

# Nature mapping with AI and remote sensing



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16.04.2026

(Foto: Miljødirektoratet)



# Project goals

- Wall-to-wall map of nature types
- Follow the Nature In Norway (NiN) typification system
- Using free/existing remote sensing data
- As accurate as possible

## 4 projects

- Mountains

Aug/2024 >>>>>>>> Dec/2026

≡ Field

- Lowlands

Aug/2025 >> Dec/2026

≡ Field

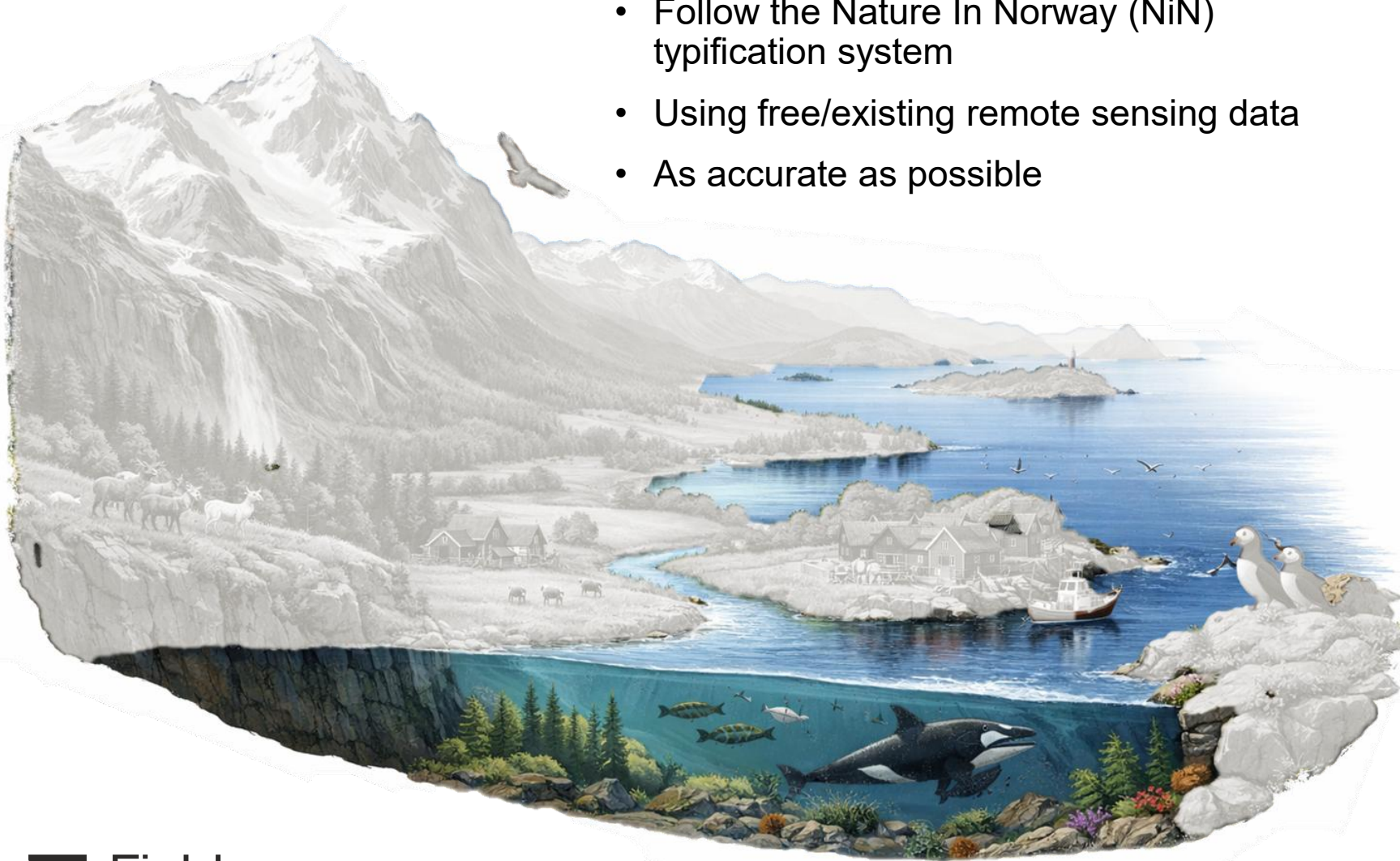
- Marine

