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Title

deadtrees.earth: Crowd-Sourced Imagery and AI for Global Insights into Tree Mortality Dynamics

Authors

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Abstract

Tree mortality rates are rising across many regions of the world. Yet the underlying dynamics remain poorly understood due to the complex interplay of abiotic and biotic factors, including global warming, climate extremes, pests, pathogens, and other environmental stressors. Ground-based observations on tree mortality, such as national forest inventories, are often sparse, inconsistent, and lack spatial precision. Earth observations, combined with machine learning, offer a promising pathway for mapping standing dead trees and potentially uncovering the driving forces behind this phenomenon. However, the development of a unified global product for tracking tree mortality patterns is constrained by the lack of comprehensive, georeferenced training data spanning diverse biomes and forest types.

Aerial imagery from drones or airplanes, paired with computer vision methods, provides a powerful tool for high-precision, efficient mapping of standing deadwood on local scales. Data from these local efforts offer valuable training material to develop models based on satellite data, enabling continuous spatial and temporal inference of forest cover and standing deadwood on a global scale. To harness this potential and advance global understanding of tree mortality patterns, we have developed a dynamic database (https://deadtrees.earth). With contributions from over 150 participants, the database already contains more than 2,000 orthoimages covering all of the Earth´s continents and biomes.

This presentation will demonstrate the resulting core functions and products from deadtrees.earth, including 1) uploading and downloading aerial imagery with optional labels of standing deadwood, 2) automatic segmentations of alive and dead trees in uploaded imagery using computer vision models, and 3) large-scale products on forest cover and tree mortality as derived from ESA´s Sentinel 1 and 2 missions. Moreover, we will discuss future directions in how such products through the integration of Earth observation, machine learning, and ground-based data, can fill critical knowledge gaps in global tree mortality dynamics and create an accessible, valuable resource for researchers and stakeholders.