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# Updating the Estonian digital soil map.

## Land and soil use research and development project


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*Copernicus Land Monitoring Service national cooperation program meeting 13.03.25*

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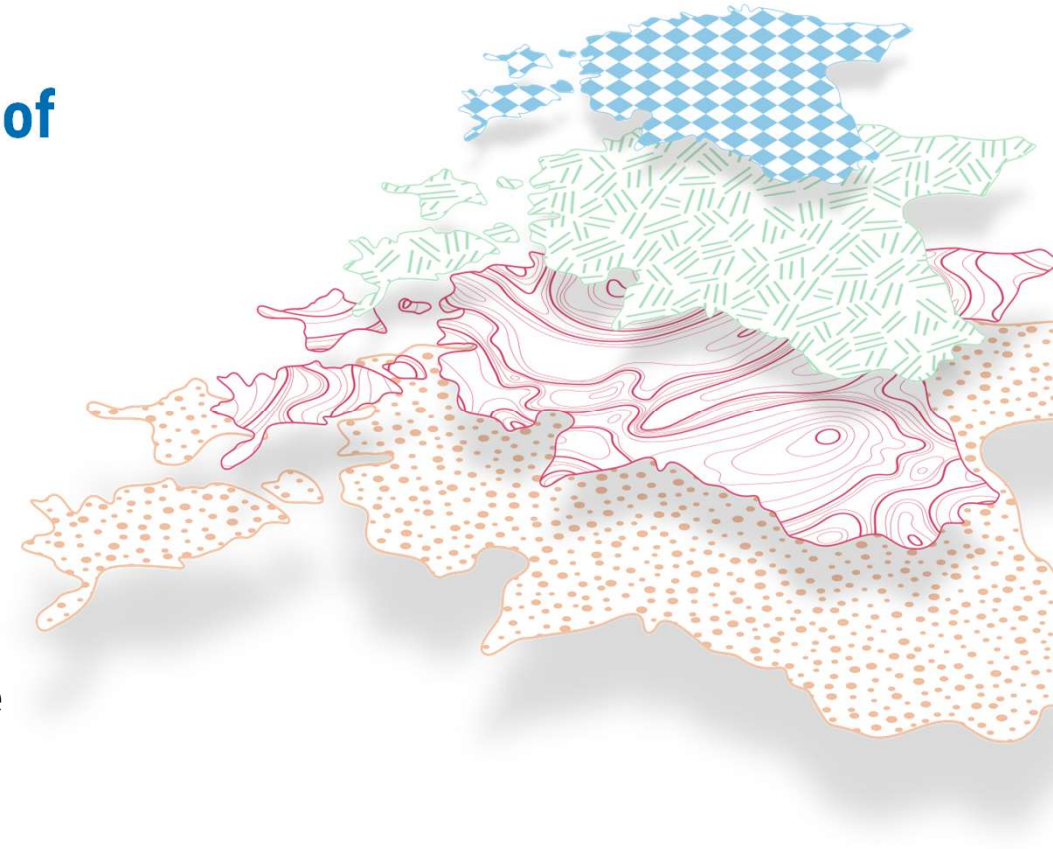
MULLA JA MAAHÕIVE KOOSTÖÖPROJEKT

# A governance system for the effective and sustainable use of land and soil, protection of biodiversity and climate change mitigation.

## Research program



**Budget and duration:** 5,7 million €, 2024–2027

**Objective:**
To create an innovative and resource-sustainable land and soil use monitoring and management system for the state, which will serve as the basis for planning and directing comprehensive and high-quality spatial decisions on land management governance in the future. The prerequisite is high-quality base data – a coherent and available science based digital data information system.

*The project is supported by the Estonian state from the revenue from greenhouse gas emission allowance trading*

https://keskkonnaportaal.ee/et/teemad/muld-ja-maahoive/maa-ja-mullakasutuse-teadus-arendusprojekt

# Main activities
## in general

| | |
|---|---|
| Updating **Estonian soil map** | 1.4 million € |
| Enhancing the basic input knowledge of **greenhouse gas reporting** | 2 million € |
| Creation of the **land and soil use governance system** | 1.7 million € |
| Enhancing **monitoring** capabilities | |
| Support activities | 0.6 million € |

