

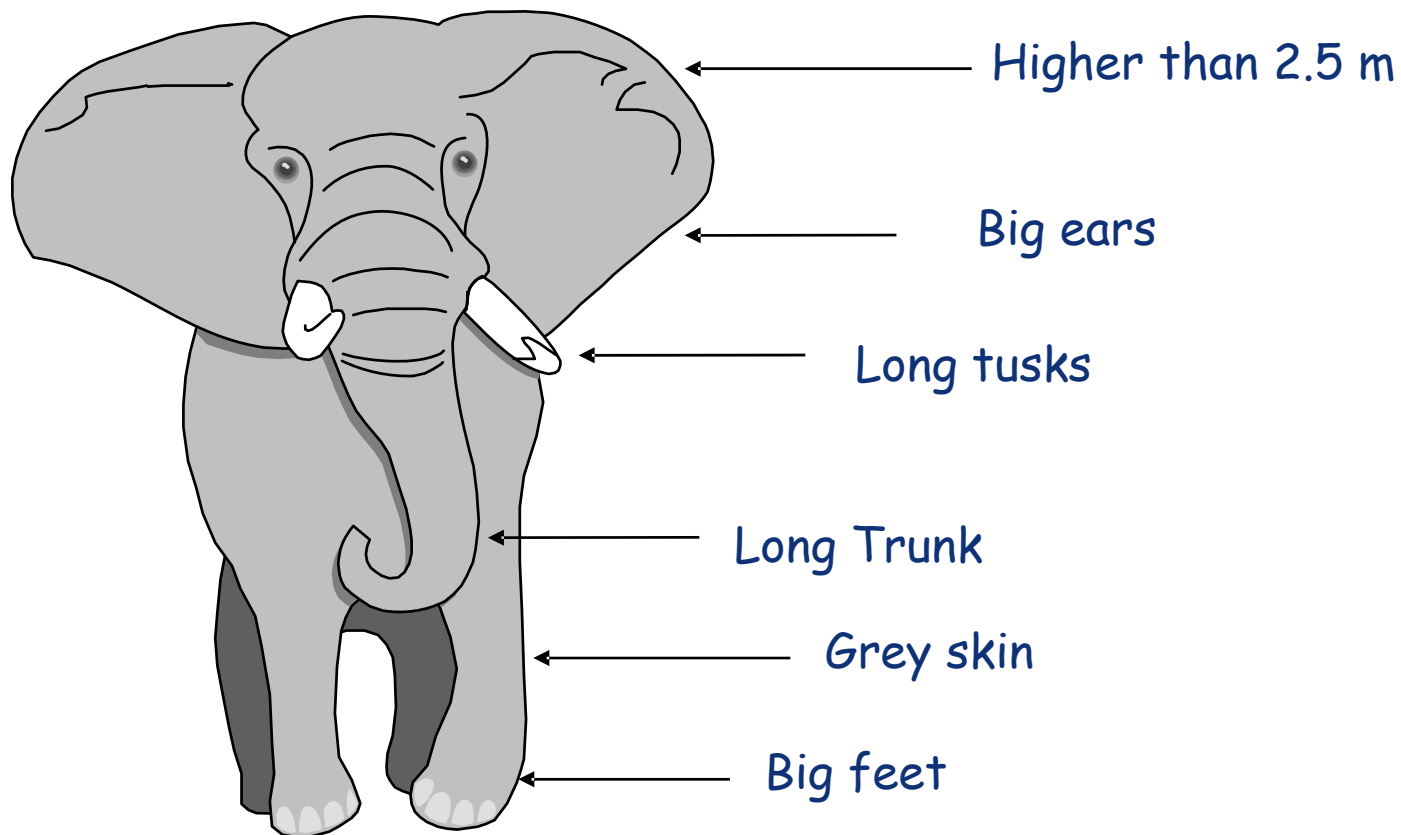


Standardization of the land cover classes in the LPIS using FAO Land Cover Classification System (LCCS)

