

# Nordic cooperation on land cover and habitat mapping using earth observation

2026







# Meeting objectives

- Kick-off Meeting – National Collaboration Programme (NCP) for Copernicus Land Monitoring Service (CLMS)
  - Presentation CLMS portfolio
  - Implementation NCP
- Selection of ongoing projects, sharing lessons learned and supporting Nordic harmonization
- Strengthening a Nordic network for ongoing cooperation and knowledge sharing

**Nordic cooperation on land cover and habitat mapping using earth observation  
including the launch of NCP CLMS**

Date: April 16<sup>th</sup> 2026 10-15 (SE, NO, DK) 11-16 (FI) 8-13 (IS)

Time (CEST (UTC+2))	Agenda	Resp.
10:00	Welcome and introduction Welcome and opening remarks Purpose of the meeting Meeting objectives	all
10:15	Presentation from European Environmental Agency (EEA) Copernicus Land Monitoring services (CLMS) – portfolio National Cooperation Programme (NCP) – why and how	EEA
11:00	<b>BREAK</b>	
11:10	How we intend to implement NCP Examples of good use cases CLMS – teasers  Finland Norway Sweden Island	10 min/country  Elise Geir Harald Camilla Michaela
11:50	Mentimeter questions – comments to the NCP 1. Do you have a use case? 2. Are you interested in participating in training – if so what topics 3. Focus groups – what topics – interest in participating?	
12-13	<b>LUNCH</b>	
13:00	<b>Land cover/Land use mapping</b>	
20 min	1. Corine Land Cover 2024 – different approaches same result	Finland, Island, Norge
10 min	2. National land cover v 2.0	Sverige
10 min	3. Nature map - AI and remote sensing	Norge
13:40	<b>Habitat and ecosystem mapping</b>	
10 min	1. Ecosystem extent account	Finland
10 min	2. Indicative mapping of forest habitats and high nature values	Sweden
10 min	3. The oldest forest - developing a national map	Norge
10 min	4. Digital Area Management in Denmark	Denmark
14:20	<b>Break</b>	

14:30	<b>Bio-geophysical Variables and Ground Motion Data</b>	
10 min	1. Calculating urban greenery and canopy cover for Nature Restoration Regulation	Finland
10 min	2. European Ground Motion Service	Island
14:50-10 min	<b>Sum up the day</b> Mentimeter questions <ul style="list-style-type: none"> <li>Reflections from the day</li> <li>Proposals for joint projects between the Nordic countries</li> </ul>	
15:00	<b>END</b>	



# Meeting rules

- Please mute your microphone and camera when not speaking.
- Please use the "raise hand" function in Teams if you wish to ask a question or comment on a topic.
- The chat is monitored by session leaders and can also be used for questions and comments.
- Presenters, keep the time 😊

We hope you enjoy the sessions and participate in the discussions!

# Mentimeter



Join at [menti.com](https://menti.com) | use code 7269 6275

How we intend to implement NCP

Good examples of use cases

# Finland



**Finland will follow the EEA *Framework and Memorandum of Understanding***

## **Mandatory modules**

- Identify and produce two or more user cases & stories for the EEA
- Organize two or more meetings promoting CLMS products and services:
  - Nordic meeting 2026
  - Webinar in May/June 2026 within Finnish Land Use/Cover Ecosystem Network
  - Joint session with Copernicus User Forum Finland in Winter Satellite Workshop (2027)
- Monitoring and reporting according to MoU

## **Voluntary modules**

- Participating at thematical focus groups and trainings (Nature Restoration Regulation)
- Carry out two stakeholder surveys on the use of CLMS data and products

# SDG 15.4.2 Mountain Green Cover for Finland using CLMS-products

Markus Törmä  
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Finnish Environment Institute  
16.4.2026



Suomen ympäristökeskus  
Finlands miljöcentral  
Finnish Environment Institute



# EOSDG Indicator 15.4.2 Mountain Green Cover

- Aim:
  - Ensure the conservation of mountain ecosystems, including their biodiversity by measuring the changes of the green vegetation (forest, shrubs, trees, pasture, cropland, etc.)
- Indicator 15.4.2 consists of two sub-indicators
  - Sub-indicator 15.4.2a, Mountain Green Cover Index (MGCI)
    - Proportion of vegetated areas from whole area
  - Sub-indicator 15.4.2b, Proportion of Degraded Mountain Land (PDML)
    - Proportion of area of degraded changes (i.e. vegetation decrease) from whole area
- Metadata
  - <https://unstats.un.org/sdgs/metadata/files/Metadata-15-04-02.pdf>

# Definition of mountain area

# Data

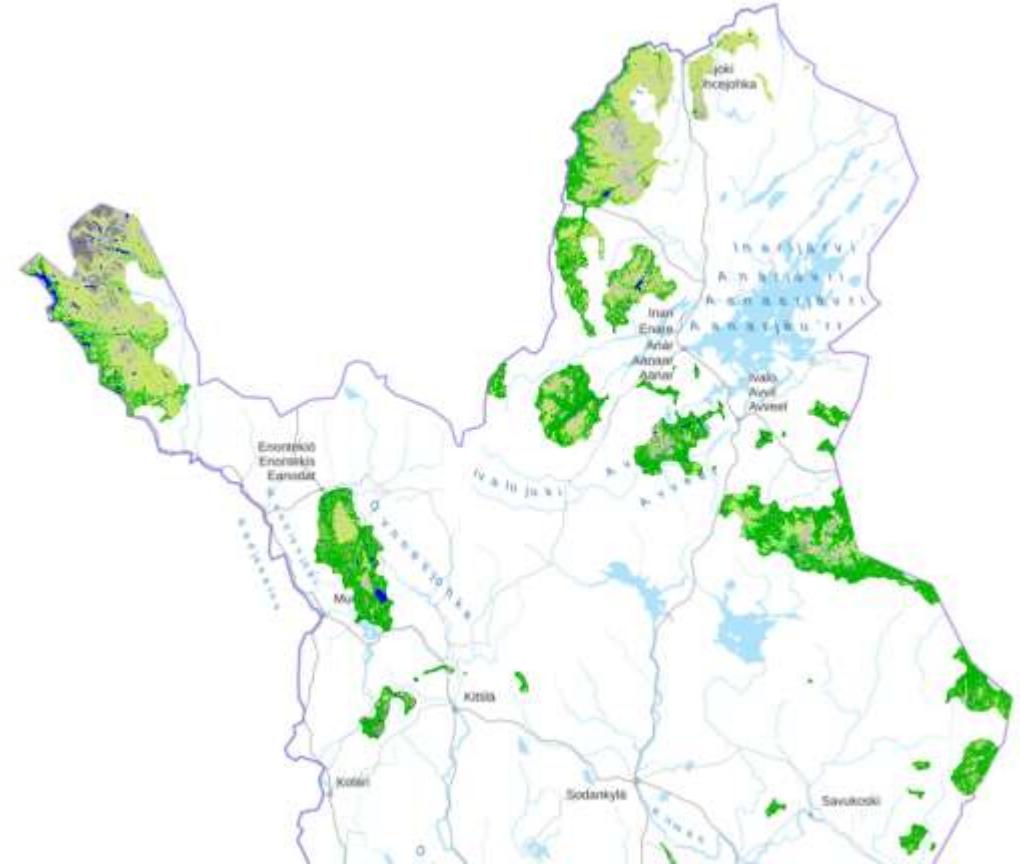
- EU-DEM: Elevation model of CLMS
- Temperature: FMI 1 km grid of daily mean temperatures 2004-2023

## Method

- Kapos mountain classes were determined using DEM
- The total mountain area was divided to Bioclimatic zones based on temperature and growing season length

## Result

- Area: 9510 km<sup>2</sup>
- Climate zone: montane
- UN Global SDG-database: Area: 2858 km<sup>2</sup>, Climate zone: montane & alpine



# Land Cover

Different input data were tested:

