

## JRC Vision and Mission Statements

### ***Vision:***

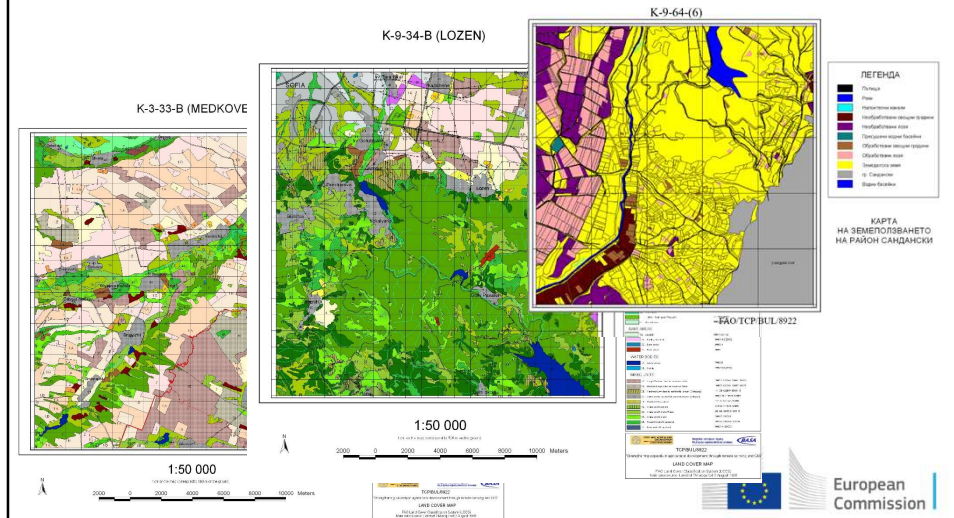
*"To play a central role in creating, managing and making sense of the collective scientific knowledge for better EU policy."*

### ***Mission:***

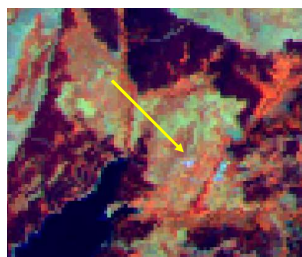
*"As the science and knowledge service of the Commission our mission is to support EU policies with independent evidence throughout the whole policy cycle."*

## A FAO-UN LCCS Story

- FAO TCP/BUL/8922
- First time use of LCCS in Europe
- Pilot LC mapping with VHR (IK)



## Same type of land – different classes



1:50 000

**LCCS name**

**Grassland/Shrubs/Trees**

**LCCS level**

**A2A10B4C1E5 / A4A11B3C1 / A3A11B2C1**

**LCCS code**

**20194 / 20023 / 20015**

**Cartographic mix**



1:10 000

**LCCS name**

**Grassland with shrubs and trees**

**LCCS level**

**A2A10B4C1E5F2F5F10G2F2F6F10G3-B12G6G9**

**LCCS code**

**21277-104773**

**Functional mix**

## LCLU datasets – Early Lessons learnt

Thematic content of the “map” depends mainly on the scope and purpose of the LCLU product

For statistics  
For land inventory  
For spatial planning  
For damage assessment  
For accountability

Same apply to the product quality  
- > it is domain-specific



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FP7 HELM Booklet



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## “Land” in the CAP

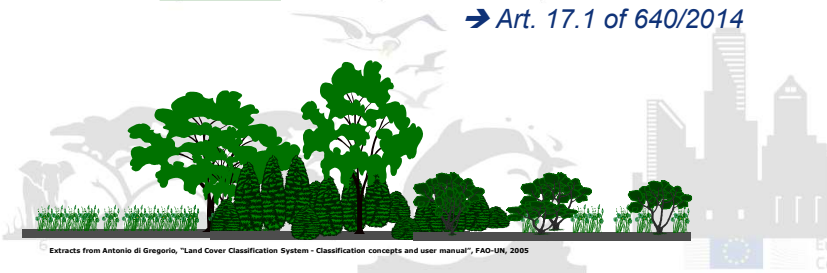
### INSPIRE DIRECTIVE EU 2/2007:

Land cover: **Physical and biological cover** of the earth’s surface including artificial surfaces, agricultural areas, forests, (semi-) natural areas, wetlands, water bodies.

