Detection of changes of organic carbon in soils

– practical considerations and limitations due to natural changes, sampling and analysis

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Webinar

Four criteria of soil C sequestration….

…in order to become a climate mitigation measure

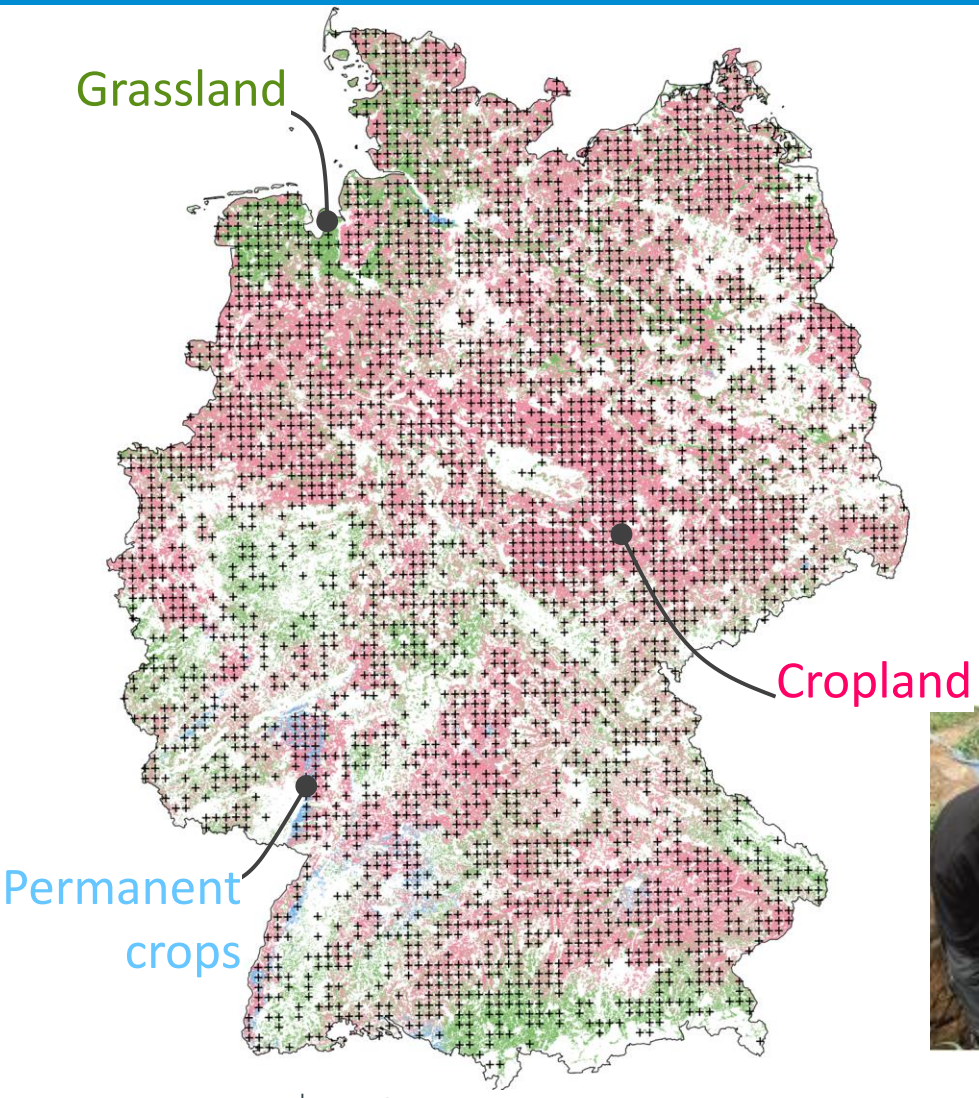
1.) No leakage (no additional org. fertiliser)

2.) Additionality

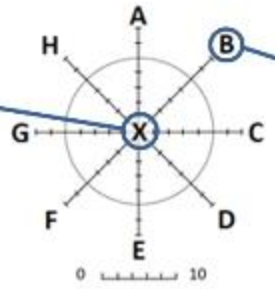
3.) Permanence of C storage

4.) Measurability

Agricultural soil inventory



- Sampling grid of 8 × 8 km (3104 sites)
- Uniform depth increments: 0-10, 10-30, 30-50, 50-70, 70-100 cm
- 124.000 soil samples
- 2012-2018



