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# BRINGING THE LCML AND EAGLE CONCEPTS TOGETHER

STANDARDS FOR THE LAND COVER AND LAND USE DOMAIN

ISO TC211 - STANDARDS IN ACTION WORKSHOP, COPENHAGEN

30. MAI 2018  
DI ROLAND GRILLMAYER

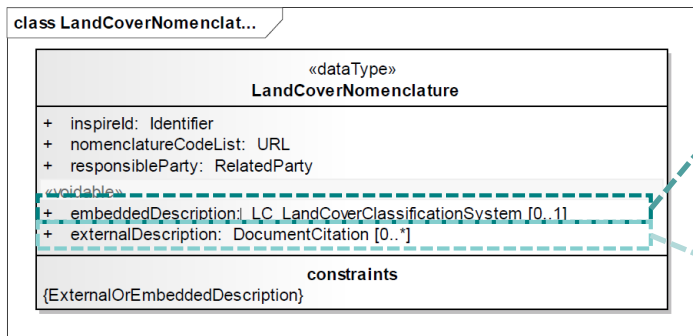
# ARGUMENTS FOR THE REVISION OF ISO19144-2

- *Priority 1 goals (P1) for upcoming LCML revision*
  - Reflect some user experience to derive priority 1 goals  
Study: Translation of the CORINE Land Cover nomenclature to the Land Cover Meta Language using LCCS3
- *Priority 2 goals (P2) – Harmonization of LCML and EAGLE Concepts*
- LCML and the EAGLE matrix represent two very similar concepts with the same scope
  - **ISO 19144-2** specifies a Land Cover Meta Language (LCML) expressed as a UML metamodel that allows different land cover classification systems to be described based physiognomic aspects. A LC-Class is described by the overall LC\_Class Characteristics and a set of land cover meta-elements and their characteristics.
  - **The EAGLE matrix** is a concept for analytic decomposition of class definitions and semantic translation between land cover nomenclatures. It is structured in three blocks: land cover components (LCC), land use attributes (LUA) and further characteristics (CH).

# P1: LCML & INSPIRE

- LCML used in the dataType „LandCoverNomenclature“ for the embeddedDescription

**TG Requirement 3** Each nomenclature used by a Land Cover Data set shall be described by at least one of the two attribute *externalDescription* or *embeddedDescription*.



## ***embeddedDescription***

it allows using ISO 19144-2 (LCML metalanguage) to provide a description of the classification system with this common metalanguage.

*LC\_LandCoverClassificationSystem* is the root class from ISO 19144-2 to **instantiate a DEFINITION** of a nomenclature with LCML.

## ***externalDescription***

this attribute allows to provide a set of URL pointing to the documentation (specification or other document) describing the classification system used and the nomenclature used.

