HoliSoils

Working together for forest soils

Holistic management practices, modelling & monitoring for European Forest Soils

Horizon 2020 project with 20 partners (May 2021- October 2025)

May

2023

Key products for LULUCF inventories

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- Review on the climate smart forestry and its impacts to soil, and evaluating the ability of soil models to account these practises

REVIEW

- Soil model ensemble – for capacity building and GHG invs

SOIL MODEL ENSEMBLE

- Soil property maps for Europe

SOIL MAPS

Review published in the Forest Ecology and Management

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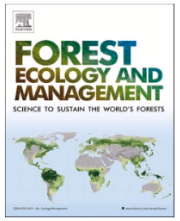
Contents lists available at ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco



Check for updates

How does management affect soil C sequestration and greenhouse gas fluxes in boreal and temperate forests? – A review

Raisa Mäkipää [a,*], Rose Abramoff [b], Bartosz Adamczyk [a], Virginie Baldy [c], Charlotte Biryol [c], Michal Bosela [d], Pere Casals [e], Jorge Curiel Yuste [f,g], Marta Dondini [h], Sara Filipek [i], Jordi Garcia-Pausas [e], Raphael Gros [c], Erika Gömöryová [d], Shoji Hashimoto [j], Mariana Hassegawa [k], Peter Immonen [a], Raija Laiho [a], Honghong Li [a], Qian Li [a], Sebastiaan Luyssaert [l], Claire Menival [c], Taiki Mori [j], Kim Naudts [m], Mathieu Santonja [c], Aino Smolander [a], Jumpei Toriyama [j], Boris Tupek [a], Xavi Ubeda [e], Pieter Johannes Verkerk [k], Aleksi Lehtonen [a]

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[h] School of Biological Sciences, University of Aberdeen. 23 St Machar Drive, Aberdeen AB24 3UU, Scotland, UK
[i] Wageningen University and Research, Wageningen Environmental Research (WENR), Droevendaalsesteeg, 3, 6708PB Wageningen, The Netherlands

REVIEW

Policy brief in the EFI www-site

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Forest soils can increase climate change mitigation with targeted management

The European Union aims to be climate neutral by 2050 under targets set in the Paris Agreement. Forest soils contain larger amounts of carbon (C) than standing biomass. Forest management can both increase and decrease carbon stock, soil CO_2 emissions, and net exchange of other greenhouse gases (GHG) such as methane (CH_4) and nitrous oxide (N_2O). Increasing the carbon sequestration in forest soils and reducing net GHG emissions is crucial to achieve the target.

REVIEW

https://efi.int/publications-bank/forest-soils-can-increase-climate-change-mitigation-targeted-management

Soil model ensemble [Elisa Bruni & Bertrand Guenet]

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- Develop an interactive online interface that launches state-of-the-art models to simulate SOC stocks and GHG fluxes at site scale.

- Publicly available for end-users such as land managers, forestry experts and scientists: https://github.com/elisabruni/Holisoils-multimodel

- A pre-release version (v0) of web tool is publicly available at the following link: https://elisabruni.shinyapps.io/test4/

and was developed using the Shiny app framework (R Core Team, 2022)

