LUCAS:
current product and its evolutions

Workshop "Land Use and Land Cover products: challenges and opportunities"
Brussels 15 Nov 2017

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Contents

a) What is LUCAS

LUCAS Field survey characteristics

- LUCAS stands for Land Use and Cover Area-frame Survey
- Organised by Eurostat every 3 years since 2001
- Harmonized in-situ European data collection
- Georeferenced point
- Detailed classification; separate LC LU
- Multiple parameters
- Ad hoc modules
- Precision indicators
- Reduced % of missing data
- No burden on respondents

a) Historical background -

LUCAS is a User oriented product

- **From crops early estimates to more environmental oriented (2001-2006)**
- **To Solid multipurpose platform including ad hoc modules [soil / transect / grassland] and other adaptations [FAO / INSPIRE / Copernicus] – (from 2009 onward)**
- **Regular User needs consultations**

LUCAS User Needs - Survey 2018

Main DGs: AGRI, ENV, CLIMA, GROW

Started in 2014

Questionnaire, bilateral meetings, workshops

→ Grassland, Soil, Copernicus

LUCAS User Needs - Grassland

Biodiversity	• **7 EAP** (Action 5: Env. Knowledge Base), Biodiversity Strategy 2020, NATURA 2000 •Ecosystems & Ecosystem Services
Greening the CAP	• **Quality of the grassland**
Climate Change	• **Carbon sequestration**
COPERNICUS – Environmental Information	• **High Resolution Layers**
Statistical assessment:	• **EUNIS** classification •Environmental value, abandonment/intensification processes (time series) …

New soil properties

New soil parameters	Why is important?	Sample required
Bulk density	▪ Movement and storage of water and solutes ▪ Soil aeration ▪ Calculation of stock of organic carbon	**Soil rings**
Soil biodiversity	▪ Nutrient cycling and fertility ▪ Regulation of carbon flux and climate control ▪ Regulation of the water cycle ▪ Decontamination and bioremediation ▪ Pest control ▪ Source of pharmaceutical resources	**Frozen soil samples**
Thickness of organic horizon in peats	▪ Carbon sequestration and climate control	**Field measurement**
Soil erosion	▪ Loss of fertile soil ▪ Reduction of soil productivity ▪ Water pollution	**Field observation**

Land cover:

BIOPHYSICAL COVERAGE OF LAND

LUCAS: 76 subclasses

Artificial land

Cropland

Woodland

Shrubland

Grassland

Bare land

Water areas

Wetlands

Land use:

SOCIO-ECONOMIC USAGE MADE OF LAND

LUCAS: 33 subclasses

Primary sector:

(for example, agriculture and forestry)

Secondary sector

(industry)

Tertiary sector

(services)

Other uses

(for example, residential use and abandoned areas)

b) methodology

How is LUCAS conducted
LUCAS sampling design

BASE 11 (1 km European INSPIRE Grid): 10.180.000 points

↓

4.434.475 EU28

↓

BASE 22 (2 km Grid):

↓

MASTER 2018: 1.090.863 points

↓

First phase photointerpretation

Stratification into 10 strata

http://ec.europa.eu/eurostat/web/lucas/data/lucas-grid

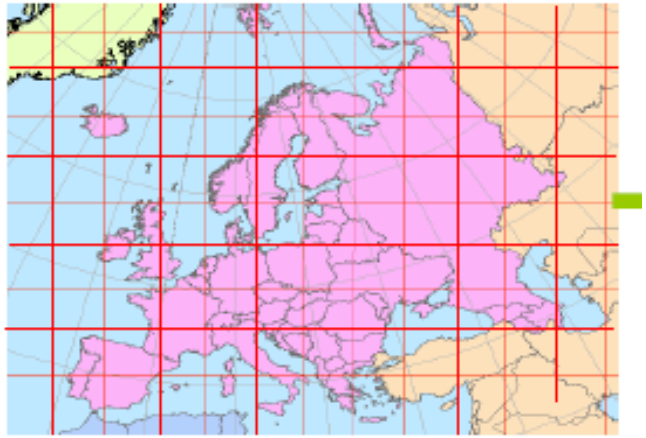
↓

Field SAMPLE 2018 (EU 28): 240.175 points

+

Office PI Sample : 97.680 points

= 337.855 total sample



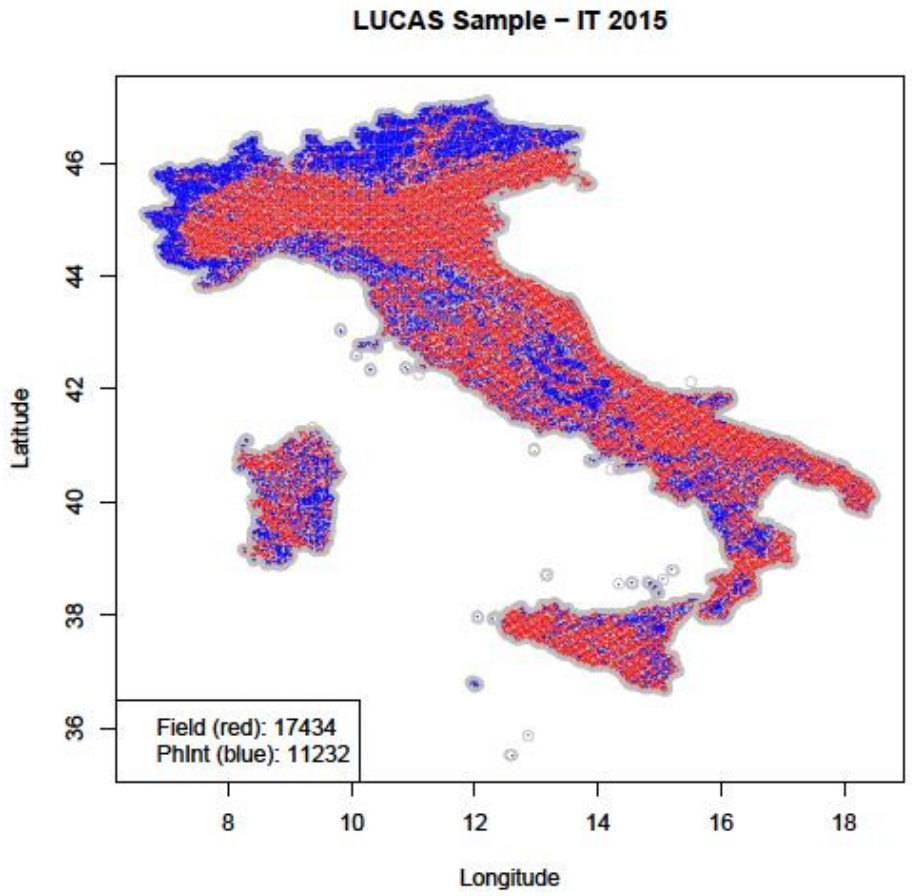
Stratification update

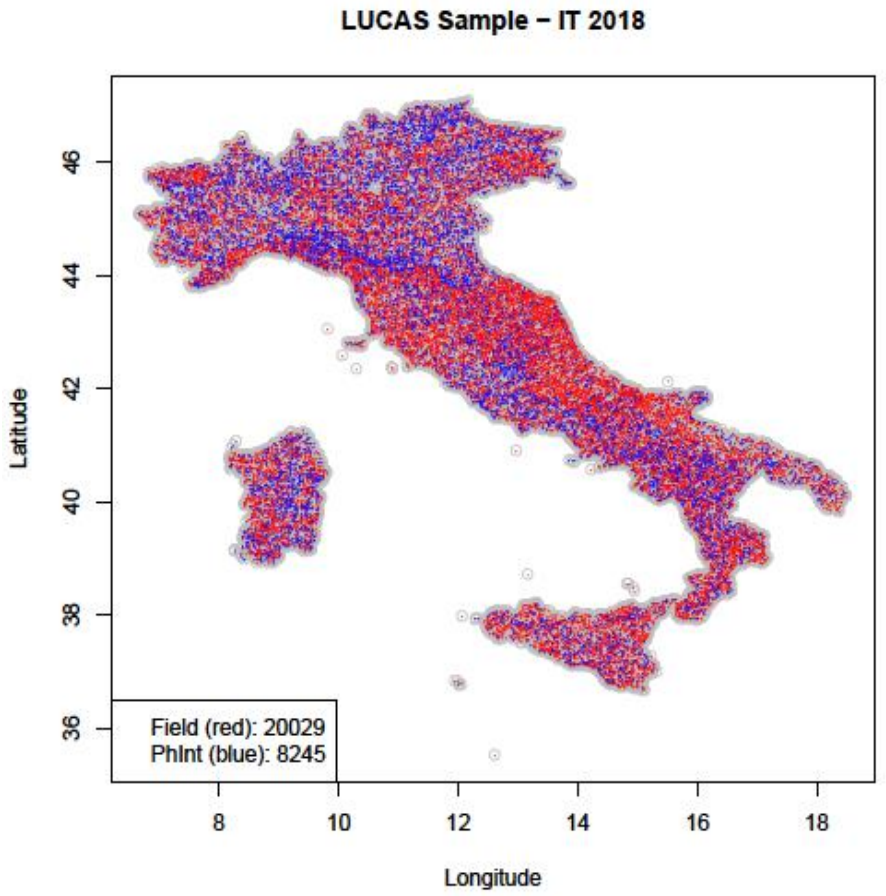
- On 714 474 points of 1 097 964 of LUCAS Grid (2 by 2)
- 10 strata (arable land, permanent crops, grass, wooded areas, shrubs, bare surface, artificial constructions and sealed areas, transitional and coastal water and "impossible to photo-interpret")
- ⇒ impact on Sample design
- ⇒ impact on Estimates [calibration]

