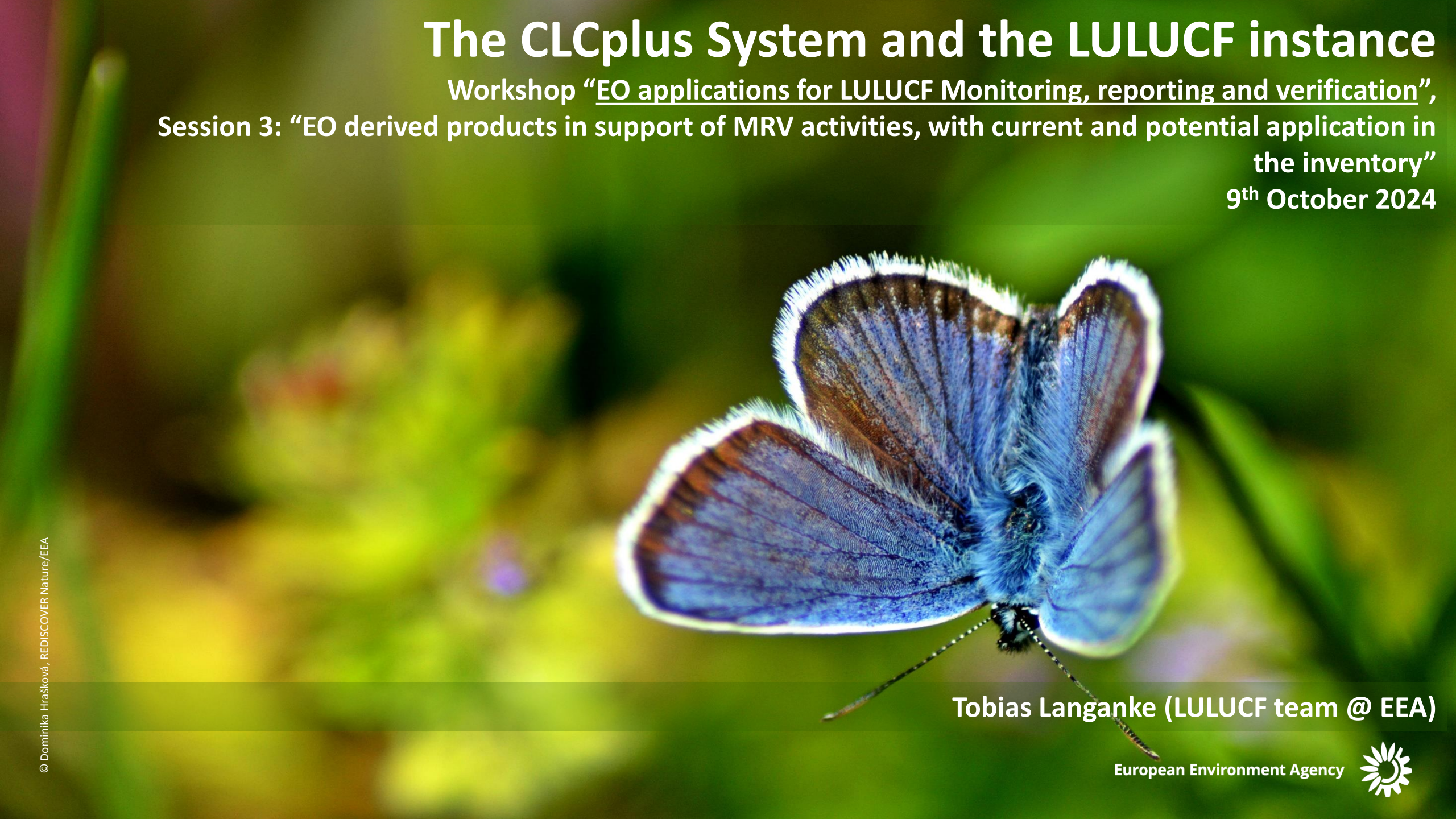
The CLCplus System and the LULUCF instance

Workshop "EO applications for LULUCF Monitoring, reporting and verification",
Session 3: "EO derived products in support of MRV activities, with current and potential application in the inventory"
9th October 2024



Tobias Langanke (LULUCF team @ EEA)

