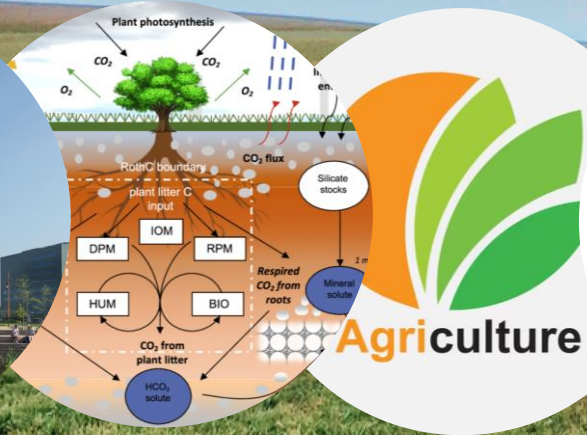


ESA AO/1-11147/22/I-EF

CARBON-RO: Research Opportunities in the Terrestrial Carbon Cluster



Agriculture



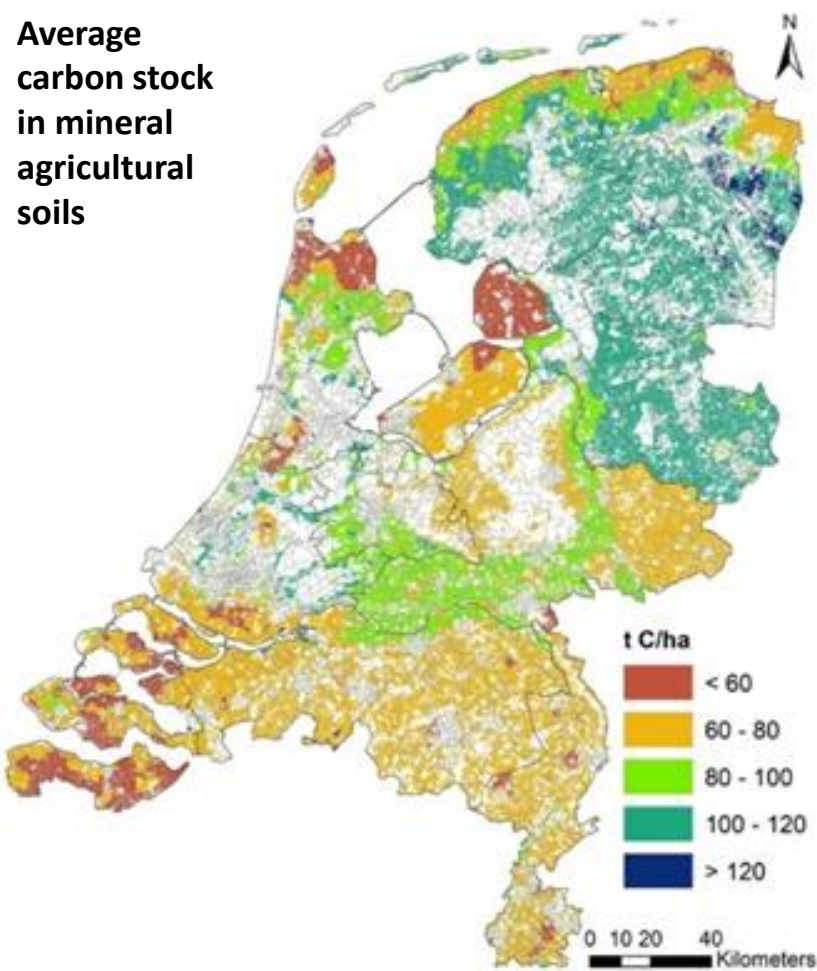
An Earth Observation framework for soil Carbon Sequestration Monitoring (E04CSM) for agricultural mineral soils

Wouter Meijninger, Jan Peter Lesschen, Chantal Hendriks, Gerbert Roerink, Allard de Wit, Johnny te Roller, Wageningen University and Research

