# Before the Plough: Mapping Potential Natural Vegetation

## An application of geotopes

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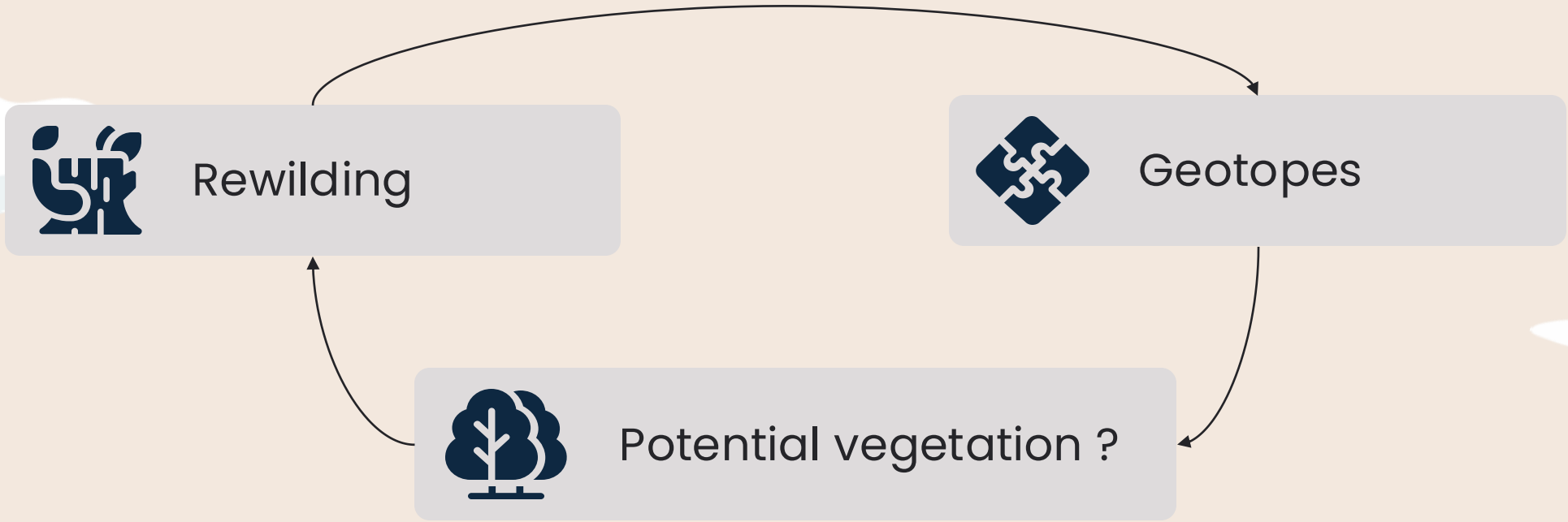
# Context



# Research questions

**What (non-wilderness) sites are most suitable for certain vegetation types based on the geotopes map?**

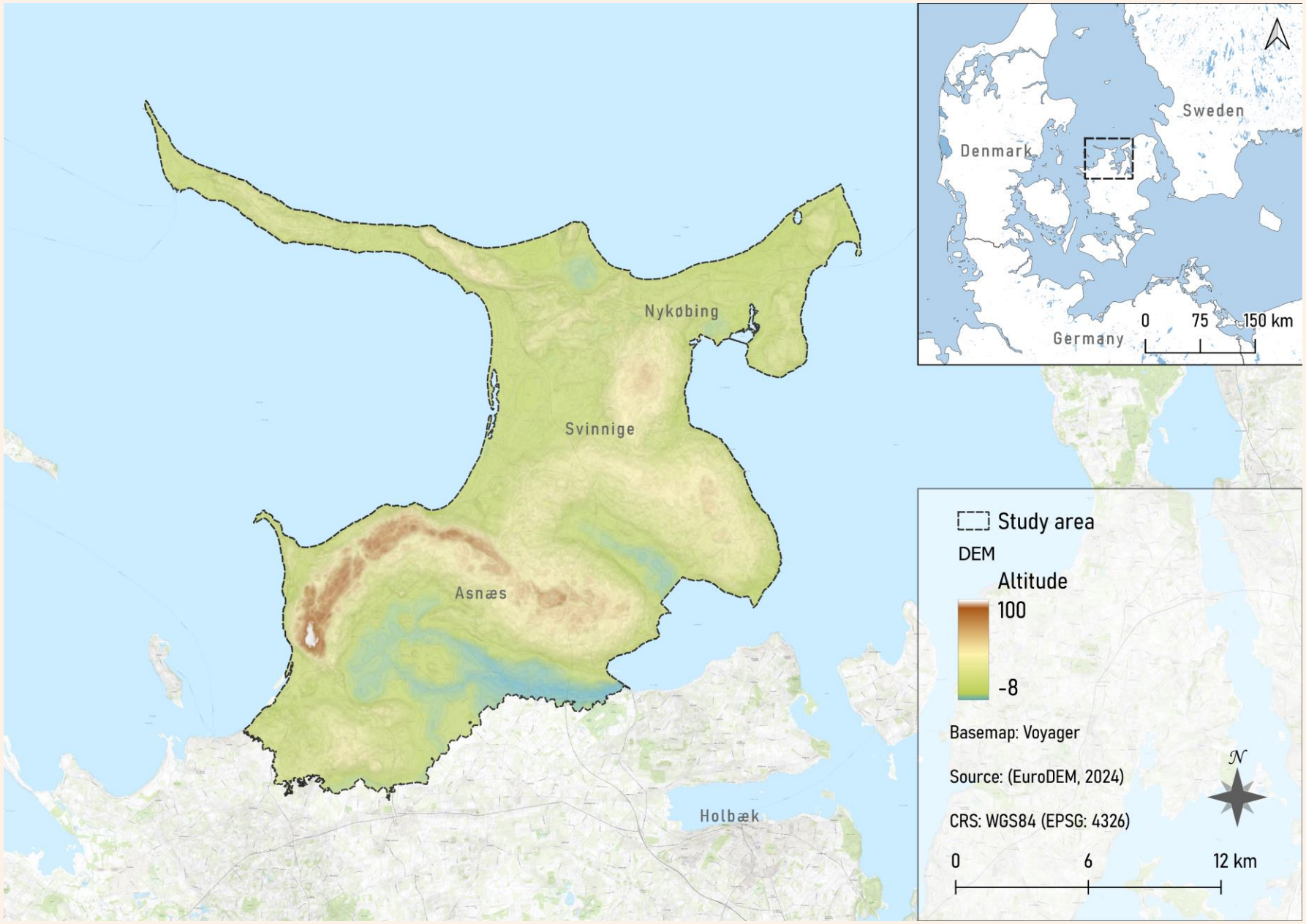
What are the optimal physical conditions (i.e. which geotopes are best) for the different potential natural vegetation?

What are the similarities between the potential natural vegetation and the real-world situation?

Are geotopes a useful tool to define potential natural vegetation?