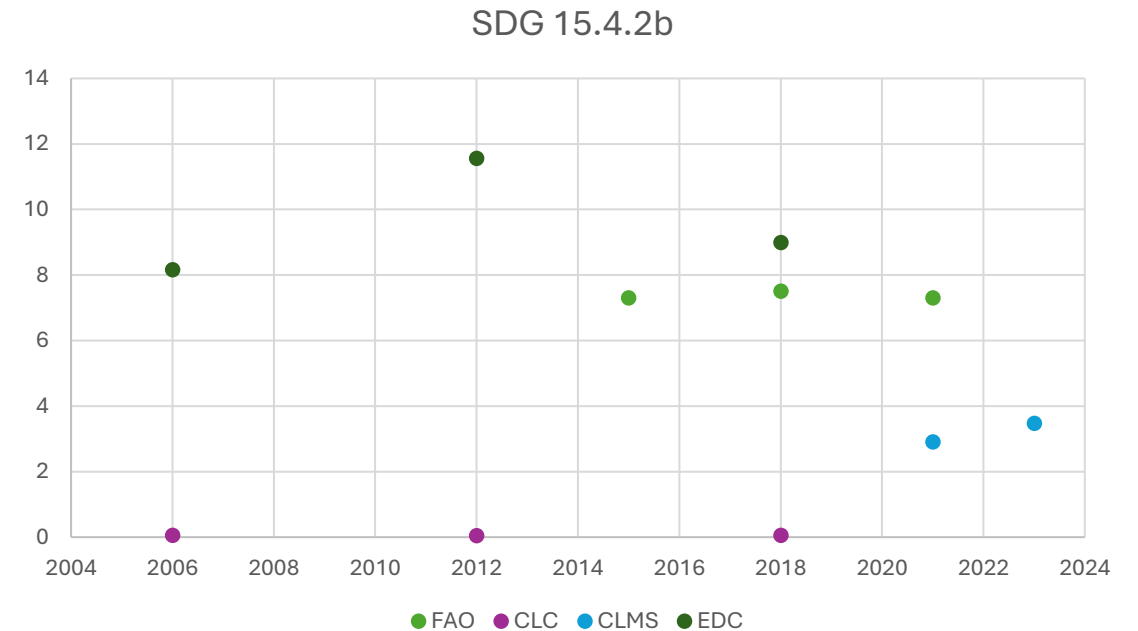
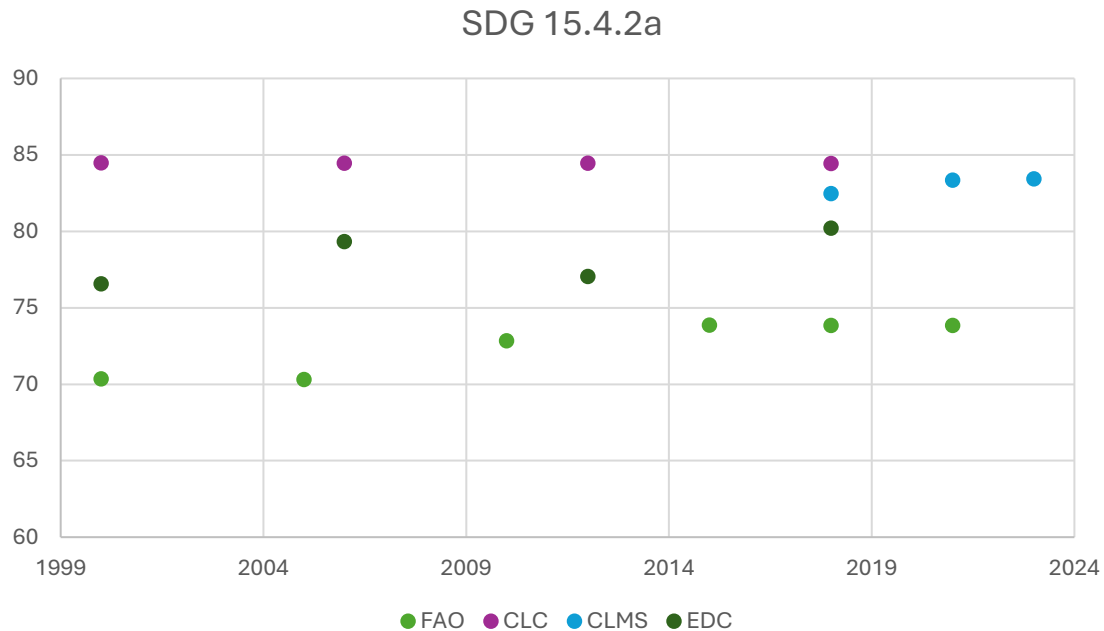
- Finnish Harmonized Corine Land Cover time series for change detection 2000 – 2018
  - 20 m pixel, 46 land cover/use classes, minimum size of change areas 0.5 ha
- CLMS CLC+ 2018, 2021, 2023 & HRL Water and Wetness 2018 & Sentinel-2 annual NDVI maximum
  - CLC+ Backbone raster: 10 m pixel, 11 thematic classes years 2018 and 2021
- Annual land cover 2000 – 2020 from Ecodatacube-project
  - Years 2000, 2006, 2012, 2018, CLC-classes, Landsat-classification, 30 m pixel

SEEA land cover classes	Green/Non-green
Croplands	Green
Grasslands	Green
Tree-covered areas	Green
Shrub-covered areas	Green
Shrubs and/or herbaceous vegetation, aquatic or regularly flooded	Green
Artificial surfaces	Non-green
Sparsely natural vegetated areas	Non-green
Terrestrial barren land	Non-green
Permanent snow and glaciers	Non-green
Inland water bodies	Non-green

		FINAL CLASS									
		Artificial surfaces	Cropland	Grassland	Tree-covered areas	Shrub-covered areas	Herbaceous or shrub vegetation, aquatic or regularly flooded	Sparsely natural vegetated areas	Barren land	Permanent snow & glaciers	Water bodies
ORIGINAL CLASS	Artificial surfaces	Stable	Agricultural Expansion	Vegetation establishment	Forest expansion	Vegetation establishment	Wetland establishment	Withdrawal of settlements	Withdrawal of settlements	Withdrawal of settlements	Withdrawal of settlements
	Cropland	Urban expansion	Stable	Withdrawal of agriculture	Forest expansion	Vegetation establishment	Wetland establishment	Vegetation loss	Vegetation loss	Glacier advance	Involution
	Grassland	Urban expansion	Agricultural Expansion	Stable	Forest expansion	Woody encroachment	Wetland establishment	Vegetation loss	Vegetation loss	Glacier advance	Involution
	Tree-covered areas	Deforestation	Deforestation	Deforestation	Stable	Vegetation loss	Involution	Deforestation	Deforestation	Glacier advance	Involution
	Shrub-covered areas	Urban expansion	Agricultural expansion	Vegetation loss	Forest expansion	Stable	Involution	Vegetation loss	Vegetation loss	Glacier advance	Involution
	Herbaceous or shrub vegetation, aquatic or regularly flooded	Wetland drainage	Wetland drainage	Wetland drainage	Wetland drainage	Woody encroachment	Stable	Wetland drainage	Wetland drainage	Glacier advance	Involution
	Sparsely natural vegetated areas	Urban expansion	Agricultural expansion	Vegetation establishment	Forest expansion	Vegetation establishment	Wetland establishment	Stable	Vegetation loss	Glacier advance	Involution
	Barren land	Urban expansion	Agricultural expansion	Vegetation establishment	Forest expansion	Vegetation establishment	Wetland establishment	Vegetation establishment	Stable	Glacier advance	Involution
	Permanent snow & glaciers	Urban expansion	Agricultural expansion	Glacial retreat	Glacial retreat	Glacial retreat	Glacial retreat	Glacial retreat	Glacial retreat	Stable	Glacial retreat
	Water bodies	Urban expansion	Agricultural expansion	Lake desiccation	Lake desiccation	Lake desiccation	Lake desiccation	Lake desiccation	Lake desiccation	Glacier advance	Stable



# Results and conclusions



- In the future: use CLMS-products

# Norway



**Norway will strictly follow the EEA *Framework and Memorandum of Understanding***

## **Mandatory modules**

- Try to identify and provide EEA with two use-cases  
We may have one (?) but need at least one more!
- Organize two or more meetings: Must be done in collaboration with others
  - Nordic meeting 2026 (possibly also 2027)
  - Break-out from national user forum 2026 (possibly also 2027)
  - Sessions in other national meeting
- Monitoring and reports according to MoU

## **Voluntary modules**

- Have not committed to any voluntary modules
- Will participate in focus teams if (sufficient) funding is available
- Will consider producing communication material if (sufficient) funding is available

## **Contact points**

[ghs@nibio.no](mailto:ghs@nibio.no)

[maria.lund@nibio.no](mailto:maria.lund@nibio.no)