# P1: LCML & INSPIRE

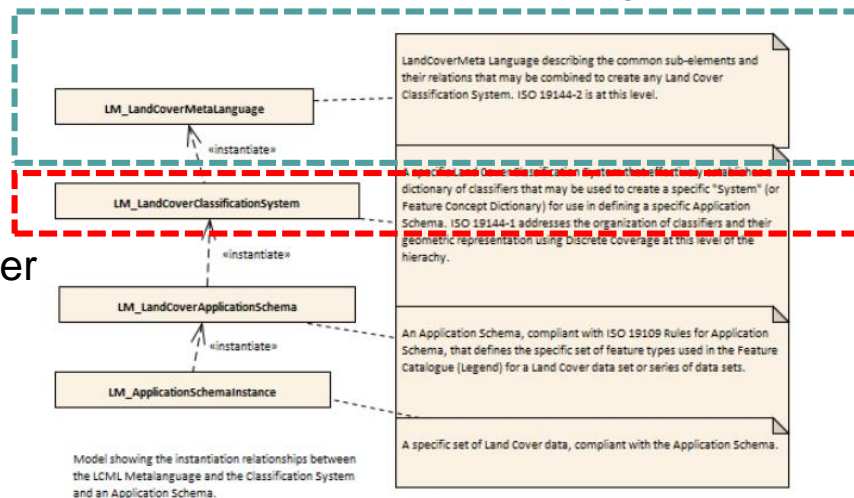
- LandCoverNomenclature.xsd

- XSD-definition *embeddedDescription*

```
▼<complexType name="LandCoverNomenclatureType">
  ▼<sequence>
    ▼<element minOccurs="0" name="embeddedDescription" nillable="true">
      ▼<annotation>
        ▼<documentation>
          -- Name -- embedded Description -- Definition -- An embedded encoding of the classification
          system according to ISO 19144-2.
        </documentation>
      </annotation>
    </element>
  </sequence>
  ▼<complexType>
    ▼<complexContent>
      ▼<extension base="anyType">
        <attribute name="nilReason" type="gml:NilReasonType"/>
      </extension>
    </complexContent>
  </complexType>
</complexType>
```

# P1: LCML – LEVEL OF ABSTRACTION

- No xsd schema of ISO 19144-2 is available at the official ISO TC211 register
- XSD automatically derived from the Harmonized Model
- Adaption of UML Diagrams needed?
- Modification of INSPIRE DS Land Cover
  - Use of LCCS Version 3
    - Export of xsd which defines the data structure the LandCoverClasses
    - really what is required for the *embeddedDescription*? →






**For the *embeddedDescription* a *instantiate* of a LC DEFINITION of a common nomenclature is foreseen**

# P1: LCML - AMBIGUOUS CLASS DOCUMENTATION

- User experience - Study “Translation of the CORINE Land Cover nomenclature to the Land Cover Meta Language using LCCS3” -Portuguese Geographic Institute (IGP)

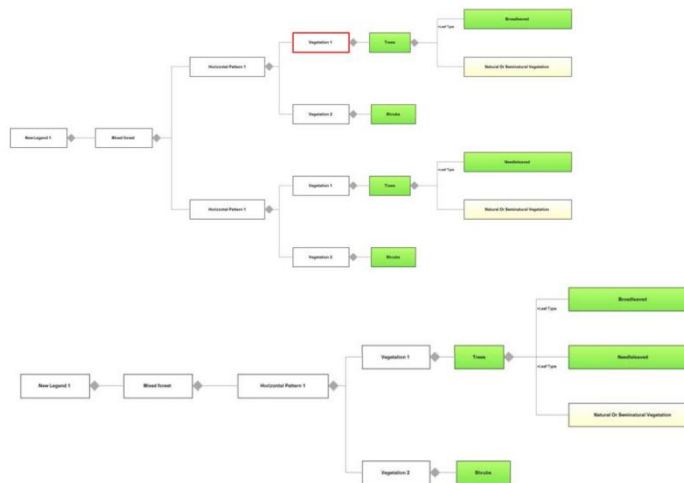
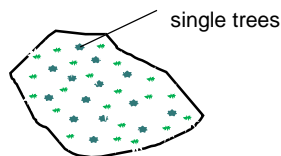
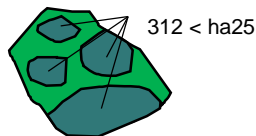
CODE	Designation	Adaptation to Portugal	Translation process	User defined structure
111	Continuous urban fabric			
112	Discontinuous urban fabric			
121	Industrial or commercial units			
122	Road and rail network and associated land			Yes
123	Ports			
124	Airports			
131	Mineral extraction sites			
132	Dump sites			
133	Construction sites			
141	Green urban areas			Yes
142	Sport and leisure facilities			
211	Non-irrigated arable land			Yes
212	Permanently irrigated arable land	Includes Drip irrigation type; Excludes irrigated permanent crops (e.g. Irrigated Orchard)		
213	Rice fields			
221	Vineyards			
222	Fruit trees and berry plantations			
223	Olive groves			
231	Pastures			
241	Annual crops associated with permanent crops			
242	Complex cultivation patterns			
243	Intensively managed agricultural areas with significant areas of natural vegetation			
244	Agro-forestry areas	Tree cover > 10%		
311	Broad-leaved forest			
312	Coniferous forest			
313	Mixed forest			
321	Natural grasslands			
322	Moors and heathland	Geographic distribution		
323	Sclerophyllous vegetation	Geographic distribution		
324	Transitional woodland/shrub	Tree cover > 10%		Yes

