Dutch soil monitoring system now and onwards

12 April 2022

Fenny van Egmond, Dorothee van Tol, Kees Teuling, Martin Knotters and many more

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LSK locations: 1998

The ‘Landelijke Steekproef Kaarteenheden’ (LSK) started in 1988, to describe the map units and determine the accuracy of the soil map of the Netherlands (1:50.000).

- 1392 locations
- Stratified random sampling: metrics
- 96 strata determined based on soil type and groundwater depth regimes
- Achieved a good geographical, soil and hydrological typology across the country
- Sampled according to horizons, multiple depths, range of soil properties, pedotransfer functions for bulk density
- Used for LULUCF reporting (remodelled to LULUCF soil classes and land use types)

Repeated in 2018: CC-NL

- Revisited LSK points
- Used LUCAS sampling protocol but:
    - replaced spade with auger
    - added penetrologger
    - bulk density with auger (unreliable also due to extremely dry summer)
- Layer sampling instead of horizons (0-30, 30-100 cm)
- Aim is to:
    - Determine SOC stock differences in 20 years
    - Aim to characterise soils of NL (N, CN etc):
    - Baseline measurement for monitoring in the future
- Multiple soil parameters (SOM, SOC, TOC, TIC, texture, pH, Ntot, Stot, fractions of C)
- Dutch soil monitoring (method and results) is largely comparable with Belgium and Denmark

Sampling protocol

Stappenplan voor bemonstering CC-NL

1. Zoek het adres op en vraag toestemming aan de landeigenaar. Overhandig hierbij de brief
2. Stel door middel van de handgps het midden van de monsterlocatie vast en markeer deze plek met een piketstok
3. Stel met behulp van een kompas het noorden vast
4. Markeer op 2m afstand van het midden naar het noorden een steekpunt met een piketstok
5. Doe voor de overige windrichtingen hetzelfde als stap 4
6. Noteer het nummer van de monsterlocatie op een schrijfbord
7. Zet de monsterzakken met daarop het nummer van de locatie en de twee monsterdieptes 0-30cm en 30-100cm open in een houder

Protocol van bodembemonstering voor CC-NL

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Education soil samplers

Land use change: not-sampled

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Examples of sampled locations

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Some information on soil profile without descriptions