Sep/2025 >> Dec/2026

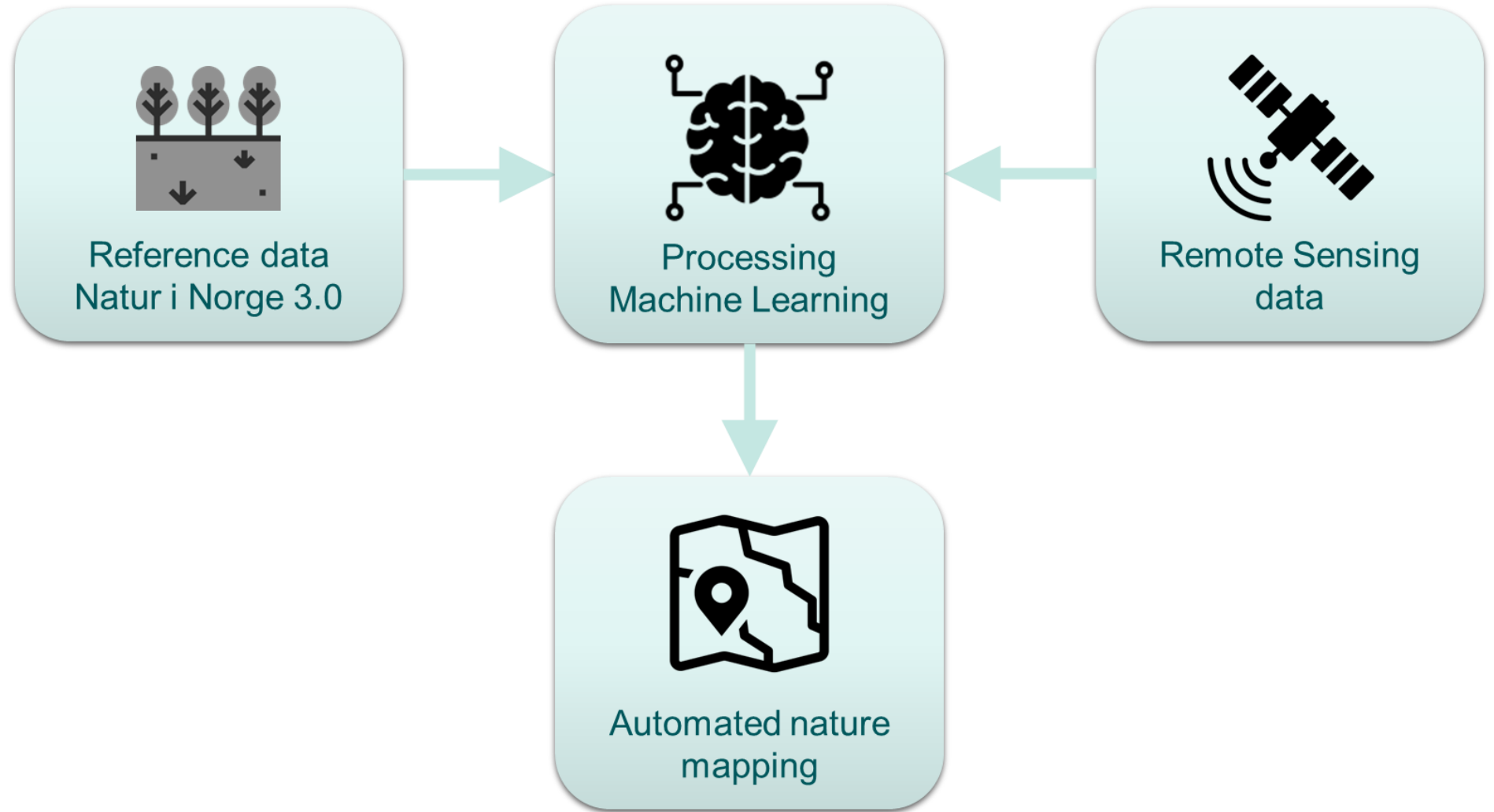


- Calcium map  
NGU

≡ Field

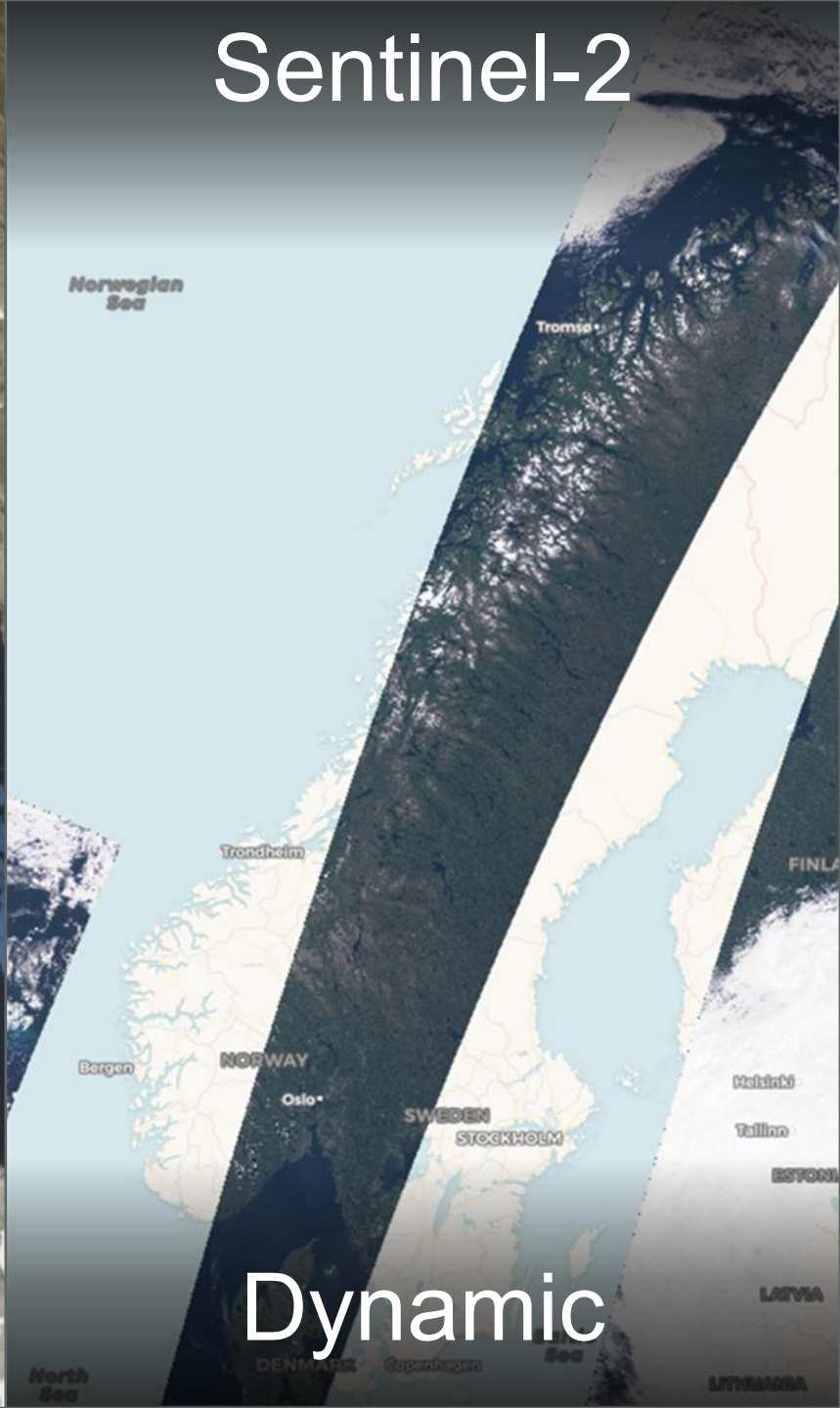


# Method



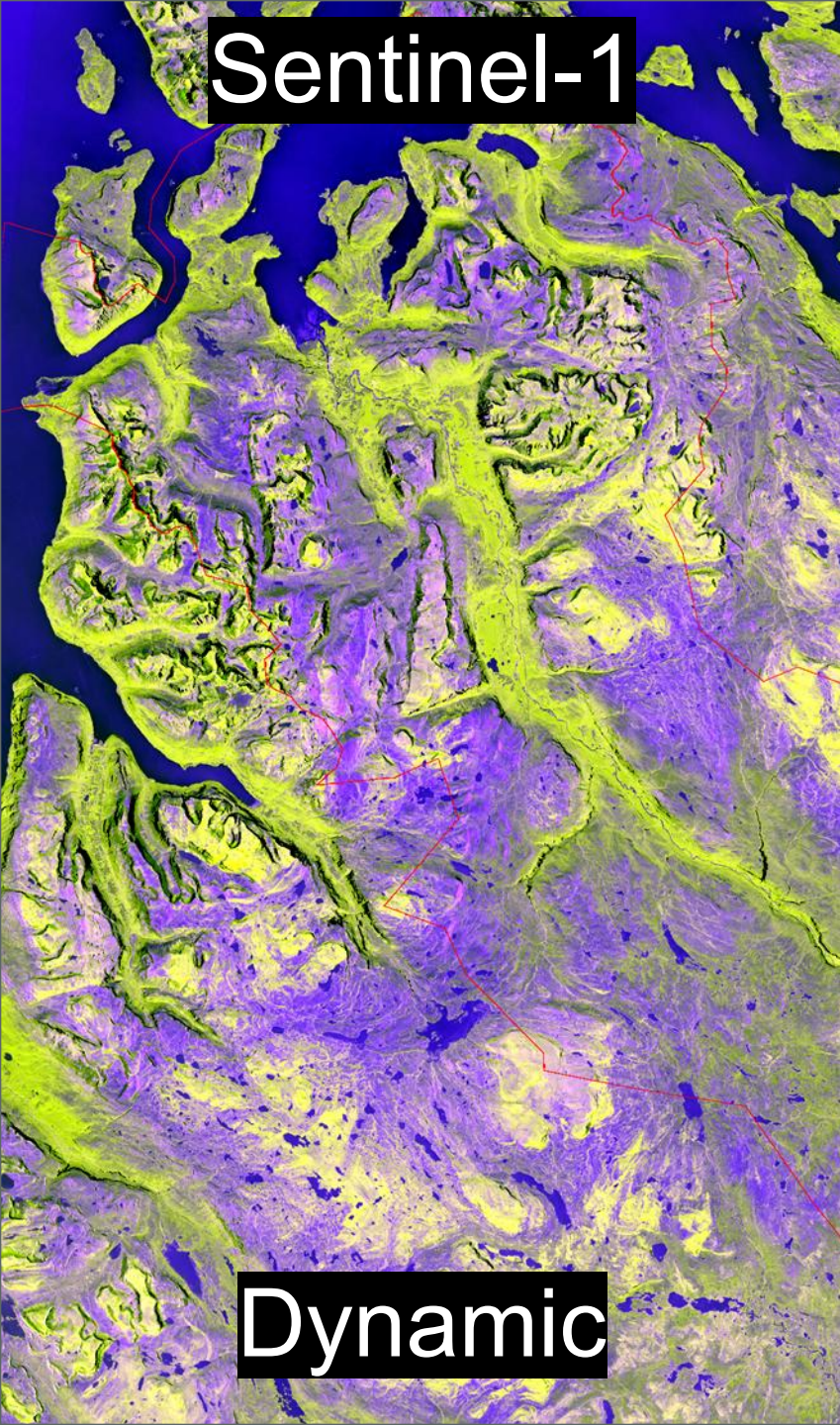
- “Standard” workflow
- Several novelties







