LPIS and semi-natural grasslands

EFNCP-DVL workshop, Hungen, December 14, 2012

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Serving society
Stimulating innovation
Supporting legislation

Outline

1. LPIS
2. parcels
3. land
4. grassland class examples
    - standard (LCCS-based)
    - user-defined (tegon-based)

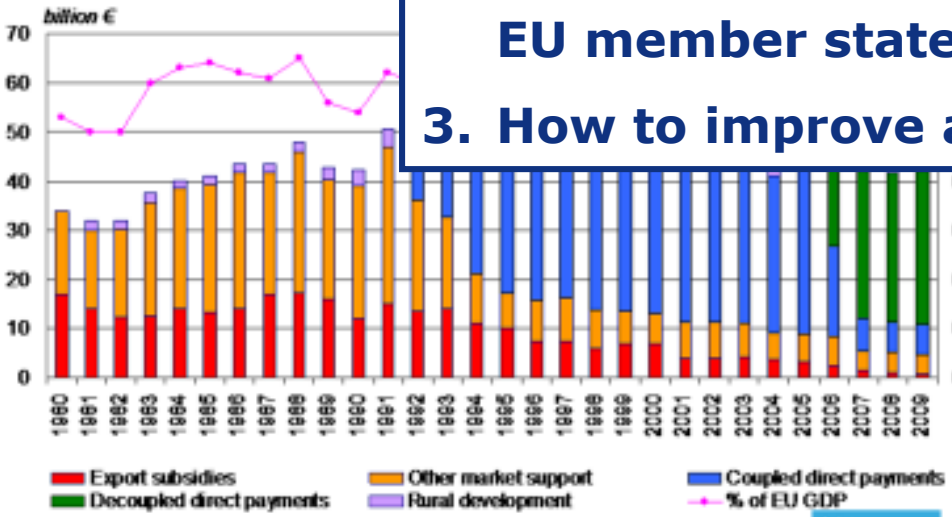
The CAP

(Common Agricultural Policy)

From an EU perspective…

1. **What kind of measurable area?**
2. **How ensure commonality over 27 EU member states?**
3. **How to improve accountability?**

Over the years….



40 bn €/year is area based aid!

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LPIS definition

There is **no definition of LPIS** in the Regulations (cfr. 2009/73-Art 17) and many competing terms (LPIS-GIS, IACS-GIS) cause confusion

→ need to apply INSPIRE compliant definitions!!!!!!

LPIS shall hold:

1. A **stable identification of land cover and/or use** units (i.e. the basis for eligibility for any scheme):
2. The "**eligible hectares**" value for area aids, originally delineated (vectorised) by survey compatible with 1:10,000 scale or better, and subsequently updated by the various IACS processes:
3. An inventory of **other features** that benefit (or preclude the right) from aid, with eligibility (and value) depending on the **other aid schemes**:

→ LF ? Greening ?

LPIS is a spatial database that permits (spatial and alphanumeric) queries and data retrieval operations in function of the farmer aid application and administrative cross checks.

→ LPIS ≡ **the single GIS** for IACS

Key spatial concepts

Art 2 Commission Regulation (EC) No 1122/2009

(1) Agricultural parcel

continuous area of land, declared by one farmer, which does not cover more than one single crop group; however, where a separate declaration of the use of an area within a crop group is required in the context of this Regulation, that specific use shall if necessary further limit the agricultural parcel; Member States may lay down additional criteria for further delimitation of an agricultural parcel;

(27) Reference parcel

geographically delimited area retaining a unique identification as registered in the GIS in the Member State's identification system referred to in Article 15 of Regulation (EC) No 73/2009

Art 6(1) Commission Regulation (EC) 1122/2009

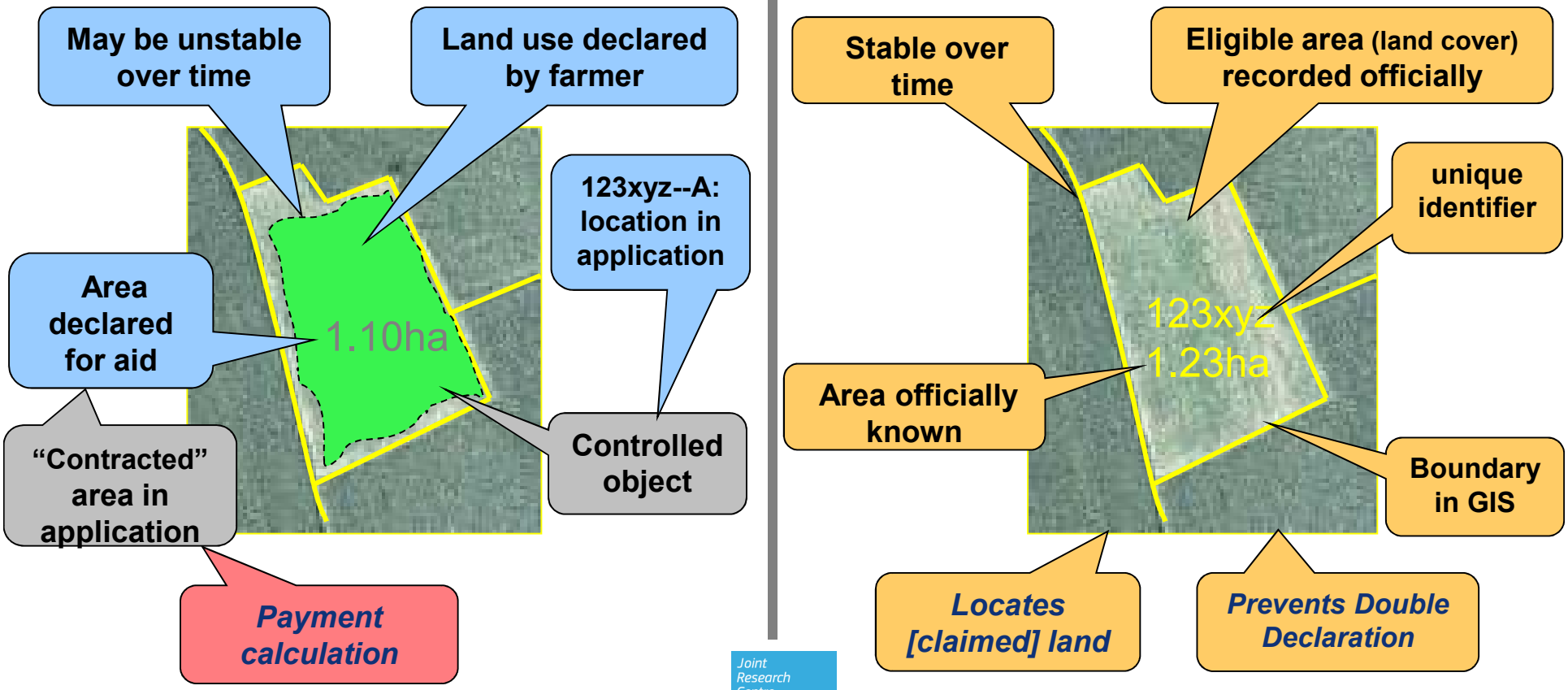
"…shall operate at reference parcel level such as cadastral parcel or production block which shall ensure unique identification of each reference parcel. For each reference parcel, a maximum eligible area shall be determined…. The GIS shall operate on the basis of a national coordinate reference system"

reference vs agricultural parcel

Agricultural Parcel — REFERS TO — LPIS Reference Parcel

unit of payment and inspection — unit of administration and control

farmer and inspectors — LPIS custodian



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undefined spatial CAP concepts

Today: implied

- Crop = unit of cultivation
- Holding = unit of exploitation / responsibility
- Landscape feature *(≠ topographic element ☹)*

Today: spatial concepts from external sources

- Areas of farming restrictions (LFA, buffer strips)

Post-2013: Greening is area based → identify + quantify land

- permanent grassland
- carbon rich soils and wetlands
- areas that are naturally kept in a state suitable for grazing or cultivation without minimum activity
- 7% EFA? GAEC LF require separate identification (as today) and quantification
- areas with natural constraints / GAEC could require further identification E.g. AECP zones or site specific erosion