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Lab analysis

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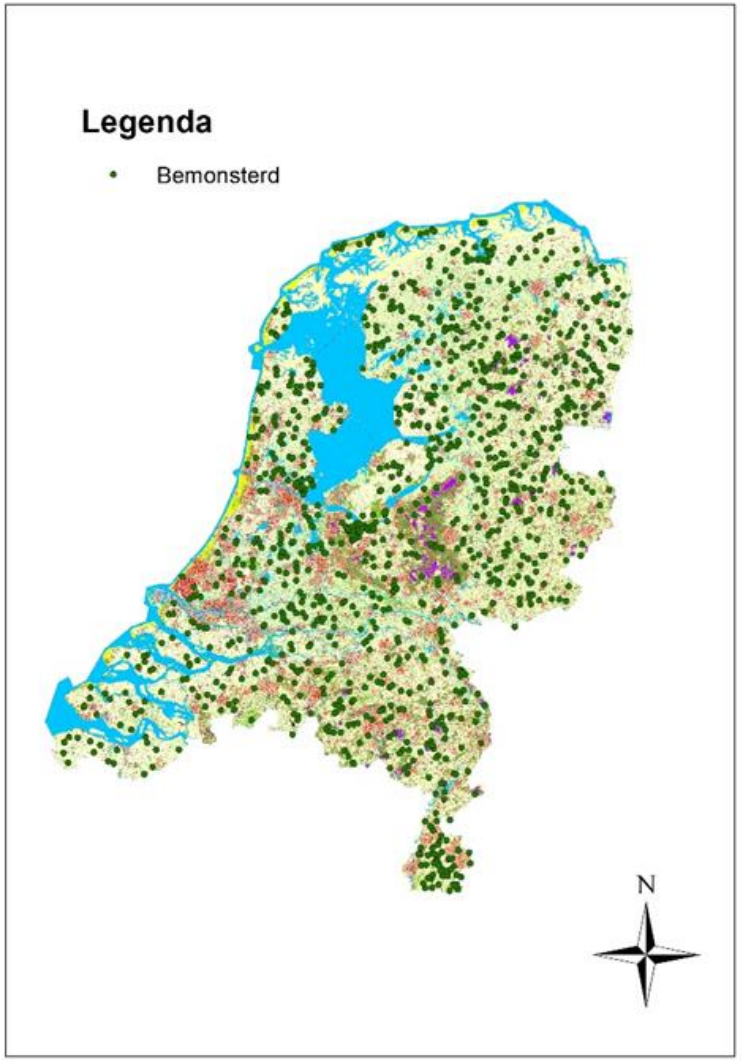
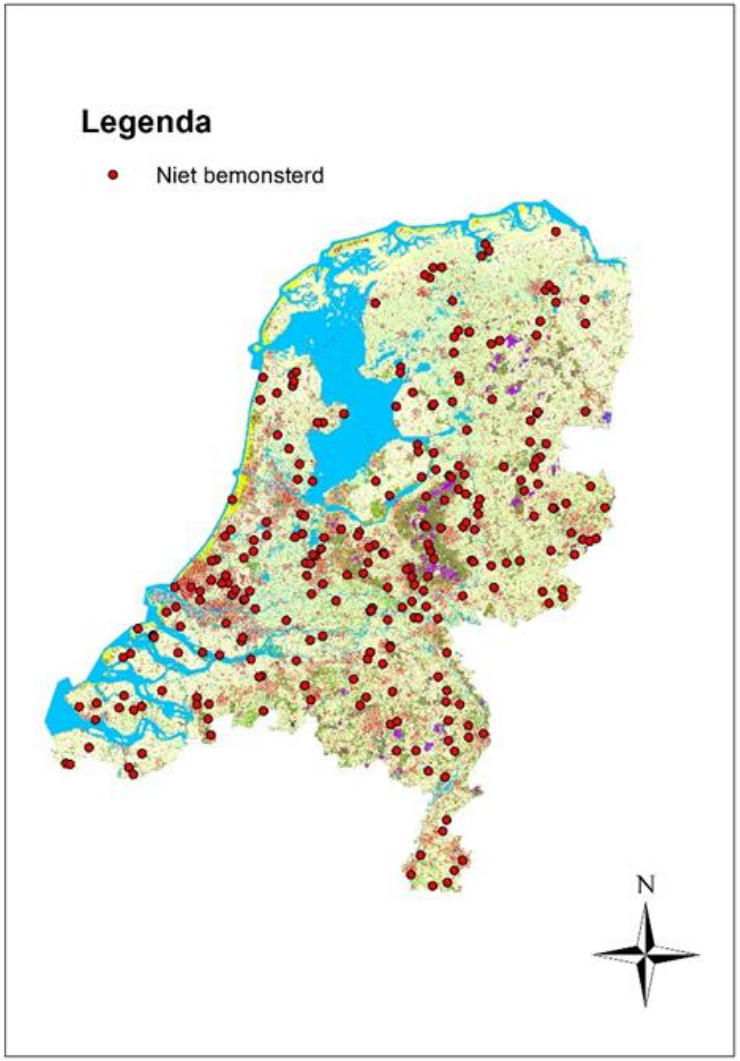
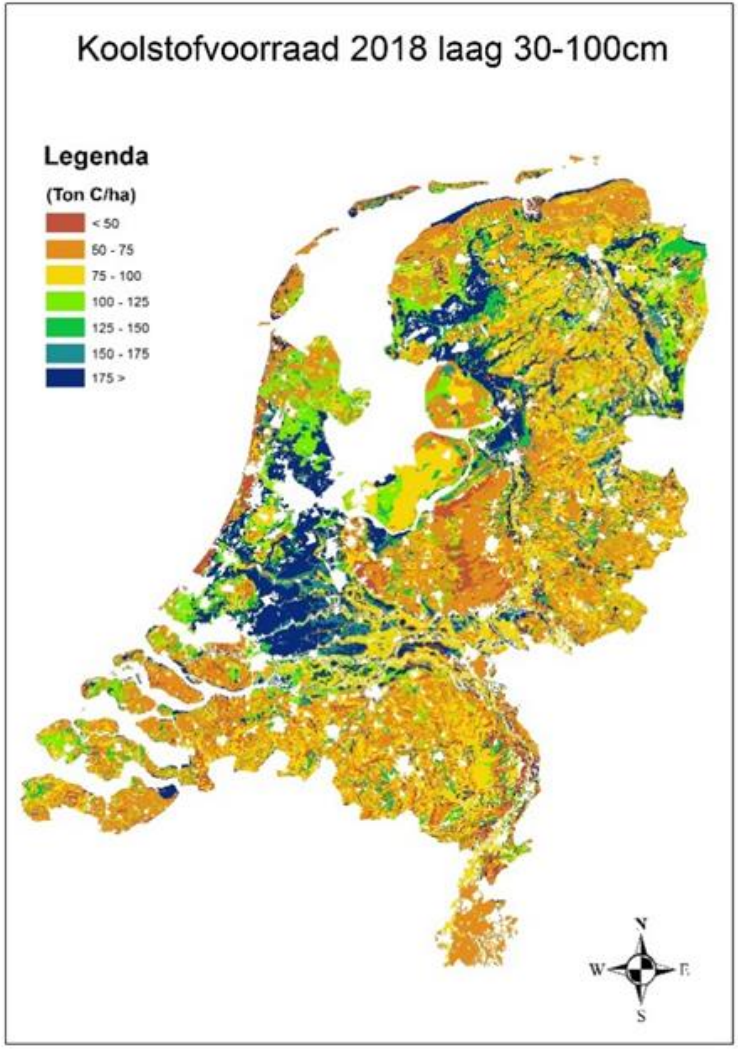
2018

