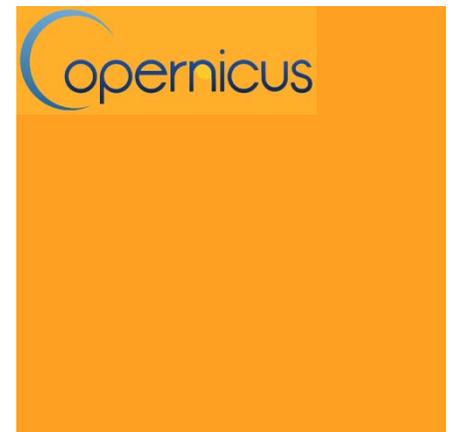
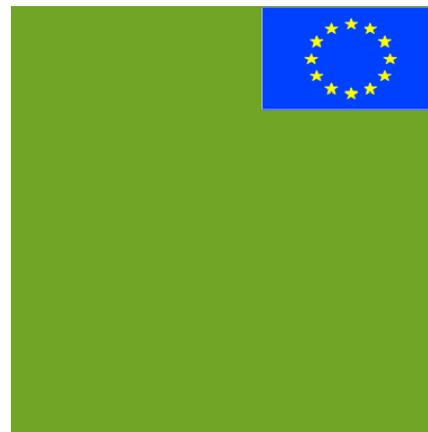
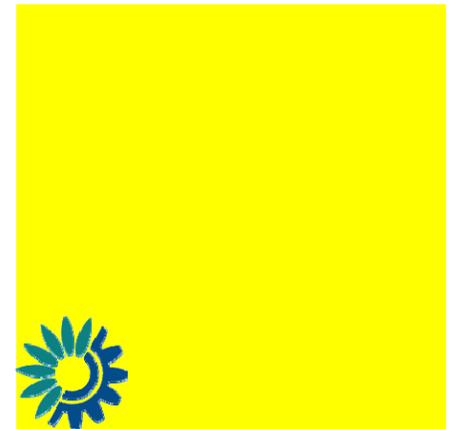
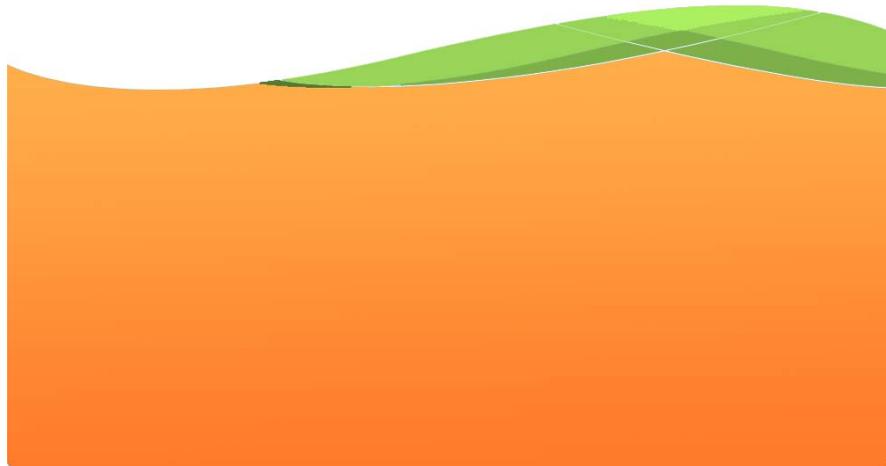


GIO-land



European Land Monitoring Activities in the frame
of Copernicus Programme

Gyorgy.Buttner@eea.europa.eu

International LCLUC Regional Science Meeting in Central Europe,
16-22 October 2014, Sopron, Hungary

Outline

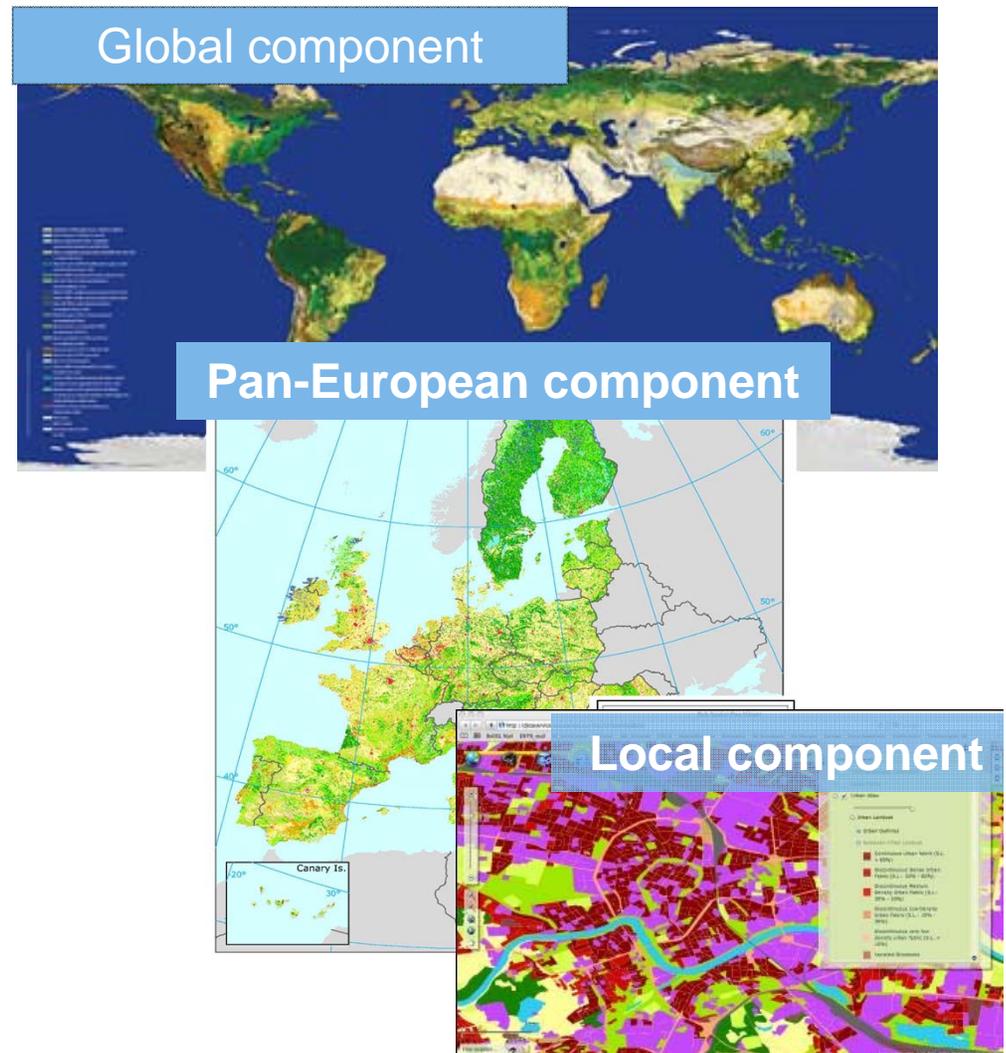
Copernicus Initial Operations land

- Programme overview
- Continental component
 - High Resolution Layers
 - CORINE Land Cover 2012
- Progress and examples
- Validation