# Sweden

Sweden will follow the *EEA Framework and Memorandum of Understanding*



## Mandatory modules

- Identify and provide EEA with two use-cases
- Organize two or more meetings in collaboration with others
  - Nordic meeting 2026 (possibly also 2027)
  - Sessions in existing national meetings as the steering group for NMD and Inter-agency collaboration on Copernicus conducted by the Swedish National Space Agency
  - Collaboration with Copernicus User Forum Sweden
- Monitoring and reports according to MoU

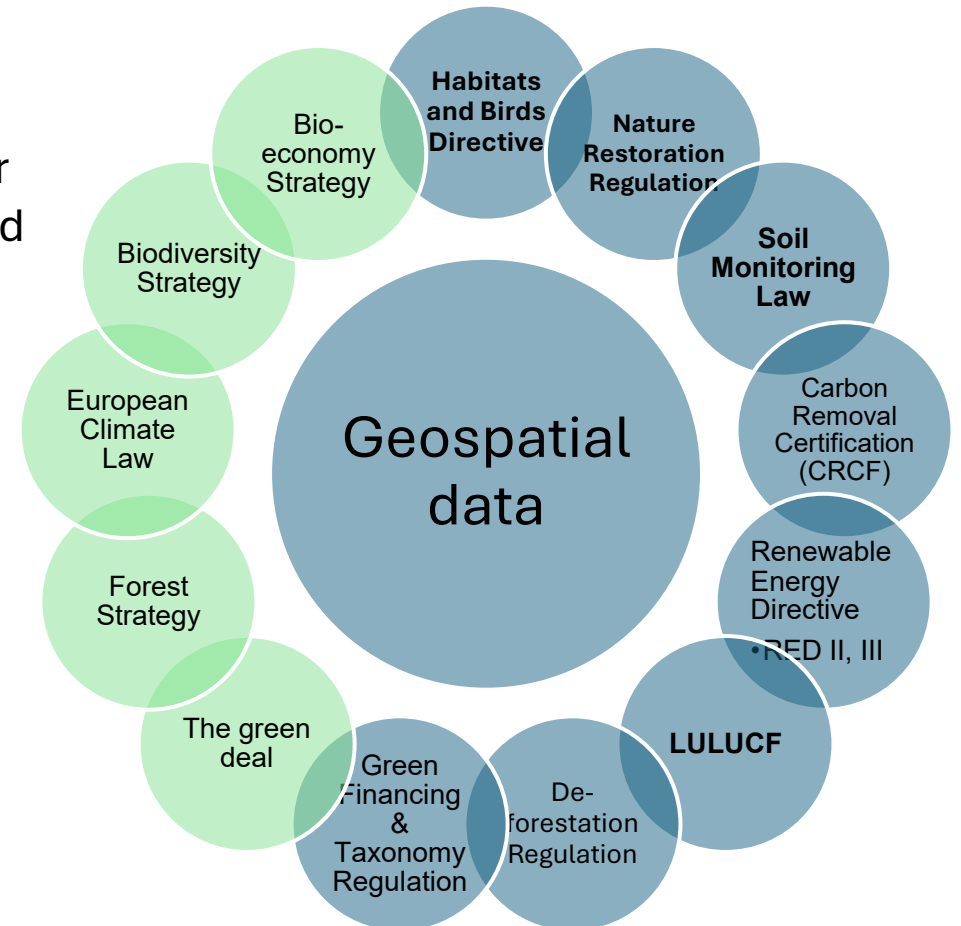
## Voluntary modules

- Participating at relevant thematical focus groups (Nature Restoration Regulation, Soil Monitoring Law, LULUCF)
- Stakeholder surveys about CLMS datasets and services

## Contact points

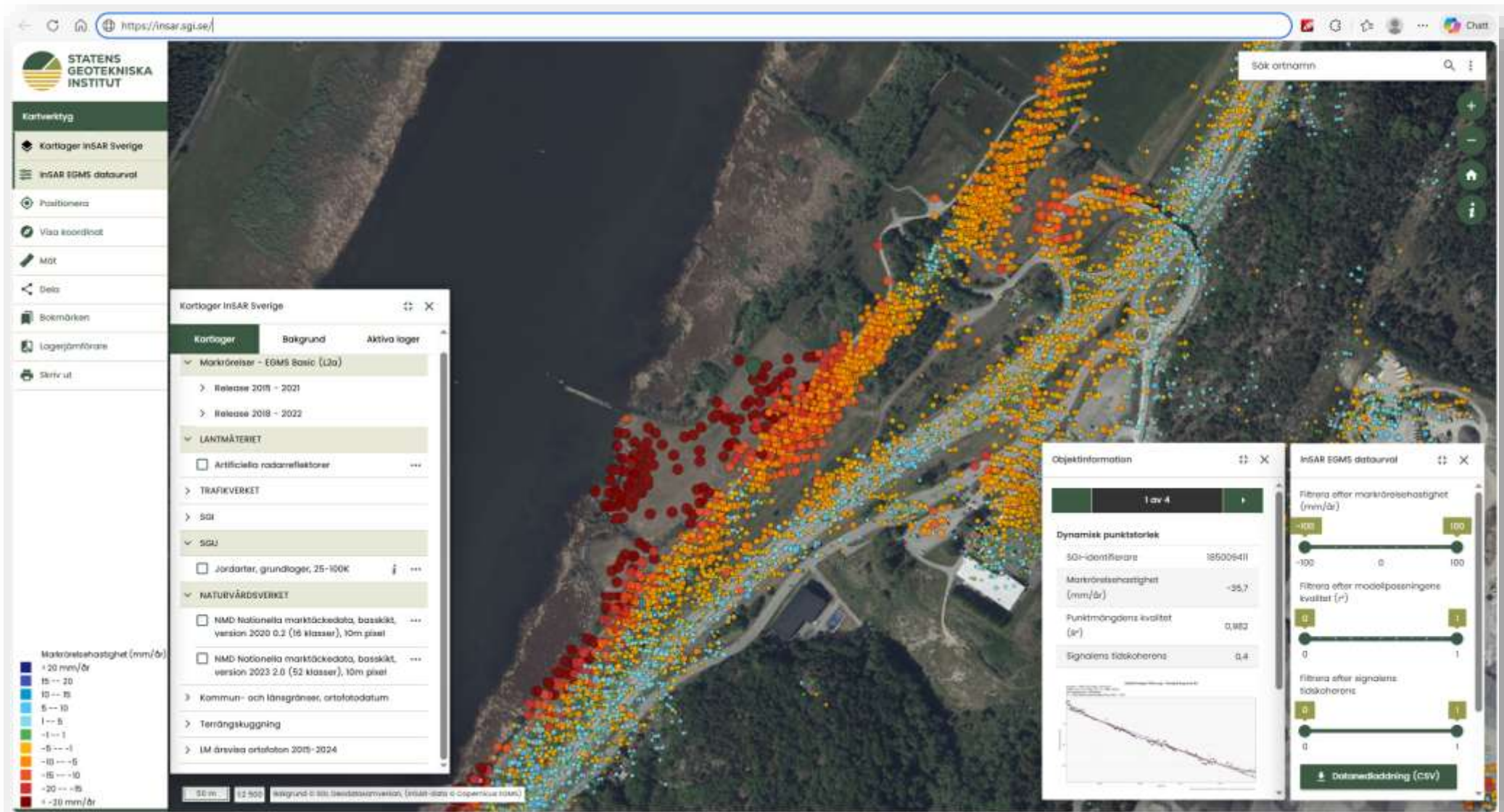
[camilla.jonsson@naturvardsverket.se](mailto:camilla.jonsson@naturvardsverket.se)

[therese.eriksson@naturvardsverket.se](mailto:therese.eriksson@naturvardsverket.se)





# New national service for tracking ground movements (based on EGMS from Sentinel 1)



# Use of CLMS Data in Ecosystem Accounts

- Statistics Sweden (SCB) uses CLMS data to develop Ecosystem Accounts under Eurostat reporting requirements.
- The main datasets currently used are Corine Land Cover (CLC), CLCplus Backbone, and HRL Tree Cover Density.
- Integration CLC and National Land Cover Data (NMD) is being assessed as a future alternative, but challenges remain regarding reference years and time-series consistency (for NMD).



