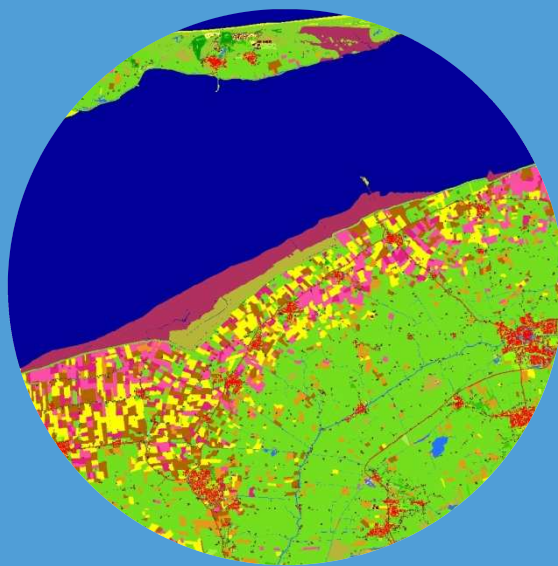


# LGN7, CLC2012 and HR layers

Specifications, production and harmonisation

March 28<sup>th</sup> 2013, Gerard Hazeu



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# Content

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- LGN7 (history, specifications, production)
- GIO Land
  - CLC2012 (specifications and production)
  - HR layers (specifications, production, verification and enhancement)
- Harmonisation
  - HELM (FP7 project)
  - EAGLE (EIONET working group)
  - LUCAS (pilot study)

# LGN in brief

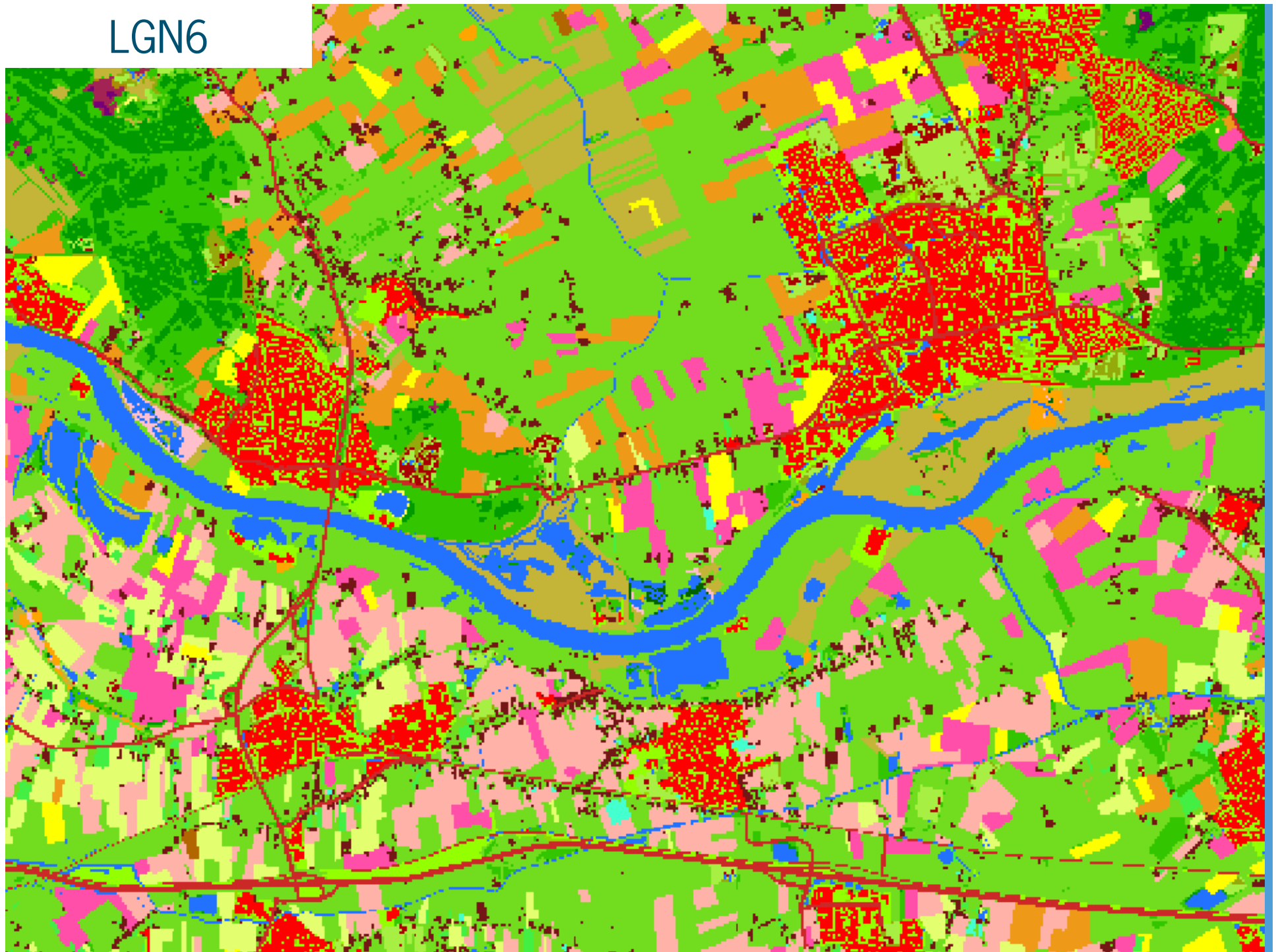
- Raster database (25\*25m grid)
- Update cyclus 3-4 year LGN1-LGN7 (1986, 1992, 1995/1997, 1999/2000, 2003/2004, 2007/2008, 2012)
- Based on satellite images, Top10vector and visual interpretation
- 39 classes (main classes urban area, forest, water, agricultural land and nature)
- (last) 7<sup>th</sup> version of Landelijk Grondgebruiksbestand Nederland (LGN7) – Dutch Land Use database

# LGN and its history

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- From experimental to highly integrated GIS database
- From mainly based on satellite imagery to combination of data sources
- From single to multi-temporal classification
- From 17 to 39 land cover/use classes
- From 67% to 80-90% accuracy
- From no to monitoring land use changes for 8 main classes
- From independent to integrated with other databases

LGN6



# Objective LGN7

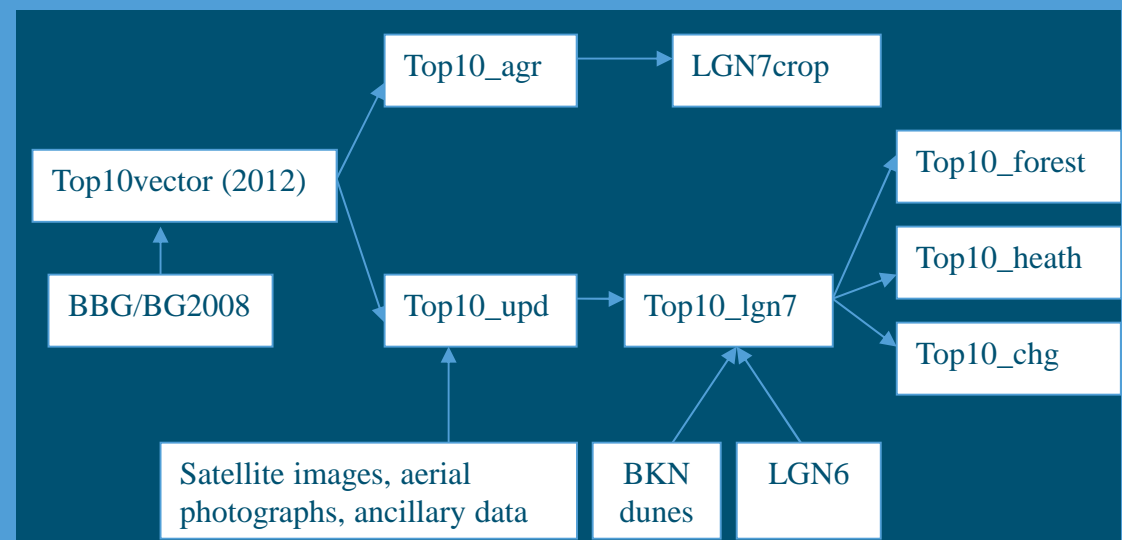
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- Topographical database as starting point
  - Common geometrical standard
- Integration with other national databases
  - Exchange/tuning of information between databases
  - Not to duplicate work
  - Focus on agricultural and nature areas
- Backwards Compatible with earlier versions
  - Monitoring land use/cover changes
- Up-to-date land use database reflecting land use for 2012

