KlimaFern:

Remote sensing for improved climate reporting

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Background

Sustainable land use and agricultural practices are essential for achieving **climate protection targets**.

Remote sensing and deep learning can improve the data basis for future monitoring and reporting schemes.

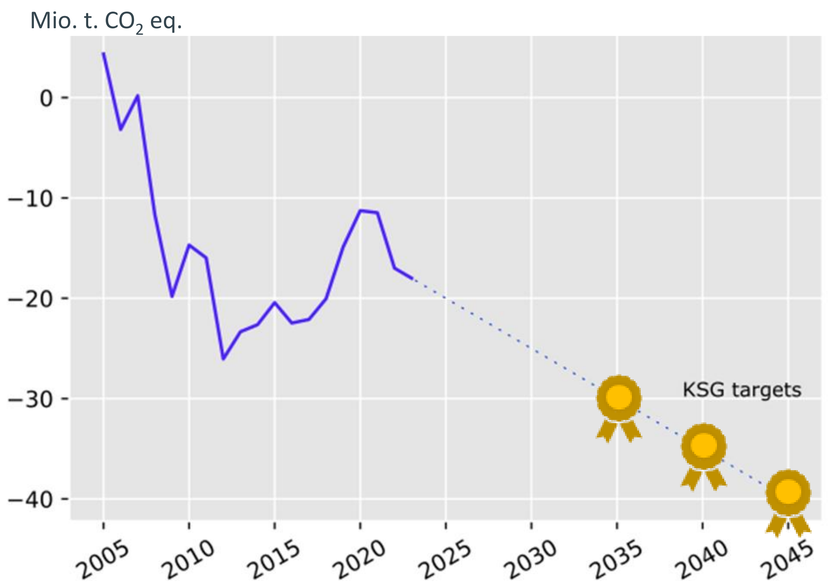

Fig 1: Estimated and targeted millions of tons of CO_2 equivalent emission reductions in the LULUCF sector in Germany (Umweltbundesamt 2022)

Project structure

SP1: Humus conservation in arable land

Hedgerows contribute to humus preservation and organic carbon accumulation but no record of their extent, dynamic and quality exists yet. Convolutional Neural Networks and time series of Planet images are used to map hedgerows across Germany and monitor their changes over time.

SP2: Conservation of permanent grassland

Compared to cropland, grassland shows higher carbon stocks and the ecological value increases with the period of conservation. Wall-to-wall maps of grassland are derived from satellite data with regard to the reporting baselines (1990, 2005) and to assess high priority areas for conservation.

SP3: Soil organic carbon content (SOC) in arable land

To validate the long-term effectiveness of climate protection measures, information on status and change in carbon content must be generated. Field data from the national soil survey and a time series of Landsat images are used to estimate SOC and SOC changes at the field level for Germany.

1 Humus conservation in arable land: hedgerows

- 215.000 diverse hedgerows in Schleswig-Holstein for training
- U-Net applied on Planet composites
- Good results even with inconsistent training dataset
  - ✓ Intersection over Union: 0.6
- Scalable to the rest of the country
- Generation of hedgerow dataset tailored to requirements of climate reporting

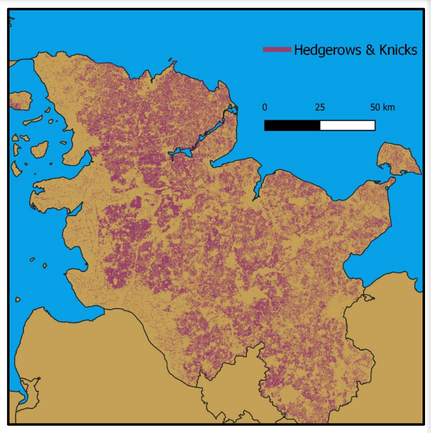

Fig 2: a) Planet image b) Field measured hedgerows c) Predicted hedgerows d) Copernicus Small Woody Features 2018 (SWF) e) Tree cover from Liu et al. (2023)

2 Grassland conservation

Maps of grassland conversion and management will be generated from long time series of EO data. A focus is on the land use on peat soils in Germany.