SOIL MODEL ENSEMBLE

Soil model ensemble – user interface

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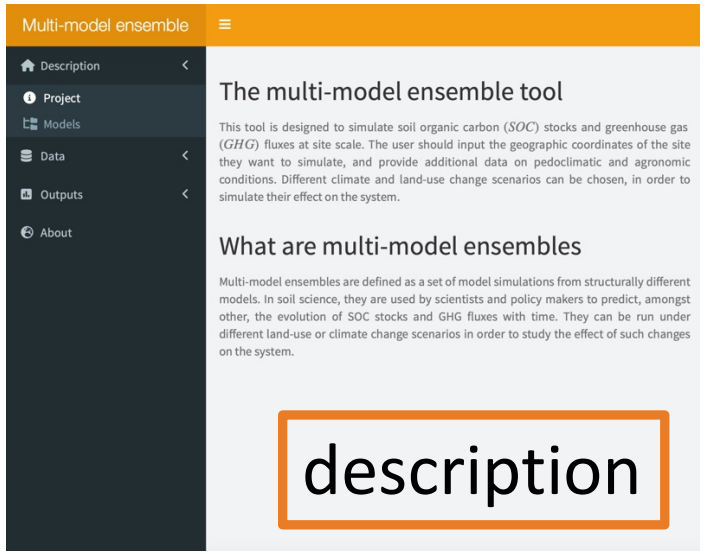
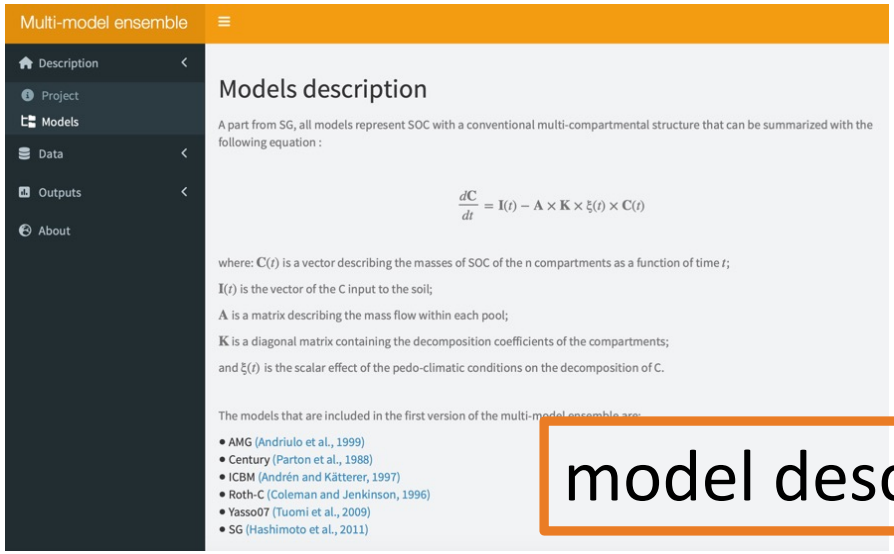
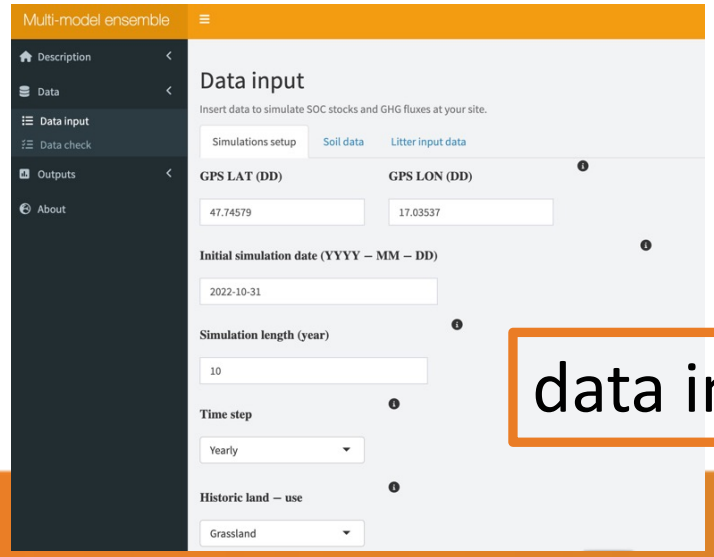