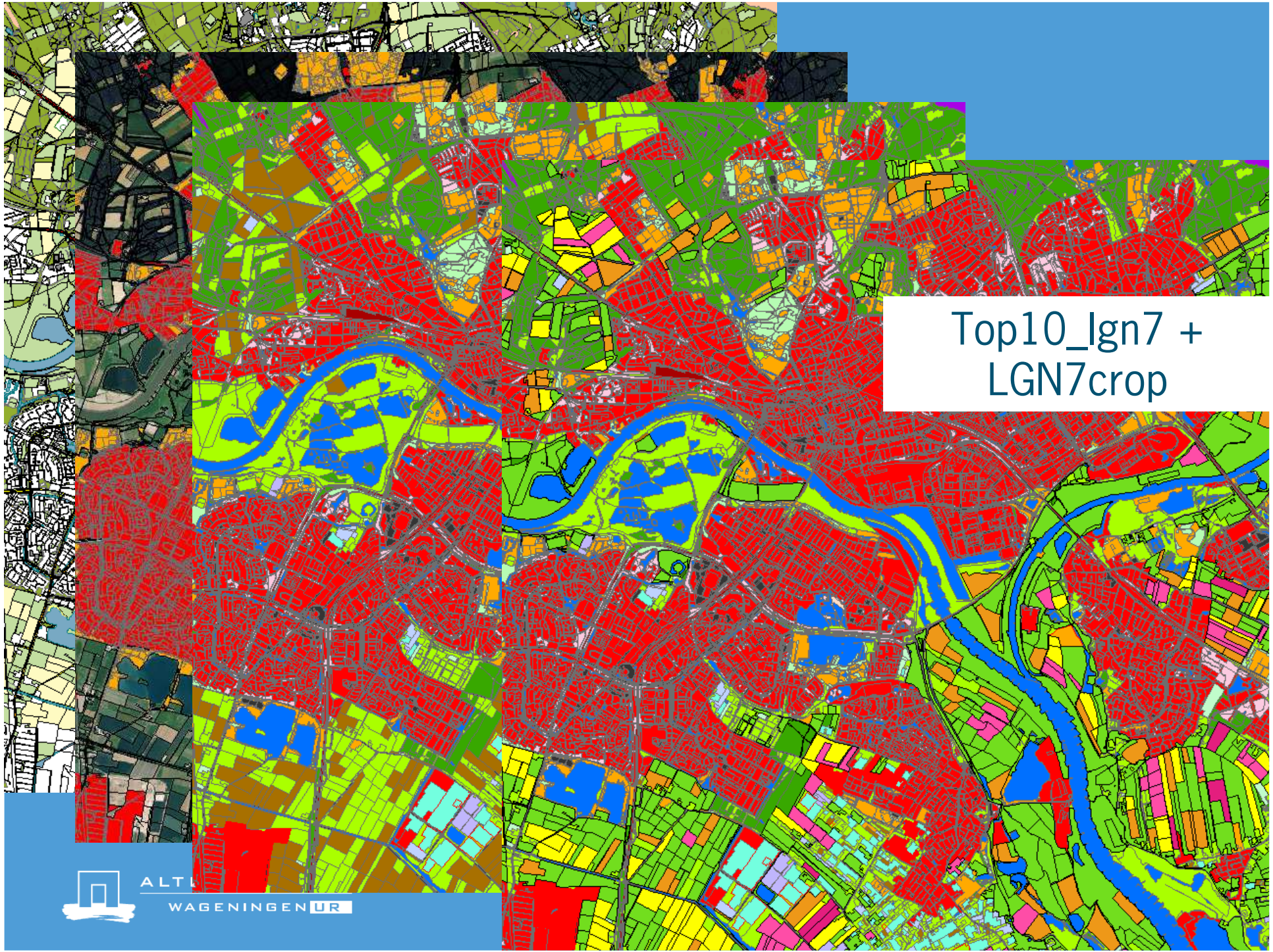
# Methodology (1)

## Top10vector as starting point

- Integrate urban areas with Top10NL
- Select agricultural areas, forest and heath land
- Change detection 8 monitoring classes
- Attribute LGN main classes to Top10NL objects in combination with other databases:
  - BBG/BG2008 (grass and forest in primary/secondary urban areas)
  - LGN6 (dune heath, mudflats and bogs)
  - Changes (new land cover/use for 8 monitoring classes)







Top10\_Ign7 +  
LGN7crop

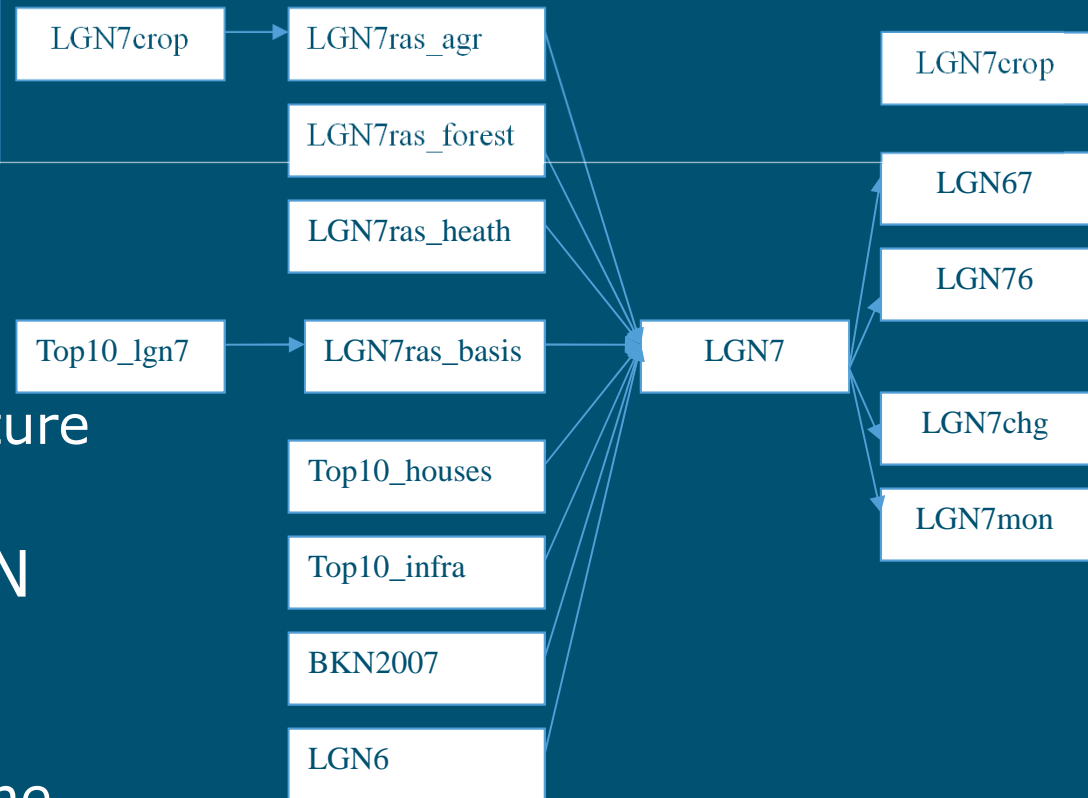




# Methodology (2)

## From feature to raster

- 25\*25m raster
  - Elimination infrastructure
- Integration other databases to refine LGN classes
  - Crop classification
  - BKN20?? (swamp, dune and natural grasslands)
  - Main roads and railways
  - Houses and buildings
  - Heath and forest classification
- Final processing (majority)