# Study area

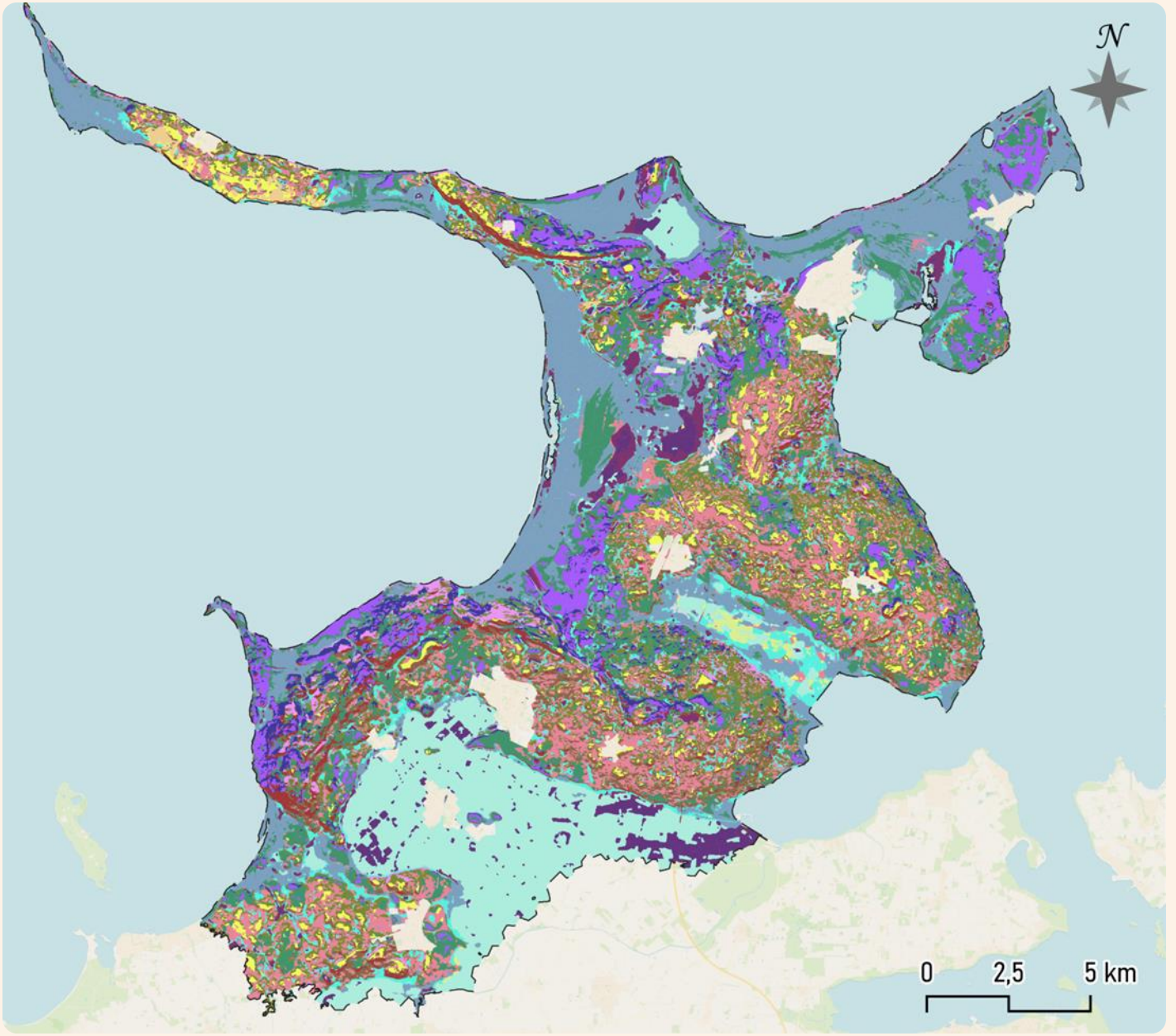
- Municipality of Odsherred
- Diverse landscape



# Assessing geotopes

Variables:

- **Toposphere**:
  - Topographic position
  - Drainage
  - Solar radiation
- **Lithosphere**:
  - Clay
  - Sand (fine & course)
  - Silt
  - Chalk
  - Soil organic carbon
- **Hydrosphere**
  - Water level summer
  - Water level winter




Christensen et al. (2025) [unpublished dataset]

**Eutrophic beech**

- High silt fraction
- Low in organic carbon & carbonate
- Low water table in winter

**Oligotrophic beech & oak**

- High silt fraction
- Low in organic carbon & carbonate
- Drier soils

**Alluvial & wet lowland forest**

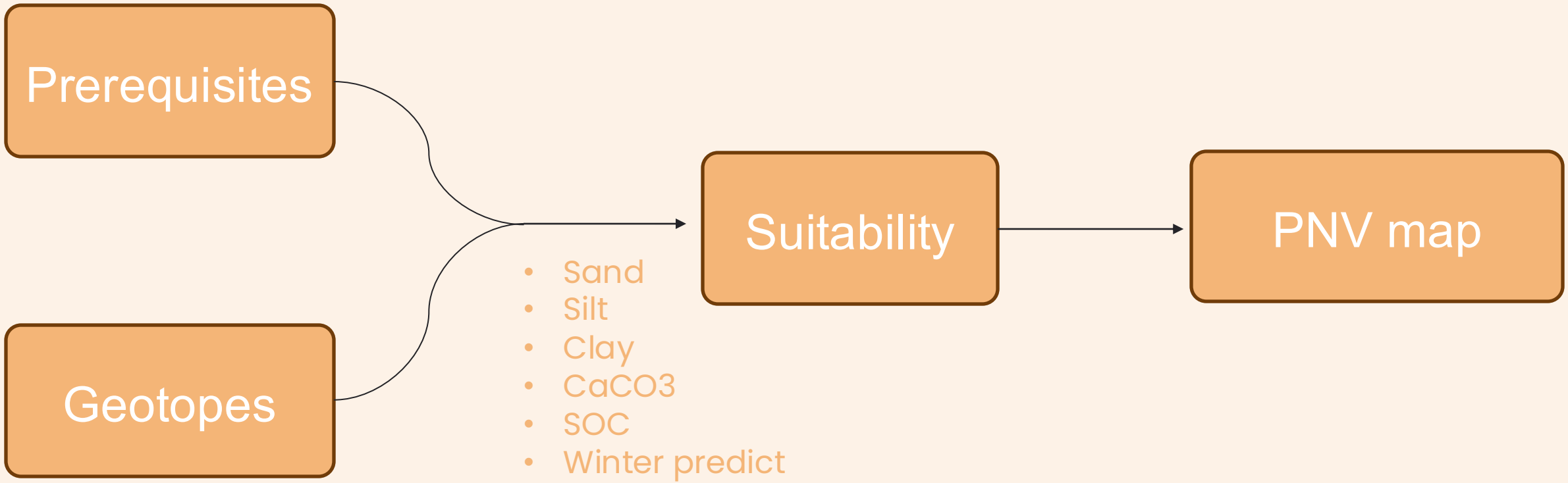
- Intermediate to high clay fraction
- High in carbonate
- High water table