85 %

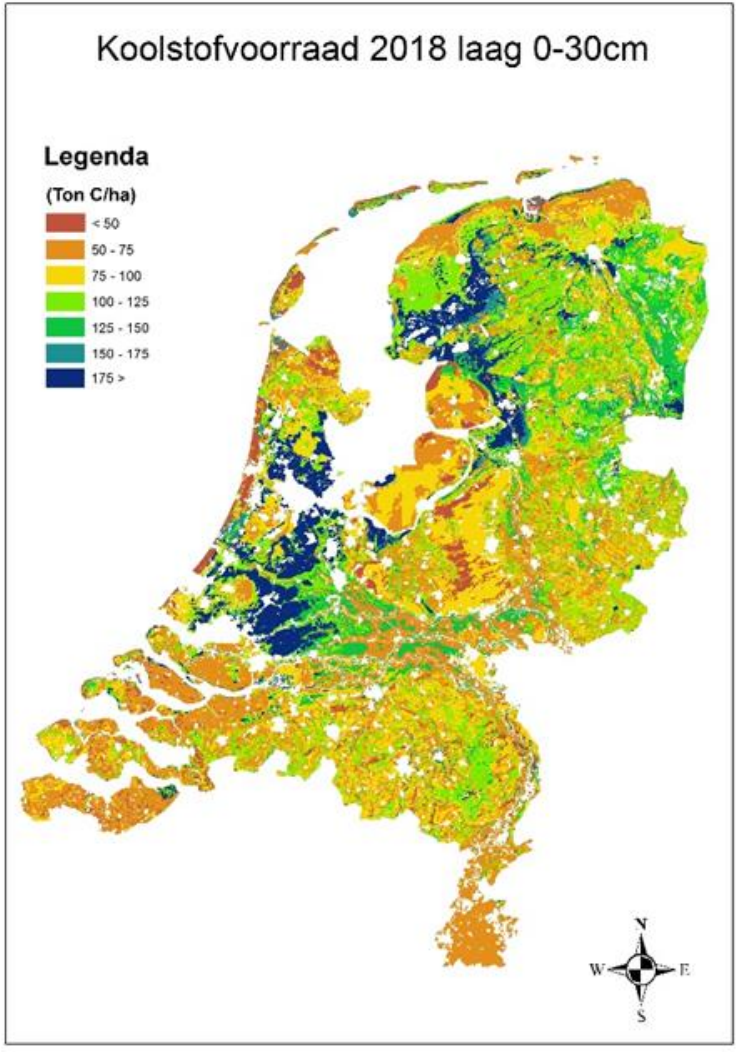




Koolstofvoorraad 2018 laag 30-100cm



Koolstofvoorraad 2018 laag 0-30cm



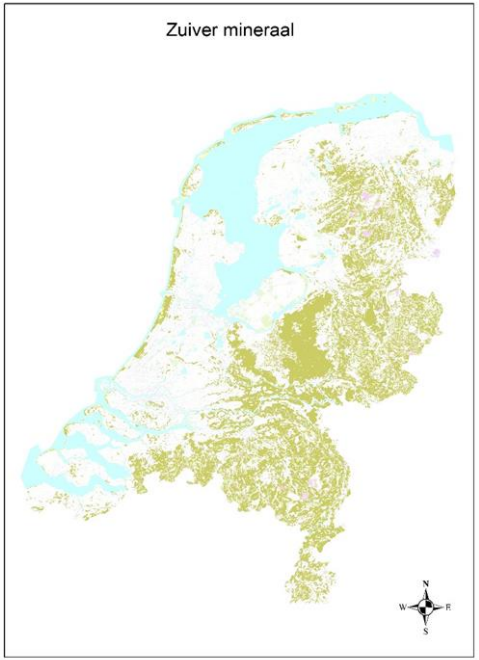
CC-NL: 2018

Estimated average soil organic matter contents (g/kg)

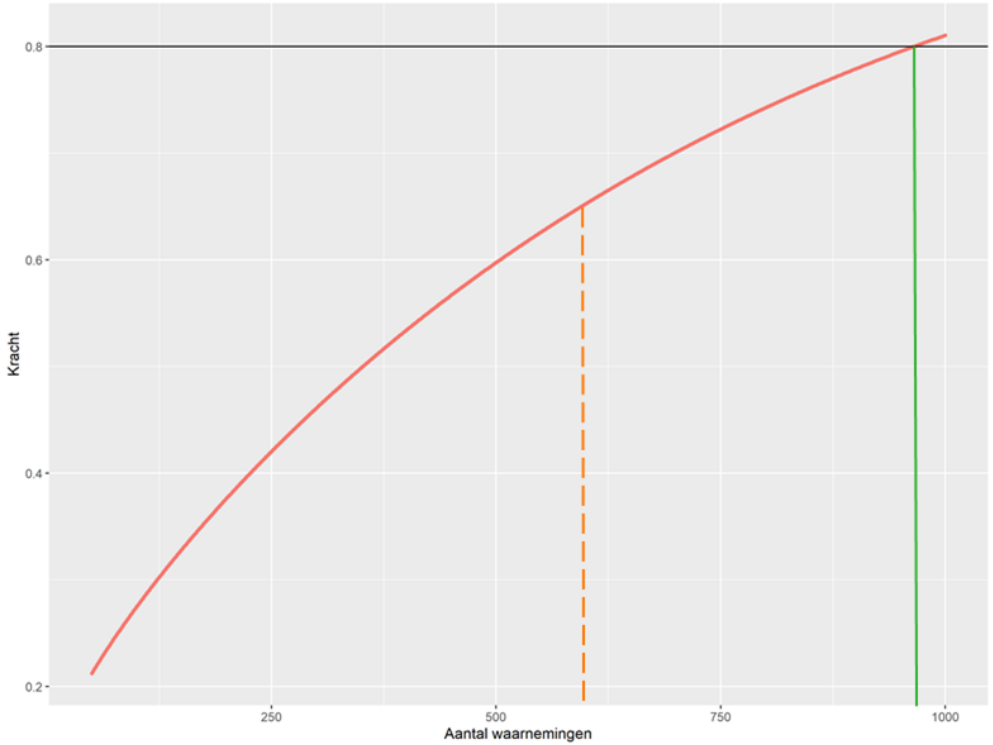
Layer	1998	2018	2018–1998
0–30 cm	64.97 (1.79)	63.92 (1.38)	−1.06 (1.56)
30–100 cm	68.43 (2.60)	50.75 (1.61)	**−17.68** (2.30)