ESA Symposium on Earth Observation for Soil Protection and Restoration

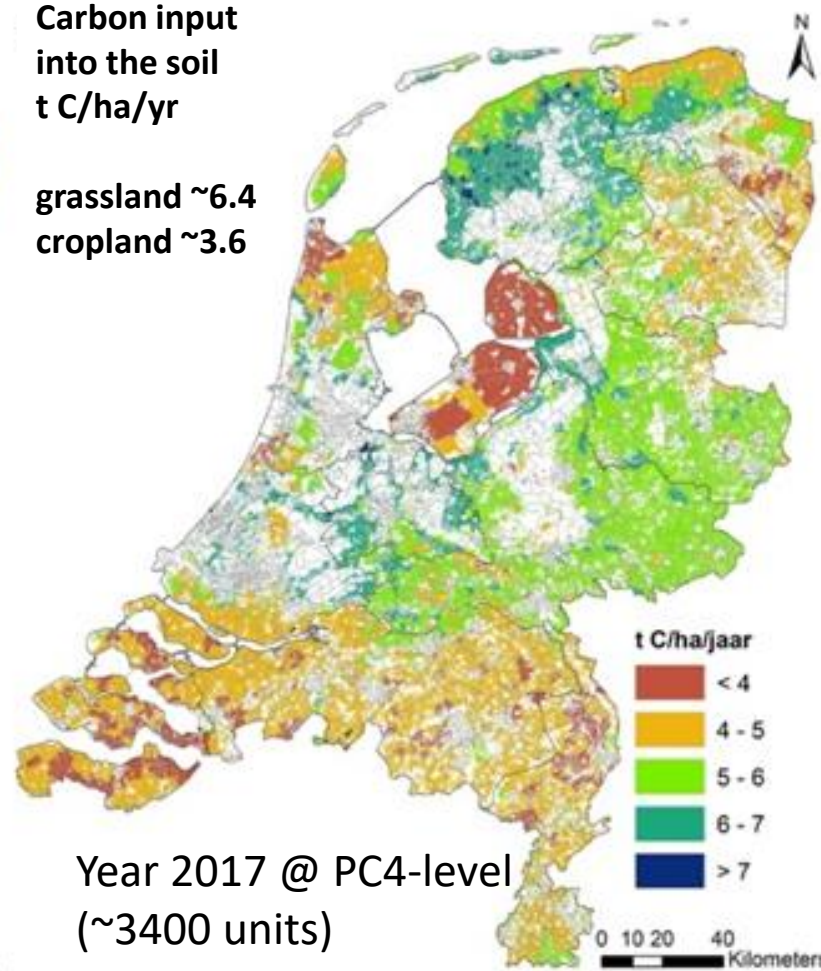
Carbon sequestration monitoring agricultural soils - Current status The Netherlands