**Peatland**

- Depth to water table less than 50 cm

# PNV types

# Method: GIS-analysis



# Method: field work

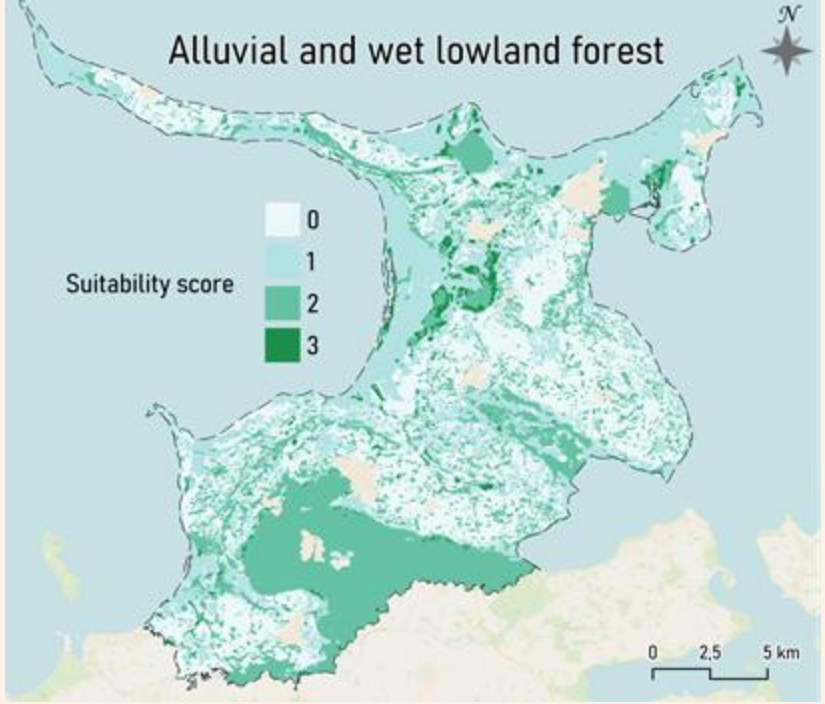
**Sample strategy**

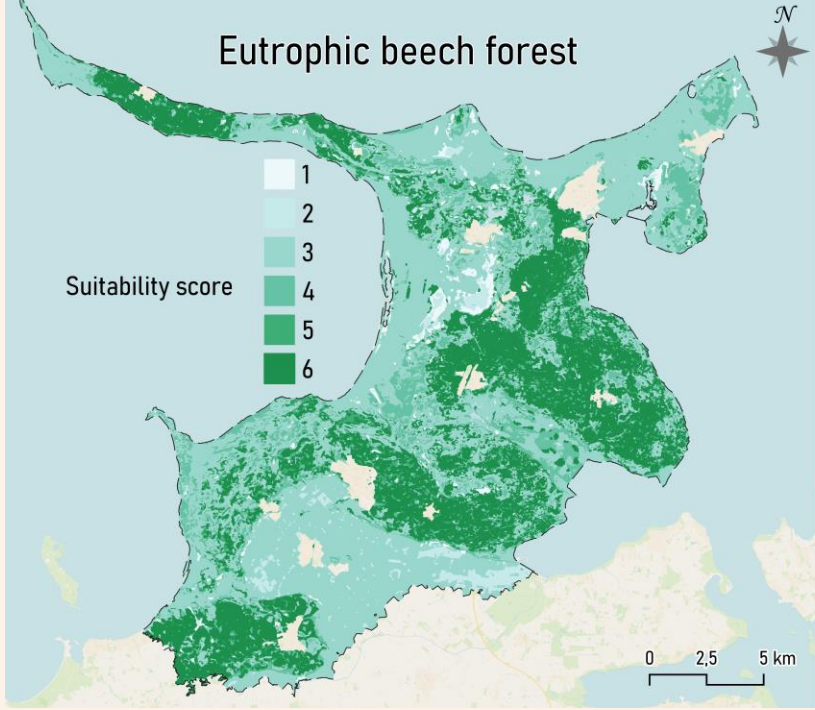
- Areas of high potential
- 3 to 4 per km²
- Conventional & edge cases
- Supplemental sample points based on holistic observations

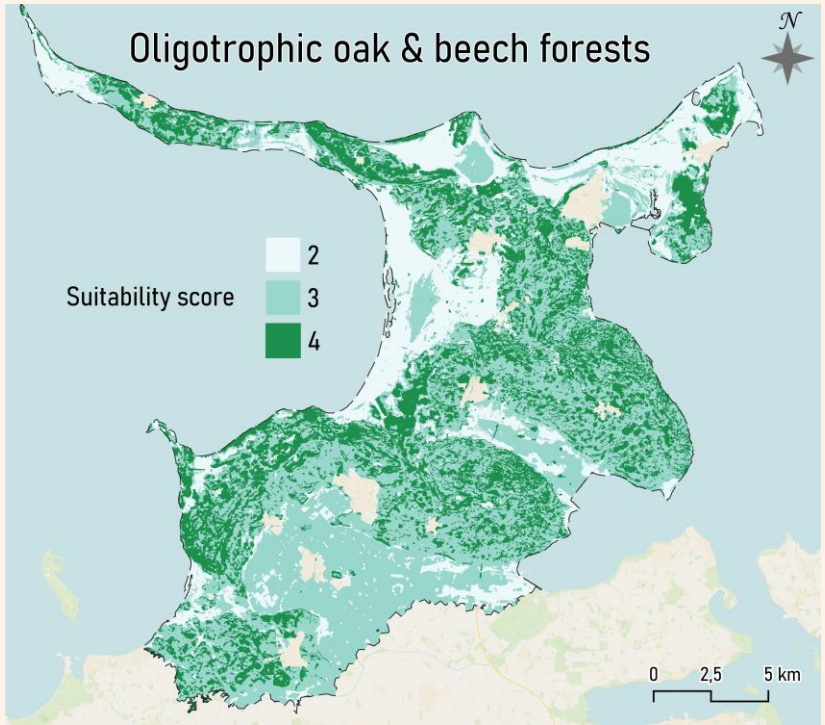
**Soil sampling**

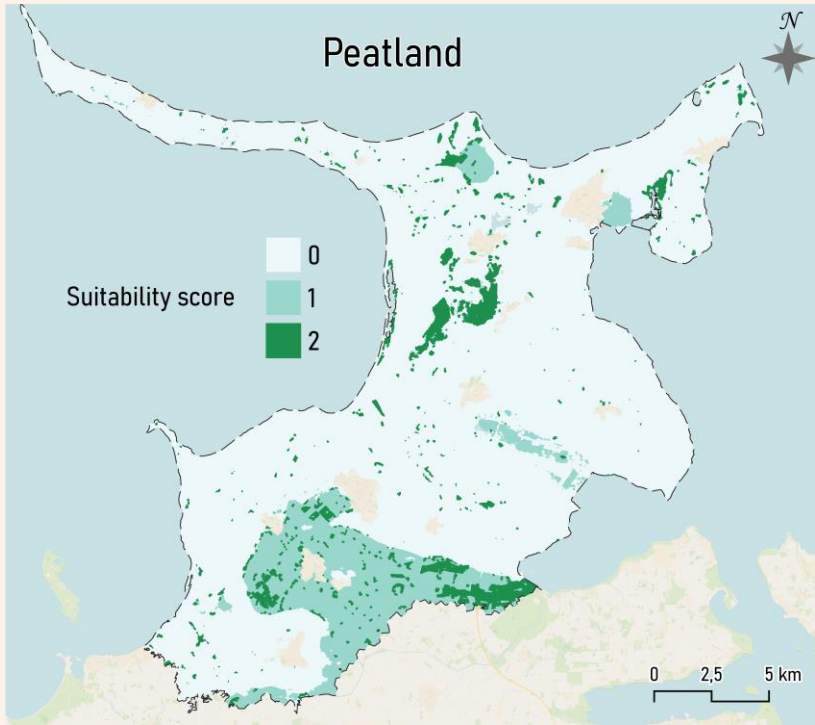
- Profile description
- pH measurement
- Soil wetness