331	Beaches, dunes and sand plains			
332	Bare rocks			
333	Sparsely vegetated areas			
334	Burnt areas			Excludes burnt 321
335	Glaciers and perpetual snow			Unexisting in Portugal
411	Inland marshes			
412	Peat bogs			
421	Salt marshes			
422	Salines			
423	Intertidal flats			
511	Water courses			
512	Water bodies			
521	Coastal lagoons			
522	Estuaries			
523	Sea and ocean			

	Straight forward translation
	Somewhat questionable translation
	Very questionable translation

# P1: LCML - UNAMBIGUOUS CLASS DOCUMENTATION

- Example Mixed Forest 313 – different ways to document one and the same CORINE LC Class



Upcoming questions for mixed forest definition:

- User mistake based on the high complexity of the LCML concepts
- Wrong use of the “mixed classes”

# P1: LCML - AMBIGUOUS CLASS DOCUMENTATION

Final considerations of the CLC-LCCS Study:

- There is more than one (correct) form to describe a Land Cover class using LCCS –  
CLC Note: *Unambiguous class definition of CLC | Complexity of LCML*
- Its not clear when to stop in detailing class descriptions  
Note: *Expert knowledge required for the formalization of the textual description of CLC classes!!*
- Dealing with horizontal and vertical patterns is not very intuitive an increase the complexity of LCCS



# PRIORITY 1 GOALS FOR UPCOMING LCML REVISION

- Clarification about the relationship and different abstraction level of LCML and LCCS with the informal annex
- Provide an official XSD for LCML / LCCS on the ISO TC211 register
- If possible ease LCML complexity for usability aspects
  - Provide some profiles reducing the complexity
- Guarantee backwards compatibility of LCML
  - Existing Software implementation which is based on LCML
  - LCCS Version 3 → in use in many projects especially in the African and Asian continent

## P2: HARMONISE LCML & EAGLE CONCEPTS

- Bringing LCML and EAGLE World together



LCML-World



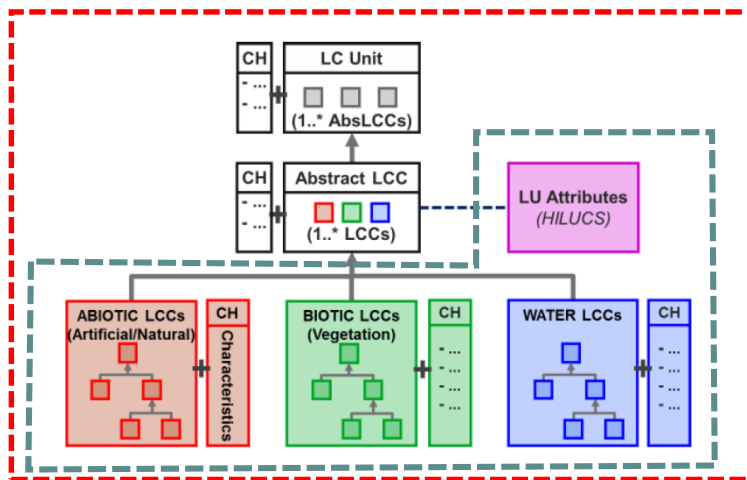
LCML-World

Talking about the same phenomena, using similar concepts but different semantic ☹️

