The EAGLE Concept
-
Paving the way for a new European Land Monitoring System

Stephan Arnold, Barbara Kosztra, Gebhard Banko, Geoff Smith, Christoph Perger, Michael Bock, Geir-Harald Strand, Cesar Martinez, Julian Delgado

EAGLE Group

Content

- Background and Motivation
- Criteria and Structure of Data Model
- Semantic decomposition
- EAGLE use cases
- Summary

Preamble: Who is „EAGLE“?

- EAGLE = EIONET Action Group on Land Monitoring in Europe
- Participants are
  - Land Monitoring experts and
  - Representatives of National Reference Centres (NRC) for Land Cover in the EEA´s EIONET (European Environmental Information and Observation Network)
- Established in 2009 as self-initiative
- Focus on object-oriented data modelling
- Open „membership“ based on own commitment
- Firstly no external funding, meanwhile supported by EEA funding, waiting for continuation …

Background and Motivation

Harmonisation and integration of different data sources on land cover and land use require:

- Clear and non-overlapping class definitions
- Synchronized time interval of data capture
- Comparable minimum mapping units
- Similar data quality

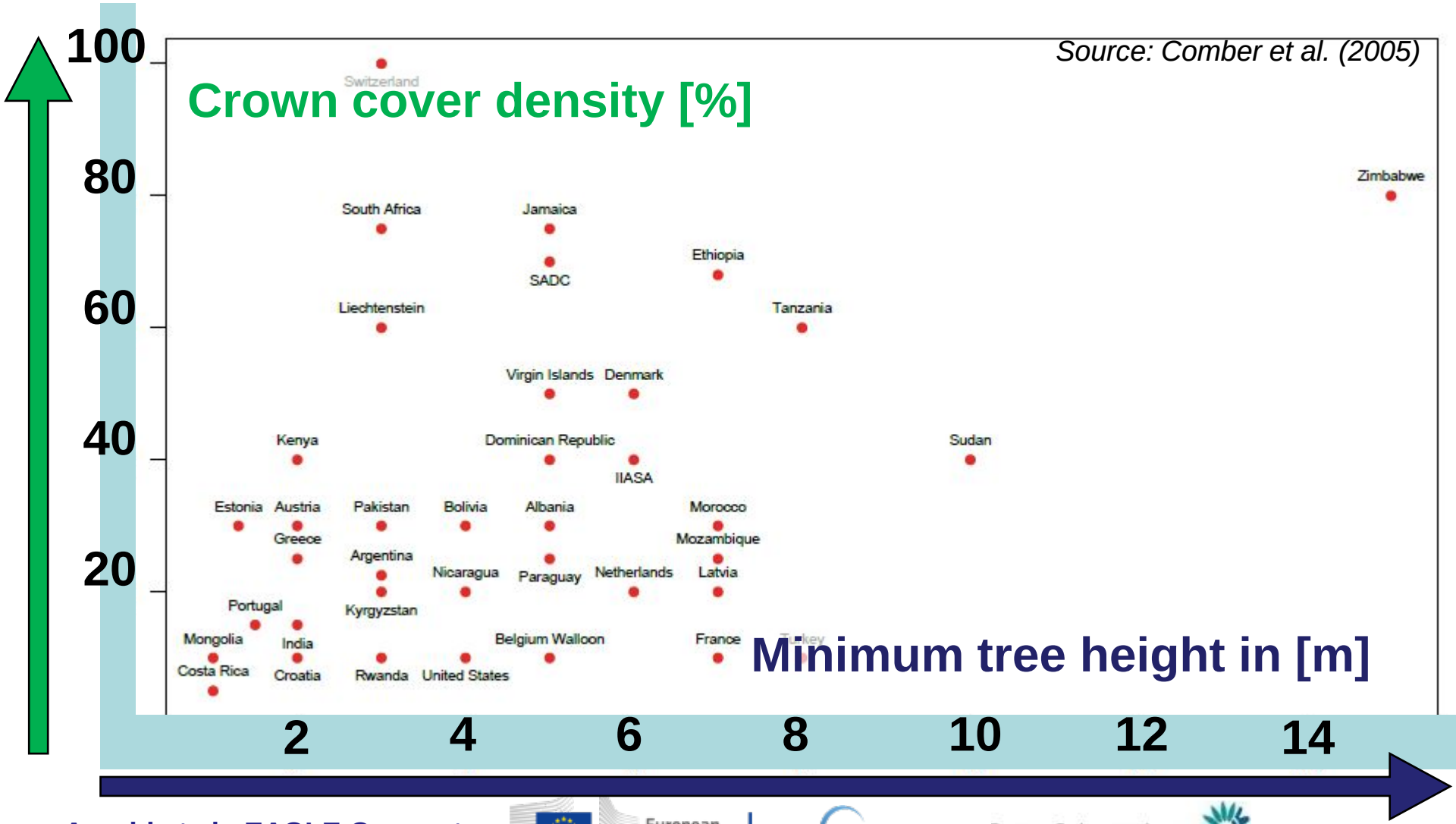
Background and Motivation

- **Many applications of LC/LU data lead to various different classification systems (on national or European level)**

  Effects :

  - Mixture of LC and LU classes
  - Specific fields of work have own emphasis on thematic categories
  - Lack of comparability between nomenclatures hamper exchange of information between data sets

Differences in „Forest“ definitions worldwide



Ein Brot (dt.) is a bread (en.) est un pain (fr.) é pane (it.) es pan (sp.) ist ein Brot …

Characterization

- Ingredients
  - Salt
  - Wheat
  - Water
  - Yiest
  - E 510, ...
- Weight
  - 1,5 Kilo
  - 3 pounds
- Color
  - light
  - dark brown
- Other details
  - biocertificated
  - vegan