Sentinel-1



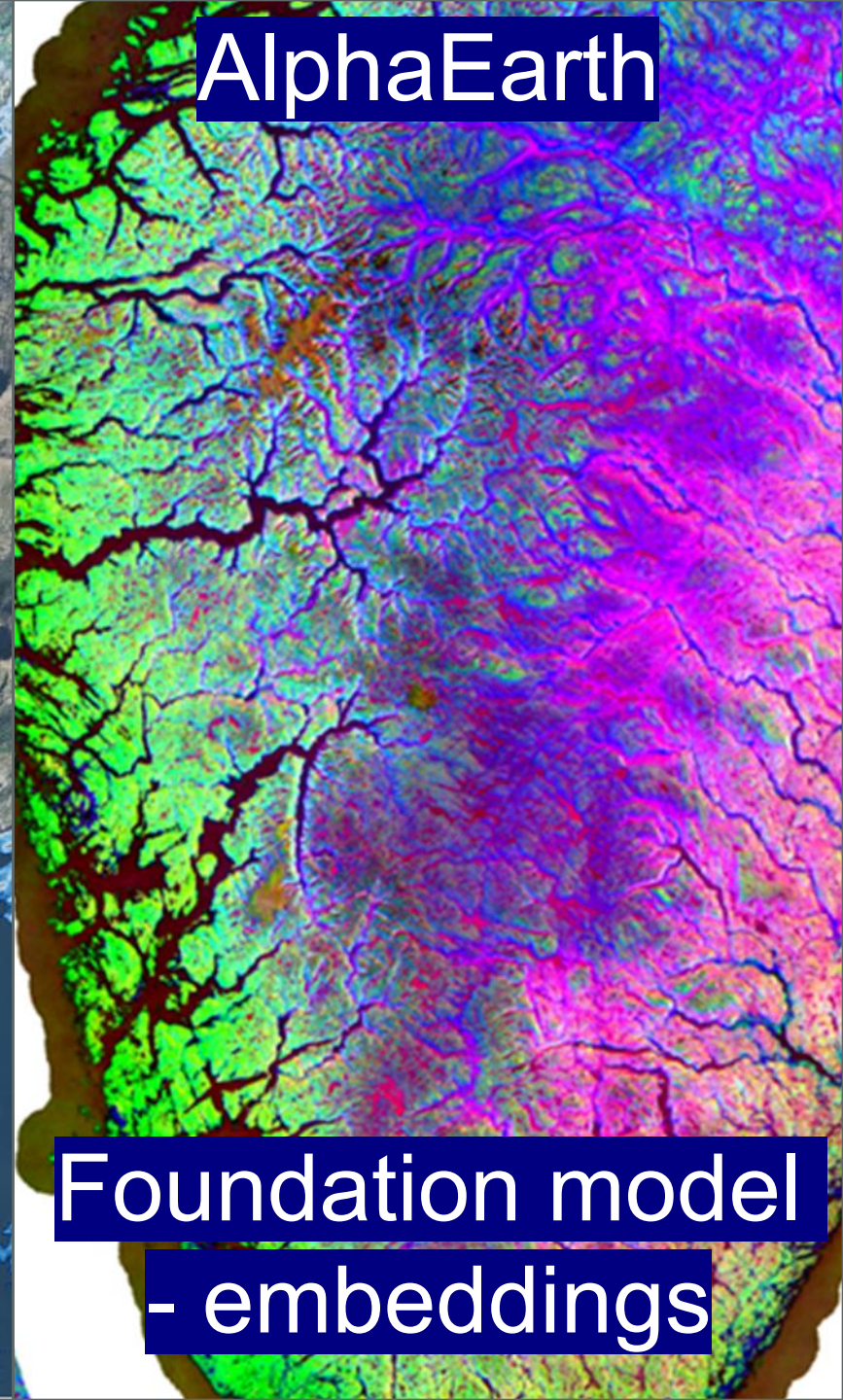
Dynamic

Bathymetric data



3D

AlphaEarth

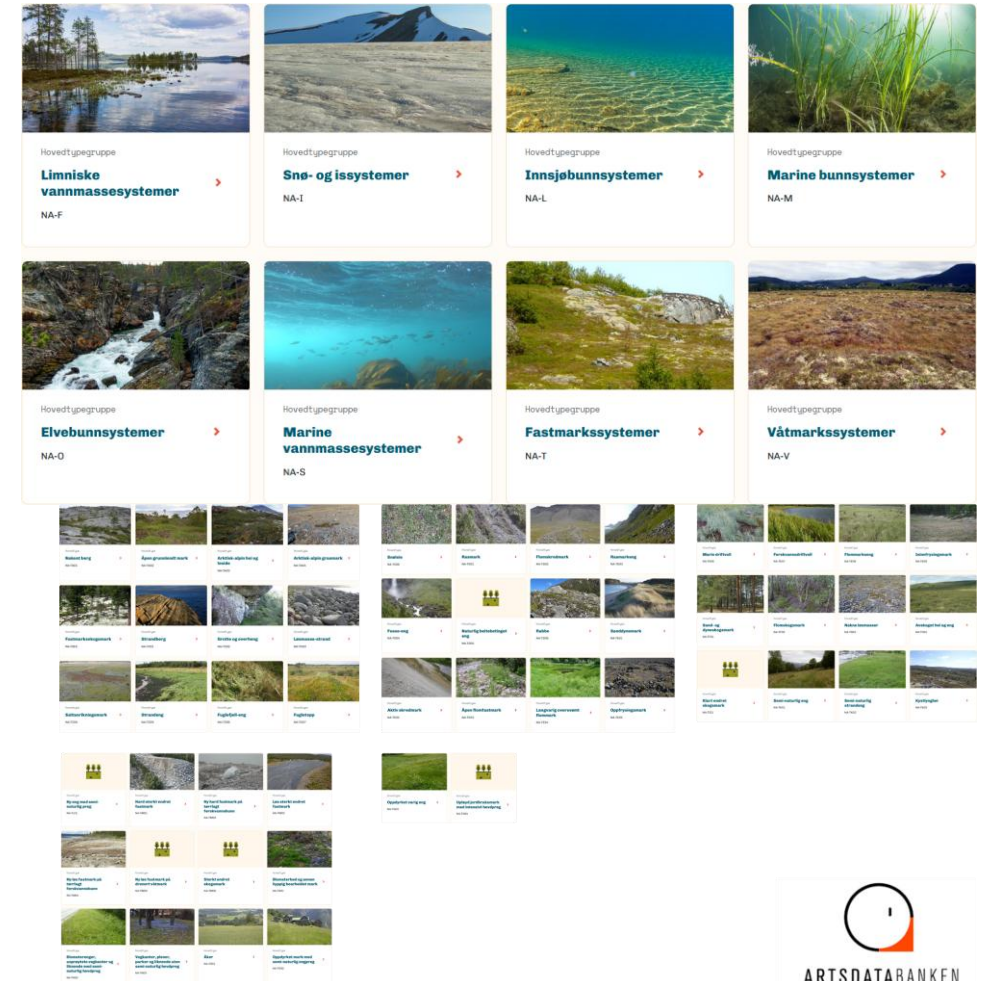