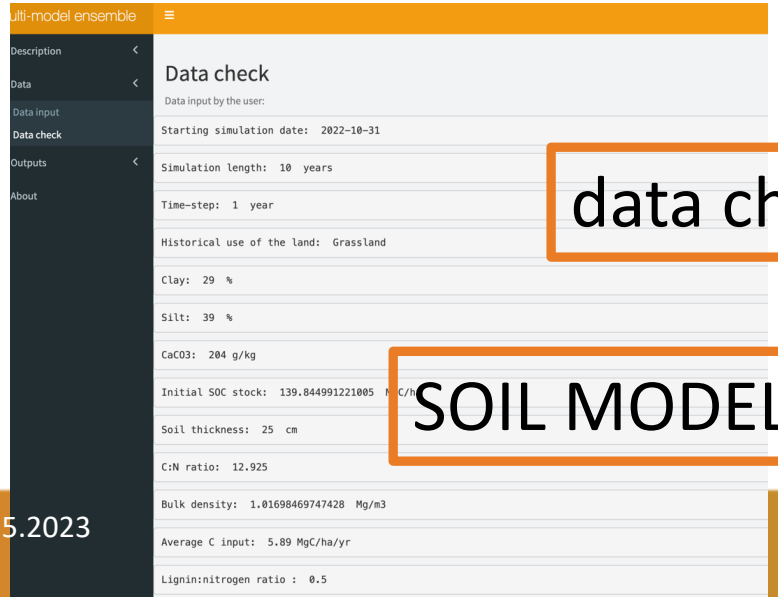
description



model description



data input



data check

SOIL MODEL ENSEMBLE