Copernicus Initial Operations land (GIO land) components

- **Global** → JRC
bio-physical parameters (Essential Climate Variables (ECVs), food security (Africa) etc.)
- **Continental** → EEA
pan-European products:
CLC 2012, six HRLs, HR satellite image mosaic
- **Local** → EEA
zooming on 'hot spots': Urban Atlas, Riparian areas
- **Dissemination** + archiving + cataloguing → EEA
- Improve **access to in-situ** data → EEA

**Various deadlines
between end 2014 and end 2015**





Copernicus Initial Operations land Geographical coverage



EEA member countries

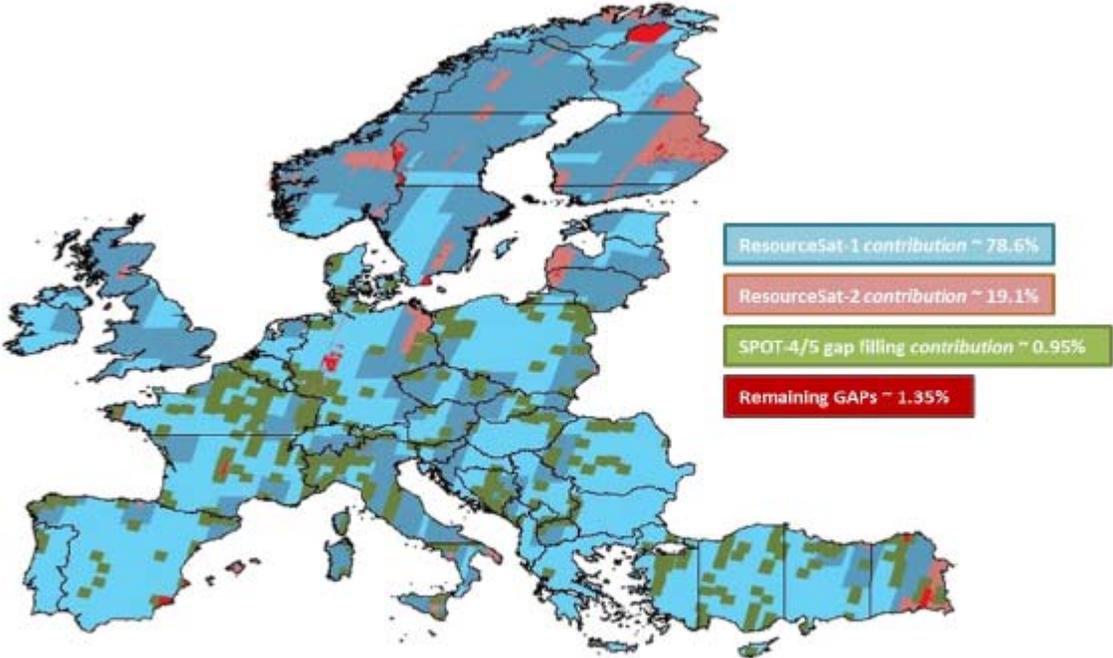
- Member countries
- Collaborating countries

- 6M km²
- 39 countries (**EEA39**)
 - EU28
 - 5 additional EEA MS
 - 6 cooperating countries



Satellite images from ESA DWH used in GIO land (Pan-EU and local)

	type
MR	IRS AWiFS (60 m monthly March Oct composite)
HR	IRS/Resourc LISS III, SPOT 4/ (20m) RapidEye (5m, 20m)
VHR	SPOT-5, Formos EROS-A/B, Ikonos, GeoEye, QuickBird, Wordview-1/2



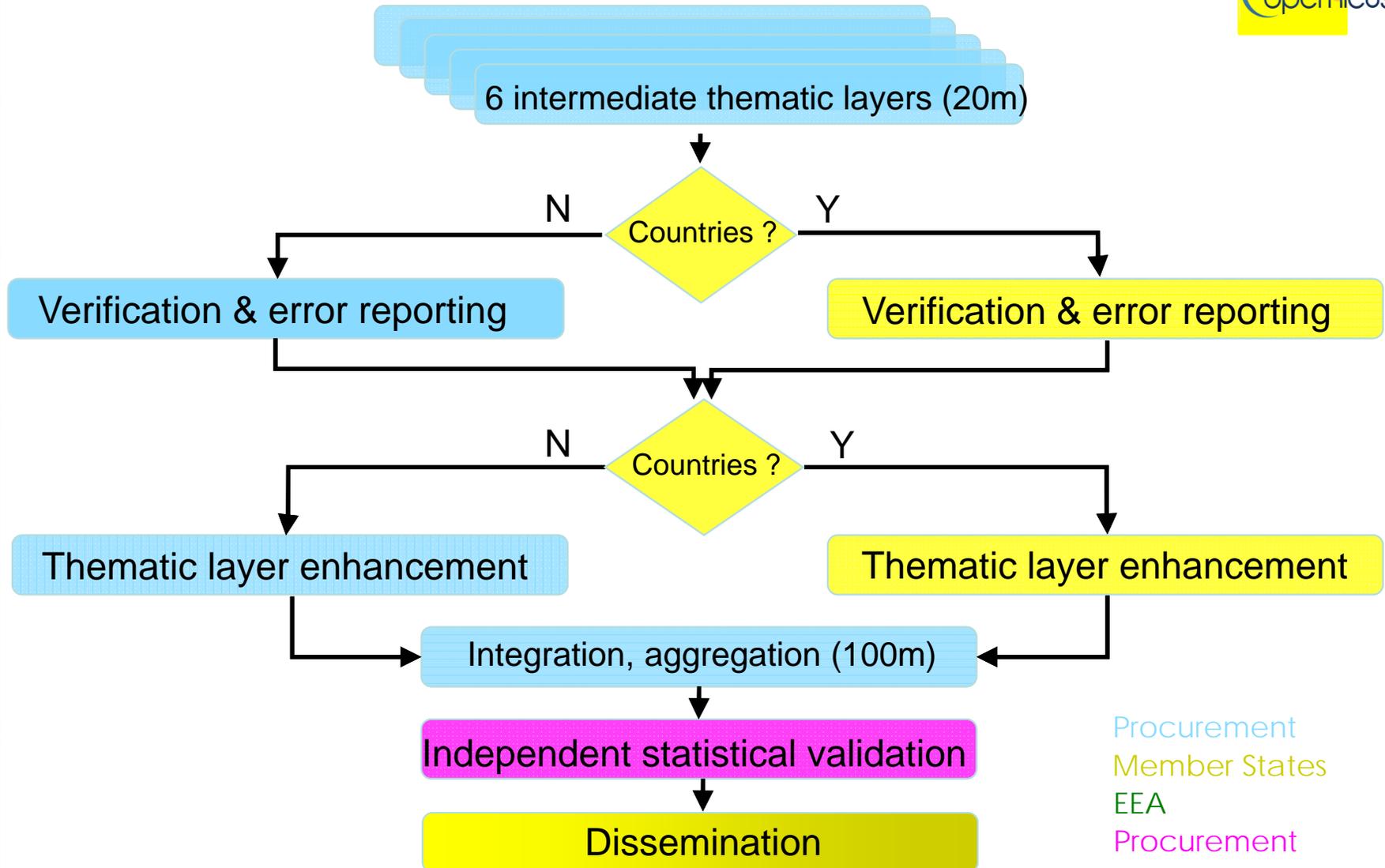
CORE_01 Coverage-1 Acquisition Achievement Overview :
 Resourcesat-1/2 and SPOT-4/5 combined contributions over continental Europe within 2011-2013