Top10\_Ign7

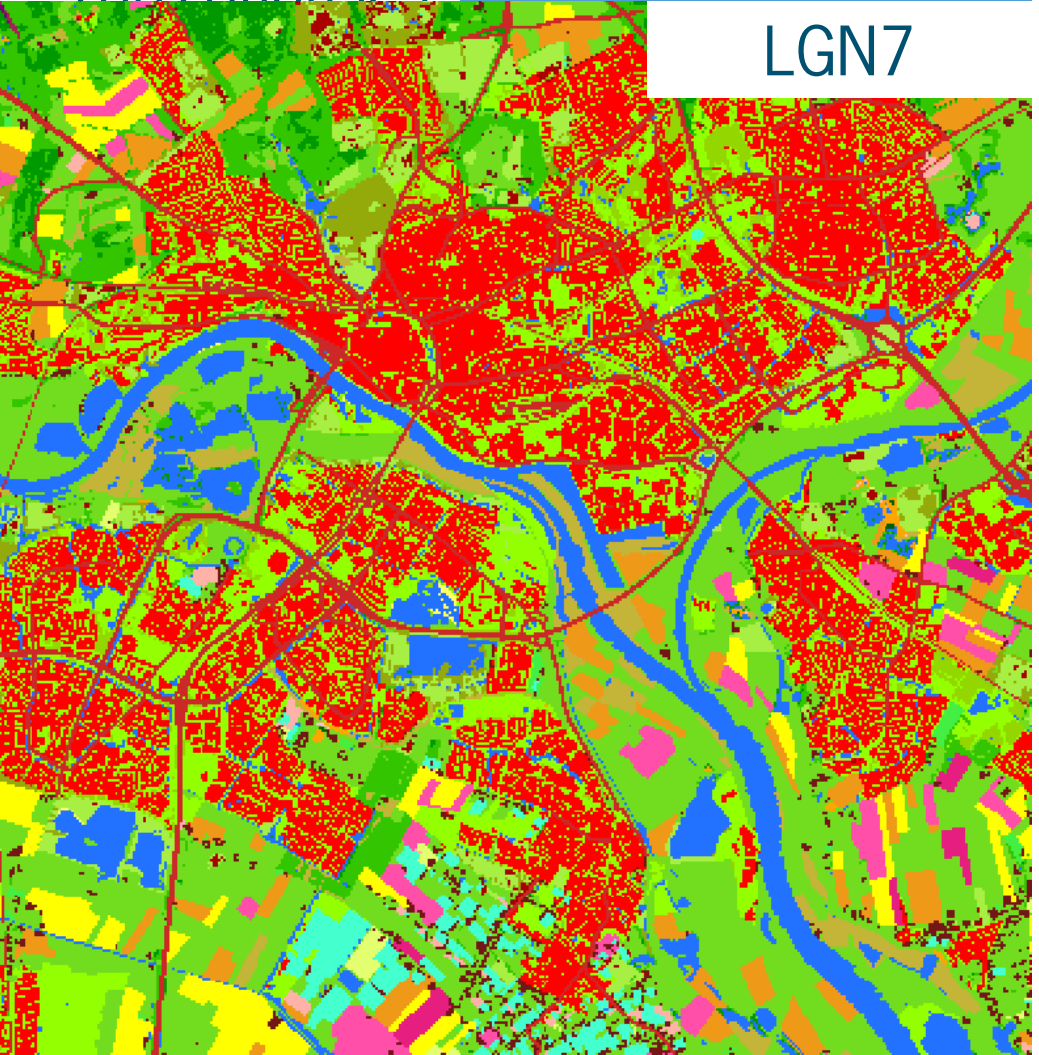
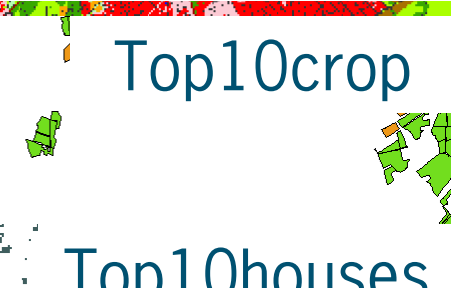
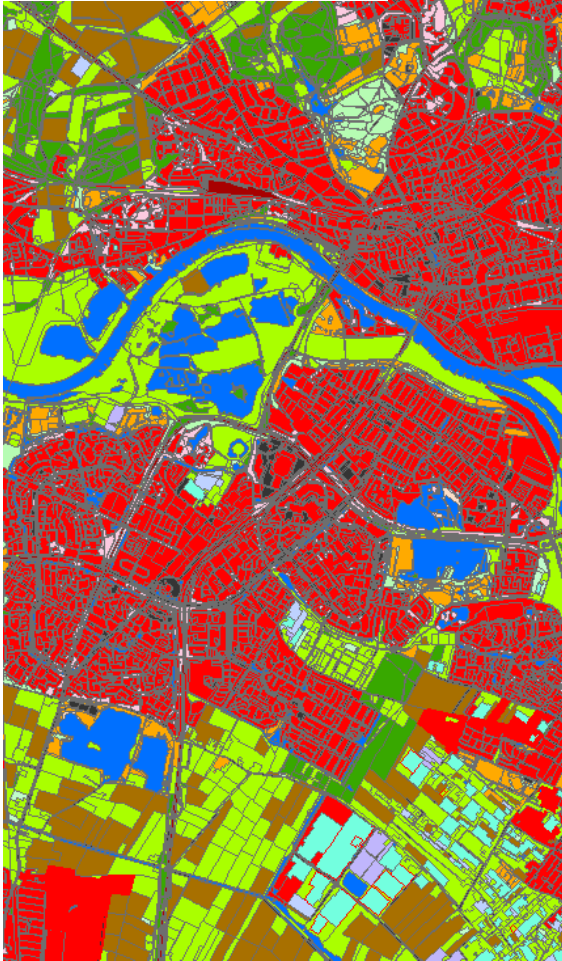
LGN7ras\_basis

Top10crop

Top10houses

Top10\_for

LGN7



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# LGN7 vs LGN6

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## ■ Datasets

- Top10NL, BBG2008, BRP2012, NSD

## ■ Methodology

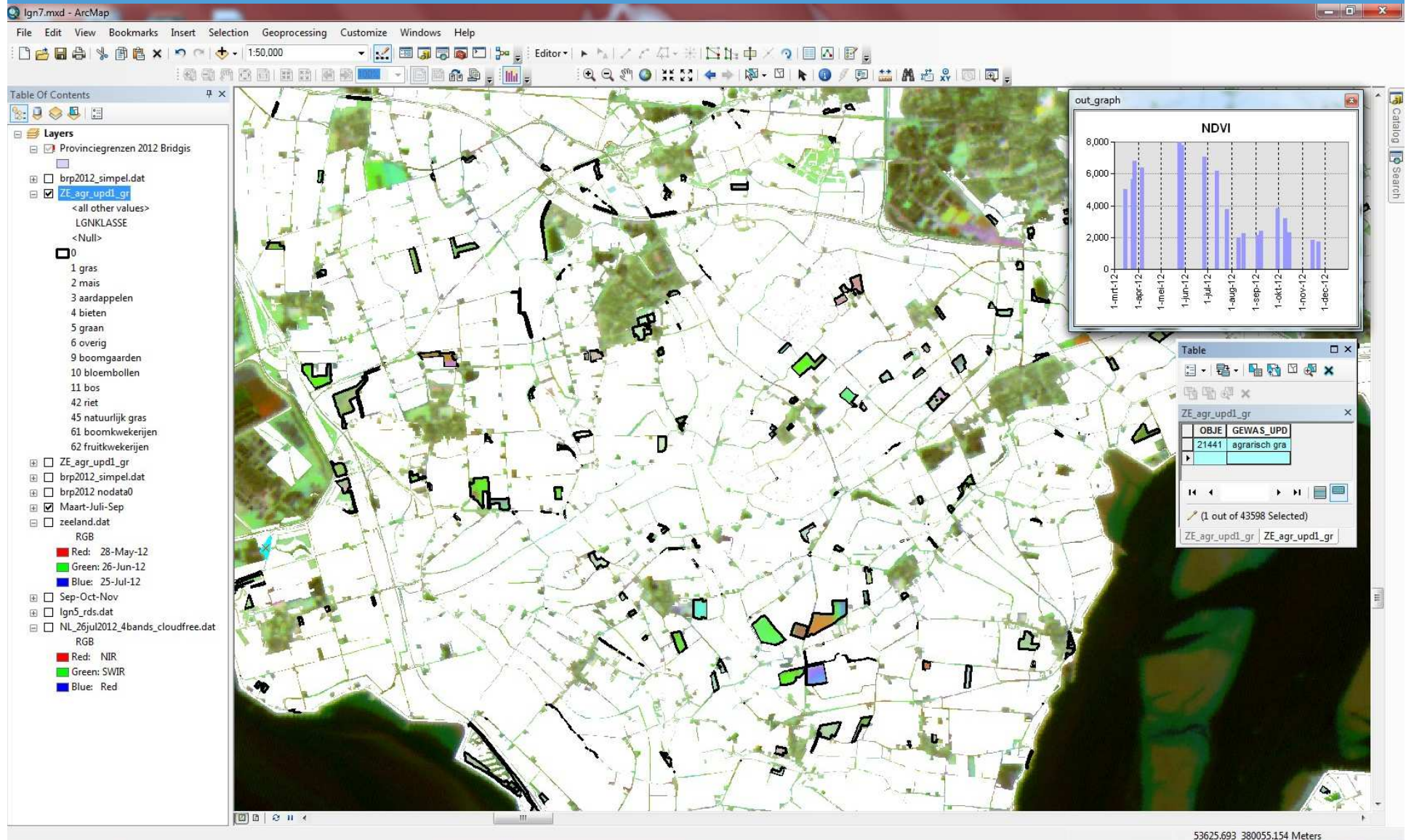
- Snapshot LC/LU for one year 2012 – total NL
- Integration Top10NL terrain, roads and water
- Integration with BRP2012 and NSD
- Dune, forest and heathland classification as LGN6
- Swamp and natural grasslands BKN20??