Soil model ensemble – UI - results

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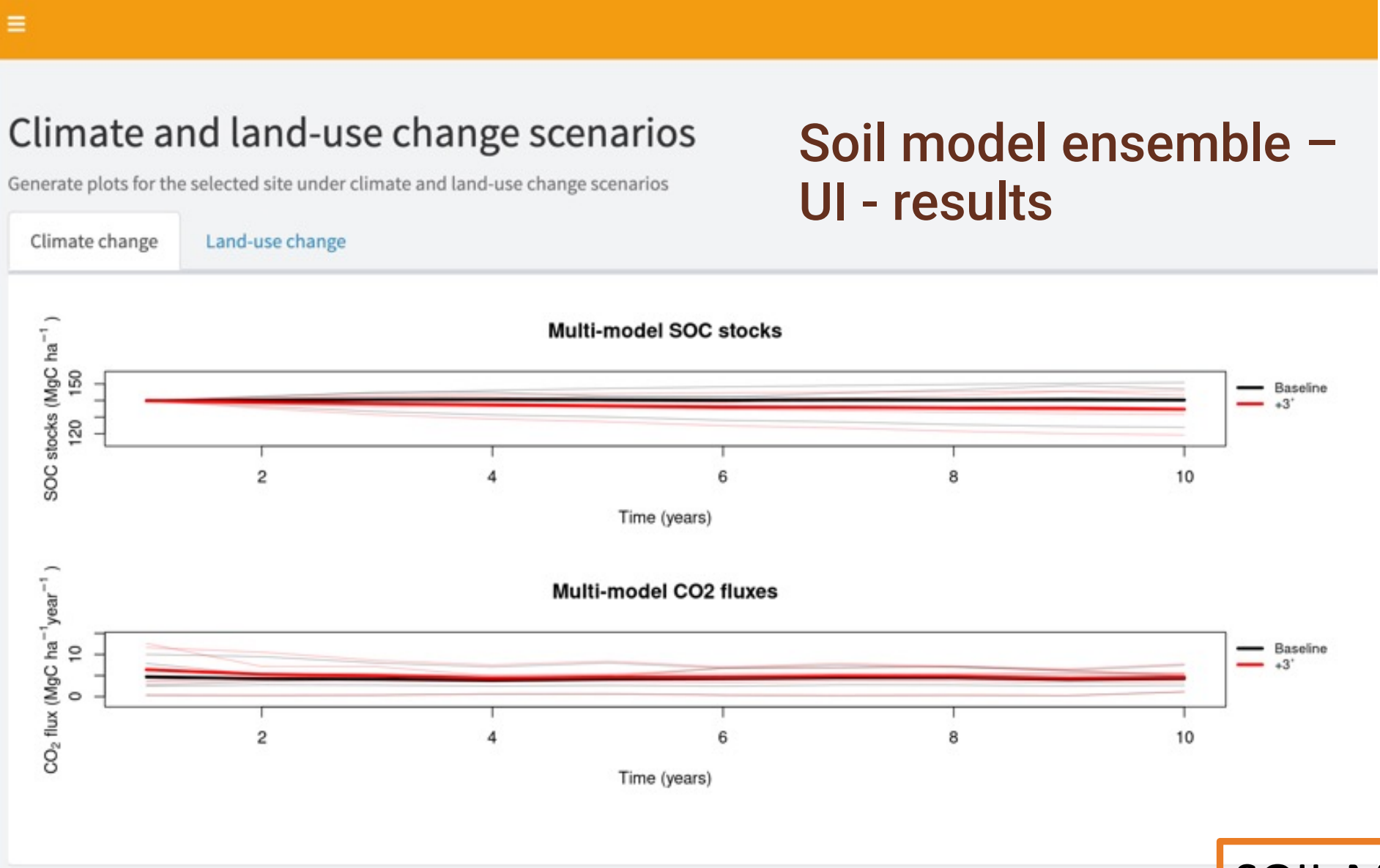