FIRE FOREST



Workflow: HRL production

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



Pan-European continental component

HRL Degree of Imperviousness

- **Automatic** derivation based on calibrated **NDVI** by SPs.
- **Degree of imperviousness: 1-100%.**
- Intermediate product: no MMU (20m x 20m), minimum mapping width: 20m
- Final product: 100m x 100m
- The only HRL having produced before for Europe (2006, 2009)



Pan-European continental component

HRL Tree cover density, Forest type

Tree cover density (TCD)

- **Automatic classification** of HR imagery by SPs
- Tree Cover **Density range: 1-100%**
- Intermediate product: no MMU (20m x 20m), minimum mapping width: 20m
- Final product: 100m x 100m



Forest type / derived from TCD

- Intermediate product (20m x 20m): **TCD $\geq 10\%$, MMU = 0.5 ha** (FAO); minimum mapping width = 20m; two dominant leaf type classes: broadleaved and coniferous
- Final product (100m x 100m): **three forest classes**. Non-forestry trees are excluded (trees used for agriculture and urban context).



Pan-European continental component

HRL Permanent Grassland

- **HR images of three reference years** (2006, 2009, 2012) used to detect the permanent presence of grassland.
- Intermediate product: no MMU (20m x 20m), minimum mapping width: 20m; **binary map** (grassland / no grassland)
- Final product: 100m x 100m. **Occurrences of permanent grassland** (0-100%). Grassland in urban context, airports and sport and recreation areas are excluded.





Pan-European continental component

HRL Wetland / wet-land

- Areas covered **temporarily by surface water** during the reference year (2012) mapped by **AWiFS monthly** time series and HR imagery.
- Intermediate product: no MMU (20m x 20m), minimum mapping width: 20m; **binary map** (wetland / no wetland)
- Final product: 100m x 100m **occurrences of wetland** (0-100%)



Pan-European continental component

HRL Water bodies

- High resolution images of three reference years (2006, 2009, 2012) used to detect the **permanent presence of surface water**.
- Intermediate product: no MMU (20m x 20m); minimum mapping width: 20m; **binary map** (water / no water)
- Final product: 100m x 100m - **occurrences of water** (0-100%)