Agriculture Unit, JRC Ispra

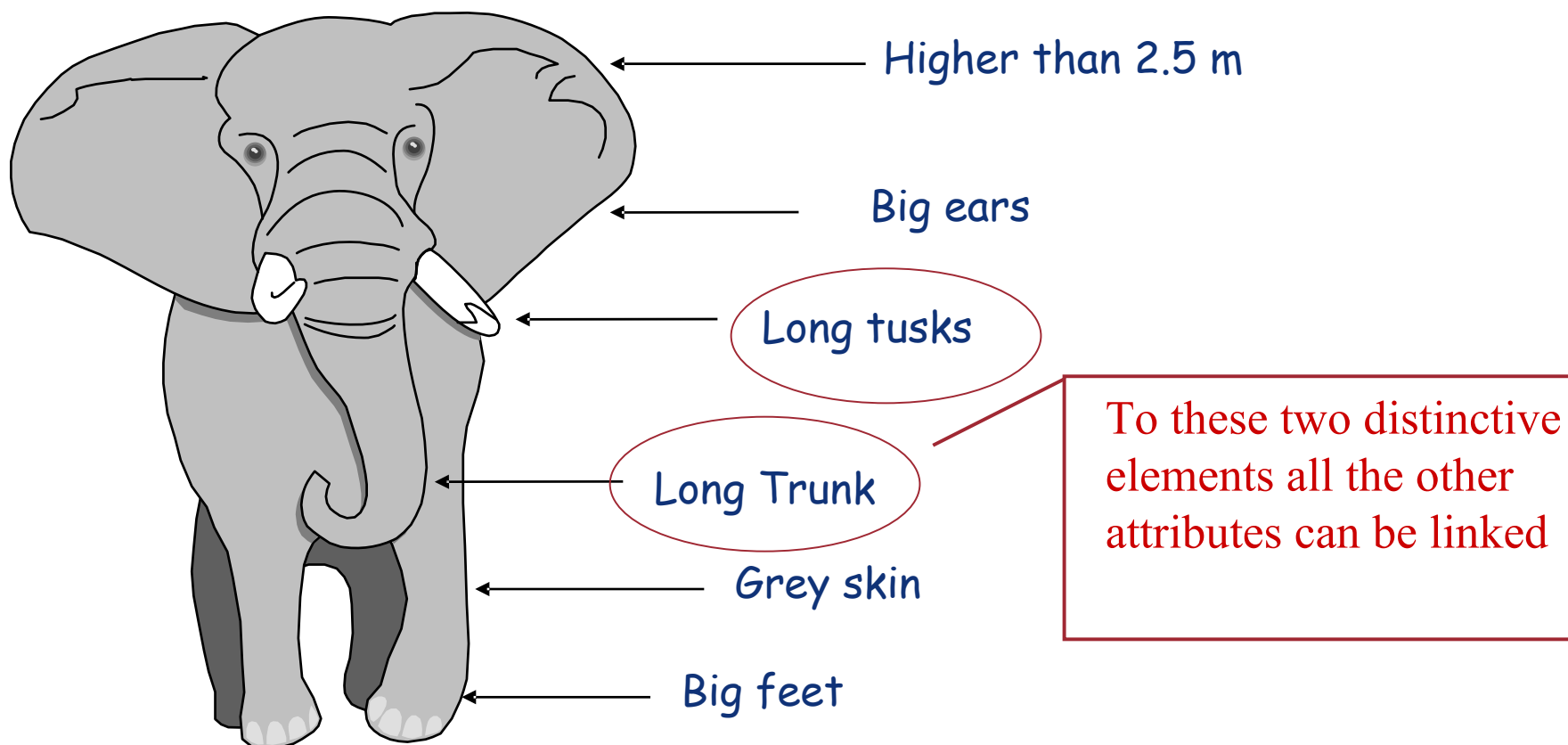
Description vs. Classification

If a description of an elephant must be done, all the possible elements can be used



Description vs. Classification

For taxonomic identification of the elephant, only the minimum of elements needed for a distinct classification will be considered.



Land types used by EU MS in their LPIS

Country	Type of land cover/use recorded	RP	Payment scheme
DK, UK-NI	None	PB	SPS
HU	SAPS eligible/SAPS non eligible	PB	SAPS
PL	1-forest; 2-tree or bushes; 3-water; 4-roads; 5-industrial area; 6-habitats; 7-other; 8-permanent grasslands; 9-orchards; 10-arable land; 11- gardens	CadP	SAPS
DE-Bavaria	farmland, permanent grassland, permanent orchard, vineyard	FB	SPS
FI	Field, forest (forestation and environmental schema) and pasture.	FB	SPS
SE	Agricultural land only	PB	SPS
LT	<ul style="list-style-type: none"> - Agricultural blocks (bl1) - Build-up blocks (bl2) with small areas of cultivated land - Miscellaneous blocks (bl3) contain all the other land cover (forests, non-eligible land, etc.) - Grassland blocks (bl4) - Orchard blocks (bl5) - Non-subsidized area blocks (bl2003) are abandoned and treated as ineligible area (reference year 30/06/2003) and claimed for subsidies after 30/06/2003. 	PB	SAPS

essentially land cover categories

Land use/ land cover definition (INSPIRE 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 44(2) Council Reg (EC) No 1782/2003

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. 49 Comm. Reg. (EC) No 796/2004



WHY a land cover concept for LPIS?

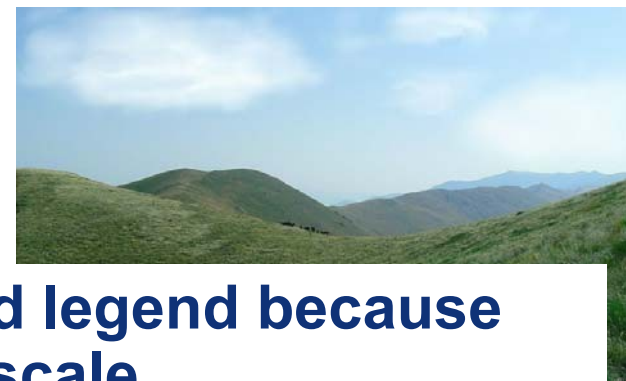
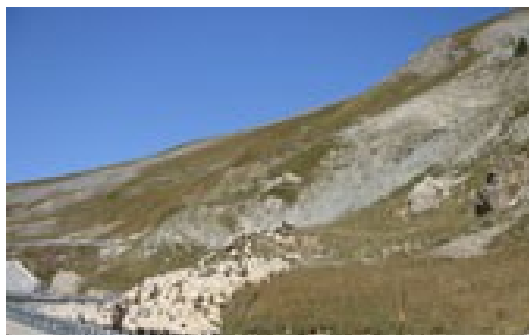
Land cover

- provides **unambiguous** characterization of Earth surface
- is the **easiest detectable** (mappable) indicator of human interventions on the land.
- is the main feature **constraining the use of land**
- is the main indicator for the **productivity** of terrestrial ecosystems

It is also a critical parameter for environmental databases.

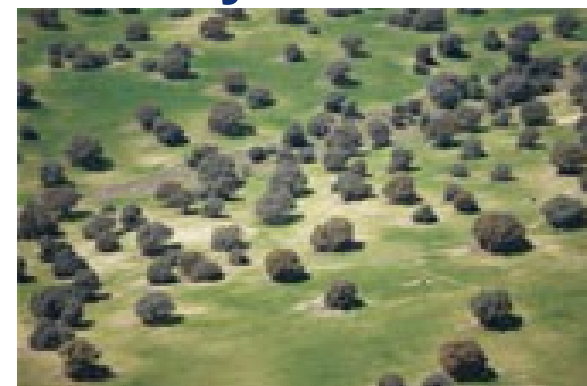
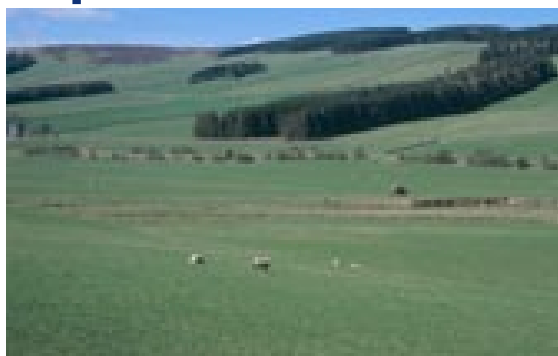
- Land cover **changes** are very **relevant to environmental policy**
- a basic geographic feature (**reference base**) for other environmental applications

Pasture on different grasslands – one definition?



