



Land Monitoring

# Towards CLC+

Conceptual design and product outlines

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## Welcome!

- Second stage of the development of the 2<sup>nd</sup> generation of CLC.
- Driven by DG GROW, EEA & EIONET Member States.
- Firmly grounded within Copernicus and the CLMS.
- Builds on feedback from NRCs since meeting in Copenhagen.
- Land domain represents probably the most diversified area of activity within the Copernicus programme.
- LULC under pins a broad range of uses and applications.
- Stakeholder contributions of requirements and opinions are vital for the success and the long-term development of land monitoring in Europe.



## Issues with CLC

- A number of deficiencies and limitations restrict wider exploitation at the Member State level and below.
  - MMU of CLC (25 ha) is too coarse to capture fine spatial details.
  - Mixed thematic classes with broad definitions difficult to interpret.
  - Insufficient thematic details or attribution.
  - Many changes smaller 5 ha of the CLC change layer.
  - 6-yearly update too slow for community policy needs.
  - Dynamic landscape features, which are highly relevant to policy, may be missed or underestimated.



## Requirements review (1)

- Key European policy requirements
  - Land Use, Land Use Change and Forestry (LULUCF)
  - Energy Union
  - Climate change monitoring
  - Long-term climate mitigation objectives
- Additional policy requirements
  - EU Biodiversity Strategy to 2020
  - Mapping and Assessment of Ecosystems and their Services (MAES)
  - Ecosystem services and natural capital
  - European ecosystem map
- **Land monitoring needs**
  - **Summarised as yearly updates with a MMU of around 0.5 ha**



## Requirements review (2)

- EIONET members needs
  - Survey by ETC of those involved with the CLMS and CLC production.
  - Addressed shortcomings of CLC and requirements for future LULC.
  - Some CLC classes cause problems because of their mixed nature.
  - A smaller MMU makes features more homogeneous.
  - MMW reduction so linear features are represented more realistically.
- **Land monitoring needs**
  - **Finer spatial resolution, 0.05 ha to 25 ha, majority 0.5 to 5 ha.**
  - **MMU for status and change layers the same.**
  - **Refined thematic detail, separation of LC and LU, split mixed classes.**
  - **Addition of further attributes to the spatial polygons.**



## Requirements review (3)

- General land domain requirements
  - Extensive document and user consultation filter for context of “land cover (including vegetation)”, etc.
  - Extraction of quantitative requirements
- **Land monitoring needs**
  - **Spatial resolutions from sub 2.5 m to 10 km, majority 10 – 30 m.**
  - **MMU preference for 0.5 to 5 ha (field / city block for Europe).**
  - **Update frequency yearly to 5 yearly.**
  - **Less specific about the thematic detail, but CLC, EUNIS, LCCS and “basic land cover” mentioned.**
  - **Thematic accuracy of the products in range 85 to 90%.**



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## Requirements review outcomes

- Summary of requirements review
  - MMU 0.5 to 5 ha, 0.5 ha for LULUCF
  - Change layer MMU = status layer MMU
  - Revised thematic content (more classes, increased characterisation)
  - 3 year to yearly update cycle
  - Pan-European coverage (EEA-39)
- Aspects of ....
  - Current CLC
  - Local Components
  - HRLs
  - EAGLE Group developments



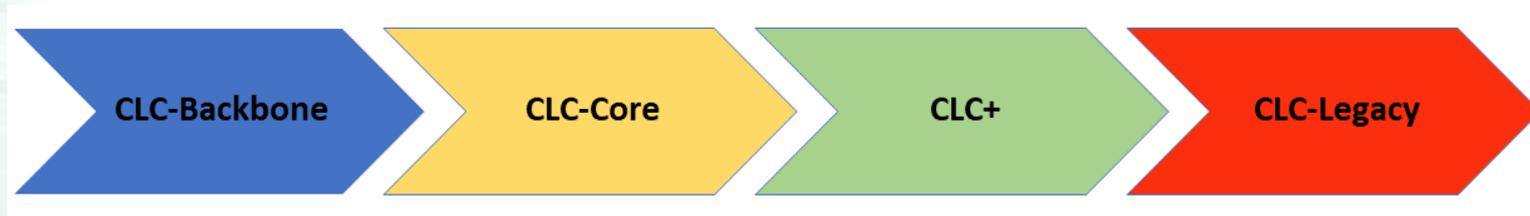
## Overview of approach

- EEA and thematic EC DGs (ENV, REGIO, AGRI, MARE, etc.) have requested
  - A higher performance pan-European mapping product
  - 2<sup>nd</sup> Generation CLC within Copernicus
  - To finally result in a so called CLC+
- EAGLE Group
  - Selected to develop the conceptual design and technical specifications for the 2nd Generation CLC
- Major shift in the concepts supporting European land monitoring
  - Can not be done in a single step
  - Time required to design, review and develop



