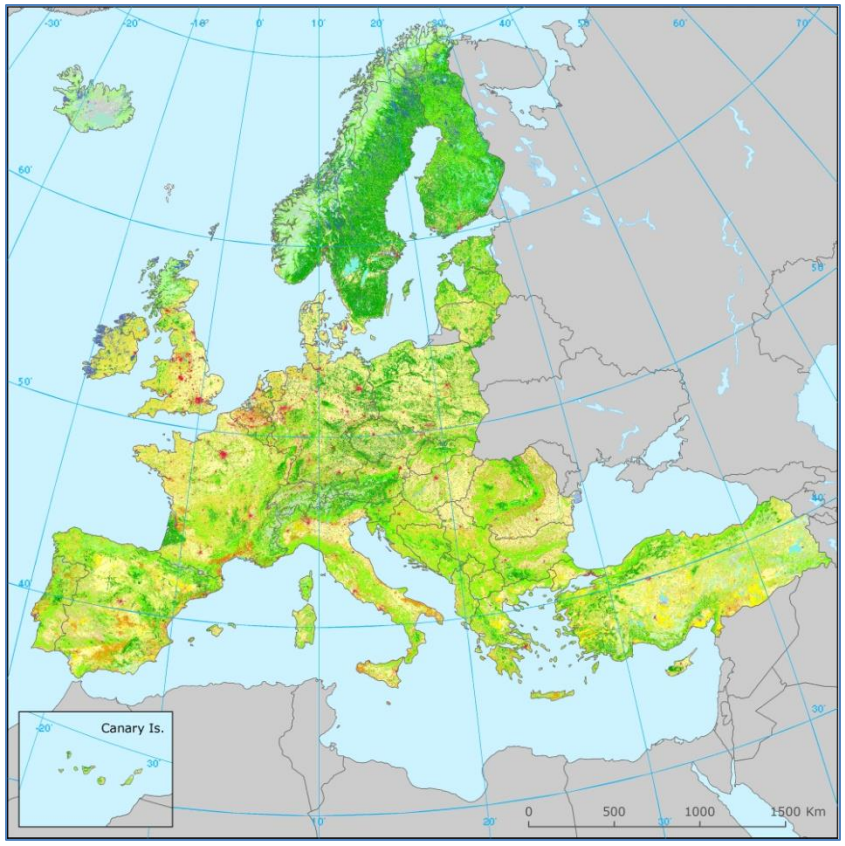
Participation in National and European land monitoring

- National segment of **European CLC update & change mapping** as NRC land cover
- Verification & enhancement of **HR land cover layers**
- **National 1:50.000 scale CORINE Land Cover** mapping (CLC50)
- Working for **European Environment Agency** (EEA) as participating in **European Topic Centres** since 2001:
  - 2001-2006: European Topic Centre - Terrestrial Environment (ETC-TE)
  - 2006-2010: European Topic Centre - Land Use &Spatial Information (ETC-LUSI)
  - 2011-2014: European Topic Centre - Spatial Information and Analysis (ETC-SIA)
  - 2015- : European Topic Centre – Urban, Land and Soil systems (ETC-ULS)

- ➢ Participation in the coordination of European land cover mapping activities (methodological developments, QA/QC, training of national teams)
- ➢ Participation in the development and testing of LC/LU related environmental indicators (land take, imperviousness & change)
- ➢ Participation in the development of a **European land monitoring strategy** (**EAGLE** working group, **FP7 HELM** project

CORINE land cover (CLC) mapping

CORINE = Co-ordination of Information on the Environment



Purpose: To provide quantitative, consistent and comparable information on land cover

Applications: Land cover is a basic data source for environmental modelling, regional planning and orientation of the environmental policy in Europe

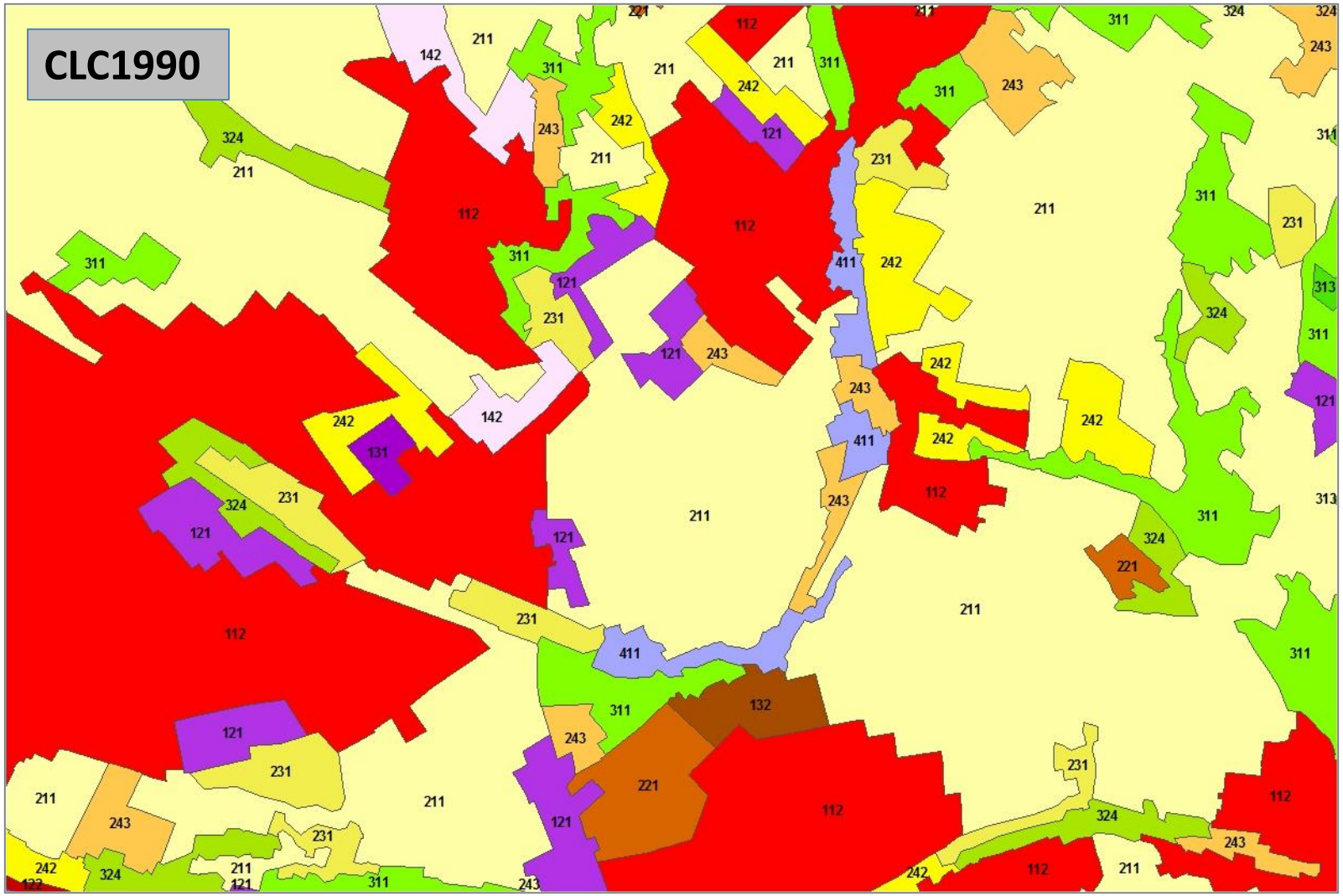
Mapping surface features at scale 1:100.000 based on physical characteristics

Minimum Mapping Unit (status): **25 ha**
Minimum Mapping Unit (changes): **5 ha**
Minimum Mapping Width: **100 m**

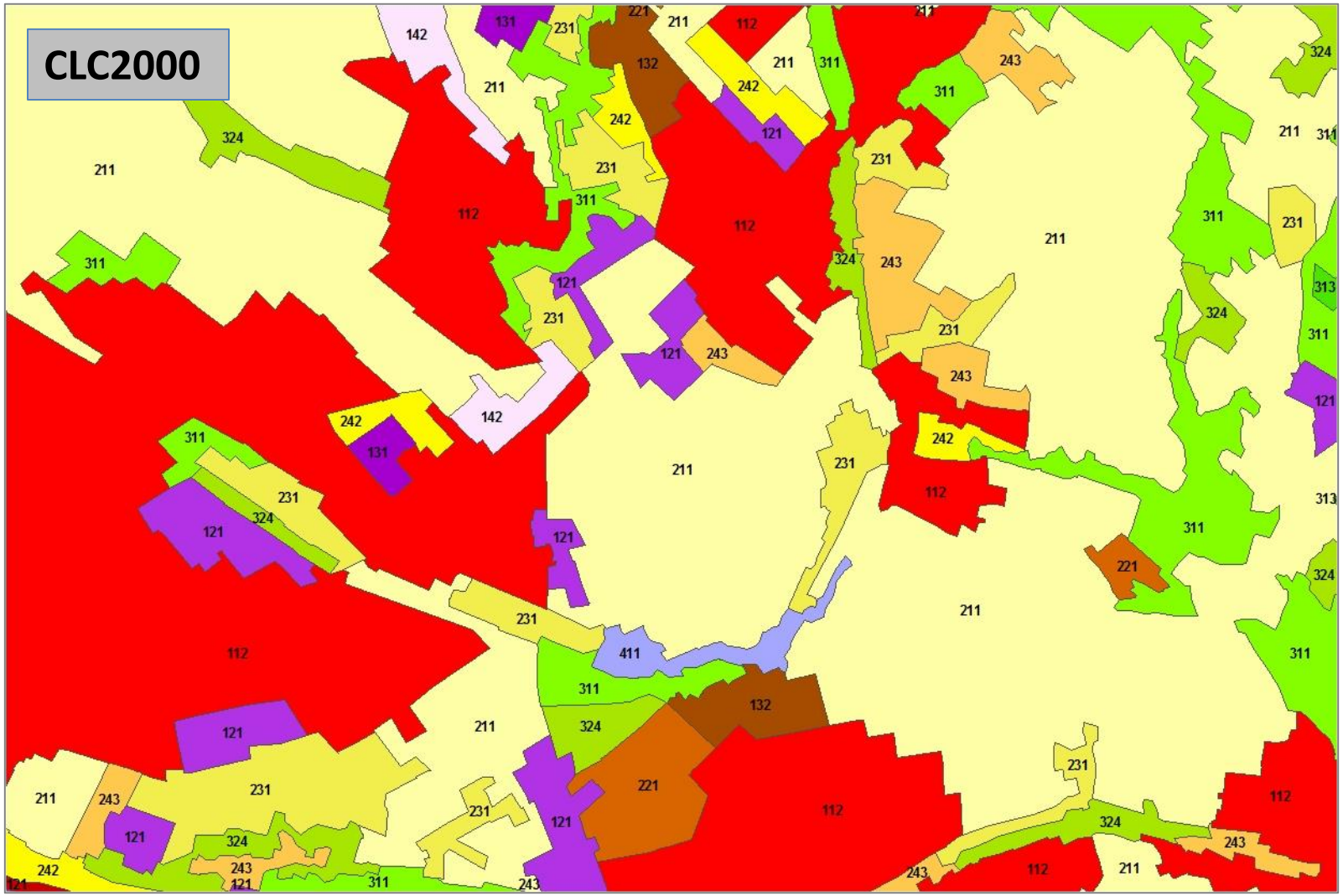
Nomenclature: 3 levels, 44 classes for Europe