Foundation model  
- embeddings



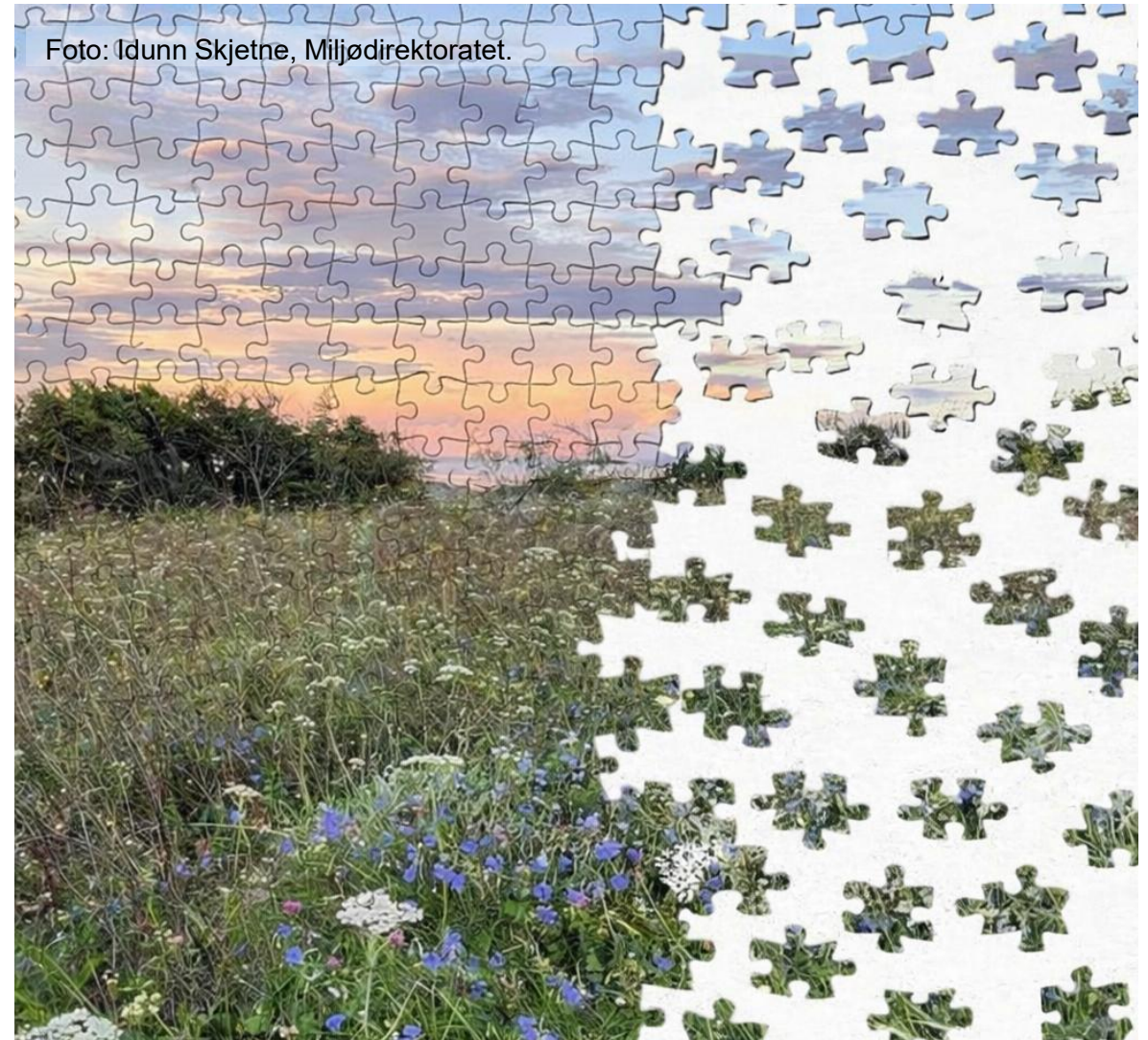
# Reference data - Natur i Norge (NiN)