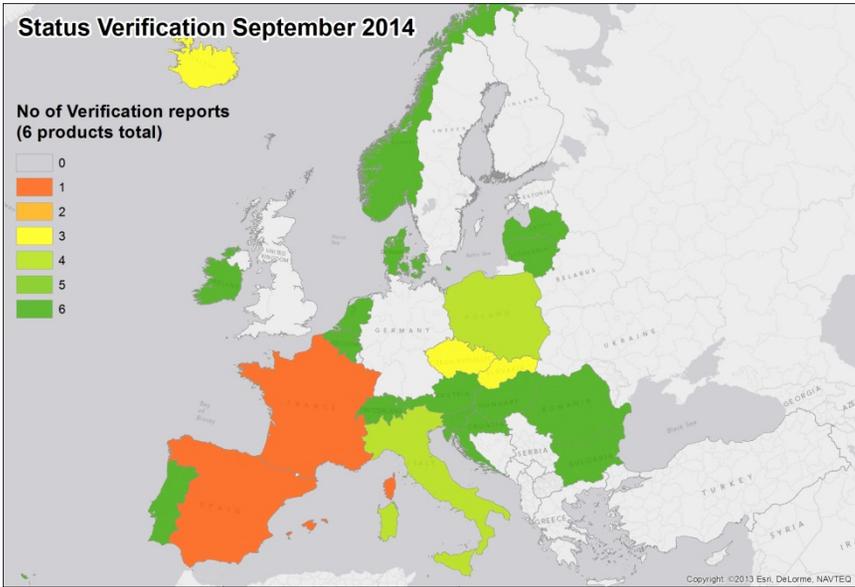




Pan-European continental component

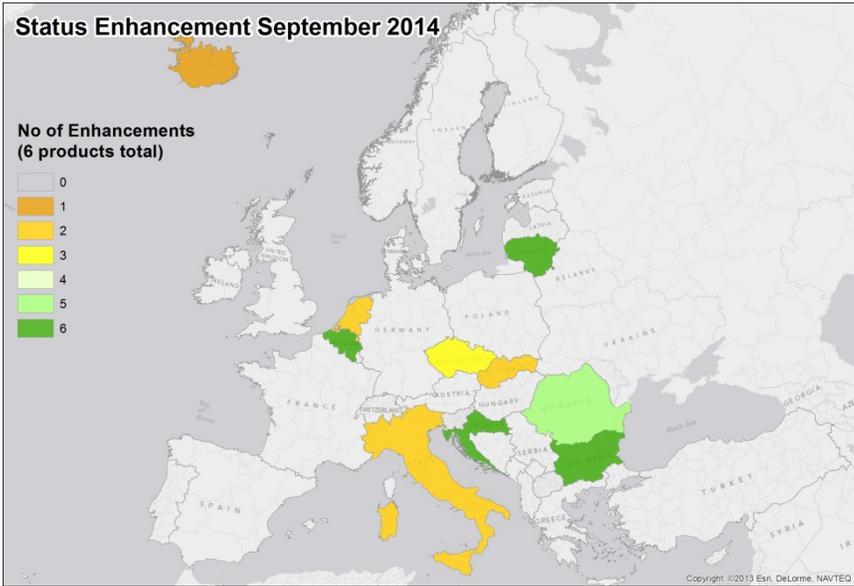
Status of verification and Enhancement

Initial production has finished for all HRLs



Progress is followed-up by

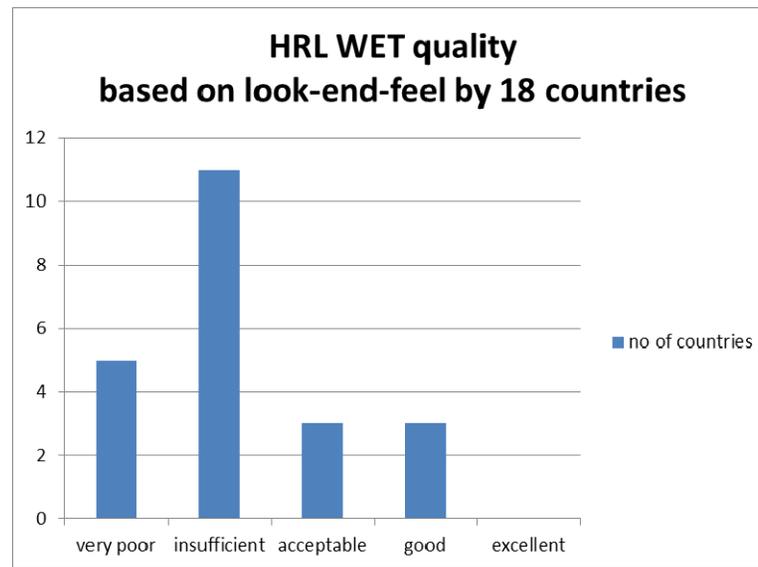
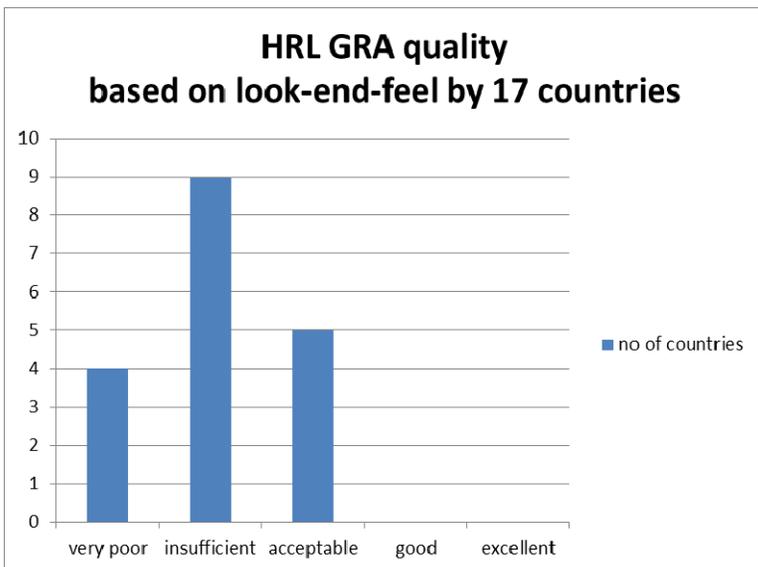
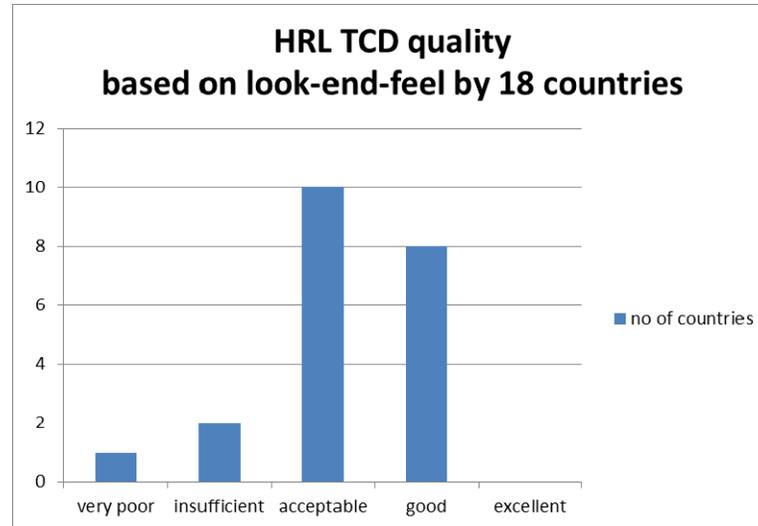
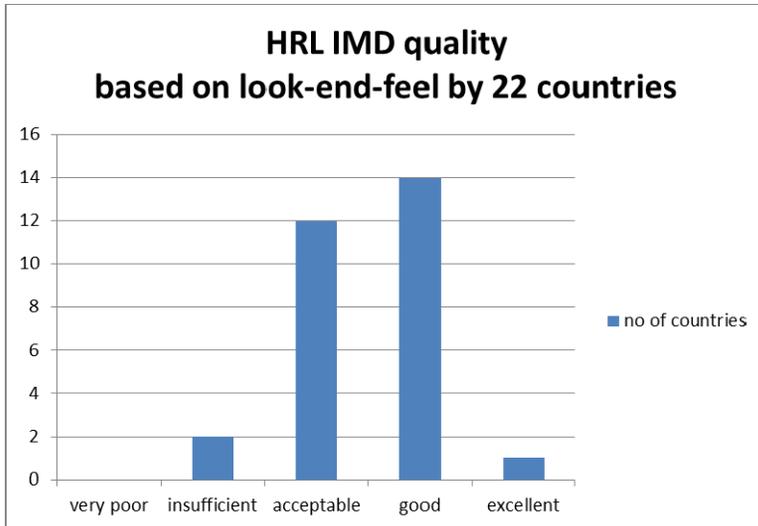
- Semantic checking of products (ETC)
- Checking of verification and enhancement reports (EEA)