Time-series: CLC1990, CLC2000, CLC2006, CLC2012, CLC2018, …

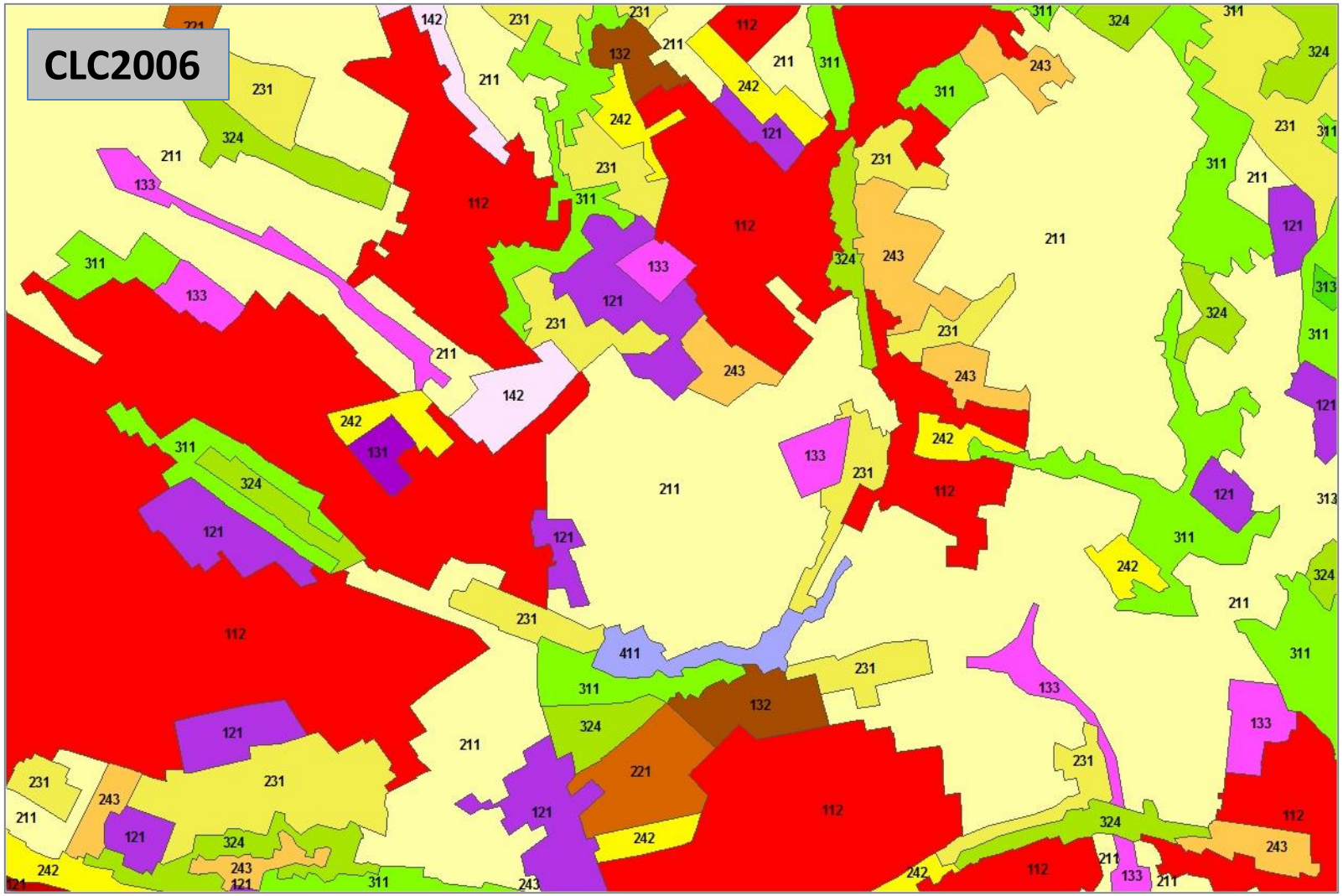
CLC time-series (suburban area north from Budapest)



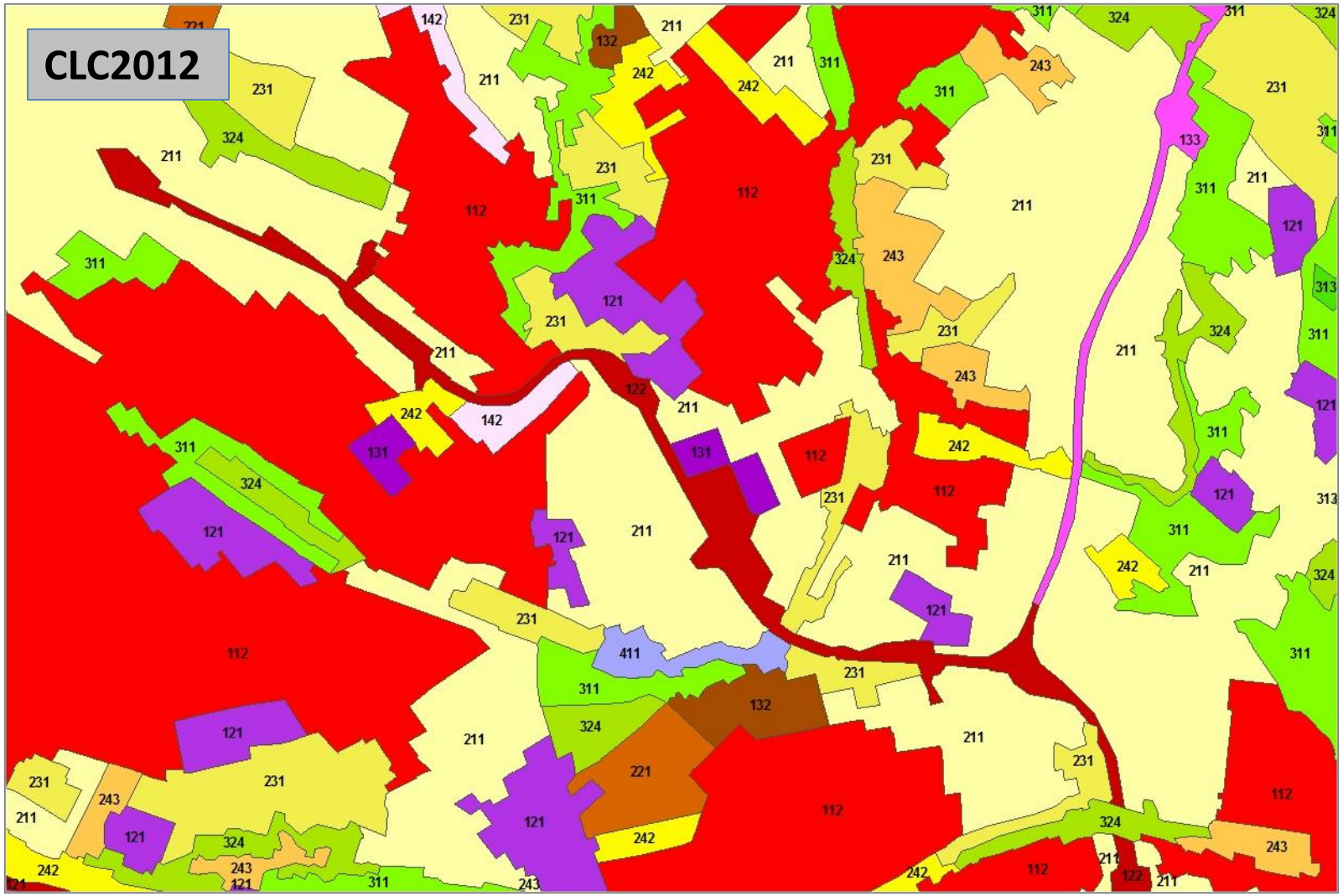
CLC time-series (suburban area north from Budapest)



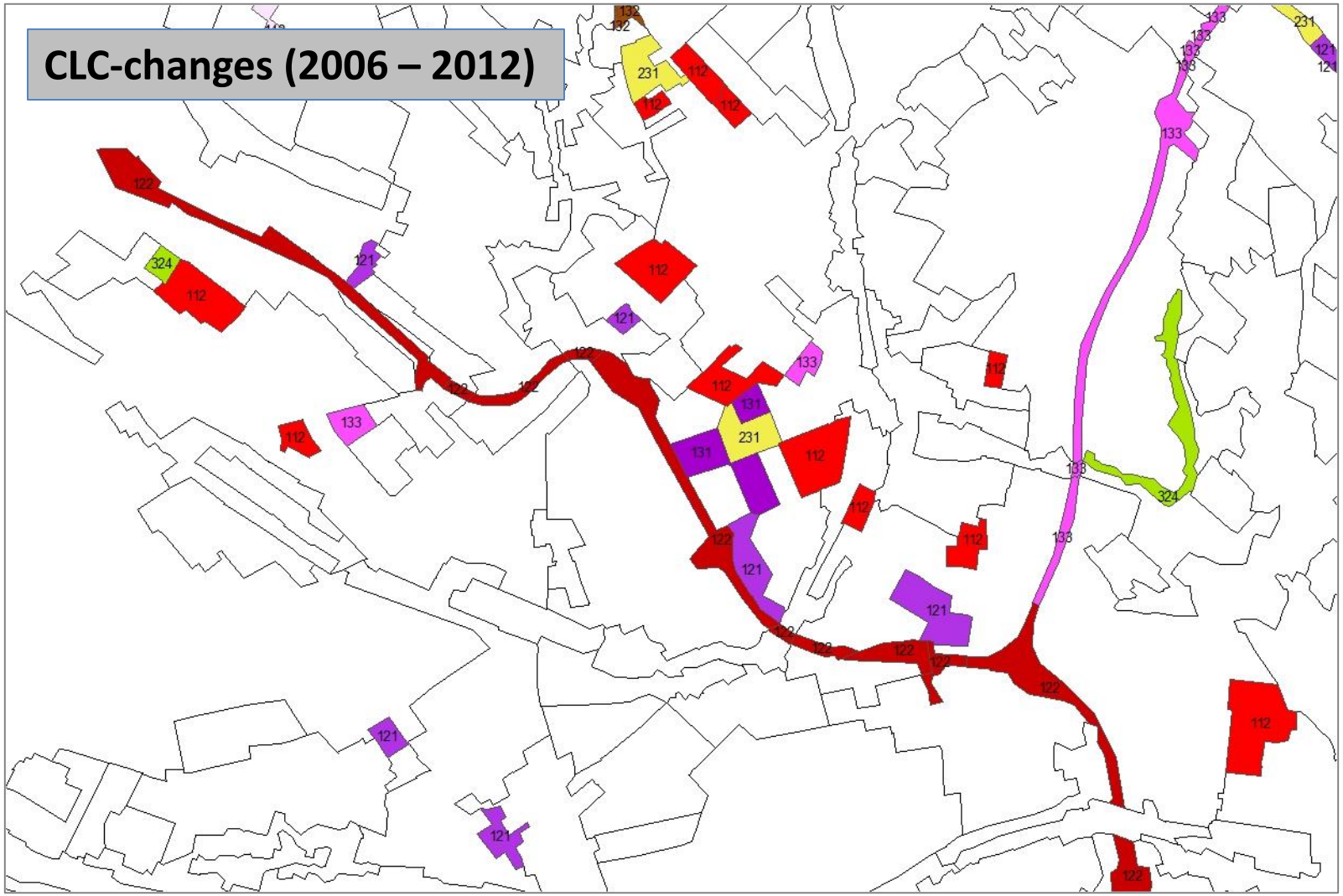
CLC time-series (suburban area north from Budapest)



