

Normalized difference vegetation index (NDVI) based low forest greenness events in Europe in 2002–2022

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Publication date:

2022-03-29

Permanent link:

<https://doi.org/10.3929/ethz-b-000505559>

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***** Dataset title *****

Normalized difference vegetation index (NDVI) based low-forest-greenness events in Europe in 2002–2022

***** Dataset abstract *****

This dataset includes events of reduced forest greenness as measured by the NDVI in Europe's temperate and Mediterranean biome in summer 2002–2022. The so-called low-NDVI events at the 0.5° (~50 km) scale are identified from forest pixel NDVI anomalies (NDVI') at 250 m resolution in a two-step approach: (1) a 250 m forest pixel is flagged if at least four out of six 16-day NDVI' values in June–August are negative, and (2) a low-NDVI event in a 50 km grid cell results if at least 80% of the contained forest pixels are flagged. The approach, therefore, identifies persisting and extensive events of reduced forest NDVI that can be used to assess their larger-scale meteorological drivers. The dataset goes along with the study by Hermann et al. (2023), where it is introduced, assessed according to its sensitivity to the tuning parameters, described in greater detail, and applied to identify meteorological precursors of these events.

***** Dataset description *****

The uploaded dataset is based on two open-access remote sensing products:

Normalized Difference Vegetation Index (NDVI)

- NASA MODIS Terra (Didan, 2015)
- temporal resolution: 16-day in March 2002 to August 2022
- spatial resolution: ~250 m
- downloaded from AppEEARS at <https://appears.earthdatacloud.nasa.gov>

Corine Land Cover (CLC)

- Copernicus Land Monitoring Service (Büttner et al., 2004)
- temporal resolution: year 2012
- spatial resolution: ~100 m
- downloaded from <https://land.copernicus.eu/pan-european/corine-land-cover>

First, we interpolate CLC to the NDVI grid by nearest-neighbor interpolation. Consequently, NDVI information is used only at forest pixels by masking all land cover except forest land cover classes (coniferous, broad-leaved, and mixed forest). The forest pixel area within each 0.5° grid cell is denoted as $FA^{0.5}$. To use sufficient NDVI information at each grid cell, only grid cells with $FA^{0.5} \geq 10\%$ are used for further processing, and are hereafter called forest grid cells. The forest grid cells are split up into those in the temperate and Mediterranean biome according to Schultz (2005; Fig. 1a). Moreover, we use NASA MODIS pixel quality, provided along with NDVI, and additionally mask all NDVI pixels that are of poor quality due to snow and clouds, and only retain NDVI pixels of marginal or good quality. The resulting gaps in NDVI timeseries are filled by linear interpolation from neighboring timesteps (Buras et al., 2021). The final NDVI time series is linearly detrended due to a detected greening trend (Bastos et al., 2017; Buras et al., 2020).

The identification of low-NDVI events at the 50 km scale takes place in two steps and is based on NDVI anomalies (NDVI') in summer. At each forest pixel, we compute NDVI' in June–August (JJA) relative to a climatological mean NDVI over all 21 years and all JJA timesteps, i.e., resulting from

an average over 126 NDVI values. Then, in a first step, each 250 m forest pixel is flagged if at least four out of six JJA timesteps show negative NDVI' (1 in Fig. 1b). Second, if the flagged area (A^{ev}) within a 0.5° forest grid cell is at least 80% of the total forest area in that grid cell (A^{for}), this forest grid cell is marked as low-NDVI grid cell (2 in Fig. 1b). Further details, including a sensitivity analysis of reasonable variations in the threshold parameters used, can be found in Hermann et al. (2023).

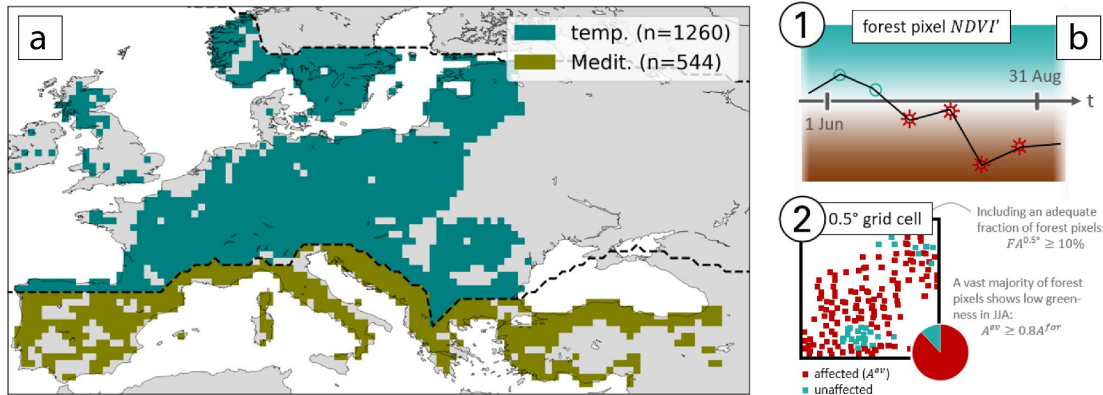


Figure 1: (a) Forest grid cells in the study domain, separated into temperate and Mediterranean forests by the black dashed line. (b) An example of the identification of low-NDVI grid cells, where (1) forest pixels are flagged if at least four out of six time steps show negative NDVI', and (2) forest grid cells are flagged if more than 80% of the forest pixels within are flagged (details provided in the text). Image taken from Fig. 1 in Hermann et al. (2023).

***** Further information for the use of the dataset *****

This dataset is useful to study larger-scale processes related to low forest-NDVI. Especially, meteorological reanalysis, such as the ERA5 dataset, are well-suited to be combined with the identified low-NDVI grid cells.

***** Dataset contents *****

The dataset is included as netcdf-file. It contains two two-dimensional (lat, lon) fields and two three-dimensional (year, lat, lon) fields:

- **biome(lat, lon):** denotes the spatial coverage of the dataset and classifies them into the two biomes, i.e., forest grid cells in temperate and Mediterranean biome.
- **FA(lat, lon):** denotes the fraction of each grid cell covered by forest pixels, i.e., the fraction of A^{ev} and A^{for}
- **EV(year, lat, lon):** denotes the event mask, i.e., marks all identified low-NDVI grid cells
- **NDVI_min(year, lat, lon):** denotes an intensity measure as described in Hermann et al. (2023)

More details regarding the content can be found in the netcdf file.

Date of the current version: 27 March 2023

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