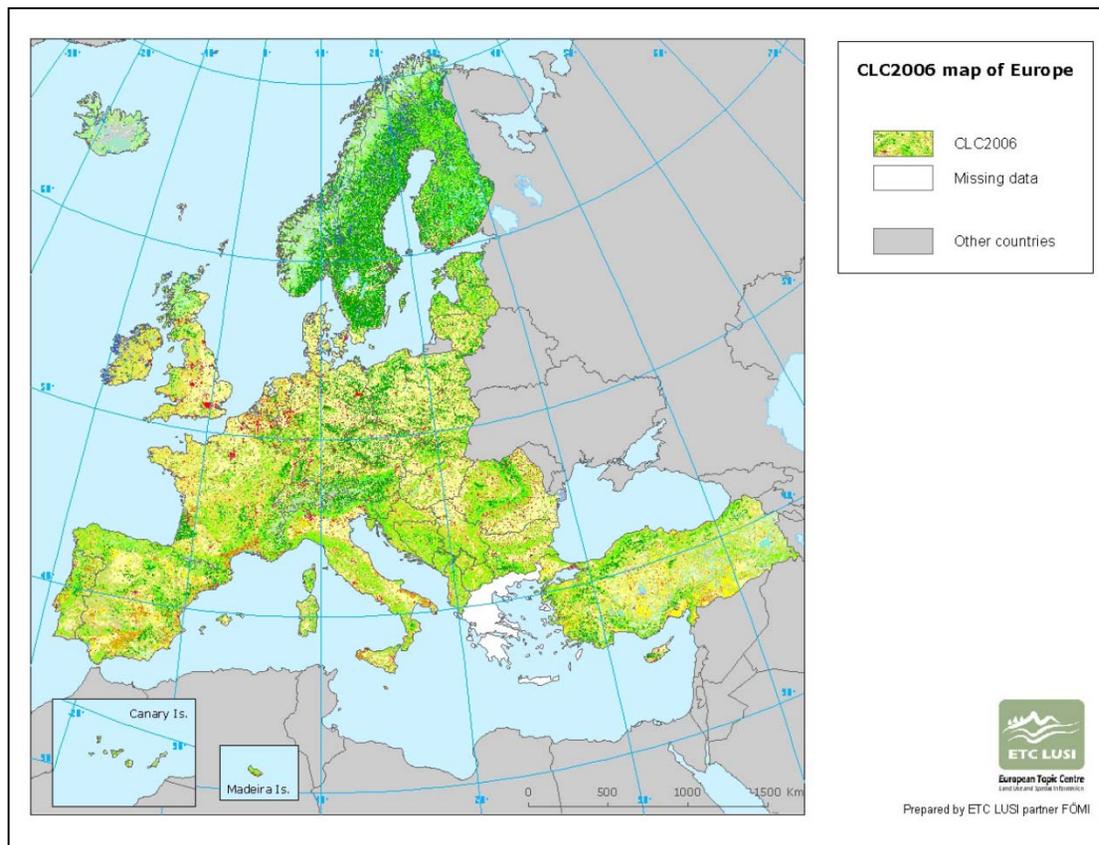
Pan-European continental component

Verification by countries (look & feel)



Pan-European Continental Component

CORINE Land Cover



Mapping surface features of Europe at medium scale based on (mostly) physical characteristics

Minimum mapping unit: 25 ha

MMU change mapping: 5 ha

Minimum mapping width = 100 m

Nomenclature (incl. LU&LC elements): 3 levels, 44 level-3 classes

Long heritage: CLC1990, CLC2000, CLC2006, **CLC2012**

National Teams (bottom-up), simple workflow

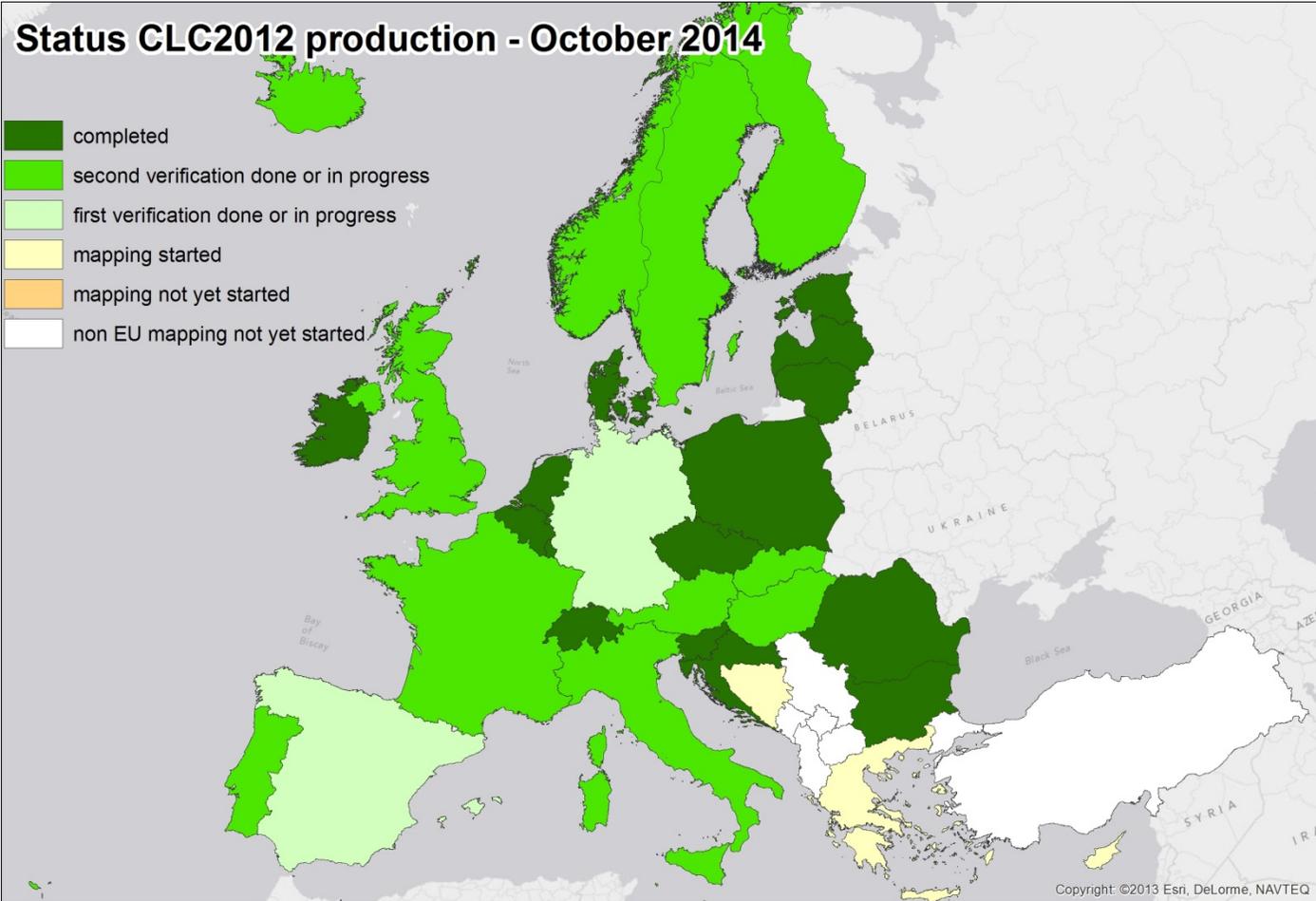
CLC-Changes_{2006,2012} are mapped;