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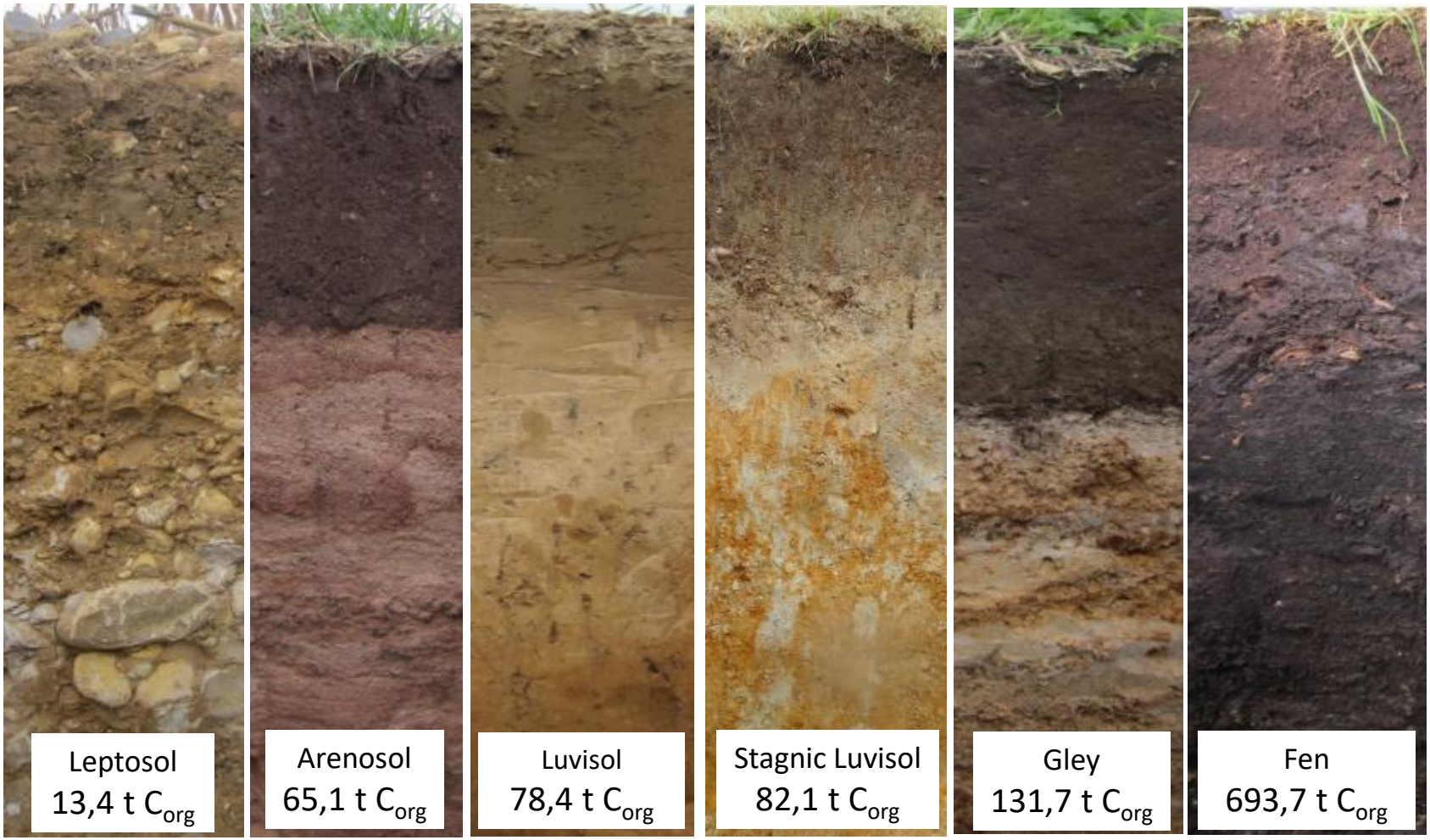
