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PEAT SOIL MAPPING AND ASSESMENT AT DIFFERENT SCALE

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The objectives of lecture

- Soil mapping basic concepts
- Soil mapping strategies
- Peat soil maps
- Trends is peat soil mapping

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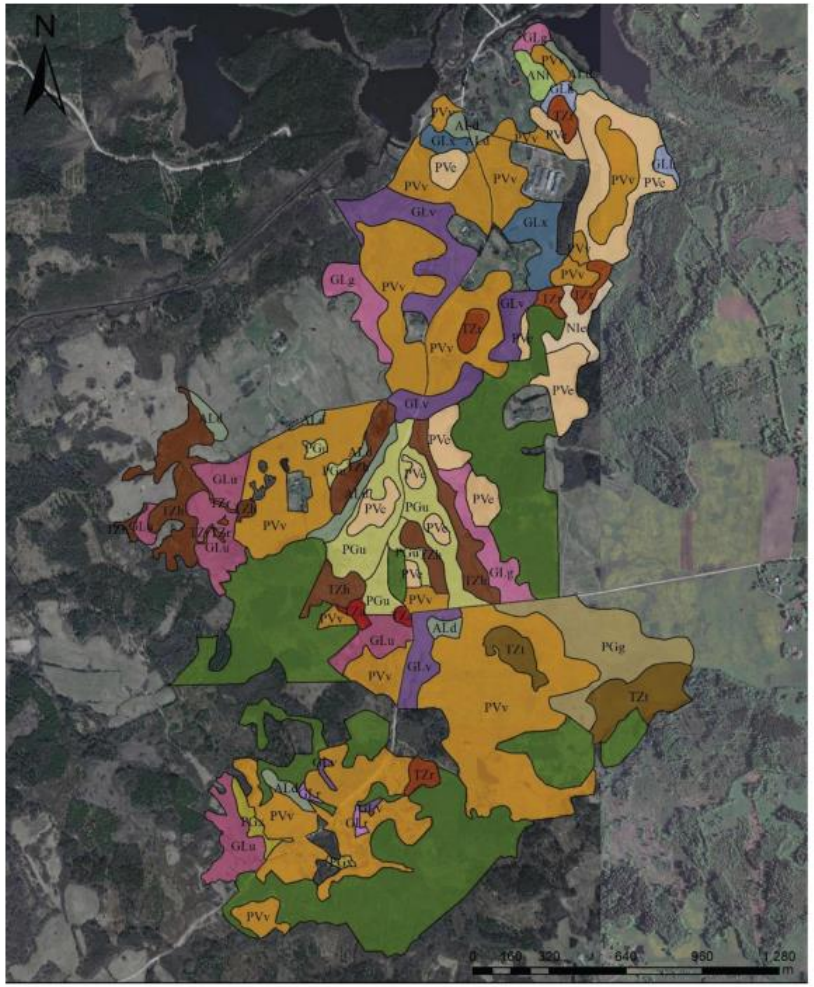
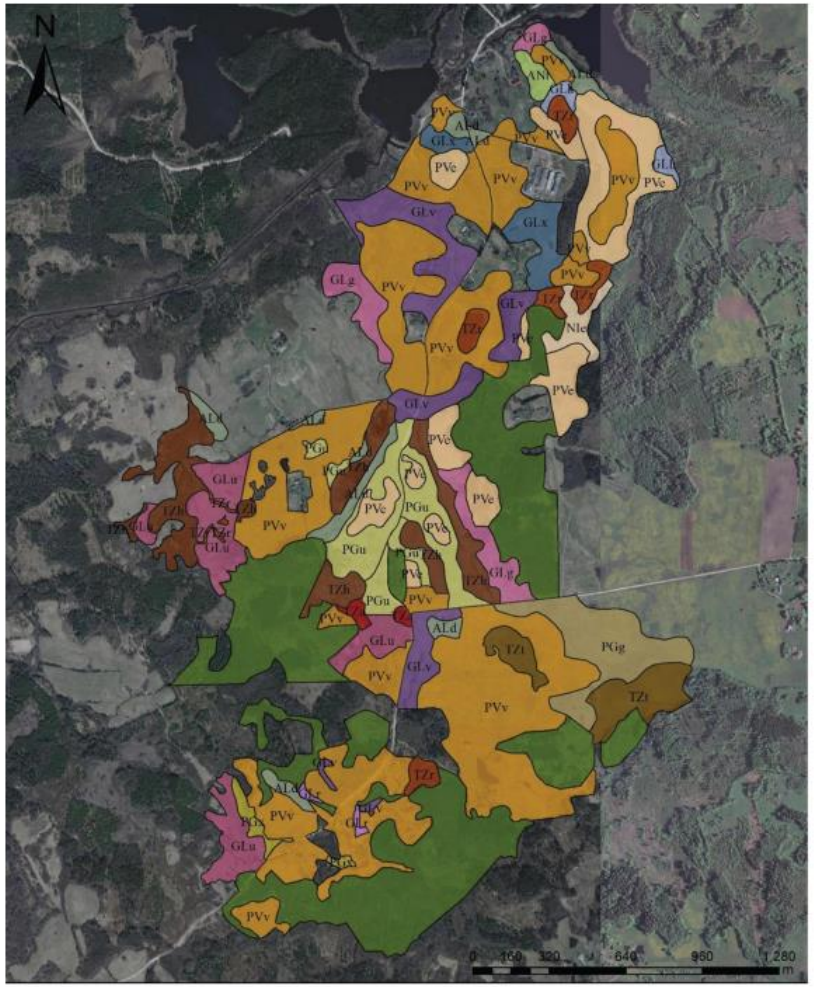
Soil description and mapping