- Natur i Norge
  - Hierarchical
  - Strong theoretical ecological foundation
  - **Is the national standard for nature mapping**
- Main nature types:
  - Mountains ~ 28
  - Lowlands ~ 73
  - Marine ~ 23
- + many more subtypes



# Why try?

- Far from all nature types will be mappable, but we will find out which types ...
  - Succeed -> These are directly ready to use
  - Fail -> These must be put aside for further research
- By doing this, we will also get a good overview over the “to do list for further research”
- We will not define new classes that would suit remote sensing better.





# Reference data – Biggest bottleneck

- Only Norwegian data can be used
- Existing NiN vegetation maps are too coarse (\*)
- Existing NiN inventory (point) data is of limited use
  - Rare classes are lacking
  - Using point data is challenging

\*they have a limited use





# Reference data - solutions

- Photo interpretation (winter work for experienced field ecologists)
- Smarter field campaigns
  - No random sampling
  - Use predefined segments that can be recognized in the field
    - No need for high accuracy GNSS
    - Faster
    - More certain data
    - More suitable for remote sensing training data
  - Searching for lacking nature types
- Active learning (Smart photo interpretation)
  - Finding and correcting errors in the whole dataset based on model results





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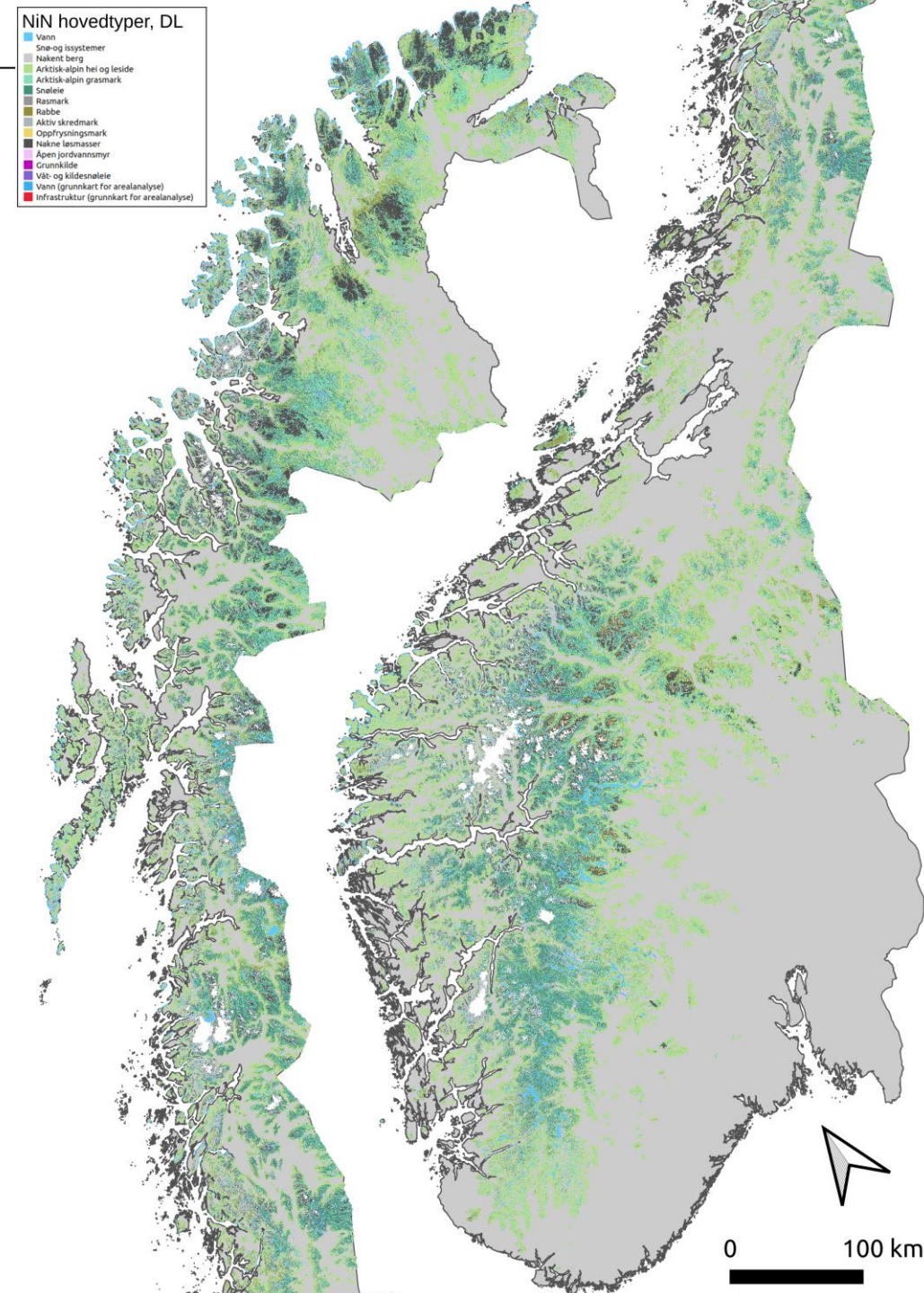
# Processing and Machine Learning