Average carbon stock in mineral agricultural soils



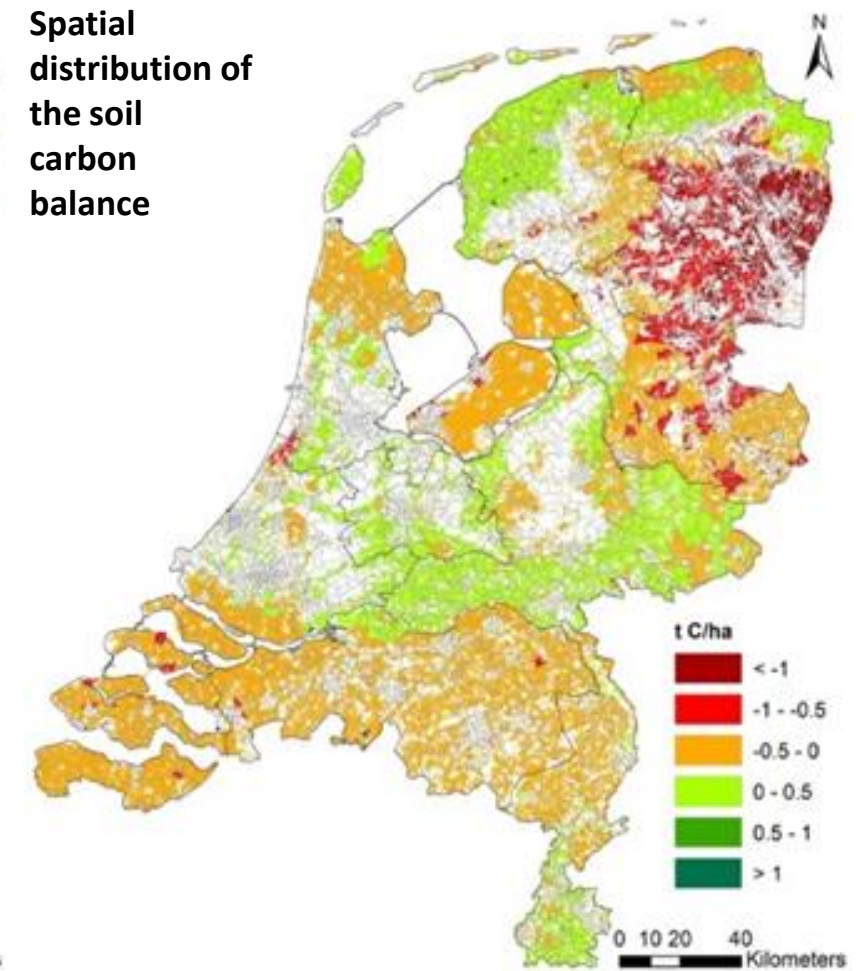
Carbon input into the soil
t C/ha/yr

grassland ~6.4
cropland ~3.6



Year 2017 @ PC4-level
(~3400 units)

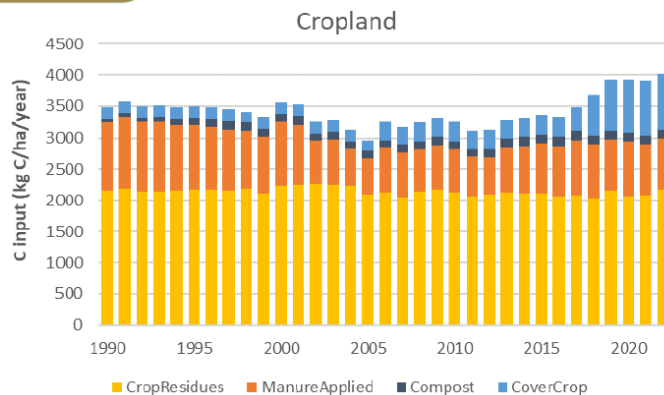
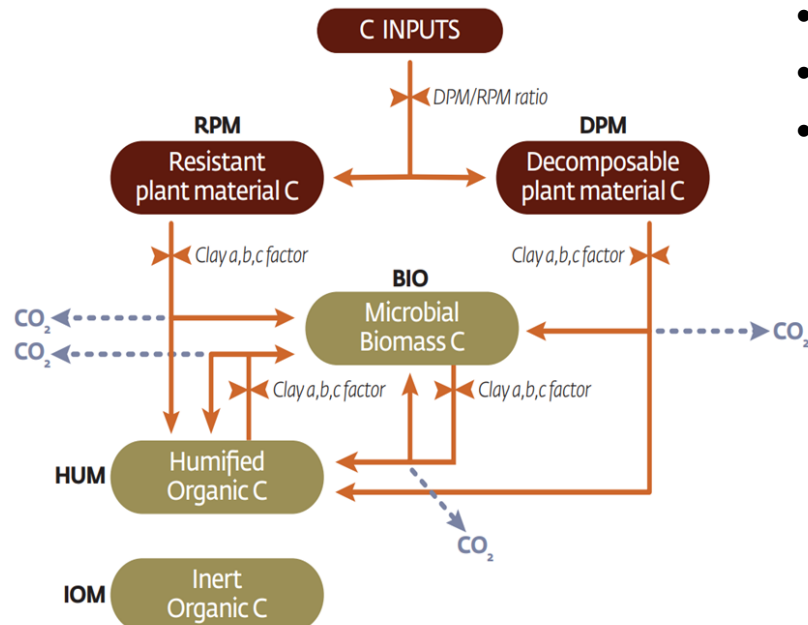
Spatial distribution of the soil carbon balance



(Lesschen, J.P., Hendriks, C.M.J., Slier, T., Porre, R.J., Velthof, G.L., Rietra, R., 2021. De potentie voor koolstofvastlegging in de Nederlandse landbouw. Wageningen, Wageningen Environmental Research. Rapport 3130.)