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Defining "parcel" of LPIS

"The identification system for agricultural parcels shall be established on the basis of maps or land registry documents or other cartographic references. Use shall be made of GIS techniques, including preferably orthoimagery, .." Council Regulation 2009/73 - Article 17

source subdivided by	**existing map/** document	**exclusive ortho-image**
physical boundary	Topographic block [≈ "City" block]	Physical block
Person (land user)	Cadastral parcel	Farmer's block
land use (crop group per user)		Agricultural Parcel
	➔ 2 layer system separate eligibility	➔ single layer, 100% "production block"

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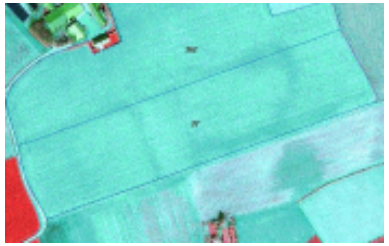
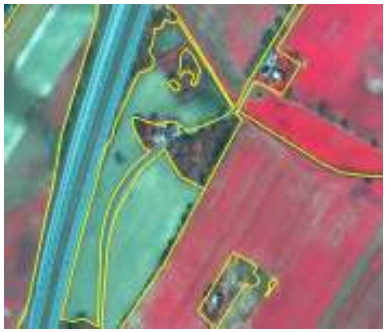
Consequences






RP	= Agricultural parcel (spatial)	< Farmer 's block/ilot	< Physical block	Cadastral / topo parcel
content / coverage	one single crop group or even "crop"	ideally one crop group	one or more crop groups	agricultural and non-agriculture
applicants	single farmer	single farmer	one or more farmers	often single farmer
temporal aspect	annual	multi-annual	semi-permanent	permanent
author	farmer	farmer	administration	3rd party
dominant perimeter	land use	land use	land cover	land tenure

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Defining "Land" of LPIS

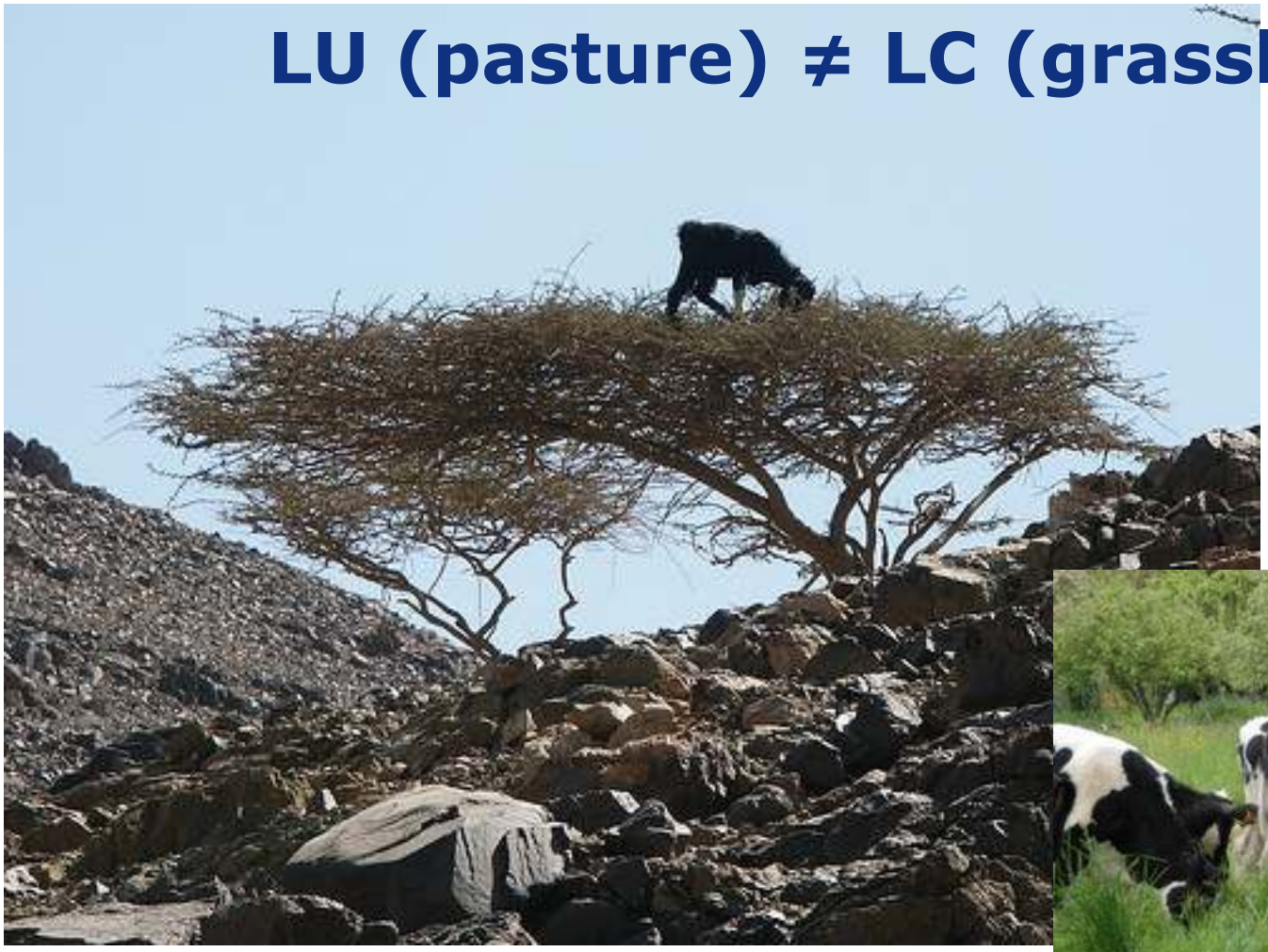
INSPIRE DIRECTIVE EU 2007/2:

Land cover: Physical and biological cover of the earth's surface including artificial surfaces, agriculture areas, forests, (semi-) natural areas, wetlands, water bodies. ➔ Art 34 Council Reg (EC) No 73/2009

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. 56 Comm. Reg. (EC) No 1122/2009

LU (pasture) ≠ LC (grassland)



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LC, LU and eligibility

Eligible ≡ when LC*, LU* and all other conditions = OK

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

LPIS mapping

Application/OTSC ➔ IACS attribute

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

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A typical 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,…).

So:

- How precise can one accurately measure/quantify these grasslands?
- Or in financial terms: how much margin of 40 bn € can one tolerate?

→ To locate and quantify the area, each member state operates its land parcel identification system (**LPIS**) at scales better than 1/10.000.

→LC for LPIS delineation

1. LC enables **unambiguous** characterization of the Earth surface, using a systematic framework or **classification system** defining the classes and criteria used to distinguish land cover, independent of scale and data capture.
   ➔ A common approach to classify land exists (FAO / ISO 19144-1) http://www.glcn.org/sof_7_en.jsp
2. LC directly relates to land use:
   1. the **easiest detectable (mappable) indicator of human interventions** on the land.
   2. the main feature **constraining land use** ➔ "***maximum eligible area***"
   3. the main indicator for the **productivity** of terrestrial ecosystems

☹ CAP land concepts can be hybrid : "permanent pasture", "household garden"

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Application of LC

Eligibility profile

Inventory of the land forms considered by each MS

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

Pro-rata

1. mixture of eligible and ineligible components, not individually delineable (spatial/temporal), in a particular land form/habitat.
2. identifiable and distinguishable
   - characteristic (physiognomic-structural) components
   - specific local context
   - known and stable proportions
   - result of a typical agricultural practice