Characterization

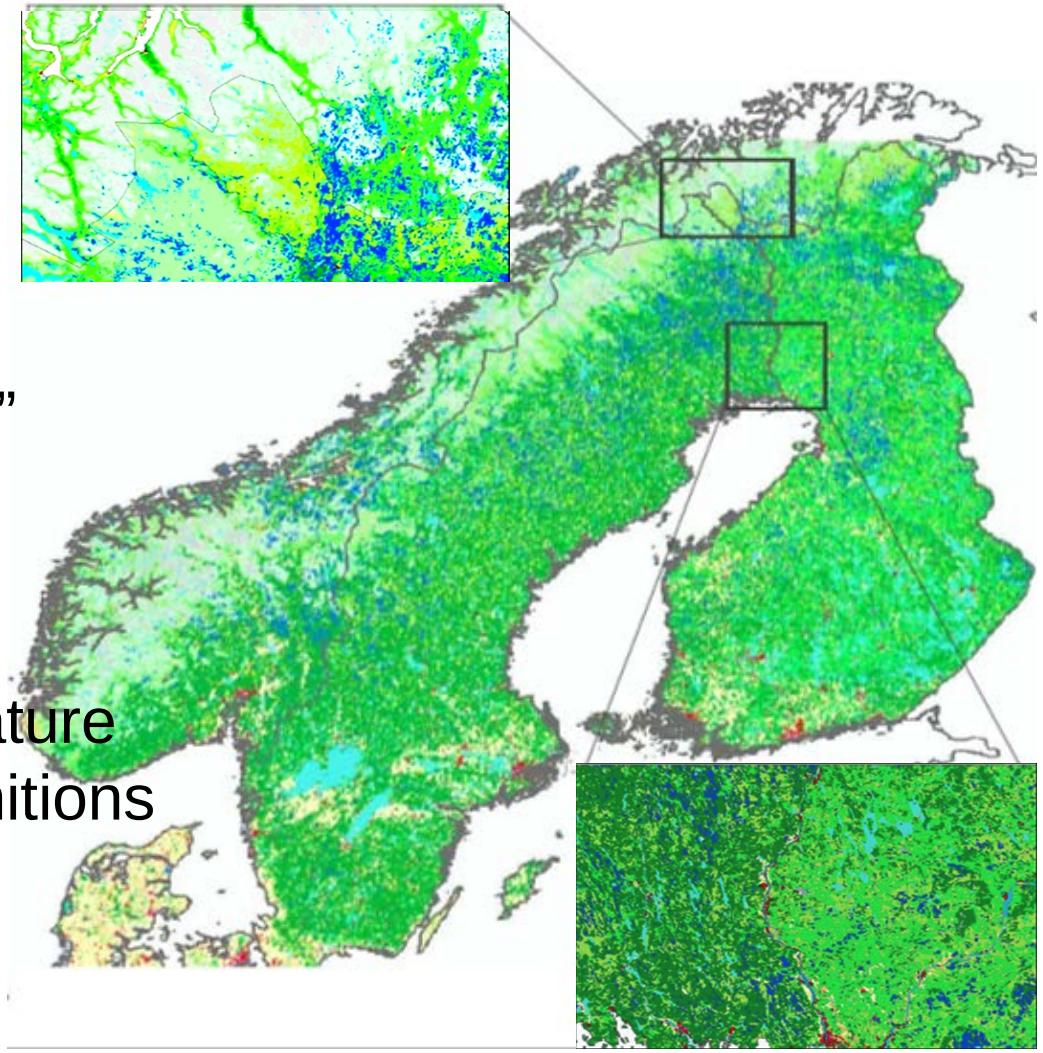
- Growth form
  - homogeneous
  - heterogenous
- Growth density
  - slosed
  - sparcely
- Soil condition
  - wet
  - dry
  - acidic
- Use / Funktion
  - Pasture
  - Recreation
  - Sport
  - Air traffic
- Ecosystem type
  - Wetland, swamp

Semantic overlap between class definitions

Alpine Calluna heath, border between SE and FI

Semantic overlap between class definitions

- CLC 333
  “Sparsely vegetated”
- CLC 322
  “Moors and heathland”
- Both products correct,
  but:
  inconsistent nomenclature
  due to overlap of definitions



Classification and Interpretation

- **Same term – different meaning**
- **Same content – different name**

+

- **difference in interpreting the class definitions or tolerance of class definition**

=> Comparable / Non-comparable data ?

Criteria for data model

- Clear separation between LC and LU
- Scale independent
- Object-oriented description instead of classification
- Complete coverage of themes LC and LU
- Modelling of temporal phenomena
- Applicable on national and European level

De-Composition of landscape

From classification to object-oriented description

De-Composition of CORINE Land Cover classes

1.1.1 Continuous urban fabric:
Most of the land is covered by structures and transport network. Buildings, roads and artificially surface areas cover more than 80% of the total surface. Non-linear areas of vegetation and bare soil are exceptional

1.1.2 Discontinuous urban fabric
Most of the land is covered by structures. Buildings roads and artificially surface areas are associated with vegetated areas and bare soil, which occupy discontinuous but significant surfaces. Between 10% and 80% of the land is covered by residential structures.

LC
LU
CH
Parameter

Structure of the EAGLE matrix

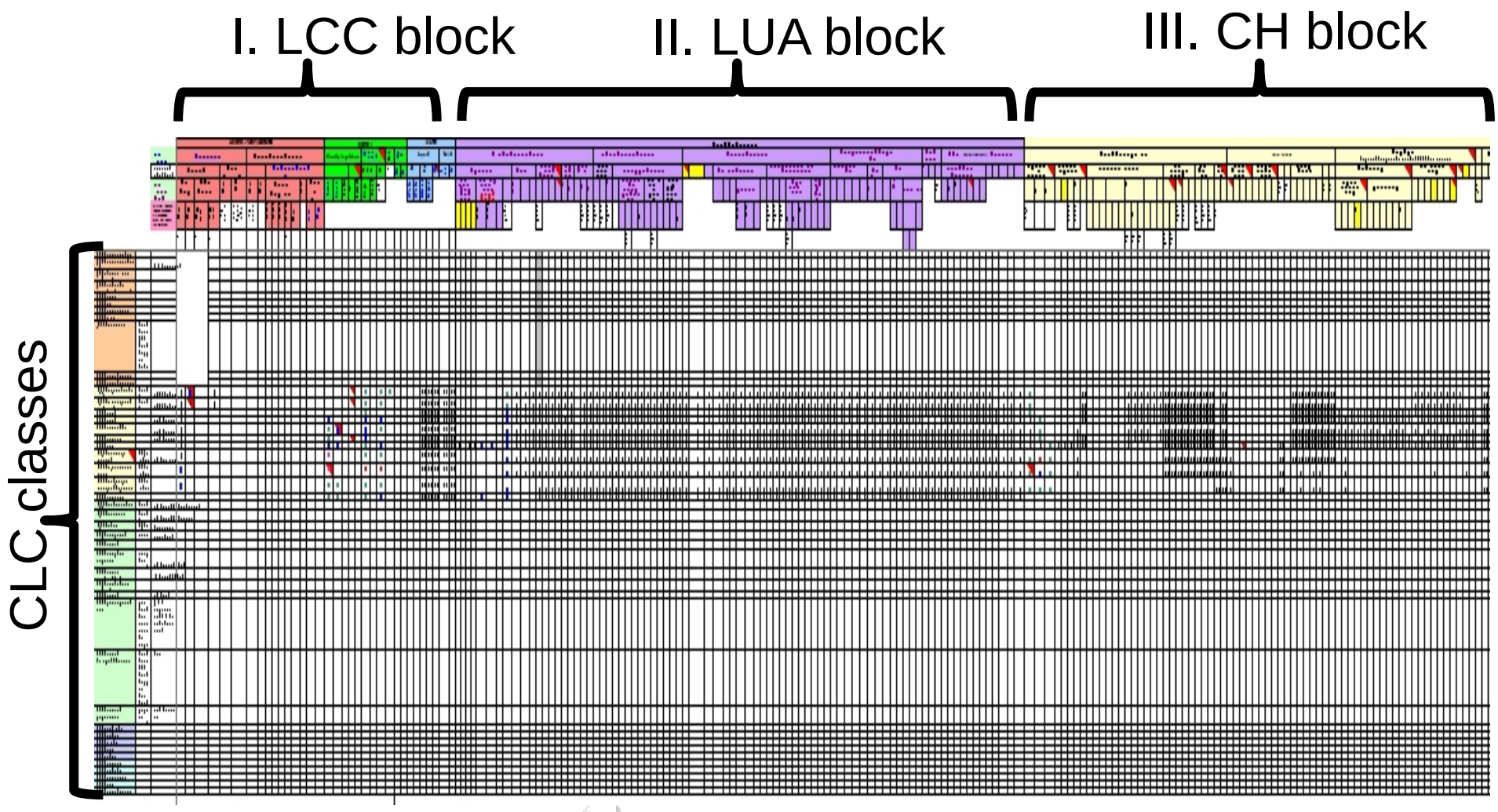
Information on landscape described with three separate blocks:

I.) LAND COVER Components – LCC
Abiotic (Artificial + Natural), Vegetation, Water Surfaces

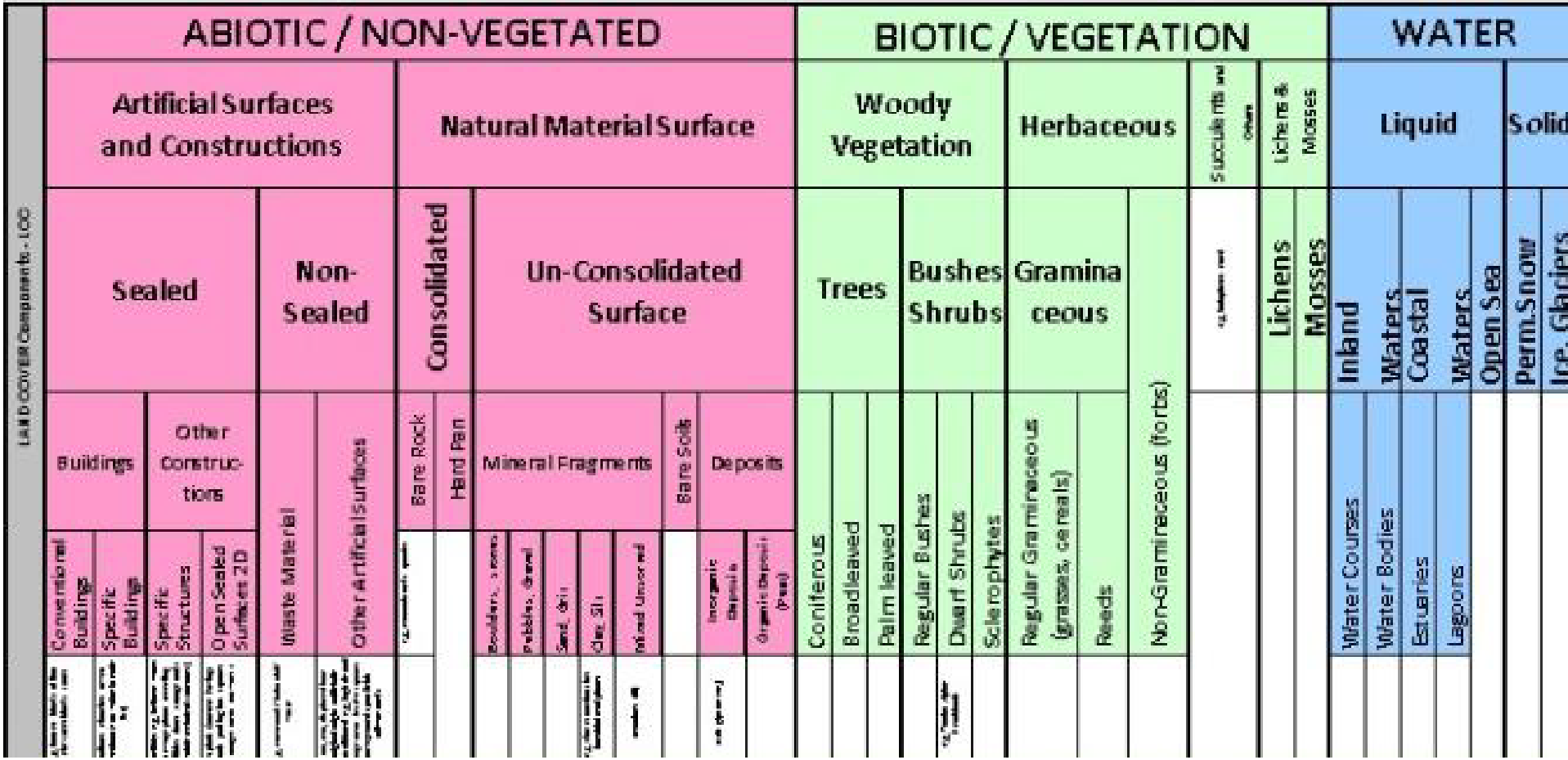
II.) LAND USE Attributes – LUA
Agriculture, Forestry, Residential, Transportation etc.

III.) CHARACTERISTICS – CH
spatial pattern, bio-physical parameters, cultivation measures, land management practices, status/condition etc.

Structure of the EAGLE matrix



Matrix as semantic comparison tool

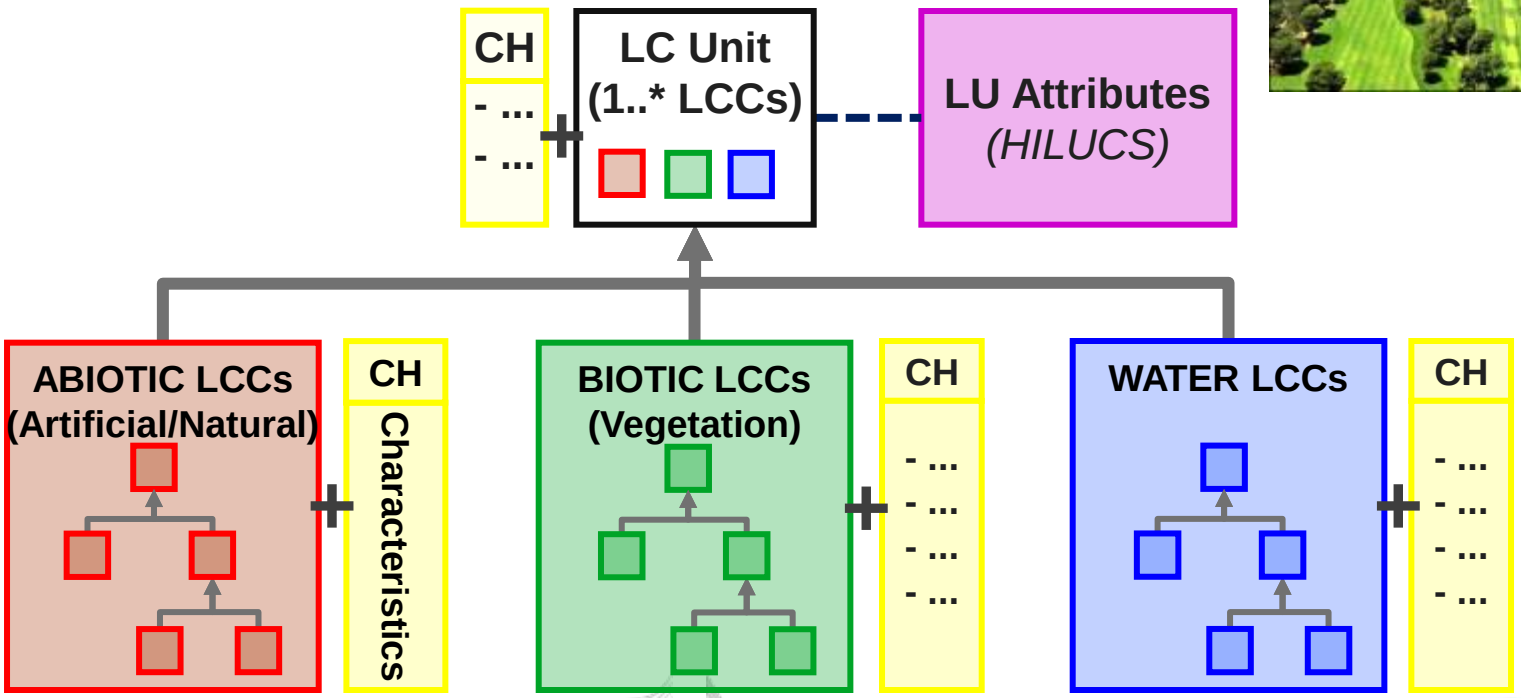


Arnold et al.: EAGLE Concept

European Commission | Copernicus | European Environment Agency |

Structure of the EAGLE data model

- Description of landscape with …
  - Land Cover Components (LCC),
  - Characteristics (CH),
  - Land Use Attributes (LUA)