→ Art 4.1.e of 1307/2013

Land use: Territory characterised according to its **current and future planned functional or socio-economic purpose** (e.g. residential, industrial, commercial, agricultural, forestry, recreational)

→ Art. 17.1 of 640/2014



Extracts from Antonio di Gregorio, "Land Cover Classification System - Classification concepts and user manual", FAO-UN, 2005



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## LC, LU and eligibility

Eligible  $\equiv$  LC (agricultural area), LU (purpose) and all conditions = OK

Land Use Land Cover	pasture	afforestation
grassland	eligible	ineligible
tree cover	ineligible	Eligible, <u>IF</u> on 2008 SPS land
managed land (e.g. golf course)	ineligible	ineligible

**LPIS mapping**      **Application/OTSC  $\rightarrow$  IACS attribute**

\*: IACS processes a combination of LC and LU concepts through spatial and alphanumeric attributes !

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## Typical CAP semantic challenge: permanent grassland

*Permanent grassland and permanent pasture, defined as land under herbaceous vegetation.*

*One European legend key is not feasible :*

- Difference in intensity (arctic to Mediterranean).
- Heterogeneity and occurrence of contaminations.
- Difference in land use (hay land, pasture, fodder crop,...).



*How precise can one accurately measure/quantify such land types?  
Or in financial terms: how much margin of 40 bn € can one tolerate?  
 $\rightarrow$  To locate and quantify the area, each member state operates its land parcel identification system (**LPIS**) at scales better than 1/5.000?*

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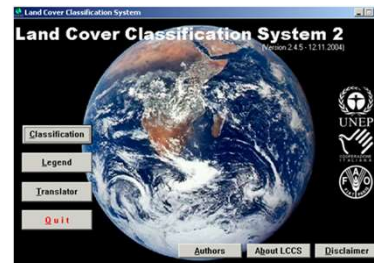


## Application of FAO-UN LCCS in LC class definition

### Eligibility profile

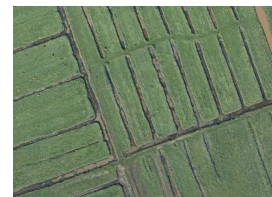
Inventory of the land forms considered by each MS

- Local name/code
- LCCcode  $\equiv$  EU mapping key!
- eligibility: 100% / 0%/pro-rata



### A success!

Italian code	Land Cover Class	Land cover Class Definition	Minimum Mapping Legend	User-defined Legend Code	LCCCode	Eligibility Hectar Factor (a percentage of 100)
666	Arable Land (general)	Continuous Field(s) Of Herbaceous Crop(s).	Arable land	A	10099	100
666	Arable Land (rainfed with fallow system)	Herbaceous Crop(s) - With Fallow System	Arable land	A	10660	100
666	Arable Land (temporary resting)	Shifting Cultivation Of Herbaceous Crops)	Natural Grassland	A	10224	100
655	Agriculture with Cultivated Trees (intercropping)	Rainfed Herbaceous Crop(s) / Permanently Cropped Area With Rainfed Tree Crop(s)	n/a	n/a	10222 / 11462	100
638	Permanent pasture (self-seed)	Closed Medium To Tall Grassland, Single Layer	Natural Grassland	N	20439-12/63	100
666	Permanent pasture (sown)	Permanently Cropped Area Graminoid Crop(s)	Grassland	G	10822-S0/01	100
659	Permanent pasture (self-seed with shrubs, rakes or trees up to 20% of the area)	Dominant Crop: Fodder - Fodder grasses	n/a	PT1	ZAGE1	80
654	Permanent pasture (self-seed with shrubs, rakes or trees up to 50% of the area)	shrubs up to 50% of the area, independent from altitude.	n/a	P12	ZAGE2	50
500	Permanent crops (plantation)	Permanently Cropped Area With Rainfed Tree Crop(s); Crop Cover: Plantation(s)	Permanent Tree crop	T	10153-W7	100



Pro-rata



## BUT, issues with complex land types

### Agro-forestry



Country and landscape specific!!