# Suitability maps PNV



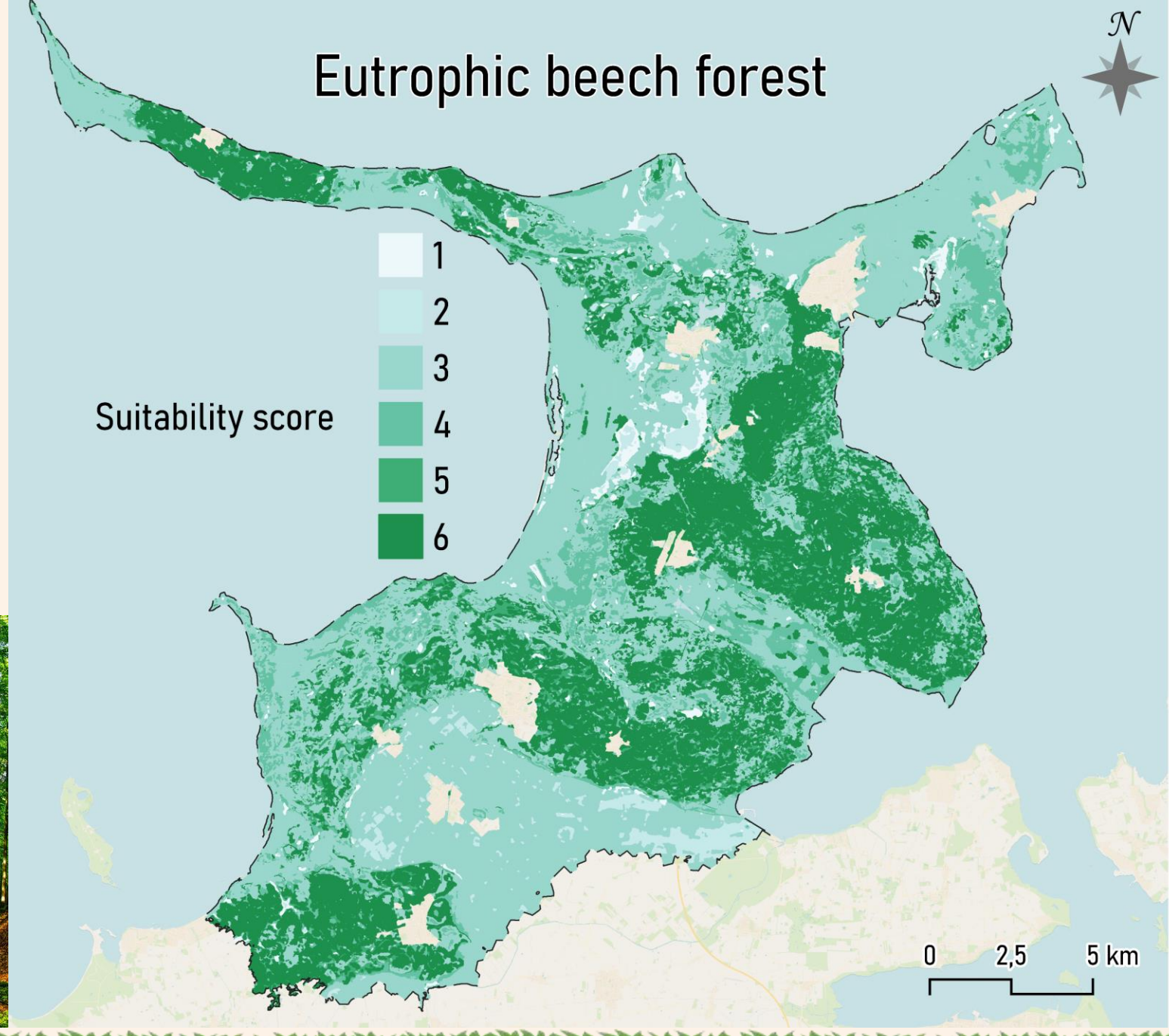



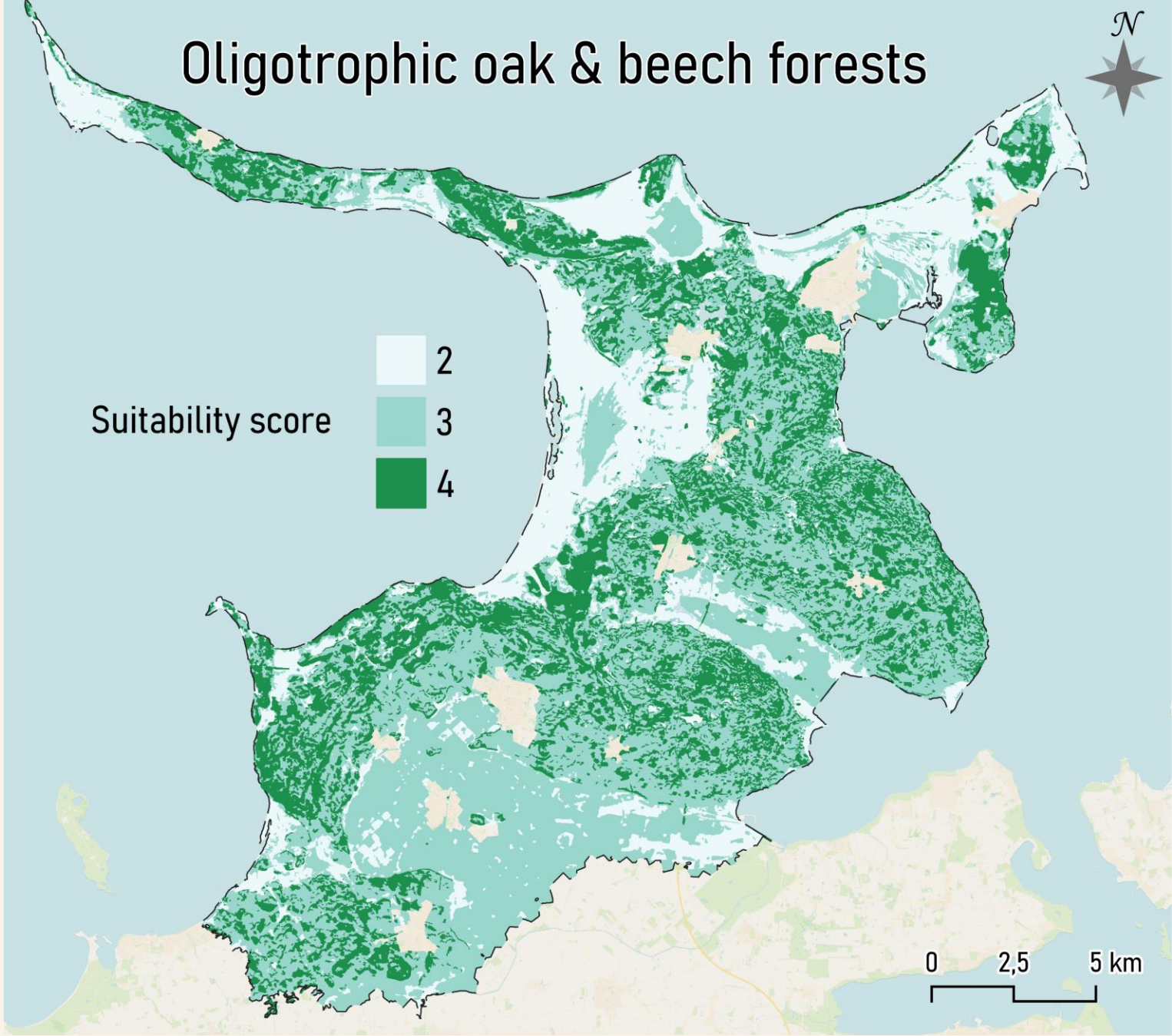
# Eutrophic beech

- High scores on ridges or hilly areas



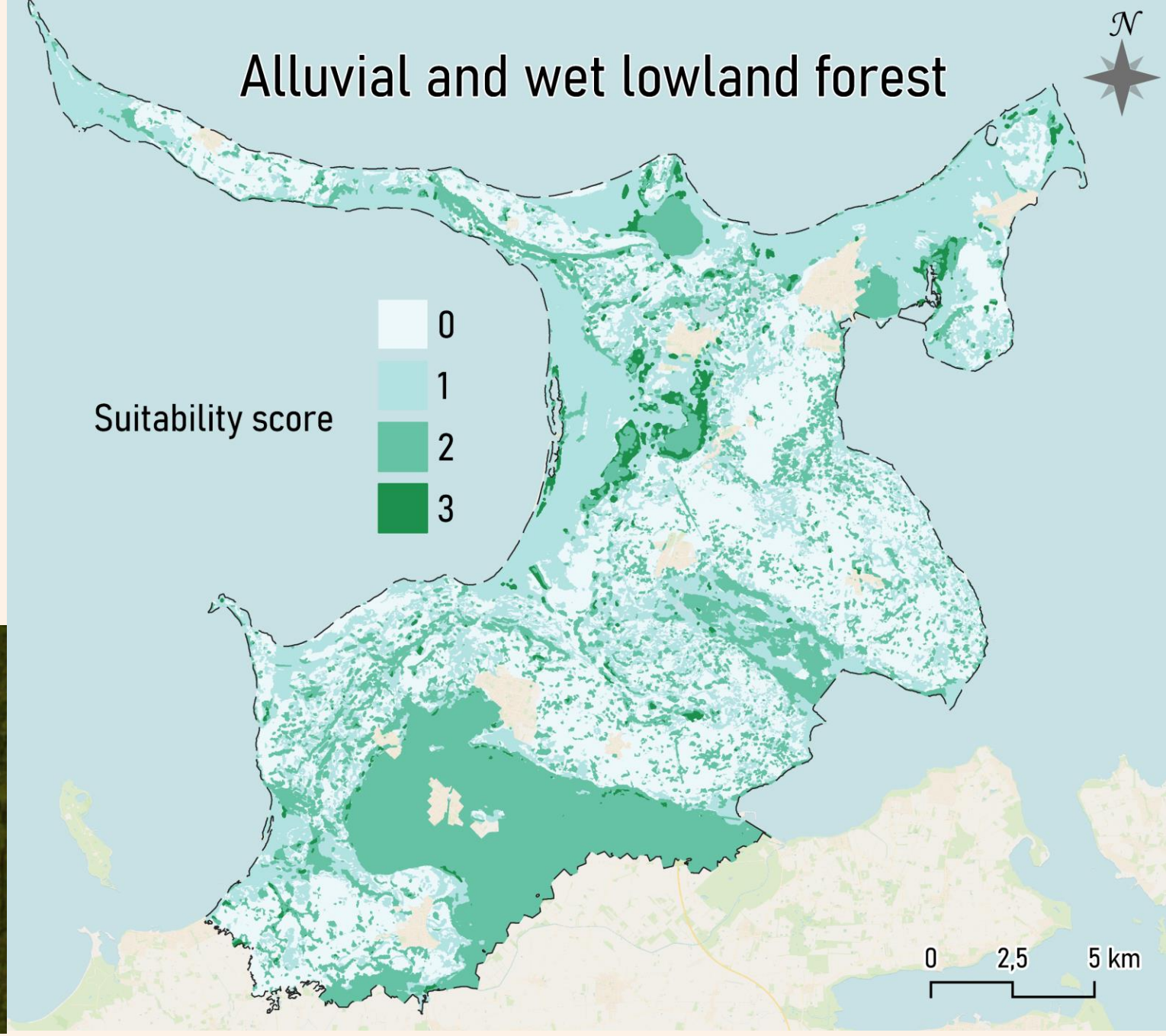