It is not possible to develop a standard legend because legends are specific by region and scale.

It is feasible to adopt standard classification systems



How to represent ('map') the LPIS land cover?

1. Using a systematic framework or **classification system** defining the classes and criteria used to distinguish land cover, **independent of scale and data capture**
2. Through a **legend**, as the expression of the classification system applied by a **methodology** at a **defined scale**

Pan-European legend	1/10,000
????	ok

Besides, many mapping exercises develop legends that are a **hybrid** of land cover and land use classes:
"permanent pasture", "household garden"

How to represent ('map') the LPIS land cover?

Technical Specifications:

- Thematic resolution – how many classes?
- Thematic accuracy – 80%, 85%, artificial classes vs. others
- Positional accuracy – RMSE 1-d \leq 2.5 m, better?
- Minimum mapping unit – 0.10 ha , 0.25ha , 1 ha, various MMUs
- Minimum width of objects – 2 m, 4 m, 5 m, 10 m
- Maximum working scale – 10 000, 5 000, larger
- Update frequency – yearly, several years
- Data sources used – orthophoto, VHR, topomaps

FAO Land Cover Classification System (LCCS)

LCCS is a new **language** to describe the different land cover features in a standardised way.

1. **Comprehensive** (cover complete range, accommodate variability, enable comparisons)
2. **Practical** (adaptable, minimal number of classifiers)
3. **Scientifically sound** (systematic, multipurpose, scale independent, UML compliant)

A **language** uses words and syntax to create semantic concepts. The combination of words within the syntax generates a very large range of concepts.

FAO/UN Land Cover Classification System (LCCS)

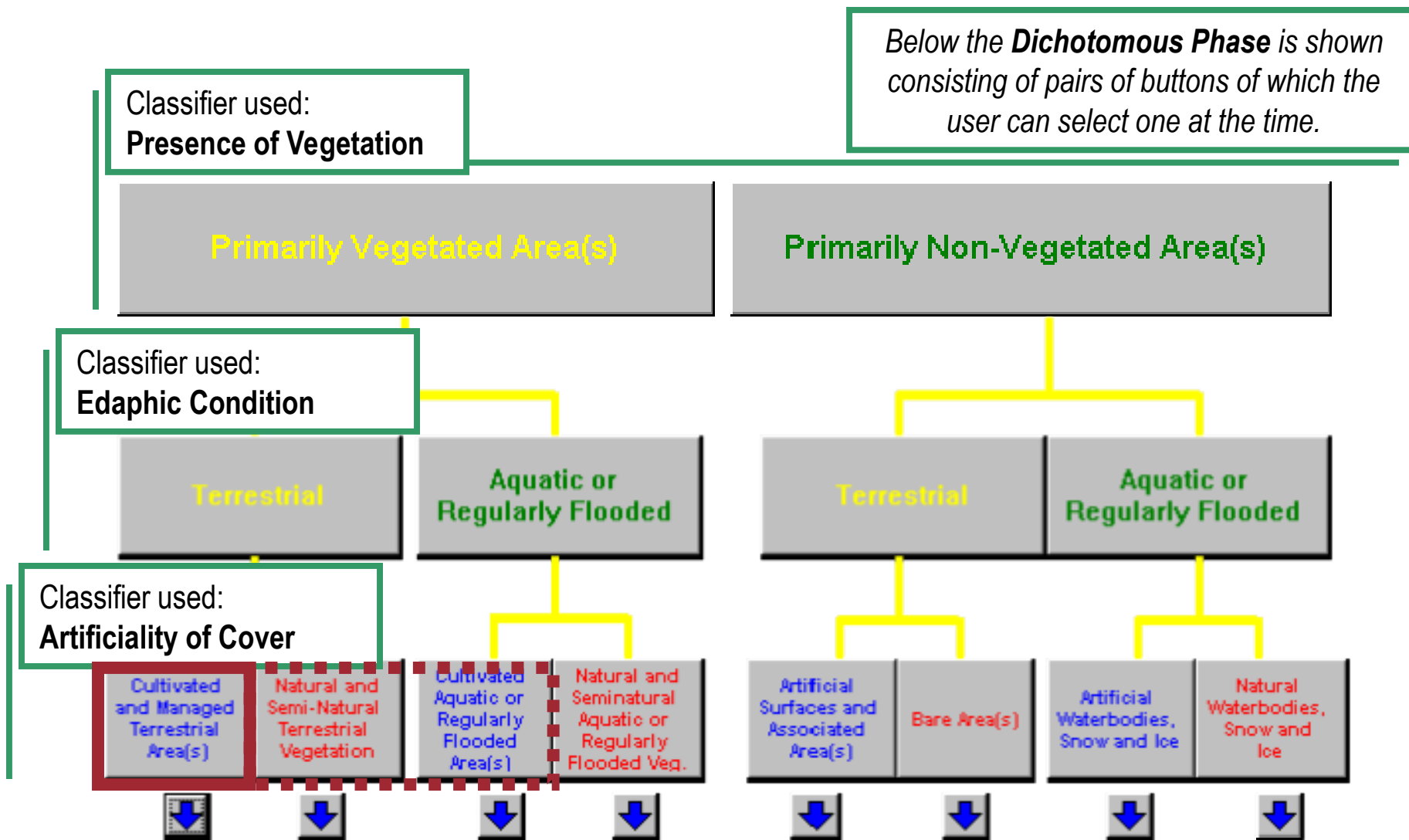
Draft ISO Standards for Land Cover Classification

ISO 19144-1 Geographic information – Classification Systems Part 1: Classification System Structure, and;