European Environment Agency

LULUCF regulation: requirements for improved monitoring and reporting

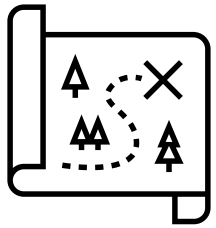
LULUCF REGULATION (EU) 2023/839

- **Art. 29:** (…)" greenhouse gas emissions and removals need to be estimated with a **higher level of accuracy** (..)"
- (..) will all require **enhanced monitoring of land** (…). **The monitoring and reporting of emissions and removals needs to be upgraded**, where applicable, **using advanced technologies** available under Union programmes, such as **Copernicus,** and digital data collected under the **Common Agricultural Policy** (..)"
- **Art. 30: "**Mapping and monitoring provisions, both in field and **remote sensing monitoring**, should be introduced in order to allow Member States to have **geographically explicit information** to identify priority areas that have the potential to contribute to climate action."

Gov Reg 2018/1999 Annex V part 3

- "For monitoring and reporting in the LULUCF sector, Member States shall use **geographically explicit land-use conversion data** in accordance with the 2006 IPCC Guidelines for national GHG inventories."
- "Member States are encouraged to explore synergies and opportunities to consolidate reporting with other relevant policy areas and strive towards greenhouse gas inventories which allow for **interoperability** with relevant electronic databases and **geographic information systems** (..)"

EEA reaction to (geospatial) policy requirements via CLMS and CET



Data provision

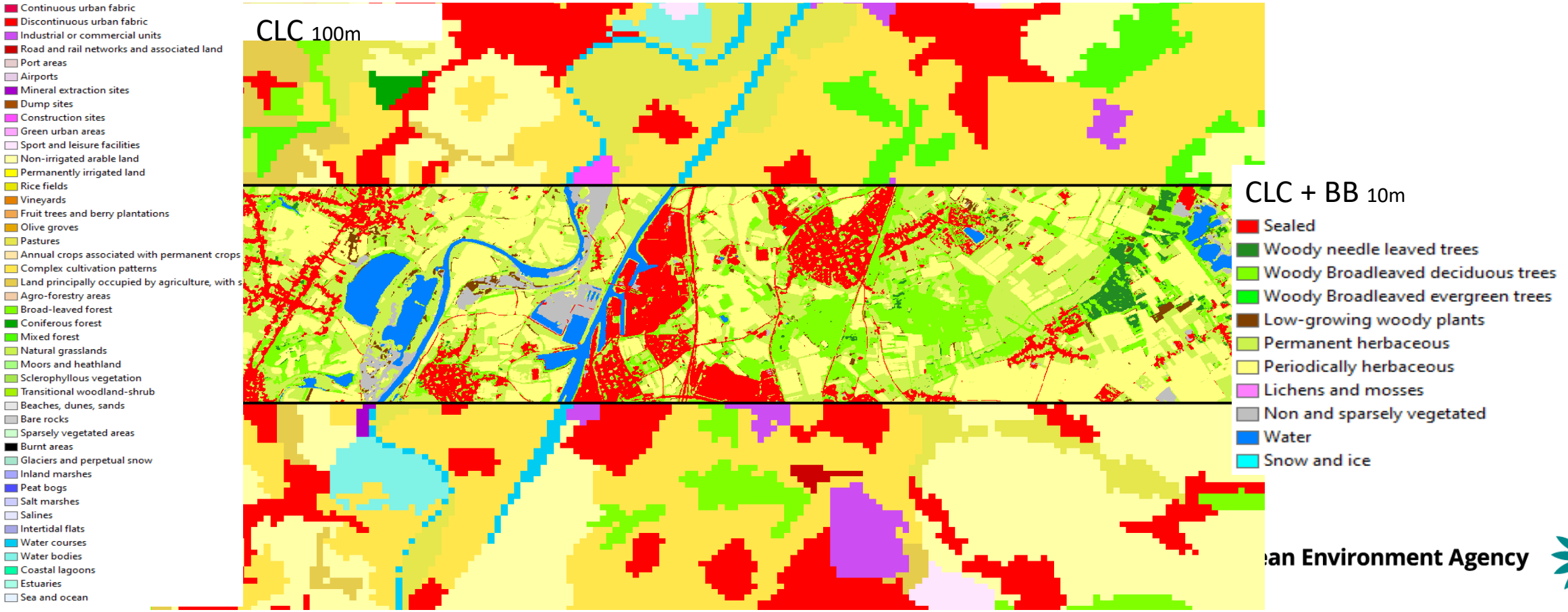
- Improved **spatial resolution, update frequency, production speed**
- **Ongoing evolution of CLMS portfolio** (e.g. **CLCplus** system and others). Harmonization and coordination with other relevant policy areas (soil, forest, agriculture, biodiversity, nature restoration, CRCF etc.)
- Targeted products for specific use cases, example**: the LULUCF instance**