## Conceptual design

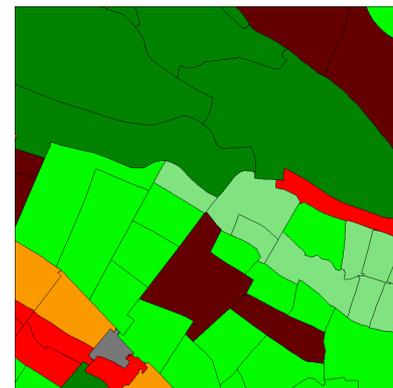
- Multi-stage process
- Multiple products
- Stand alone characteristics
- Different production philosophies
- Different resource models
- Industrial and Member State involvement



These are “working names” and not fixed.



- Outline:
  - Wall-to-wall coverage (EEA-39)
  - Complete the picture started by the LoCo which cover less than one third of EEA-39.
  - Spatially detailed, large scale
  - Vector format
  - Based on geospatial and EO data
  - Limited, but robust thematic detail
  - Geometric backbone
  - Basic land cover inventory to support other products within and beyond CLMS





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## CLC-Backbone (2)

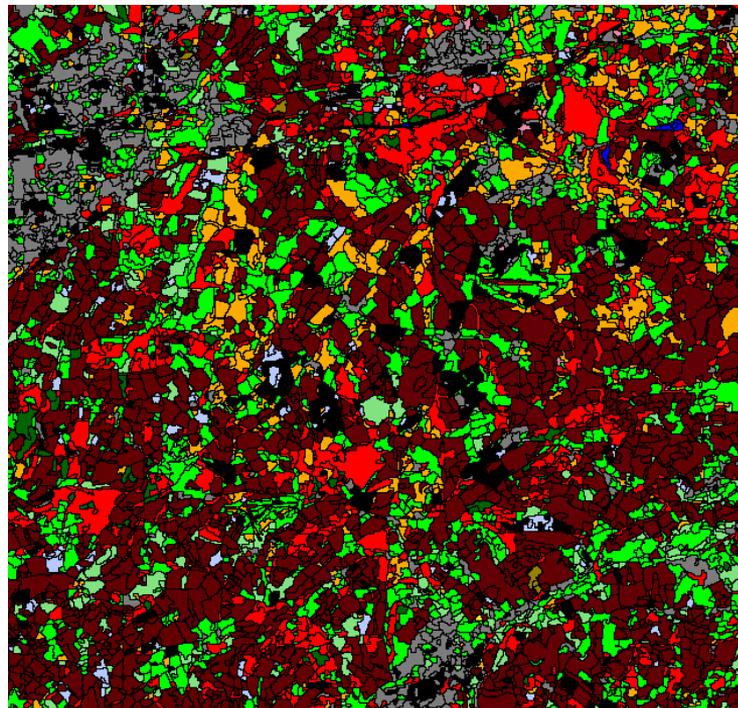
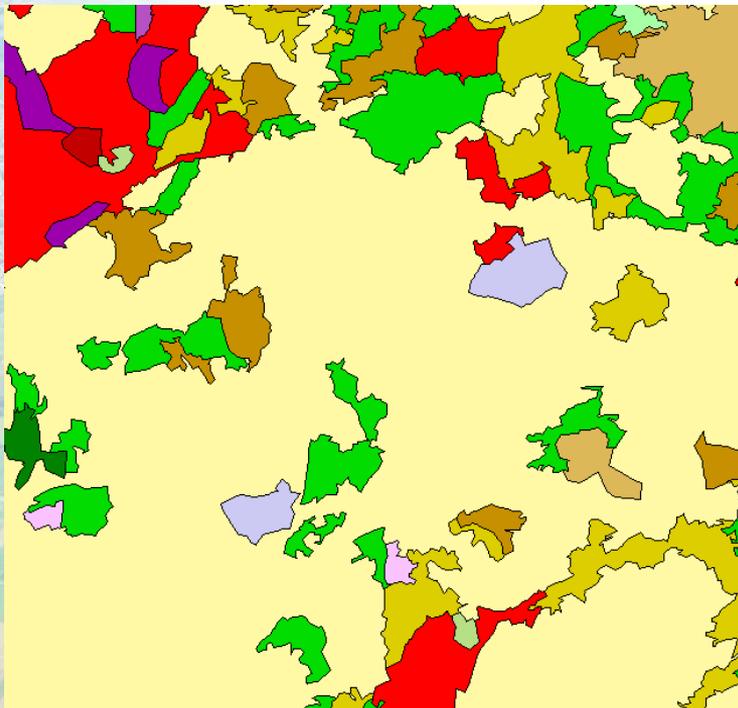
CLC-Backbone