# Oligotrophic oak & beech

- Similar distribution to eutrophic beech
- Scattered



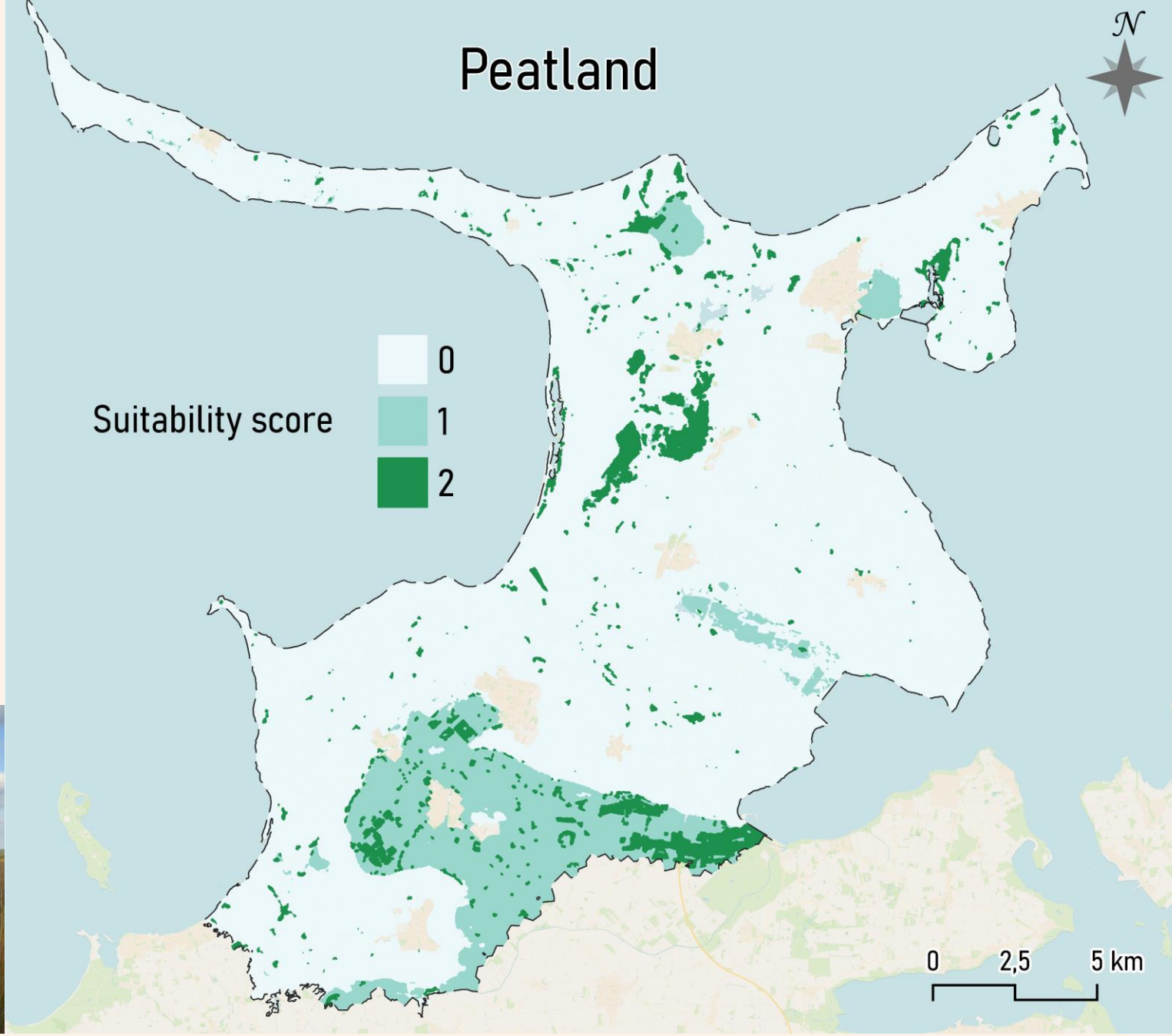
# Alluvial and wet lowland forest

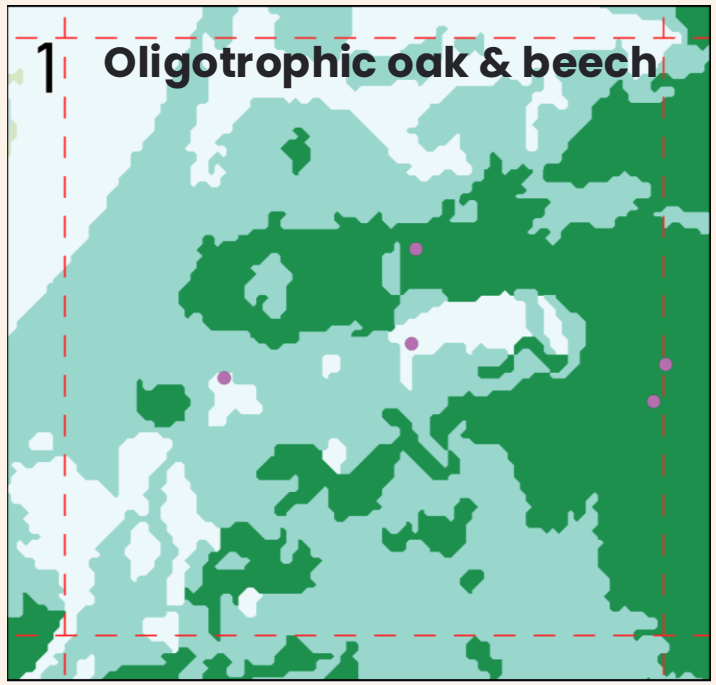
- Polders and edges of current peatlands