# P2: HARMONISE LCML & EAGLE CONCEPTS

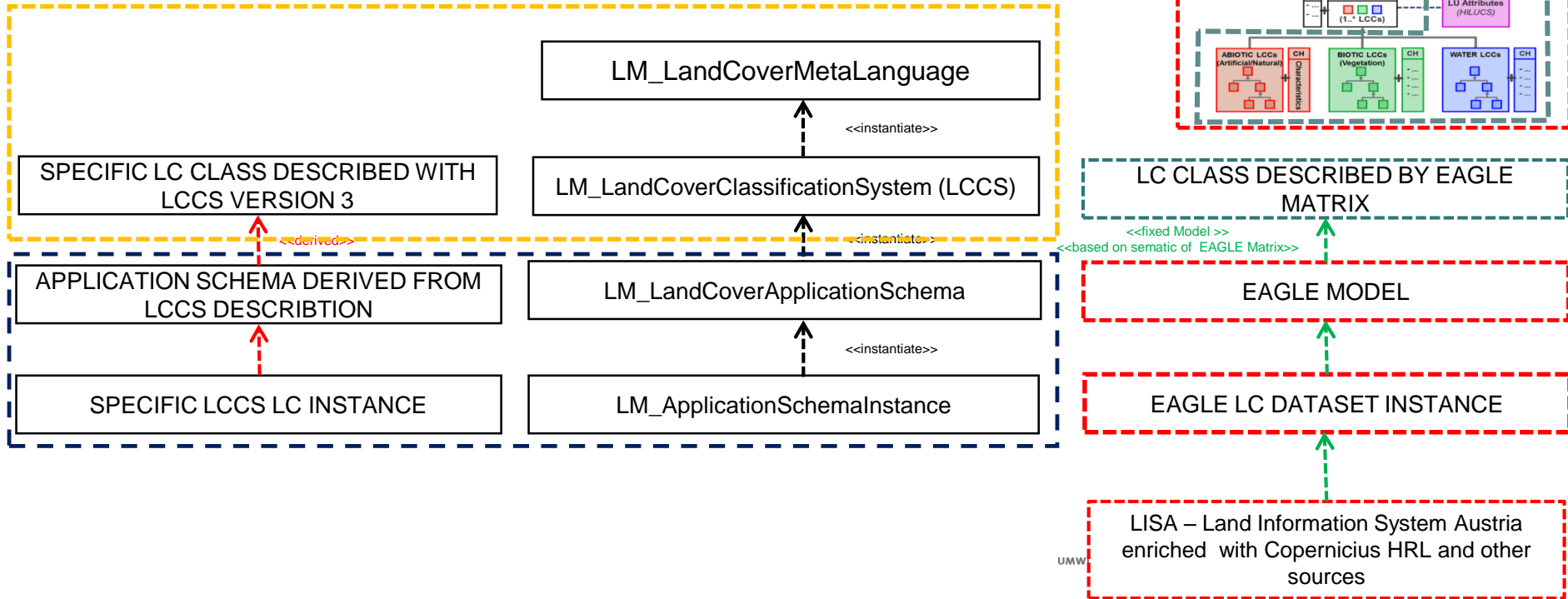
## GENERAL EAGLE CONCEPT: EAGLE PROVIDE A

- **EAGLE Land Cover Data model** using the semantics of the **EAGLE matrix** (main difference to LCML)
- **EAGLE matrix** represent Land Cover Class definitions in a machine-readable way (vice versa LCCS)
- **LC Datasets** which are instanced/encoded based on the EAGLE Land Cover Data Model can be automatically transformed in any LC-Nomenclature which is documented with the EAGLE matrix.



