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Next generation of European forest disturbance maps based on the Landsat archive

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Forest canopy disturbances such as caused by bark beetle, fire, windthrow or harvest have increased in the past three decades and are expected to increase further in response to climate and land use change. Consistent information on forest canopy disturbances is therefore essential to understanding changes in forest dynamics, structure and demography over time and space. As part of the ForestPaths Horizon project we aim to create the next generation forest disturbance maps, extending both the time frame and context of existing pan-European forest disturbance assessments. Disturbances are mapped using the Landsat archive at 30 meters resolution for 1984-2021. A new machine-learning based approach trained on manually labelled reference pixels is applied to the time series, estimating forest disturbances annually and accounting for stand-replacing and non-stand replacing disturbances, as well as different causal agents (i.e., bark beetle, fire, windthrow or harvest). Summarising annual disturbance maps over time ultimately allows to detect multiple disturbance events and recovery signals per pixel and thus for the characterization of complex disturbance trajectories (e.g., multiple fires, thinnings before final harvest). We test our approach at national levels for three countries accounting for three forest biomes: boreal (Finland), temperate (Germany) and Mediterranean (Spain); covering a total land area of 1,194,526 km² and a total of 65,623 Landsat images. The results from those initial tests will provide information on the accuracy and precision of the annual, wall-to-wall maps of forest disturbances and pave the road for a consistent disturbance monitoring system of all of Europe's forests.