

Project *brief*

Thünen Institute of Forest Ecosystems

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Tree species mapping for German forests

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- **Dense time series data from Sentinel satellites in combination with national forest inventory (NFI) data allow the mapping of dominant tree species for large, environmentally diverse areas.**
- **Most dominant species are mapped with high accuracy, proving the approach suitable for its use in forest disturbance analysis or the assessment of forest resilience to climate change.**
- **Map accuracy varies according to different forest stand structures and species compositions, which requires further research on mapping heterogeneous and mixed species stands.**

Background and aims

Detailed and spatially explicit information on the state of our forests, including tree species composition, is crucial for forest management and research on forest ecosystems. With changing climate conditions adding stress on forest ecosystems, such information becomes increasingly relevant at regional and national levels. Typically, species composition is monitored through large scale forest inventory systems relying on sample-based statistics.

Remote sensing is a promising tool to expand this information, including species composition, to become spatially explicit, including species composition. This study aims at mapping tree species for the area of Germany by combining Sentinel-2, Sentinel-1, and NFI data.

Methodological approach

Time series data with a five-day temporal resolution is derived by processing all available Sentinel-2 imagery from 2017 and 2018, complemented by monthly Sentinel-1 composites. While the dense Sentinel-2 time series data captures the phenological dynamic and the differences in spectral reflectance of tree species, Sentinel-1 data is included to provide information on the physical and structural properties of the forest canopy.

To take the environmental gradient across Germany into account, increasing the variation in reflectance characteristics, data on topography, meteorology, and climate are included.

Those data sets are combined with reference data derived from the NFI to train machine learning models and validate resulting species maps with up to eleven tree species groups for the area of Germany.

First results

The overall patterns of mapped tree species groups throughout Germany capture the species distribution estimated by the NFI well (Figure 1). The most dominant species, namely beech, oak, spruce, and pine, are mapped with high accuracy. Increased false classification rates occur for minor broadleaved species and due to their similarity in spectral and phenological signal for fir, douglas fir, and spruce.

Map accuracies further vary depending on forest stand structure and species composition. While tree species can be attributed well for homogeneous, single species stands, heterogeneous mixed species stands appear to be more challenging.

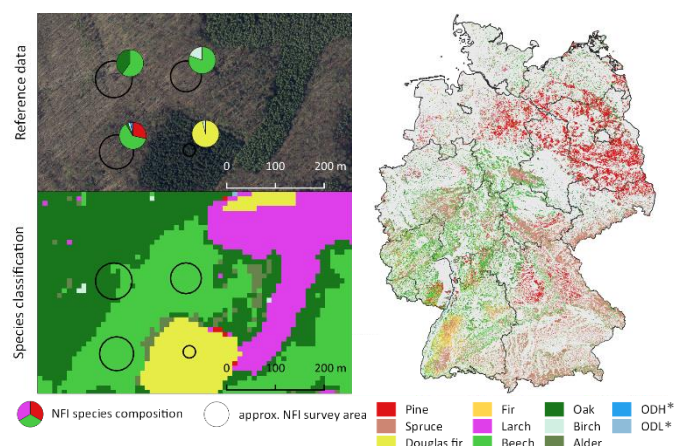


Figure 1: First national tree species map (right) and species classification on NFI plot level (left). *ODH/ODL: other deciduous species with high/low life expectancy.

Further Information

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