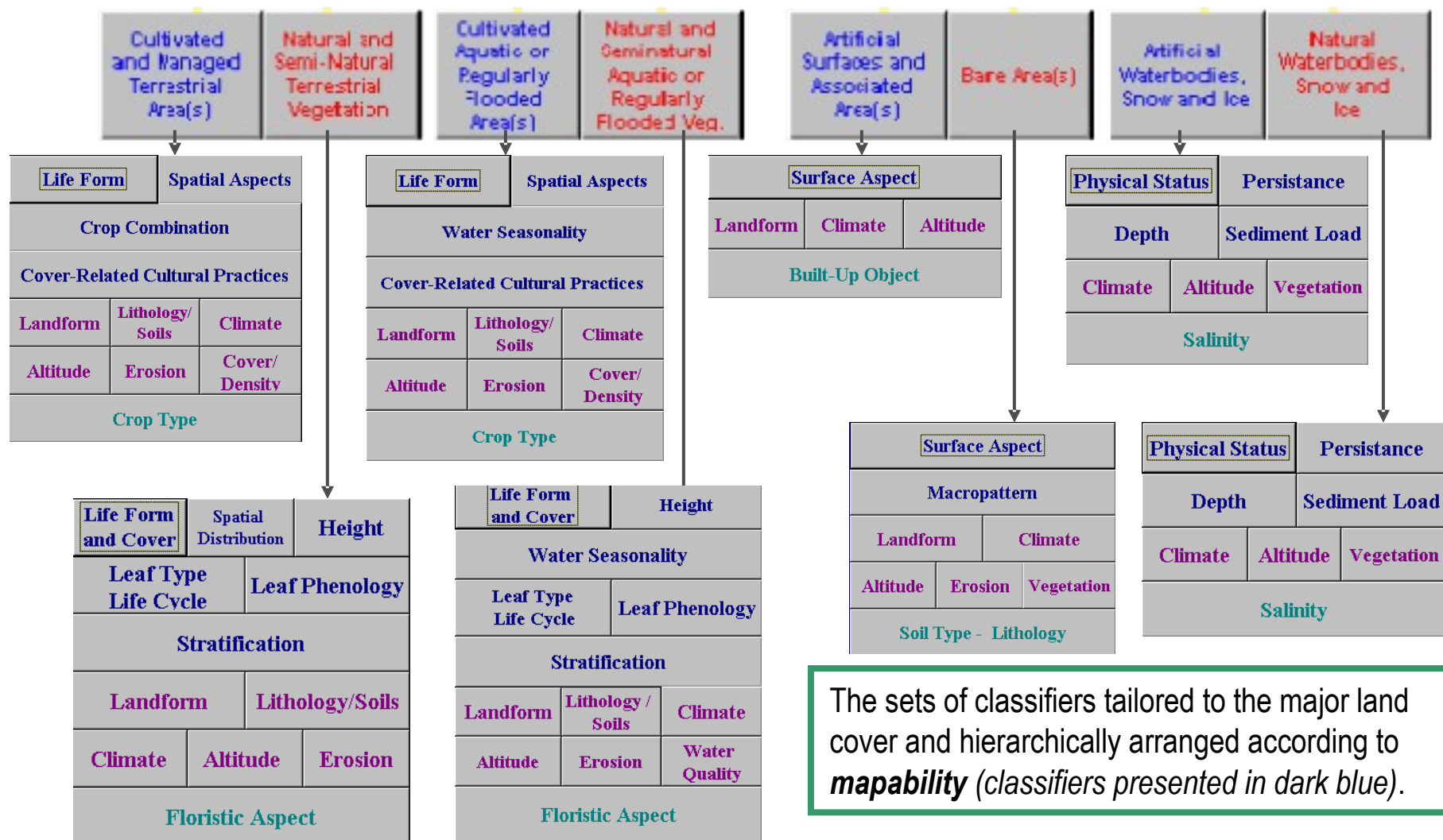
ISO 19144-2 Geographic information – Classification Systems Part 2: Land Cover Classification System (LCCS: UN-FAO, 2005)