AMG, Century, ICBM, Roth-C, Yasso07, SG, …

SOIL MODEL ENSEMBLE

Soil model ensemble – summary

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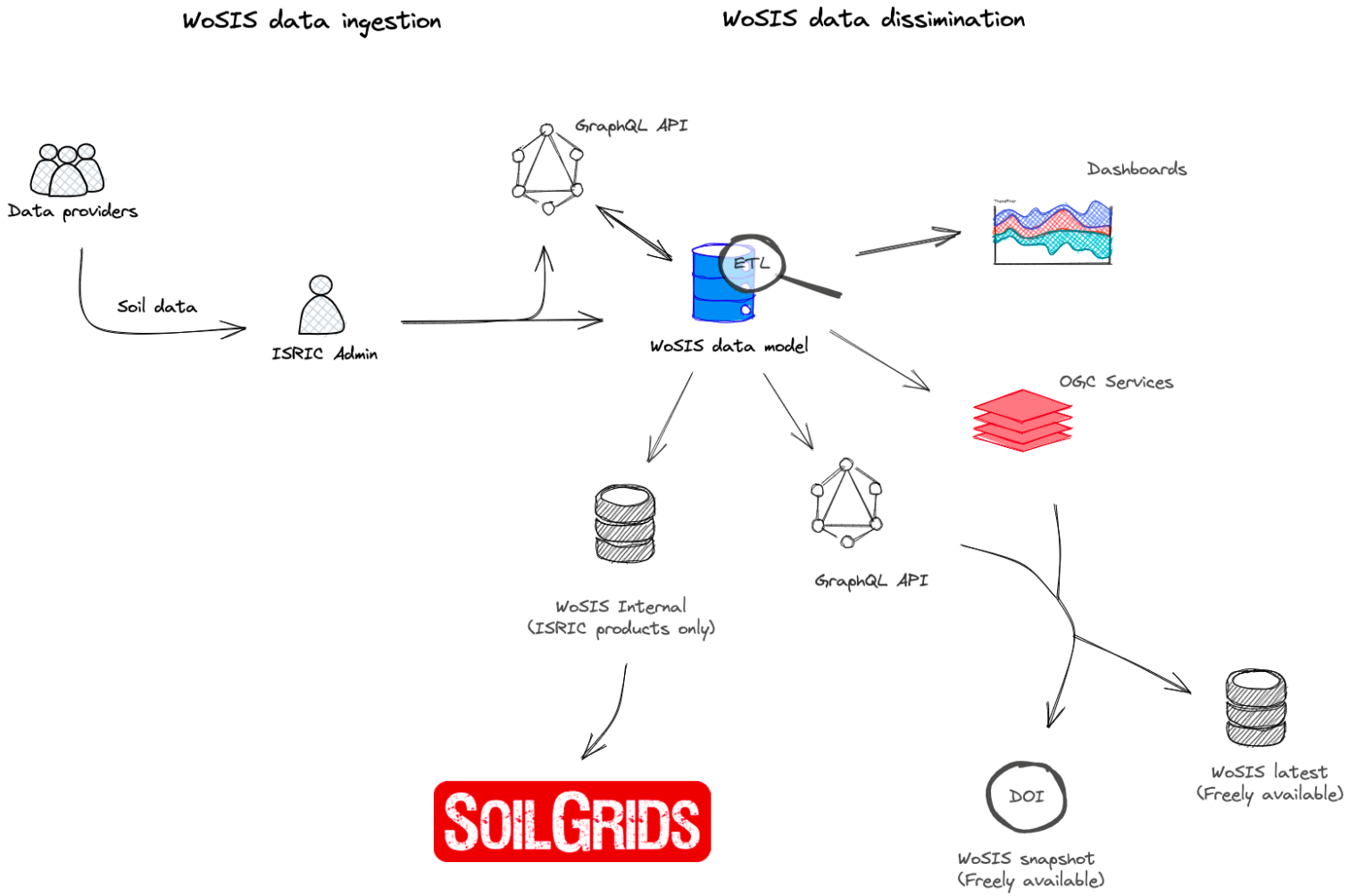
- If input data lacks:
  - soil property data are extracted from **ESDAC** maps
  - and climate variables from the **ISIMIP** repository