Determining spatial reference objects

Polygons: single objects, distinct feature types, individual are sizes

Grid cell: descriptive characterization, standardized spatial reference unit

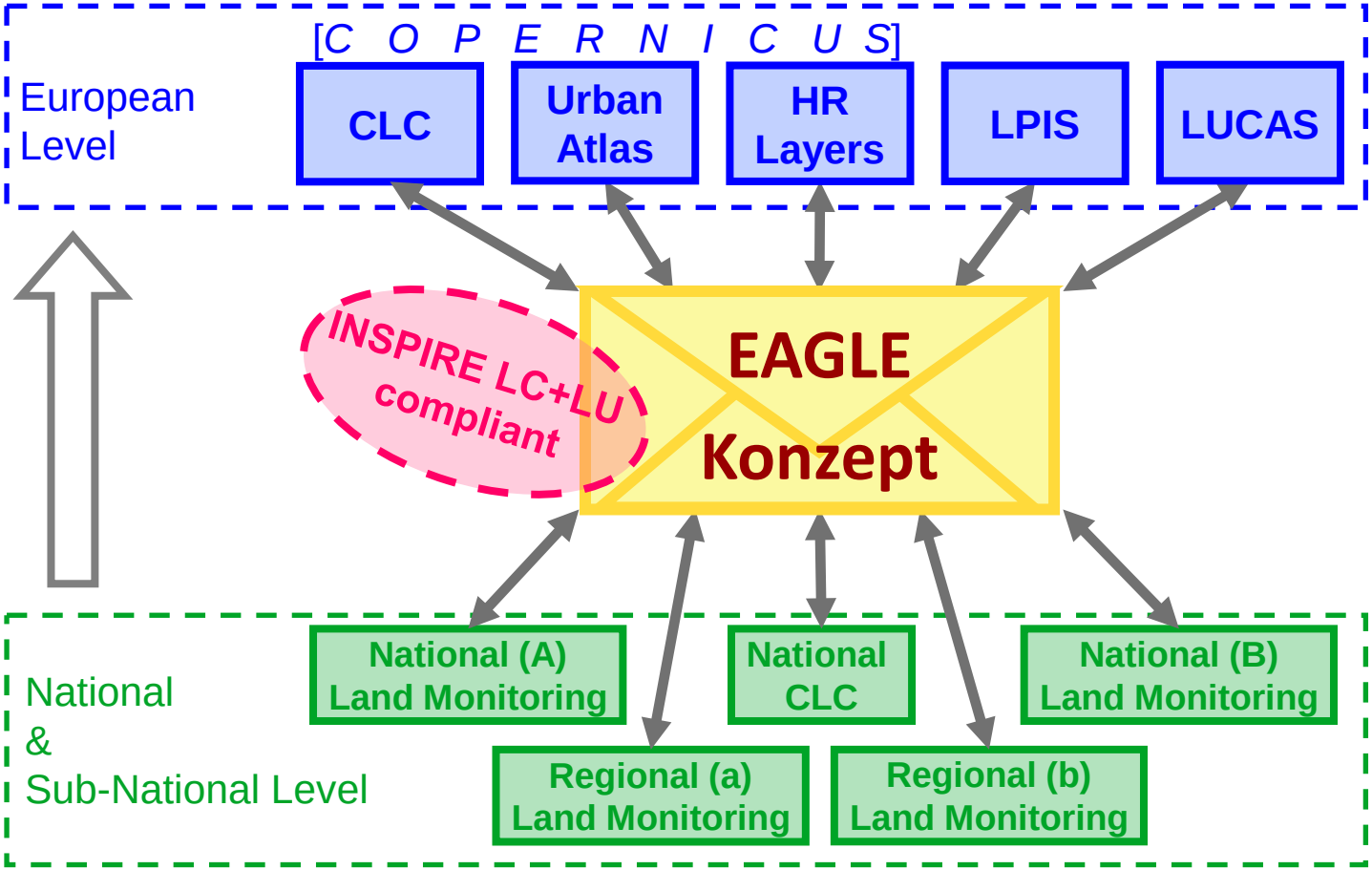
Example: „Rural Settlement“

- **Land cover components (LCC):**
  - Conventional buildings
  - Trees, broad leaved
  - Herbaceous plants
  - Open sealed surfaces
- **Land use attributes (LUA):**
  - Permanent residantial
  - Agriculture; own consumption
  - Road transportation network
- **Further characteristics (CH):**
  - Soil sealing degree = 35%
  - Built-up pattern = discontinuous, single houses
  - Agricultural measure: Mowing

© B. Kosztra

EIONET Action Group EAGLE Land Monitoring in Europe

Integration schema for a future land monitoring framework in Europe



Vision

- **Implementation of a multi-variant applicable Land Monitoring Concept**
- **Object-oriented data model is applicable for 2 main approaches:**
  - **<u>Semantic comparison</u> of definitions between different classification systems or single classes**
  - **<u>Descriptive characterization</u> of landscape for collection and mapping of LC/LU for future initiatives**

