

EGU22-3593

<https://doi.org/10.5194/egusphere-egu22-3593>

EGU General Assembly 2022

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Do Landsat satellite estimates of canopy disturbance reproduce tree mortality rates observed from forest inventories across Spain?

Daniel Nadal-Sala¹, Cornelius Senf², Thomas Pugh³, Nadine Ruehr¹, Julen Astigarraga⁴, Paloma Ruiz-Benito⁴, Miguel A. Zabala⁴, and Adriane Esquivel-Muelbert³

¹Karlsruhe Institute of Technology, IMK-IFU, Garmisch-Partenkirchen, Germany

²Technical University of Munich, Ecosystem Dynamics and Forest Management Group, Munich, Germany

³University of Birmingham, School of Geography, Earth and Environmental Sciences, Birmingham, UK

⁴University of Alcalá, Department of Life Sciences, Madrid, Spain

Tree mortality rates have increased in Europe during the last three decades with trends expected to keep increasing into the future. This makes long-term forest health monitoring essential. In this regard, Landsat satellite observations provide annual estimates of canopy disturbance at moderate (30 meters) resolution. However, canopy disturbances do not always translate directly into tree mortality, as satellites only observe canopy trees at an aggregated grid level. Therefore, there is a need to validate Landsat estimates against actual ground-based tree mortality measurements. In this sense, National Forest Inventories (NFI) quantify the spatial distribution of tree mortality at regional level, but they are costly and have a lower temporal resolution than satellite observations (mostly every ten years). NFI are potentially an excellent asset to validate Landsat estimates, though the spatial agreement between NFI-derived tree mortality and Landsat disturbance estimates has yet to be assessed.

Here we compare Landsat spatial canopy disturbance rates with tree mortality rates derived from the 2nd and 3rd Spanish National Forest Inventories for the 1986-2008 period ($n = 45564$ stands). We compared the spatial distribution of Landsat canopy disturbance rates with the inventory-derived tree and biomass mortality rates on a grid size of 0.25° . There is positive correlation between satellite estimates and tree mortality obtained from inventories ($r = 0.52$, $p < 0.001$). In the case of biomass mortality, the correlation disappears ($r = 0.26$, $p > 0.05$). The correlation also weakens as the number of inventoried stands per forest cover extension decreases at grid level. In addition, both canopy disturbance rates and measured tree mortality rates were positively correlated with burned area, thus highlighting fire as a major driver of forest disturbance in Spain. Our results demonstrate that Landsat estimates are correlated spatially with tree mortality obtained from NFI, opening the door to make such analysis extensive to other European countries.