- **Soil mapping/survey** – soil field studies in field to produce soil map
- **Soil mapping shows soil spatial distribution within mapping area;**
- **Mapping incormation consists:**
  - **Soil map;**
  - **Geographical conditions, land use, soil information layers**
  - **Additional soil pits and augering pionts**



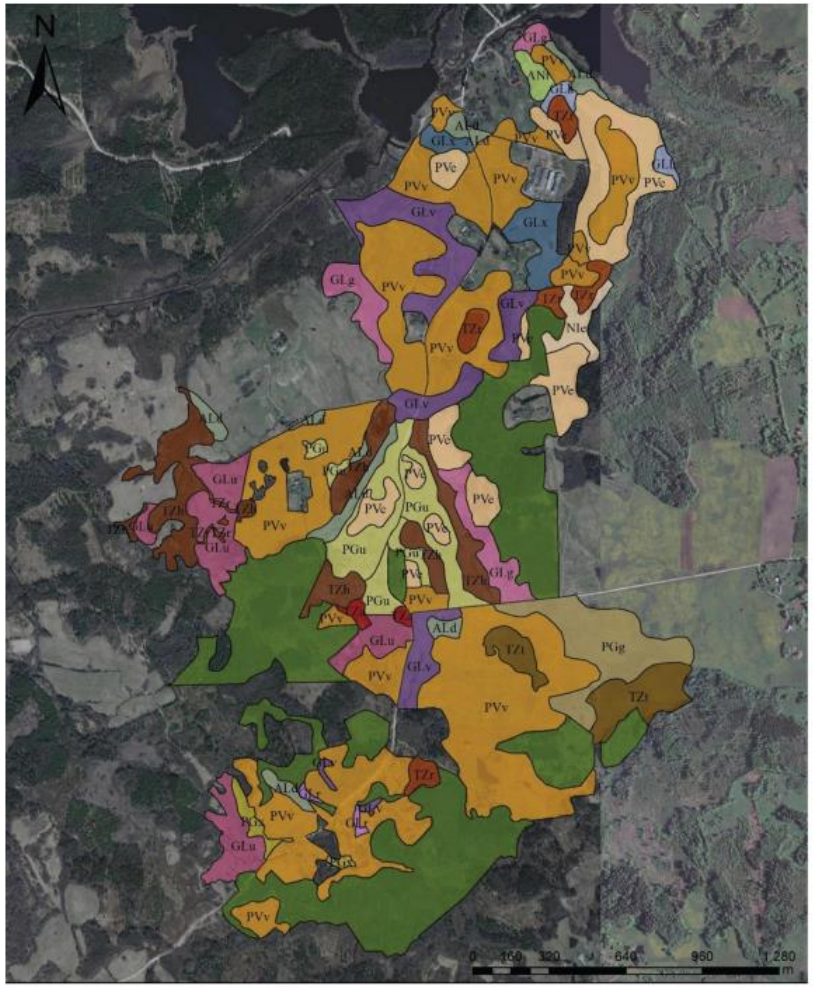
Soil description and mapping

- **Soil mapping** is the process of delineating natural bodies of soils, classifying and grouping the delineated soils into map units, and capturing soil property information for interpreting and depicting soil spatial distribution on a map (usda.gov)



Soil map contour

- Closed line in map that shows boundaries of object or properties.