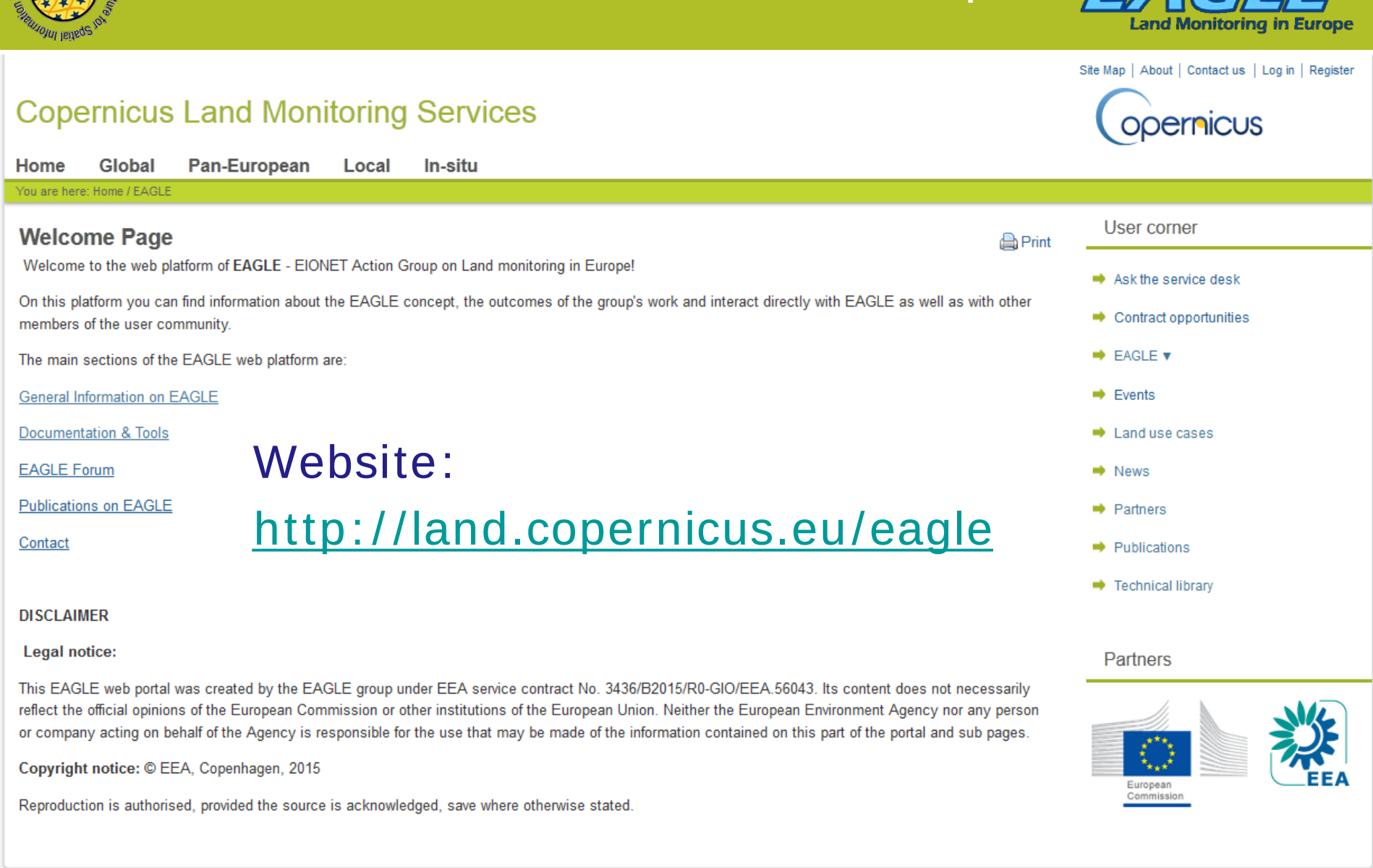
Summary

The Eagle concept …

- Instrument for **semantic analysis and comparison** of class definitions
- not a new classification system, but vehicle for **semantic harmonisation** and transformation,
- is INSPIRE **compliant**,
- can provide flexible framework for future **mapping initiatives**,
- helps to **avoid redundant data** capture,
- applicable on **raster** or **polygon** data,
- follows principle of integrating **bottom-up / top-down approach** in the European land monitoring process,
- supported by **EEA**, observed by **Eurostat**

Literatur on EAGLE

- *Arnold, S., B. Kosztra, G. Banko, G. Smith, G. Hazeu, M. Bock, N. Valcarcel Sanz (2013):*The EAGLE concept – A vision of a future European Land Monitoring Framework.
  In: R. Lasaponara, L. Masini and M. Biscione (Eds.), Towards Horizon 2020: Earth Observation and Social Perspectives. 33th EARSeL Symposium Proceedings, S. 551-568. EARSeL and CNR, Matera.
- *Arnold, S., Kosztra, B., Banko, G., Milenov, P., Smith, G., Hazeu, G. (2014):* Explanatory Documentation of the EAGLE Concept. EEA, Copenhagen.
- *Arnold, Smith, Hazeu, Kosztra, Perger, Banko, Strand, Valcarcel-Sanz, Bock (2015):*The EAGLE Concept - A Paradigm Shift in Land Monitoring.
  In: Ahlqvist, Fritz, Janowicz (Eds.): Land Use and Land Cover Semantics - Principles, Best Practices, and Prospects,Taylor & Francis, CRC Press


Site Map | About | Contact us | Log in | Register
Copernicus Land Monitoring Services
Copernicus
Home Global Pan-European Local In-situ
You are here: Home / EAGLE
Welcome Page
Print
Welcome to the web platform of EAGLE - EIONET Action Group on Land monitoring in Europe!
On this platform you can find information about the EAGLE concept, the outcomes of the group's work and interact directly with EAGLE as well as with other members of the user community.
The main sections of the EAGLE web platform are:
General Information on EAGLE
Documentation & Tools
EAGLE Forum
Publications on EAGLE
Contact
Website:
http://land.copernicus.eu/eagle
DISCLAIMER
Legal notice:
This EAGLE web portal was created by the EAGLE group under EEA service contract No. 3436/B2015/R0-GIO/EEA.56043. Its content does not necessarily reflect the official opinions of the European Commission or other institutions of the European Union. Neither the European Environment Agency nor any person or company acting on behalf of the Agency is responsible for the use that may be made of the information contained on this part of the portal and sub pages.
Copyright notice: © EEA, Copenhagen, 2015
Reproduction is authorised, provided the source is acknowledged, save where otherwise stated.
User corner
Ask the service desk
Contract opportunities
EAGLE
Events
Land use cases
News
Partners
Publications
Technical library
Partners
European Commission
EEA
Copyright Copernicus Programme | Last update 07 Apr 2016 | Top

EIONET Action Group EAGLE Land Monitoring in Europe

EAGLE data model Version 2.3

EAGLE Meeting, March 2015, Frankfurt am Main

http://land.copernicus.eu/eagle

Thank you for your attention!

EAGLE website:

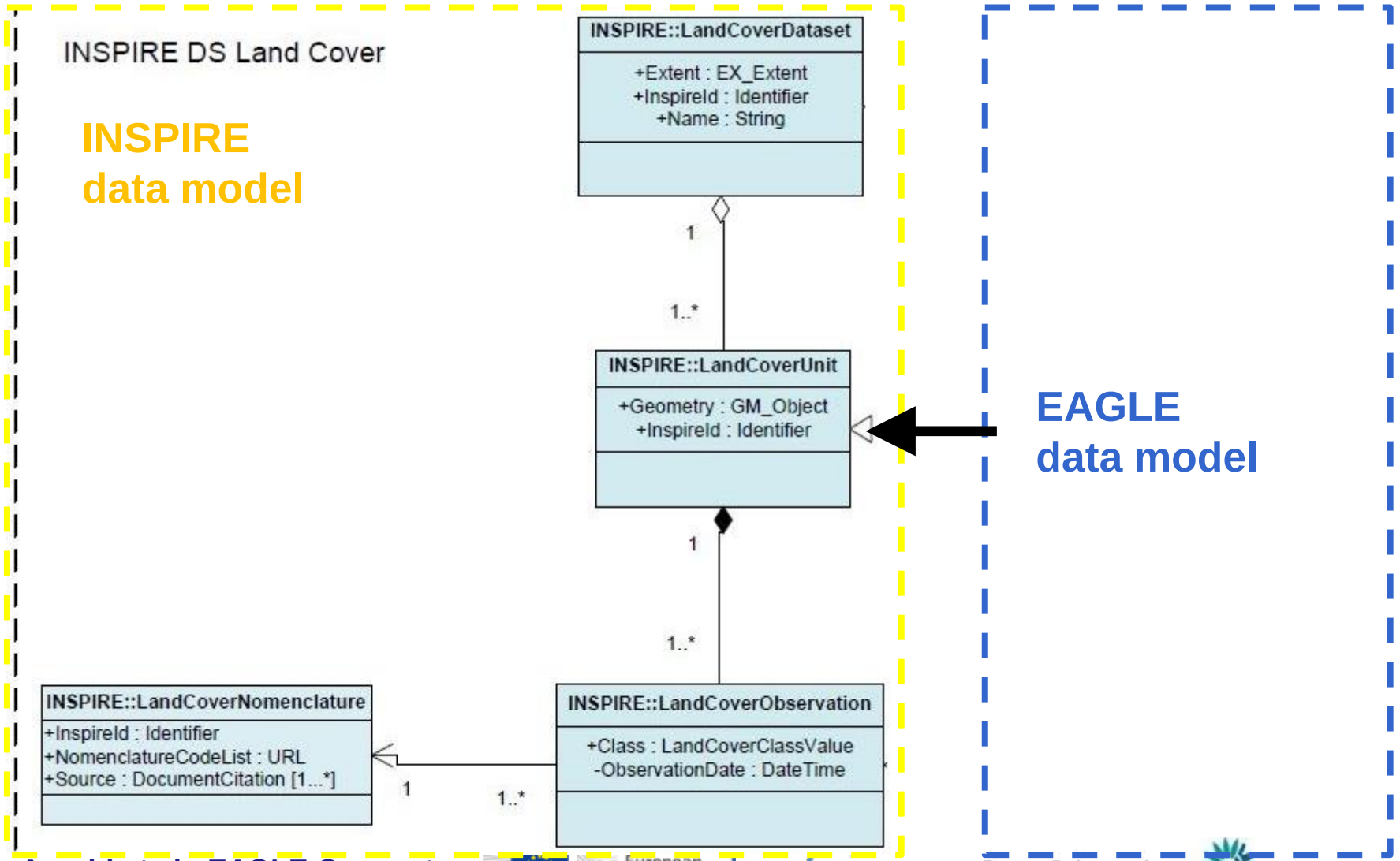
http://land.copernicus.eu/eagle

Fedaral Statistical Office (DESTATIS)
Land Use Statistics

Stephan Arnold
Telefon: +49 (0) 228 / 99 643 8612
stephan.arnold@destatis.de
www.destatis.de

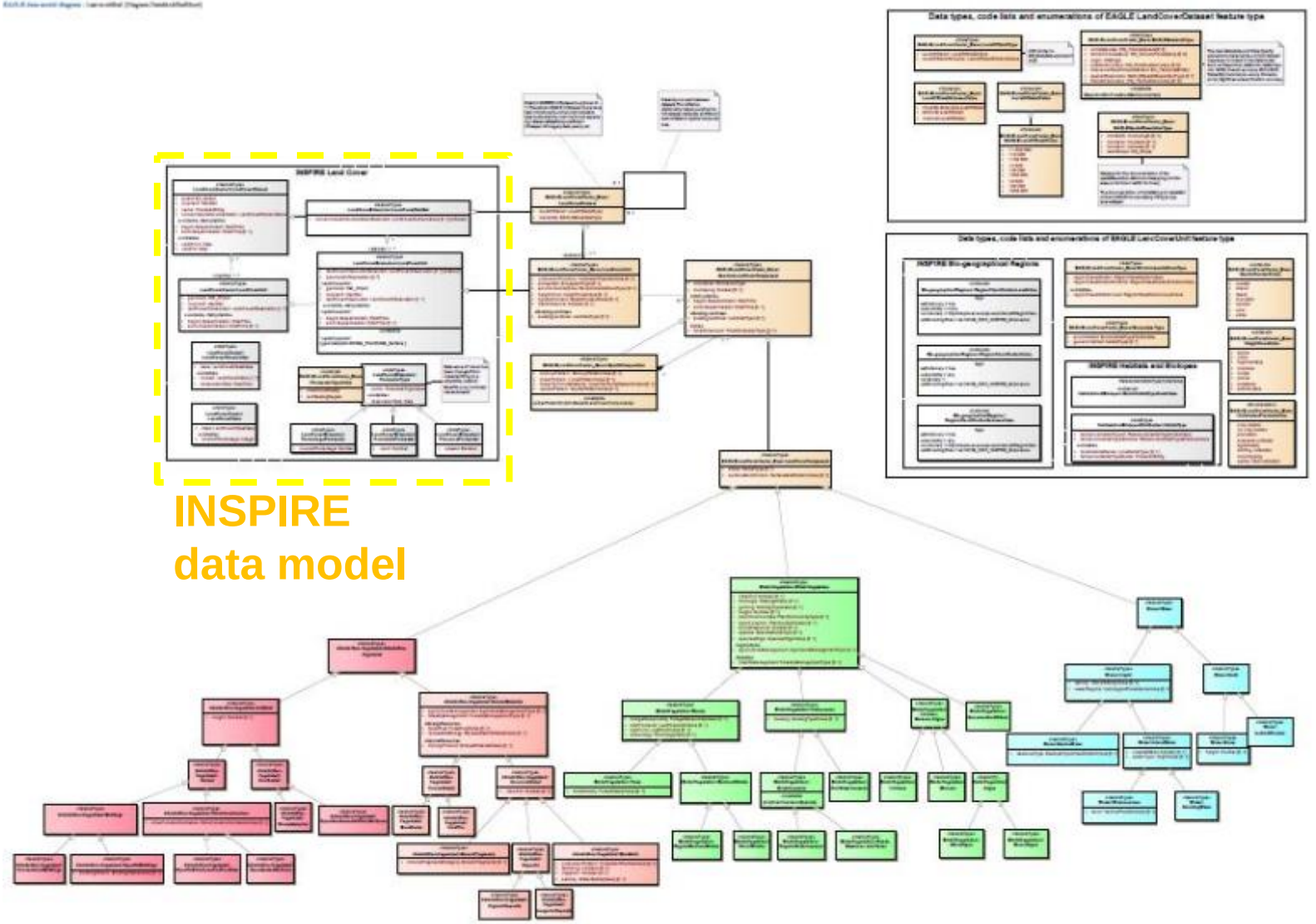
Additional slides

INSPIRE LC Data model



Arnold et al.: EAGLE Concept

EAGLE UML model overview



Online Tool: EAGLE Matrix population and comparison tool (EMPACT)