Italian code	Land Cover Class	Land cover Class Definition	Minimum Mapping Legend	User-defined Legend Code	LCCCode	Eligibl Hectar facto (a percentag of th
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 Crop(s)	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	A	10222 / 11492	100
638	Permanent pasture (self-seed)	Closed Medium To Tall Grassland, Single Layer	Natural Grassland	N	20439-12763-	100
666	Permanent pasture (sown)	Permanently Cropped Area Graminoid Crop(s) Dominant Crop: Fodder - Fodder grasses	Grassland	G	10822-S0701	100
659	Permanent pasture (self-seed with shrubs, roks or trees up to 20% of the area)	rocks up to 20% of the area, indipendent from altitude.	n/a	PT1	ZAGE1	80
654	Permanent pasture (self-seed with shrubs, roks or trees up to 50% of the area)	rocks up to 50% of the area, indipendent from altitude.	n/a	PT2	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

http://mars.jrc.it/mars/content/download/1977/10526/file/S1_Devos_prorata.pdf

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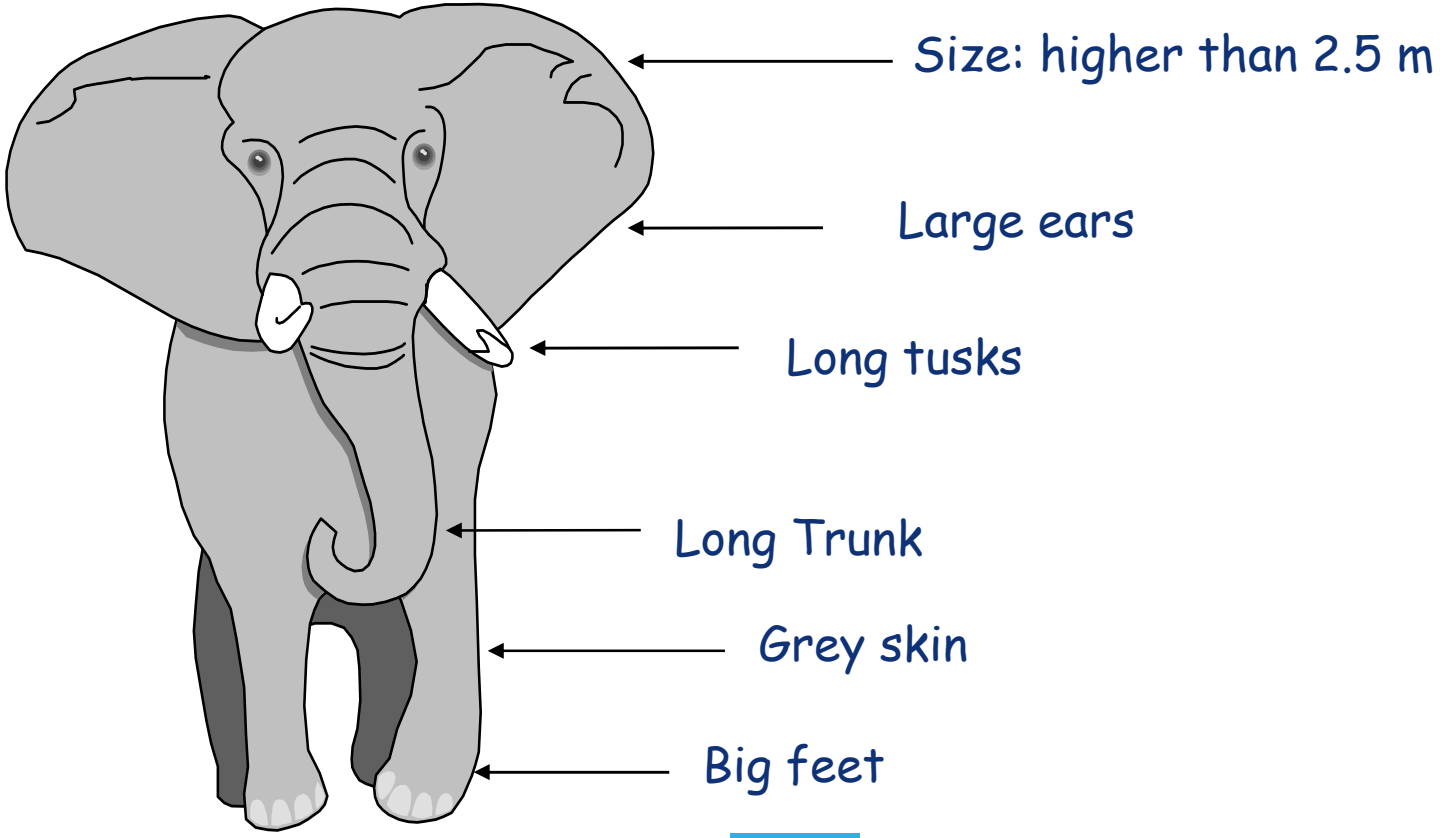
Description vs. Classification

For a **description** of an elephant, all the possible elements can be used



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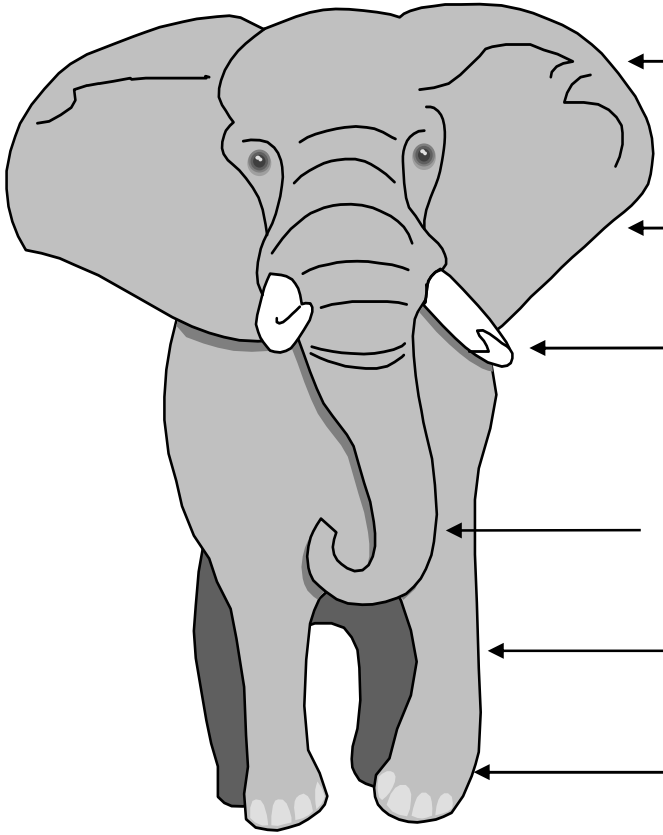
Description vs. Classification

For the **taxonomic identification** of the elephant, consider only the minimum of elements needed



Size: higher than 2.5 m

Large ears

Long tusks

Long Trunk

Grey skin

Big feet

these 2 distinctive elements classify, all other can be linked attributes

Loxodonta africana
(ex: oxyotis)

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10 Eligible land cover seed classes

derived from every explicitly mentioned crop in the Regulations

Land Cover Class	Land cover Class Definition	Minimum Mapping Legend	User-defined Legend Code	LCCCode	Representation of eligible land (direct aid) (Yes/Pro rata/Conditional)	Eligible Hectare factor (as percentage of the geometric area of the mapped feature)
Arable Land (general)	**Continuous Field(s) Of Herbaceous Crop(s).**	**Arable land**	**A**			
Arable Land (rainfed with fallow system)	Herbaceous Crop(s) ., With Fallow System	Arable land	A			
Arable Land (temporary resting)	Shifting Cultivation Of Herbaceous Crop(s)	Arable land	A			
Arable Land with Patches of Trees (up to 15% of the surface)	Herbaceous Crop(s) ., With Fallow System / Sparse Trees And Sparse Herbaceous	n/a	tbd			
Arable Land with Patches of Scattered Trees (up to 4% of the surface)*	Herbaceous Crop(s) ., With Fallow System / Scattered Trees And Sparse Herbaceous	Arable land	A			
Agriculture with Cultivated Trees (intercropping)	Rainfed Herbaceous Crop(s) / Permanently Cropped Area With Rainfed Tree Crop(s)	n/a	tbd			
Permanent pasture (self-seed or sown)	**Closed Medium To Tall Grassland, Single Layer Floristic Aspect: Groups of Plant Species // Permanently Cropped Area With Graminoids Crop(s) Dominant Crop: Fodder - Fodder**	**Grassland**	**G**			

A arable land
G grassland
N natural grassland
H greenhouse
T permanent tree crop
S permanent scrub crop
C permanent herbaceous crop
P short rotation coppice
R (irrigated) rice
K kitchen gardens (SAPS only)

