Estimating grassland parameters from Sentinel-2: A model comparison study

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Link to the paper

Background

- Accurate grassland mapping can help to develop sustainable management strategies
- Remote sensing data enable mapping of relevant biophysical grassland parameters such as biomass and LAI
- Biophysical parameters can be estimated based on empirical or radiative transfer models
- Research questions:
  - ➢ Are the spectral and spatial resolutions of Sentinel-2 (S-2) data sufficient to quantify and map the spatial distribution of LAI and above ground biomass on a grassland field in Brandenburg?
  - ➢ How do results from empirical modeling and radiative transfer modeling compare?

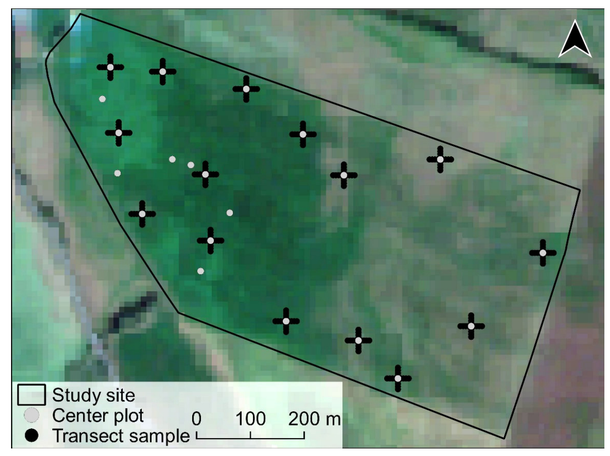
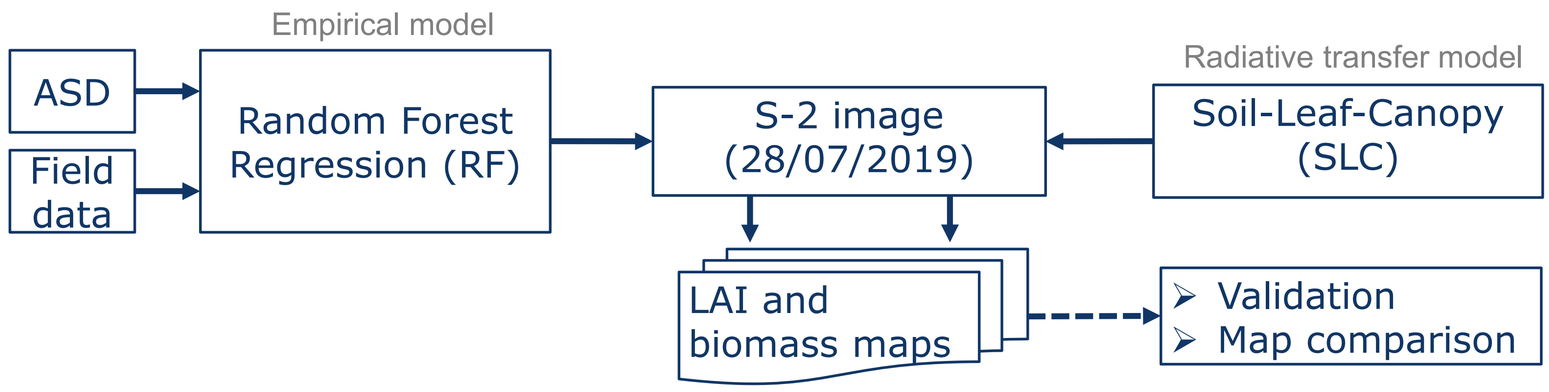


Fig. 1: Study area (approx. 43 ha) in Brandenburg and the location of the sampled field plots.

Data & Workflow

- 21 central plot locations were selected in the field (Fig.1)
- Leaf Area Index (LAI), compressed sward height (CSH) and spectral measurements (ASD) were taken every 5 m along a transect
- Biomass (BM) was destructively sampled at the plot center and dried in the laboratory to calibrate a linear CSH ~ BM model
- ASD measurements were resampled to S-2 bands
- Models were individually applied to a S-2 image to derive BM and LAI maps



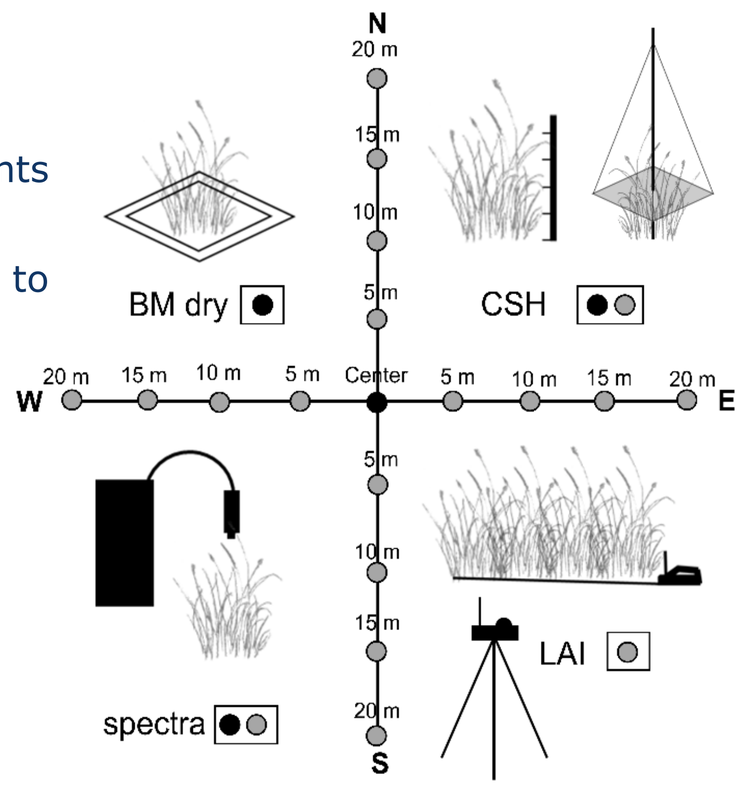


Fig. 2: Field plot sampling design and measurements overview.