Eagle Matrix Tool | Home | Decomposition | Comparison | Export / Import | Login

Nomenclatures | Classes

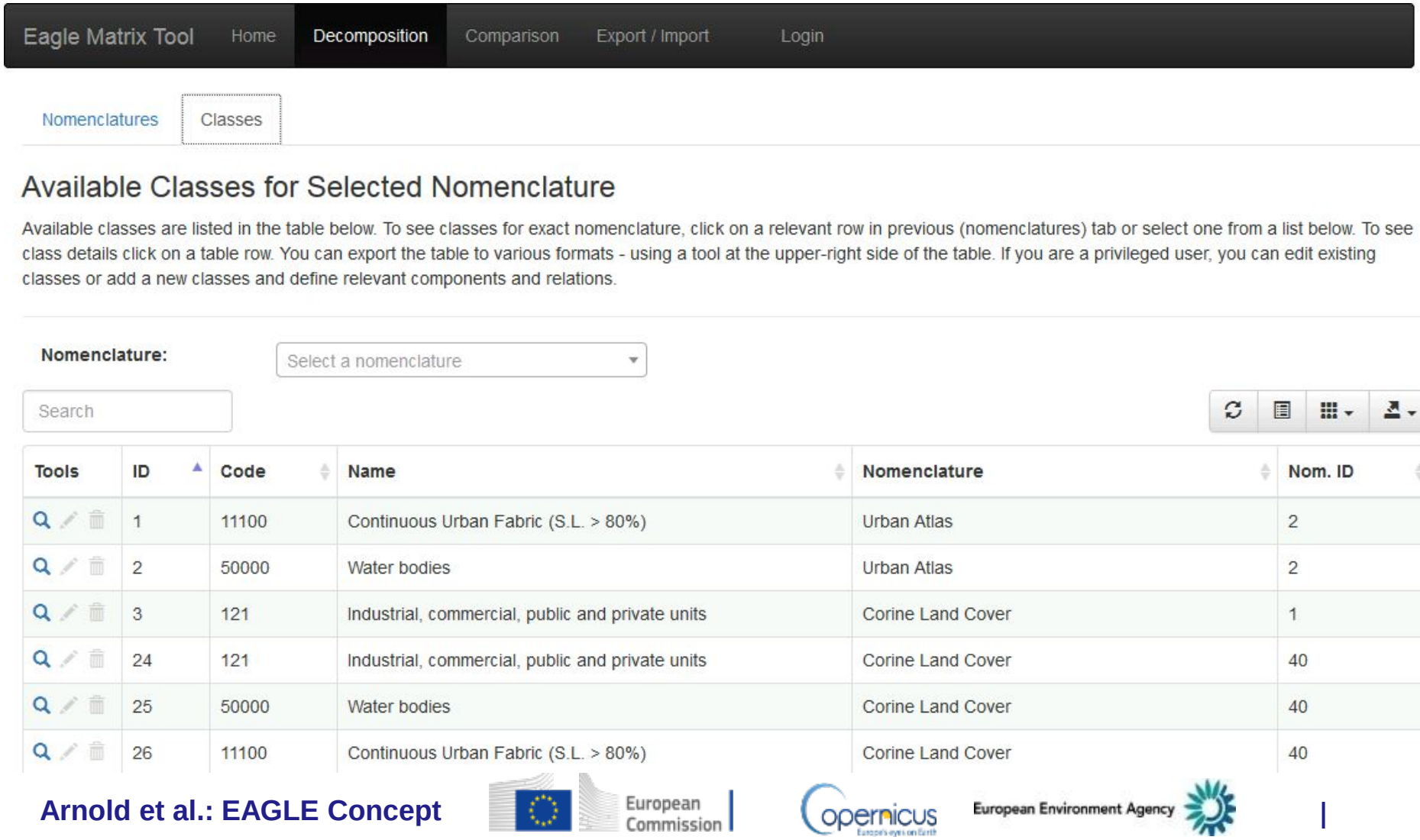
Nomenclatures Overview

Available nomenclatures are listed in the table below. To see nomenclature's classes click on a table row. You can export the table to various formats - using a tool at the upper-right side of the table. If you are a privileged user, you can edit existing nomenclatures or add a new nomenclature.

Search in: (any column) Search

Tools	ID	Code	Name	Promoter	Version	Tags	Modified by	Modified
	1	CLC	Corine Land Cover	Copernicus	01.01	draft,locked	Antonin Orlik	2015-08-25 14:29:09
	2	UA	Urban Atlas	Copernicus	01.01	draft,locked	Antonin Orlik	2015-08-25 14:29:09

EAGLE Matrix population and comparison tool (EMPACT)



EAGLE Matrix population and comparison tool (EMPACT)

Nomenclature	Land Use / Cover Area Frame Survey	Urban Atlas
Code	A10	11100
Class	Roofed Built-up Area	Continuous Urban Fabric (S.L. > 80%)
Mandatory	Buildings Primary Production Sector Industries (Secondary Sector) Services (Tertiary Sector) Transport Networks, Logistics, Utilities	Conventional Buildings Permanent Residential Other Residential AND Open Sealed Surfaces Road Network (Incl. Parking Lots)
Optional		Specific Buildings Residential Transport Networks, Logistics, Utilities Inland Water Urban Greenery And Parks Woody Urban Greenery And Parks Herbaceous Urban Greenery And Parks Succulent and Others Urban Greenery And Parks Mosses Lichens Urban Greenery And Parks
Excluded	Other Constructions Biotic / Vegetation	

EAGLE Use Case [DE]

NATFLO

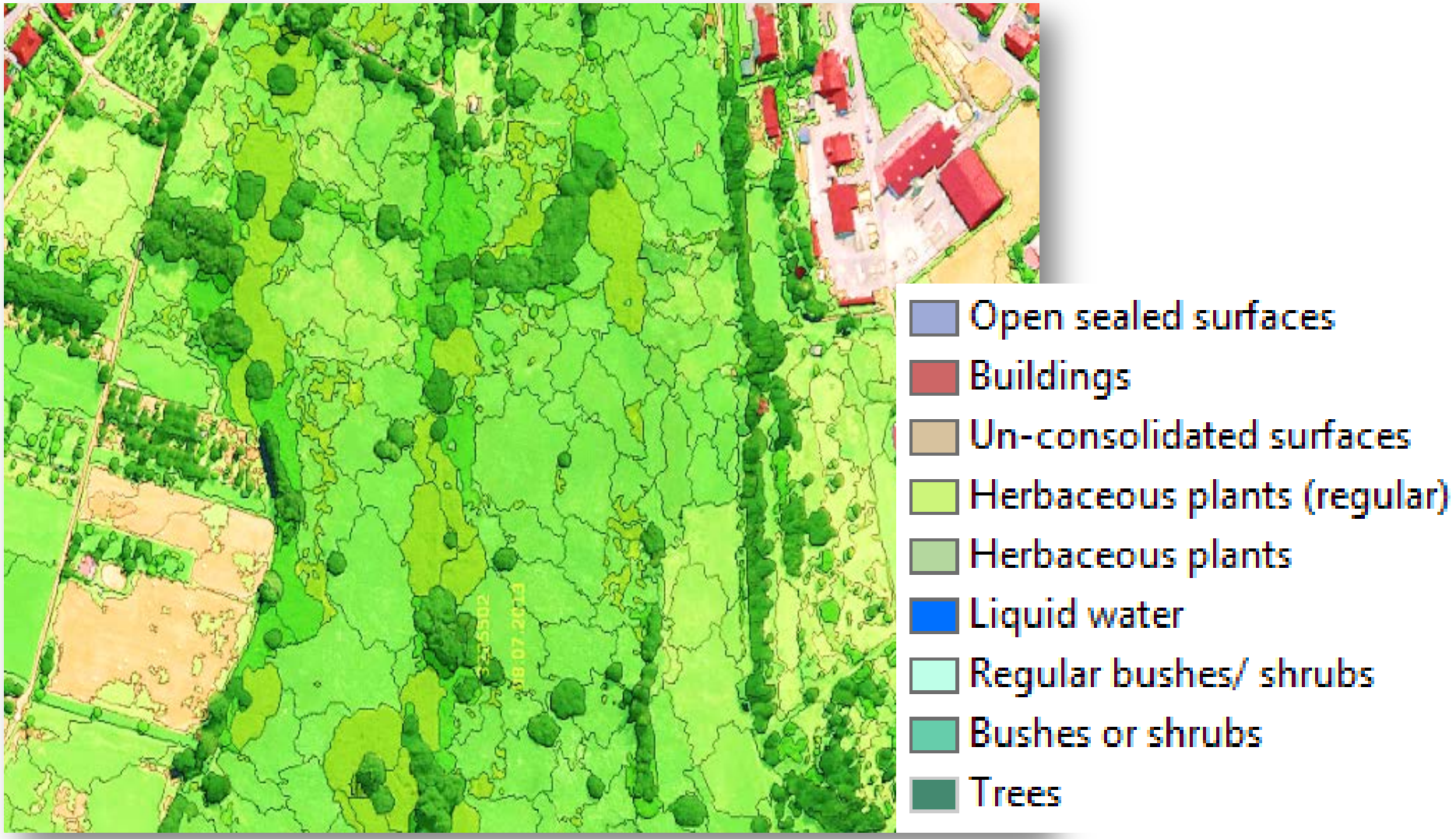
Remote sensing based landscape objects for nature conservation