Agro-Forestry - QU type "B" (PT)  
LCCCode: 20317-13218-Zt2303(1)[Z2307](1)[Z2309](1)[Z2317]  
Woodland with Open Medium to Tall Herbaceous Layer  
Floristic Aspect: Cork Oak or Holm Oak or Pyrenean Oak

### Landscape Features



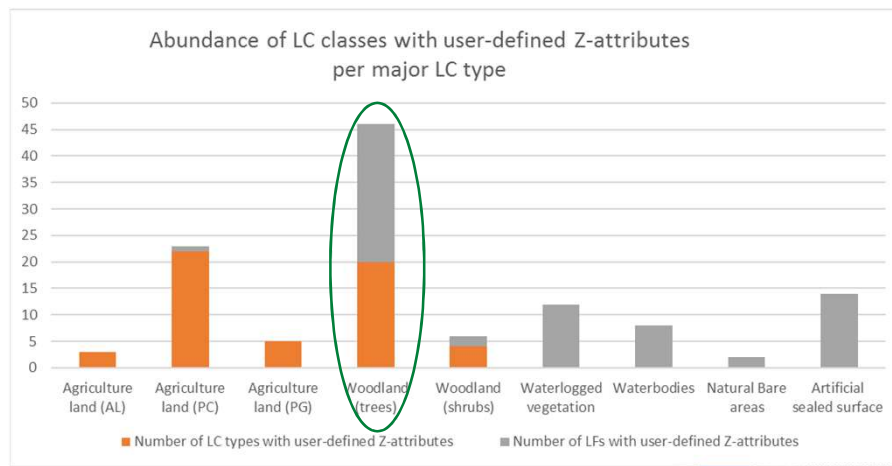
Field Copses (DE)  
LCCCode: 20278-13313-T2(1)[Z701]  
Medium High Trees with Medium High Shrubs  
Floristic Aspect: Groups of Plant Species  
User-defined attribute: Area Less than or equal to 2000 m2



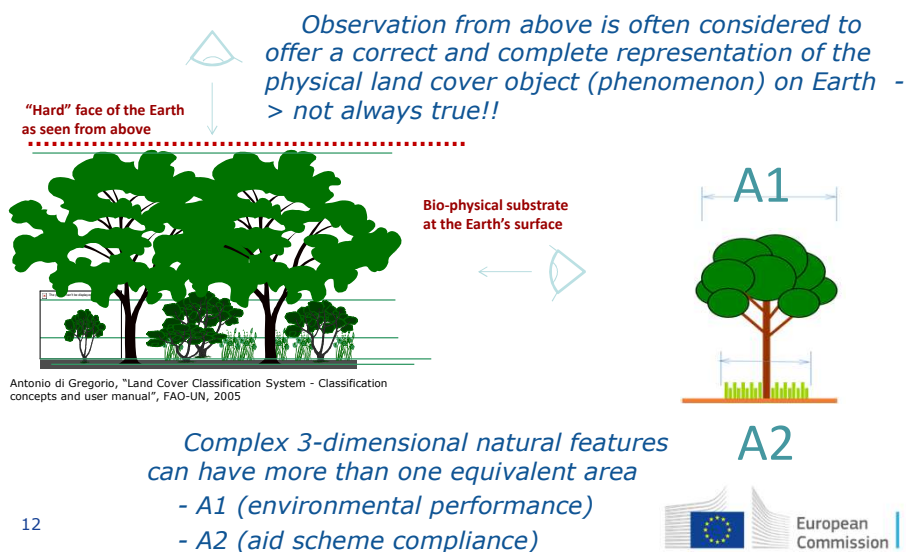
## Complexity of MS eligibility profiles - ratio of Z-attributes

119 class entries with user-defined Z-attributes from a total of 929 (13%)