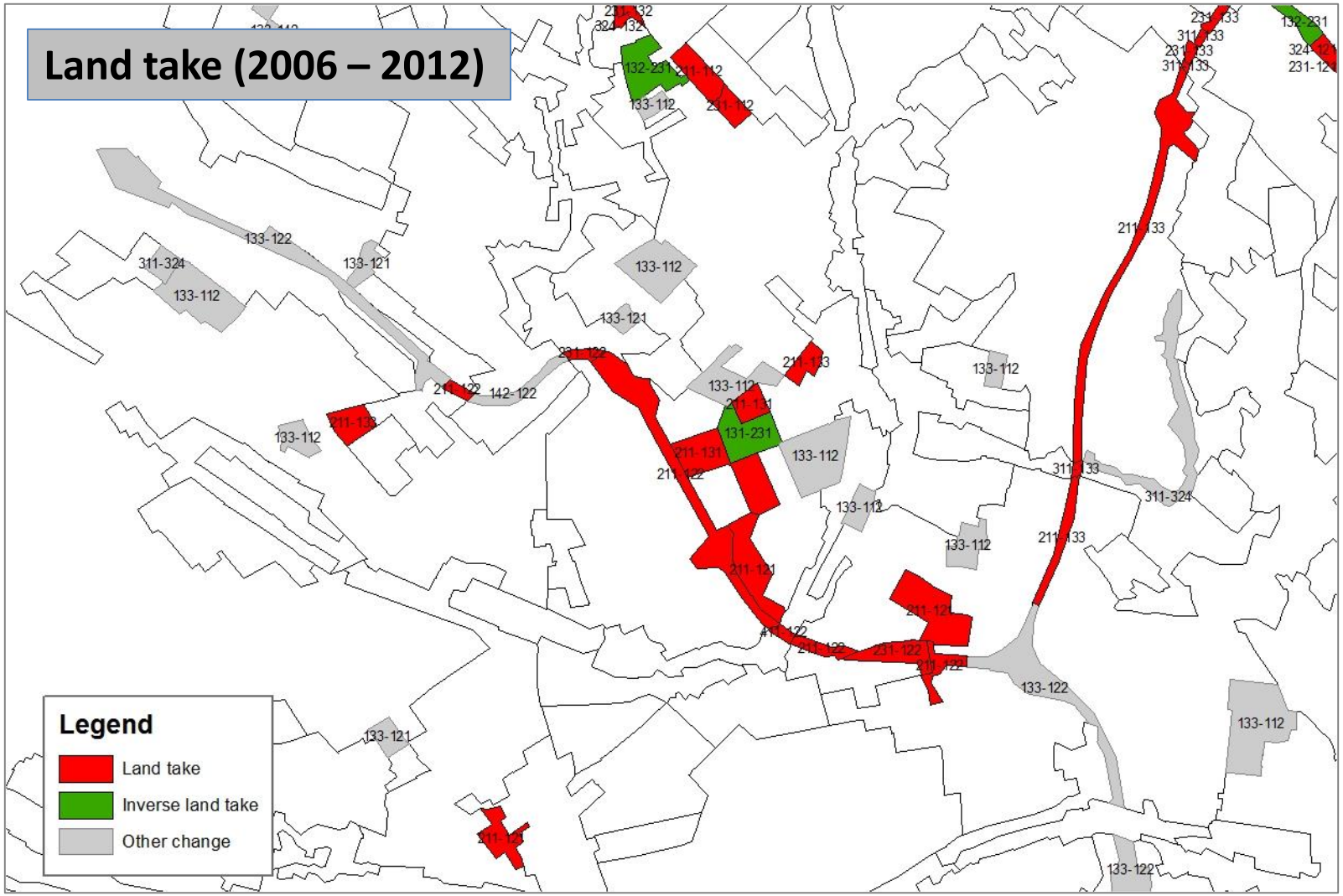
CLC time-series (suburban area north from Budapest)



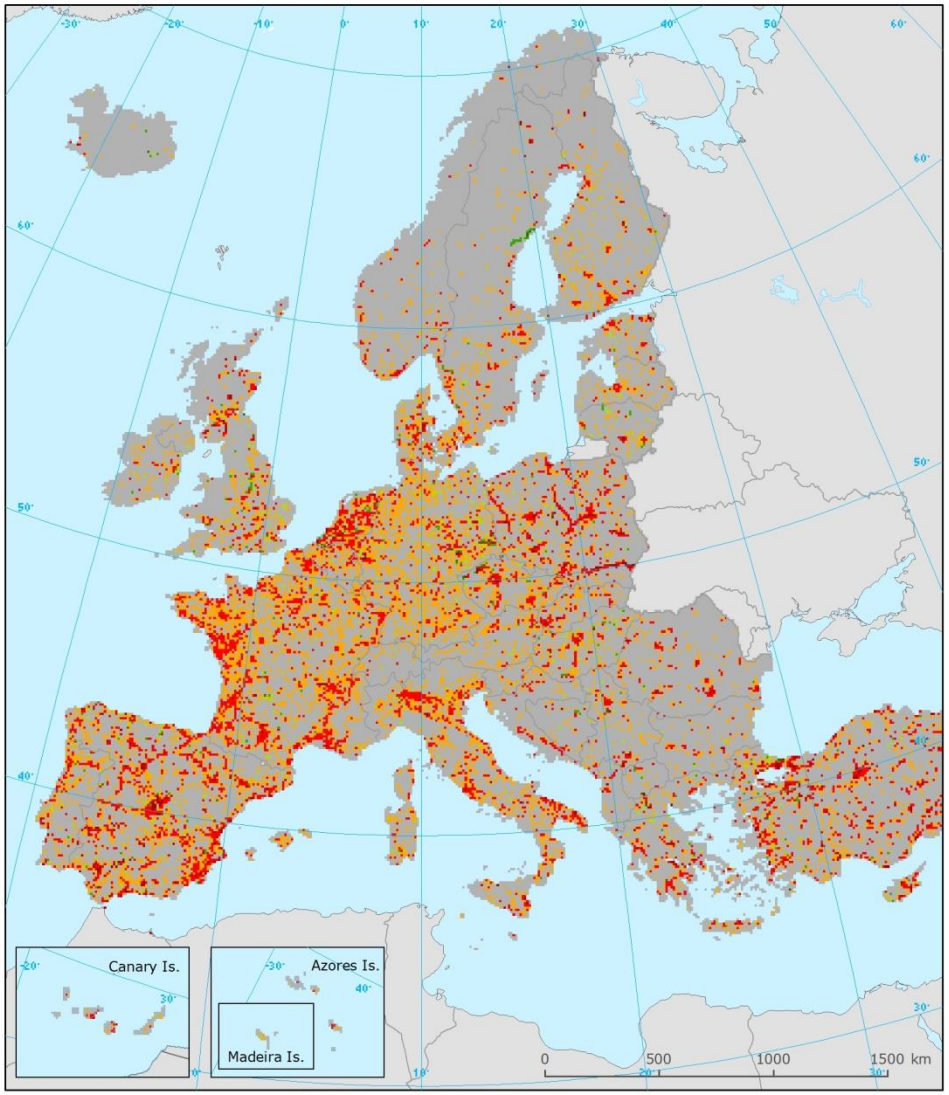
CLC-changes (suburban area north from Budapest)

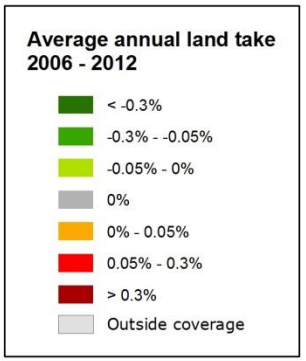


CLC-changes (suburban area north from Budapest)



Average annual land take between 2006-2012 in Europe



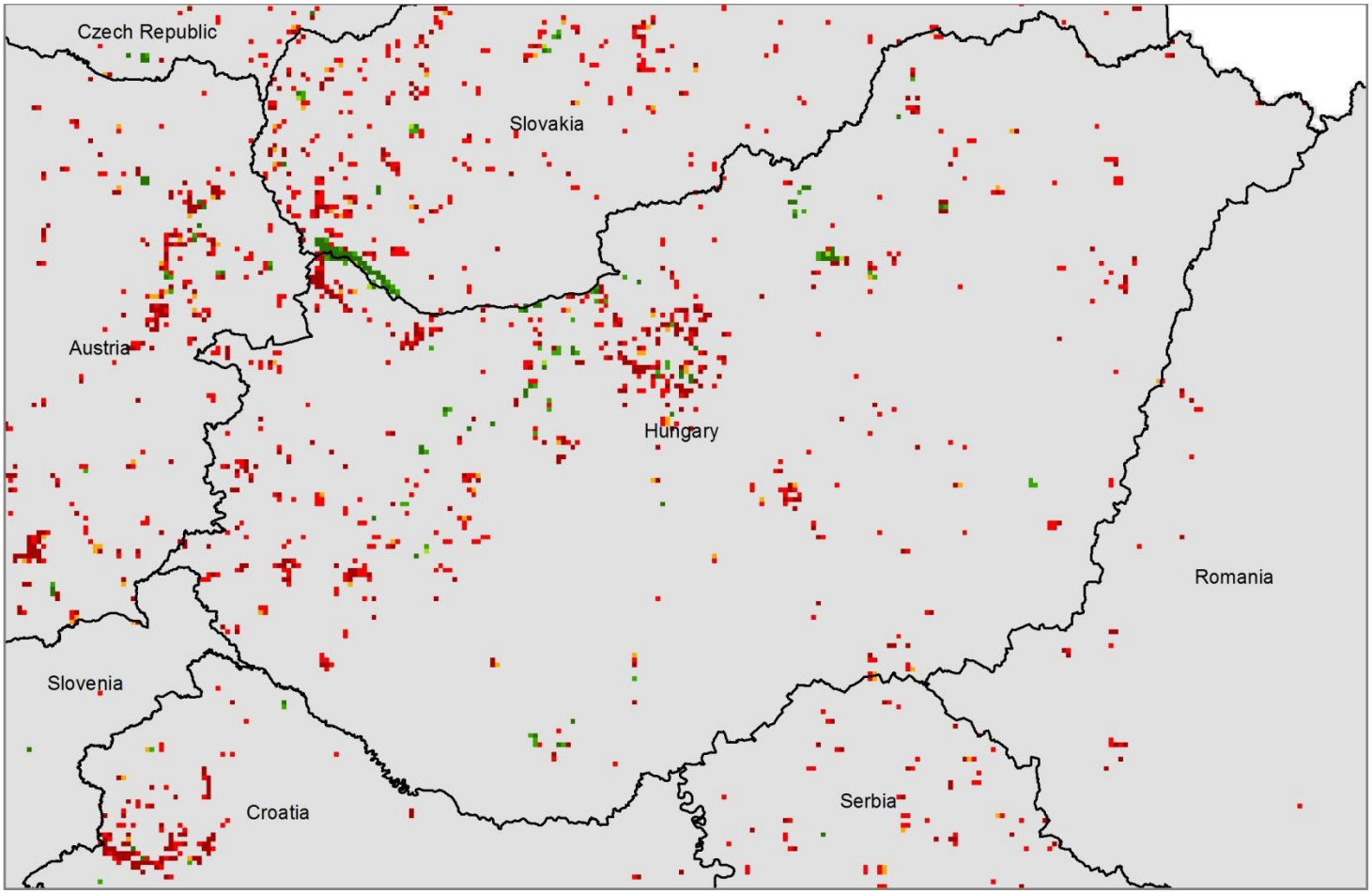


Land take: Change of the amount of agriculture, forest and other semi-natural and natural land taken by urban and other artificial land development.