Sample design 2018

- It covers all territory of EU including both field part and photo interpreted sample.
- It takes into account accessibility of the single points, possibly revising the accessibility criteria used so-far.
- It takes into account the propensity to change of land cover.
- It fulfils the requirements and instructions for the new elements of the LUCAS 2018 survey (soil package, grassland module and Copernicus adaptation).
- It ensures as much as possible comparability with the previous LUCAS surveys.
- It allows solid estimation of main variables at the lowest regional level possible

Revised sample structure





Longitudinal structure of 2018 sample

Total number of points : 337855

of which 23% surveyed already in 2009/2012/2015

25% visited once or twice

52% new entries

New Elements in the estimation (2015)

- Estimation process involves:
  - **Alignment of classification 2009/2012 to 2015**
  - **Mapping of LUCAS classification/parameters to FAO classification [fine-tuned algorithm]**
  - **Taking into account LC1/LC2 (Weight split LC1_percent LC2_percent) LU1/LU2 (50 / 50%)**
  - **Inclusion of field and PI points to last 3 surveys**
  - **Treatment of transitional water as separate strata**
  - **NUTS 2013**
- Two set of aggregated tables for Land Cover
  - **According to LUCAS classification**
  - **According to FAO forest classes**

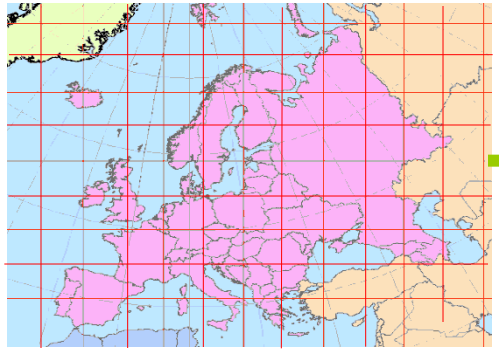
Constraint to the Master Totals - IPF

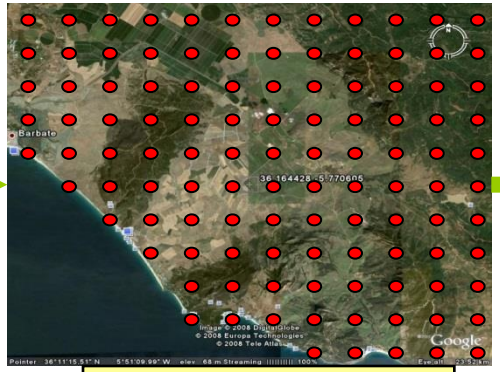
- Elevation in 6 classes
- NUTS2 by STRATA
- NUTS1 by elevation (4 classes)
- NUTS0 by strata by elevation (6 classes)
- Country

Assessment of 2015 results

- **Total Coverage of LUCAS Area [Field combined with PI]**
- **Better use of LUCAS parameters (LC1/2 & FAO)**
- **Improved coherence w/ other statistics [MS (eg. Secondary sector NL) and CLC]**
- **Overall coherence with FAOSTAT**

LUCAS data collection process

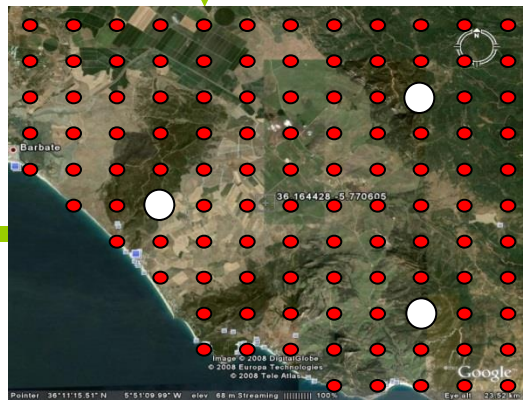




1 100 000 points

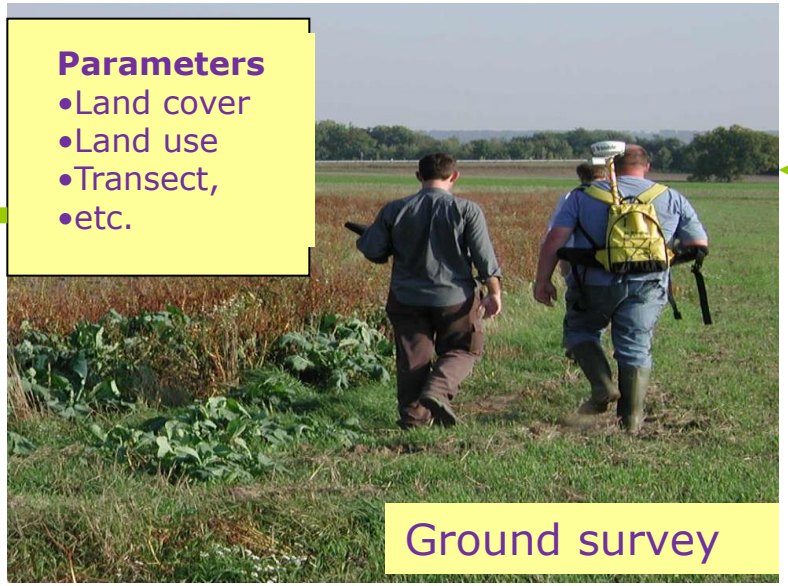
Photointerpretation :

Classification in 10 strata



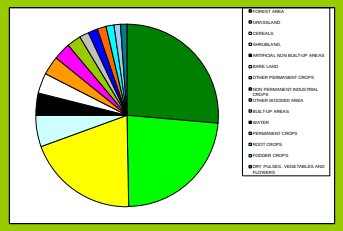
Total Sample of 370,000 pts

Parameters
- Land cover
- Land use
- Transect,
- etc.