- out of them 65 are related to landscape features



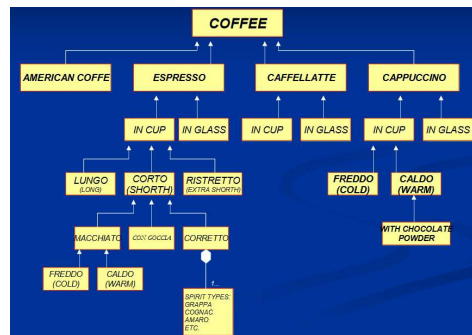
## Data capturing challenge: Earth Observation vs. physical phenomenon





## Towards LCCS 3, based on LCML

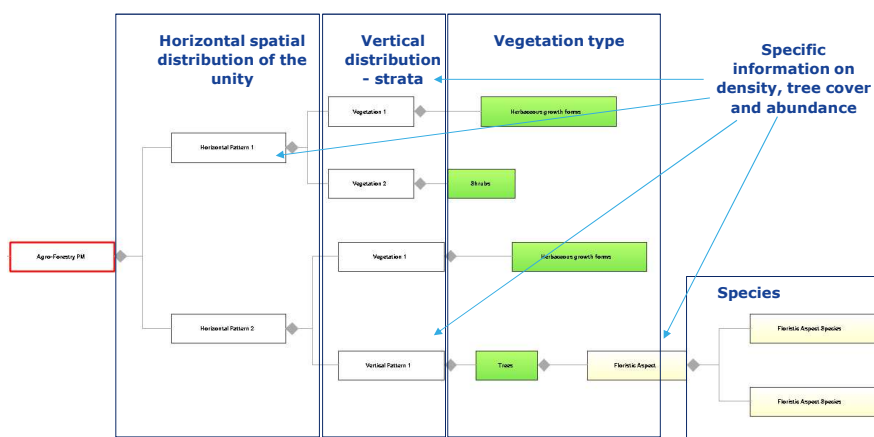
- Standardized (ISO 19144-2)
- User-friendly
- No need for standalone z-attributes
- Scalable and modular (no fixed ranges)
- LU concepts present
- **And clearly separated from LC**



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Di Gregorio, 2009

## Example – Agro-forestry (PM)



Prepared with LCCS3

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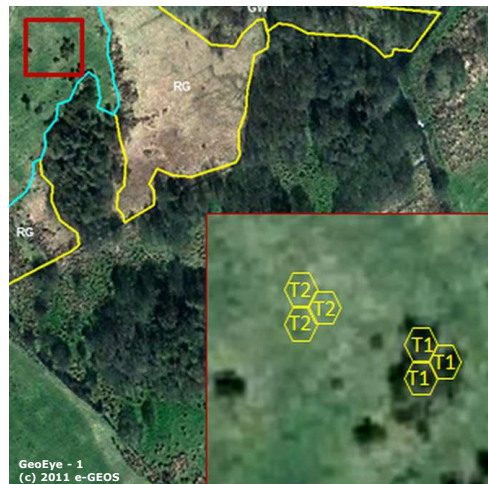
## The tegon concept

*"horizontally homogeneous, physical spatial object with a notable spatial dimension and a specific life cycle, characterized by the presence of a substrate, and possibly one or more vertical biotic or abiotic strata."*

- Extends typically over some square meters
- Represents a well-defined, distinct and measurable material reality

Traditional land cover observations correspond to **"polytegons"**

- **Homogeneous** (similar tegons e.g. a forest has only tree type tegons)
- **Heterogeneous** (different tegons, e.g. savannah has herbaceous type and tree type tegons)



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Devos W., Milenov P., Applying tegon, the elementary physical land cover feature, for data interoperability, Land Use and Land Cover Semantics: Principles, Best Practices and Prospects, Taylor and Francis Group, LLC publication, Chapter 11, ISBN 9781482237399 - CAT# K23167



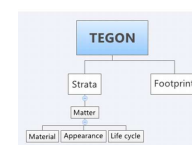
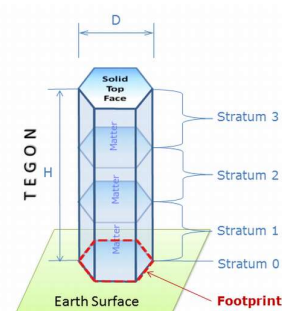
## Generic tegon structure

▪ **Shape:** a n-gonal prism with base (D) and height (H) from the top part of the soil O horizon to the "solid" face of the Earth surface as seen from above.