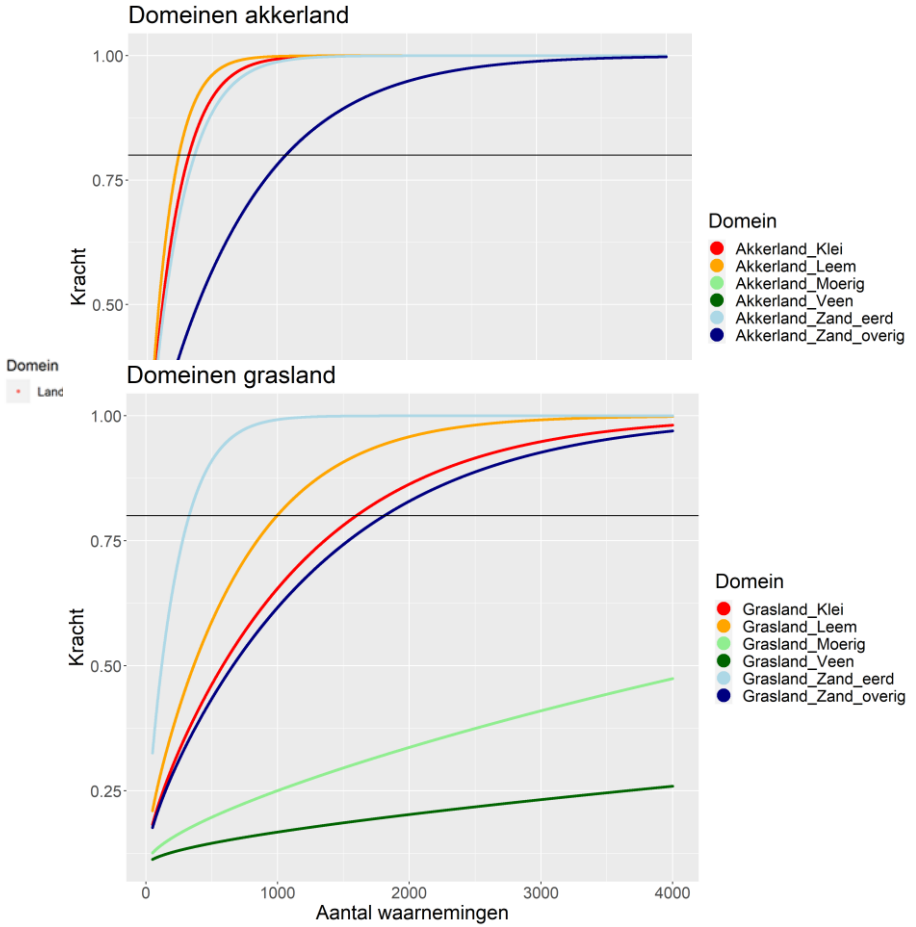
SOC = SOM x ~ 0.40 – 0.55, depending on pH, texture, Al content

Advice: monitor SOM, SOC, N_{tot}, S_{tot}



Number of points needed to assess change in SOC





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Adding locations in next campaign 2023?