## ■ Products

- LGN7, LGNchange, LGN7mon, LGN76, LGN67
- LGN7 crop as individual dataset skipped

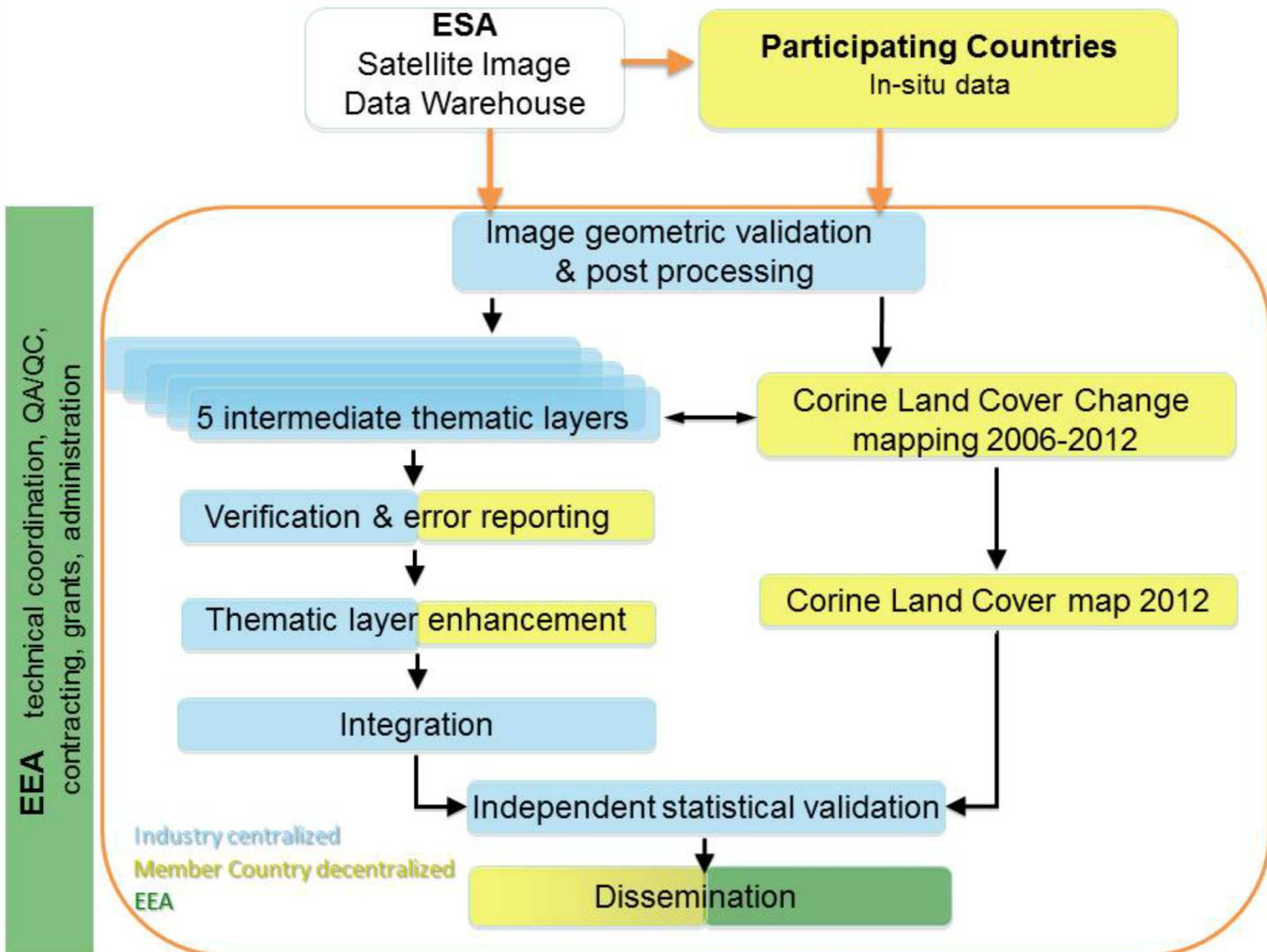


# Methodology crop classification





# GIO Land 2011-2013





# Specifications CLC2012 and CLCchange

- Specifications and production standardised over Europe:
    - mapping scale 1 : 100 000
    - minimum unit is 25 ha (CLC2012) and 5ha (CLCchanges 2006-2012)
    - standard legend: hierarchical with 44 (3th level), 15 (2nd level), 5 (1st level) classes
    - CLC nomenclature (Netherlands): 30 classes out of 44 classes
    - geometric accuracy is 100 m, thematic accuracy: 85%
    - visual interpretation (CAPI method) - change mapping first approach
    - CLC2012 = CLC2006rev (+) CLC-Change2006-2012
- 4th version after CLC1990, CLC2000, CLC2006





# Satellite images (IMAGE2012)

- Two coverages as in 2006
- IRS-P6 (COV1) and **RapidEye (COV2, no SWIR band)**
- The same images are used by HRLs
- Use the later image in case of differences in LC (e.g. clearcut, constructions)

	IRS LISS III (coverage-1) <b>CORE-01</b>	RapidEye (coverage-2) <b>CORE-01</b>
<b>No. of bands</b>	4	5
<b>Channels</b>	Green, red, NIR, SWIR	Blue, green, red, red-edge, NIR
<b>Ground sampling dist.</b>	23.5 m	6.5 m
<b>Bit depth</b>	7	Up to 12
<b>Delivered resolution</b>	25m,European, 20m,National	25m,European, 20m,National, 5m (UTM)