Soil complex

- A soil complex = areas of two or more soils
  - intricately mixed
  - small in size that they cannot be shown separately on the soil map.
- two or more dominant soils, and the pattern and relative proportions are about the same in all area.

Markovski et al., 2021

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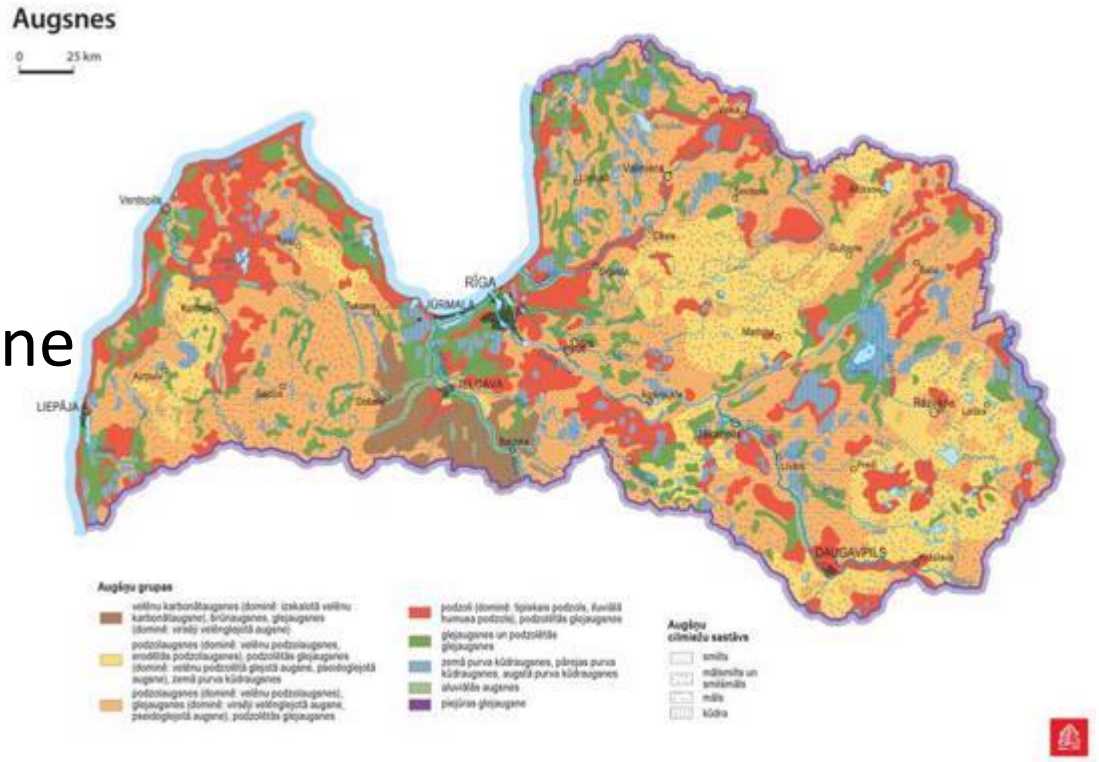
Soil complex

- Used in the large-scale maps;
- Example: In the Austrumlatvija lowland peatsoils and gleysoils are mapped in one complex



Soil association

- Soil association is combination of two or more classification units;
- No need for dealination;
- Peat soils in Latvia occurs in upland soil association: peat soils, sod – podzolic soils, eroded – colluvic soils.

Markovski et al., 2021

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Soil mapping strategies and scale

- **General research maps**: usually in territories without soil surveying. Scale 1:2 000 000 to 1: 5 000 000;
- **Compilations**: soil maps are created from other soil mapping information. Scale 1:1 000 000 or smaller.
- **Medium resolution mapping**: combination of aerial images and intense field data collection. Scale 1: 1 000 000 to 1: 250 000
- **Detailed mapping**: Scale from 1: 25 000 to 1 : 10 000. Mains source of information – field works.
- **Intensive mapping**: usually scale is 1:2500 to 1:10 000. Grid sampling.