Rhineland-Palatinate, Ministry of Environment […]

- **Input data:**
  - **Topographic reference data** and **digital terrain** and **surface models** (land surveying authority)
  - Combination of **aerial** and **satellite imagery**
  - **Object-based** analysis and **segmentation** of aerial images and HR-nDSM

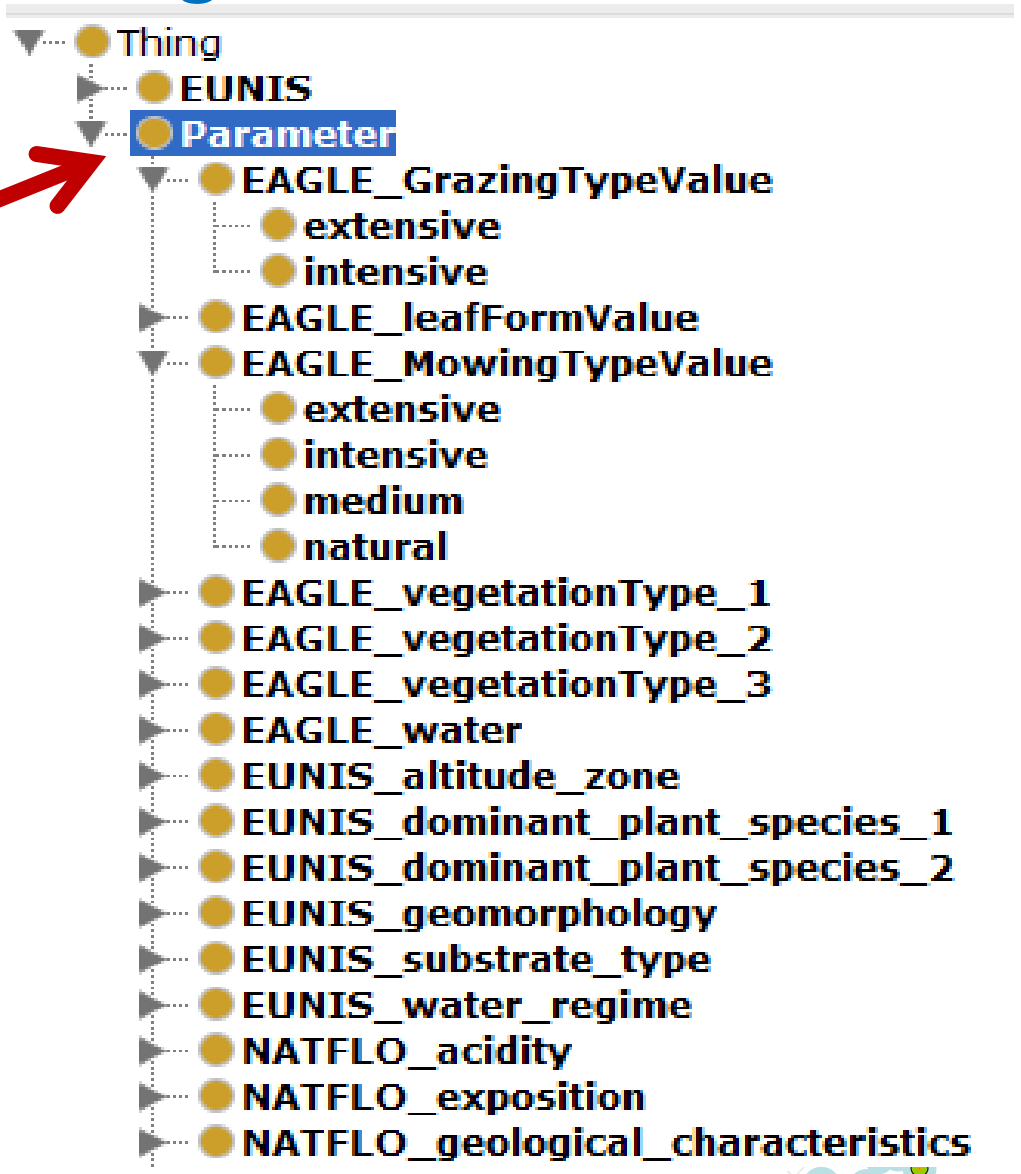
RLP Agroscience
Institute for Agroecology

NatFlo Mapping approach



Database structure and management

Indicator oriented description of objects with environmental parameters and characteristics derived from input data



Assigning EUNIS classes to landscape units

Annotations: E1.7

comment [language: en]

n-Mediterranean dry acid and neutral closed grassland

Description: E1.7

Equivalent To

ontology based reasoning

```
(has_EAGLE_MowingTypeValue some natural)
  and (has_EAGLE_vegetationType_1 some graminaceous)
  and (has_EAGLE_vegetationType_2 some herbaceous)
  and (has_EUNIS_water_regime some arid)
  and (has_NATFLO_acidity some acid)
  and (has_NATFLO_geological_characteristics some siliceous)
  and (has_NATFLO_root_penetration some flat)
  and (has_NATFLO_usage_intensity some low)
  and (has_NATFLO_wetness some dry)
  and (has_EAGLE_Biotic_Vegetation some {true})
  and (has_EAGLE_Trees some {false})
  and (has_NATFLO_bog some {false})
  and (has_NATFLO_bosk some {false})
  and (has_NATFLO_cultivated some {false})
```

EAGLE Use Cases

- Masterplan of AdV (german association of land surveying authorities): separation and completion of LC and LU features types
- Natur- und Umwelt Monitoring System Nordrhein-Westfalen (NUMO NRW)
- COBWEB project (citizen science data collection)
- Hungarian test case on CLC data derivation based on national data sources through EAGLE concept
- LandSense, IIASA
- IGN Spain: EAGLE geometric test case
- … <you could be the next in this list> Project