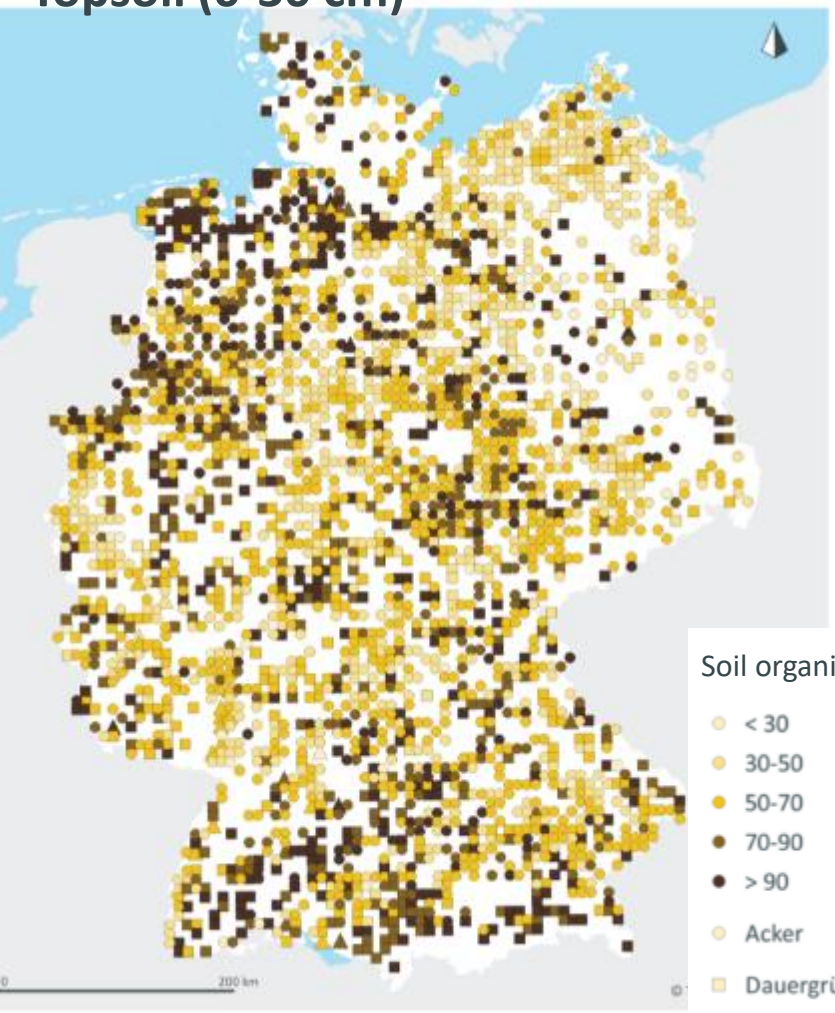
Soil carbon stocks are highly variable (numbers in t C_{org} /ha)