Outreach, cooperation & support

- Improvements in **outreach, training, product documentation, communication** and **data provision**
- **Workshops, handbooks (e.g. LULUCF handbook)**
- **Training activity** (e.g. CLCplus country specific trainings)
- **Increased interaction and exchange with countries** (EIONET and directly with monitoring and reporting experts for example on LULUCF)

CLC and CLCplus BB: comparative differences

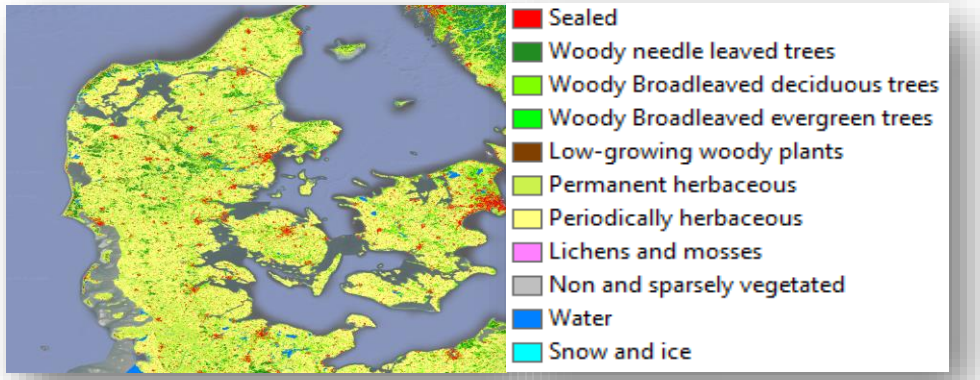
CLC (traditional Corine Land Cover): human interpreter (country expertise), rich *land use* content, consistent and reliable change mapping, coarse spatial resolution and infrequent updates
CLCplus BB: relatively highly automated *land cover* product, high update frequency, high spatial resolution, few classes, land cover only, no change product



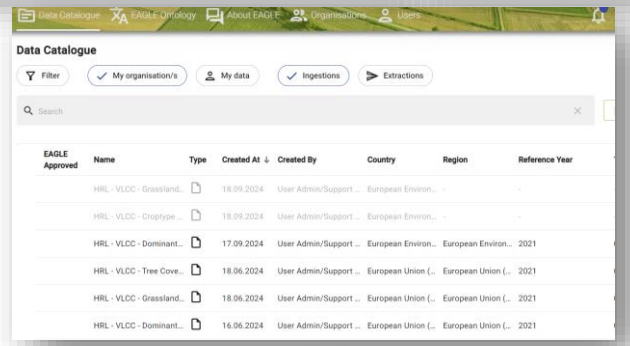
an Environment Agency

CLCplus: System with 3 main components

1. **CLCplus BB** (Backbone): wall-to-wall 11 class 10m ***land cover*** **mapping**



2. **CLCplus Core**: **Online database and web interface** to harmonize input data to EAGLE and extract 100m grid geospatial data

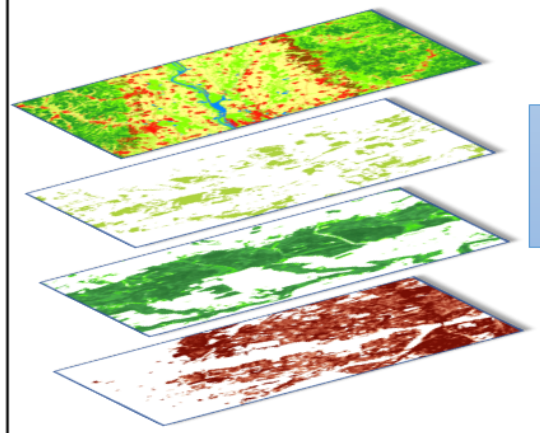


3. **CLCplus Instances**: tailor made **100m grid** products using CLCplus Core and existing data. Current only product: *LULUCF instance*