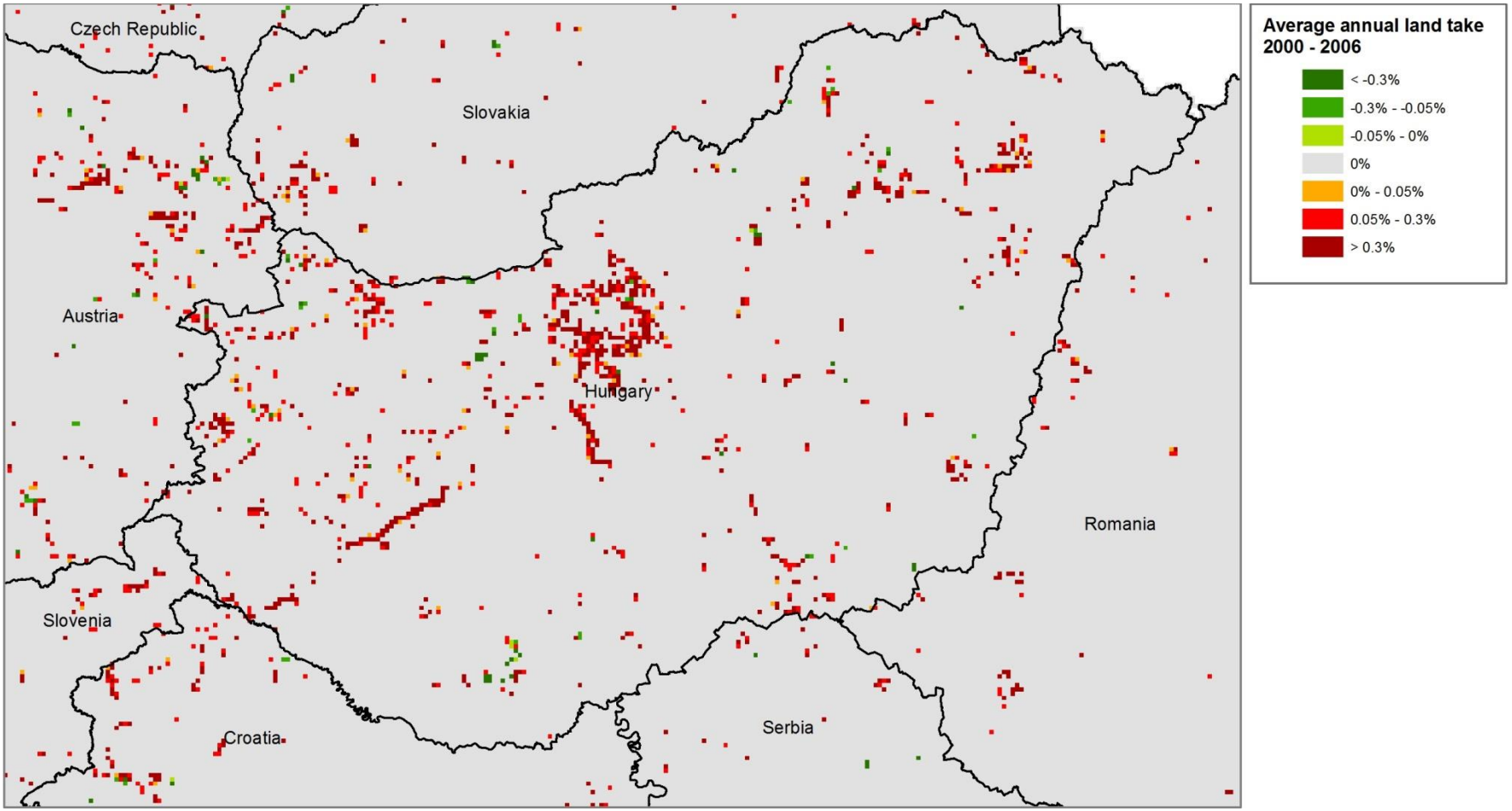
Methodology: 1km grid based calculation on the basis of CLC-change data

Related policy documents:
- COM(2010) 2020 final, Europe 2020: A strategy for smart, sustainable and inclusive growth
- European Landscape Convention
- Roadmap to a Resource Efficient Europe
- 7th Environment Action Programme
- …

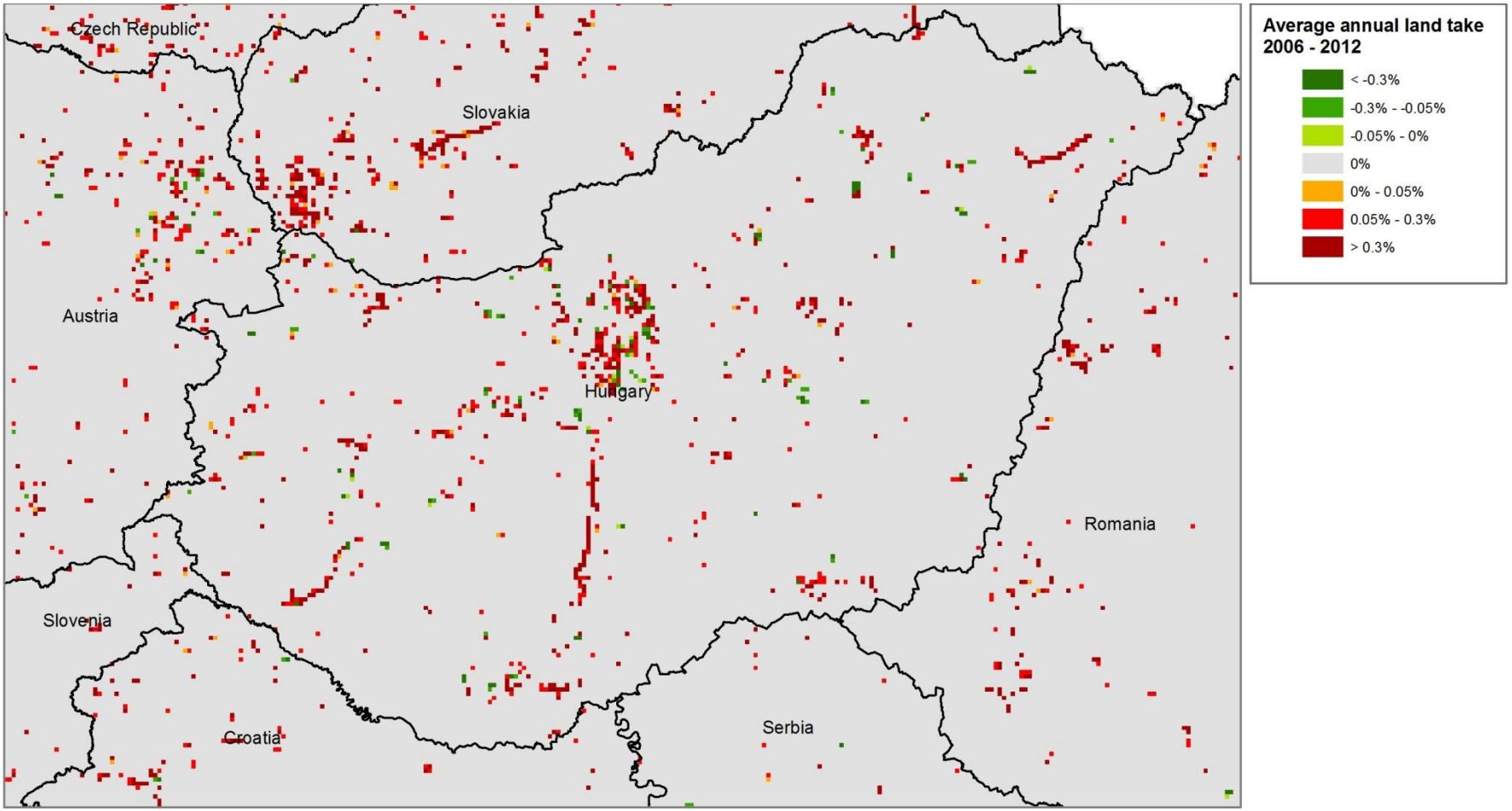
Average annual land take in Hungary and surroundings



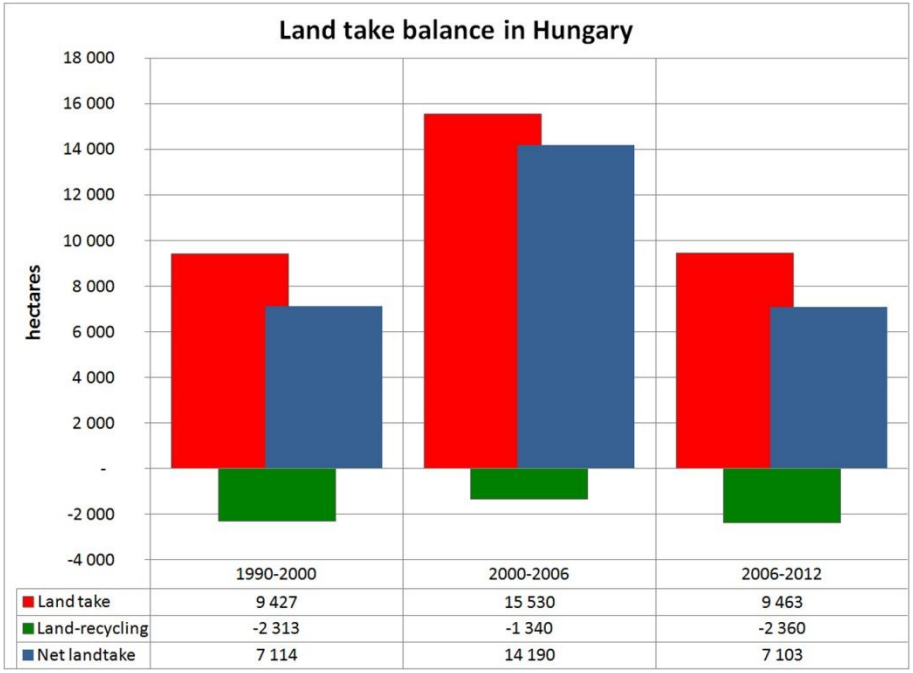
Average annual land take in Hungary and surroundings



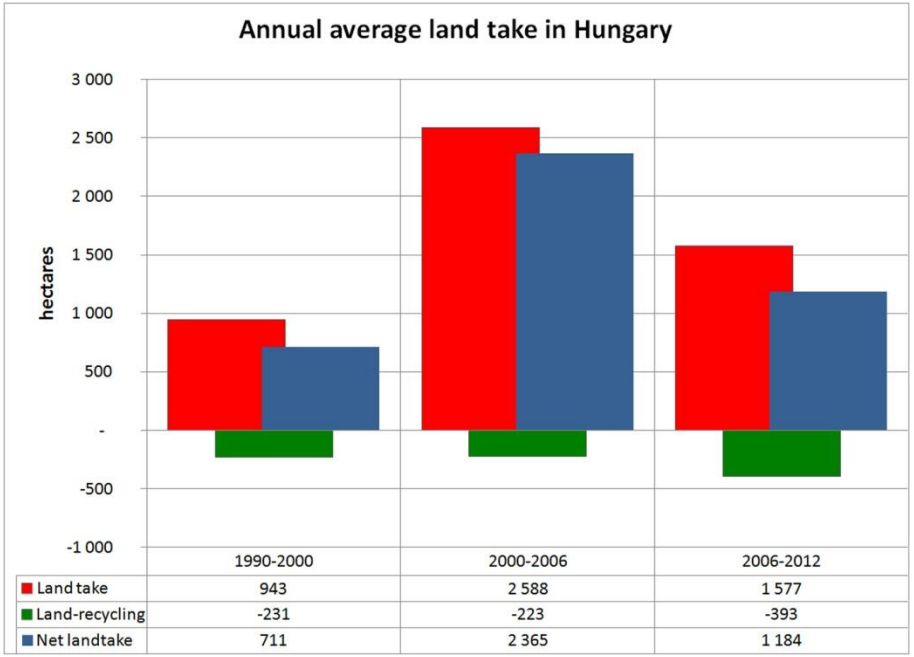
Average annual land take in Hungary and surroundings



Land take balance in Hungary between 1990 - 2012

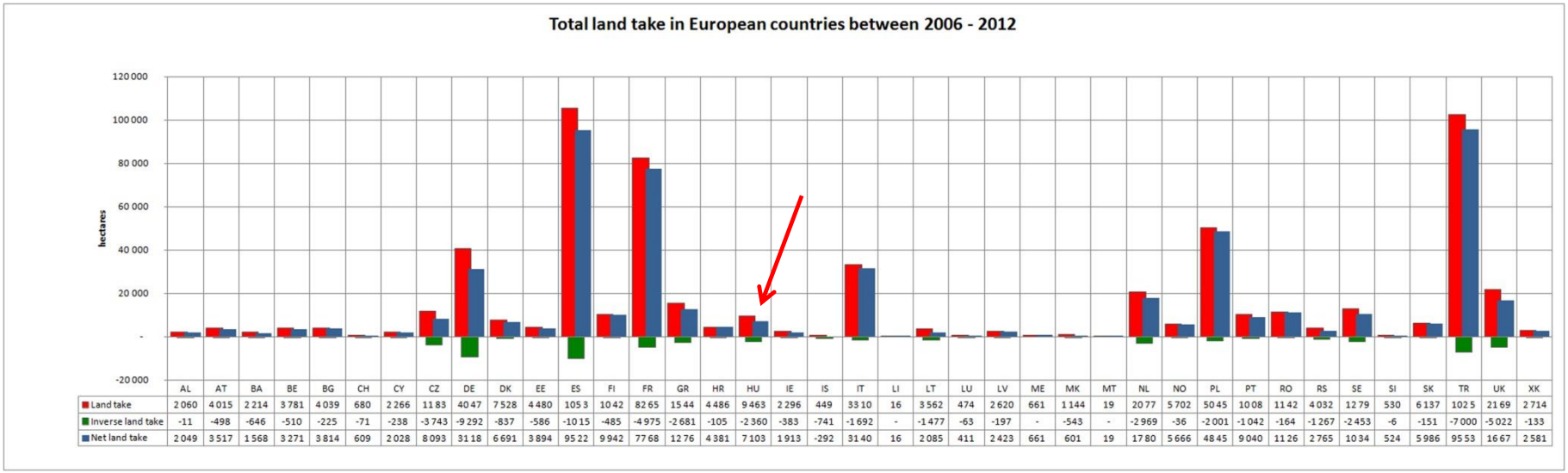


	1990-2000	2000-2006	2006-2012
Land take	9 427	15 530	9 463
Land-recycling	-2 313	-1 340	-2 360
Net landtake	7 114	14 190	7 103