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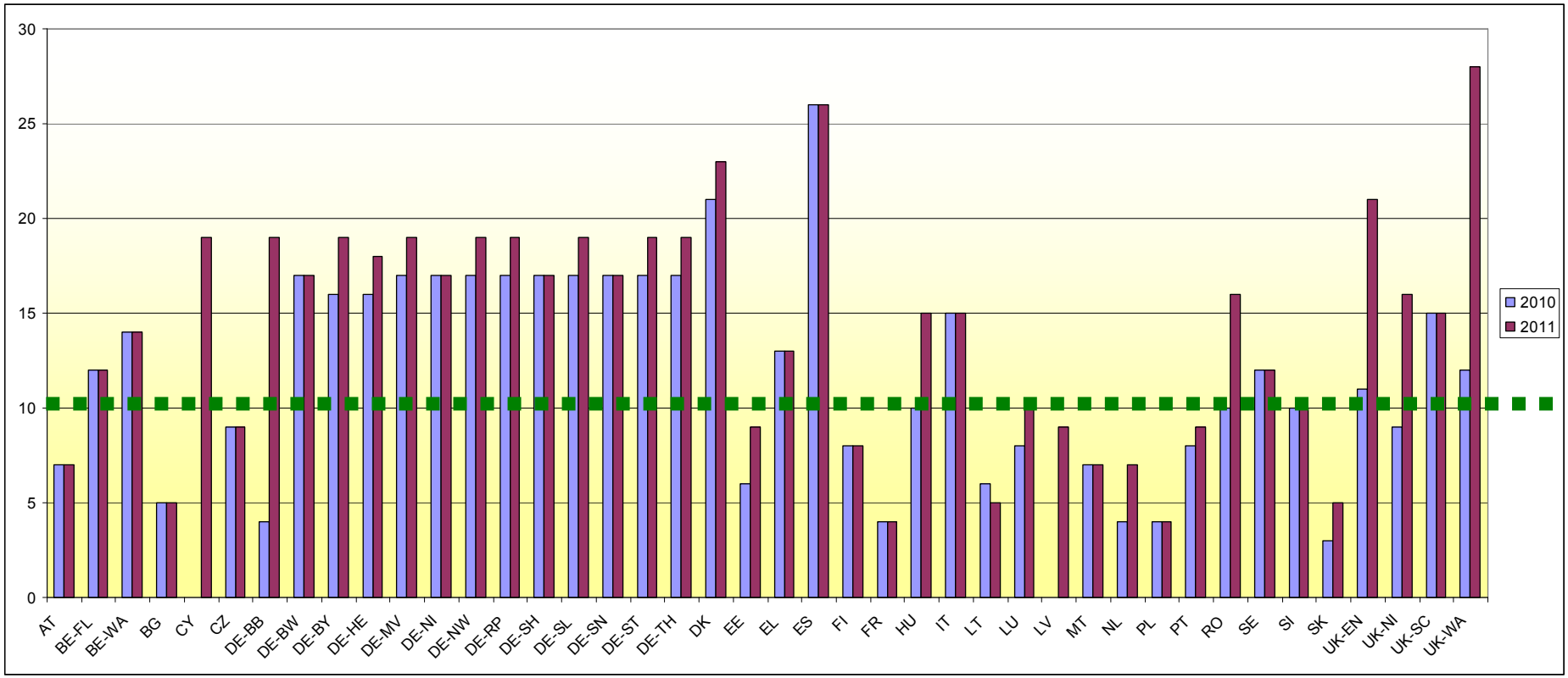
of agricultural LC types per EU MS

- 30 % of the LPISs consider the 10 pre-defined mapping classes appropriate;
  what is relevant is what the other 70 % of the LPISs does.



Pasture → G: grassland (Belgium)

Basic classifier: Cultivated and Managed Terrestrial Areas

Life Form: Herbaceous (graminoids)

Spatial Aspect – Field size: N/A

Spatial Aspect – Distribution: Continuous

Spatial Aspect – Crop Combination: Single Crop

Cover-related Cultural Practices - Water Supply: Rainfed

Cover-related Cultural Practices – Cultivation Time Factor: Permanent

Technical Attribute – Crop Type - Fodder - Fodder grasses

Classifier Result	Boolean Formula	Standard Class Name	Code
Herbaceous Crops	A4XXB5C1D1D9-S0701	Permanently Cropped Area Graminoid Crop(s) Dominant Crop: Fodder grasses	10822-S0701

Pasture → N: natural grassland (Bulgaria)

Basic classifier: Natural and Semi-Natural Terrestrial Vegetation

Life Form: Herbaceous (graminoids)

Height: 0.3-0.8 m

Cover: Open (60 - 15%)

Spatial Distribution: N/A

Leaf Type and Leaf Phenology: N/A

Stratification: 2nd Layer of Trees

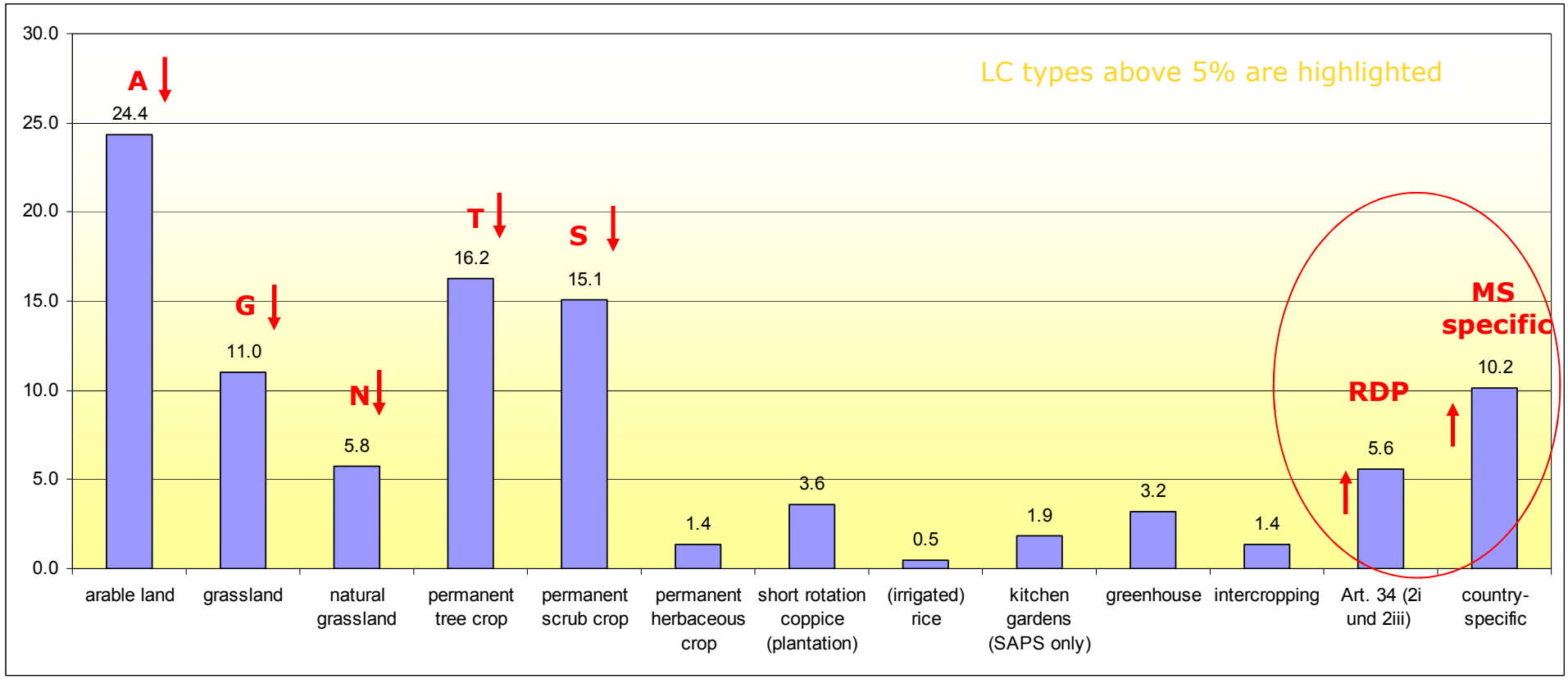
- **Cover:** Sparse (15 - 5%)
- **Height:** 7.0-3.5 m