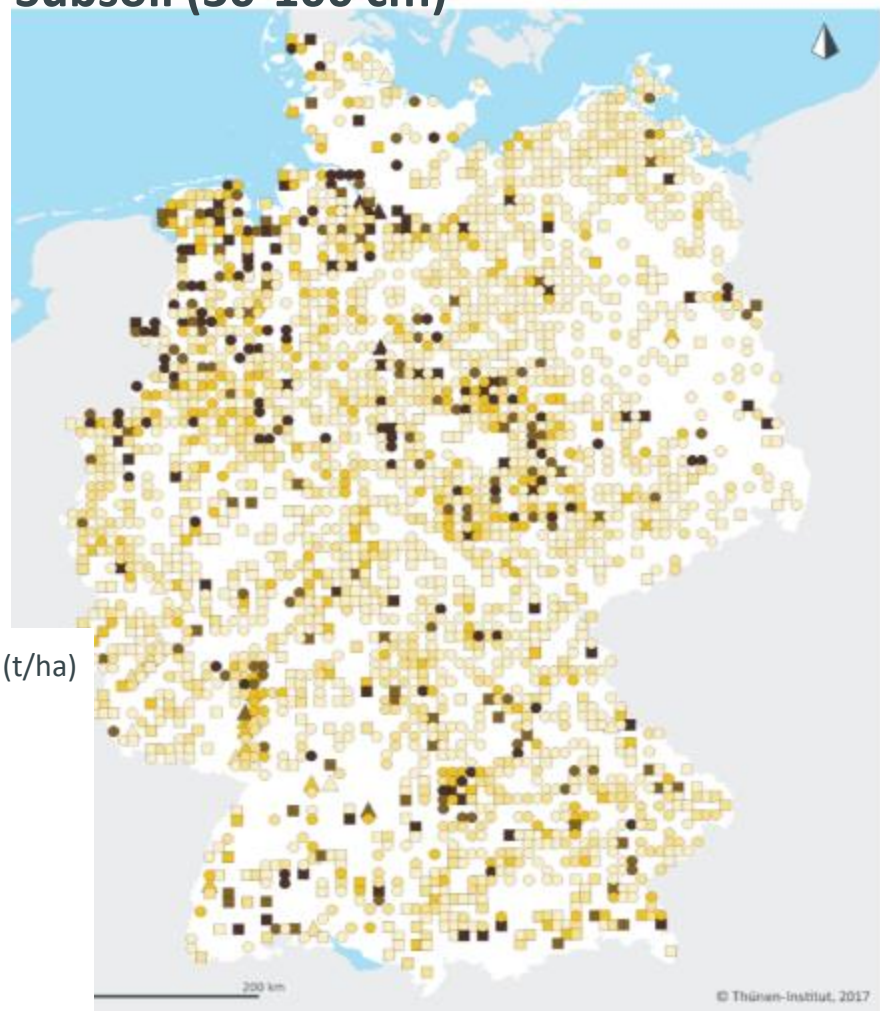


Soil organic carbon in Germany

Topsoil (0-30 cm)



Subsoil (30-100 cm)



Soil organic carbon stocks (t/ha)

- < 30
- 30-50
- 50-70
- 70-90
- > 90
- Acker
- Dauergrünland
- Sonderkultur

Jacobs et al. 2018, Thünen Report 64

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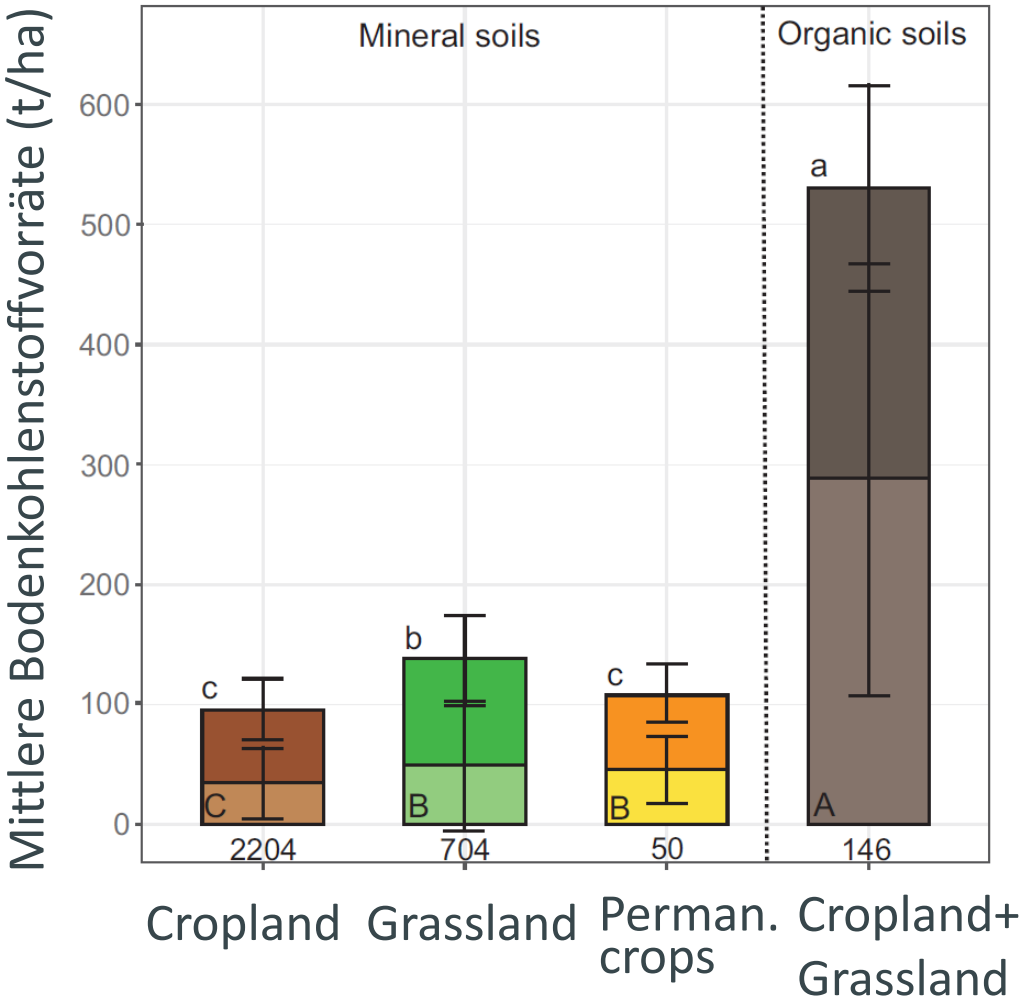
Mean soil organic carbon stocks