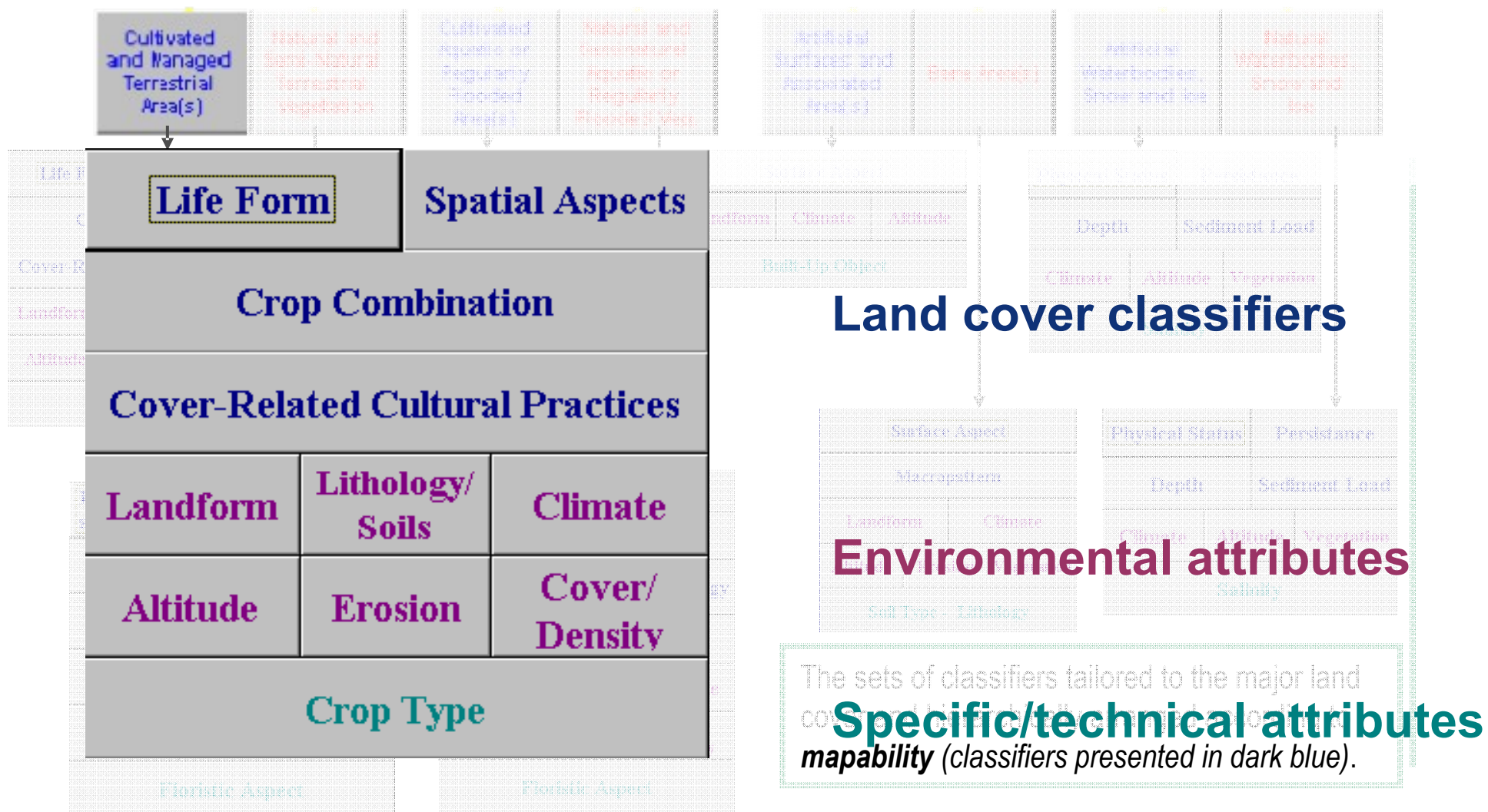
The initial Dichotomous Phase



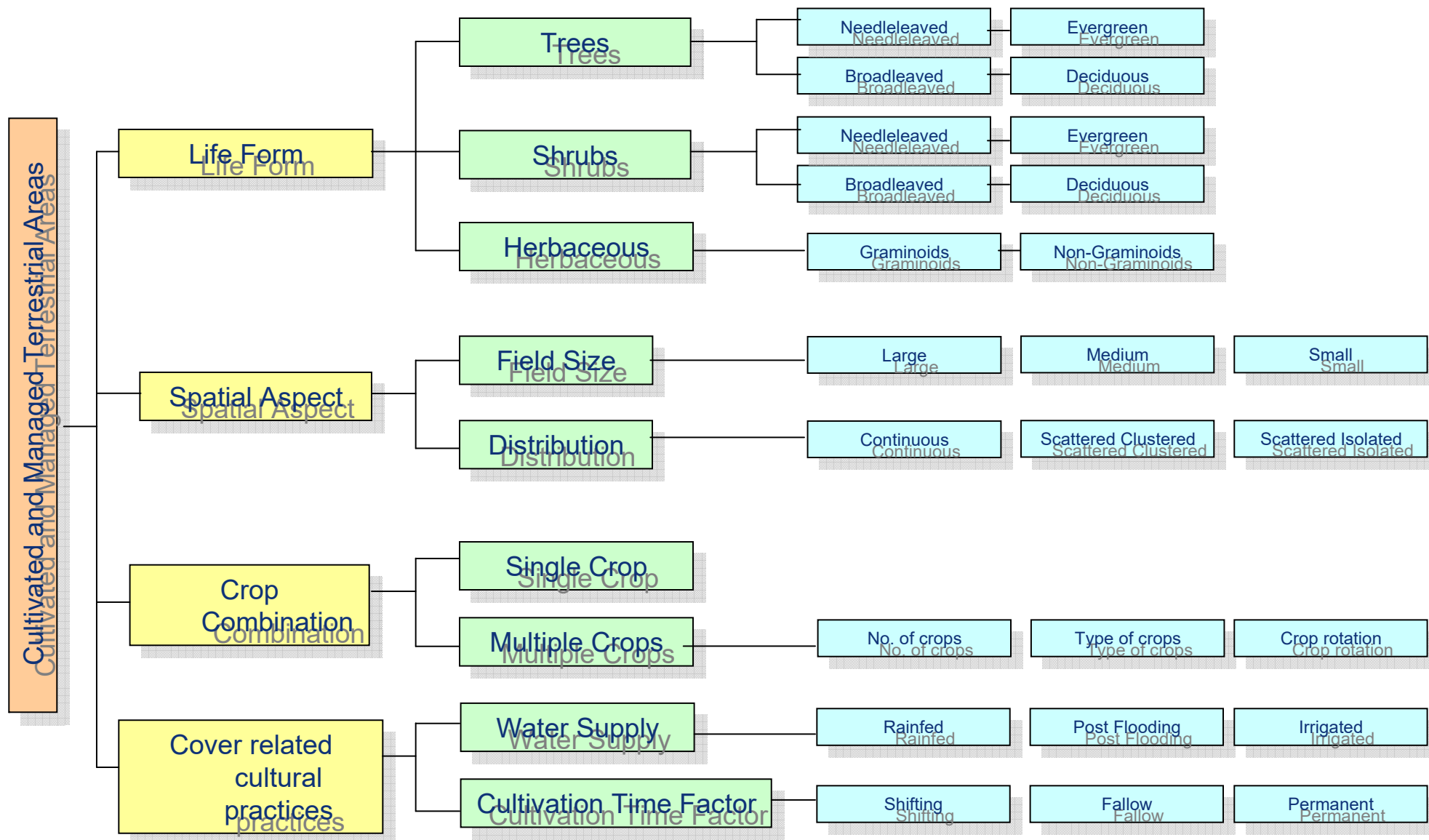
The subsequent **Modular-Hierarchical Phase**



The subsequent **Modular-Hierarchical Phase**



Classifier used in "Cultivated and Managed Terrestrial Areas"



Main Challenge

Does this framework enable us to delineate something that is a better representation of the maximum eligible area, than the land use delineation?