CLCplus instances – basic idea

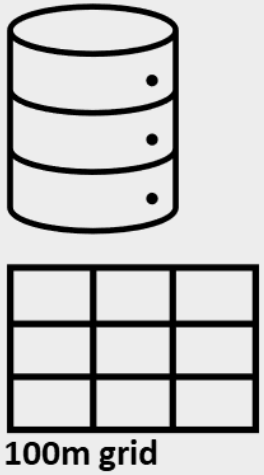
Existing external Data

Various multi-source Land Cover and Land Use Datasets



Ingestion and mapping to EAGLE

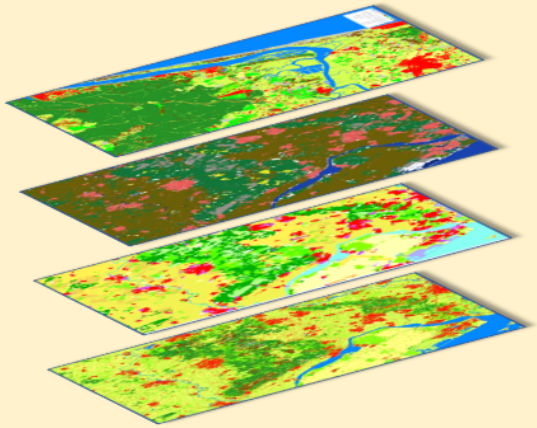
CLC+ Core Database and web application



Extraction rules to produce Instances

Tailor-made “Instances” for policy support

Various 100m grid derived products for downstream use



CLCplus LULUCF instance –aim & concept

Aim: Development of **geospatial datasets that can support the LULUCF needs**. Main support is with the "**LULUCF instance**"

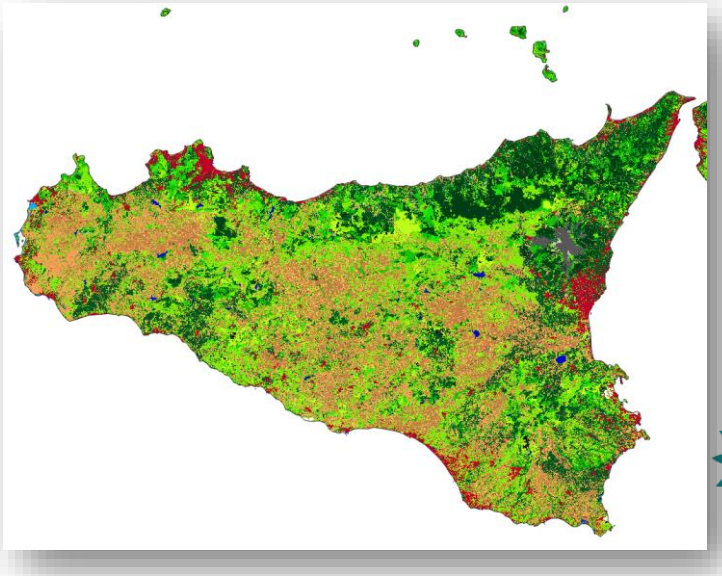
- Provide EEA with (country) **independent activity data proxies** (workflow under development)
- **Support countries** with their own spatially explicit monitoring/reporting **(training options open)**

Concept:

- Use a **flexible database solution** (CLC+ Core) to:
  - **Input datasets:** any European-wide or national dataset possible
  - **Harmonize** existing (dissimilar) LC/LU input data by using a common nomenclature (EAGLE)
  - **Combine datasets** by developing extraction rules in the system (based on the EAGLE elements)

Output: LULUCF Instance

- Spatial coverage: EEA 38
- Temporal coverage: 2018 & 2021 (from 2021 on yearly update)
- Raster with 100m grid
- 6 main LULUCF categories & 26 sub-classes
- Distribution: currently as expert product "on request"