	Nr of locations	Extra locations compared to 2018
1998	1389	-
2018	1152	-
Add	1389	237
Future proof*	1626	474
Climate agreement**	1991	839

* Prepared for land use change

**Allows determination of Dutch sequestration aim (0,5 Mton seq. per year in mineral soils in agriculture: in line with 4p1000 initiative) for agriculture on mineral soils only. Further stratification requires more locations.

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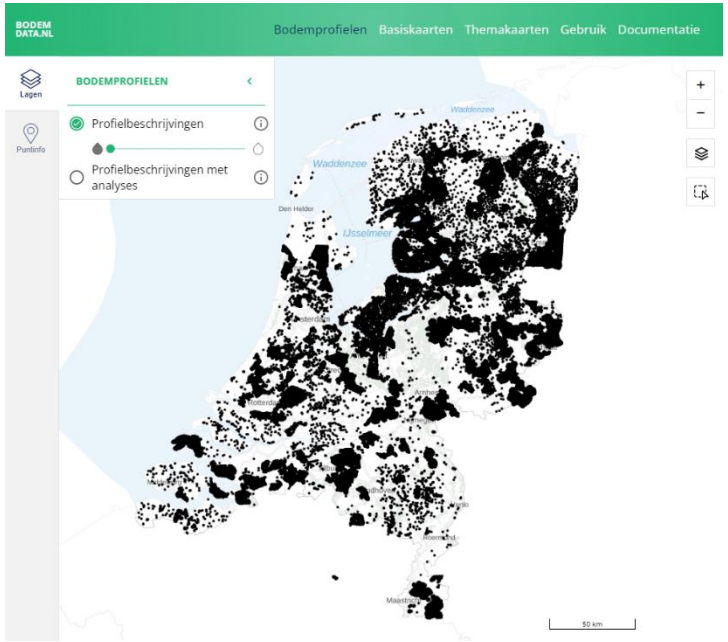
Key Registry Subsurface: Soil and Geology (BRO)

- Soil profile descriptions (auger)
- Soil profile descriptions (pit) and lab analyses
- Soil class map 1:50.000
- Geomorfology map 1:50.000
- Groundwater table depth model: 50 m resolution
- Available at:
  - Bodemdata.nl
  - PDOK, BRO loket



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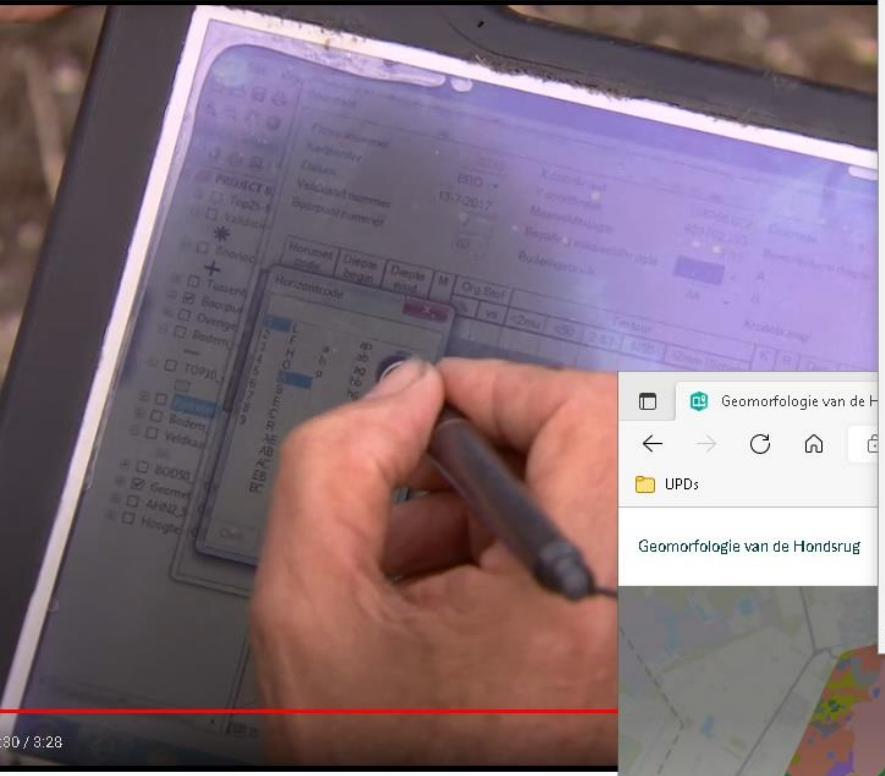
Basisregistratie Ondergrond