Expected advantages:

Æ A priori and comprehensive classification system

Æ Consistent and multipurpose classes

Æ true reference with Boolean formula

Æ Practical

Æ Concept of (variable) minimal mapable area

Æ Occurrence of Mixed mapping units (thresholds (10%/)-20%-50%)

Classification of LPIS land cover using LCCS

Arable land (BE – Wallonia)

Basic classifier:

Cultivated and Managed Terrestrial Areas

Life Form: Herbaceous

Spatial Aspect – Field size: N/A

Spatial Aspect – Distribution: Continuous

Spatial Aspect – Crop Combination:

Multiple Crops

Cover-related Cultural Practices - Water Supply: Rainfed

Cover-related Cultural Practices – Cultivation Time Factor: Fallow



Classifier Result	Boolean Formula	Standard Class Name	Code
Herbaceous Crops	A3XXB5C2D1D8	Herbaceous Crop(s), with Fallow System	10660

Classification of LPIS land cover using LCCS

Pasture (BE – Wallonia)

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

Classification of LPIS land cover using LCCS

Arable land (Bulgaria)

Basic classifier:

Cultivated and Managed Terrestrial Areas

Life Form: Herbaceous

Spatial Aspect – Field size: N/A

Spatial Aspect – Distribution: Continuous

Spatial Aspect – Crop Combination: N/A

Cover-related Cultural Practices - Water Supply: Rainfed

Cover-related Cultural Practices – Cultivation Time Factor: Shifting



Classifier Result	Boolean Formula	Standard Class Name	Code
Herbaceous Crops	A3XXB5XXD1D7	Shifting Cultivation of Herbaceous Crop(s)	10224

Classification of LPIS land cover using LCCS

Pasture (Bulgaria)

Basic classifier:

Natural and Semi-Natural Terrestrial Vegetation

Life Form: Herbaceous (graminoids)

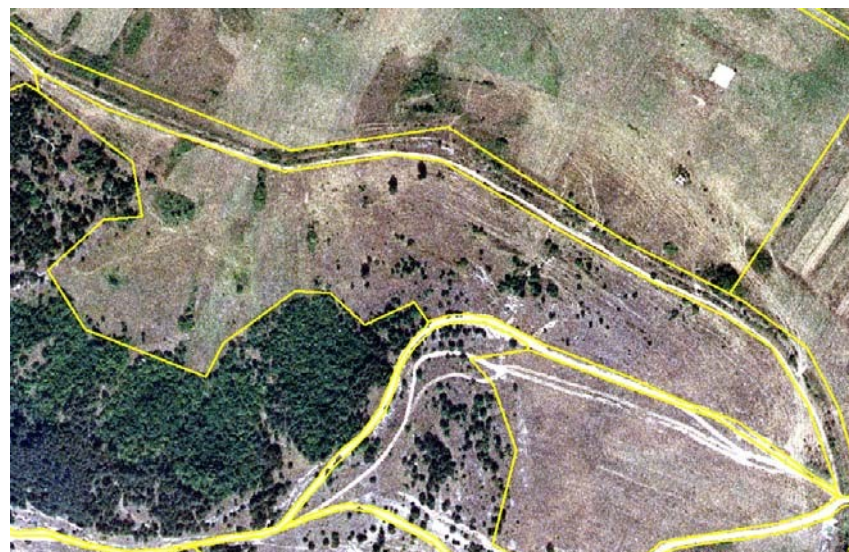
Cover: Open (60 - 15%) **Height:** 0.3-0.8 m

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

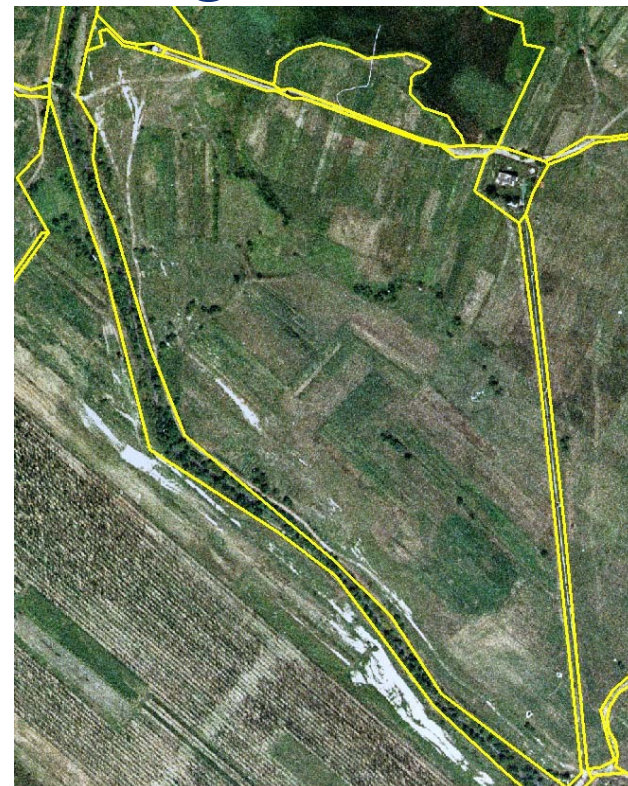
Classifier Result	Boolean Formula	Standard Class Name	Code
Grasslands	A6A11B4XXXXXXF2F5 F10G2F1-T2 Modifier: B12G7	Open Medium Tall Grassland With Low Trees, Floristic Aspect: Groups of Plant Species	20486-12290-T2

Classification of LPIS land cover using LCCS

Arable Land with Patches of Sparse Trees

Basic classifiers:

- **Cultivated and Managed Terrestrial Areas (dom. class)**
- **Natural and Semi-Natural Terrestrial Vegetation (sec. class)**



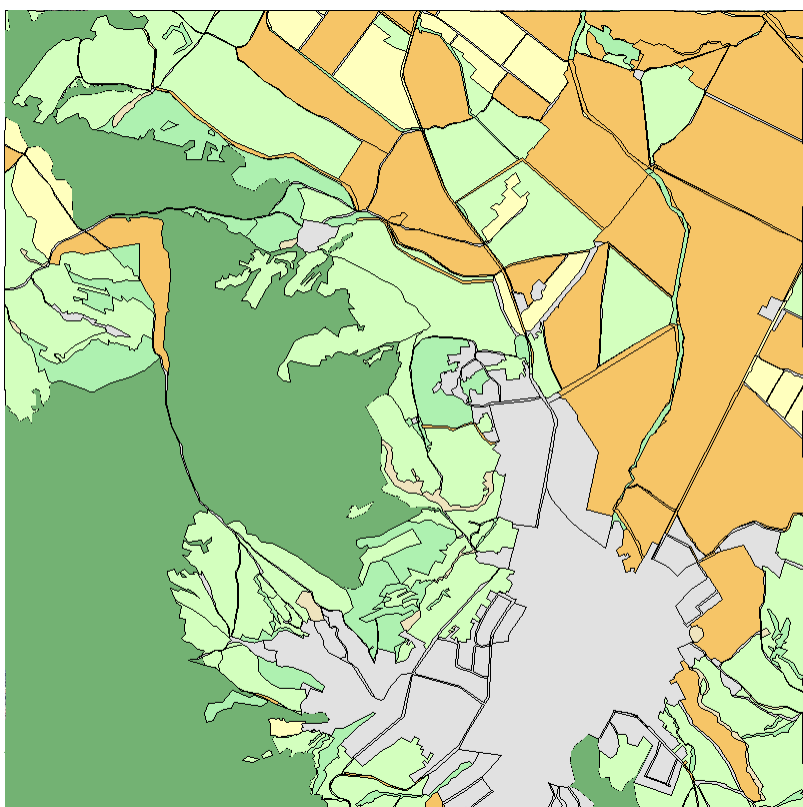
Classifier Result	Boolean Formula	Standard Class Name	Code
Mixed Class	A3XXB5C2D1D8 / A3A14B2XXXXXXF2F4F1 0G4-A16	Herbaceous Crop(s) ., With Fallow System / Scattered Trees And Sparse Herbaceous	10660 / 20505-9032