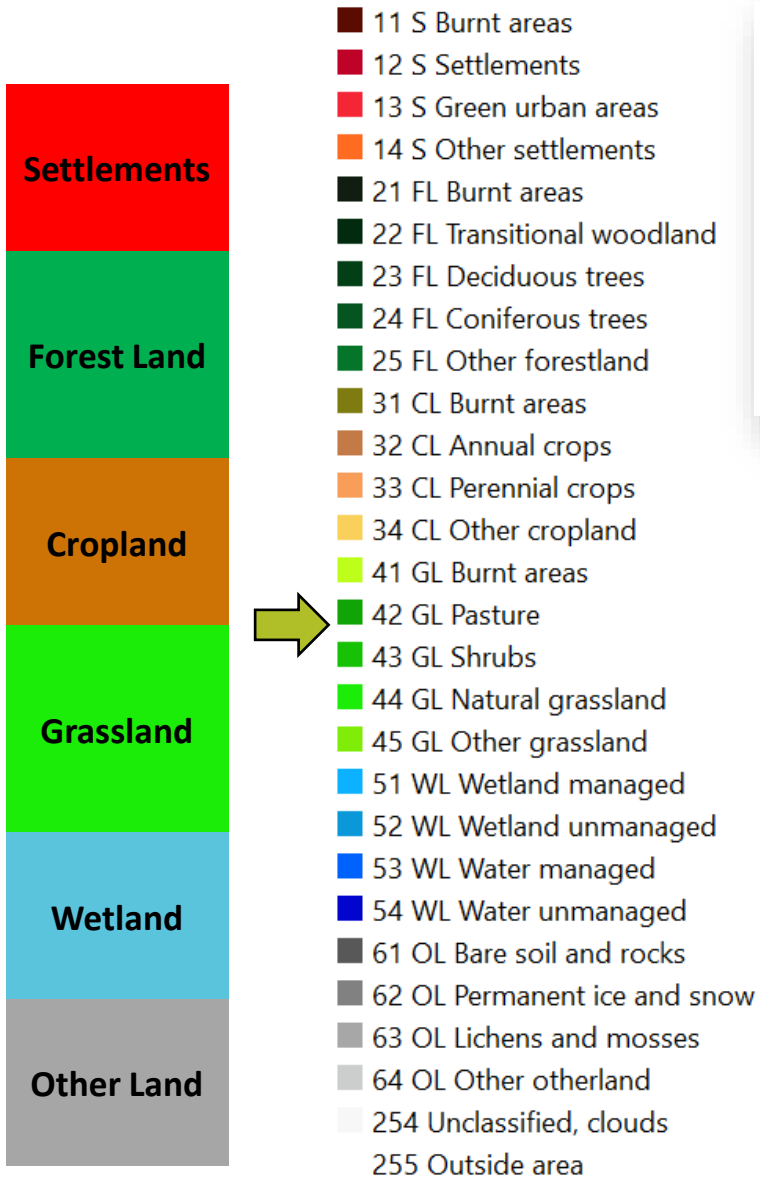


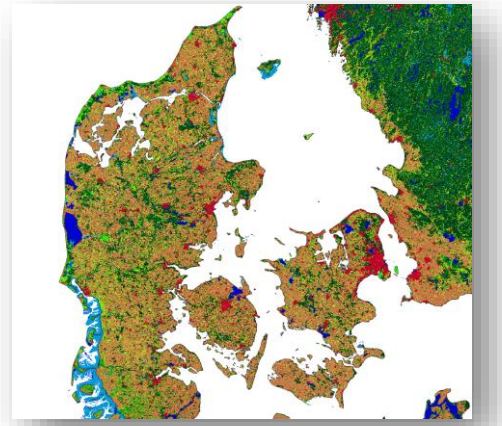
LULUCF instance example 2021

Input datasets for LULUCF 2021:

Product Category	Product Name	Reference year	Data format
CLMS HRL-VLCC			
Forest	Tree Cover Density	2021	Raster
Forest	Dominant Leaf Type	2021	Raster
Cropland	Crop Type	2021	Raster
Grassland	Grassland	2021	Raster
Herbaceous	Herbaceous	2021	Raster
Water and Wetness	Water and Wetness	2018	Raster
CLMS HRL-NVLCC			
Imperviousness	Degree of Imperviousness	2021	Raster
CLMS CLC / CLC+ Backbone			
CLC+ Backbone	CLC+ Backbone	2021	Raster
CLC	Corine Land Cover	2018	Raster/Vector
CLMS Local Components			
Urban Atlas	Urban Atlas LC/LU	2018	Vector
Riparian Zones	Riparian Zones LC/LU	2018	Vector
Natura 2000	Natura 2000 LC/LU	2018	Vector
Coastal Zones	Coastal Zones LC/LU	2018	Vector
Other products			
Burned Areas	EFFIS	2021	Raster

