UNIVERSITÄT
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UFZ HELMHOLTZ
Zentrum für Umweltforschung

Bachelor thesis

Derivation of a spectral tree species specific pre-disturbance state in forest areas

October 6, 2022

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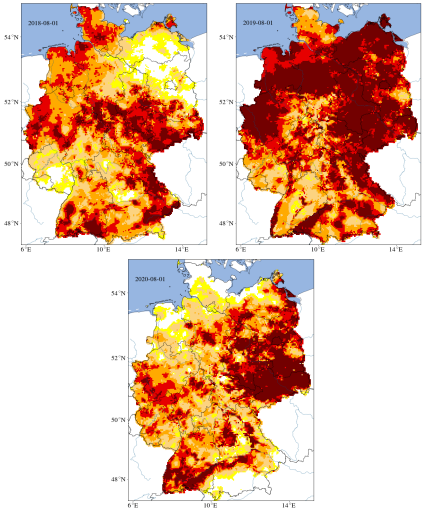
- extreme weather events increase in duration, intensity, and frequency
- abiotic and biotic disturbances can threaten the stability of forest stands
- especially affected:
  - coniferous
  - pure stands
  - species inadequately adapted to local environmental factors

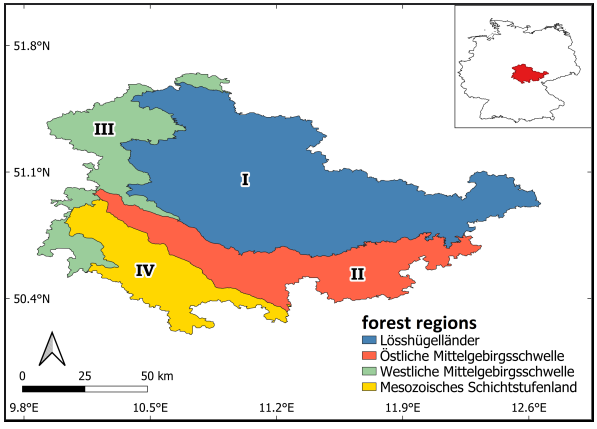


drought status of total soil (1.8 m) in august (2018 - 2020) [1]

[1] source: UFZ-Dürremonitor/ Helmholtz-Zentrum für Umweltforschung.

- objectives
  - detection of forest disturbance
  - derivation of spectral pre-disturbance state
- which species?
  - pine, larch, spruce, oak and beech
- study area
  - type of data (damage, species, areas dominated by one species)
  - availability of data (open data policy)

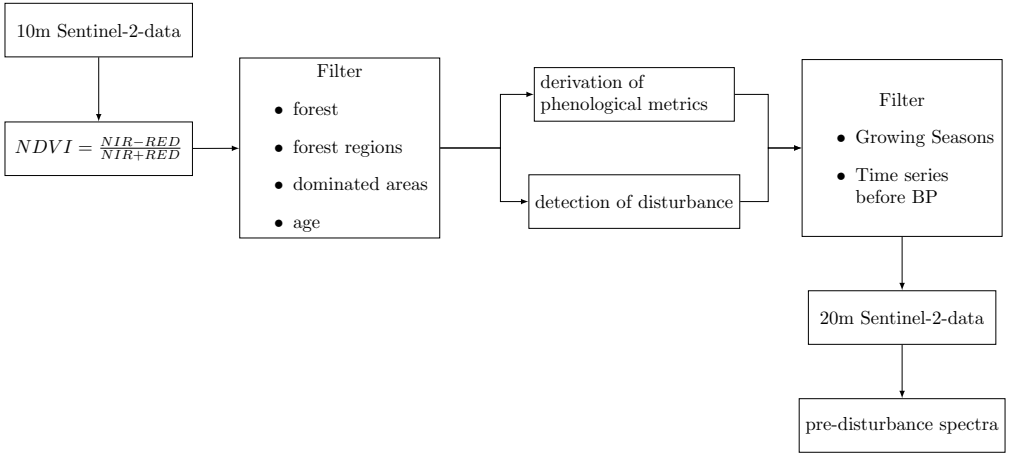
Thuringia



[2]

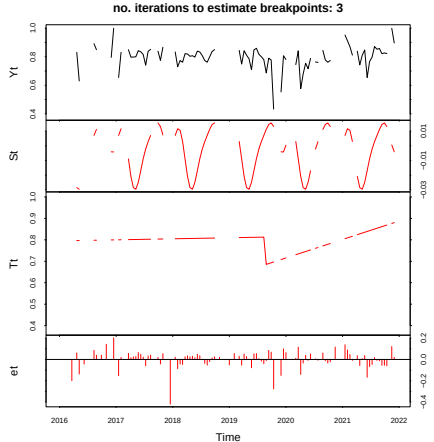
[2] Gauer, J. & E. Aldinger. 2005. Waldökologische Naturräume Deutschlands-Forstliche Wuchsgebiete und Wuchsbezirke. Mitt. Ver. Forstl. Standortskunde u. Forstpflanzenzüch- tung 43. ; Thünen-Institut. 2022. Forstliche Großlandschaften (2005). https://gdi.thuenen.de/wo/wgwb/