CLC2012 = CLC2006+CLC-Changes



Pan-European Continental Component

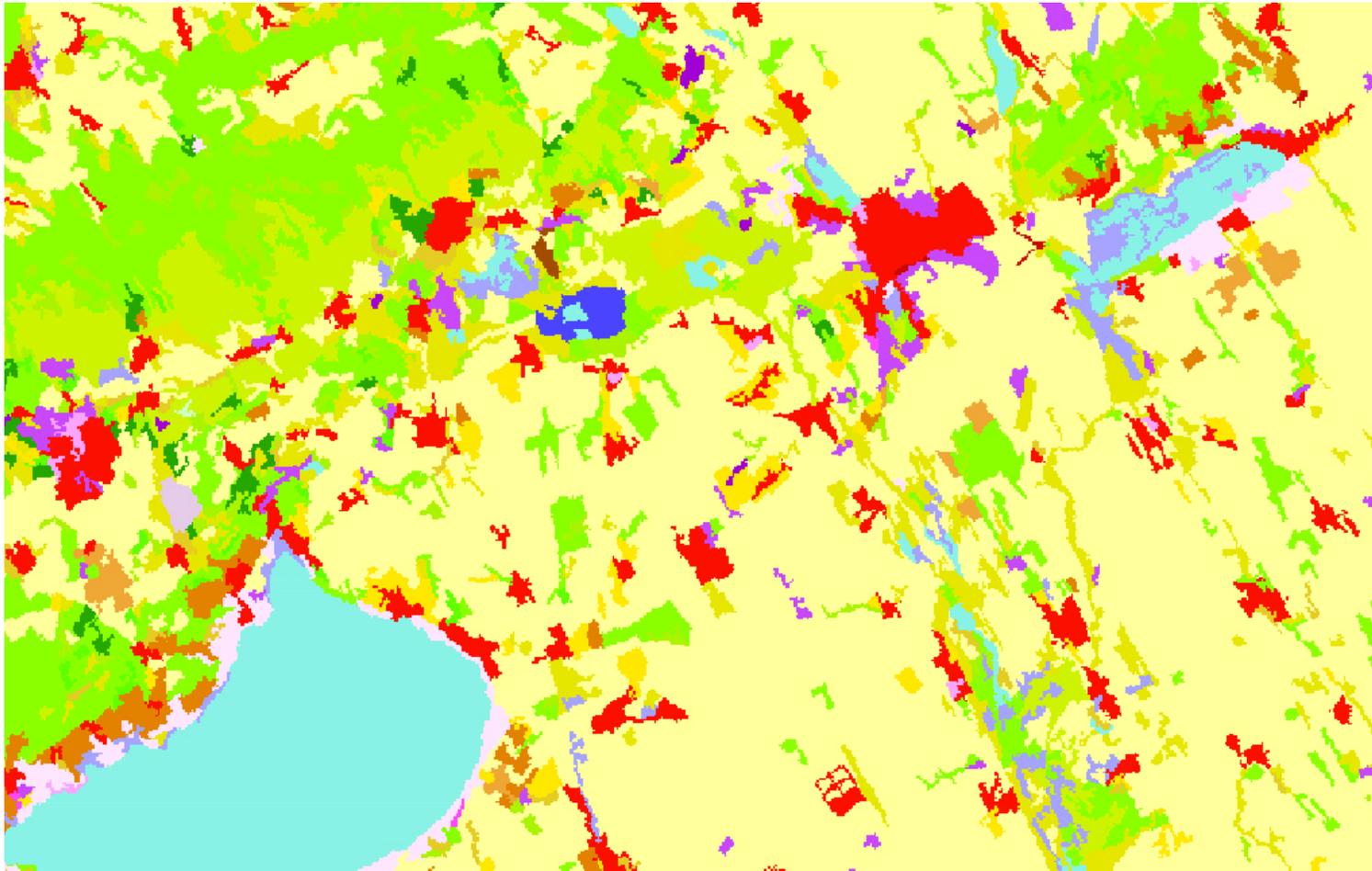
CLC status – October 2014



Progress is followed-up by 2 verifications in each country by EEA & ETC-SIA

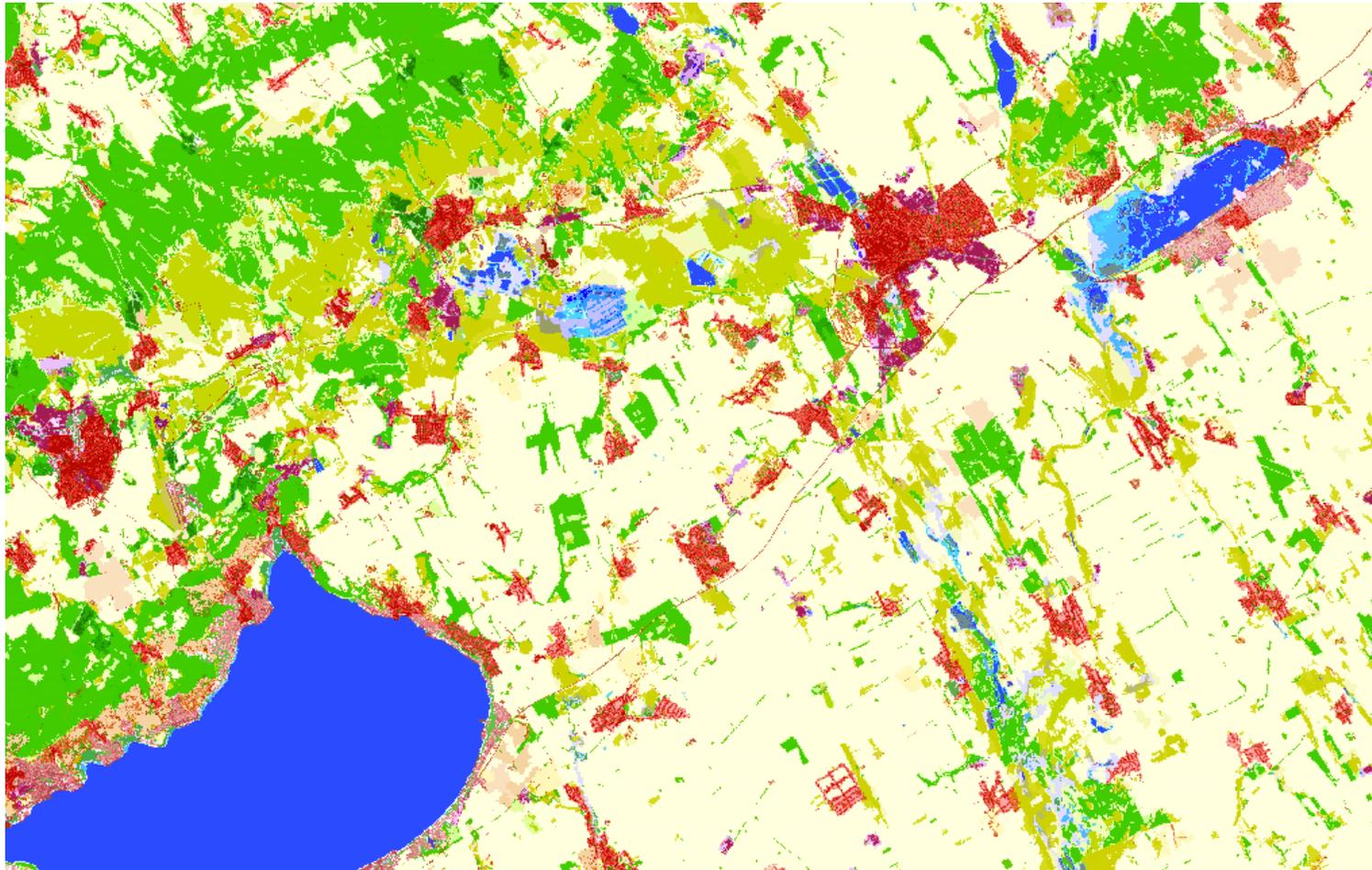


CORINE Land cover map



Lake Balaton (HU)

CLC + HRLs: Imperviousness + Forest type + Grasslands + Wetlands + Water



Integrating CLC and HRLs: Lake Balaton (HU)



GLO land final products

Validation

- To derive an **independent estimation** of the **accuracy** of **ALL** the **European products** by using higher resolution information
- Primary aim is to **inform users** about the accuracy of final products
- No feedback to improve production
- ..but influence **planning of next update**
- Enable to assess validity of change detection in time series

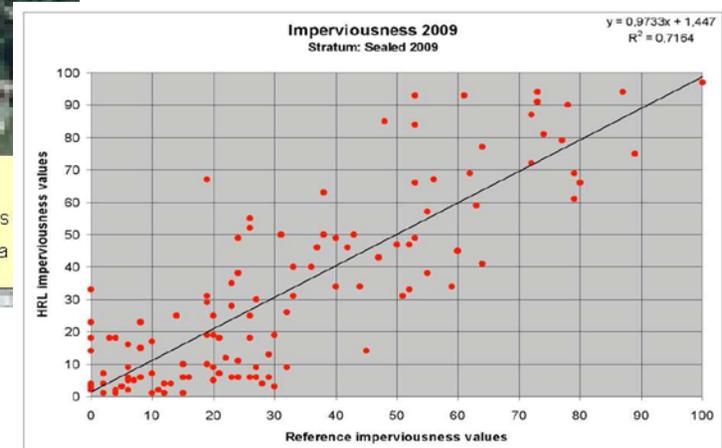
Validation of HR density layers

Independent estimation of densities



Example IMD:

- *Random sampling inside the density layer.*
- *Counting the number of impervious points inside the 100x100 m grid cell on a **VHR image**, the degree of imperviousness in the sample cell is estimated*



Source: G. Maucha, FÖMI



Validation of GIO land map layers

HRL Built-up, HRL Forest type, CLC, CLCC...

- **Samples** are to be selected **randomly** to check **commission** as well as **omission** errors.
- Locations should be **blindly** interpreted (i.e. without using the HRL) based on an independent HR (VHR) imagery.