Additionally: **IMAGE2009**  
See DWH, CORE-02

Additionally: optical  
**VHR2** coverage over EU,  
see DWH, CORE-03

Additionally: European  
**monthly MR composite**,  
see DWH, CORE-08

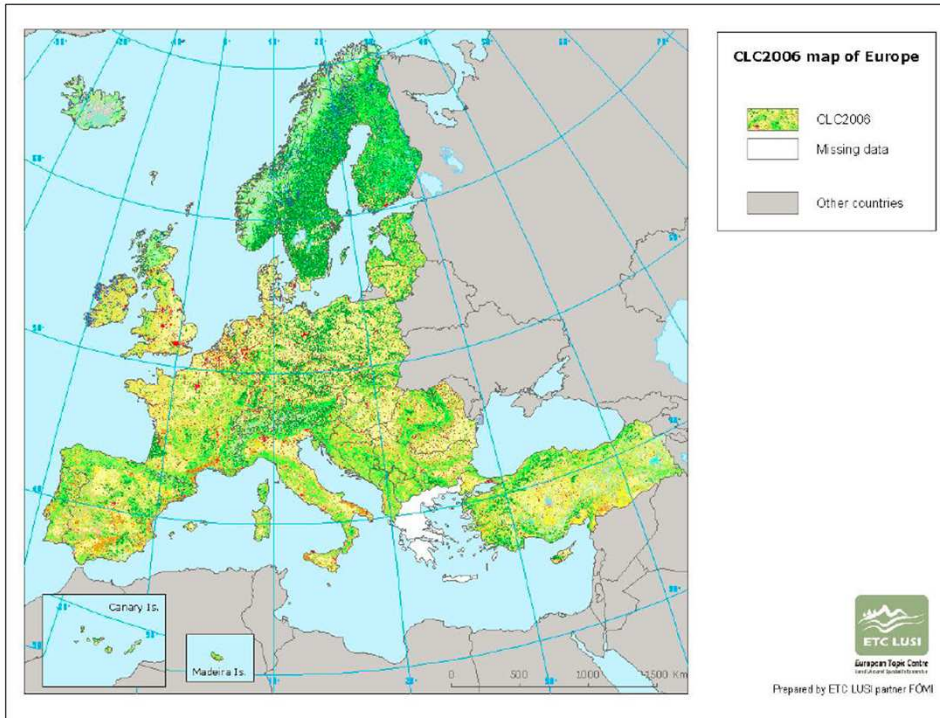


# Participating countries EEA39

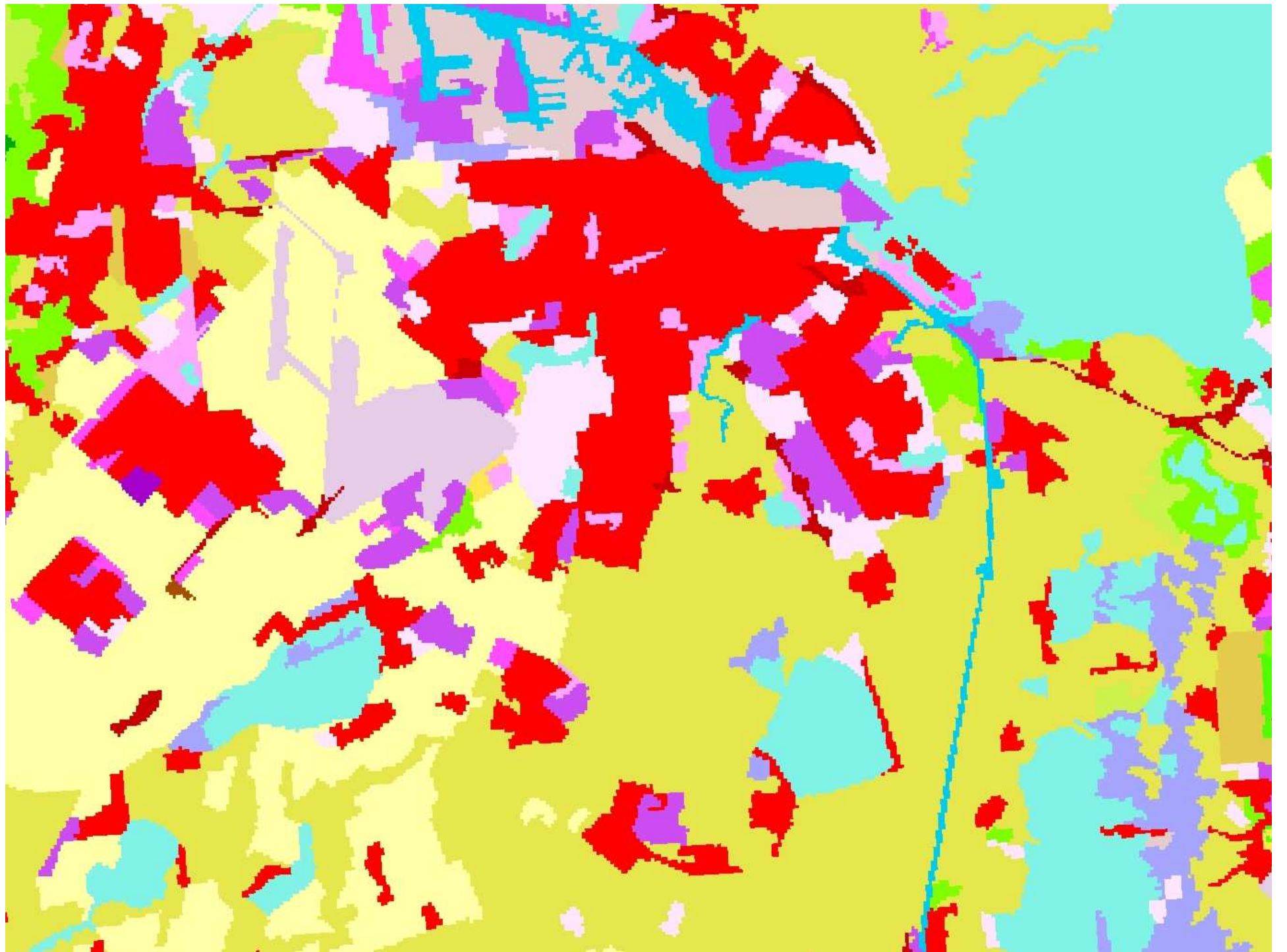
European Environment Agency

## Land cover classes

- |  |                             |
|--|-----------------------------|
| Continuous urban fabric  | Agro-forestry areas         |
| Discontinuous urban fabric   | Broad-leaved forest         |
| Industrial or commercial units   | Coniferous forest           |
| Road and rail networks and associated land   | Mixed forest                |
| Port areas   | Natural grasslands          |
| Airports   | Moors and heathland         |
| Mineral extraction sites   | Sclerophyllous vegetation   |
| Dump sites   | Transitional woodland-shrub |
| Construction sites   | Beaches, dunes, sands       |
| Green urban areas  | Bare rocks                  |
| Sport and leisure facilities   | Sparsely vegetated areas    |
| Non-irrigated arable land  | Burnt areas                 |
| Permanently irrigated land   | Glaciers and perpetual snow |
| Rice fields  | Inland marshes              |
| Vineyards  | Peat bogs                   |
| Fruit trees and berry plantations  | Salt marshes                |
| Olive groves   | Salines                     |
| Pastures   | Intertidal flats            |
| Annual crops associated with permanent crops   | Water courses               |
| Complex cultivation patterns   | Water bodies                |
| Land principally occupied by agriculture, with significant areas of natural vegetation | Coastal lagoons             |
|  | Estuaries                   |
|  | Sea and ocean               |
|  | NODATA                      |



Hopefully,  
political and/or  
financial  
constraints  
will not prohibit  
covering the  
planned **EEA39**