Workflow


10m Sentinel-2-data
$NDVI = \frac{NIR-RED}{NIR+RED}$
Filter
forest
forest regions
dominated areas
age
derivation of phenological metrics
detection of disturbance
Filter
Growing Seasons
Time series before BP
20m Sentinel-2-data
pre-disturbance spectra

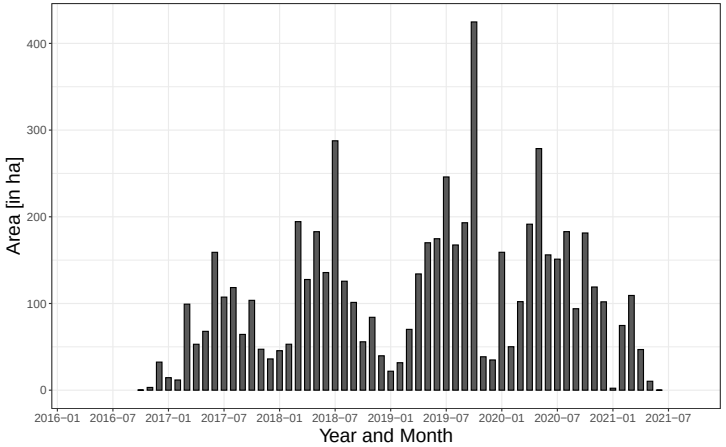
Breaks For Additive Seasonal and Trend (BFAST)

- pixel-based change detection approach (BFAST) [3]
- decomposition in trend, seasonal and reminder components
- iterative estimation of time and number of changes (magnitude & direction)

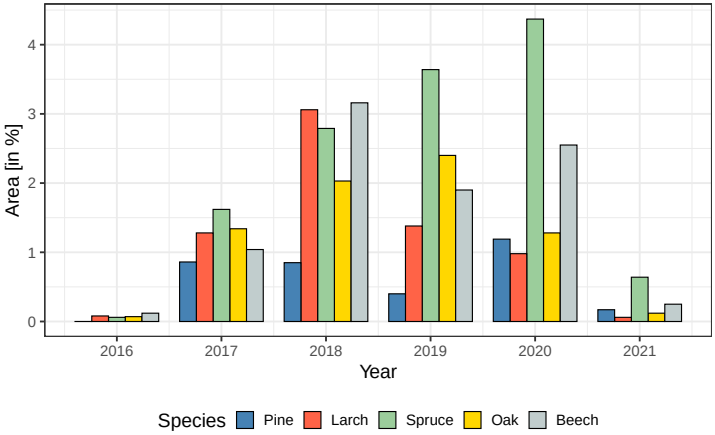


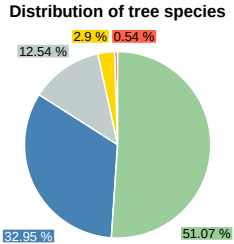
[3] Verbesselt, J. et al. 2010. Detecting trend and seasonal changes in satellite image time series. Remote Sensing of Environment 114(1). 106–115. doi:10.1016/j.rse.2009.08.014.

Temporal distribution of disturbances

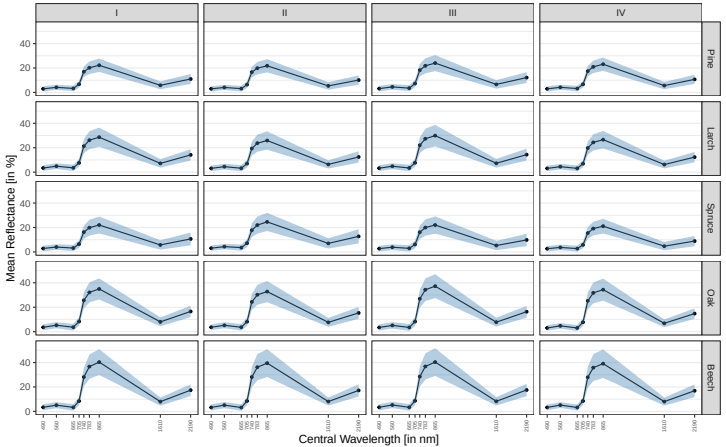


Disturbances per species

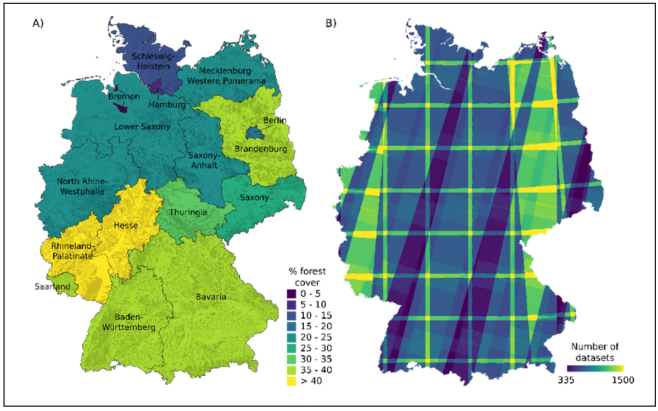




Pre-disturbance spectra



Limitations



[4]

[4] Thonfeld, F. et al. 2022. A First Assessment of Canopy Cover Loss in Germany's Forests after the 2018-2020 Drought Years. Remote Sensing 14(3). doi: 10.3390/rs14030562.

Thank You For Your Attention !

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