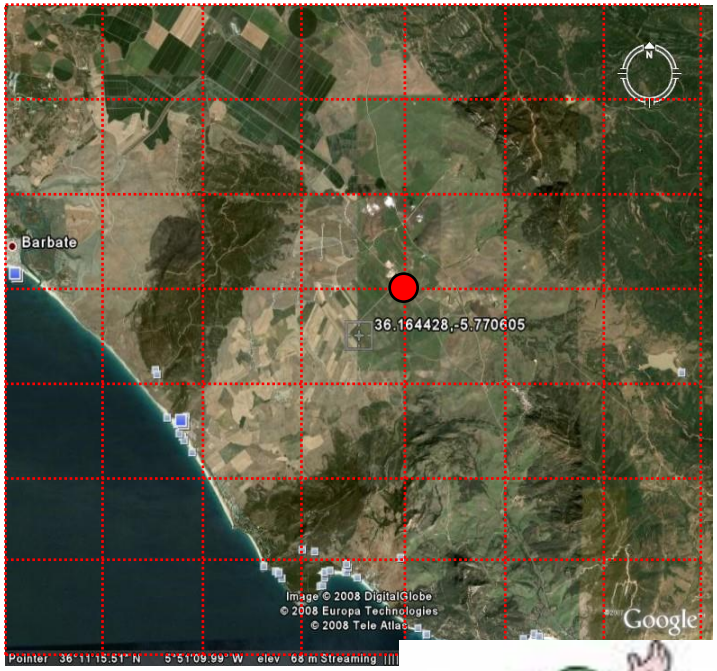


Ground survey

Dissemination



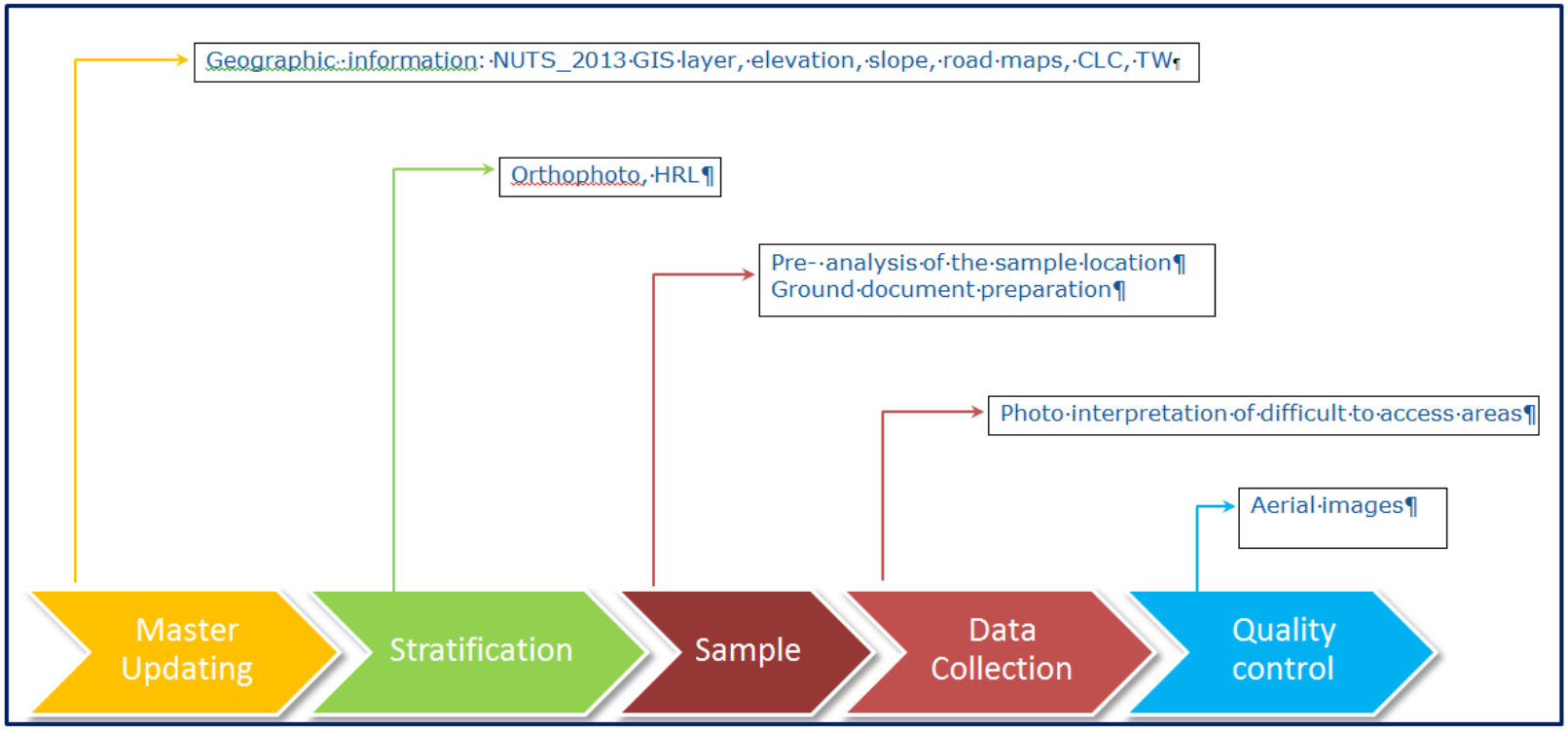
Data collection process: Ground survey



Land Cover "sun-flower"

Land Use "agriculture"

LUCAS production process – Use of auxiliary information and aerial images



How are RS and auxiliary information integrated in LUCAS

Role of PI

1) PI of master grid

2) PI in field [wall fence, military area]

3) PI of excluded areas

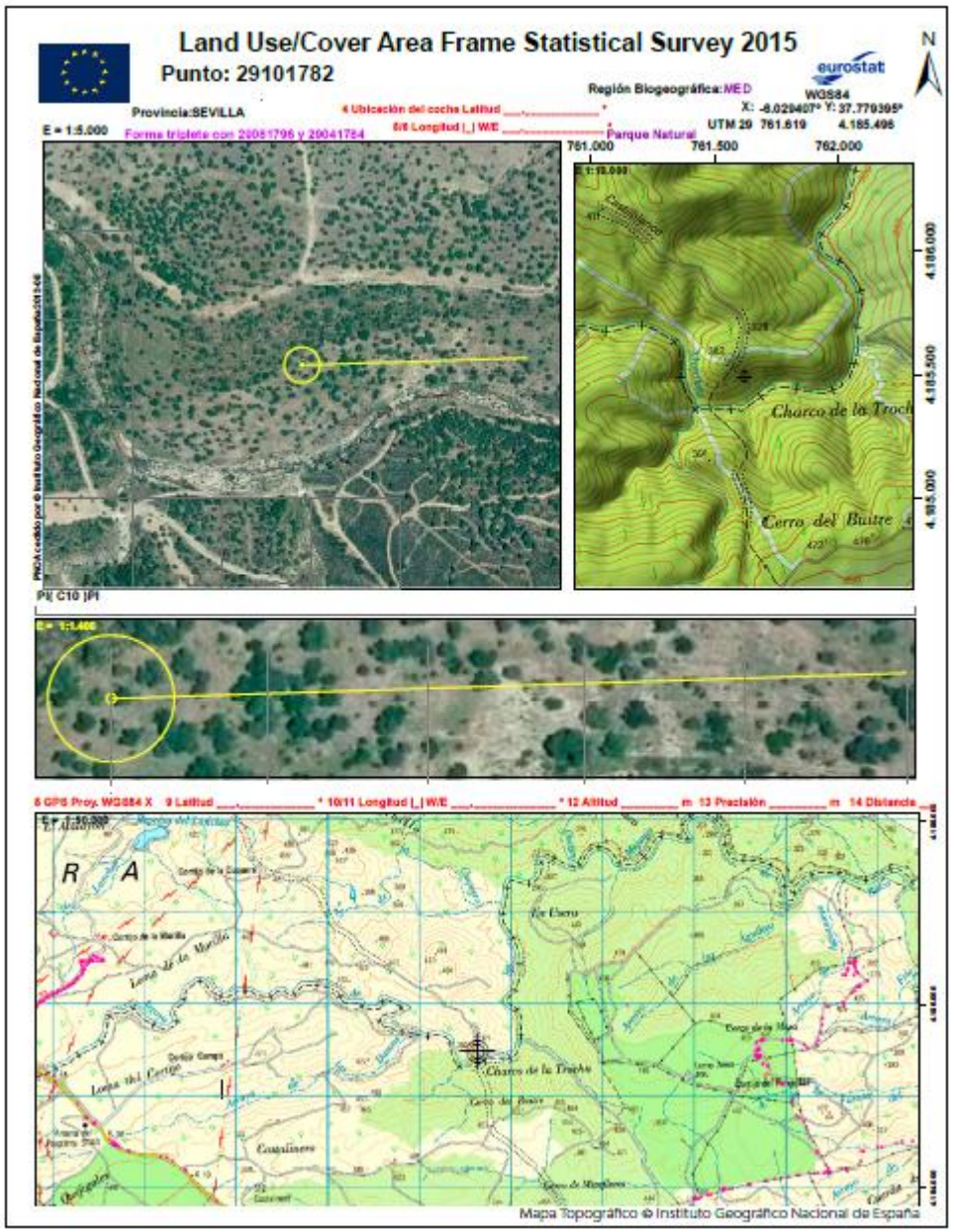
Role of auxiliary info

1) Preparation of master (elevation, road..)

2) Eligibility criteria [CLC]

3) Ground Document preparation

4) Visual Quality Control



Example of Ground Document

Informative content

- **Classification**
- **Alignments with INSPIRE PLLC for vegetation**

- **Core LUCAS**
  - Current land cover and land use +
  - Environmental information (e.g. irrigation, grazing, burned areas)
- **Add on**
- **Current products [transect/ soil]**
- **LUCAS 2018**
  - Soil "extended"
  - Grassland
  - Copernicus [specific instructions / degree of urbanization (parameter)/ % of imperviousness

INFORMATIVE CONTENT

Field form (extract)

22	**Percentage of land coverage (%) LC1:** 1 ☐ %LC1 < 5 2 ☐ 5 ≤ %LC1 < 10 3 ☐ 10 ≤ %LC1 < 25 4 ☐ 25 ≤ %LC1 < 50 5 ☐ 50 ≤ %LC1 < 75 6 ☐ 75 ≤ %LC1 < 90 7 ☐ %LC1 ≥ 90 8 ☐ N.R.	25	**Percentage of land coverage (%) LC2:** 1 ☐ %LC2 < 5 2 ☐ 5 ≤ %LC2 < 10 3 ☐ 10 ≤ %LC2 < 25 4 ☐ 25 ≤ %LC2 < 50 5 ☐ 50 ≤ %LC2 < 75 6 ☐ 75 ≤ %LC2 < 90 7 ☐ %LC2 ≥ 90 8 ☐ N.R.	31	**Percentage of land use (%) LU1:** 1 ☐ %LU1 < 5 2 ☐ 5 ≤ %LU1 < 10 3 ☐ 10 ≤ %LU1 < 25 4 ☐ 25 ≤ %LU1 < 50 5 ☐ 50 ≤ %LU1 < 75 6 ☐ 75 ≤ %LU1 < 90 7 ☐ %LU1 ≥ 90 8 ☐ N.R.	34	**Percentage of land use (%) LU2:** 1 ☐ %LU2 < 5 2 ☐ 5 ≤ %LU2 < 10 3 ☐ 10 ≤ %LU2 < 25 4 ☐ 25 ≤ %LU2 < 50 5 ☐ 50 ≤ %LU2 < 75 6 ☐ 75 ≤ %LU2 < 90 7 ☐ %LU2 ≥ 90 8 ☐ N.R.
If LC CXX, or D10 or E10 & area size ≥ 0.5 ha				**If height of trees at maturity above 5 m**			
26	**Height of trees at the moment of survey** 1 ☐ < 5 m 2 ☐ ≥ 5 m 8 ☐ N.R.	27	**Height of trees at maturity** 1 ☐ < 5 m 2 ☐ ≥ 5 m 8 ☐ N.R.	28	**Width of feature:** 1 ☐ < 20 m 2 ☐ ≥ 20 m 8 ☐ N.R.		
35	**Land management:** 1 ☐ Visible signs of grazing 2 ☐ No signs of grazing 8 ☐ N.R.	36	**Special status:** 1 ☐ Protected 2 ☐ Hunting 3 ☐ Protected and Hunting 4 ☐ No special status 8 ☐ N.R.	37	**Special remark on land cover/use:** 1 ☐ Tilled and/or sowed 2 ☐ Harvested field 3 ☐ Clear cut 4 ☐ Burnt area 5 ☐ Fire break 6 ☐ Nursery 7 ☐ No Remark 8 ☐ N.R. 9 ☐ Temporarily dry (river bed / lake) 10 ☐ Temporarily flooded		

Environmental parameters - % of

<10 % 10 - 25 % >75 %

For coverages with trees: assess the crown coverage

Land cover refers

LC1: B71; LC1% <10%
LC2: E20; LC2% >75%

LC 1: C10; LC1%: >75%

When summed up, % can be below or above 100 %

ad hoc modules – 1) Transect 2015

List of transect linear elements

Code	Label
1	Grass margins<3 m
2	Heath/Shrub, tall herb fringes<3 m
10	Single tree, single bushes
11	Avenue trees
12	Conifer hedges<3 m
13	Bush/tree hedges/coppices, visibly managed (e.g. pollarded) <3 m
14	Bush/tree hedges, not managed, with single trees, or shrubland deriving from abandonment<3 m
15	Grove/Woodland margins (if no hedgerow) <3 m
21	Dry stone walls
22	Artificial constructions (other than dry stone walls)
23	Fences
24	Electric lines
31	Ditches, channels<3 m
32	Rivers, streams<3 m
41	Ponds, wetland<3 m
51	Rocks outcrops with some natural vegetation
61	Tracks
62	Roads
63	Railways
71	Other linear elements

Source: Eurostat
All elements above are to be coded irrespective their width except for 01, 02, 12, 13, 14, 15, 31, 32, 41 (less than 3 m).