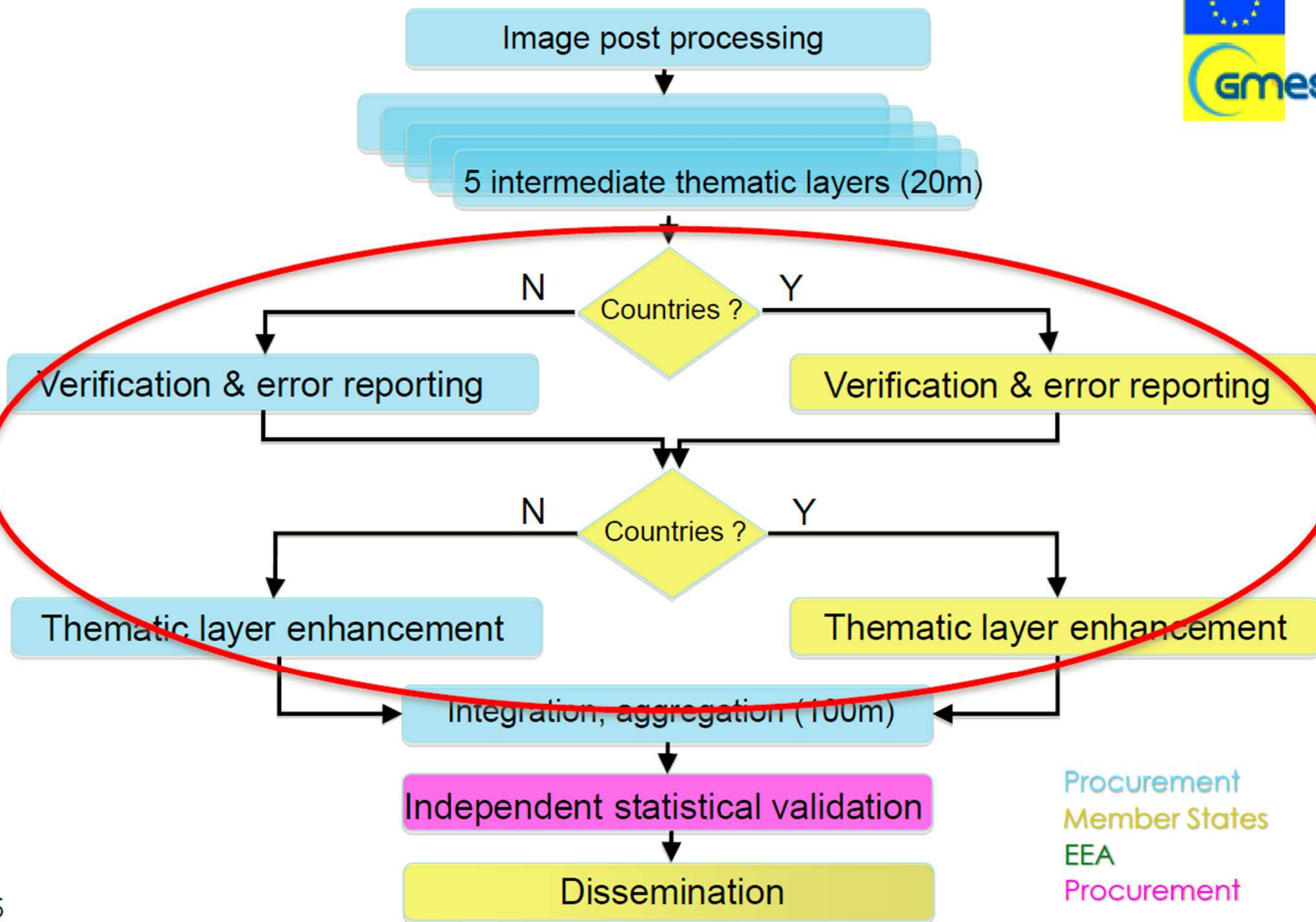


# Workflow: HRL production

European Environment Agency



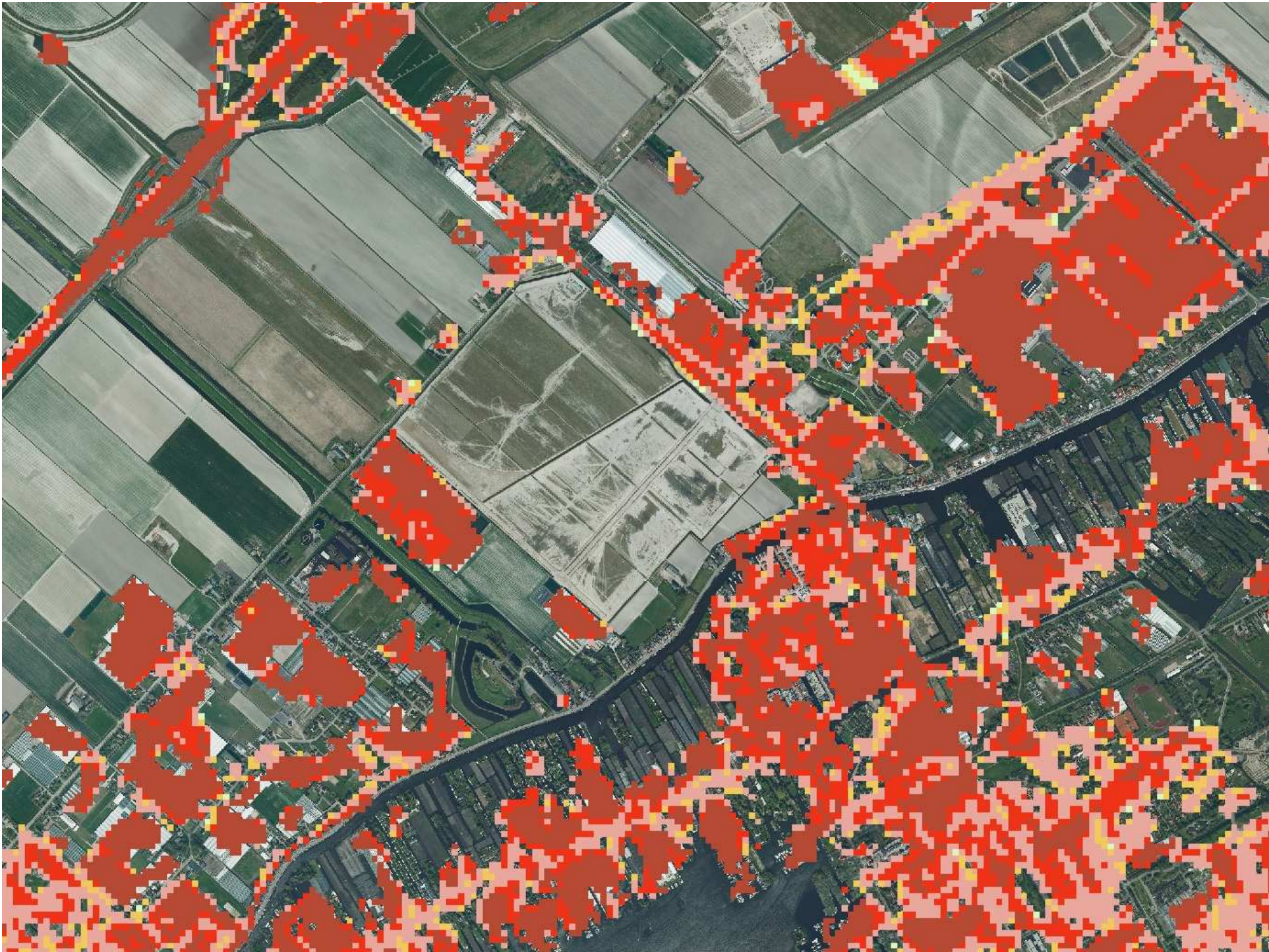
technical coordination, QA/QC,  
contracting, grants, administration



# Specifications HR layers

- Coverage EEA39
- Mapping at 20\*20m resolution by service providers, final results 100\*100m
- HR layers:
  - Degree imperviousness (0-100%, >30% built-up)
  - Tree cover density (0-100%, >30% forest) and forest type (broadleaved/coniferous) + SL
  - Permanent grassland (permanent for 2006-2009-2012)+ SL
  - Wetlands (WEPI – yes/no)
  - Water bodies (WEPI – yes/no)
- Attribute information to enrich objects, more regular intervals







# Verification HR layers

European Environment Agency



Products to be verified  
20m x 20m, national projection

- Degree of Imperviousness
- Tree Cover Density
- Forest Type, consisting of two layers
- Permanent Grassland (based on 2006-2009-2012 data)  
consisting of two layers
- Wetlands (based on 2006-2009-2012 data)
- Water Bodies (based on 2006-2009-2012 data)



## Purposes of verification

- To **identify systematic classification errors** that are eligible for later **enhancement**.
- The **intermediate products** (20m x 20m resolution) will be verified by **national teams** (or if not interested, by **Service Providers**).
- Shall be checked for **omission** and **commission** errors.
- Shall be carried out **comparison** of the s in-situ data (e.g. top satellite imagery).