- Advantages
  - The interface is user-friendly so anyone can use it even without a background in modeling
  - The tool is easily extendable to other land-uses and continents as long as global maps are available

- For capacity building, GHG-invs and future scenarios

SOIL MODEL ENSEMBLE

Soil property maps by ISRIC and TI: WoSIS diagram [Niels Batjes & Nicole Wellbrock]



SOIL MAPS

Datasets received

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- Forest soil data for Europe were collated.

- This activity resulted in ~7,200 profiles (4 datasets), with various license constraints.
    - Open license profiles 2,320
    - Restricted license profiles 4,880

- Challenging positional accuracy aspect on some datasets.

- These profiles are to represent ~227 million ha forest soils (~3.1 points / 1000 km^2).

SOIL MAPS

Data ingestion, standardisation and harmonisation

- Basic quality/consistency control
- Identify repeated profiles
- Standardise attribute names
- Standardise analytical method descriptions
- Standardise units (incl. conversion factors)
- Plausibility checks (min, max, mean)

➢ **Standardisation** procedures (from WoSIS):
  ➢ Organic versus mineral soil layer

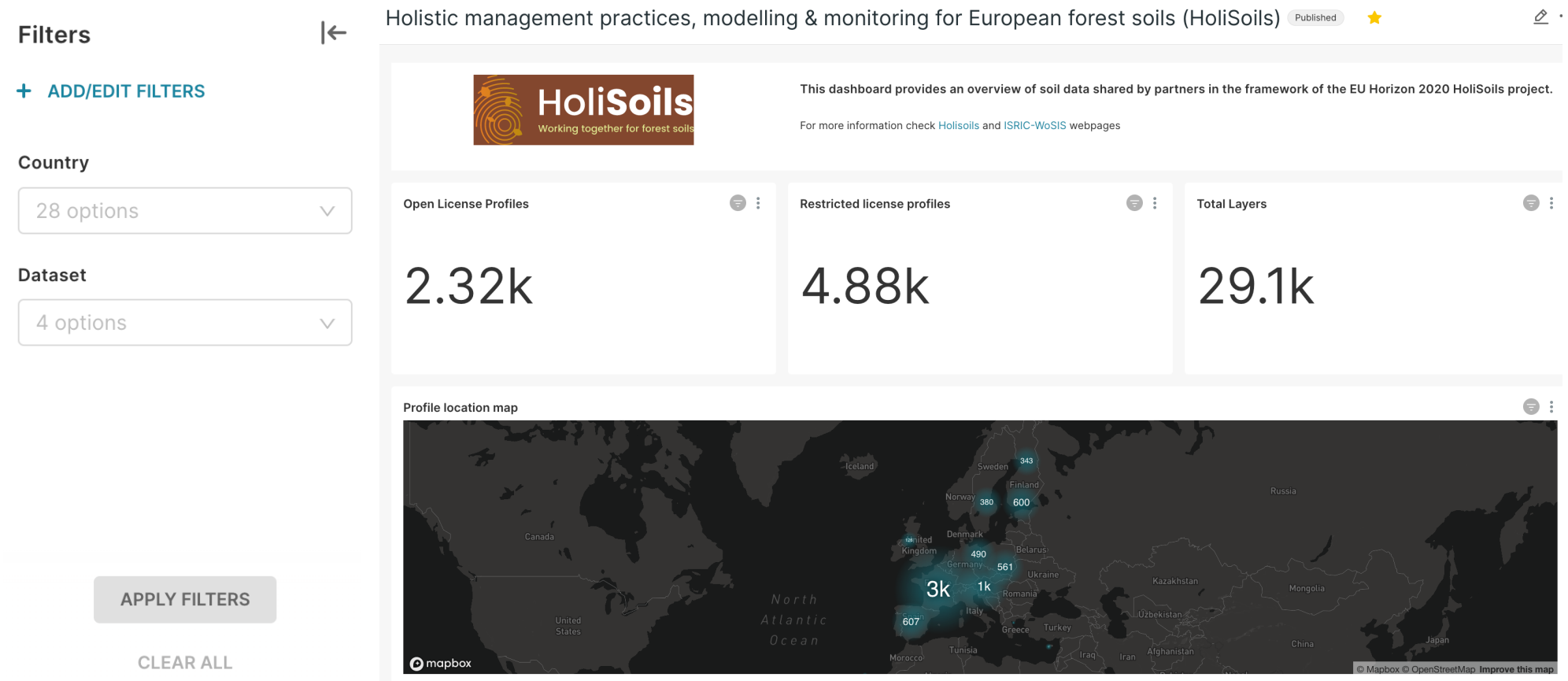
- Bulk density
- Carbon (Total & Organic)
- Calcium carbonate
- Cation exchange capacity
- Total Nitrogen
- Electrical conductivity (Ec_x, Ec_{sat})
- pH (H_2O, KCl, $CaCl_2$, NaF)
- Coarse fragments
- Texture (sand, silt, clay)
- Water retention (at specified tensions)
- Available P (specified methods)

Also:
- *Classification*: FAO (year, WRB (year), USDA Soil Taxonomy (year), as provided
- *Horizon designation* (as provided, cleaned only)