- Organic soils contain 5 times more C than mineral soils (0-100 cm)

- Mineral soils (0-100 cm):
  - Cropland: 96 t C/ha
  - Grassland: 135 t C/ha



Poeplau et al. 2020, JPNSS

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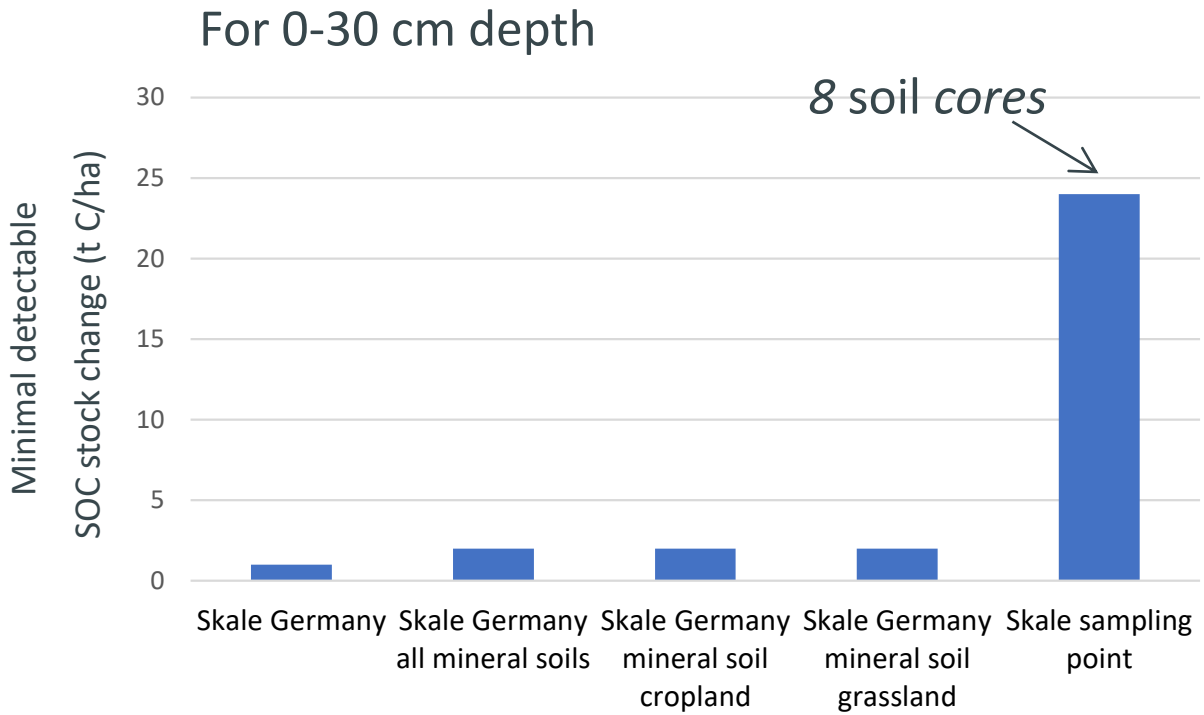
Soil monitoring national scale and field



- We can detect soil C stock changes at national scale within 10 years but not at field/point scale