Technical Attribute - Floristic Aspect – Groups of Plant Species

Classifier Result	Boolean Formula	Standard Class Name	Code
Grasslands	A6A11B4XXXXXXF2F5F10G2F1-T2 Modifier: B12G7	Open Medium Tall Grassland With Low Trees, Floristic Aspect: Groups of Plant Species	20486-12290-T2

Abundance of agriculture types LPIS QA 2011

%



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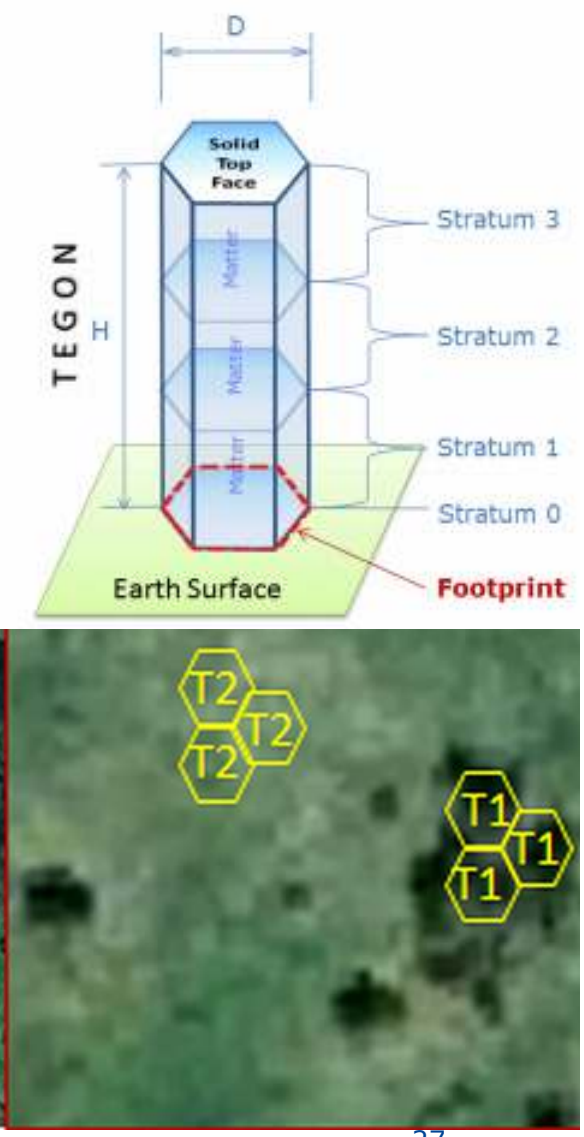
The tegon

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

- size: ca 1-100 square meters
- well-defined, distinct and measurable reality
- independent of capture method

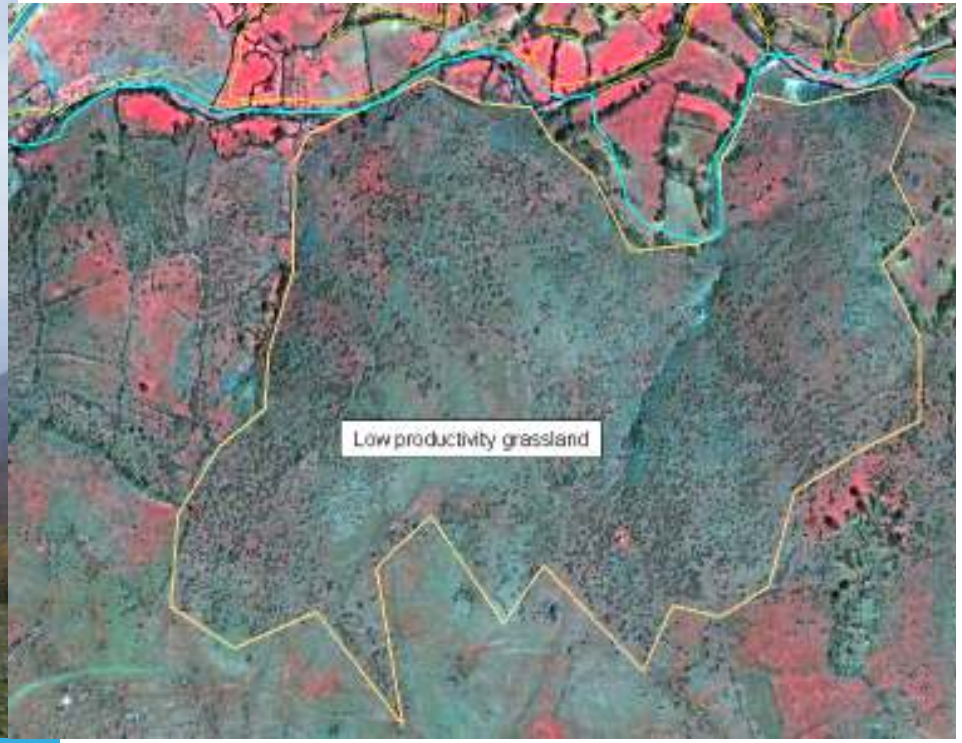
Traditional LC observations are "**polytegons"**, a mix of tegons.

TEGONS use LCCS semantics but in the prism structure!
Full 3D + lifecycle ≠ top view



low-productivity grassland
common in semi-mountainous region of Southern Europe. In general, this pastoral area is an intricate mixture of open herbaceous vegetation and low shrubs, developed on rocky soil at relatively higher altitudes (above 500 meters)

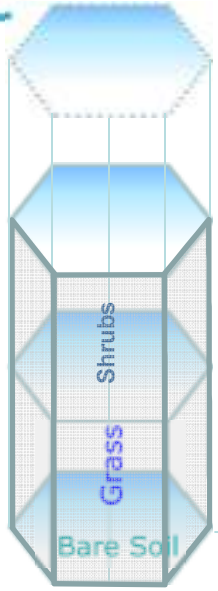
In SPS/SAPS → "pro-rata" eligible



T2 - shrub

T1 - grass

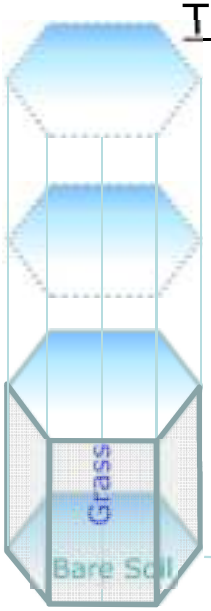
T3 – bare rock



- Biotic - Vegetation
- Woody – Shrubs
  Height – 0.5 to 3 m
- Perennial

- Biotic - Vegetation
- Herbaceous – Group of plant species
- Perennial

- Abiotic - Natural Bare Area
- Unconsolidated
- Perennial



- Biotic - Vegetation
- Herbaceous – Group of plant species
  - Height – 0.3 to 0.8 meters
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- Abiotic - Natural Bare Area
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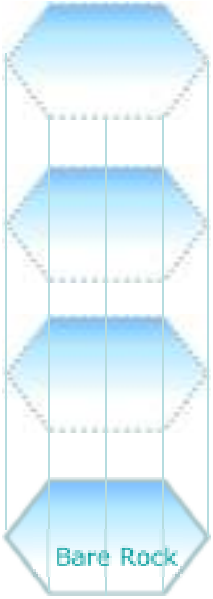

- Abiotic - Natural Bare Area
- Consolidated
- Perennial

All expressions are LCCS/LCML semantics

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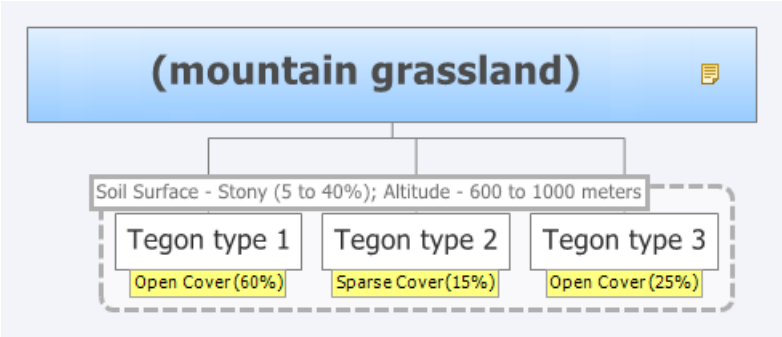
Final definition