# Pollination indicator for ecosystem accounts

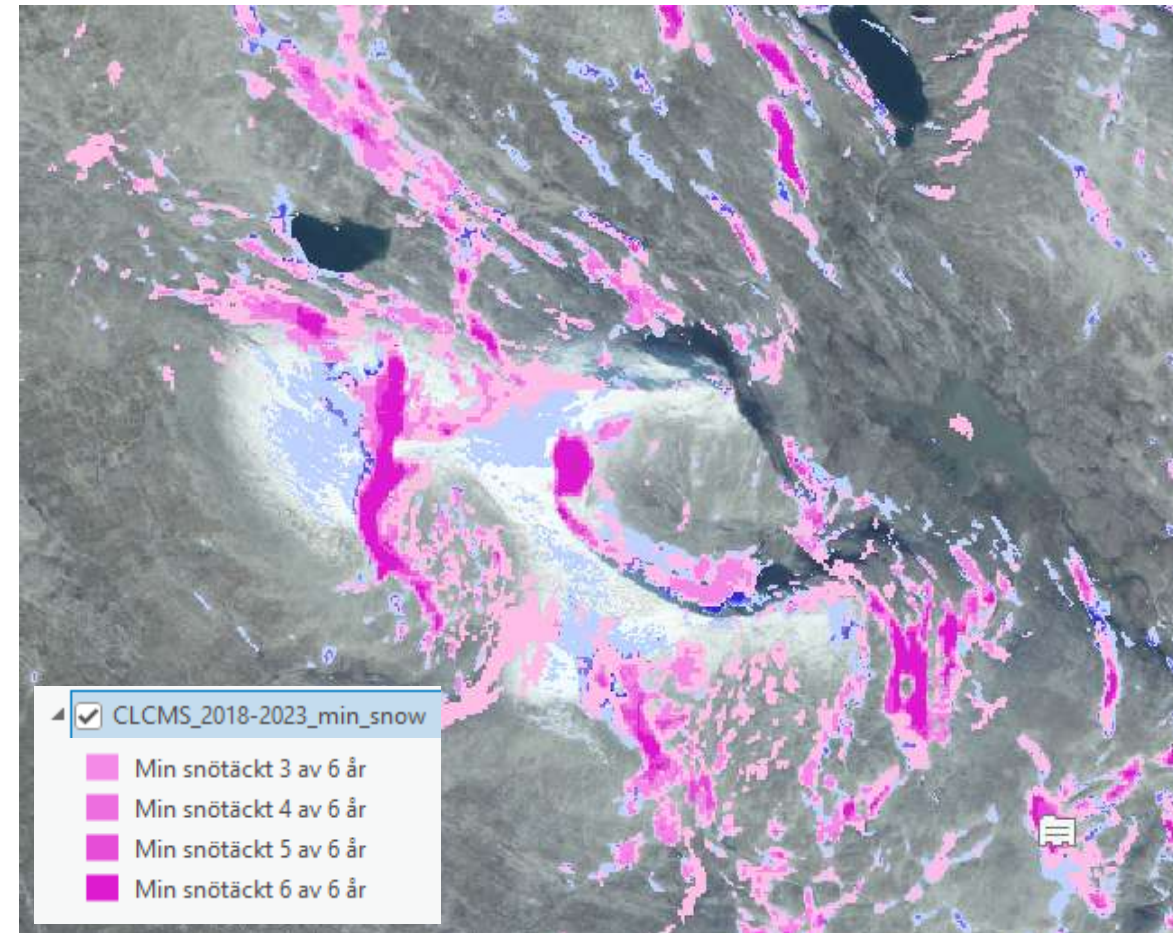
- EU-financed project led by Statistics Sweden, supporting the European Green Deal and the development of ecosystem accounts.
- Develops a Swedish indicator for crop pollination within the SEEA Ecosystem Accounting framework
- Tests and compares different methods and data sources, including CLMS, national data, and a simple indicator approach.
- Engages experts and stakeholders to improve quality, usability, and links to nature restoration and impact monitoring. Report is coming soon.





# CLMS in Swedish National Land Cover Database

- The Persistent Snow Area (PSA) from CLMS can be used to map areas where snow is present throughout the hydrological year, 0-1 year.
- The product is generated on a yearly basis from fractional snow cover products and provides the extent of persistent snow cover.
- Data is available since 2016; data errors restrict usage before 2018.
- Individual years overestimates (maps seasonal snow), recalculated to snow covered 3-6 out of 6 year provide relevant estimations of persistent snow patches.



# Iceland



Iceland will follow the *EEA Framework and Memorandum of Understanding*

## Mandatory modules

- Identify and provide EEA with two use-cases
- Organize two or more meetings in collaboration with others
  - Nordic meeting 2026 (possibly also 2027)
  - Sessions in other national meetings
  - Or possibly Copernicus User Forum Iceland (2027)
- Monitoring and reports according to MoU

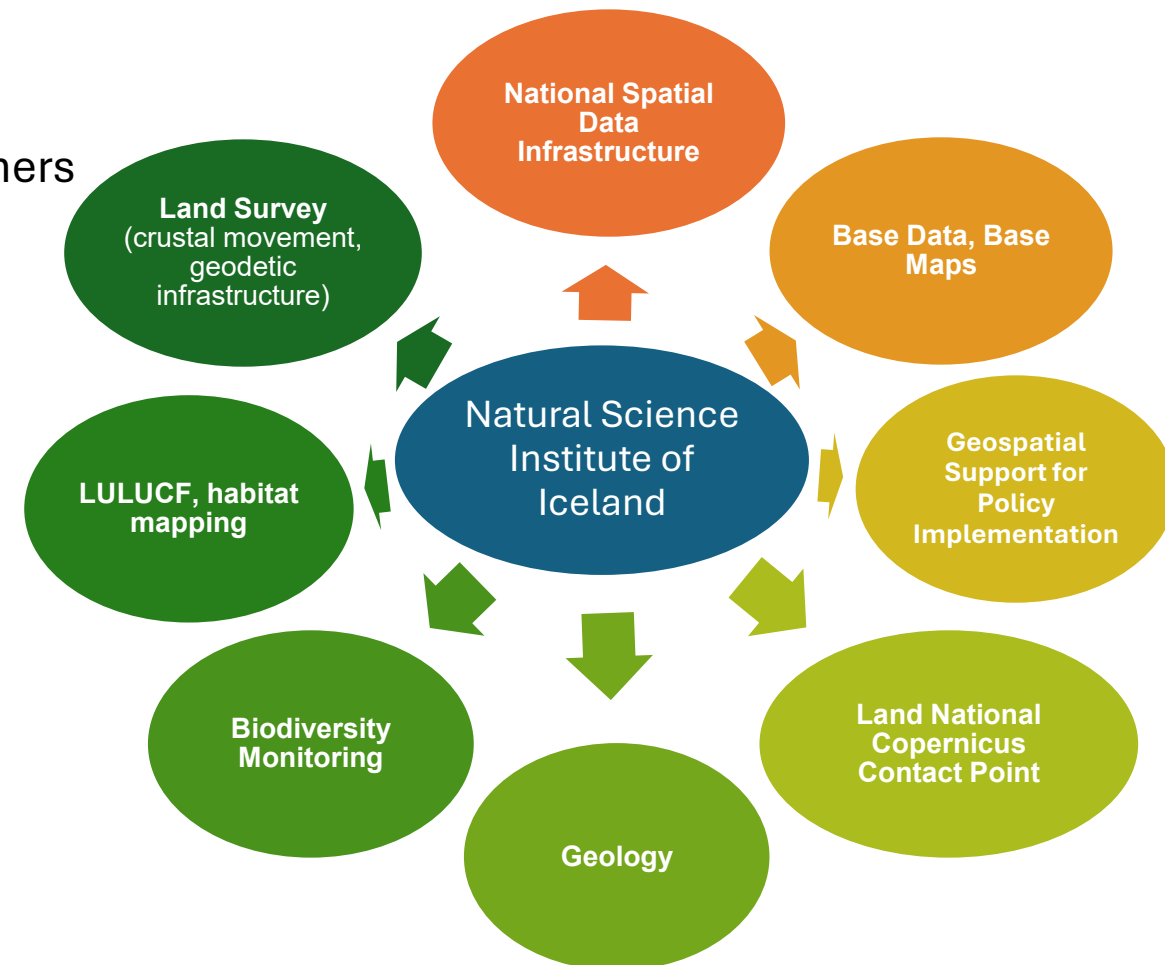
## Voluntary modules

- Will consider participate in thematical focus group
- Planned a user survey to detect use-cases
- add CLMS and NCP content to [www.copernicus.is](http://www.copernicus.is)

## Contact points

[marco.pizzolato@natt.is](mailto:marco.pizzolato@natt.is)

[michaela.hrabalikova@natt.is](mailto:michaela.hrabalikova@natt.is)





## Gögn

Leita

<https://natt.gis.is>



✓ Þéttleiki trjáþekju 2023 ☰

~~X~~ 0 - all non-tree covered are

1% tree cover density

2% tree

3% tree

4% tree

5% tree

6% tree

7% tree

8% tree

9% tree

10% tre

11% tre

12% tre

13% tre

14% tre

15% tre

16% tre

17% tre

18% tre

19% tre

Tree Cover Density 2023 (raster 10 m, 100 m), Europe, yearly

### General info

Downloaded from <http://ajphaphapublications.org/>



Aerial view of a dense green forest canopy.

