



A satellite-based analysis of forest disturbances across Europe

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Forest disturbance are inherent ecosystem processes and the disturbance regime of an ecosystem is described by the size, shape, frequency and severity of disturbance events occurring in this particular ecosystem. There is accumulating evidence that climate change and land use alter disturbance properties globally, potentially shifting disturbance regimes beyond their historic range of variability. Assessing changing disturbance regimes is challenging, though, as it requires (i) a spatially explicit but consistent assessment of forest disturbances that (ii) covers long-enough time periods to derive regime indicators. We tackle this challenge by estimating trends in, and mapping spatial patterns of, forest disturbances from satellite time series for the period 1984-2018 and across 35 countries in Europe. We first used a sample-based visual assessment of > 20,000 satellite time series to estimate robust temporal trends in disturbance rates. Second, we used the sample-based data to map spatial pattern of forest disturbances at a grain of 30 meters. Third, we developed a set of disturbance regime indicators that are explicitly suitable for characterizing disturbance regimes from remote sensing maps. Results from Central Europe show that forest disturbance rates have doubled in the last three decades. The disturbance maps showed a high variability in spatio-temporal patterns. Based on this variability, we could map distinct disturbance regimes that reflect both land use (history) and biogeographic variability in tree species and disturbance agents. Those maps will serve as important baseline for assessing changes in disturbance regimes under climate change. Further, we highlight that Europe's forests are complex human-environmental systems, where both natural and human factors shape current and future disturbance regimes.