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Scale and data frequency

Strategy	Scale	Distance between points	Frequency of observations
General research maps	1 : 1 000 000	10 km	1 per 10 000 ha
Compilations	1: 250 000 1:100 000	2,5 km 1 km	1 per 625 ha 1 per 100 ha
Medium resolution mapping	1 : 50 000	500 m	1 per 25 ha
Detailed mapping	1 : 10 000	100 m	1 uz ha
Intensive mapping	1 : 5 000	50 m	4 uz ha

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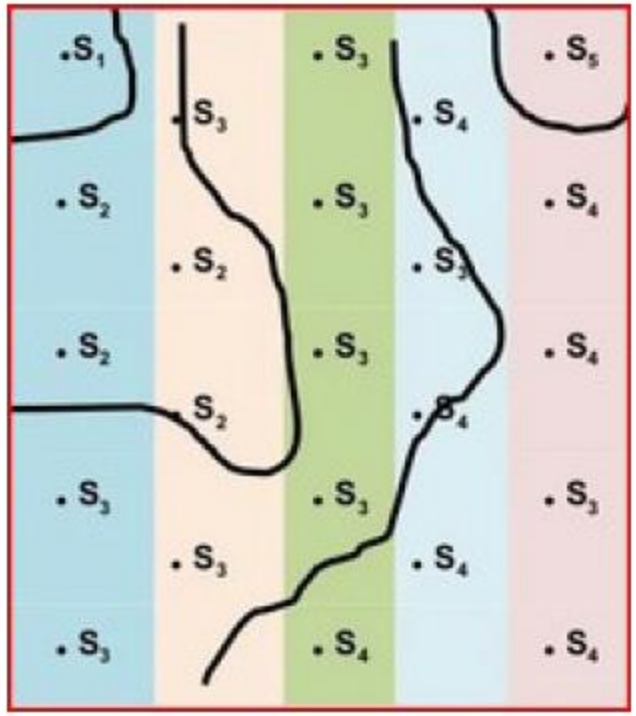
Scale and contour size

Minimum size of mapping unit (ha)	Scale
<1	1 : 15 840 <
0,4 – 0,6	1 : 12 000 ------- 1: 31 680
1,6 - 16	1 : 20 000 --------1 : 63 360
16 – 252	1 : 63 360 --------1: 250 000
252 - 4000	1: 250 000--------1 : 1 000 000

Soil mapping methologies

- Mapping based on preproduced grid – small territories;
- Mapping based on expert knowledge and improvisation – large territories;