CLC-Core

CLC+

CLC-Legacy

- Example using UK Land Cover Map





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## CLC-Core (1)

CLC-Backbone

CLC-Core

CLC+

CLC-Legacy

- Outline:
  - Next stage of development after CLC-Backbone
  - A consistent, multi-use repository for environmental information
  - Grid database with EAGLE data model
  - Populated with a broad range of land cover, land use and ancillary data, forming the information content
  - Derived from CLMS and external sources
  - MS contribution (land use, habitats, etc.)
  - Engine to deliver tailored thematic information.



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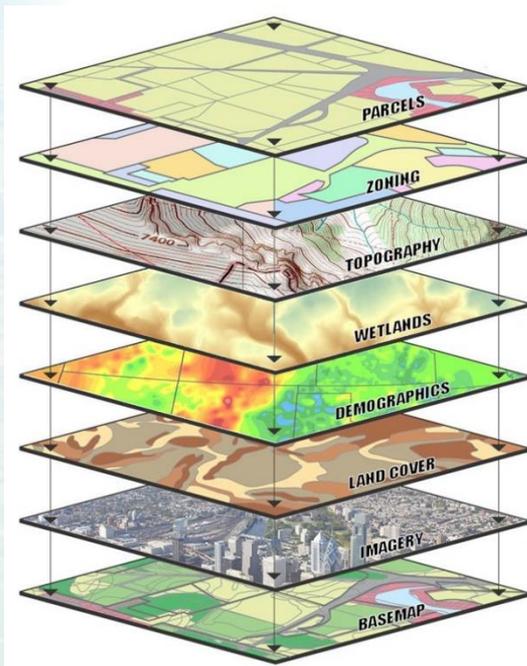
# CLC-Core (2)

CLC-Backbone

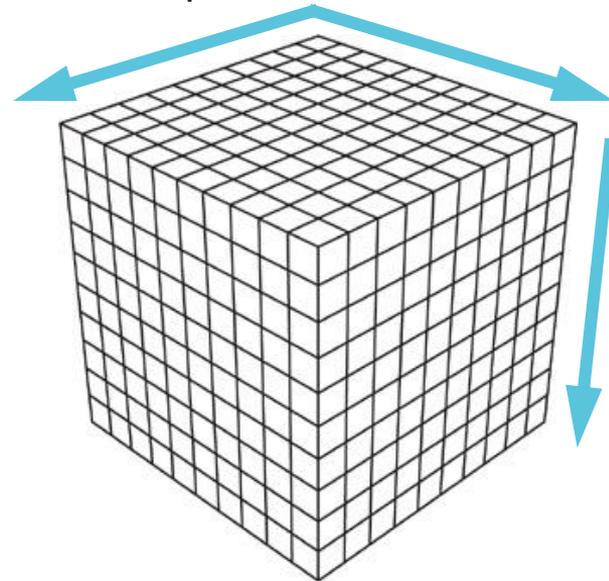
CLC-Core

CLC+

CLC-Legacy



Spatial domain



EAGLE  
Data  
Model

Source: CSU,  
<http://heleneloyan.cikeys.com/update/gis-layers/>



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## CLC-Core (3)

CLC-Backbone

CLC-Core

CLC+

CLC-Legacy

- Technical specification:
  - Format: GRID database.
  - Grid size: 10 x 10 m to 1 x 1 km.
  - Thematic detail: Rich attribution of LU, LC and ancillary information
  - Update cycle: Dynamic update as new information becomes available
  - Reference year: 2018
  - Production year: 2019 (TBD)
  - Structure: EAGLE-Grid approach
  - Inputs: CLC-Backbone, all available HRLs, LoCo, ancillary data, national data provisions (e.g. LU), etc...