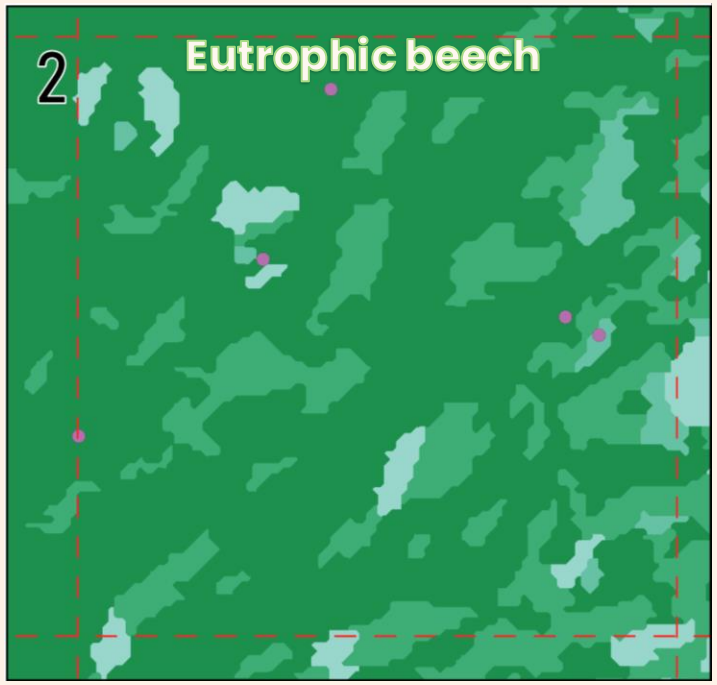


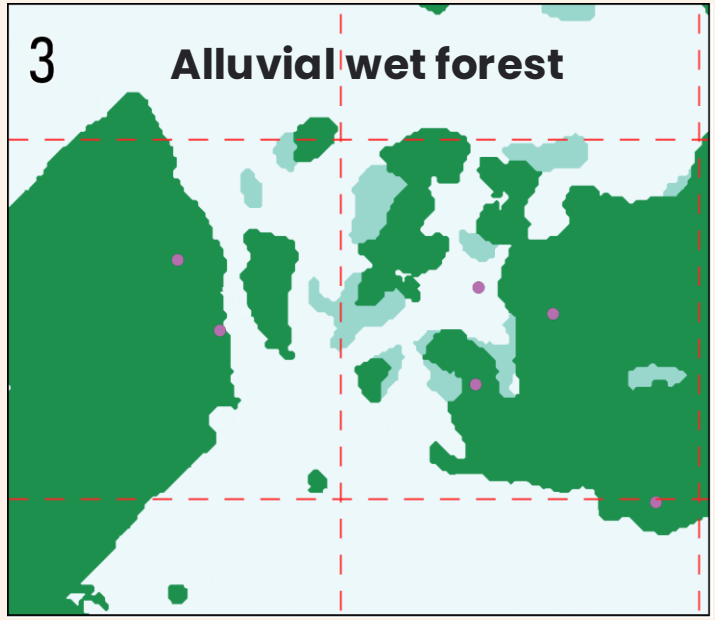
# Peatland

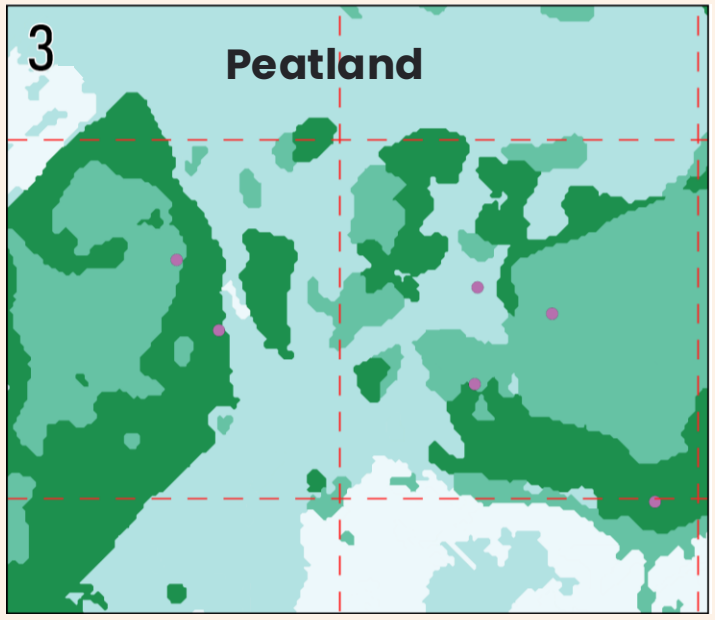
- Dispersed patches
- Lammefjord & Trundholm Mose