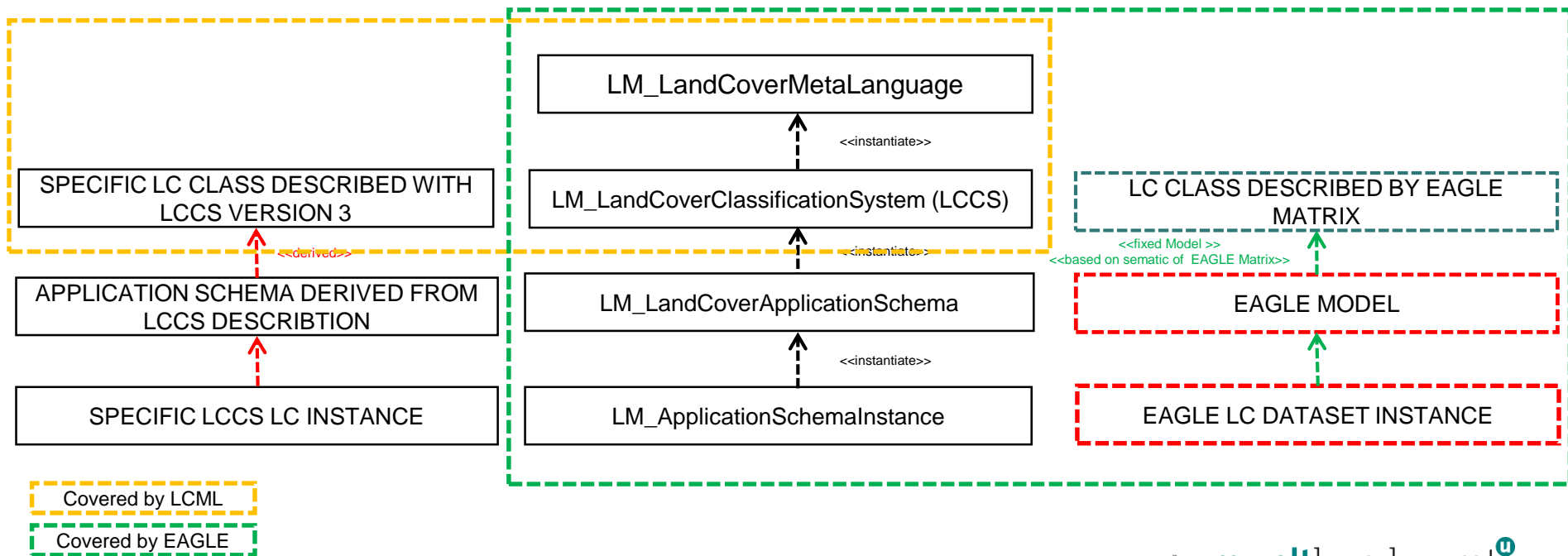
# P2: HARMONISE LCML & EAGLE CONCEPTS

- Relationship between EAGLE Concepts and LCML



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- Relationship between EAGLE Concepts and LCML



## P2: HARMONISE LCML & EAGLE CONCEPTS

- Sematic of the EAGLE Matrix is more restrictive
  - user defined structures are not allowed
  - e.g. Land Use is restricted to HILUC Classes
- Documentation of Land cover nomenclature is much more intuitive
  - Only one “horizontal pattern” is available
  - Documentation of a LC-Class using the EAGLE matrix is build up as a “linear workflow”
  - Documentation of a LC-Class using LCCS is more decision tree oriented
    - ending in ambiguous LC class descriptions
- Shortcomings of the EAGLE Matrix
  - Definition of value ranges (e.g. Tree Cover Density between 30% and 70%) is not covered at the moment!

# PRIORITY 2 GOALS FOR LCML REVISION

- Bringing the LCML and EAGLE World together would
  - decrease the confusion within the LC community and
  - increase the semantic interoperability for land cover datasets worldwide
- Possible reviewing/harmonization strategies at ISO TC211
  - Establishing a semantic harmonization between the terms and definitions of the eagle components and LCML meta classes
    - Based on a semantic mapping (ontology based approach)
    - Modification of the eagle matrix (adaption to the LCML semantics)
    - Modification of LCML (more critical – backward compatibility aspects)
  - Establishing the EAGLE Matrix using the profiling mechanism of ISO TC 211 (informal ANNEX of ISO 19144-2)
  - Topic Land Use → in both Concepts shortcomings according the LU aspects?

# NEXT STEPS

## Establishing a Project 0 at ISO/TC211 – Resolution tomorrow

- Bringing together the domain experts of LC and LU
  - Call for experts!!
  - Develop a cross domain understanding of LC and LU
  - Who to deal with the semantic and conceptual harmonization issues between LCML and EAGLE?
    - Which ISO mechanism are available and most suitable
  - Discuss what standards are required to increase the needless information exchange between the child themes Land Cover and Land Use
- For both, priority 1 and priority 2 revision of LCML funding is needed!!



# BRINGING THE LCML AND EAGLE CONCEPTS TOGETHER

## ISO TC211 - STANDARDS IN ACTION WORKSHOP



30. MAI 2018

### **DI Roland Grillmayer**

Environment Agency Austria

Biodiversity & Nature Conservation

T: +43-(0)1-313 04/3331

F: +43-(0)1-313 04/3700

M: +43-(0)-676-9410850

[roland.grillmayer@umweltbundesamt.at](mailto:roland.grillmayer@umweltbundesamt.at)

Web: [www.grillmayer.eu](http://www.grillmayer.eu)