## Services

Provides at pan-European level in the spatial resolution of 10 m and 100 m the level of tree cover density in a range from 0% to 100% for the 2023 reference year.

남자 10명, 여자 10명, 총 20명

by the following:

Click here to go to the next slide

DOI (rasier 10 m): <https://doi.org/10.2591/6w677443e-h794731c-h40-304r/2w-488d>

You can find instructions on how to cite CIMS data in our [Data policy](#) section.

10 km

NSII Data Portal

Vegetation and farm boundaries

DEM

## Geology of Iceland

Bedrock mapping  
for avalanche...

Historical Aerial  
Imagery Viewer

## Geodetic Map Viewer

## Nature protection

## Seal haul-out sites

N 65° 1' 43" W 18° 51' 53"  
 ISN93: 506379, 503191  
 European Environment Agency



# Copernicus á Íslandi



Copernicus  
Sentinel data 2024

Add a section about  
Copernicus Land in  
Icelandic

## Hvað er Copernicusaráætlunin



**What is the Copernicus Programme?**  
EU Defence and Space



Climate change • Climate change  
refers to long-term shifts in ...

FULL, FREE AND OPEN  
ACCESS TO DATA



ATMOSPHERE MONITORING

MARINE ENVIRONMENT MONITORING

# Mentimeter



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# LUNCH BREAK

12:00-13:00 CET

10:00-11:00 GMT

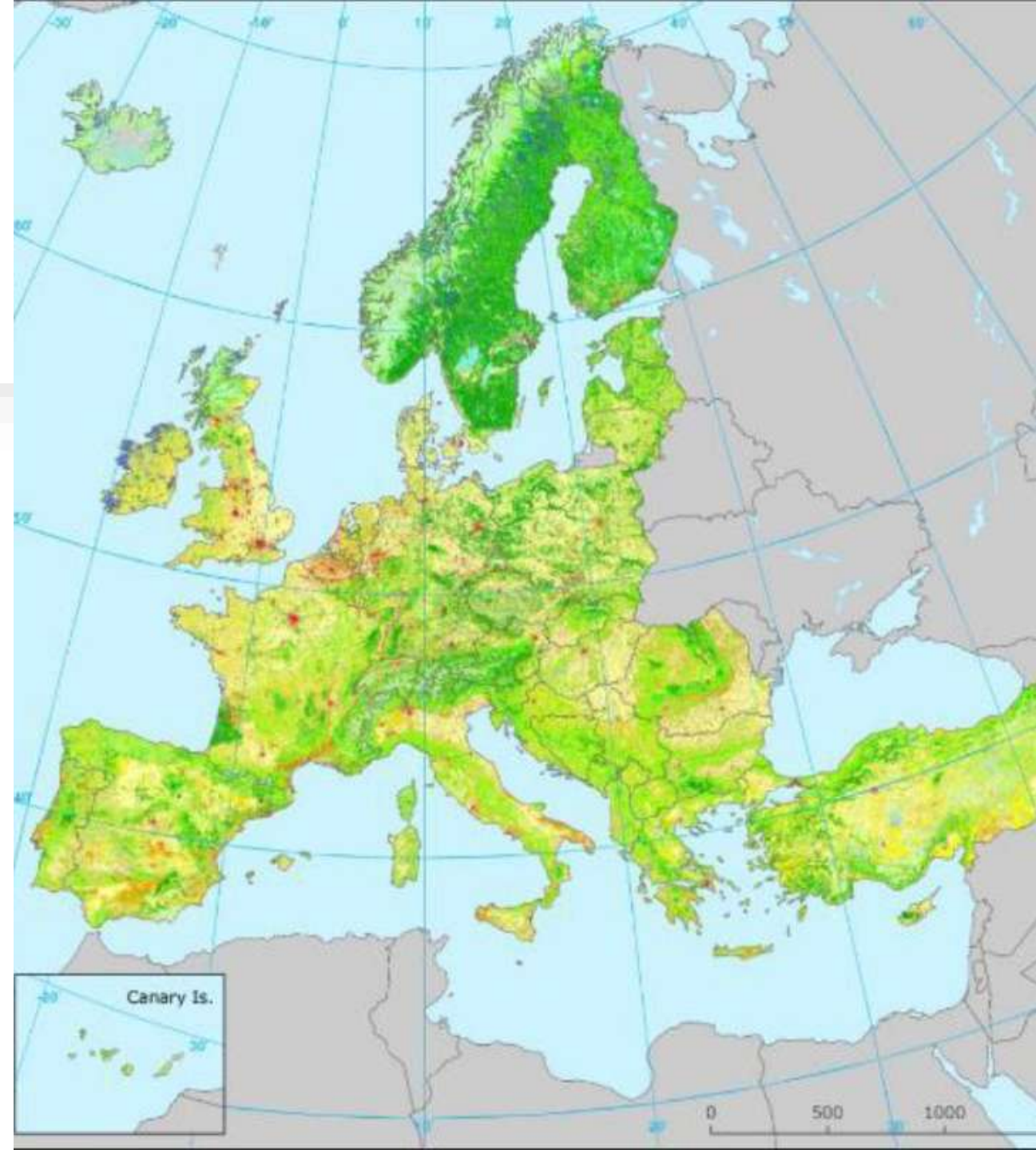


# Corine Land Cover 2024



# Land cover / Land use mapping

- Content of session
  - Corine Land Cover 2024: Norway, Finland, Iceland
  - National: Swedish National Land Cover 2.0
  - National: Norwegian Nature Map
- Corine Land Cover classification
  - Pan-European land cover since 1990s
  - Currently 32+7 countries participating
  - Interpretation: visual interpretation of Sentinel-2 images
  - Characteristics: 44 classes on third level, 25 ha MMU, 100 m MFW, 5 ha change MMU



# Finland

## Background

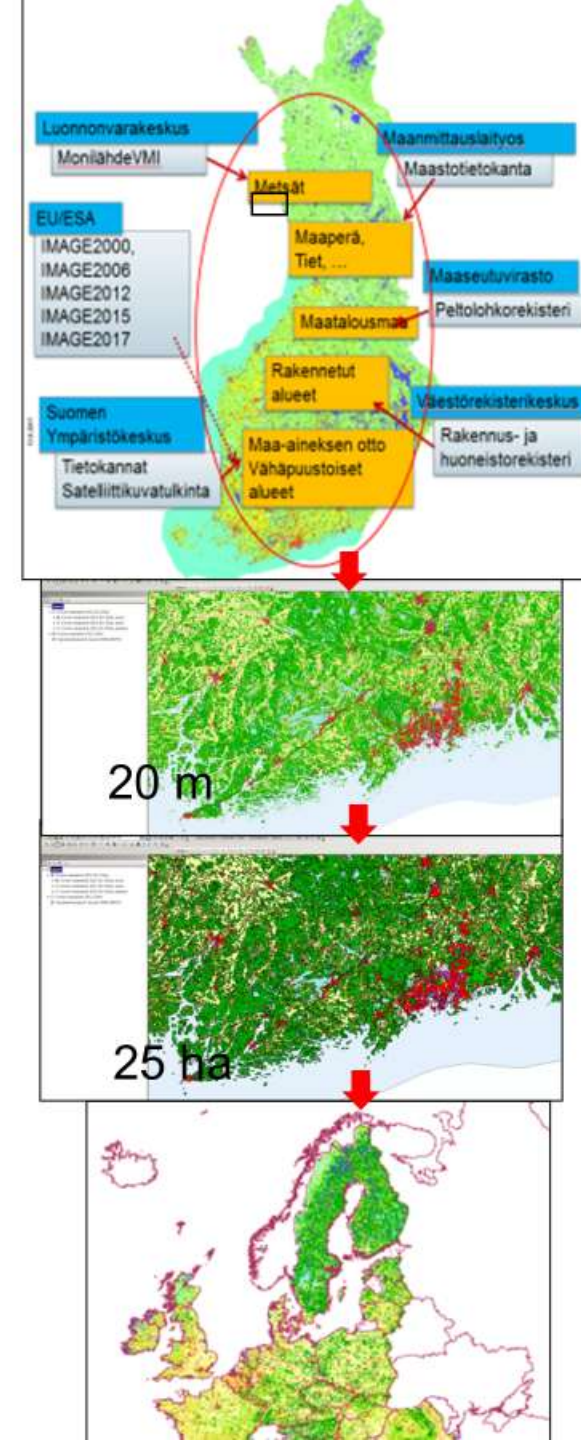
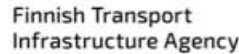
- Corine Land cover data production in Finland
  - Participation since 2000
  - Updates for 2006, 2012, 2018 & 2024
  - Coordinated and mainly produced by Syke
- Syke is motivated to update Corine Land cover data
  - Also a high resolution (20m raster) version of land cover is produced (parallel to EU data) for national users
    - National HR corine data is heavily used at Syke
    - Plus over 23000 downloads by other users since 2018
    - End User surveys indicate that the HR land cover/land use data and the time series is very important to users
    - The new update is frequently asked for by end users