- Processing and storage on local IT-infrastructure
- Modelling
  - Training, validation, testing
- Production of results
- Experiments
  - Comparing added value of different remote sensing data
  - Incorporating novel data sources: Foundation models (AlphaEarth, DinoV3, Tessera, Thor)
  - Testing different model architectures
- Model-Architectures
  - Machine Learning and predefined segmentation
  - Deep learning
- Loss functions)
  - Use of ecological distance in loss functions
- Data fusion/Ensembling
  - Stack in advance
  - Multi-encoder networks
  - Ensembling with mode-specific networks

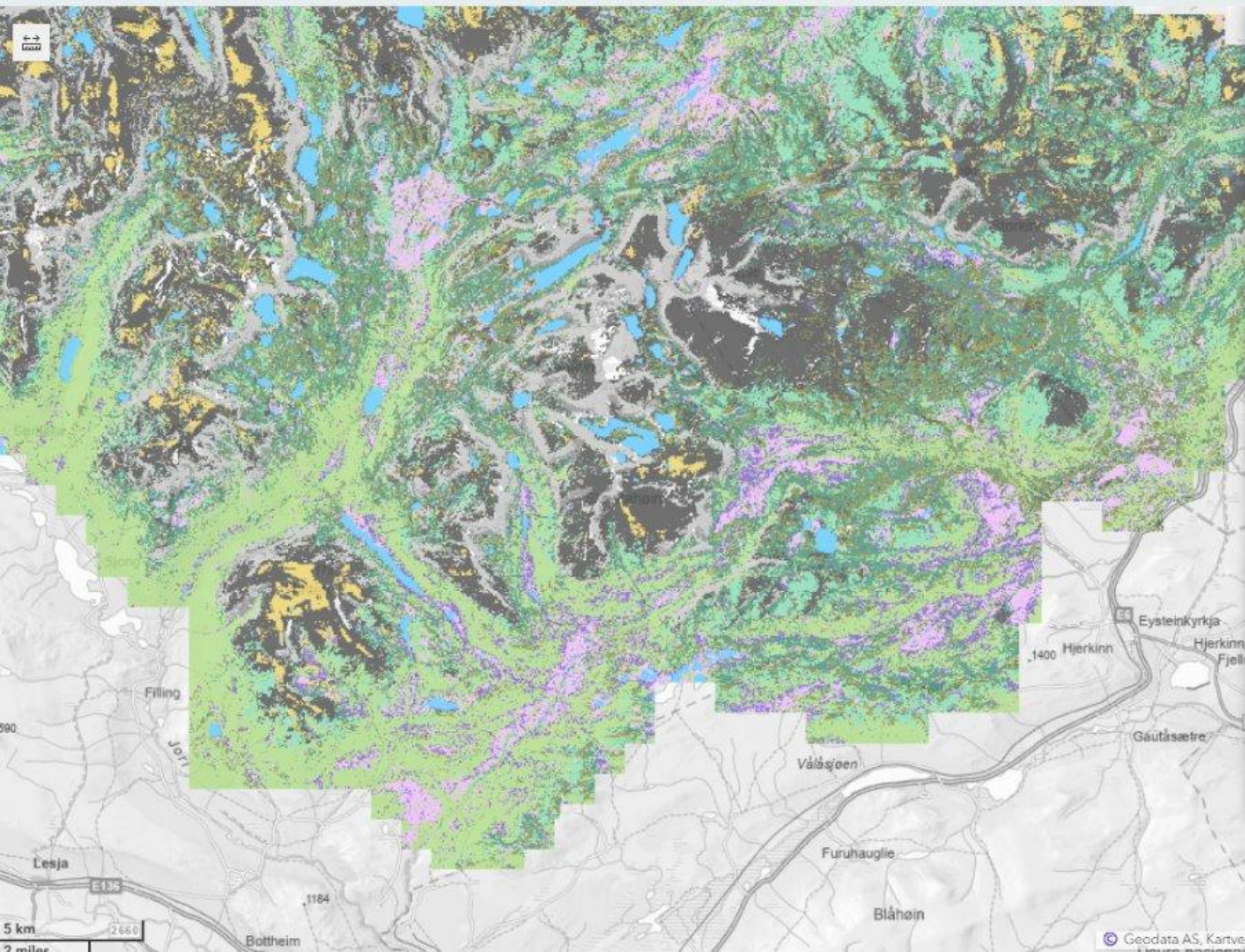


# Status / Results

- Mountains
  - Produced two nation-wide versions (2024 and 2025)
  - Produced both Machine Learning and Deep Learning maps
- Lowlands
  - Produced 8 test municipalities April 1<sup>st</sup>, 2026
- Marine
  - Produced a pilot area December 1<sup>st</sup>, 2025







Kartlagsliste

☒ Hovedtyper - Dovrefjell

Hovedtype

- NA-TA03 Arktisk-alpin hei og leside
- NA-TA04 Arktisk alpin grasmark
- NA-TC08 Snøleie
- NA-TD06 Rabbe
- NA-TE05 Oppfrysningsmark
- NA-I Is
- NA-TA01 Nakent berg
- NA-TE02 Aktiv skredmark
- NA-TD01 Rasmark
- NA-TG01 Nakne løsmasser
- NA-VA01 Åpen jordvannsmyr
- NA-VC03 Grunnkilde
- NA-VC04 Våt- og kildesnøleie
- NA-F Vann