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CLC+ (1)

CLC-Backbone

CLC-Core

CLC+

CLC-Legacy

- Outline:
  - One potential end point for this exercise
  - An improved LULC monitoring product relative to CLC
  - Multi-functional geospatial dataset
  - Addressing a broad range of requirements at European, national and regional scales
  - Based on CLC-Core and CLC-Backbone, along with the local components and HRLs
  - Expand the mapping philosophy away from single attribute thematic classification



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CLC+ (2)

CLC-Backbone

CLC-Core

CLC+

CLC-Legacy

- Technical specification:
  - Format: Raster and vector.
  - MMU: TBD, related to CLC-Backbone.
  - MFW: TBD, related to CLC-Backbone.
  - Thematic detail: Beyond CLC, adopt EAGLE concepts
  - Update cycle: 3 - 6 years.
  - Reference year: 2018
  - Production year: TBD
  - Input data: EO data, CLC-Core and CLC-Backbone



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## CLC-Legacy (1)

CLC-Backbone

CLC-Core

CLC+

CLC-Legacy

- Conventional CLC
- Must be back compatible
- Support existing systems
- New application evolving ....



# A LAND COVER ATLAS OF THE UNITED KINGDOM



Alasdair Rae

2017



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## CLC-Legacy (2)

CLC-Backbone

CLC-Core

CLC+

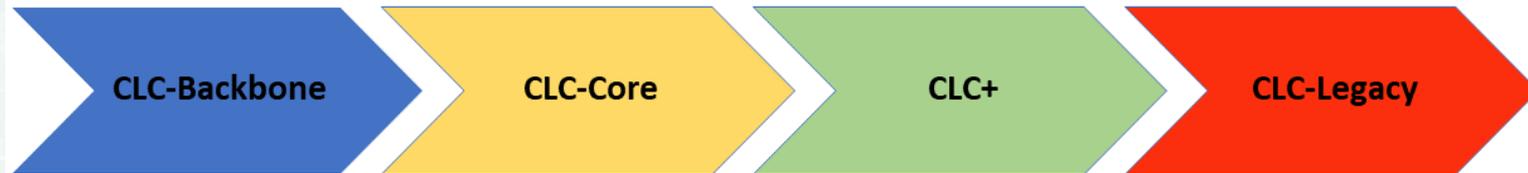
CLC-Legacy

- Technical specification
  - Format: Raster and vector.
  - MMU: 25 ha (5 ha changes)
  - MFW: 100 m
  - Thematic detail: CLC 44, plus potential improvements to attribution
  - Update cycle: 6 years.
  - Reference year: 2018, 2024, ....
  - Production year: 2017, TBD, ....
  - Input data: Existing CLC, CLC-Core, CLC+ and EO data



## Involvement of Member States

- Input to and review of the conceptual framework and technical specifications.
- Support to population of thematic information in CLC-Core.
- Potential change mapping activities.
- Member State benefits
  - CLC-Backbone aligned to national / local mapping requirements
  - Access to information rich CLC-Core
  - CLC+ contributes to national reporting

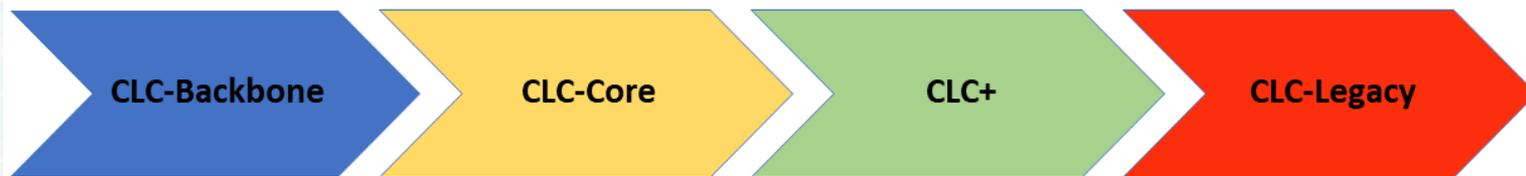




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## Involvement of Industry

- Production of CLC-Backbone
- Support production of other products (e.g. supply EO data, etc.)
- Implementation and maintenance DB infrastructure.
- Validation of products
- Industry benefits
  - Increased awareness of EO capabilities across stakeholder community
  - Additional Copernicus products and services to support downstream application development





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## Next step in conceptual development

- This is the end of the second stage of four in the project.
- Already a significant amount of feedback has been received.
- Will continue to elaborate the conceptual strategy and technical specifications.
  - Two more deliverables up to March 2018.
- Communicate these developments to the stakeholders involved in European land monitoring.
- Success of the project and the long term development of land monitoring in Europe relies on all the relevant stakeholders contributing their requirements and opinions to this process.



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## Next step in implementation

- Collate and incorporate feedback from this meeting.
- Present revised and extended versions of conceptual design and technical specifications to the Copernicus User Forum in February 2018 and Copernicus Committee.
- Collate and incorporate further feedback.
- Call for tender for CLC-Backbone production.
- Deliver the final version of the conceptual design and technical specifications at the end of March 2018.



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Thank you for your attention.

Any questions?