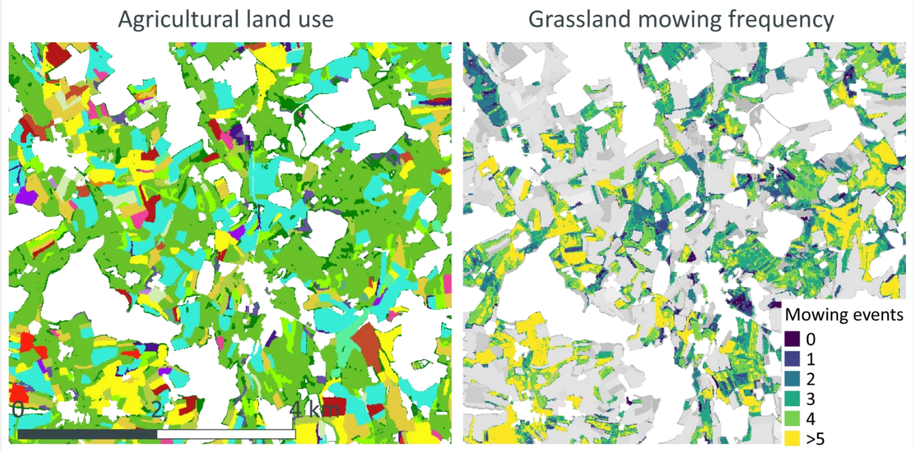

Fig 3: Agricultural land use (Blickensdörfer et al. 2022) and predicted mowing events (Schwieder et al. 2022) based on Sentinel-1/Sentinel-2/Landsat-data.

3 Soil Organic Carbon mapping

Bare soil composites of Landsat time series are explored to assess status and changes in cropland SOC content across Germany

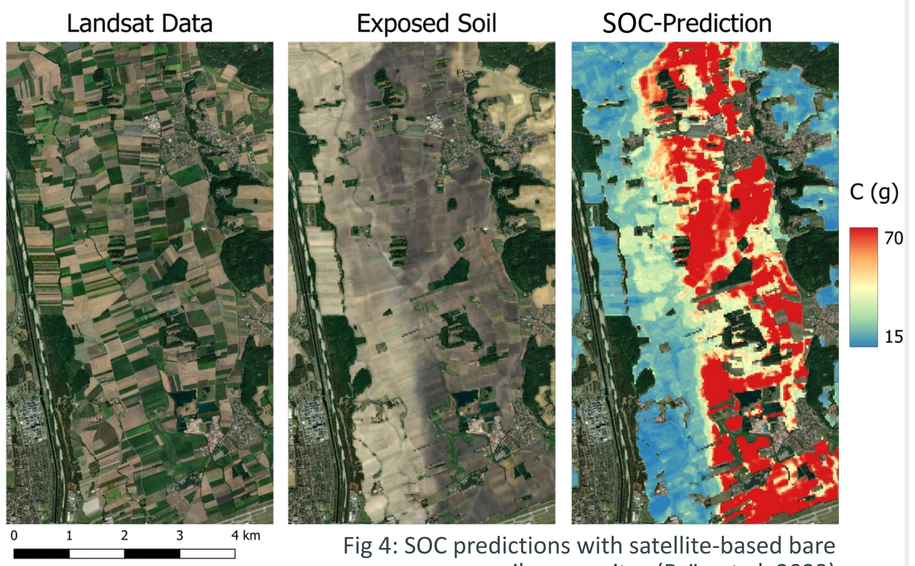

Fig 4: SOC predictions with satellite-based bare soil composites (Brög et al. 2023)

Liu, S. *et al. The overlooked contribution of trees outside forests to tree cover and woody biomass across Europe* (2023) Research Square preprint. doi:10.21203/rs.3.rs-2573442/v1.

Blickensdörfer, L. *et al.* Mapping of crop types and crop sequences with combined time series of Sentinel-1, Sentinel-2 and Landsat 8 data for Germany. *Remote Sensing of Environment* **269**, 112831 (2022).

Schwieder, M. *et al.* Mapping grassland mowing events across Germany based on combined Sentinel-2 and Landsat 8 time series. *Remote Sensing of Environment* **269**, 112795 (2022).

Broeg, T. *et al.* Transferability of Covariates to Predict Soil Organic Carbon in Cropland Soils. *Remote Sensing* **15**, 876 (2023).

Weiterführende Informationen zur **Thünen-Fernerkundung:** https://www.thuenen.de/theo

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