LCCS allows understanding the class of map polygon

Class Name	Low productivity grassland
Classifiers	A2A11B4XXXXXXF2F6F10G3-A12B12G9-N2N4P9
Class Code	20458-244-N2N4P9



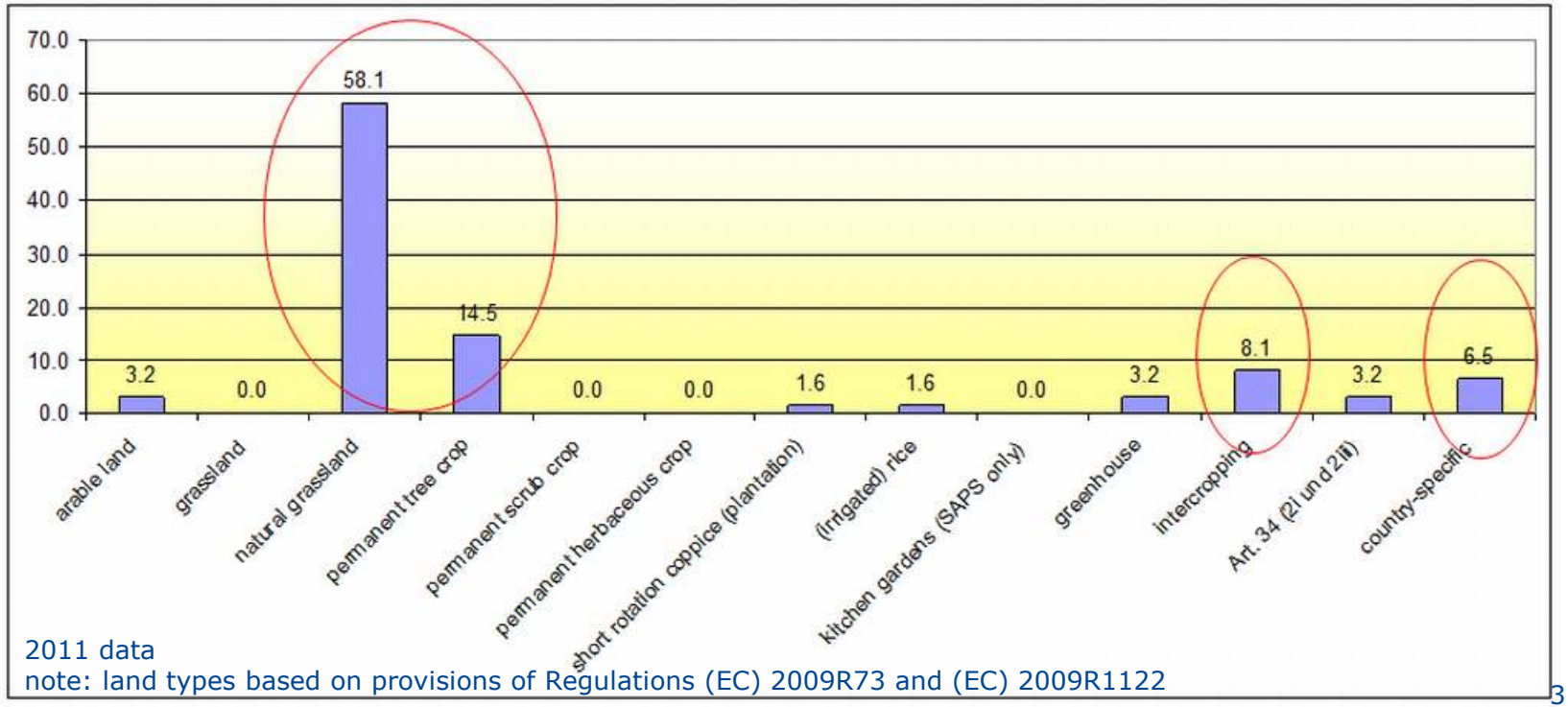
BUT tegon combinations describe any specific land type

- Exact description of all what is there
- Spatial pattern/interaction/organisation beyond 1 observation
- Variable presence of strata
- Quantification and qualitative attributing of the components

What are the "tegon" classes for?

- 151 homogeneous classes (specializing 10 LCCS group for 28 LPIS).
- 62 country-specific (heterogeneous) classes (see graph below)
  - 34 grassland LC types, having intrinsic mixtures or multi-strata
  - 4 "country-specific" entries relate to heather.

Additionally, 116 art 34. non-agricultural "landscape features" (regionally defined).



2011 data
note: land types based on provisions of Regulations (EC) 2009R73 and (EC) 2009R1122

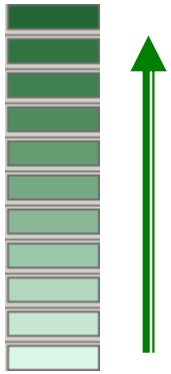
Geographically

Provisional grassland complexity per MS

#(sown + natural + pro-rata) grassland classes

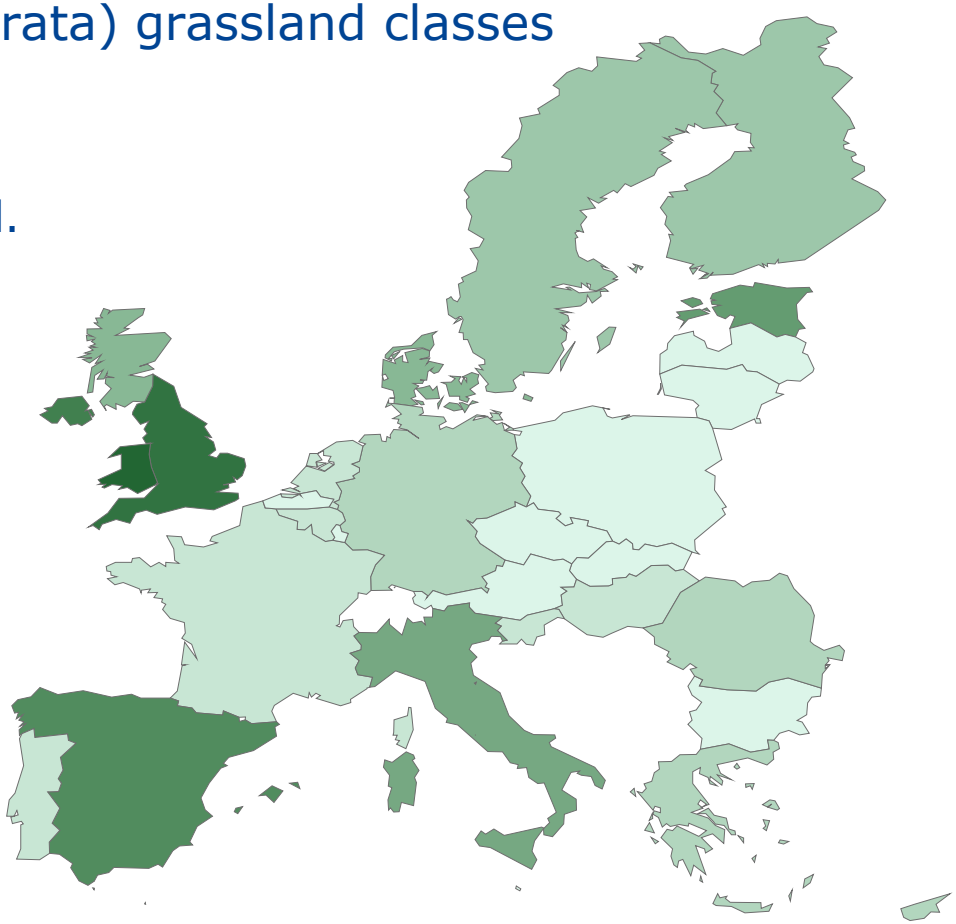
Note:

- IE missing.
- 13 DE Länder combined.