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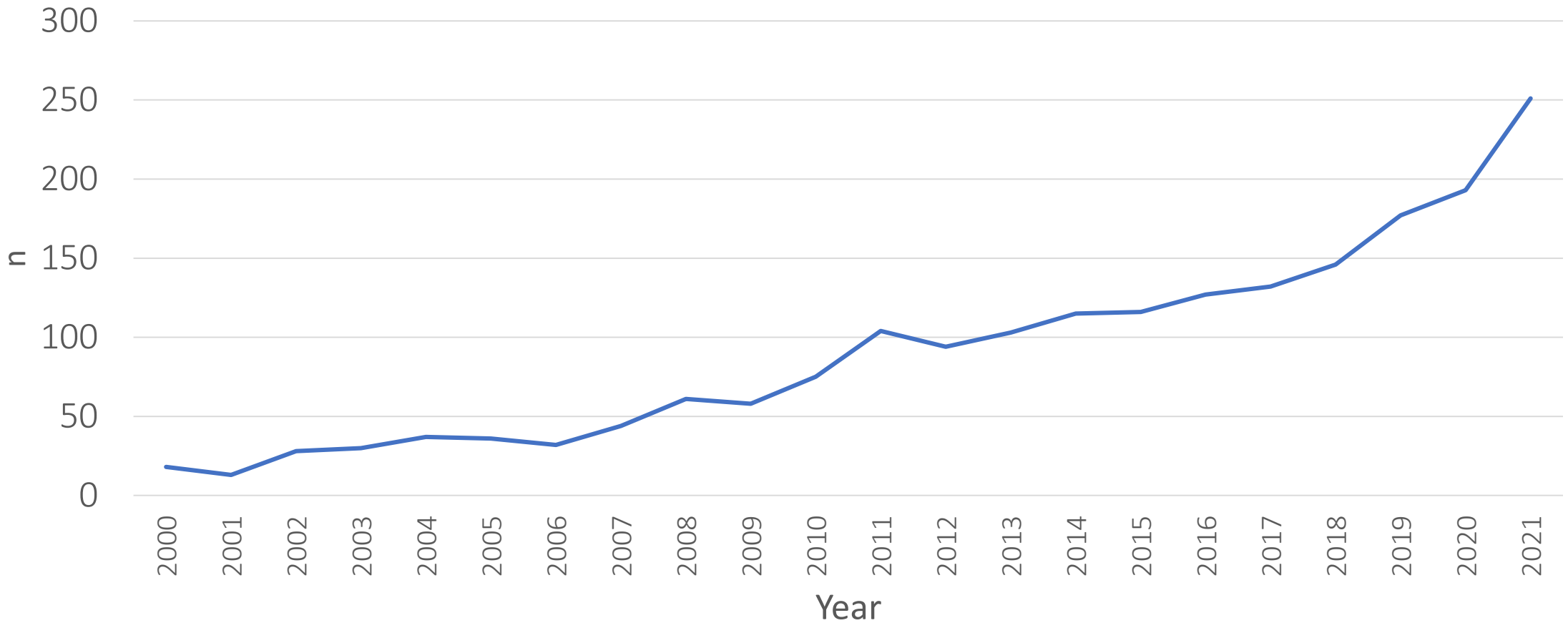
Number of entries in ‘Scopus’ database by keywords: soil, carbon, remote, sensing



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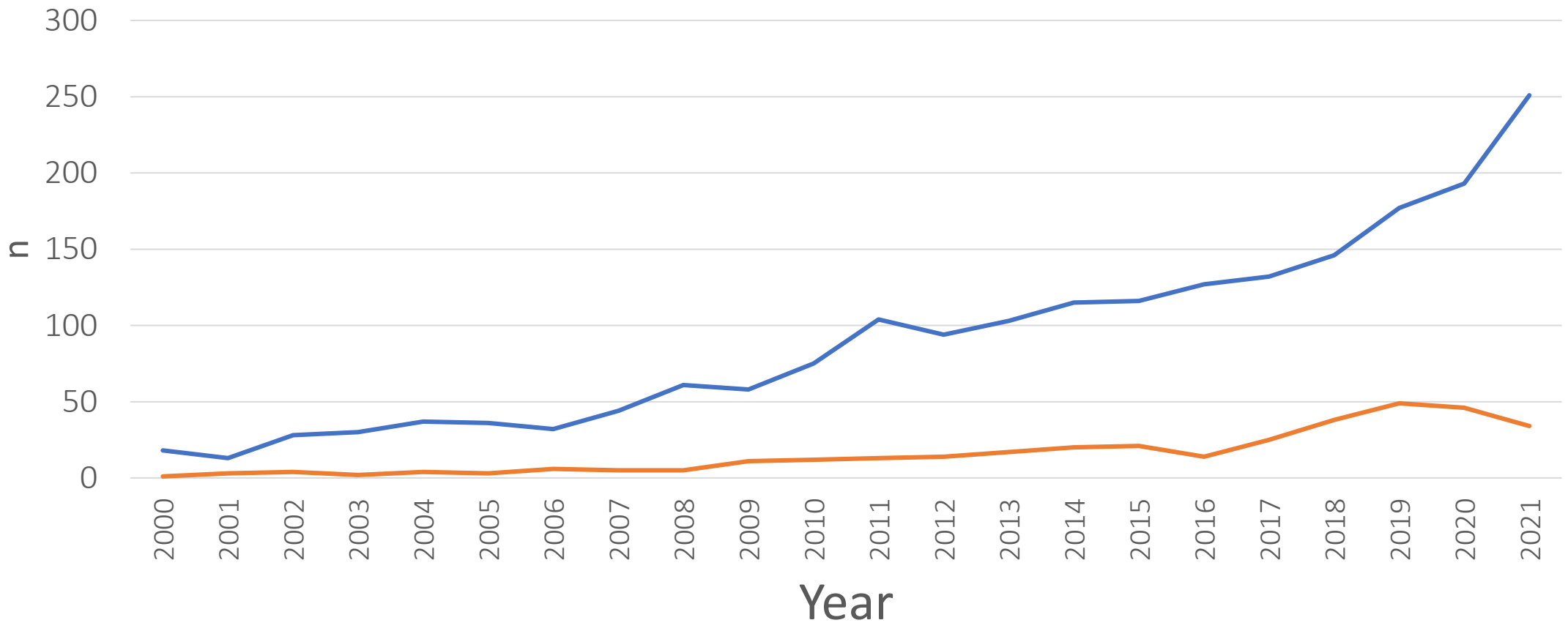
Number of entries in ‘Scopus’ database by keywords: peatland, remote, sensing