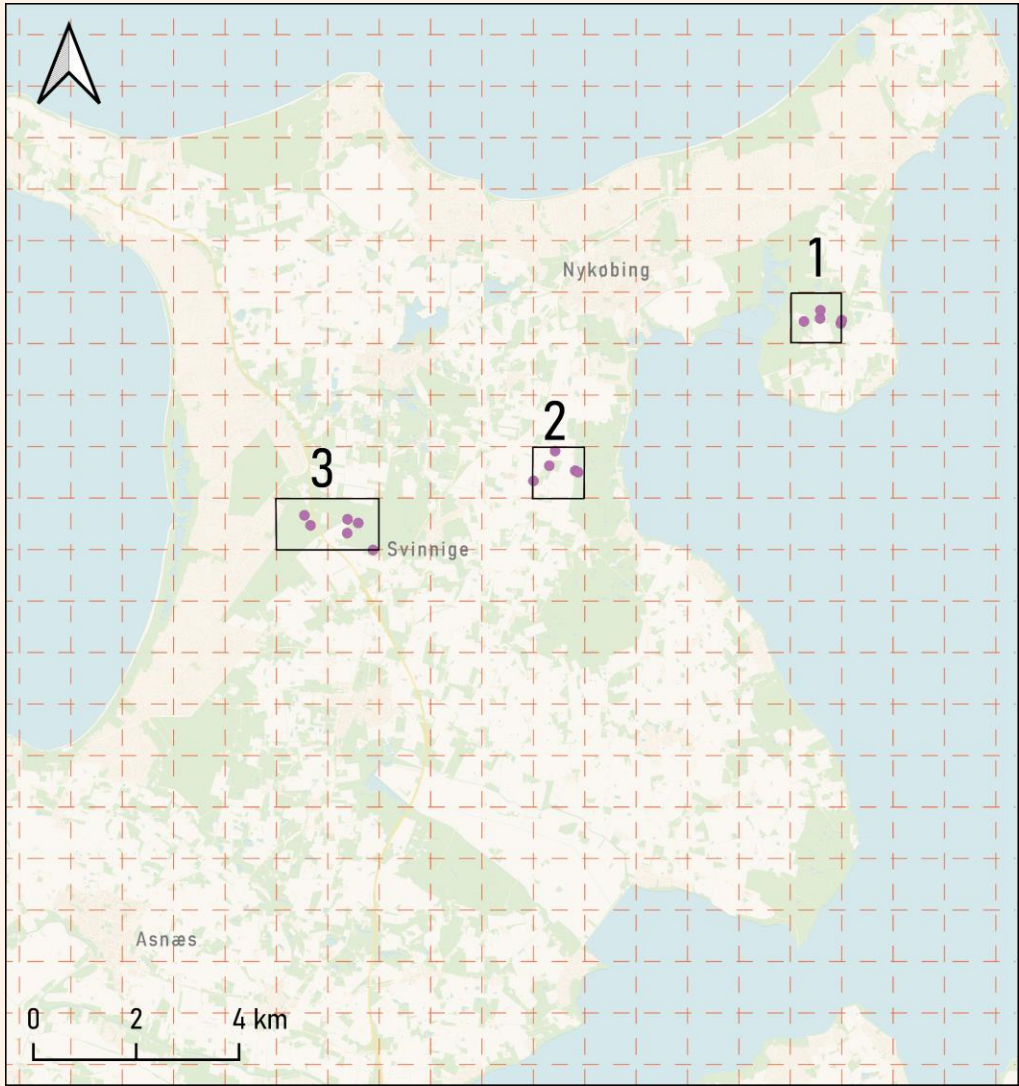



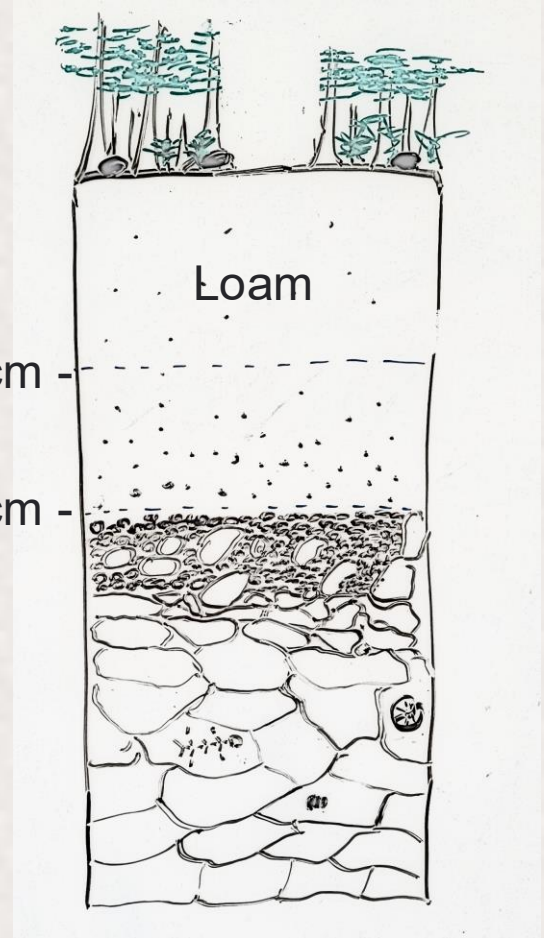




# Soil sampling

1: Nakke
2: Annebjerg
3: Trundholm Mose



# Eutrophic beech

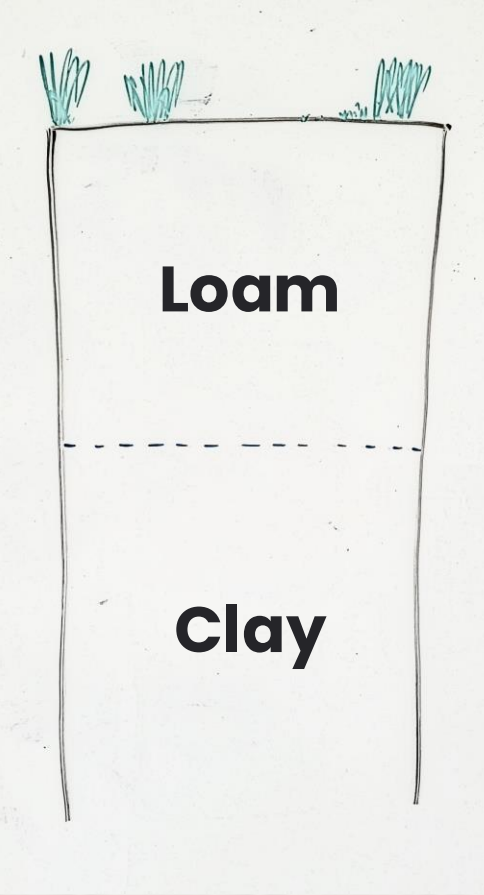



## Match

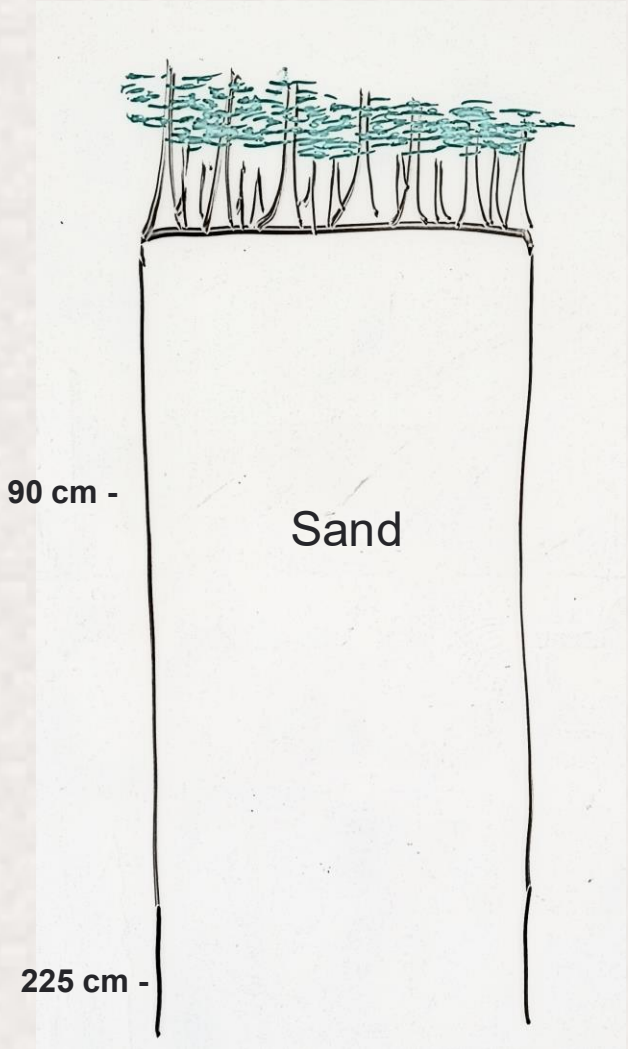
- Loamy rich soil
- higher pH (7,5) means base saturation
- Good drainage
- Weathering volcanic rock supplies minerals

## Mismatch

- Clay layer prevents water infiltration
- Wet conditions and sand sub ideal for Eutrophic beech



# Oligotrophic beech forest match vs mismatch

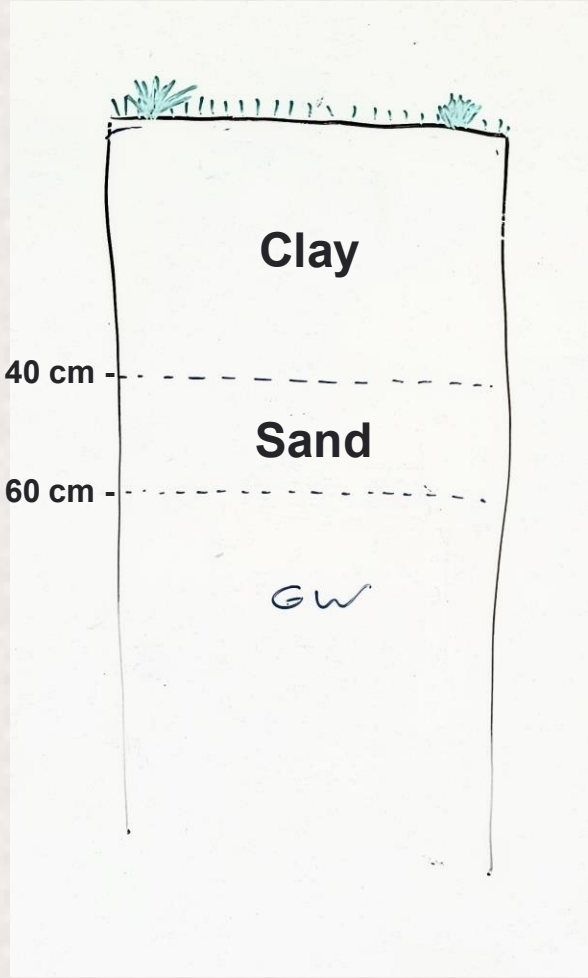



## Match

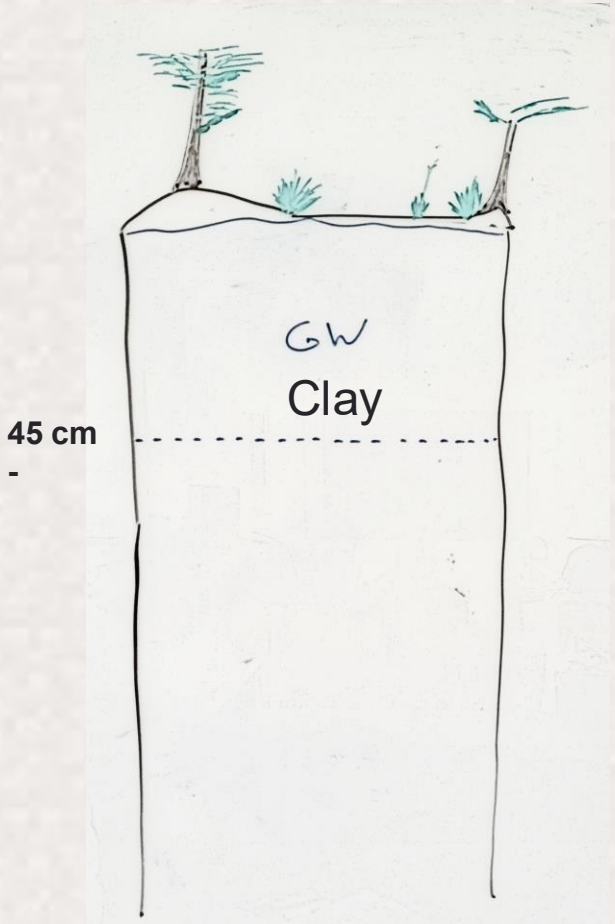
- Deep soil on large dune with no discernable profile development
- Low mineral content due to leeching and low CEC
- Mineral poor soils result in low biodiversity

## Mismatch

- Impermeable clay layer means very wet
- Isolated local depression not mapped in potential map