# Finnish method – database merge

- CLC2024 update is based on usage of existing national in situ land cover/use datasets and semi-automated processing of multitemporal satellite images
- Integration of national in-situ data sources on land cover/use from several data producers
  - Topographic database
  - Building and dwelling register
  - Land Parcel Information system
  - Multisource National Forest Inventory
  - National Road and Street Database
  - Environmental registers, DB on water bodies and riverbeds
  - Missing data interpreted or digitized
- Land cover/land use changes detected using multitemporal
  - Satellite data: land cover changes
  - In-situ land use/land cover data: land use changes
- Outputs
  - High resolution LC/LU status layer and LC/LU changes - MMU: 20 m, 0.5 ha
  - EU data generalized from above - MMU: 25 ha, 5 ha
- This approach has been applied since CLC2000



# CLC2024 update: status of the project

- No (major) changes to the method applied and input data used
- IMAGE2024 – Copernicus Sentinel-2 Global mosaic service has been used (reflectance and index mosaics)
  - No need to check clouds and their shadows manually
- Novelty in 2026: solar parks have been mapped and will be a sub class of 121
- Status of the end products:
  - EU CLC2024 status layer (revised CLC2018 is not part of our production method) & EU CLC changes 2018-2024
    - 1st verification done, 2nd verification on the way: data sent to EEA
  - Metadata documents
    - Under finalization
  - National high resolution status layer CLC2024 and changes 18-24
    - Under finalization: will be published in early June or September



# Iceland – Production method

- We use the recommended method of **Change mapping first**
- Revising CLC2018 around areas that have changed and then mapping the changes
- Creation of statuslayer 2024 from the revised CLC2018 and CLC-change layers
- Production tools from the EEA
  - Using the **Interchange / Intercheck** software for revision and change mapping
  - **ArcGIS** to work with the whole database and generating the CLC2024 status layer with the help of an **ArcGIS tool from the EEA**
  - **CLMS QC Tool** for last check and a harmonised delivery to the EEA

# Established connections with Institutions in Iceland

- We use a **mixture** of photointerpretation and insitu data from various institutions
- **Some institutions** can deliver data for the whole country but others have incomplete/partial data
- In the beginning we used **planning data** from the municipalities for artificial surfaces. But that data is sometimes actual and sometimes just plans.
- The **road administration** and the **National Land Survey** had good data for roads and mines
- **Aviation authorities** have info about airports
- The **Farming Association** has limited information on class 211, Non-irrigated arable land
- We payed the **Forestry service** to help them getting their data in order for the whole country
- Our own institute the **Natural Science Institute** has data for the (3.2), 3.3, 4.1, and 4.2 classes
- **University of Iceland** provides data on the glaciers
- **Most of the data needs extra work to be suitable for CLC-use**

# Data from other institutions covering the whole country

## 1- Artificial surfaces

### 1.1 Urban fabric

- 111 Continuous urban fabric
- 112 Discontinuous urban fabric

### 1.2 Industrial, commercial & transport

- 121 Industrial or commercial units
- 122 Road and rail networks and associated land
- 123 Port areas
- 124 Airports

### 1.3 Mine, dump & construction

- 131 Mineral extraction sites
- 132 Dump sites
- 133 Construction sites

### 1.4 Artificial, non-agricultural vegetated

- 141 Green urban areas
- 142 Sport and leisure facilities

## 2 - Agricultural areas

### 2.1 Arable land

- 211 Non-irrigated arable land
- 212 Permanently irrigated land
- 213 Rice fields

### 2.2 Permanent crops

- 221 Vineyards
- 222 Fruit trees and berry plantations
- 223 Olive groves

### 2.3 Pastures

- 231 Pastures

### 2.4 Heterogeneous agricultural

- 241 Annual crops associated with permanent crops
- 242 Complex cultivation patterns
- 243 Land principally occupied by agriculture, with significant areas of natural vegetation
- 244 Agro-forestry areas

# Data from other institutions covering the whole country

## 3 - Forests and semi-natural areas

### 3.1 Forests

- 311 Broad-leaved forest
- 312 Coniferous forest
- 313 Mixed forest

### 3.2 Shrub and/or herbaceous vegetation

- 321 Natural grasslands
- 322 Moors and heathland
- 323 Sclerophyllous vegetation
- 324 Transitional woodland-shrub / new plantations

### 3.3 Open spaces with little/no vegetation

- 331 Beaches, dunes, sands
- 332 Bare rocks
- 333 Sparsely vegetated areas
- 334 Burnt areas
- 335 Glaciers and perpetual snow