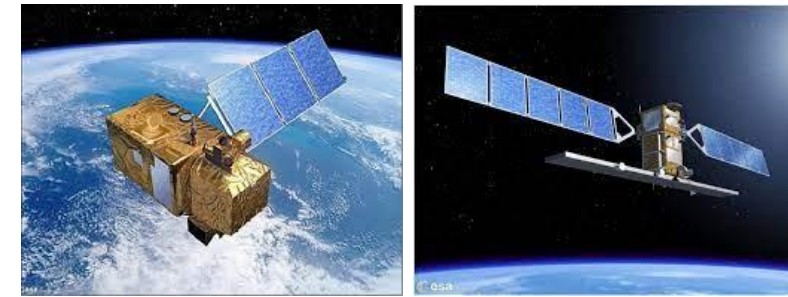
Carbon sequestration monitoring agricultural soils - Current status The Netherlands

RothC model



Model inputs:

- Climate data (T_{air} , precip, PET)
- Soil data (SOC_{init} , clay%, BD)
- Land Use Management Data
 - **Crop calendar**
 - Monthly Soil Cover [binary]
 - Irrigation
 - **Monthly C-inputs from plant residues**
 - Crop yields + HI (regional statistics from CBS, EUROSTAT)
 - Monthly C-inputs from organic fertilizer + grazing animals
 - Livestock, regulations, practices
 - DPM/RPM ratio, an estimate of the decomposability of the incoming plant material

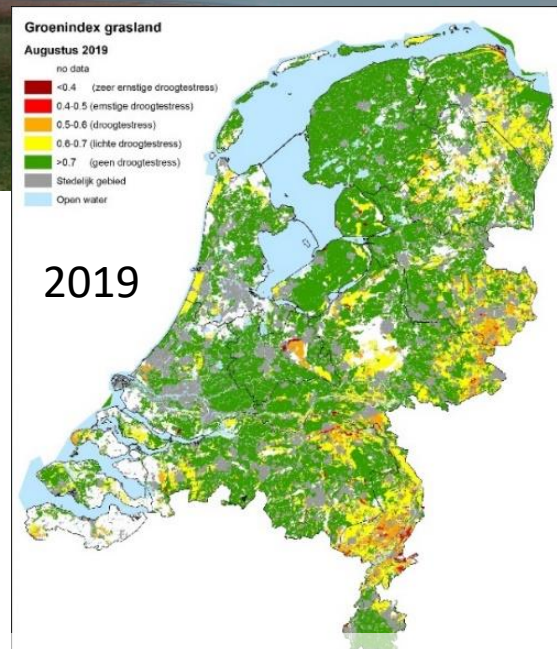
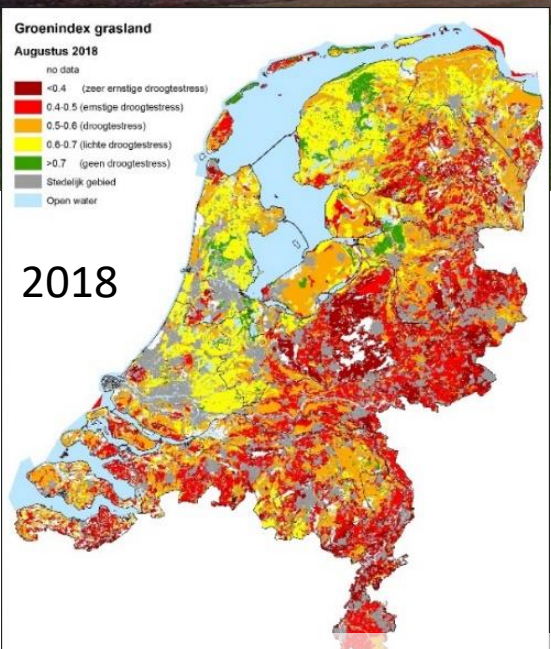