Test Cases – Bulgarian LPIS

The Reference Parcel is Physical Block.

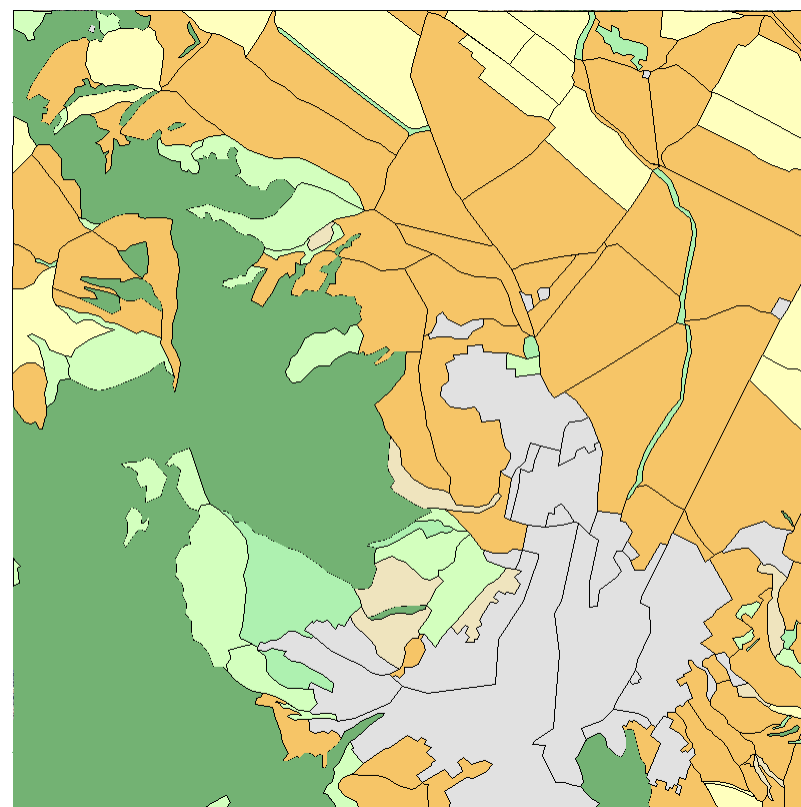
Full coverage of the country. LC/LU code assigned to each RP

LPIS Land cover/Land use map 1:10 000



-  Forest
-  Arable land
-  Mixed
(arable/grass/trees)
-  Grassland
-  Woodland
-  Urban