Land cover transect classification

Code	Label
AAA	Artificial land
BS0	Straw cereals
B16	Maize
B17	Rice
B20	Root crops
B31	Sunflower
B32	Rape and turnip seeds
B33	Soya
B34	Cotton
B36	Tobacco
BC0	Other ind crops
B40	Dry pulses, vegetables and flowers
B50	Fodder crops
B70	Fruit trees and berries
B81	Olive groves
B82	Vineyards
BP0	Other permanent crops
C10	Broadleaved and evergreen woodland
C20	Coniferous woodland
C30	Mixed woodland
D10	Shrubland with sparse tree cover
D20	Shrubland without tree cover
E10	Grassland with sparse tree/shrub cover
E20	Grassland without tree/shrub cover
E30	Spontaneous vegetation
F00	Bare land
G10	Inland water bodies
G20	Inland running water
G30	Coastal water bodies
G50	Glaciers, permanent snow
H10	Inland wetlands
H20	Coastal wetlands

Source: Eurostat

2) Top-Soil parameters

- **soil types;**
- **soil textures (sand, silt, clay);**
- **pH levels;**
- **organic carbon;**
- **phosphorous, nitrogen and potassium;**
- **soil erosion;**
- **susceptibility to compaction**

Adaptations to Copernicus (test module 2018)

a) Sampling:

50 points per class per validation area

b) In-situ information:

Extent of land cover in the 4 cardinal directions

Record first new land cover

Up to 50 m

c) - Classification fine tuning: e.g.

- Exclude combination G12/U111
- Info on airport/port for U317 Logistics and storage
- Separate U361: Amenities, leisure/museum, culture

Surveyor code	ITSUF01	Date	11/10/2017	Start time	22:30	End time	23:00	Point ID	41322426

Point(s)

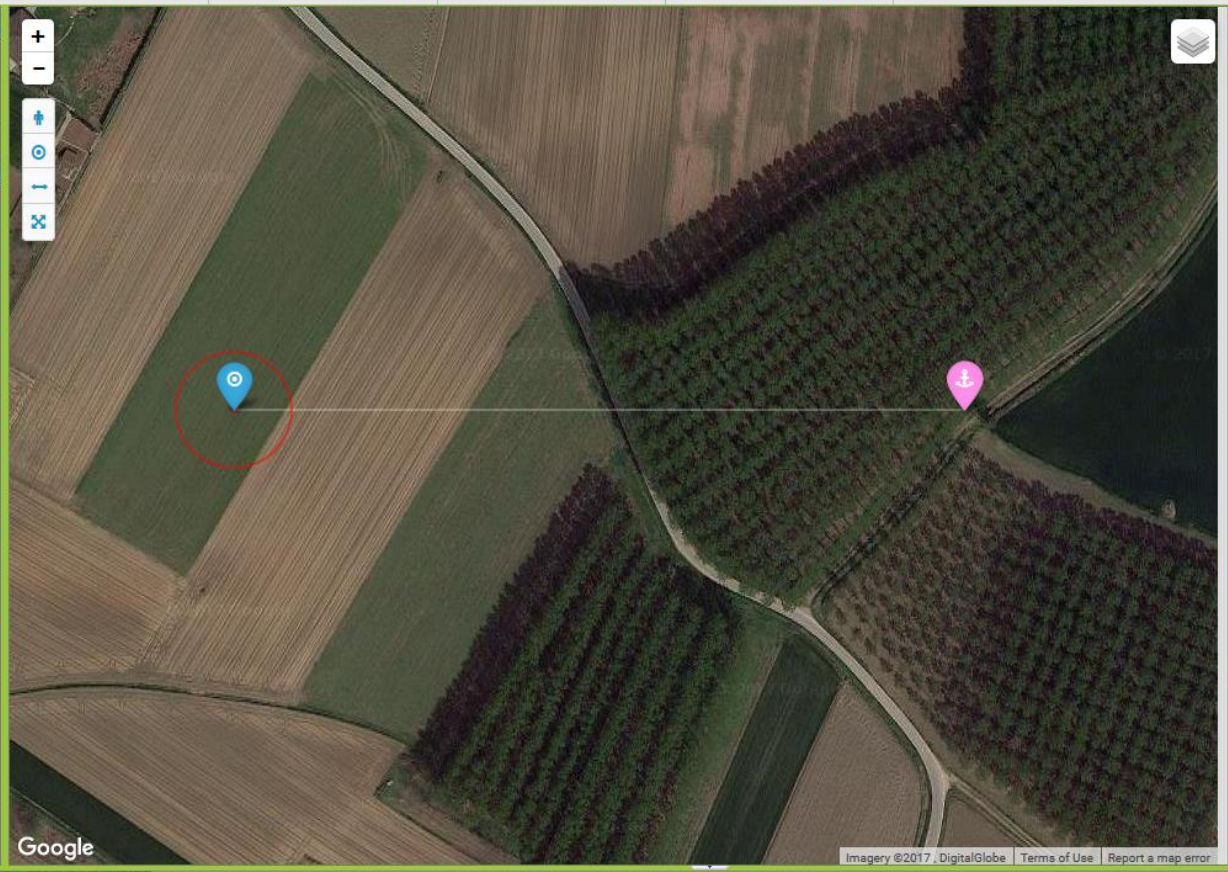
Remove All

IT-407-024-42

IT-413-224-26

Settings

- Sample Point
- Survey Position
- Circle 1.5 m.
- Circle 20 m.
- Copernicus
- End Of Transect
- Transect Line
- Track
- Photos
- Additional Photos
- Grassland Transect Line



Properties

- Identification and access
- Point observation
- Land cover and use
- FAO parameters
- Land management
- Special remarks
- COPERNICUS

- Copernicus LC 8 - Not relevant
- Extension of LC1 to the North 30
- Extension of LC1 to the East 30
- Extension of LC1 to the South 30
- Extension of LC1 to the West 30
- Breadth of Copernicus LC on N No information
- Breadth of Copernicus LC on E No information
- Breadth of Copernicus LC on S No information
- Breadth of Copernicus LC on W No information
- Next LC to the North (if LC1 < 50m) B4 - Dry pulses, vegetables and flowers
- Next LC to the East (if LC1 < 50m) B4 - Dry pulses, vegetables and flowers
- Next LC to the South (if LC1 < 50m) B4 - Dry pulses, vegetables and flowers
- Next LC to the West (if LC1 < 50m) B4 - Dry pulses, vegetables and flowers