Results & Discussion

- Spatial patterns were similar from both methods, with highest differences at the extreme ends
- The model comparison to field data (Fig. 5) shows good relations and an acceptable normalized root mean square error (NRMSE) for SLC and RF

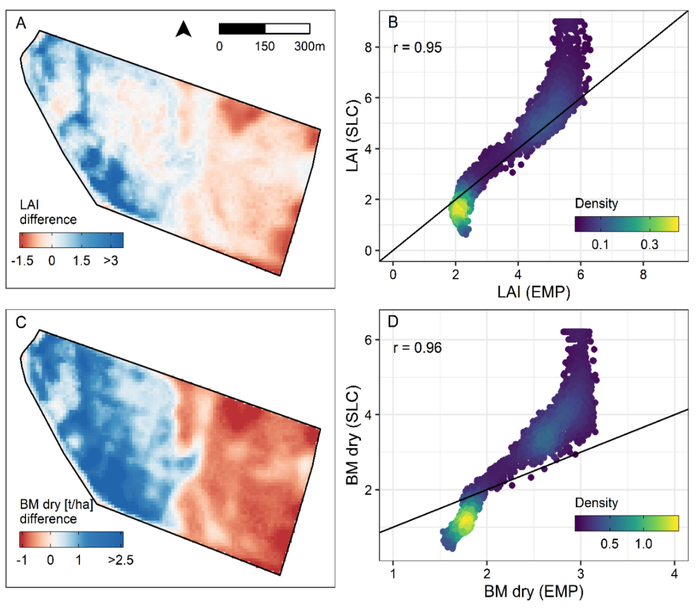


Fig. 3: Difference maps (A, C) and scatterplots (B, D) of LAI and BM resulting from the empirical model and the RTM.

- High agreement between harvested biomass (1.8 t/ha) and modelled mean biomass (SLC: 2.49 t/ha, RF: 2.23 t/ha)
- Both methods yield comprehensible biomass and LAI estimates
- Complex species composition of test site requires representative training data and model optimization
- Further research should focus on model transferability to different environments, seasons, grassland types, and management

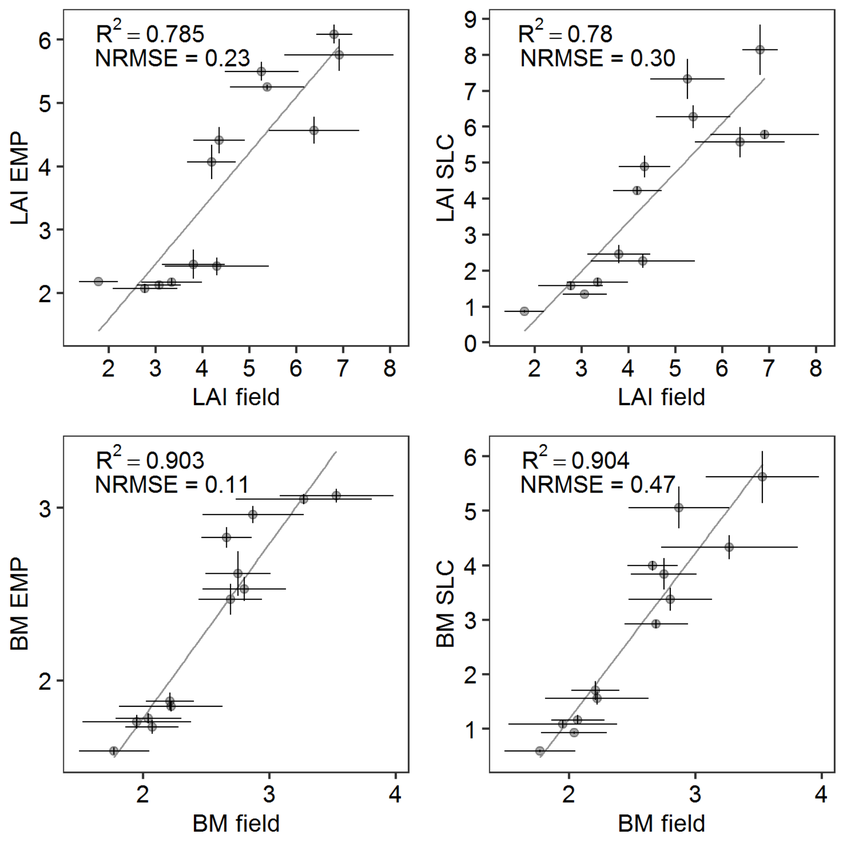


Fig. 4: Comparison of average (+/- 1 standard deviation) LAI (upper row) and BM (lower row) values for each transect measured in the field to the SLC and empirical model outputs averaged within a 20 m buffer around the central coordinate (EMP = empirical model; SLC = Soil-Leaf-Canopy).

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