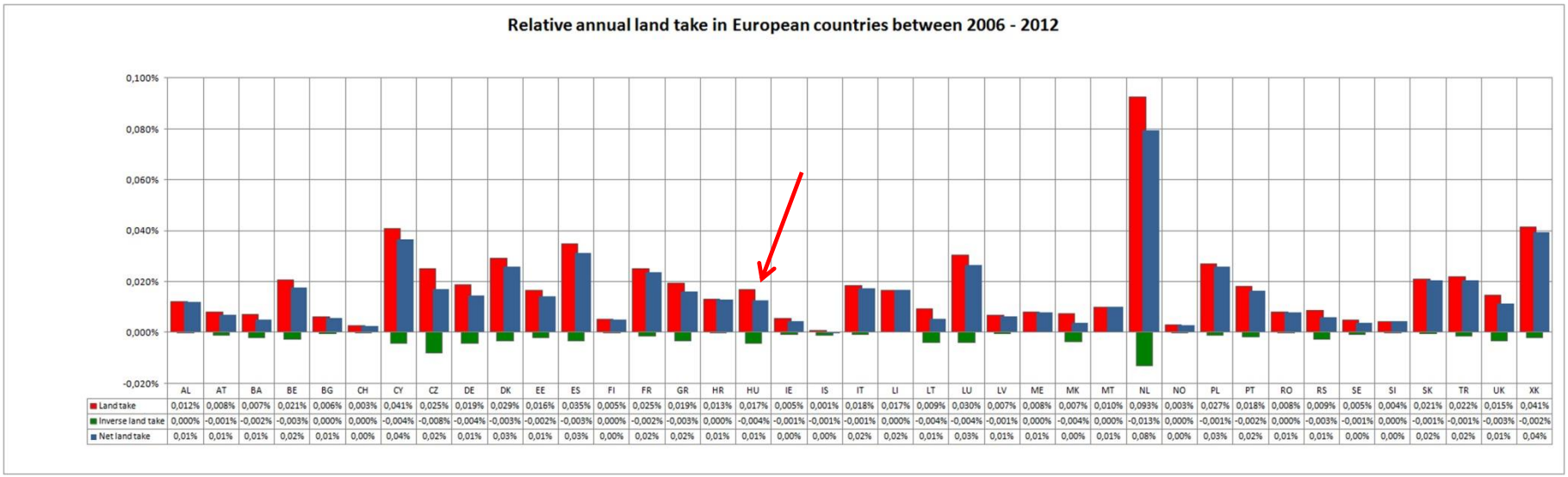


	1990-2000	2000-2006	2006-2012
Land take	943	2 588	1 577
Land-recycling	-231	-223	-393
Net landtake	711	2 365	1 184

Land take balance in Europe between 2006 - 2012



	AL	AT	BA	BE	BG	CH	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HR	HU	IE	IS	IT	LI	LT	LU	LV	ME	MK	MT	NL	NO	PL	PT	RO	RS	SE	SI	SK	TR	UK	XK
Land take	2 060	4 015	2 214	3 781	4 039	680	2 266	11 83	40 47	7 528	4 480	105 3	10 42	82 65	15 44	4 486	9 463	2 296	449	33 10	16	3 562	474	2 620	661	1 144	19	20 77	5 702	50 45	10 08	11 42	4 032	12 79	530	6 137	102 5	21 69	2 714
Inverse land take	-11	-498	-646	-510	-225	-71	-238	-3 743	-9 292	-837	-586	-10 15	-485	-4 975	-2 681	-105	-2 360	-383	-741	-1 692	-	-1 477	-63	-197	-	-543	-	-2 969	-36	-2 001	-1 042	-164	-1 267	-2 453	-6	-151	-7 000	-5 022	-133
Net land take	2 049	3 517	1 568	3 271	3 814	609	2 028	8 093	31 18	6 691	3 894	95 22	9 942	77 68	12 76	4 381	7 103	1 913	-292	31 40	16	2 085	411	2 423	661	601	19	17 80	5 666	48 45	9 040	11 26	2 765	10 34	524	5 986	95 53	16 67	2 581



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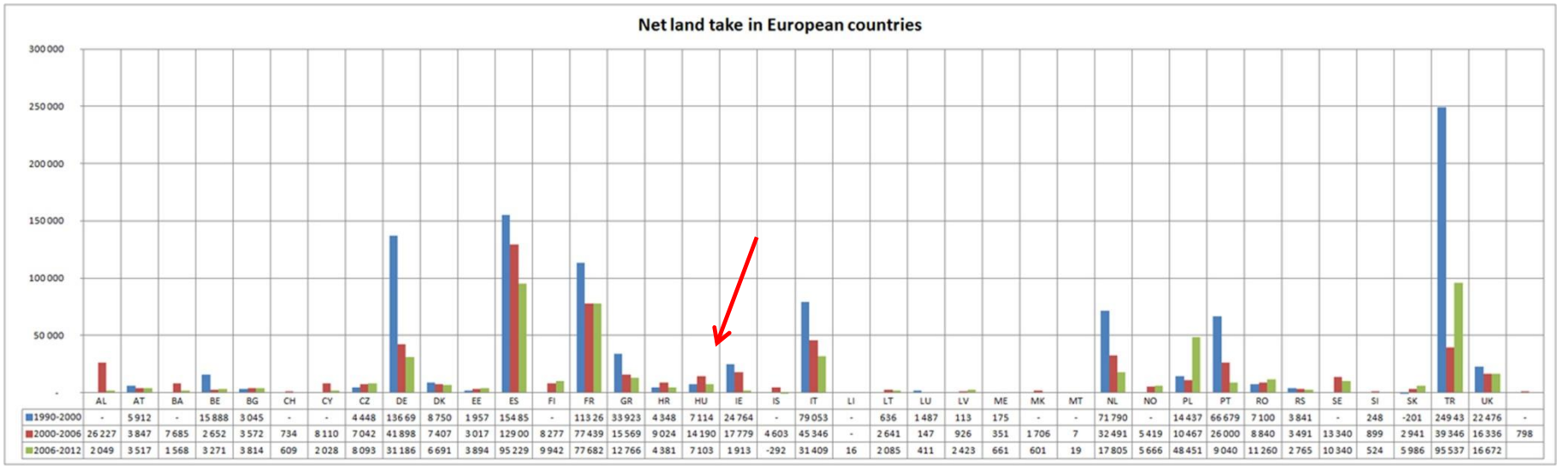
Land take	0,012%	0,008%	0,007%	0,021%	0,006%	0,003%	0,041%	0,025%	0,019%	0,029%	0,016%	0,035%	0,005%	0,025%	0,019%	0,013%	0,017%	0,005%	0,001%	0,018%	0,017%	0,009%	0,030%	0,007%	0,008%	0,007%	0,010%	0,093%	0,003%	0,027%	0,018%	0,008%	0,009%	0,005%	0,004%	0,021%	0,022%	0,015%	0,041%
Inverse land take	0,000%	-0,001%	-0,002%	-0,003%	0,000%	0,000%	-0,004%	-0,008%	-0,004%	-0,003%	-0,002%	-0,003%	0,000%	-0,002%	-0,003%	0,000%	-0,004%	-0,001%	-0,001%	-0,001%	0,000%	-0,004%	-0,004%	-0,001%	0,000%	-0,004%	0,000%	-0,013%	0,000%	-0,001%	-0,002%	0,000%	-0,003%	-0,001%	0,000%	-0,001%	-0,001%	-0,003%	-0,002%
Net land take	0,01%	0,01%	0,01%	0,02%	0,01%	0,00%	0,04%	0,02%	0,01%	0,03%	0,01%	0,03%	0,00%	0,02%	0,02%	0,01%	0,01%	0,00%	0,00%	0,02%	0,02%	0,01%	0,03%	0,01%	0,01%	0,00%	0,01%	0,08%	0,00%	0,03%	0,02%	0,01%	0,01%	0,00%	0,00%	0,02%	0,02%	0,01%	0,04%

Net land take in Europe between 1990 - 2012



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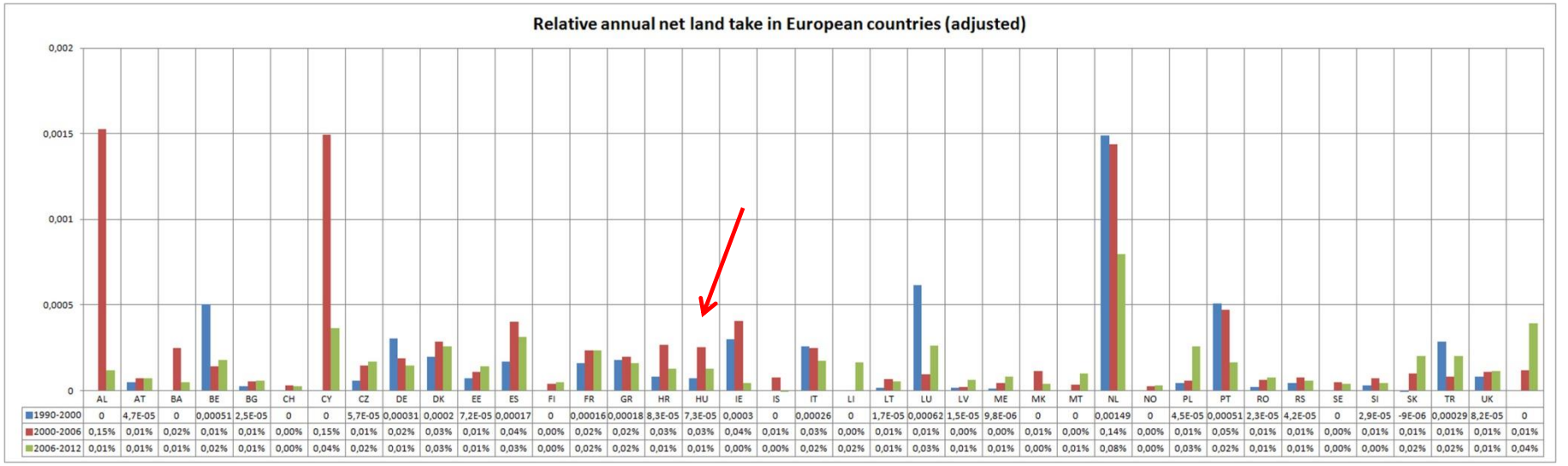
1990-2000	-	5 912	-	15 888	3 045	-	-	4 448	136 69	8 750	1 957	154 85	-	113 26	33 923	4 348	7 114	24 764	-	79 053	-	636	1 487	113	175	-	-	71 790	-	14 437	66 679	7 100	3 841	-	248	-201	249 43	22 476	-
2000-2006	26 227	3 847	7 685	2 652	3 572	734	8 110	7 042	41 898	7 407	3 017	12 900	8 277	77 439	15 569	9 024	14 190	17 779	4 603	45 346	-	2 641	147	926	351	1 706	7	32 491	5 419	10 467	26 000	8 840	3 491	13 340	899	2 941	39 346	16 336	798
2006-2012	2 049	3 517	1 568	3 271	3 814	609	2 028	8 093	31 186	6 691	3 894	95 229	9 942	77 682	12 766	4 381	7 103	1 913	-292	31 409	16	2 085	411	2 423	661	601	19	17 805	5 666	48 451	9 040	11 260	2 765	10 340	524	5 986	95 537	16 672	