- The interpreted value will be compared with the HRL value (produced by the SP).
- **Contingency matrix** and **omission** and **commission** error rates are derived.
- **Commission** error can be estimated with acceptable accuracy using relatively **few samples**.
- Estimating **omission error** with acceptable accuracy/ confidence is difficult, if the target class has low percentage of occurrence. **Stratification** should be applied.



Pan-European continental component:

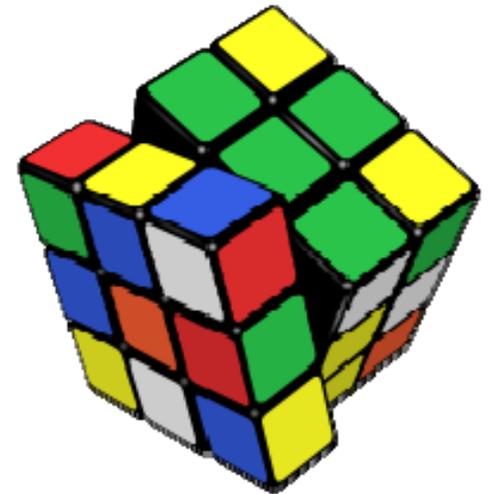
Challenges

- Getting **39 countries** on board (GA,...)
 - Participation of non-EU countries ...
- **Satellite image acquisition** remains a bottleneck (meteorology, improper acquisition windows)
- Working with **national teams** with **different level of expertise**
- **Keep timing** in a complex production process
- Designing a **meaningful European validation**.

Copernicus Initial Operations land

- EEA is responsible for the continental (pan-European) and the local components;
- Continued production of CORINE Land Cover and HRL Imperviousness;
- New continental HR layers: tree cover density, forest type, permanent grassland, wetlands, water bodies;
- Final results will be available in the course of 2015;
- Data are freely accessible, validated source of LC information for Europe, which underpins a broad range of EC policies and complements national data;
- Bring Copernicus land services to an operational status.

Thanks for your attention !