More complex

Less complex



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TEGON application

proper semantic modeling and description/classification of all grassland types in Europe could be possible, comprising the following 2 steps:

1. Decomposition of each grassland on its elementary units (Tegons)
2. Reconstruction of the specific grassland type:
    1. Through the functional mix between its different tegons
    2. Defined/constrained by the specific conditions of the environmental and landscape (expressed as meta-classifiers)

Overall conclusion

Greening → area aid → **identification and objective quantification** are critical! → LPIS → **€!!!**

a **land cover** approach is the only approach that supports both:

- the traditional 2D /"top view" LC mapping approach is too limited
- but, ID-cards could be issued to any proposed land cover type, including 34 specific and some 25 LCCS grassland types

the **land use** monitoring will drive all LPIS designs to converge on smaller, land tenure based reference parcels

technical attributes for HNV and any other eligibility conditions can be supported as LPIS attribute (based on meta-classifiers)

PLEASE USE THIS CONCEPTUAL FRAMEWORK!!!!!

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Thank you!

Pavel MILENOV

Wim DEVOS

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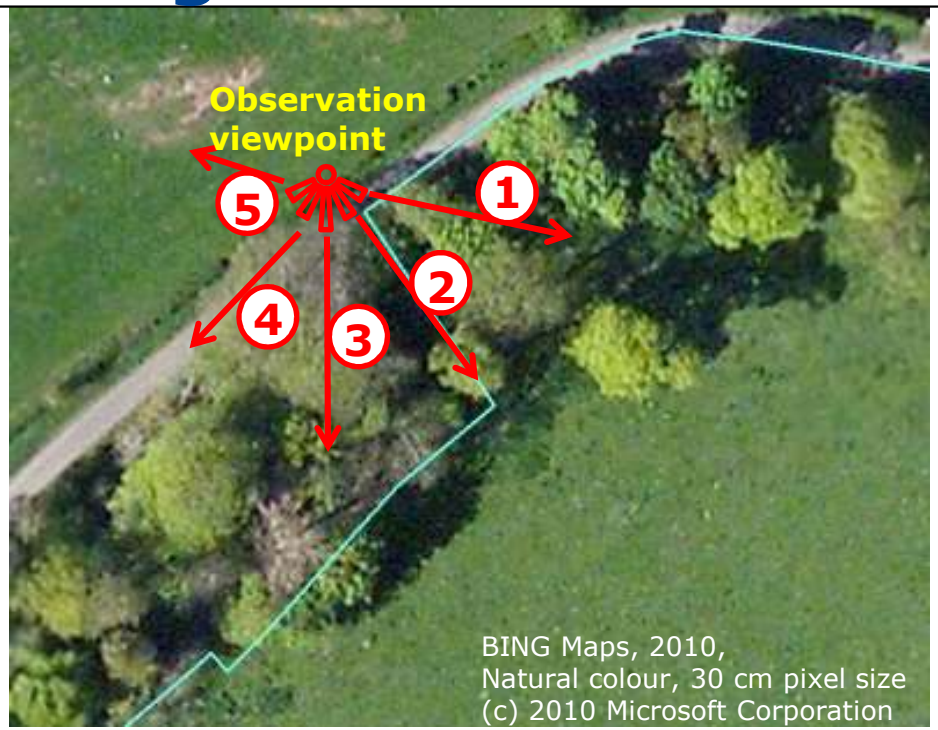
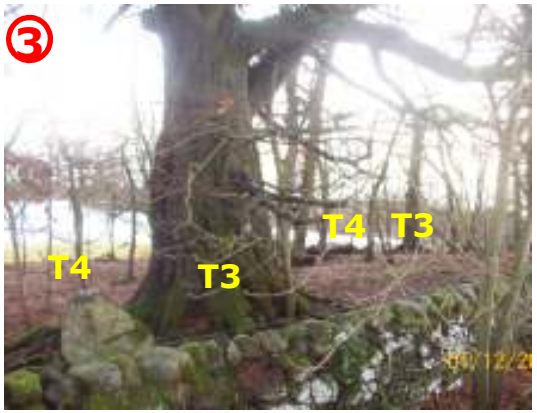
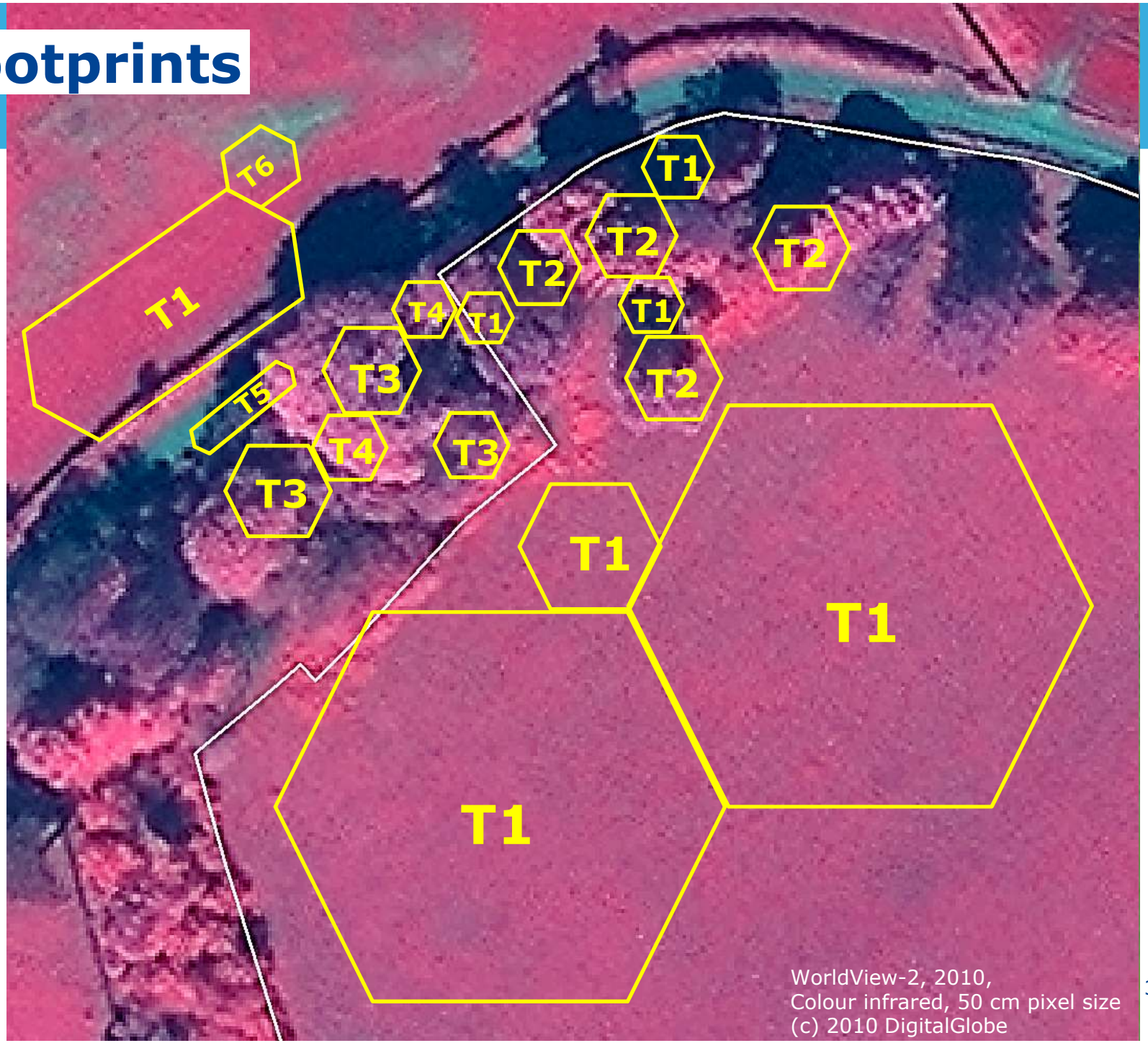
Looking at the substrate