Sentinel-1 & 2 for CAP monitoring:

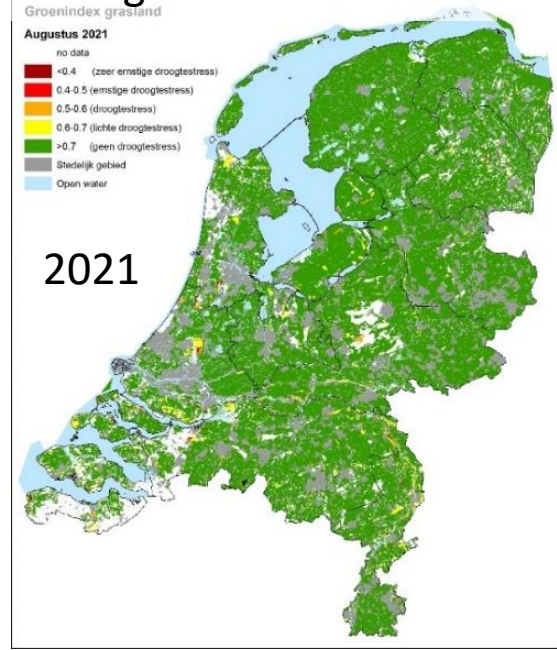
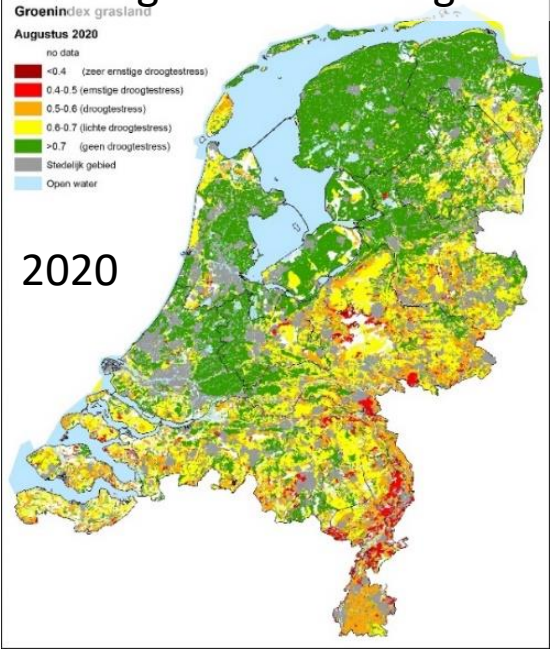
- **Soil Cover**
- **Main + 2nd/catch/cover crops**
 - **SOS, EOS**
- **Crop biomass DMP (LUE-model + fAPAR)**
- *Grass renewal*
- *Ploughing*

PC4 level → Parcel level
(Tier 3 inventory)