# Results – in progress

- Finding out which NiN types
  - Can be mapped right now
  - Won't be mappable (ever)
  - Could be mappable with extra effort
- Criteria
  - Detectable in remote sensing data
  - Possible to find enough reference data (rare nature types)
  - Variation within the nature type
  - Size of the nature type
- Which types are important for Miljødirektoratet?

nin_codes	class_names	total_n_polygons_project	total_n_polygons_external
-	Snø og isflater; Arktisk-alpin hei og leside; Arktisk-alpin grasmark; Grotte og overheng; Fugletope; Snøleie; Flomskredmark; Fosse-eng; Naturlig beitebetinget eng; Rabbe; Langvarig oversvømt flommark; Oppfrysingsmark; Ferskvannsdrikkvann; Isinnfrysingsmark; Våt- og kildesneleie; Permafrost-våtmark; Oppfrysingsvåtmark	44	1656
NA-TA01	Nakent berg	77	5084
NA-TA02	Åpen grunnlendt mark	145	3650
NA-TB01	Fastmarksskogsmark	8481	70651
NA-TC01	Strandberg	237	4708
NA-TC03	Løsmasse-strand	594	654
NA-TC04	Saltanrikningsmark	0	49
NA-TC05 / NA-TK02	Strandeng; Semi-naturlig strandeng	367	5189
NA-TC06	Fuglefjell-eng	0	156
NA-TD01	Rasmark	92	1278
NA-TD03	Rasmarkeng	26	250
NA-TE01	Sanddynemark	272	778
NA-TE02	Aktiv skredmark	10	285
NA-TE03	Åpen flomfastmark	216	0
NA-TE06	Marin drikkvann	10	910
NA-TE08	Flommarkeng	18	0
NA-TF01	Sand- og dynesmark	7	0
NA-TF02	Flomskogsmark	539	5595
NA-TG01	Nakne løsmasser	116	1180
NA-TH01	Avskoget hei og eng	914	4866
NA-TI01	Klart endret skogsmark	907	0
NA-TK01	Semi-naturlig eng	635	24542
NA-TK03	Kystlynghei	778	9137
NA-TL01	Ny eng med semi-naturlig preg	13	0
NA-TM01 / NA-TM02	Hard sterkt endret fastmark; Ny hard fastmark på tørrlagt ferskvannsbunn	23	489
NA-TM03 / NA-TM04 / NA-TM05	Løs sterkt endret fastmark; Ny løs fastmark på tørrlagt ferskvannsbunn; Ny løs fastmark på drenert våtmark	324	2909
NA-TM06	Sterkt endret skogsmark	82	126
NA-TN01 / NA-TN03	Blomsterbed og annen hyppig bearbeidet mark; Vegkanter, plener, parker og liknende uten semi-naturlig hevdpreg	109	76
NA-TN02	hevdpreg	23	5
NA-TO01 / NA-TO02 / NA-TO03 / NA-TO04	Åker; Oppdyrket mark med semi-naturlig engpreg; Oppdyrket varig eng; Utsjøyd jordbruksmark med intensivt hevdpreg	1446	432
NA-VA01 / NA-VG01 / NA-VG02 / NA-VK01 / NA-VK02	Åpen jordbruksmyr; Ny naturgitt torvmark; Ny naturgitt grunn våtmark; Slåttemyr; Semi-naturlig våteng	1299	27875
NA-VB01 / NA-VF02	Myr- og sumpskogsmark; Strandskogsmark	395	13991
NA-VC01	Åpen nedløpsmyr	563	1402
NA-VC02 / NA-VC03	Torvmarkskilde; Grunnkilde	2	1157
NA-VF01	Nedløpsmyr-skogsmark	145	0
NA-VI01	Klart endret våtmarksskogsmark	11	0
NA-VM01 / NA-VM02 / NA-VM03 / NA-VM04 / NA-VM05 / NA-VM06 / NA-VO01	torvmark på menneskebettinget forsumpet fastmark; Sterkt endret, ikke torvproduserende våtmark; Ny grunn våtmark på tidligere ferskvannsbunn; Ny grunn våtmark på menneskebettinget forsumpet fastmark; Sterkt tråkkpreget våtmark	190	0
n_total_classes		36	
threshold_n_polygons		100	
n_classes_with_samples_above_threshold		21	

\*"-." denotes excluded classes



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# Summary

- Ambitious goals, limited time
- Where we succeed, the resulting classes will be directly relevant for decision making
- Unique combination of remote sensing data on a national scale
- Focus and innovations on the collection of reference data
- Transparent and efficient tool for mapping nature types

# Teams



Mountains

Lowlands

Marine

 Field

 Field

 **sállir natur**

 **sállir natur**

**NIVA**  
Norwegian institute for  
water research

**NR**  **Norsk  
Regnesentral**  
NORWEGIAN COMPUTING CENTER

**Biota**  
Naturkompetanse

**NORCE**

 **Field**

**Miljøfaglig**  
Utredning

 **Field**



Leverandører og projektgruppen for naturkart i februar 2026  
med første versjoner av testkart (Foto: Miljødirektoratet)





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# Contact

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