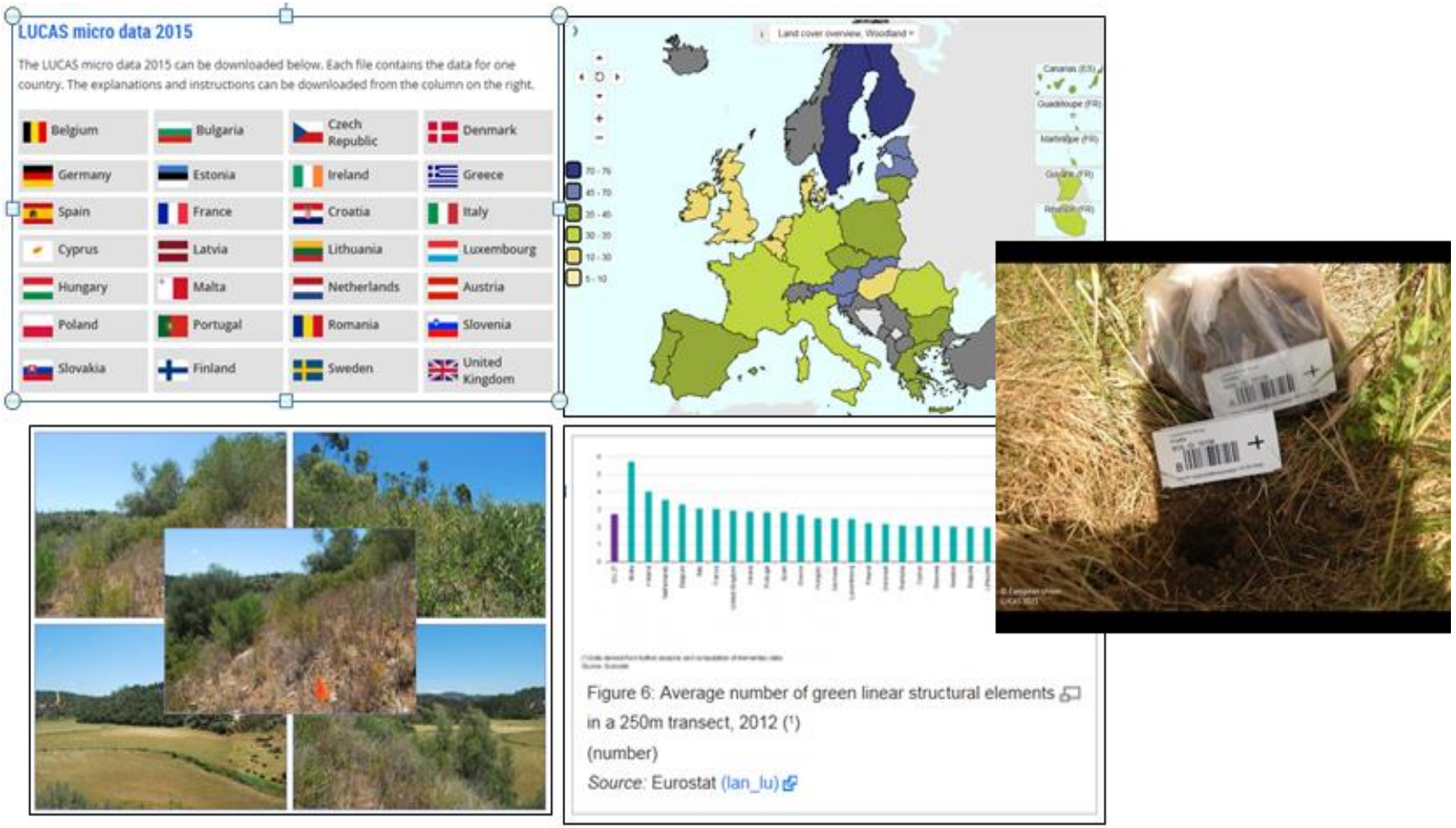
G

A

Output

- What do we publish
- Where to find the information

LUCAS products



http://ec.europa.eu/eurostat/web/lucas/overview

LUCAS surveys' output

3 types of harmonised land cover/use information for EU:

- **Micro data (primary data): land cover, land use and environmental parameters associated to the single surveyed points,**

- **Point and landscape photos in the four cardinal directions,**

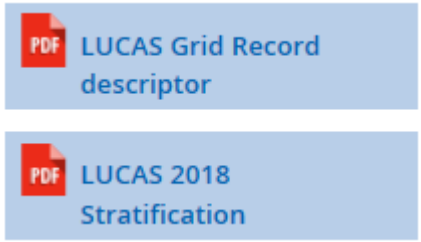
- **Statistical tables with aggregated results by land cover, land use at geographical level (estimates based on point data conveniently weighted).**

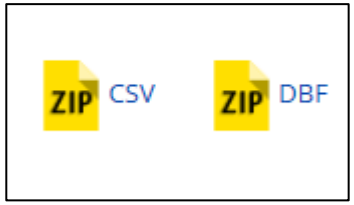
POINT INFORMATION

- **GRID [2 x 2 Km]**

http://ec.europa.eu/eurostat/web/lucas/data/lucas-grid

  - 1090863 points



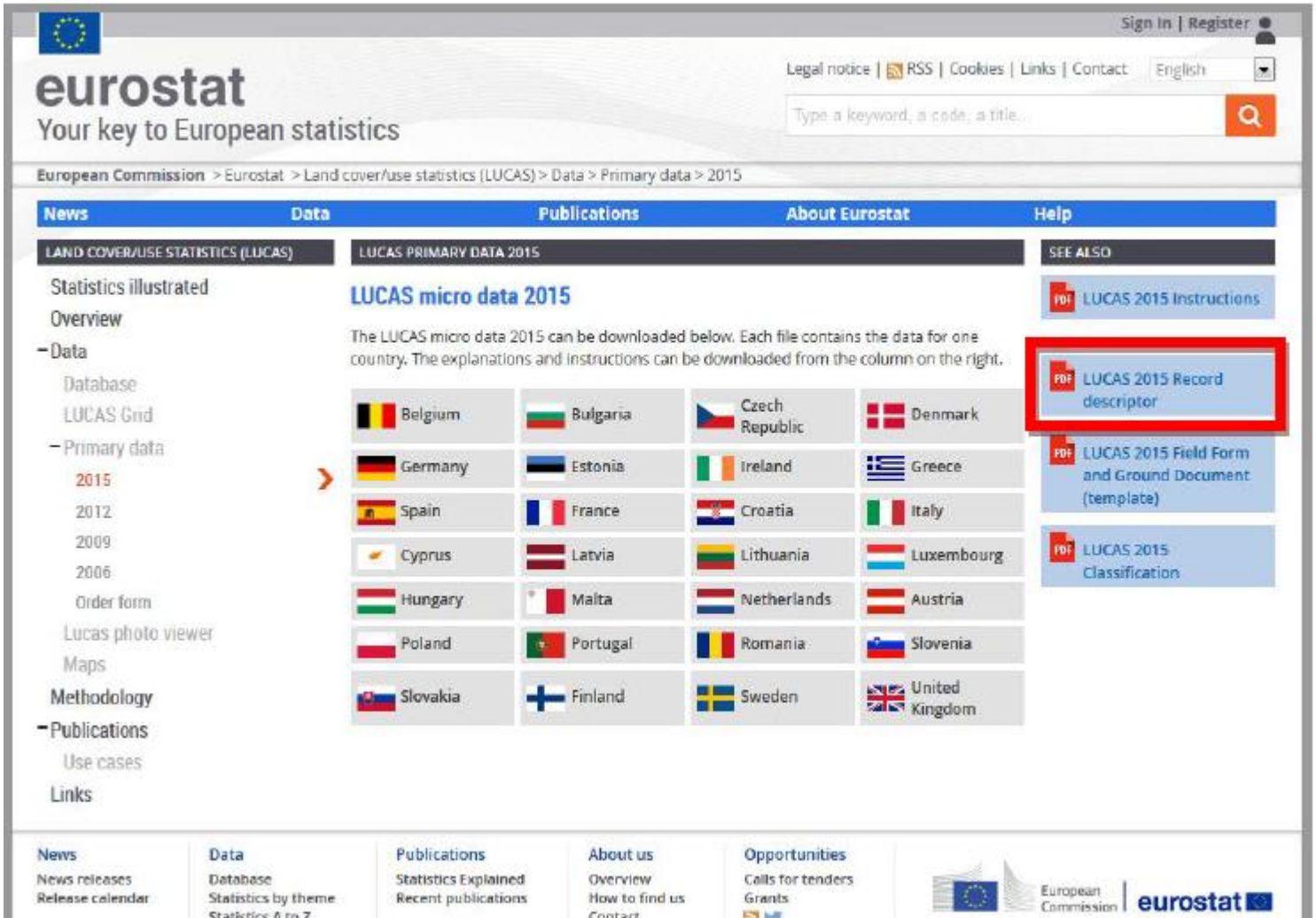


- **Primary data: by year**
  - Country file
  - Survey Documentation (field form, Instruction, classification, nuts_area, quality check..)

LUCAS Primary data: 2006-2015

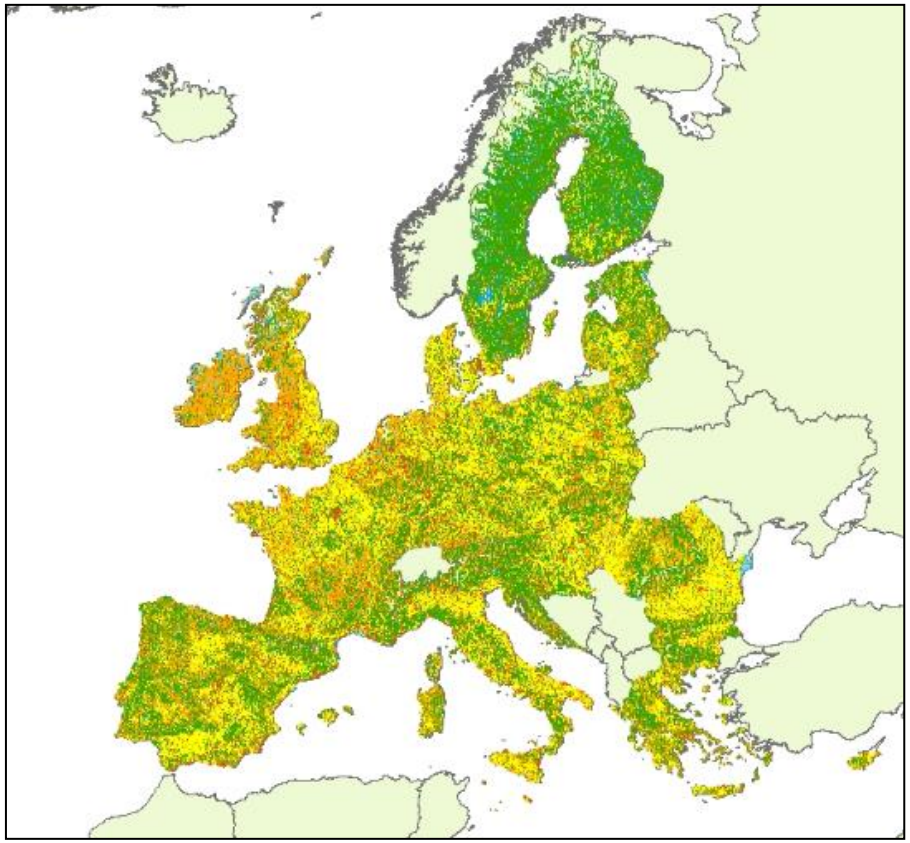
European Commission

Country-specific files available at
http://ec.europa.eu/eurostat/web/lucas/data/primary-data/YYYY