Jacobs et al 2018, Thünen report

- Possible C stock increase in 10 yrs: around 1 - 2 t/C

SOC measurements

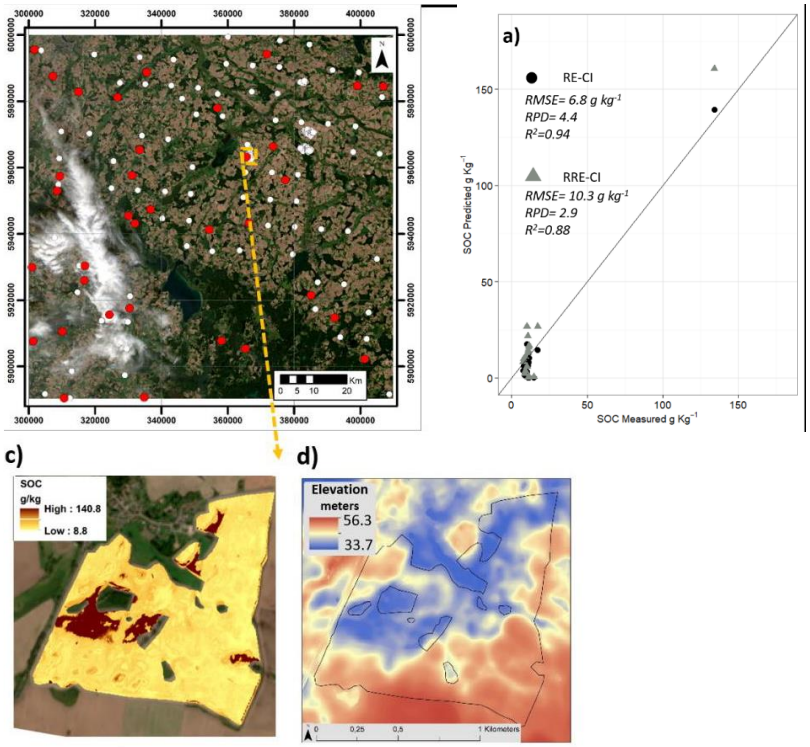
- **Mean soil organic carbon content in croplands (Germany):** **1.52%**
- **Achievable increase on site in 10 years** **0.03%-points**
- **Lab error** **0.03%-points**
- **Field variability** **0.18%-points**
- **Mean soil organic carbon content after 10 years of „carbon farming“** **1.55%**

Remote sensing

Remote sensing data help to estimate SOC stocks at field to continental scale

Error at regional scale: 0.68%-points

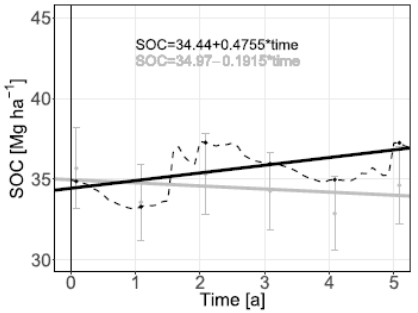
- Promissing studies to estimate SOC stocks **BUT NOT** SOC stock changes
- **Problems:** Large C ranges, plant cover, very small change rates



Castaldi et al. 2019, Remote Sens.

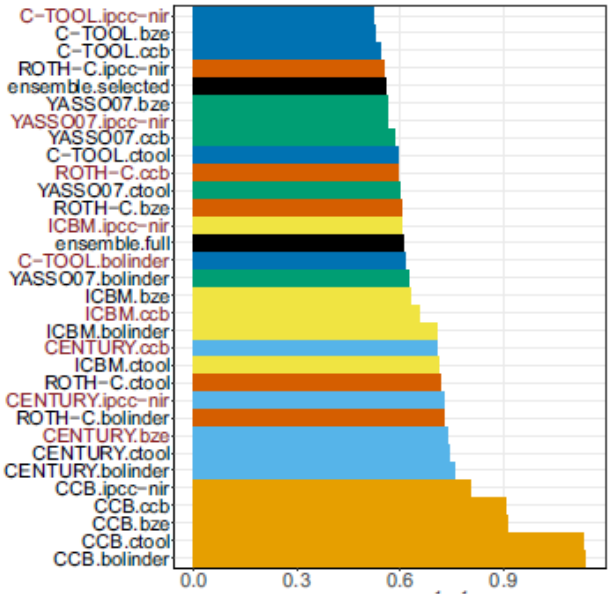
SOC Models

Soil carbon models can help to estimate SOC stocks changes



Model errors depend on model selection and calibration

- Regional specific calibration and validation is required
- Modelling based CO_2-certificates = measure based CO_2-certificates ?!
- **Problem:** Required input data on C input to the soil is not available



Riggers et al. 2019, Geoderma

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Thank you for your attention!

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