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Soil carbon prediction in mineral soils

VIS-NIR reflectance

Limitations:

- **Sol cover**
- **Soil texture**
- **Stoniness**
- **Vegetation**

Prediction of distribution of peat soils and soil carbon stock

- **Data for boundary prediction: landcover, DEM, satellite images;**
- **C Stock, bulk density, accumulation rates, peat depth**

Minasny, B. et al. (2019) ‘Digital mapping of peatlands – A critical review’, Earth-Science Reviews, 196, p. 102870.

- **Higher accuracy when more than one covariate is used**

Prediction of distribution of peat soils and soil carbon stock

- **Combination of spatial data and phenological indicies improve model accuracy (He et al., 2021) and carbon stock predictions (Lopatin et al., 2019);**
- **Combination of LiDAR and radiometric data can predict peat layer (Gatis et al., 2019);**
- **DEM can be used to predict depressions, it must be used in combination with other indicies to predict peat soils (Stengård et al., 2020)**

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Reference List

Thank You for Your attention!

Qusetions?

Reference List

- Beamish, D. (2014) 'Peat Mapping Associations of Airborne Radiometric Survey Data', *Remote Sensing* , pp. 521–539. doi:10.3390/rs6010521.
- Gatis, N. *et al.* (2019) 'Mapping upland peat depth using airborne radiometric and lidar survey data', *Geoderma*, 335, pp. 78–87. doi:https://doi.org/10.1016/j.geoderma.2018.07.041.
- He, X. *et al.* (2021) 'Soil organic carbon prediction using phenological parameters and remote sensing variables generated from Sentinel-2 images', *CATENA*, 205, p. 105442. doi:https://doi.org/10.1016/j.catena.2021.105442.
- Krankina, O.N. *et al.* (2008) 'Meeting the challenge of mapping peatlands with remotely sensed data', *Biogeosciences*, 5(6), pp. 1809–1820. doi:10.5194/bg-5-1809-2008.
- Lopatin, J. *et al.* (2019) 'Using aboveground vegetation attributes as proxies for mapping peatland belowground carbon stocks', *Remote Sensing of Environment*, 231, p. 111217. doi:https://doi.org/10.1016/j.rse.2019.111217.
- Lupikis, A. *et al.* (2017) 'Carbon stock changes in drained arable organic soils in Latvia: Results of a pilot study', *Agronomy Research*, 15, pp. 788–798.
- Middleton, M. *et al.* (2012) 'Ordination and hyperspectral remote sensing approach to classify peatland biotopes along soil moisture and fertility gradients', *Remote Sensing of Environment*, 124, pp. 596–609. doi:https://doi.org/10.1016/j.rse.2012.06.010.
- Markoski, M., Mitkova, T., Tanaskovik, V., Spalevic, V., Novićević, R. (2021). Soil distribution in Crna River basin and its importance for agricultural production. The Journal Agriculture and Forestry. 67. 125-138. 10.17707/AgricultForest.67.1.11.
- Minasny, B. *et al.* (2019) 'Digital mapping of peatlands – A critical review', *Earth-Science Reviews*, 196, p. 102870. doi:https://doi.org/10.1016/j.earscirev.2019.05.014.
- Stengård, E. *et al.* (2020) 'Inventory and Connectivity Assessment of Wetlands in Northern Landscapes with a Depression-Based DEM Method', *Water* . doi:10.3390/w12123355.