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eld onder onze voeten: Landelijk gebied

4 DISLIKE SHARE SAVE ...

Environmental Research

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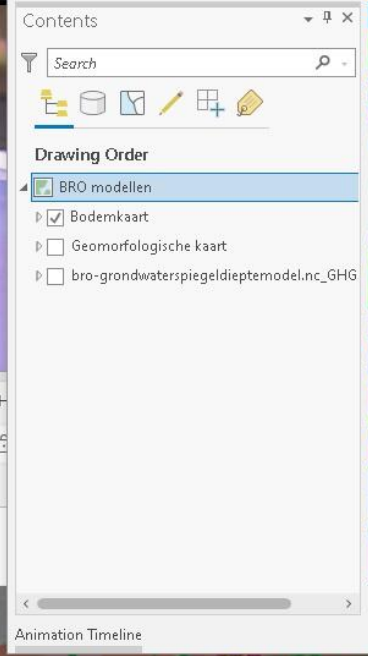
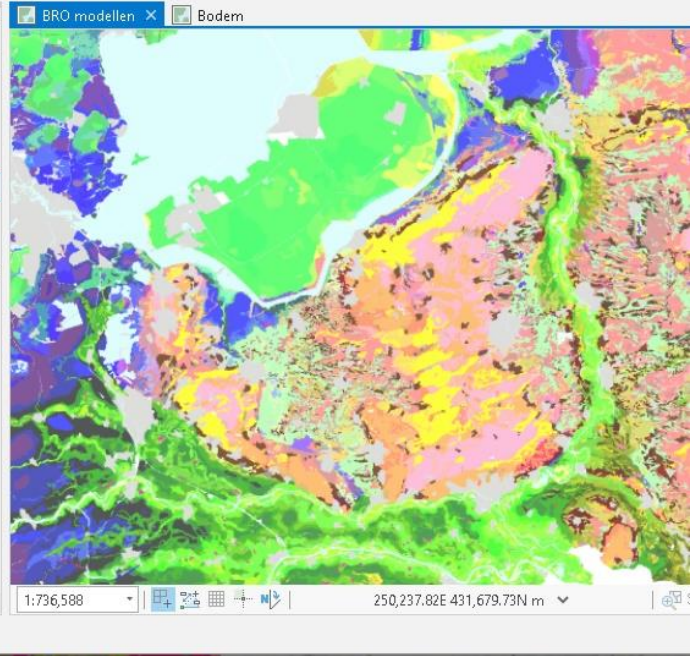
en vaak geen idee hoe de bodem onder hun voeten eruit ziet. Toch is de situatie aiveld bepalend voor de kwaliteit van de dingen die ze bovengronds doen, of het et verbouwen van voedsel, het aanleggen van infrastructuur, het graven van