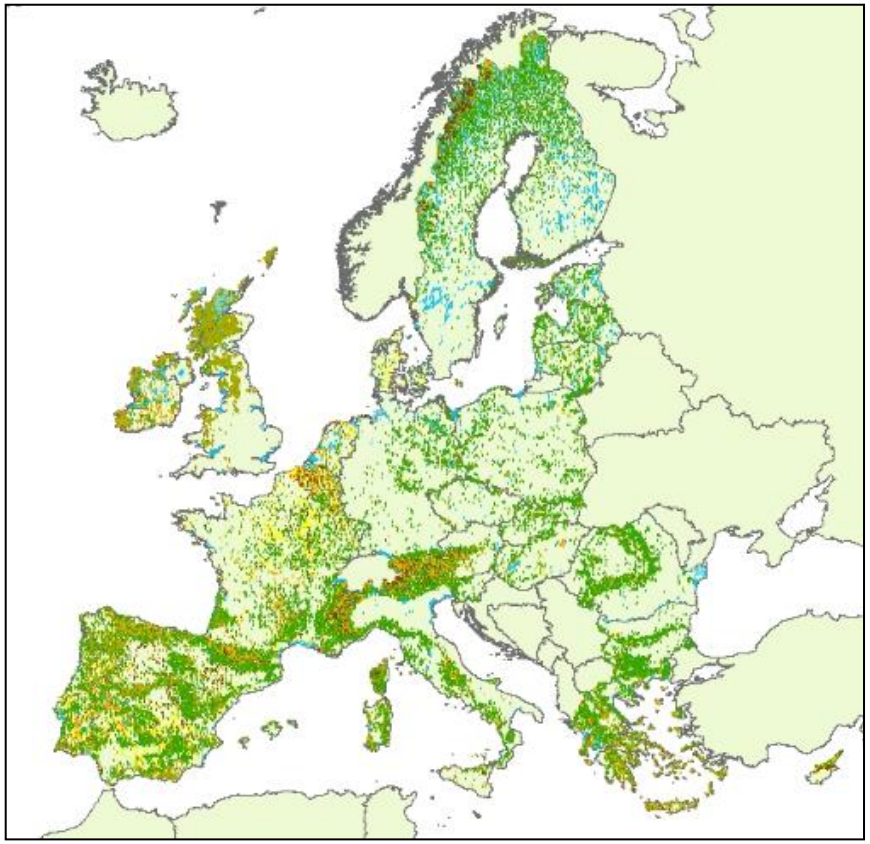


LUCAS 2015 – LC - unweighted results

Field points



PI points



Indicators

LUCAS Transect indicators 2012

The LUCAS Transect point indicator's tables 2012 can be downloaded below. Each file contains the data for one country. This release includes SEI (Shannon Eveness), SDI (Shannon Diversity) and Richness variables. The explanations and instructions can be downloaded from the column on the right.

Belgium	Bulgaria	Czech Republic	Denmark
Germany	Estonia	Ireland	Greece
Spain	France	Italy	Cyprus
Latvia	Lithuania	Luxembourg	Hungary
Malta	Netherlands	Austria	Poland
Portugal	Romania	Slovenia	Slovakia
Finland	Sweden	United Kingdom	

LUCAS transect 2012 with segment lenght

In 2012 for a subset of the survey points (1283 points) the extension for each element inside the transect was collected and can be downloaded below. The file contains the data for all countries. The explanation and instructions can be downloaded from the column on the right.

Measured transect

http://ec.europa.eu/eurostat/web/lucas/data/primary-data/2012

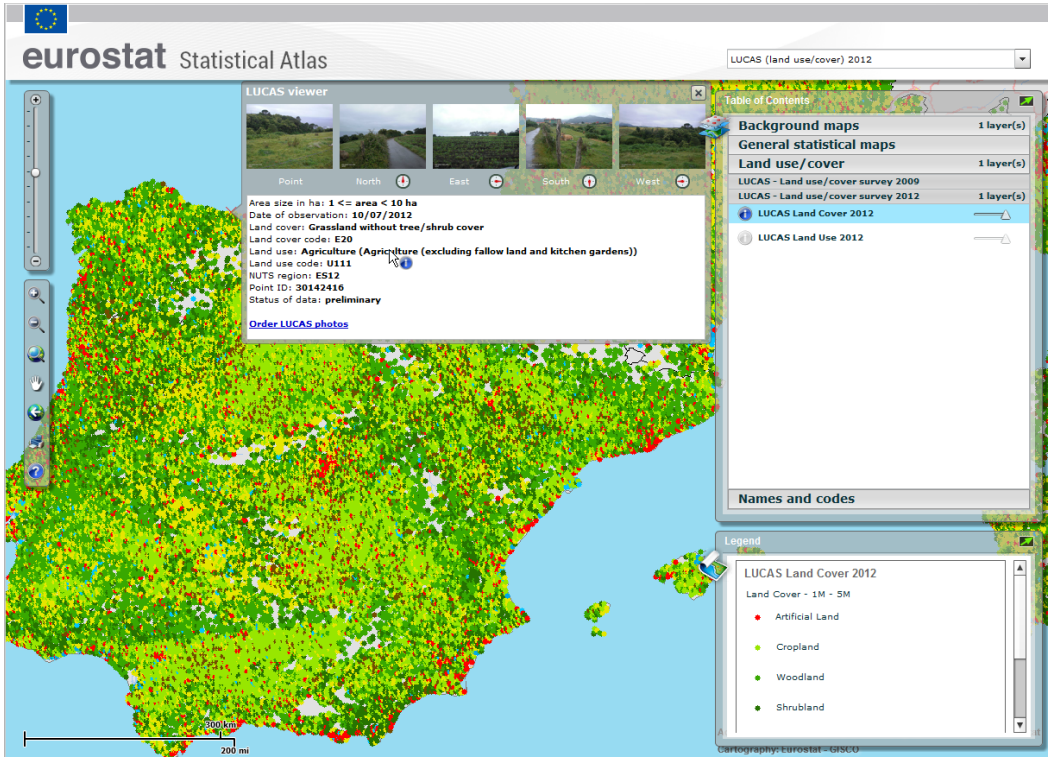
Examples of photographs

Central photograph: the surveyed LUCAS point;

remaining images taken from the surveyed point to the north, south, east and west.

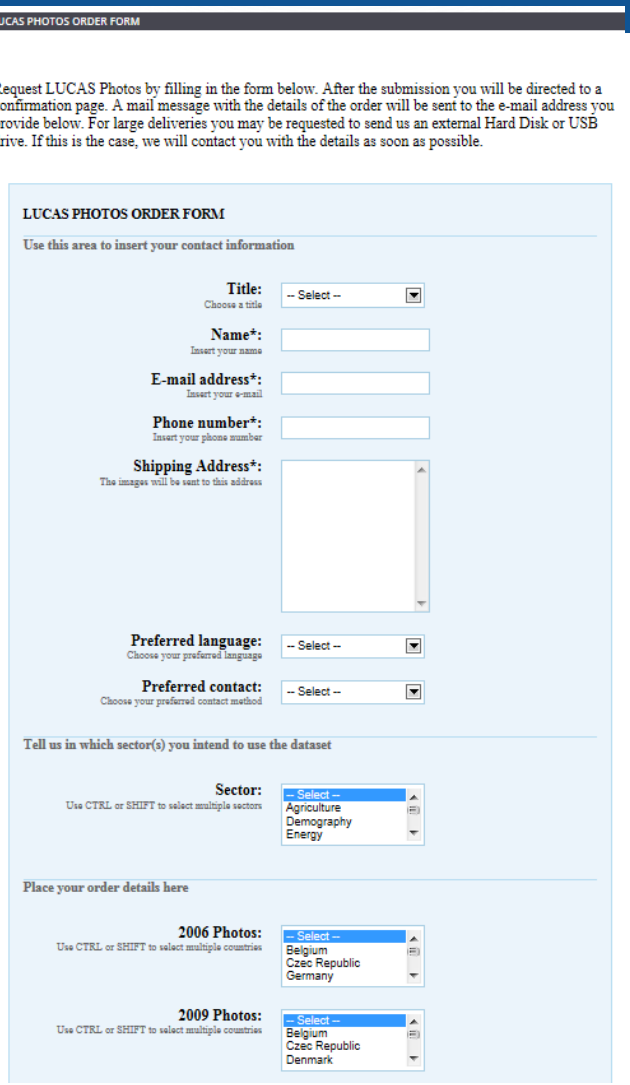
LUCAS Viewer

Interactive photo viewer within Eurostat's statistical atlas
http://ec.europa.eu/eurostat/web/lucas/lucas-photo-viewer



LUCAS Photo archive: 2006,2009,2012,2015 How to access

Photo archive from LUCAS. Photographs can be requested by using the online form http://ec.europa.eu/eurostat/web/lucas/data/primary-data/order-form



LUCAS PHOTOS ORDER FORM

Request LUCAS Photos by filling in the form below. After the submission you will be directed to a confirmation page. A mail message with the details of the order will be sent to the e-mail address you provide below. For large deliveries you may be requested to send us an external Hard Disk or USB drive. If this is the case, we will contact you with the details as soon as possible.