LULUCF categories & sub-classes:





- **2021** final version: June 2024
- **2023** final version: Q1/2025
- **2022** final version Q2/2025
- **2024 and after** expected Q1/inventory year +2

CLCplus instances – 3 main use scenarios (most likely first)

Scenario 1: Use as **independent activity data proxy** to support LULUCF MRV at EEA: A pan-European LULUCF instance is produced annually, largely based on the same rules and pan European data. Aim: best possible EO based activity data proxy to identify systematic issues in country reporting for LULUCF

Scenario 2: **Countries use the CLCplus Core database/web interface** by ingesting **their own national data** (or adding additional national data to already existing datasets)

Scenario 3: (some) **countries use LULUCF instance data directly** as the geospatial data basis for (some) of their LULUCF monitoring and reporting

Use of LULUCF instance as independent data for EEA (in development)

New LULUCF instance based additional checks (under development)

EEA

EEA and MS to **Explore differences** together and identify possible issues on either side

Member States

CLMS

Delivery LULUCF instance maps and tables Q4 inventory year +1

Compare instances derived and country reported figures

EEA

Significant differences that are not explainable with the inventory report

Reasonable match instance and country reporting

Member States

Delivery LULUCF CRF/NIR
15st January inventory year +2

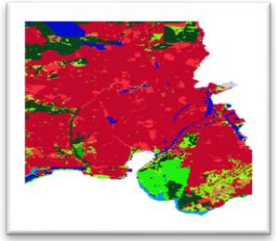
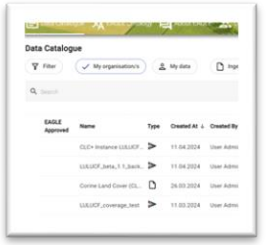
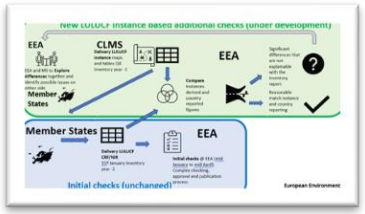
EEA

Initial checks @ EEA (mid January to mid April). Complex checking, approval and publication process

Initial checks (unchanged)

European Environment Agency

LULUCF Instance – main messages (1 of 2)

Independent EO based activity data proxies **are now becoming available**		
Bi-annual rapid land cover status mapping to support the use case (**CLCplus BB**) fully **operational** and now available for 2018 and 2021 (2023 in production)		
Dedicated online database and web application **(CLCplus Core) fully functional and available** for pan **European instances** work AND fully **operational for country use**		
Support workflow for MRV under development and needs implementation and testing. First results and conclusions will be available in early 2025		

LULUCF Instance – main messages (2 of 2)

Quality and consistency of LULUCF instance **variable** across categories (lack of input data for some LULUCF categories), and **not yet systematically understood in detail.** **Validation and uncertainty information** for Instances needs to be better understood.		
Main gaps in input data remain, in particular **around *land use* data** and land management		

LULUCF Instance – ongoing work

- **Quality checks of instances** by ETC DI
- **Outreach and feedback from countries** LULUCF reporting experts
- Continued focus on **additional datasets/ gap-filling**
- Running **trainings** for individual countries
- Evaluating options for **additional validation activity**
- Evaluating options for **improved change category mapping**
- **Developing and testing workflow** for LULUCF instance use with CET3 MRV experts

CLCplus – access and availability

CLCplus component	Availability	Inventory/Reference years
CLCplus BB (BackBone)	Free and open CLMS portal https://land.copernicus.eu/en/products/clc-backbone	2018 2021 2023 (from end 2024, in production)
CLCplus Core	Free and open use as Expert system with EIONET password. Contact EEA if interested https://clcplus-core.land.copernicus.eu/	n.a.
CLCplus LULUCF instances	Free and open on request (online download planned)	2018 2021 2023 (and 2022) in production

Questions?

Thank you

Tobias Langanke/WG1 meeting 12/10/2023