**Independent Land Cover Mapping 1:10 000
Using LCCS concept**

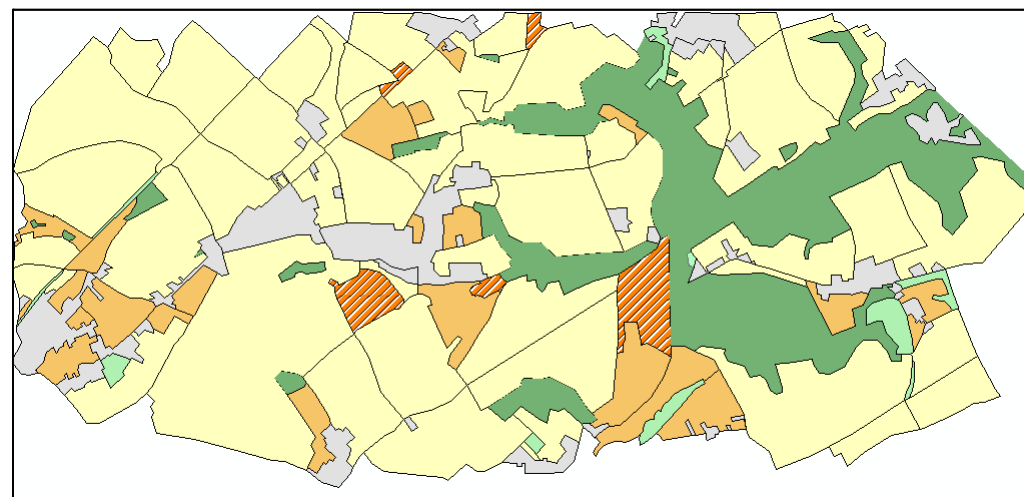


Test Cases – Belgian (Wallonie) LPIS

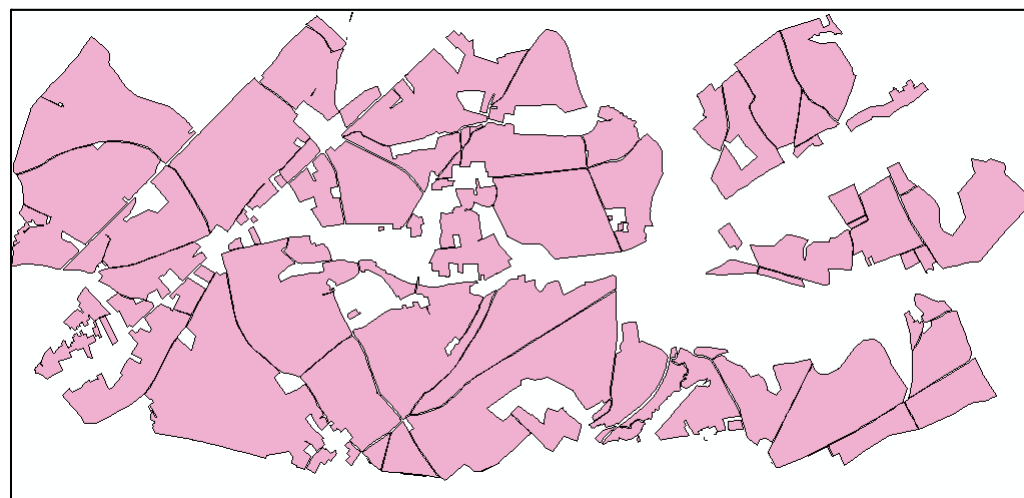
The Reference Parcel is the Physical Block,
aggregated of adjacent agricultural parcels
Only Agriculture land is covered with RP



Independent Land Cover
Mapping 1:10 000
Using LCCS concept



Reference Parcels from
the LPIS 1:10 000



Art. 44 of Reg 796/04 classes in LCCS

LCCS classifier results after strict interpretation

LC	User Label	Code	Boolean Formula
3Herbaceous Crops	Arable Land (general)	10099	A3XXB5C2
3Herbaceous Crops	Arable Land (temporary resting)	10224	A3XXB5XXD1D7
5Non-Graminoid Crops	Permanent crops (banana)	11002-S0604	A5XXB5C1D1D9-S0604
5Non-Graminoid Crops	Permanent crops (hops)	11002-S0803	A5XXB5C1D1D9-S0803
1Tree Crops	Permanent crops (orchards)	10153	A1XXB5XXD1D9
2Shrub Crops	Permanent crops (vineyards)	10566-1891-S0610	A2XXB5C1D1D9-A7A10-S0610
5Grasslands	Permanent pasture (self-seed)	20439-12763-T2	A6A10B4XXXXXXF1-B15-T2
4Graminoid Crops	Permanent pasture (sown)	10822-S0701	A4XXB5C1D1D9-S0701

Art. 44 of Reg 796/04 classes in LCCS (extended)

LCCS classifier results with additional land uses, environmental attributes, mixed classes,.....

LC	User Label	Code	Boolean Formula
3Herbaceous Crops	Arable Land (general)	10099	A3XXB5C2
3Herbaceous Crops	Arable Land (rainfed with fallow system)	10660	A3XXB5C2D1D8
3Herbaceous Crops	Arable Land (temporary resting)	10224	A3XXB5XXD1D7
9Mixed Class	Arable Land with Patches of Scattered Trees (v2)	10660 / 20505-9032	A3XXB5C2D1D8 / A3A14B2XXXXXXF2F4F10G4-A16
9Mixed Class	Arable Land with Patches of Trees (v1)	10660 / 20505	A3XXB5C2D1D8 / A3A14B2XXXXXXF2F4F10G4
5Non-Graminoid Crops	Permanent crops (banana)	11002-S0604	A5XXB5C1D1D9-S0604
5Non-Graminoid Crops	Permanent crops (family gardens)	11135	A5B2B5C2D3D9
5Non-Graminoid Crops	Permanent crops (hops)	11002-S0803	A5XXB5C1D1D9-S0803
1Tree Crops	Permanent crops (olive trees)	10494-1-S0910	A1XXB5C1D1D9-A7A9-S0910
1Tree Crops	Permanent crops (orchards)	10153	A1XXB5XXD1D9
2Shrub Crops	Permanent crops (shrub type)	10188	A2XXB5XXD1D9
2Shrub Crops	Permanent crops (vineyards)	10566-1891-S0610	A2XXB5C1D1D9-A7A10-S0610
5Grasslands	Permanent pasture (self-seed with shrubs)	20488-12292-T2	A6A11B4XXXXXXF2F6F10G3-B12G9-T2
5Grasslands	Permanent pasture (self-seed)	20439-12763-T2	A6A10B4XXXXXXF1-B15-T2
4Graminoid Crops	Permanent pasture (sown)	10822-S0701	A4XXB5C1D1D9-S0701

Conclusions

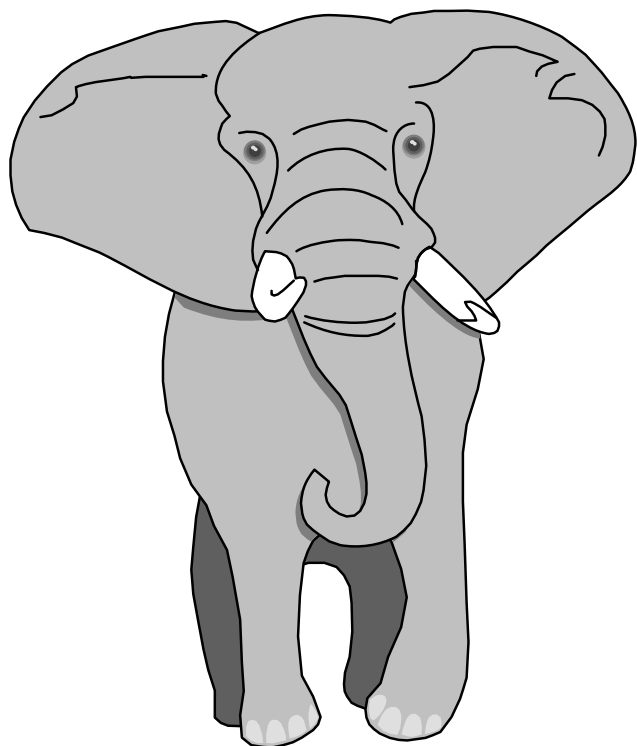
LCCS methodology seems feasible:

- Classes can be defined based on the classifiers
- Corresponding land features can be mapped at required scale

Further work needed

- Acceptance of the land cover concept as basis for LPIS-eligibility quantification
- The LCCS-based LPIS legend(s) need to be agreed
- The mixed effects to be quantified

Thank you for your attention!



Look Sancho! An elephant!

¡No señor!
It's a *Loxodonta africana oxyotis*