# „Creation of a modern concept for a large-scale digital soil map and updating of the existing soil map“

## MULD2 (SOIL2) project

### Timeline

- Procurement: 2024 spring
- Contract with 3 R&D institutions: July 2024
- Regular meetings with steering group
- I report: 1.11.24
- II report: 30.09.25
- Public seminar: end of 2025
- Final seminar: end of 2026
- Deadline: 1.11.26

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# SOIL2 main activities

- Objective: update of the national large-scale (1 : 10 000) digital soil map
  - polygons as well variables
- Focus: organic soils and other most likely changed soils
- Also: urban and coastal areas, eroded soils, areas with missing data, etc.
- Comprehensive field works and laboratory analyses
- Novel methods: soil change matrix, AI, remote sensing data (incl. satellite, LiDAR, and drone data), etc., combined with existing data sets and field work
- Novel approach: raster data cube + classical vector map.
  - Totally machine readable
- Consolidation and enabling the use of different approaches in regard of classifications (incl. WRB), definitions (what is organic soil), etc.

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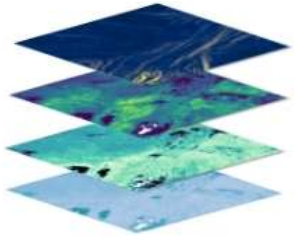
# SOIL2 data cube prototype

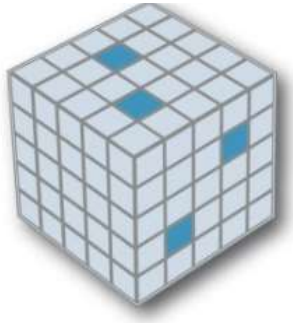
Advantages of a data cube:

- Enables fast queries and machine learning
- Compact, i.e. takes up little memory compared to an analog vector map
- Allows for efficient storage of data in the cloud
- Data is in a single standardized form
- Enables dynamic temporal updating
- Enables geographic modeling using machine learning, which in turn helps to continuously update data, including using remote sensing data

Separate raster layer for each depth and variable



Data cube, consisting of ca 100 raster layers (geotif, netcdf), all of which can be queried and analyzed separately or together



Enables fast queries and machine learning, because the data is in a single standardized form

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maastikugeoinformaatika töörühm

*The entire GIS workflow is built on free software.*

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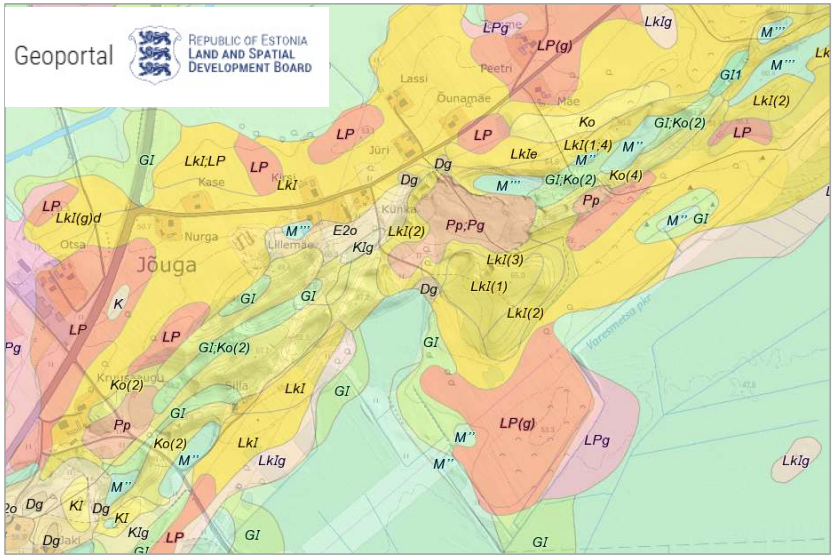
# The need for updated large-scale soil map




- Basis for **various land use-related spatial decisions** and data, incl. land valuation, subsidies, management decisions, protection measures, etc.
- Soil Strategy 2050 - > Soil Monitoring and Resilience Directive -> **soil health indicators**, forthcoming **land take hierarchy**, etc.
- **Spatially explicit and up-to-date base** for GHG (LULUCF) reporting, ecosystem accounting, nature restoration activities, etc.

Water

Food and timber

Hazardous substances

Land as resource

Carbon

Health and environment

Economy and environment

Digital soil

Digital soil map

Data, information

Organisms

Climate resilience

Soil formation

Sustainability

Nutrients

Biodiversity

# Example: ecosystem services values derived from soil map variables