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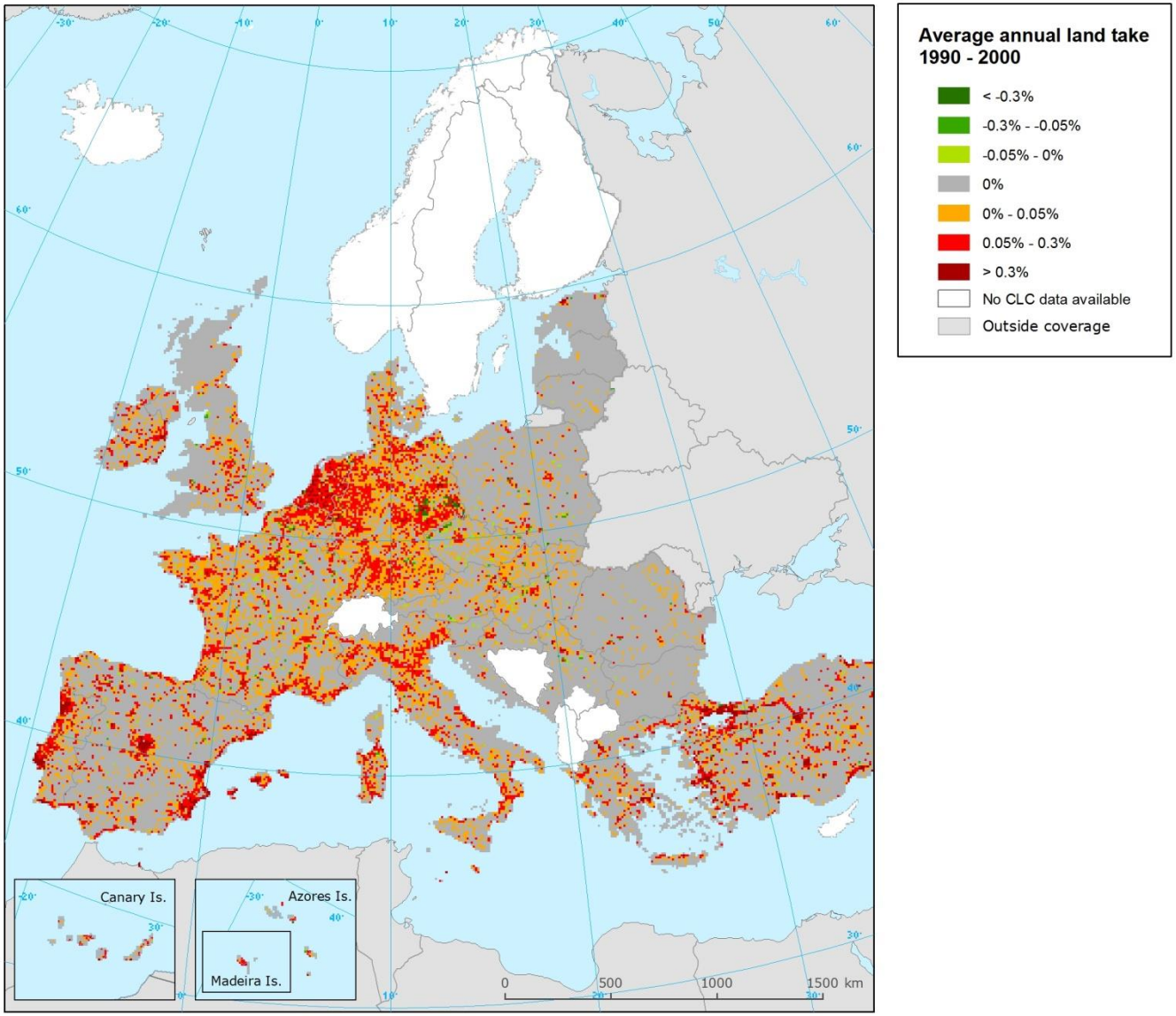
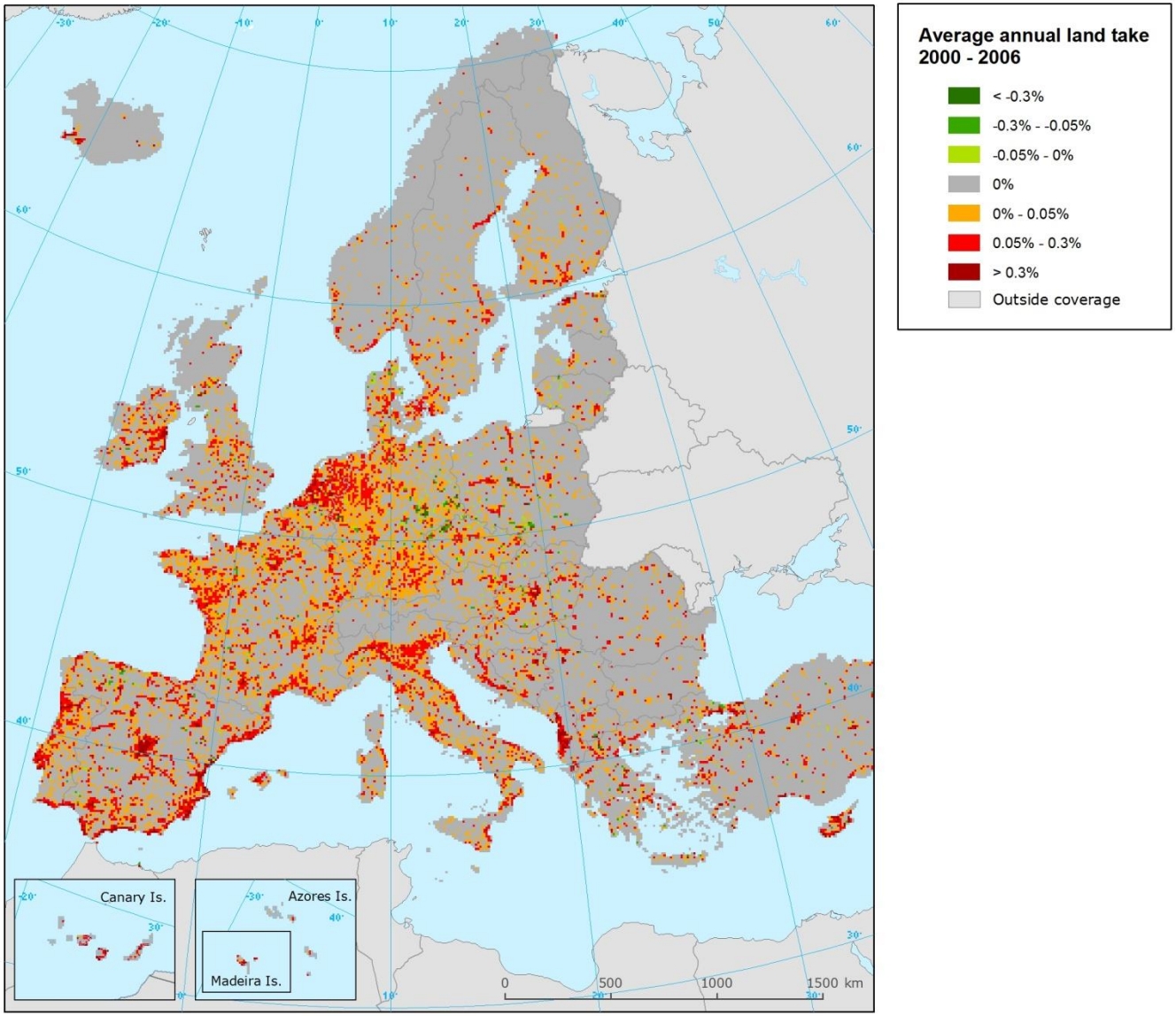
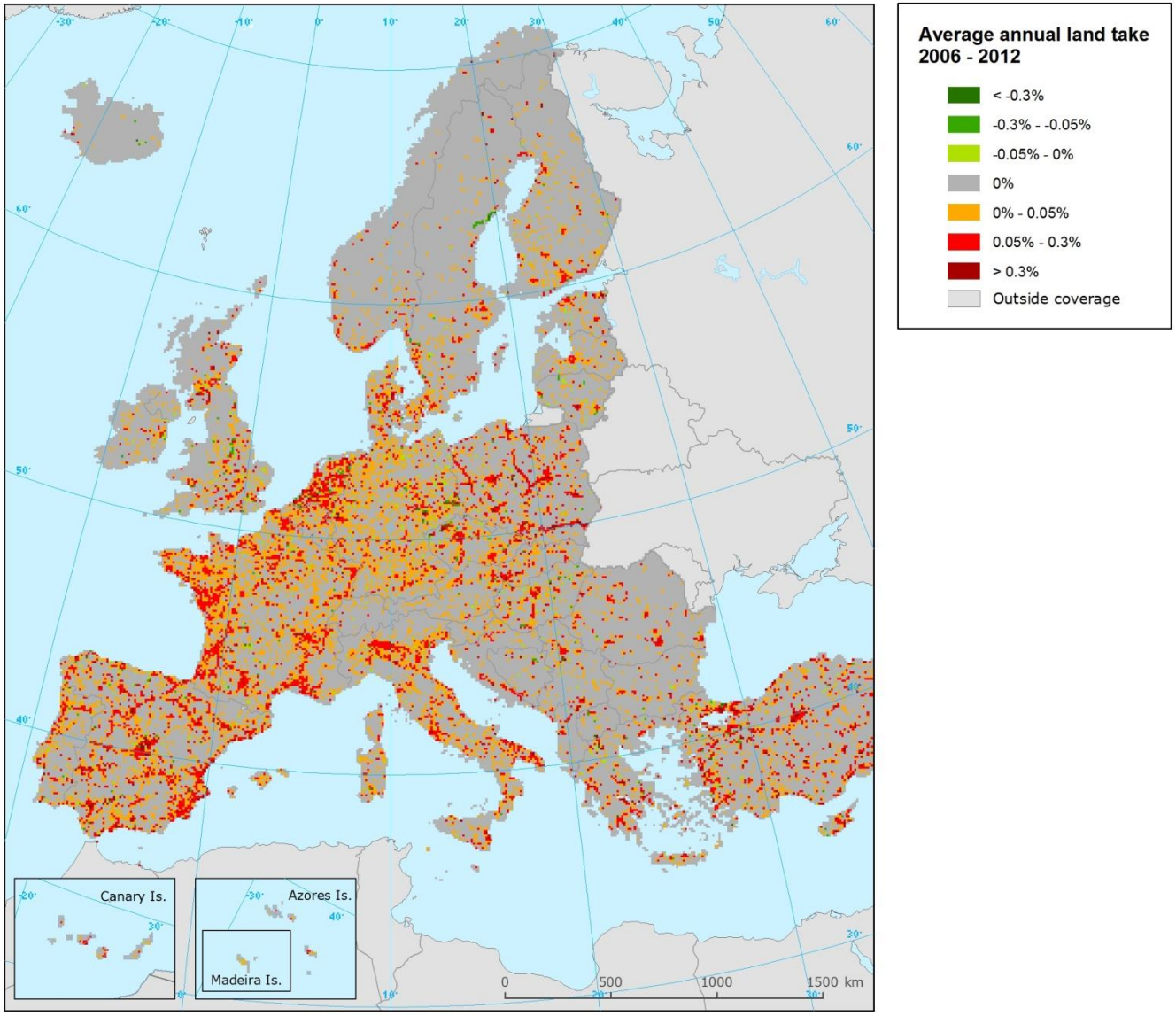
1990-2000	0	4,7E-05	0	0,00051	2,5E-05	0	0	5,7E-05	0,00031	0,0002	7,2E-05	0,00017	0	0,00016	0,00018	8,3E-05	7,3E-05	0,0003	0	0,00026	0	1,7E-05	0,00062	1,5E-05	9,8E-06	0	0	0,00149	0	4,5E-05	0,00051	2,3E-05	4,2E-05	0	2,9E-05	-9E-06	0,00029	8,2E-05	0
2000-2006	0,15%	0,01%	0,02%	0,01%	0,01%	0,00%	0,15%	0,01%	0,02%	0,03%	0,01%	0,04%	0,00%	0,02%	0,02%	0,03%	0,03%	0,04%	0,01%	0,03%	0,00%	0,01%	0,01%	0,00%	0,00%	0,01%	0,00%	0,14%	0,00%	0,01%	0,05%	0,01%	0,01%	0,00%	0,01%	0,01%	0,01%	0,01%	0,01%
2006-2012	0,01%	0,01%	0,01%	0,02%	0,01%	0,00%	0,04%	0,02%	0,01%	0,03%	0,01%	0,03%	0,00%	0,02%	0,02%	0,01%	0,01%	0,00%	0,00%	0,02%	0,02%	0,01%	0,03%	0,01%	0,01%	0,00%	0,01%	0,08%	0,00%	0,03%	0,02%	0,01%	0,01%	0,00%	0,00%	0,02%	0,02%	0,01%	0,04%