## 4 - Wetlands

### 4.1 Inland wetlands

- 411 Inland marshes
- 412 Peat bogs

### 4.2 Coastal wetlands

- 421 Salt marshes
- 422 Salines
- 423 Intertidal flats

## 5 - Water bodies

### 5.1 Inland waters

- 511 Water courses
- 512 Water bodies

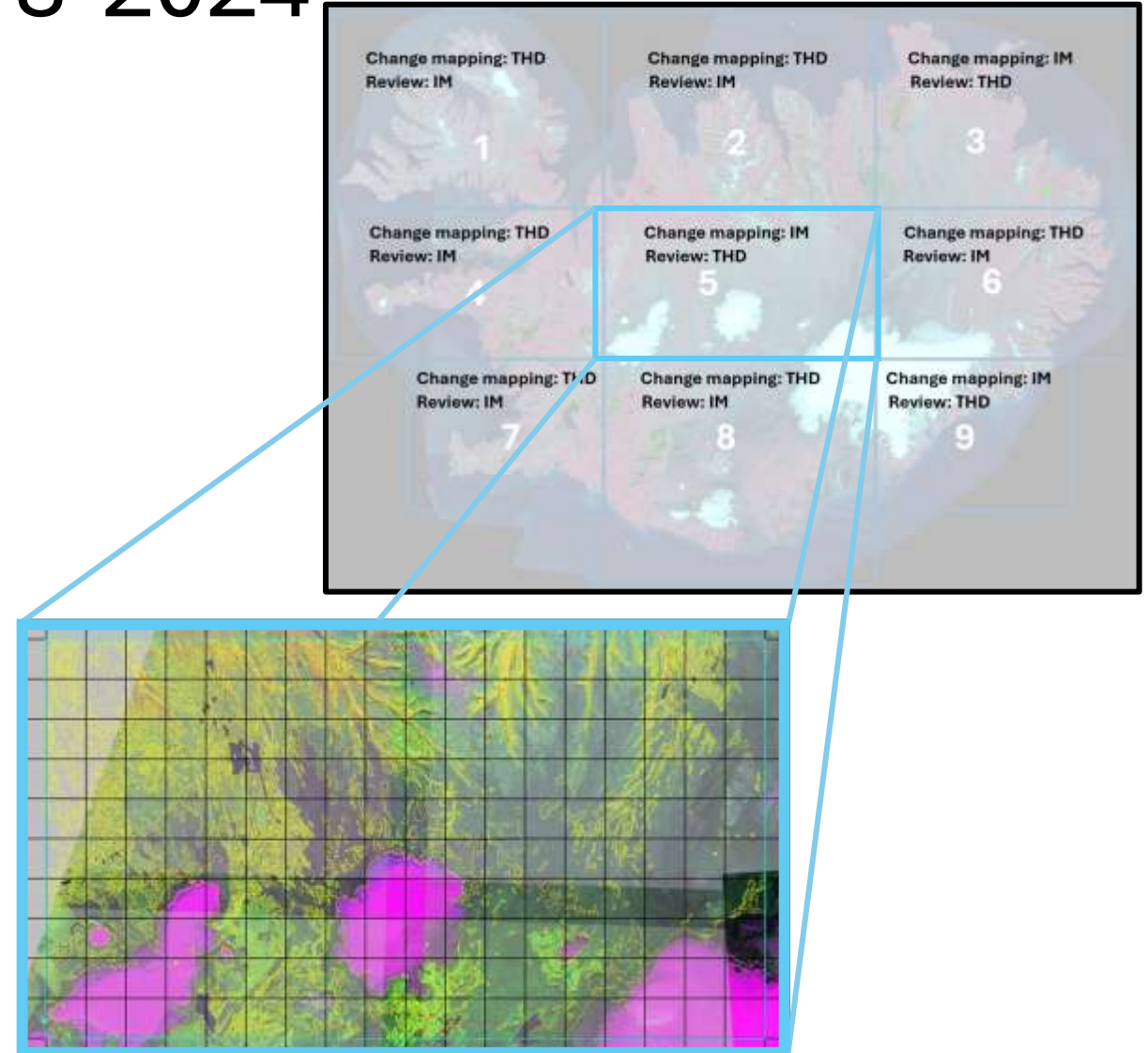
### 5.2 Marine waters

- 521 Coastal lagoons
- 522 Estuaries
- 523 Sea and ocean



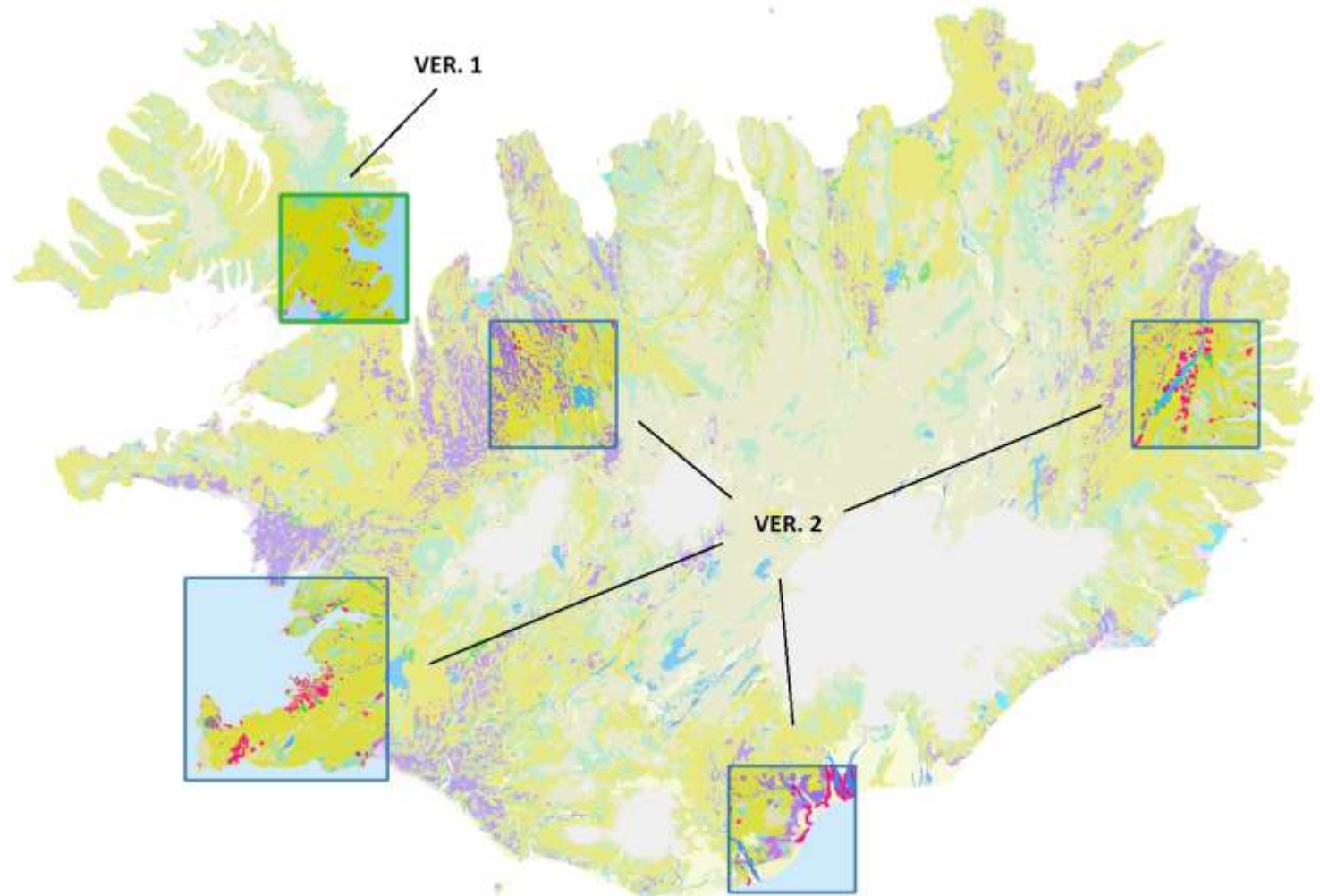
# CLC change mapping 2018-2024

- Iceland is divided into 9 work units
- Each area split into smaller areas, 10 x 10 km
- Changes mapped by interpreter 1
- And then reviewed by interpreter 2
- Remarks from review discussed and corrections applied where needed



# Verification of the CLC-technical team

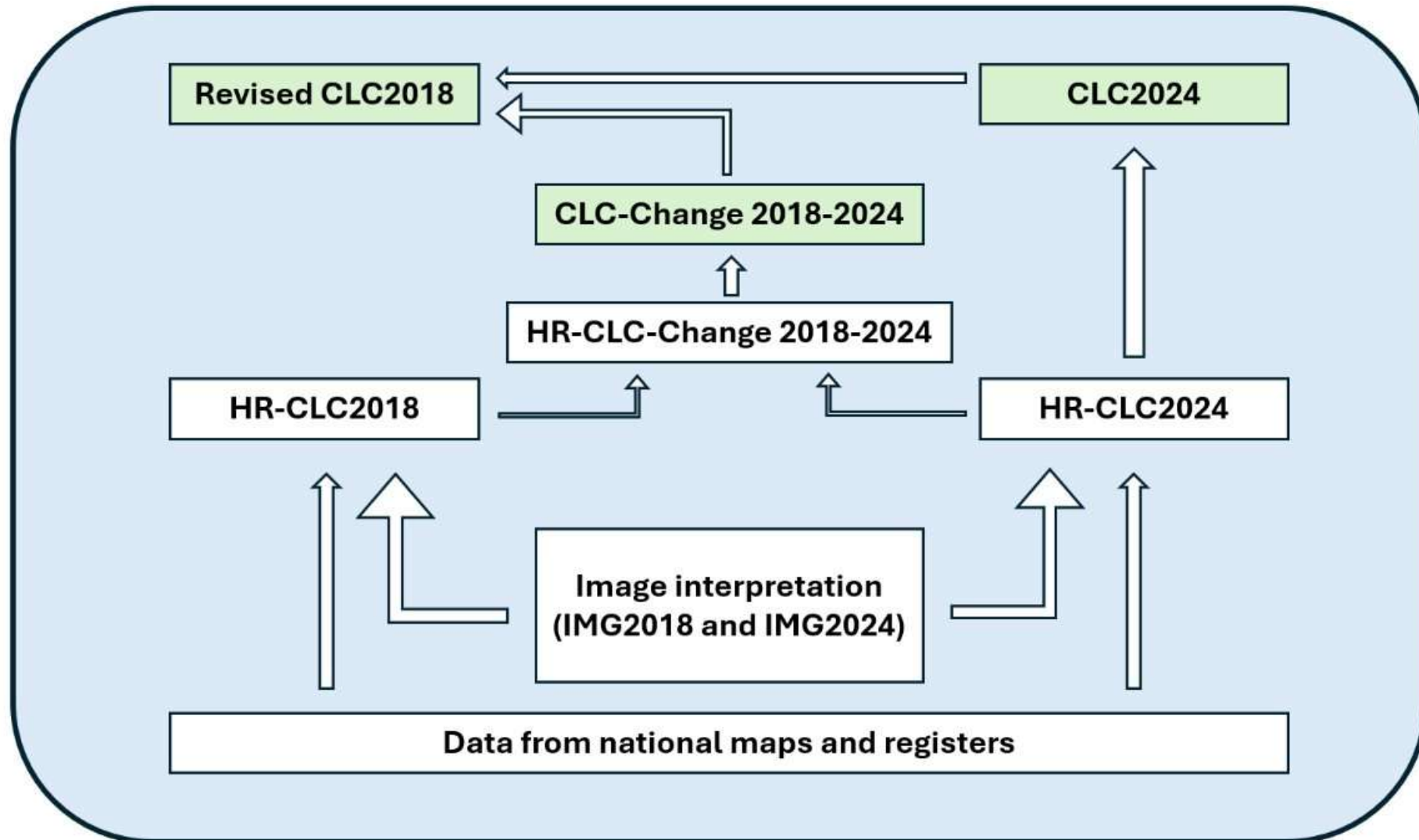
- Traditional verification by the CLC technical team
- **First verification** after mapping 10 - 30% of the country  
Area chosen by the National team and verified by the CLC technical team
- **Second verification** after mapping 75% of the country  
4 Areas chosen by the CLC technical team and verified by them