## Three levels of verification

- General overview of data quality (**obligatory**)
  - ❖ Highly qualitative
- Look-and-feel verification (**obligatory**)
  - ❖ Qualitative
- Statistical verification (**new, highly recommended**)
  - ❖ Quantitative



# Enhancement of verification L

European Environment Agency



## Enhancement Density layers and map layers

### Possibilities to correct omission errors

HRL	Density / Map	Enhancement by countries	Enhancement by SP
Imperviousness	Density	<b>not possible<sup>+</sup></b>	possible
	<i>Built-up map</i>	<i>possible</i>	not applicable
Tree cover	Density	<b>not possible<sup>+</sup></b>	possible
	<i>Tree-cover map</i>	<i>possible</i>	not applicable
Forest type	Map	possible	possible
Grassland	Map	possible	possible
Wetland	Map	possible	possible
Water	Map	possible	possible

<sup>+</sup>Outlines of omitted impervious or tree cover areas should be provided, but not densities







# Purposes of enhancement

- Improve the quality of the **six intermediate HRLs** (20m x 20m, national projection) produced by SPs.
- Enhancement means:
  - **Removing** an area from the intermediate HRL, because evidences show that the area does not belong to the HF
  - **Supplementing** because evidences show that the area does not belong to the HF



## Enhancement Technical solution

**Country:** Vector editing is proposed to use for delineating areas of omission and commission errors. Densities can not be estimated.

**SP:** Remove omission and commission errors by using the SPs own algorithms. Densities should be estimated (imperviousness, tree cover density).

- **Coding of omissions and commissions** according to specification (see Guidelines).
- Rasterised (20m x 20m) enhancement data have to be added to the intermediate layer.



# Harmonisation – bottom-up approach (1)

- **HELM (Harmonised European Land Monitoring):** a move to make European land monitoring more productive by increasing the alignment of national and sub-national land monitoring endeavours and by enabling their integration to a coherent European data system (<http://www.fp7helm.eu/>)

=> A vision for harmonised land monitoring in EU

- Pilot study EUROSTAT “Harmonisation LU/LC statistics – synergy between LUCAS and national systems”
- INSPIRE-TWG: data specifications for LC/LU
- GeoWiki: validation of LC through citizen participation

# Harmonisation – bottom-up approach (2)

- EAGLE (Eionet Action Group on Land monitoring in Europe): main objective is to provide a European conceptual data model, that
  - separates LC from LU information
  - supplies a comprehensive representation of both LC and LU information; and
  - allows the use of information from national datasets to support a European Land Monitoring System through a “bottom-up” approach (<http://sia.eionet.europa.eu/EAGLE>)

=> datamodel

# Land Cover and Land Cover Components

## Bread:

### ■ Classification

- bred = bred

### ■ Characterisation

#### ■ Outer apperance

- Weight
- Length

#### ■ Inaredients

- salt
- wheat
- water
- veast
- E 510, ...

#### ■ Colour

- bright
- dark

#### ■ Other characteristics

- Organic
- GMO free





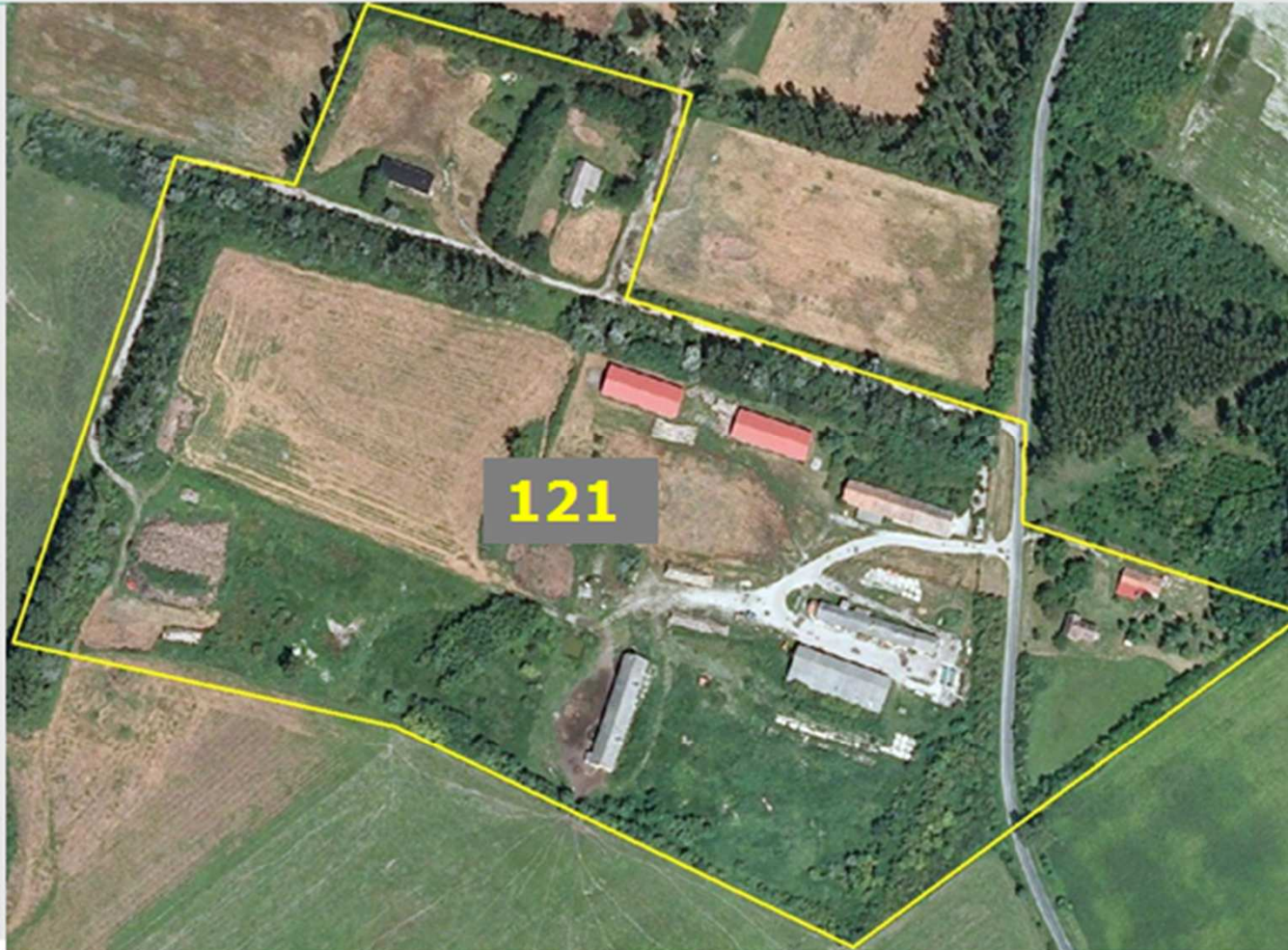
# What is the content of CORINE (or national LC) classes in different countries?