- **Matter:** irreducible biophysical constituent of the substrate that the tegon represents. Matter is further characterised by:

1. **Material:** the substance that builds-up the matter. biotic (vegetation) or abiotic (water, artificial construction, mineral deposit).
2. **Appearance:** the condition in which the material appears (outward impression). It is material-specific: physiognomy for the vegetation; surface aspect for the bare soil or rock; physical state for the water.
3. **Life cycle:** definite time period with unchanged characteristics of material or appearance.

- **Footprint:** base of the nadir-projected n-gonal prism.
- **Strata:** set of layers within the topological space of the substrate holding various layers of solid matter.

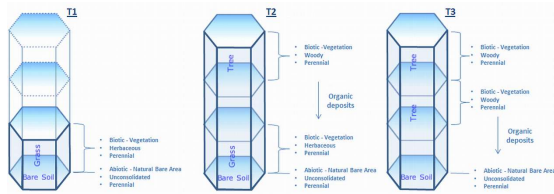
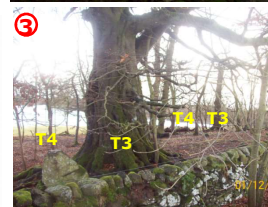
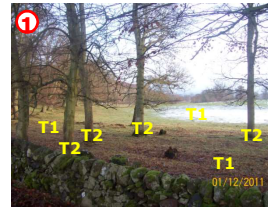
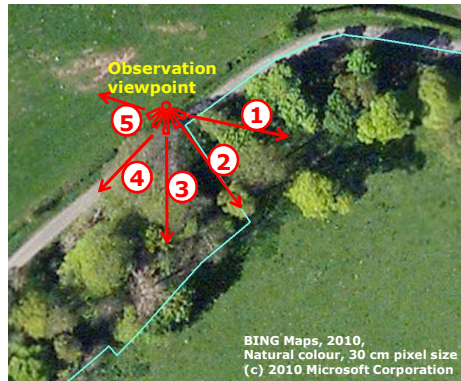


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## Looking at the substrate



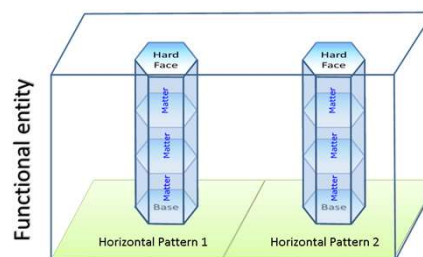
European Commission

## TEGON+LCML

Still LCML semantics are focused in modelling LC class definition within a mapping product

Applying LCML semantics through the TEGON strata structure would better tackle the physical feature itself

TEGON+LCML could introduce additional rules for stratum and functional entity for automation of the semantic classification.



## Test exercise: GAEC WS in Prague 2016

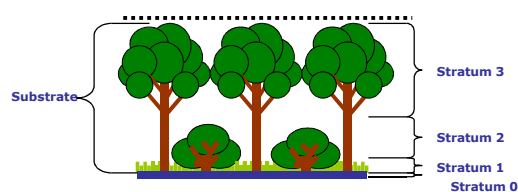
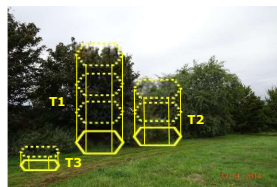
### Field case n.3 - interpretations



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## Application of TEGON approach for modelling of 3D physical nature of the landscape feature



The whole landscape feature is a composition of a number of tegons of these 3 types (polytgon)