Contact

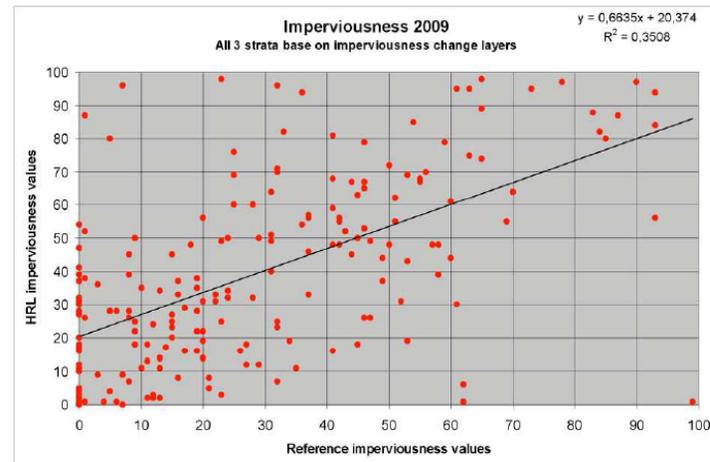
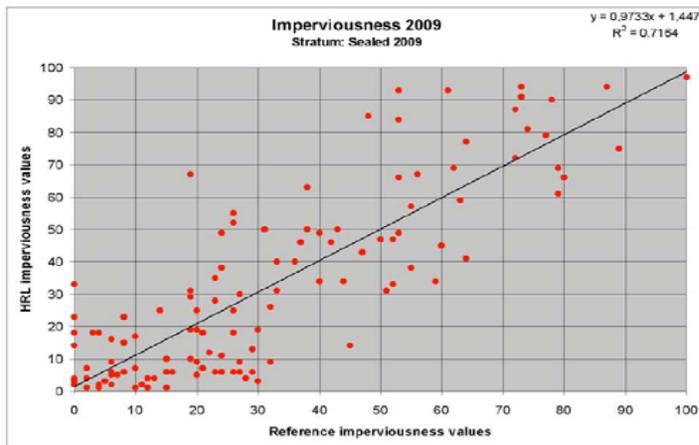
- Webpage Copernicus: <http://land.copernicus.eu>
- GIO land at EEA:
<http://www.eea.europa.eu/themes/landuse/gio-land/gio-land>

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Senior advisor
Copernicus Land Monitoring Services
European Environment Agency
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Validation of HR density layers

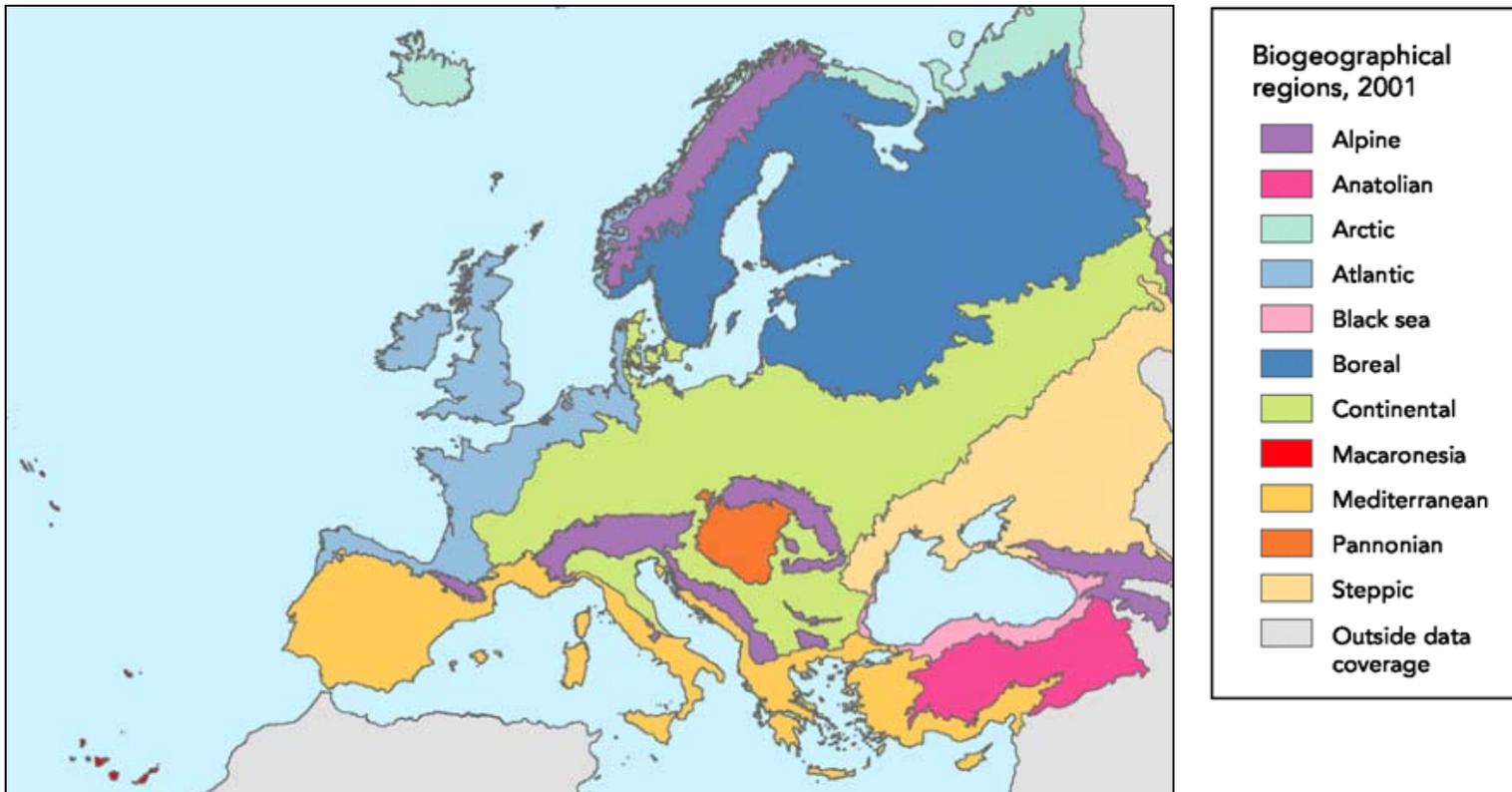
Scatter plots

- Scatter-plot provides the overall view about the agreement between product and reference densities.
- Parameters of the linear trend-line fitted on samples provide information about the calibration.
- Correlation values provide information about the average deviation of sample values from the fitted trend-line .



Stratification for validation

An example



- Bio-geographical regions of Europe can be used for stratification
- Separate results should be derived for each strata



Validation data

Independent, higher resolution

Not easy to find suitable validation data, especially for multi-year products (CLC-Changes, grassland, wetland, water)

- **National orthophoto** (39 countries): wide access is not realistic
- **Google Earth:** hi-res coverage is not available everywhere; acquisition date is sometimes not correct
- **Eurostat LUCAS 2012/2006:** LU/LC codes and field photographs; applicable to validate map products; EU27 coverage only, sampling focused on agriculture
- **VHR data in DWH** (2011-2013): full coverage, but lots of wintertime images