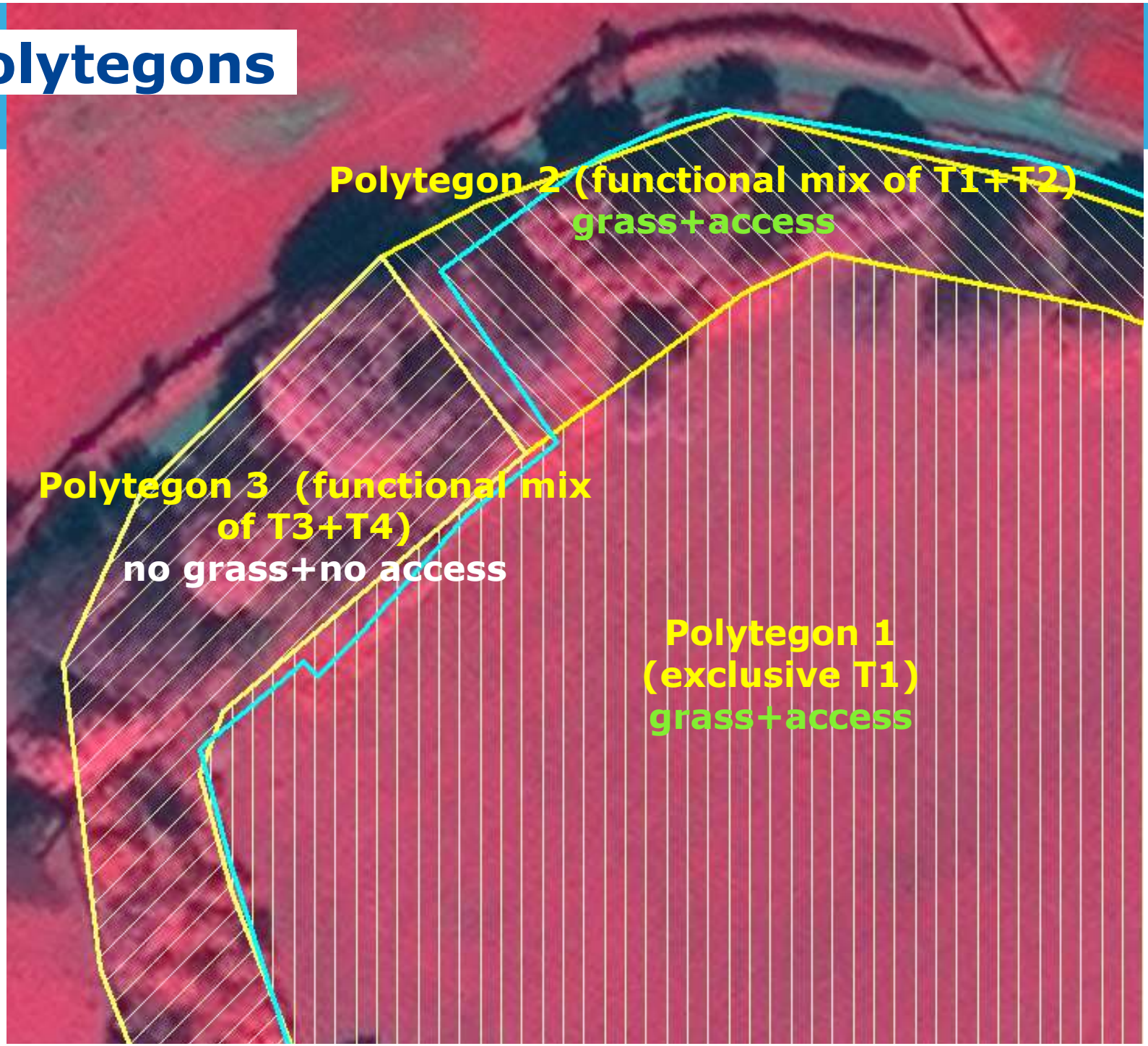


Footprints

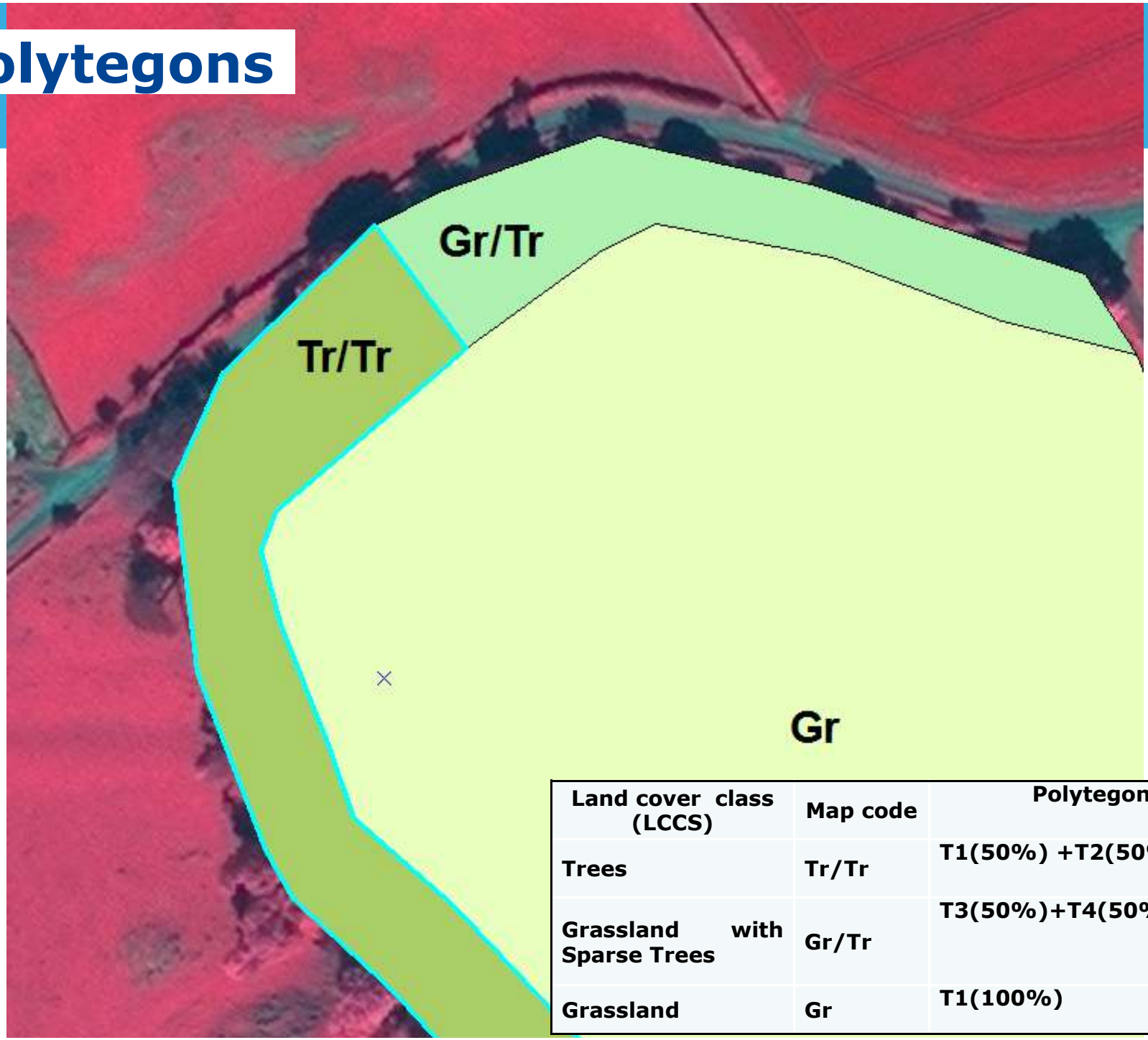


WorldView-2, 2010,
Colour infrared, 50 cm pixel size
(c) 2010 DigitalGlobe

Polytegons


Polytegon 2 (functional mix of T1+T2)
grass+access
Polytegon 3 (functional mix of T3+T4)
no grass+no access
Polytegon 1 (exclusive T1)
grass+access

Polytegons



Land cover class (LCCS)	Map code	Polytegon
Trees	Tr/Tr	T1(50%) +T2(50%)
Grassland with Sparse Trees	Gr/Tr	T3(50%)+T4(50%)
Grassland	Gr	T1(100%)