SOIL MAPS

Provided data

https://dashboards.isric.org/superset/dashboard/holisoils

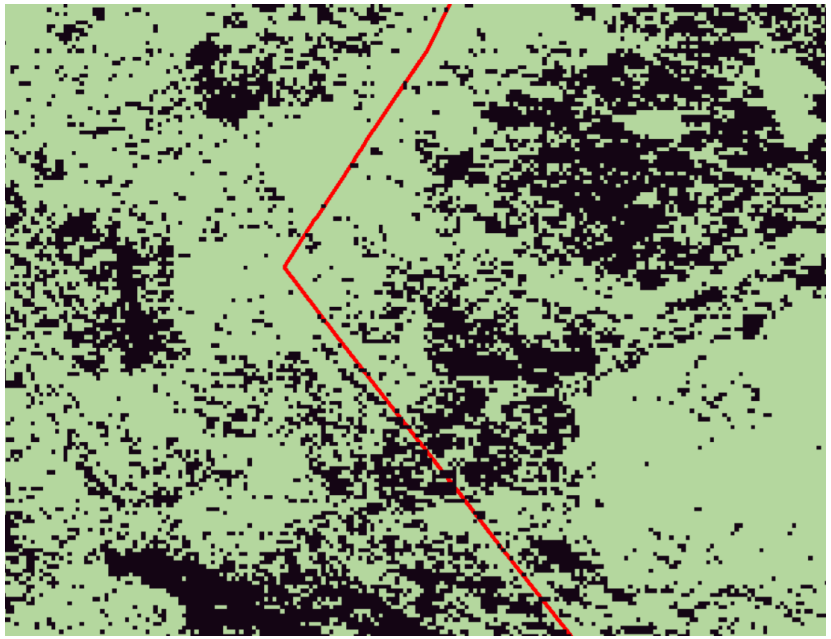


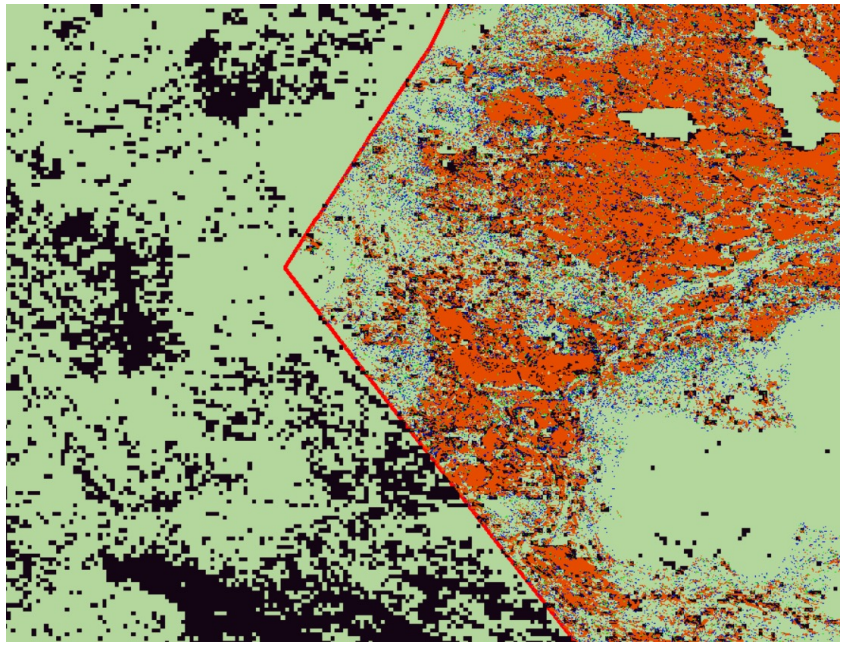
It can take a few seconds (20s –30s) to update, please be patient!

SOIL MAPS

Peatland maps [Aura Salmivaara - Luke]

- Greifswald Mire Center European peatmap in 150m resolution as a baseline
- The baseline map is updated with data from Sweden, Finland, Netherlands, …
- The Swedish map in 2m resolution (Ågren et al. 2022) was created by machine learning methods utilizing soil wetness index derived from ALS data
- In Finland ML methods are also utilized to produce improved peat map in 50m resolution
- In Holisoils
  1) a 100m peat map will be created and is used as covariate in soil mapping by ISRIC
  2) a segmented dataset on drained peatland forests will be created





Ågren, A. M., Hasselquist, E. M., Stendahl, J., Nilsson, M. B., and Paul, S. S.: Delineating the distribution of mineral and peat soils at the landscape scale in northern boreal regions, SOIL, 8, 733–749, https://doi.org/10.5194/soil-8-733-2022, 2022.

peat 30-40 cm
peat 40-50 cm
>50 cm peat

SOIL MAPS

Thank you for your attention

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