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- same name ...different content
  - bred ≠ bred
  - 112 discontinuous urban fabric (DE) ≠ 112 discontinuous urban fabric (NO)
- „population“ of CORINE (or national) LC classes with
  - independent diagnostic criterias [© G-H. Strand]
  - additional characteristics

# Characterisation of a class

CLC polygon with different LCC component



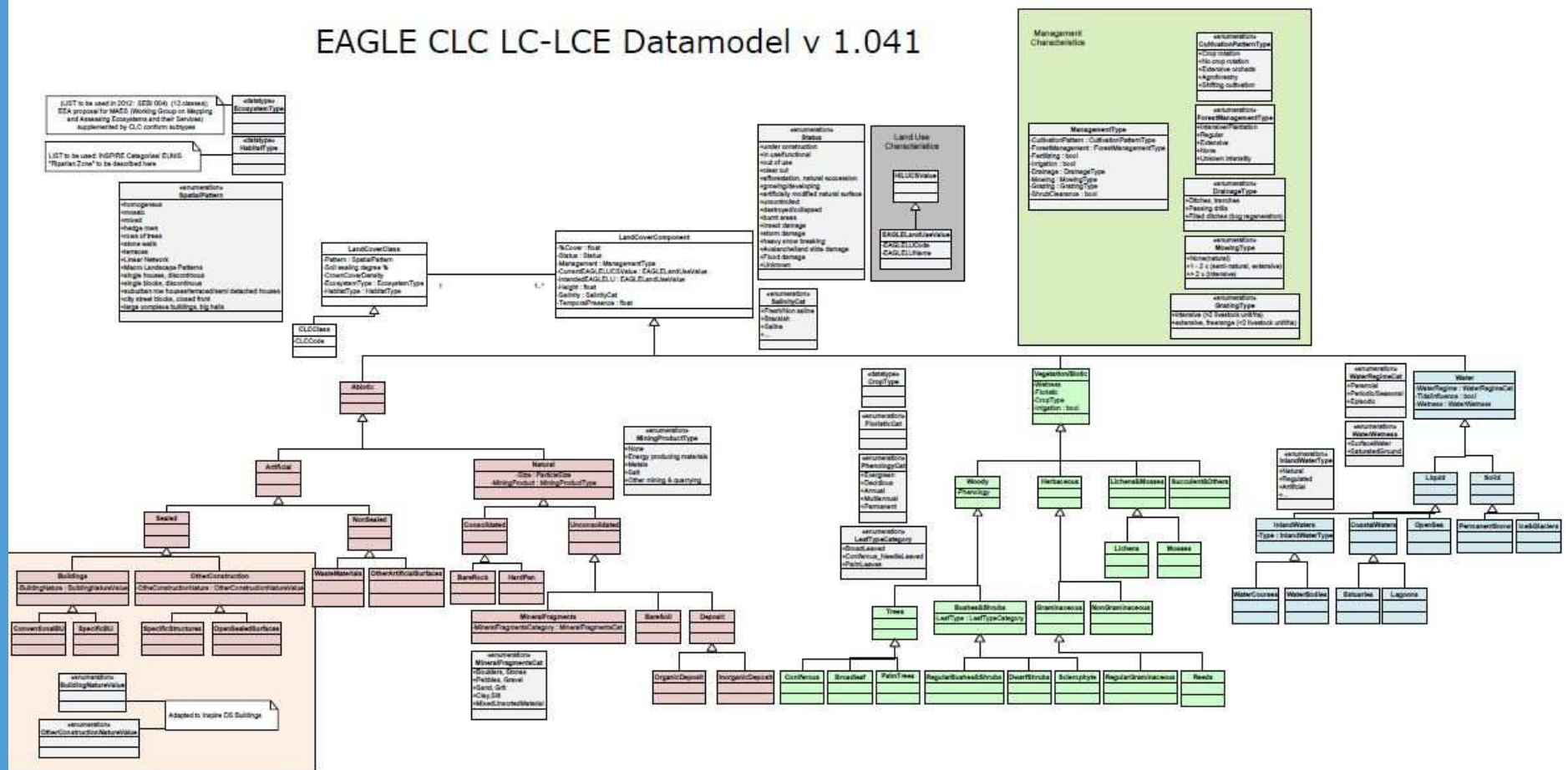


Describing the land cover composition of each land surface unit / nomenclature class by attaching more than one LCC to it



# EAGLE - Data model

EAGLE CLC LC-LCE Datamodel v 1.041





# EAGLE - Bottom-up approach

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- Acknowledge that land monitoring develop on European AND national level
  - Diversity of national land monitoring system (none .... fully operational)
  
- Tools are necessary
  - semantic transformation
    - EAGLE data model
  - spatial transformation
    - Vector generalization
    - Raster generalization

# Outlook LGN – CLC/HR

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## ■ LGN

- Yearly crop update, more detail in crop classification
- NSD – Sentinels and explore use of radar
- Regular update of complete LGN

## ■ CLC/HR

- Two speed approach: CLC (6 year) and HR (3 year) cycle
- Bottom-up approach / break in methodology / implementation EAGLE concept

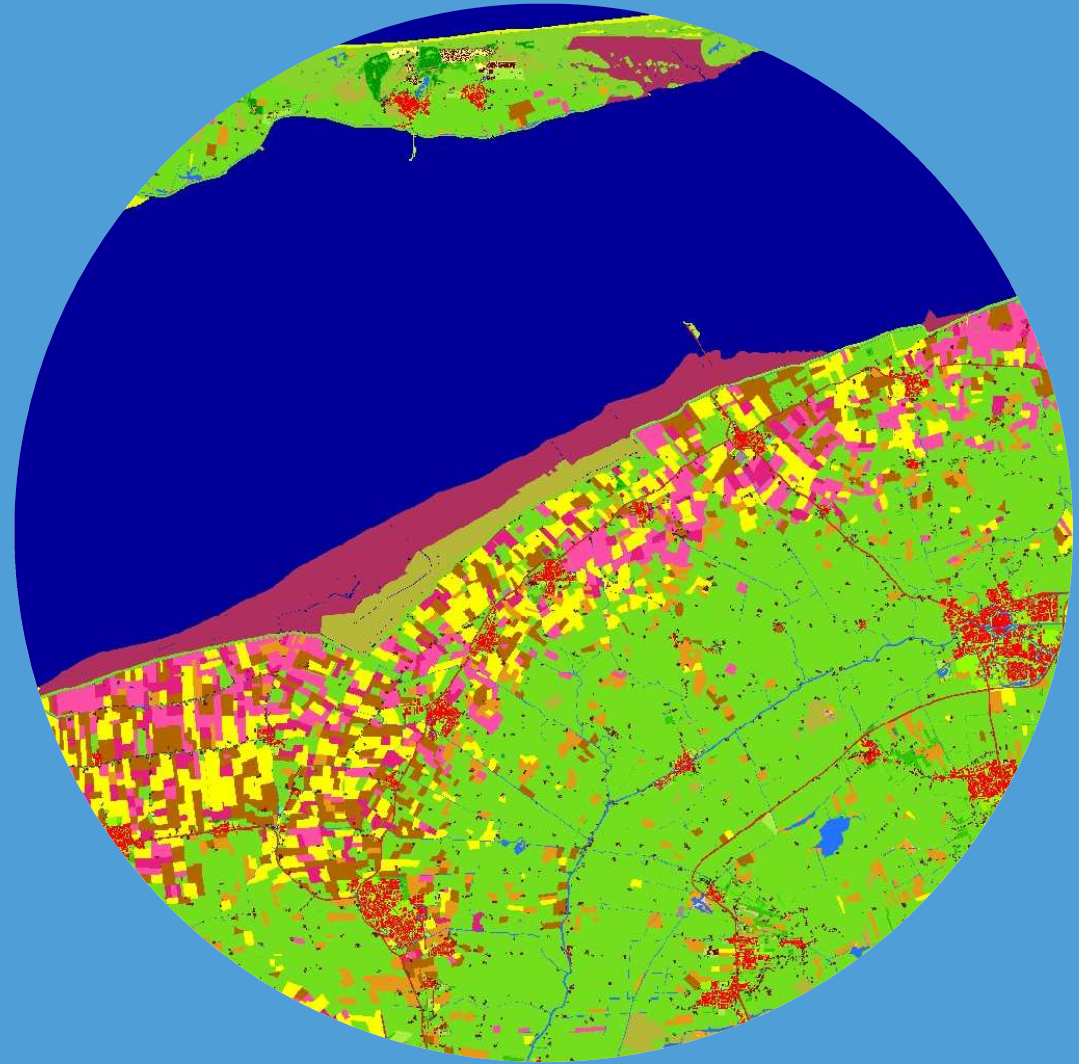
# Outlook - harmonisation – LGN & CLC

- Differences in semantics (LGN:CLC - 1:m, m:1 relaties), spatial and temporal resolution
- Ideally:
  - One common Dutch standard (one thematical, temporal and geometrical basis) on which different national products are based => coordination
  - Production of CLC is produced on basis of national products by semantic and spatial aggregation
  - National LC/LU =>> CLC on basis of conversion tools =>> one fits all solution that can be applied at different moments
- Monitoring changes vs change in methodology =>> 2 versions of CLC2012 and generalisation rules

# Thanks

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EAGLE members



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