It can still be named in line with the country context (for example "patches of trees")

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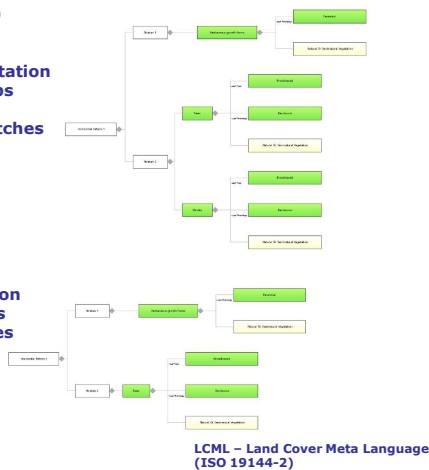
## Modelling of case No.3 with combined TEGON and LCML (Land Cover Meta Language) approach



**Tegon 1 (T1)**  
 •3 layers of permanent natural vegetation  
 •Grass, shrubs trees  
 •Compact patches densely distributed

**Tegon 2 (T2)**  
 •2 layers of permanent natural vegetation  
 •Grass, low trees  
 •Compact patches sparsely distributed

**Tegon 3 (T3)**  
 •1 layer of permanent managed grassland  
 •Linear strip at the border to arable land



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## Outcomes of the exercise

- Defining the **proper semantics** is a key prerequisite for efficient data capturing of land features
- We need to understand and **model the 3D bio-physical substrate** of land cover and its functional relationship before data are collected and their cartographic products are derived
  - only then the information captured could be used efficiently
- The Land Cover Meta Language combined with TEGON concept can be the solution
  - TEGON already applied in the context of the IACS
  - LCML seems to provide much more intuitive and comprehensive description of the land cover phenomena comparing to LCCS

## What about land use?



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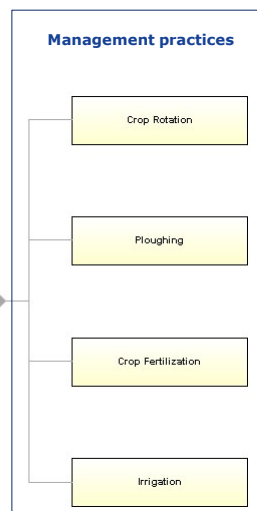
## Recording land use in LCML

Land use information can be assigned as separate characteristic the land cover feature

- In EU CAP LC-LU cardinality can be one to many (but not the inverse)



**Essential for the introduction of CAP monitoring to substitute the current on-the-spot control**

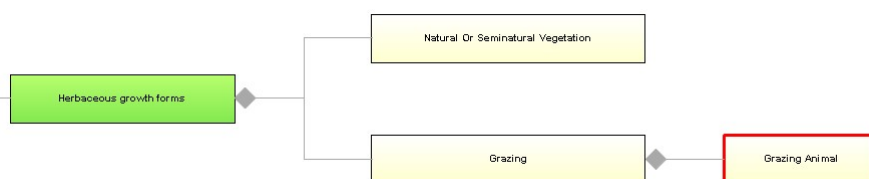


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## Link with GSAA and OTSC

Can be integrated within the GSAA and the controls



Farmer can provide annual in-situ information through the Geospatial Aid Application (GSAA)

- Fully in place in all EU Member States from 2018

Properties	
(Name)	Grazing Animal
Description	Describe the grazing animal
Animal Type	Cattle

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## Summary and follow up

- LCML has great potential in the future EU CAP context
  - **Establishment of LC-LU relationship**
  - **Semantic interoperability for CAP impact/performance assessment**
  - **Integration of field (farmer) and EO (service) data for CAP monitoring**
  - **Can support in-situ component of COPERNICUS in general**
- 
- But more work is needed
  - **In close collaboration with ISO / INSPIRE / FAO**
  - **Using TEGON concept developed by JRC D5**
  - **Towards Land Characterization Meta Language?**

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M.C. Escher, Waterfall, 1961

*"We adore chaos because we love to produce order."*

M.C. Escher

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