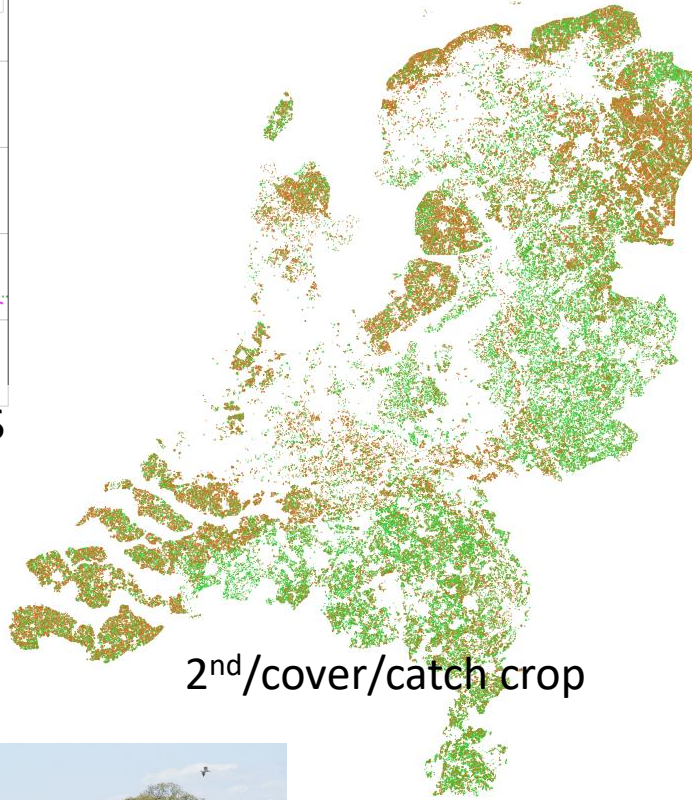
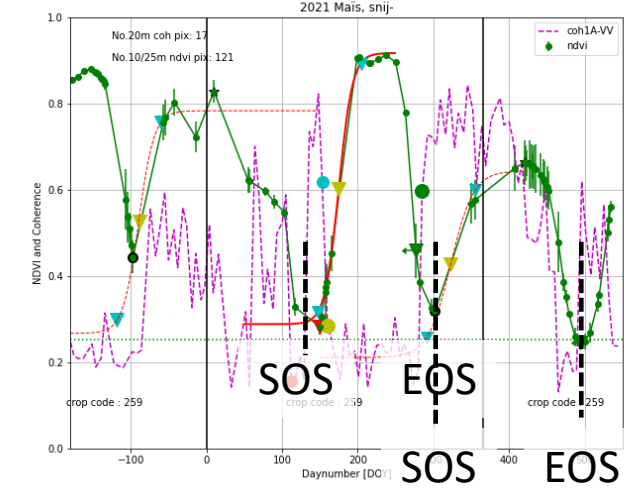
Main advantages of RS-data @ parcel level



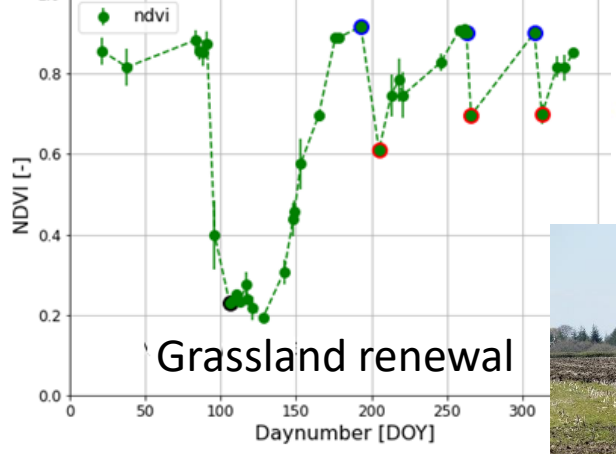
Vegetation Cover grassland August 2018 to 2021



cropland



grassland



Carbon sequestration monitoring - proposed framework

Feed carbon models (RothC) with more RS-data/products to improve SOC-monitoring

→ Tier 3 inventory:

- Data is more realistic and accurate
 - Crop calendar + Vegetation cover
 - Biomass or DMP (yield, HI)
 - Main crop + 2nd crop
- Simulations @ parcel level
 - Improve national carbon sequestration monitoring
 - Carbon farming
 - Carbon credit systems
 - KPI's in Agriculture

Plan 2024: Do RothC simulations for years 2018-2023 (6 yrs)

- **for ~500.00 parcels**

Plan 2025: Do validation (field campaigns in 2018, 2023) for ~200 parcels

RS-data availability:

- National archives, agricultural monitoring services (used for CAP)

Alternatives sources:

- Copernicus Land Monitoring Service (CLMS):
 - HR-VPP data
 - SOS, EOS of s1 & s2 (10, 100m)
 - -> Vegetation Cover
 - DMP (300m)

Challenges:

- LPIS-data (crop +parcel boundaries)

Thank you!

wouter.meijninger@wur.nl