LUCAS PHOTOS ORDER FORM

Use this area to insert your contact information

Title: Choose a title — -- Select --

Name*: Insert your name

E-mail address*: Insert your e-mail

Phone number*: Insert your phone number

Shipping Address*: The images will be sent to this address

Preferred language: Choose your preferred language — -- Select --

Preferred contact: Choose your preferred contact method — -- Select --

Tell us in which sector(s) you intend to use the dataset

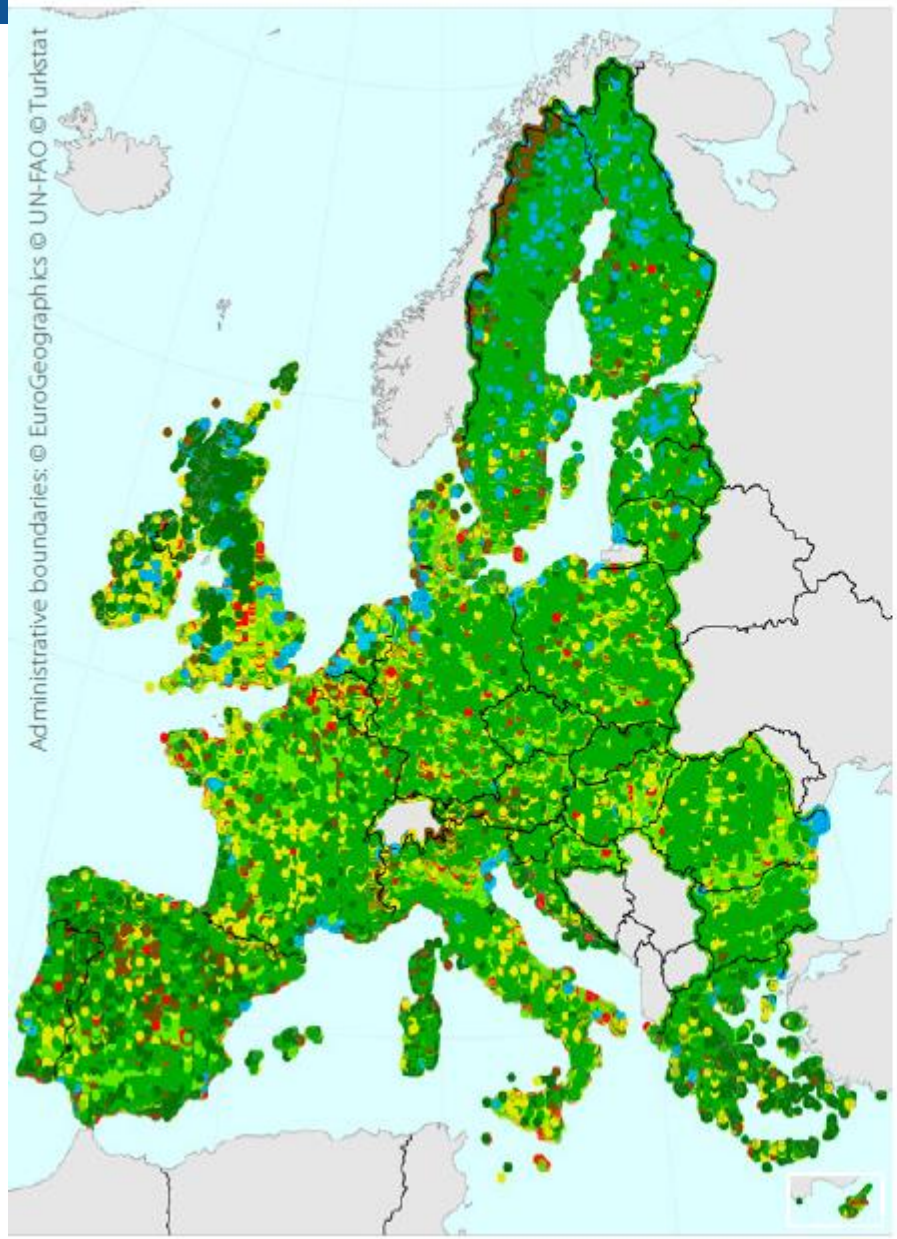
Sector: Use CTRL or SHIFT to select multiple sectors — -- Select --, Agriculture, Demography, Energy

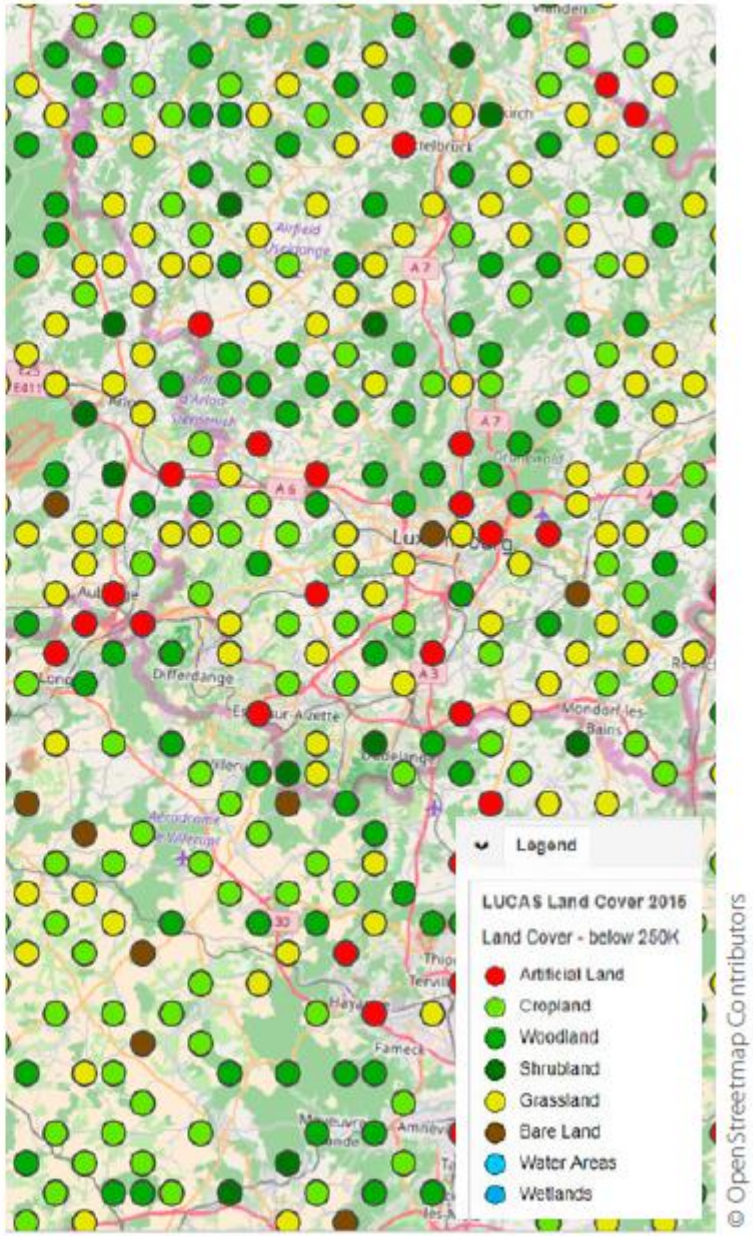
Place your order details here

2006 Photos: Use CTRL or SHIFT to select multiple countries — -- Select --, Belgium, Czec Republic, Germany

2009 Photos: Use CTRL or SHIFT to select multiple countries — -- Select --, Belgium, Czec Republic, Denmark

Point distribution



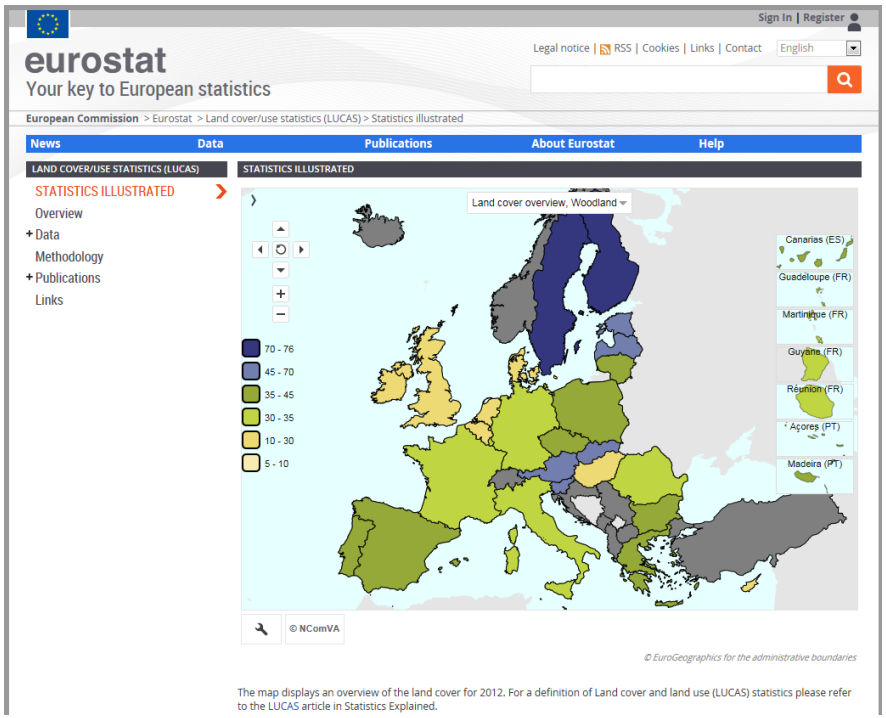


Database

- Land cover and land use, landscape (LUCAS) (lan)
  - Land cover overview by NUTS 2 regions (lan_lcv_ovw)
  - Land covered by artificial surfaces by NUTS 2 regions (lan_lcv_art)
  - Land use overview by NUTS 2 regions (lan_use_ovw)
  - Land cover for FAO Forest categories by NUTS 2 regions (lan_lcv_fao)

Data base / LC / LU / FAO:

- KM^2
- % of total area
- Cv
- M^2 per capita / for artificial areas



http://ec.europa.eu/eurostat/web/lucas/statistics-illustrated

How to use the data

NUTS classification

- **Estimates on line currently at 2013 Nuts**

POINT coordinates

- **LUCAS point is a theoretical point located on the grid.**
- **Coordinates of the theoretical point are available in the LUCAS Grid both non projected (WGS84 latitude and longitude) and projected Lambert Albers Equal Area (ETRS89 + LAEA).**
- **On the survey microdata you can find the coordinates from where the point was observed by the surveyor (also in WGS84 latitude and longitude).**

What is LUCAS used for?