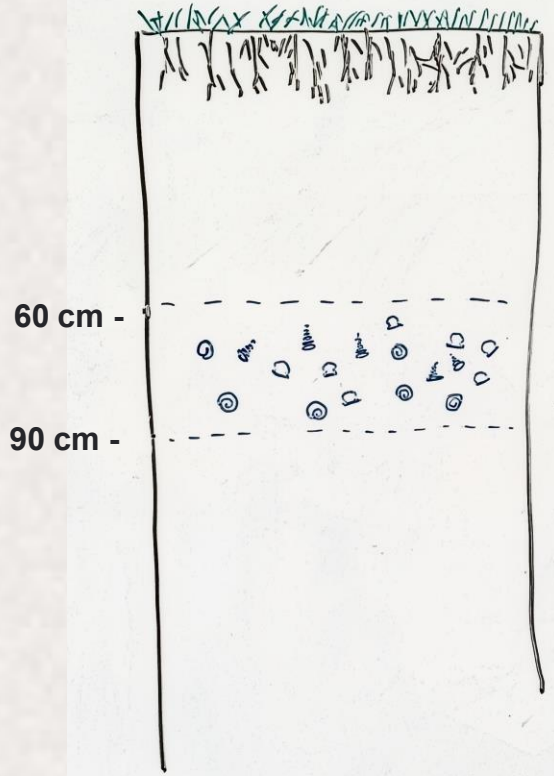


# Alluvial forest habitat diversity

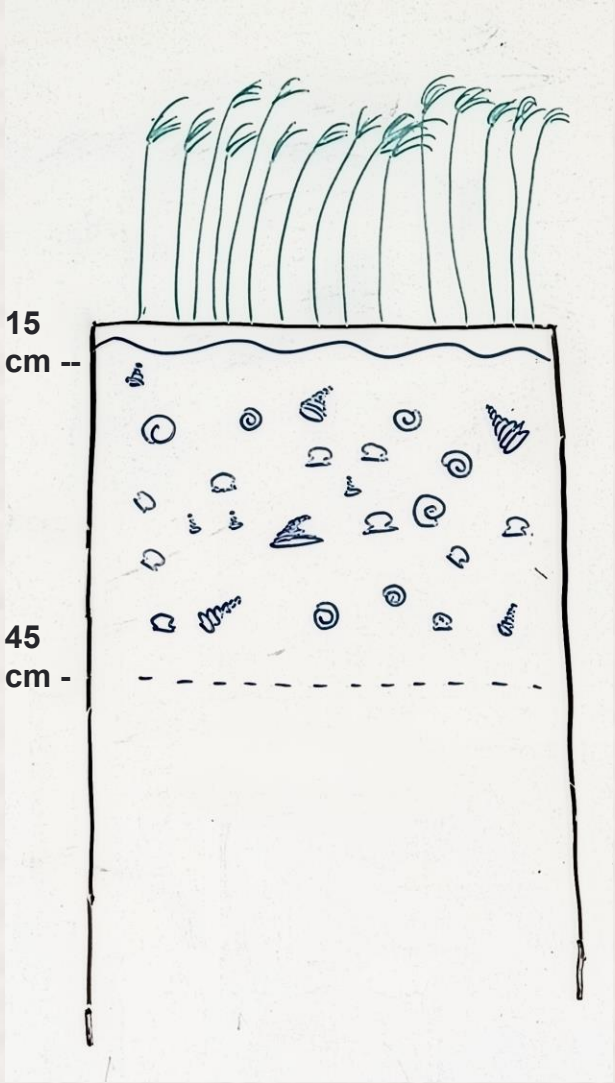



- Clay layer above layer of sand
- Raised bog and perched water table
- Important for biodiversity

- Dark clay soil with high water table
- Alluvial forest grows in many conditions



# Peat

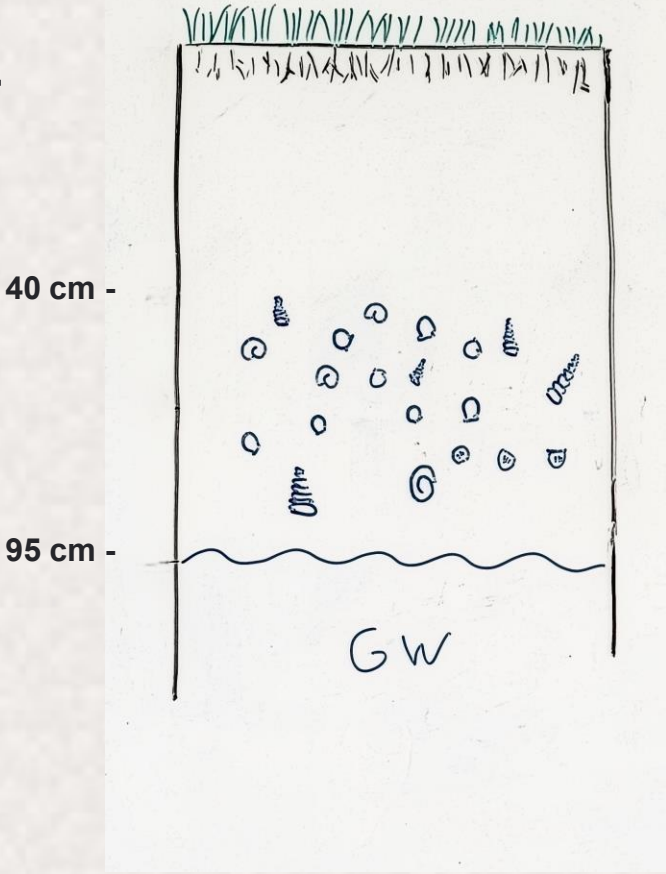



## Match

- High water table
- Rich soils
- Gyttja prevent low pH
- Current pH not reflective of the ideal state.

## Mismatch

- Groundwater map bad accuracy
- Low groundwater means no peat.



# Field observation

- 16 soil samples
- Eutrophic beech best predicted
- Alluvial forest often ignored, but never wrongly expected

→ Missing variables

| | Observed | | | |
|---|---|---|---|---|
| Expected | EB | OOB | AF | P |
| EB | 6 | 1 | 1 | 0 |
| OOB | 2 | 2 | 0 | 1 |
| AF | 0 | 0 | 2 | 0 |
| P | 0 | 0 | 3 | 2 |

| | | | | |
|---|---|---|---|---|
| Probability of detection | 0,75 | 0,67 | 0,33 | 0,67 |
| False alarm rate | 0,33 | 1,5 | 0 | 1,5 |

| VEGETATION MAP VALIDATION | | | | |
|---|---|---|---|---|
| **Soil samples** | **Expected PNV** | **Observed** | **Reason** | **Correct** |
| 1 | P | AF | | |
| 2 | P | AF | | |
| 3 | P | P | | X |
| 4 | EB | EB | | X |
| 5 | AF & P | AF | | ± |
| 6 | P | P | | X |
| 7 | EB | OOB | pH too low | |
| 8 | OOB | OOB | | X |
| 9 | OOB | OOB | | X |
| 10 | OOB | P | Too wet | |
| 11 | EB | EB | | X |
| 12 | EB | EB | | X |
| 13 | EB & AF | AF | | |
| 14 | EB | EB | | X |
| 15 | EB & OOB | EB | | ± |
| 16 | EB & OOB | EB | | ± |

EB = eutrophic beech forest
OOB = oligotrophic oak & beech forest
AF = alluvial and wet lowland forest
P = peatland

# Discussion : Variables

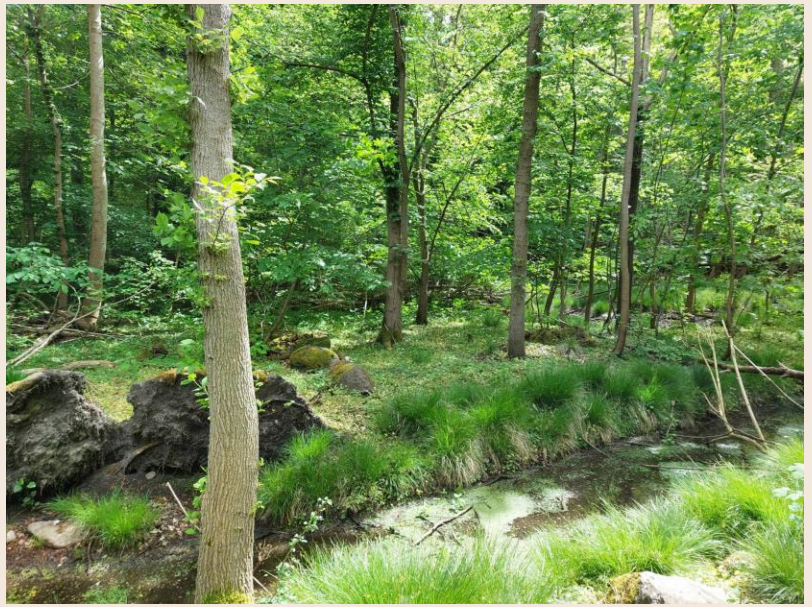
- Extra variables for PNV
  - Accurate pH map
  - Soil hydricity
  - Drainage structure
  - CEC (cation exchange capacity)

# What’s next

- PNV map could be improved
  - Better variables
  - Weighted factors for variables
  - Intensive field studies

# Correlation vs causality

- pH values important factor in many PNVs
  - Peat low pH caused by external factors
  - Necessity for low pH questionable
  - Euthrophic beech forest needs high base saturation
  - Euthrophic beech will grow on high pH soils



# Are there any questions?

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