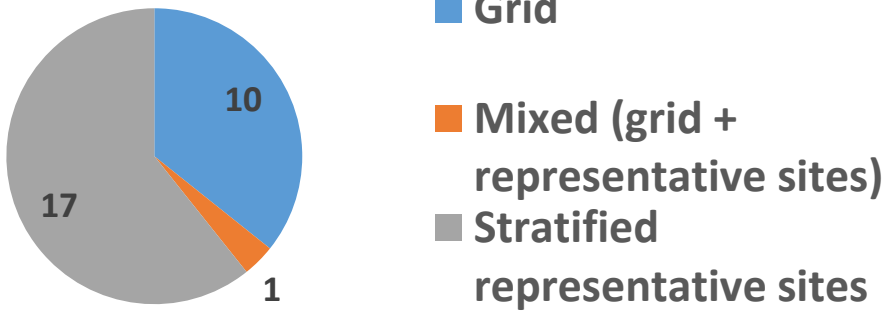


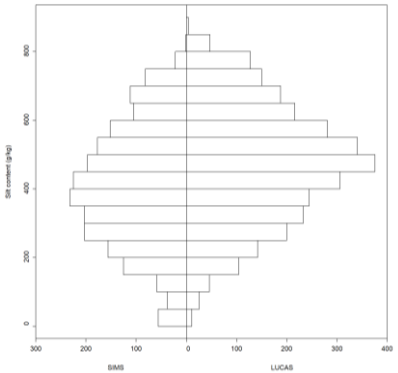


Links with EJP/use for NL

Within EJP SOIL the Netherlands will do (a.o.):

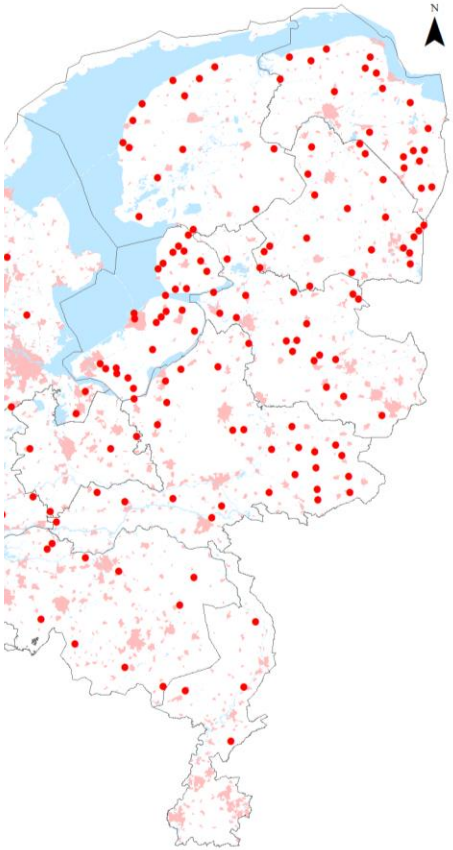
- Comparison of datasets, ~~protocols~~, lab methods and sampling designs: national – LUCAS
- Develop transfer functions (from sampling to analytical methods), taking the opportunity of LUCAS 2022
- Develop method to combine sampling designs for data analysis (metrics)





Sampling design

CC-NL



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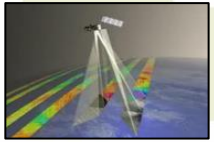
Innovation in methods: Sensing related projects

- SensRes: using sensor data for downscaling digital soil maps to higher resolutions
- STEROPES: improving SOC estimation from remote sensing (EO) by correcting for disturbing factors. 2021-2023 (36 months)
  - Test improvement per factor and together compared to DSM (validation)
  - Evaluate results in different agro-ecological zones
- ProbeField: improving SOC and soil fertility estimation based on proximal sensors and existing soil spectral libraries, incl 3D mapping. 2021-2024 (36 months)
  - Test applicability in accuracy and costs of single and combinations of proximal soil sensing techniques and other data sources for soil property prediction
  - Derive best practice advice for converting 1 or 2D measurements into 3D information on soil properties
- EJP SOIL T6.4: improving methodologies: synergy between projects and final advice







EJP SOIL
European Joint Programme

General technical questions

- Should we synchronise with LUCAS or not: more detail in space **or** time
- What will the data be used for in future?
- Is it then still fit for purpose (density, temporal dimension, land use type/change, soil type, parameters, indicators etc.)
- What will the (legal) implications be of sharing data with new Directives/laws
- How does that influence consent for data collection and/or data sharing?
- How to integrate new data sources effectively (Open Data and Data Governance directives, EU data spaces)

Thank you!

Wageningen Environmental Research

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