Mapping land take and soil sealing in the frames of Copernicus land monitoring

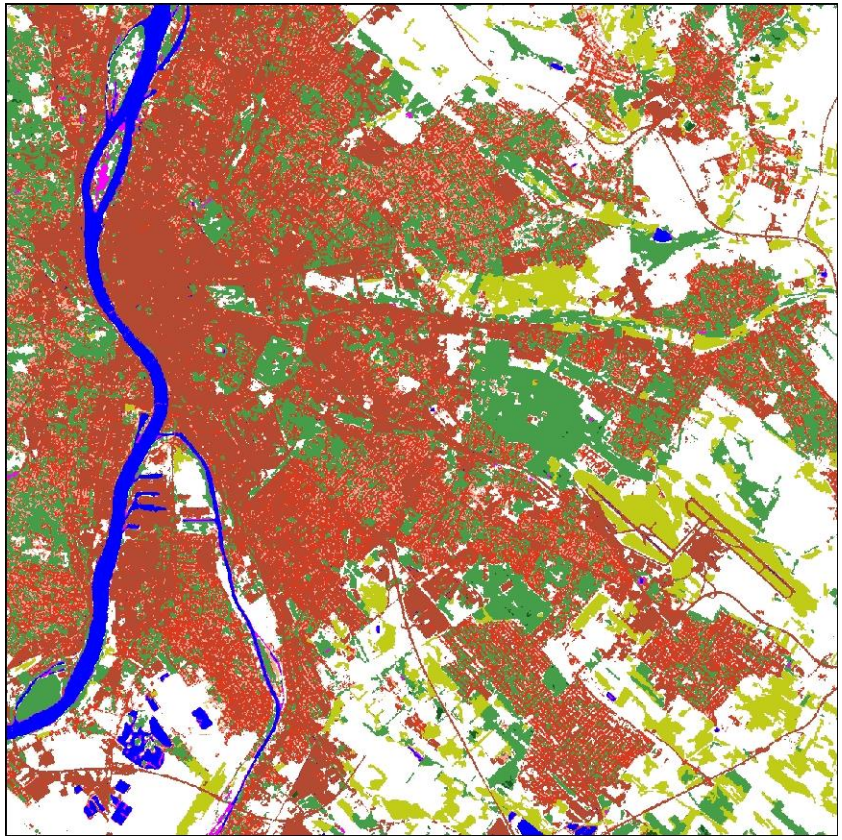


Mapping land take and soil sealing in the frames of Copernicus land monitoring



Mapping land take and soil sealing in the frames of Copernicus land monitoring

Copernicus High Resolution Layers



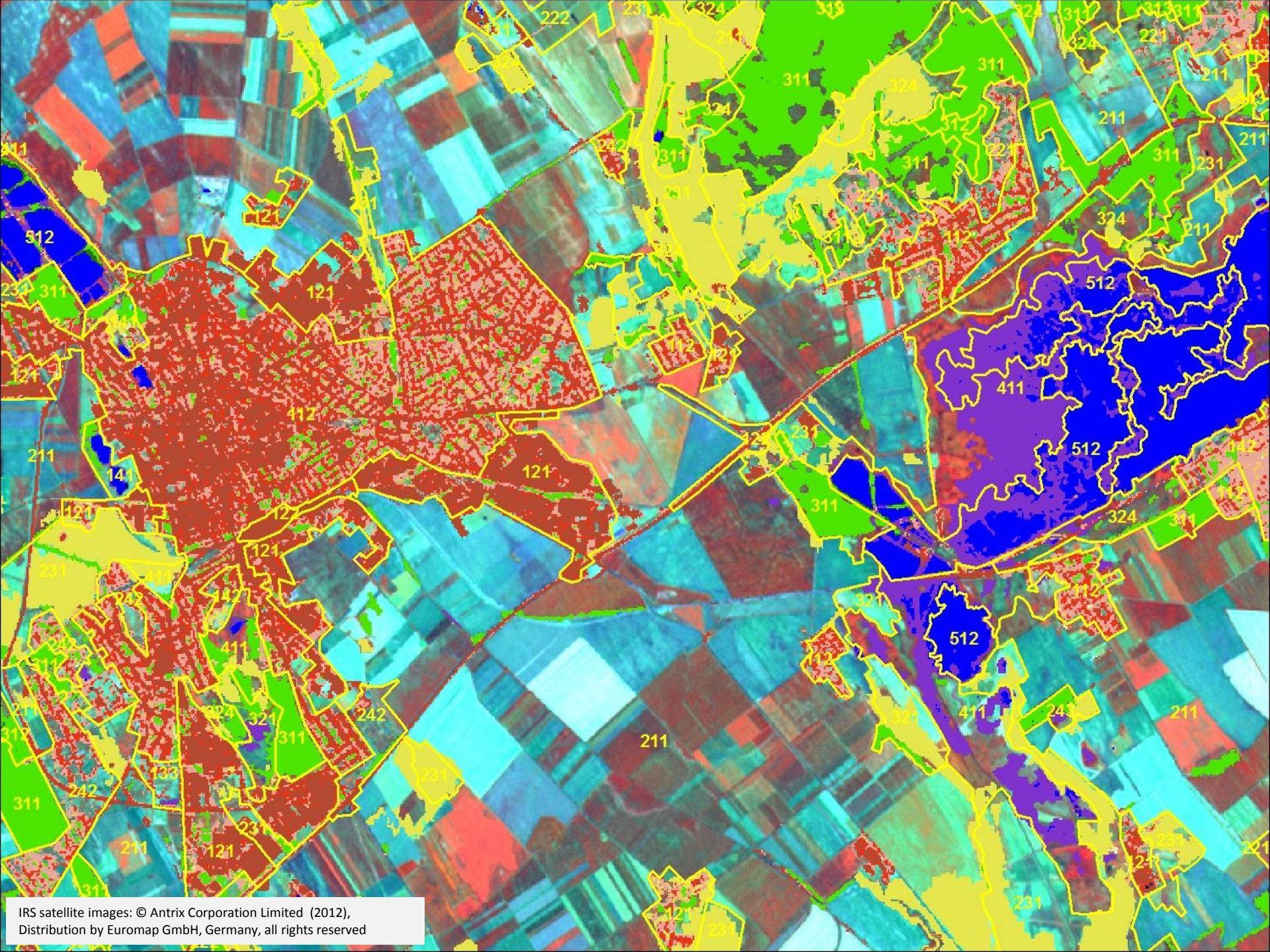
5+ Thematic land cover layer (2012):

1. Imperviousness
2. Tree Cover Density+ Forest types + additional support layer
3. Natural and semi-natural grasslands
4. Wetlands
5. Permanent Water Bodies

Method: Semi-automatic classification of satellite imagery

Resolution: **20m / 100m**
Minimum Mapping Unit (Forest types only): **0,5 ha**
Minimum width of mapped linear elements: **20 m**

Time series: 2006, 2009 (Imperviousness only), 2012 (5+ layers), **2015, 2018…**


222
311
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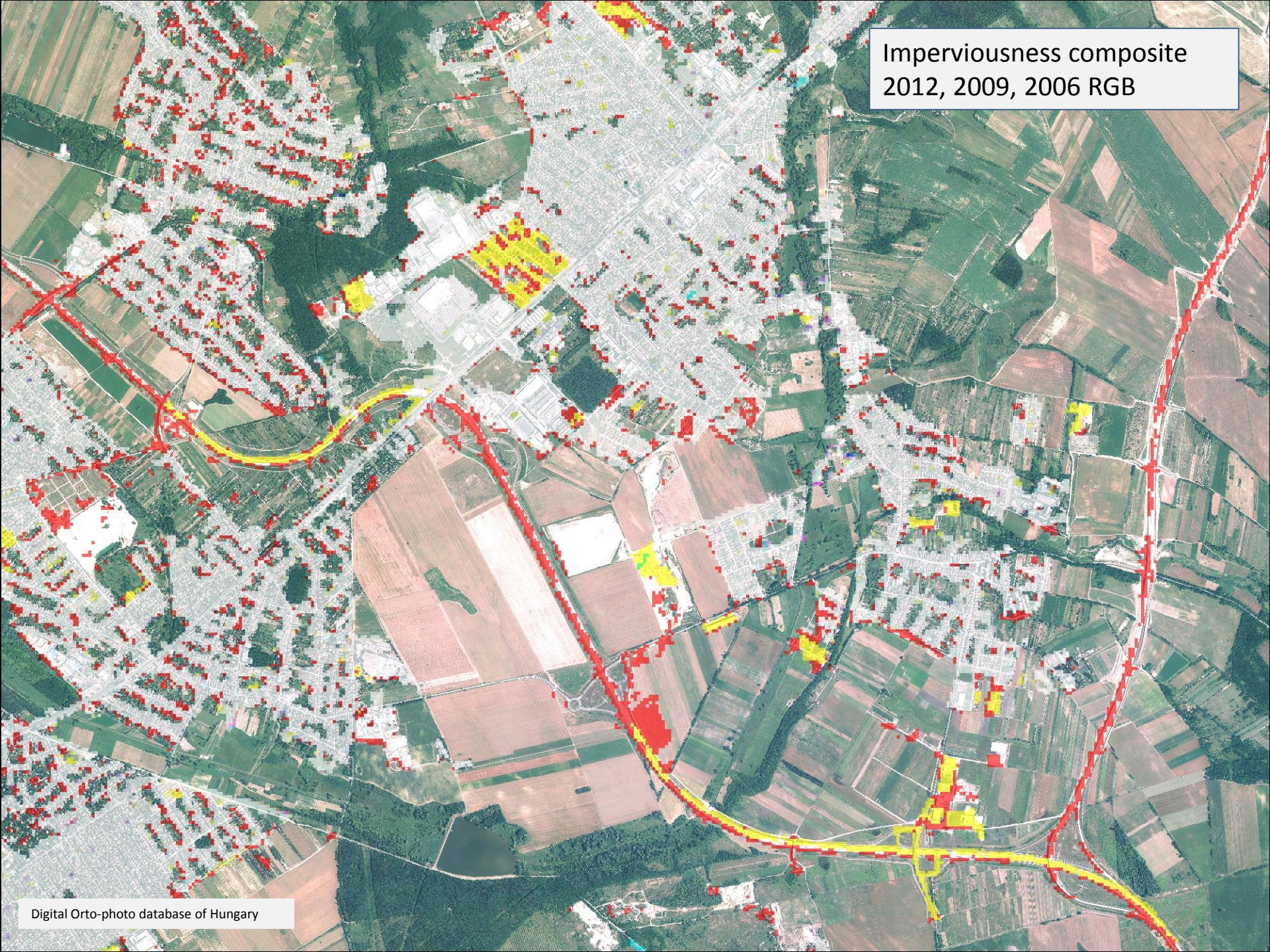
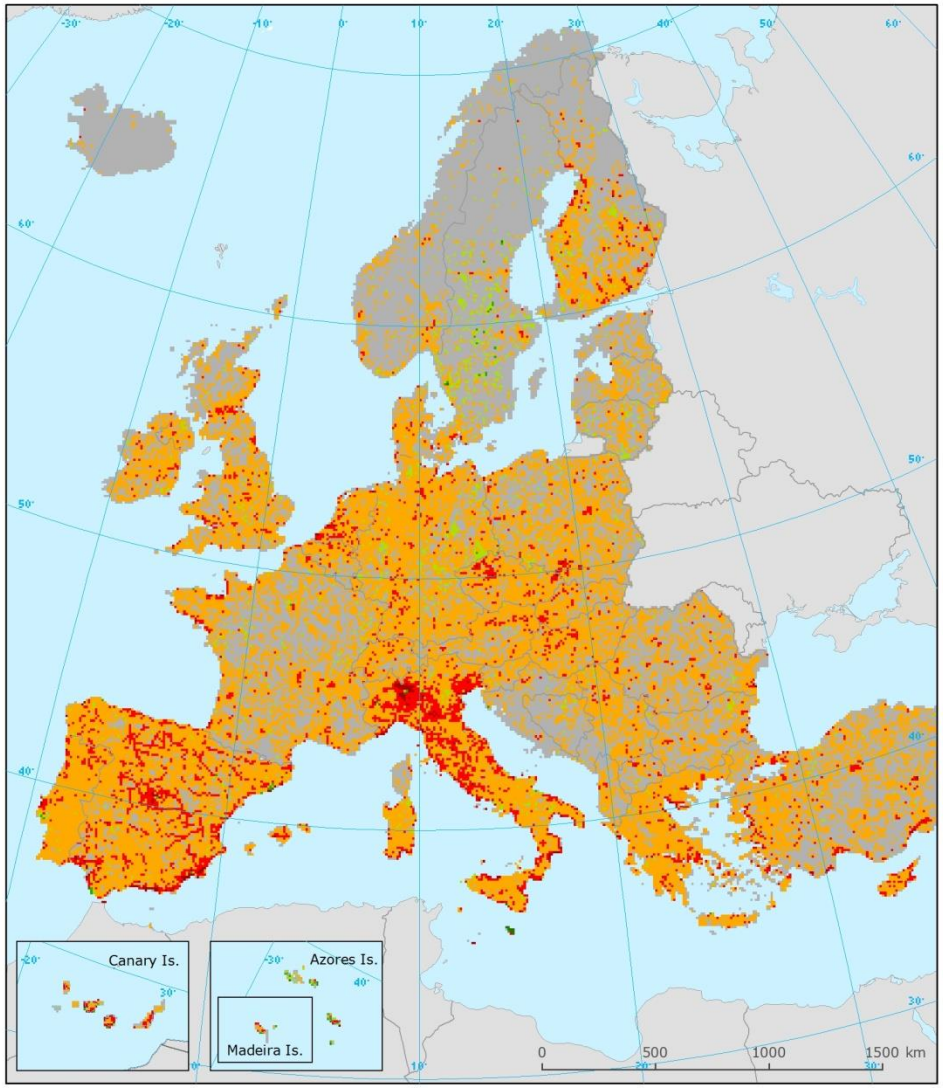
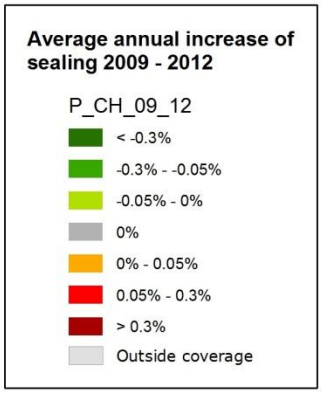
IRS satellite images: © Antrix Corporation Limited (2012),
Distribution by Euromap GmbH, Germany, all rights reserved