Policy areas:

Data from LUCAS can be used to help analyse and contribute to the development of various EU policy areas:

Common Agricultural Policy

Integrating environmental concerns in the Common Agricultural Policy;

Soil thematic strategy

Protecting the soil, as detailed in the soil thematic strategy;

EU biodiversity strategy

Promoting biodiversity and conservation, through the EU's biodiversity strategy;

Europe 2020

Encouraging the efficient use of resources for sustainable growth, as in the resource-efficient Europe initiative;

Copernicus

Land monitoring, spatial planning and resource management, as carried out by the Copernicus earth observation programme;

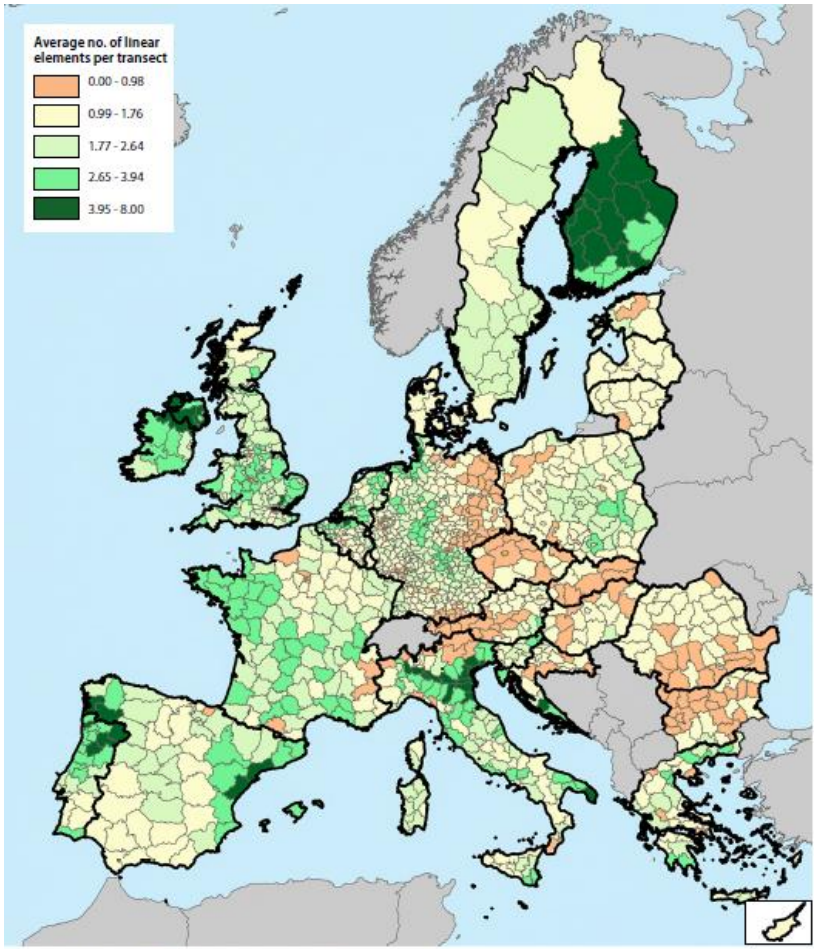
Climate change

Tackling climate change, through monitoring conducted by the European Environment Agency, as well as actions under the European climate change programme.

USE CASES

European Commission

LUCAS Survey 2015 — NUTS 3 average number of linear elements per transect with agriculture as main land cover



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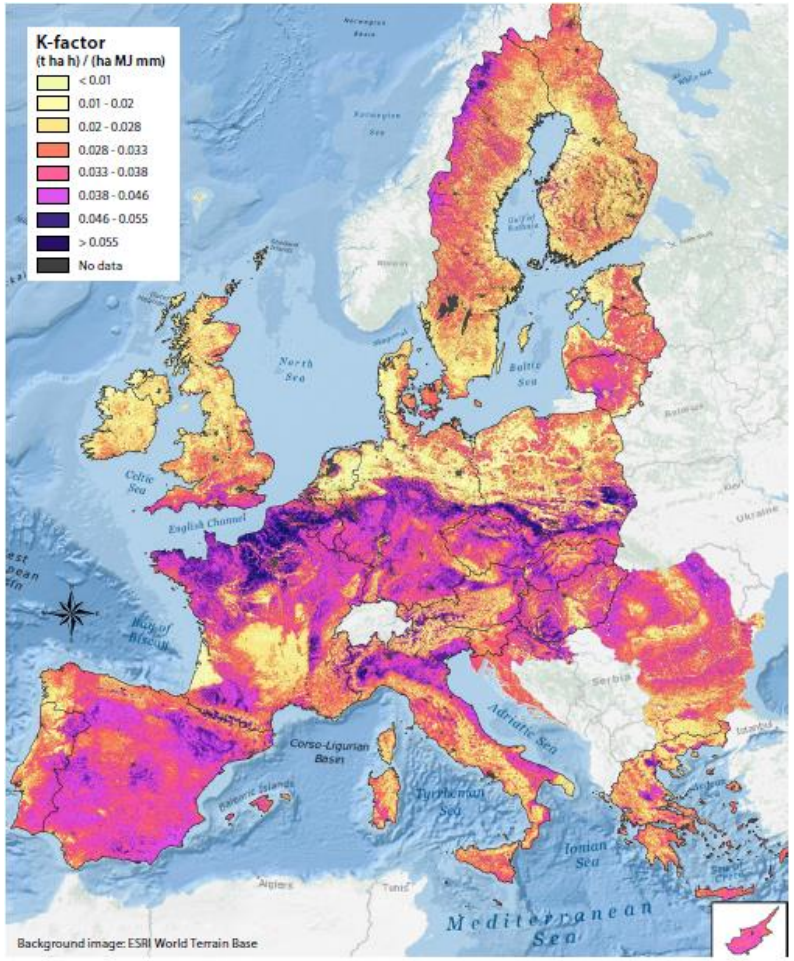
Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat

Soil erodibility in Europe (K factor)



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CONCLUSION

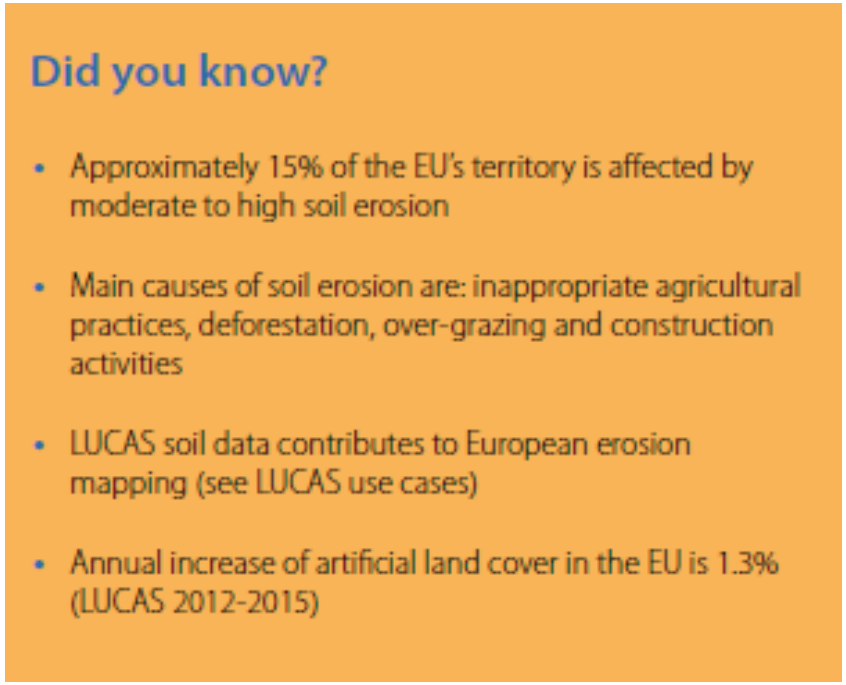
User oriented product

Interrelation with national/ pan-european products

Towards which convergence LUCAS / Copernicus?

Thank you for your attention!

The new LUCAS compact guide is coming soon:



http://ec.europa.eu/eurostat/web/lucas/overview