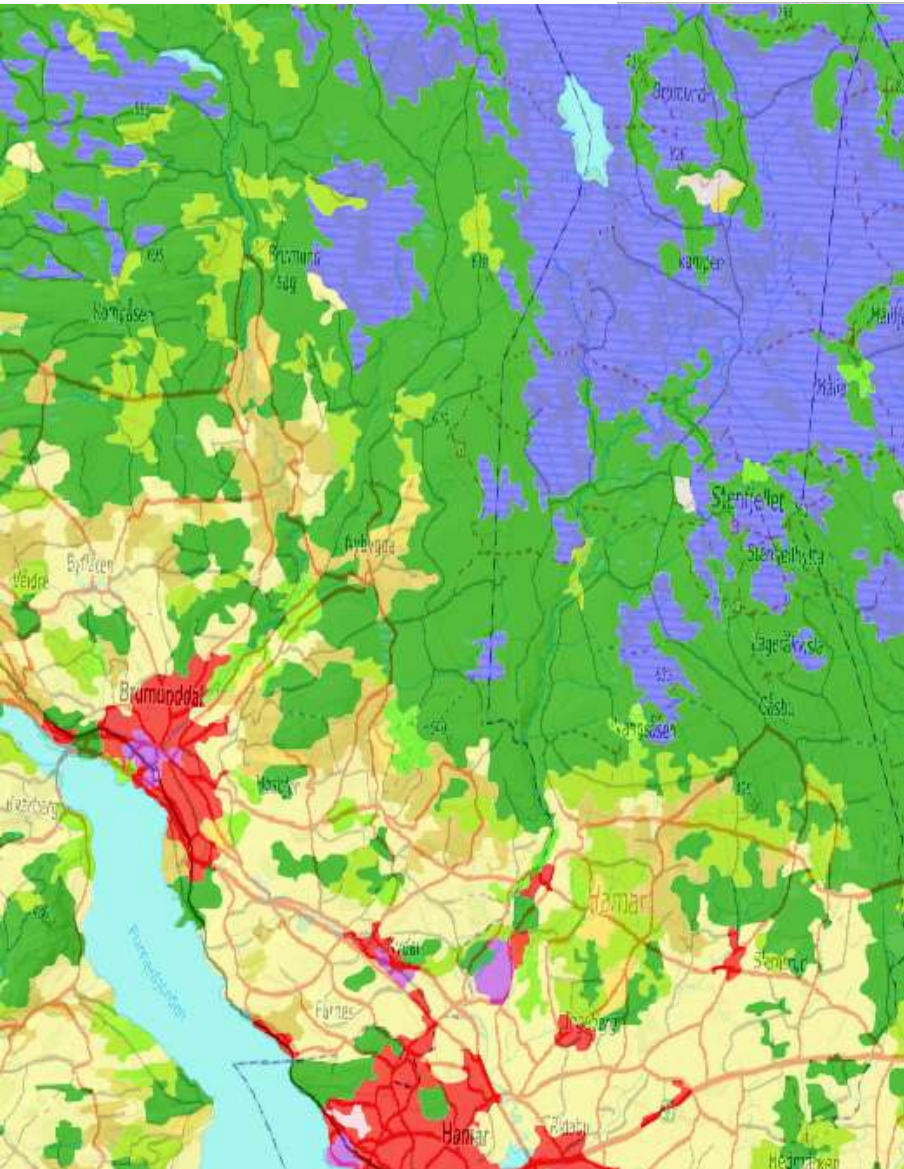
# Iceland - Status of CLC2024 and future

- The **revision and change** mapping is finished for the whole country
- **Verification 1 and 2 are finished** and we are working on corrections from verification 2
- The mixed method of CLC mapping in Iceland is going well but the main challenges ahead are to estimate the general change/increase in vegetation.
- We are hoping that new remote sensing and AI methods can help there

# Norway – a bottom-up approach



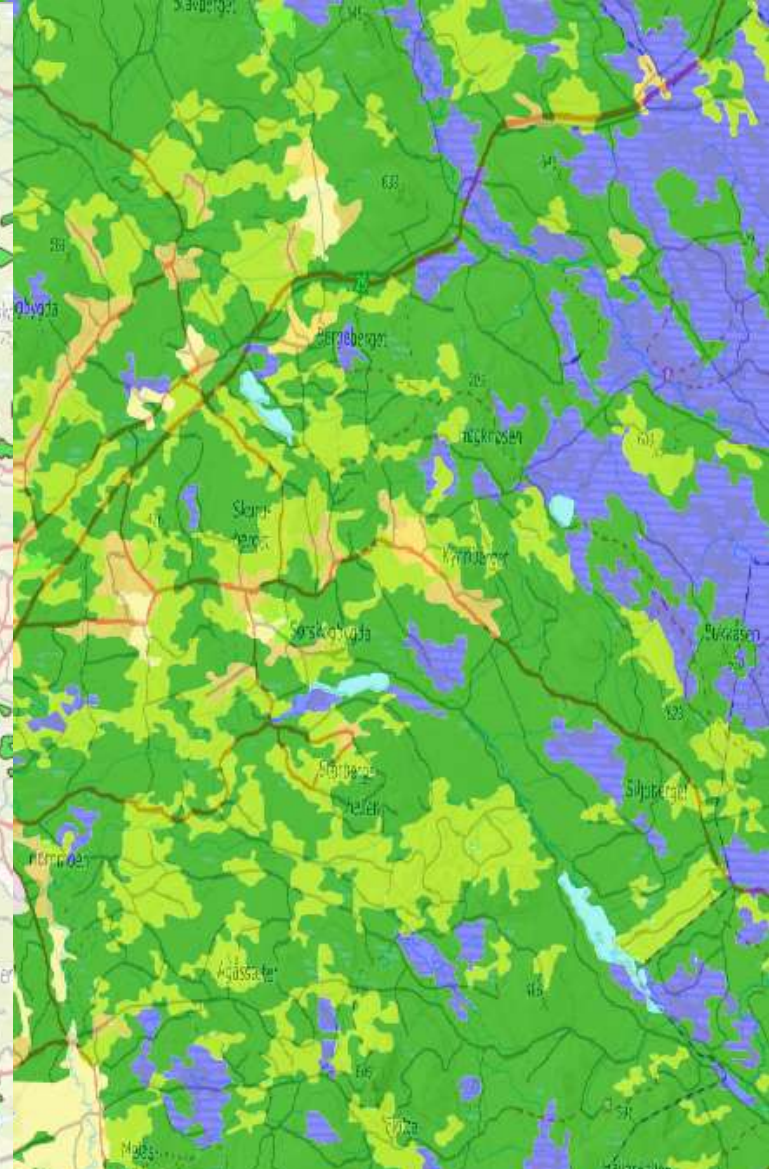




**CLC-2018**



**CLC-Changes**



**CLC-2024**



# Norway – Current status (April 2026)

- National CLC-2024 and CLC-Changes-2018-24 are produced
- Revised CLC-2018 have been produced by "backdating" CLC-2024 using CLC-Changes
- All dataset have complete national coverage
- Carried out 1st verification - not yet any 2nd verification
- Developing metadata – can deliver by end of April

Challenges (1st verification):

- Contradictory comments – MMU and MFW

# Mentimeter



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Sum up the day