Imperviousness composite
2012, 2009, 2006 RGB
Digital Orto-photo database of Hungary

Average annual increase of soil sealing between 2009-2012 in Europe



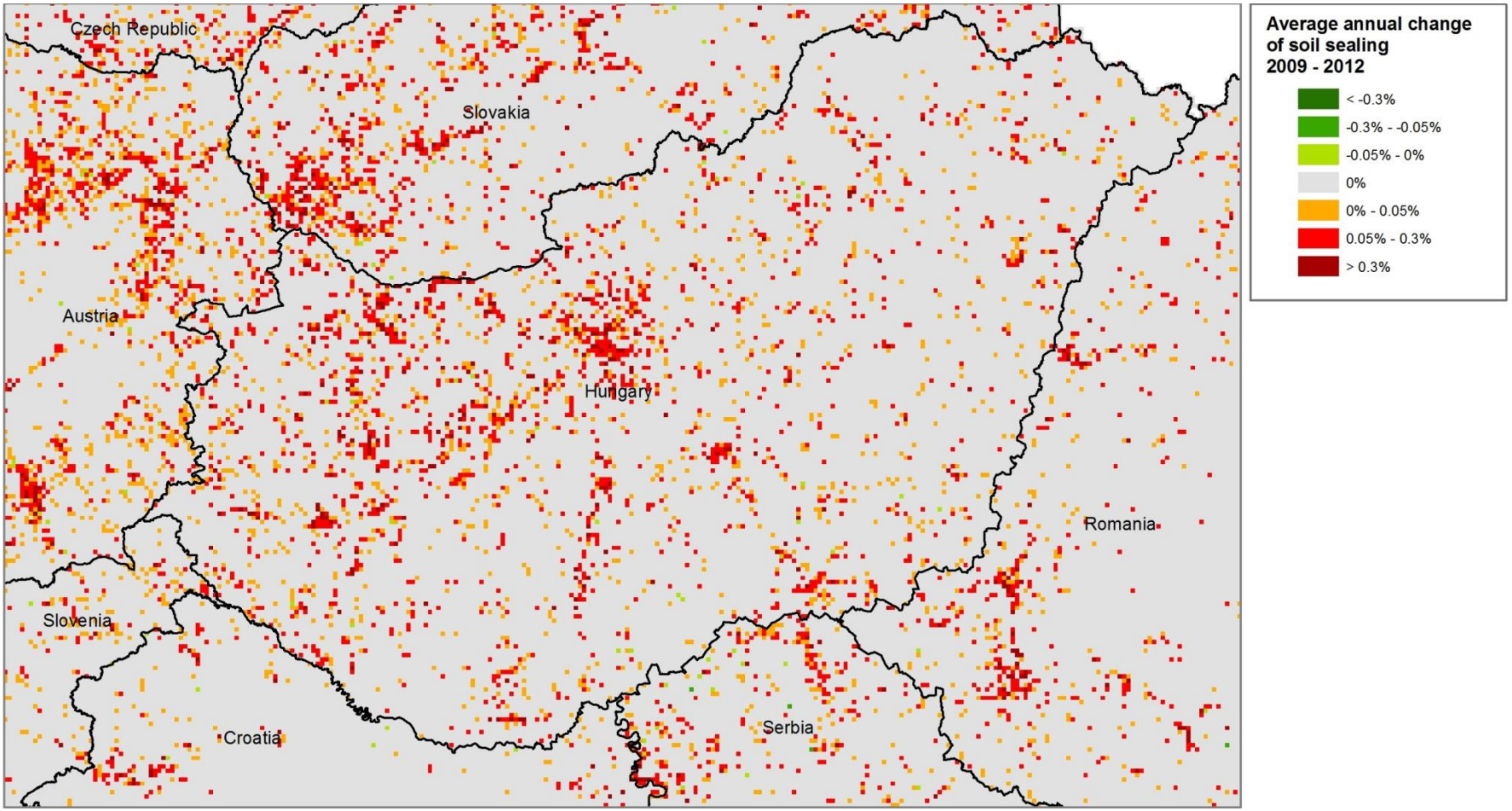


Imperviousness change indicator:

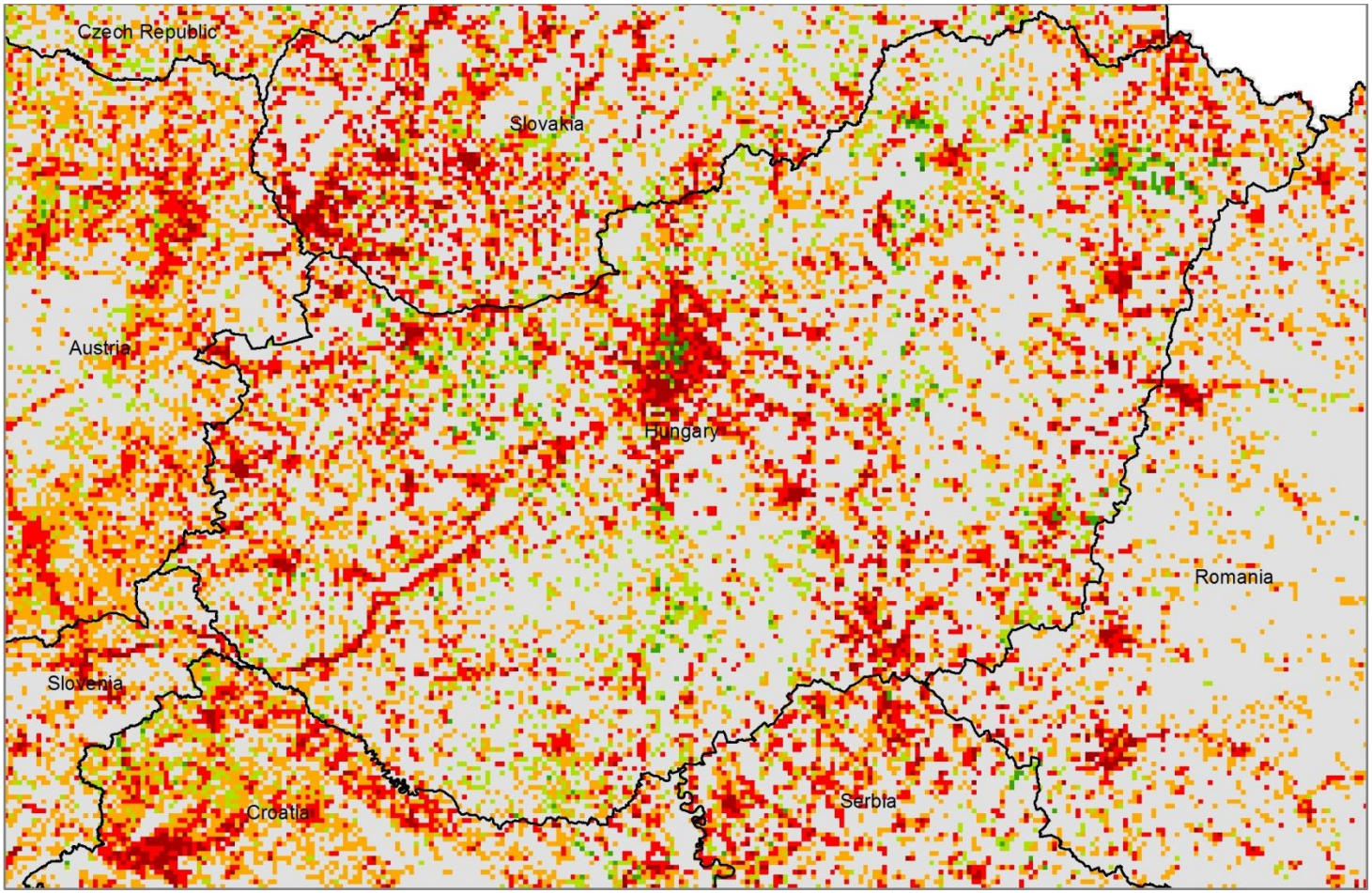
Defined by the change of soil sealing between reference years

Methodology: 1km grid based calculation on the basis of Imperviousness change data

Average annual change of soil sealing in Hungary and surroundings



Average annual change of soil sealing in Hungary and surroundings



Clearly overestimated

Re-calculation of IMD time series is in progress

Useful links

COPERNICUS programme: http://www.copernicus.eu/

COPERNICUS land monitoring (information & available data):
http://land.copernicus.eu/

Copernicus land monitoring data for Hungary:
http://www.fomi.hu/portal/index.php/projektjeink/foldfelszin-monitorozas-corine

Land take indicator:
http://www.eea.europa.eu/data-and-maps/indicators/land-take-2/

Imperviousness change indicator:
http://www.eea.europa.eu/data-and-maps/indicators/imperviousness-change/

Thank you for your attention!

Contact details:

Maucha Gergely
leader of department

Institute of Geodesy, Cartography & Remote Sensing
Department of Environmental Applications of Remote Sensing
1149 Budapest, Bosnyák tér 5.
phone: +36 1 460 4176
e-mail: maucha.gergely@fomi.hu
web: www.fomi.hu