



Abstract

Modelling the Behavior and Extent of Mid-Holocene Lightning-Caused Fires in Portugal [†]

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Abstract: Fires of natural origin are usually a very small fraction of the total number of fires in southern Europe, and as such, they are not relevant to contemporary fire regimes and policies, even if they occasionally develop into large-scale conflagrations. However, lightning-caused fires might have been a relevant landscape-level disturbance prior to the anthropogenic control exerted through land use and land cover, fire use, and wildfire suppression. Our goal was to simulate fire behavior characteristics (rate of spread, fireline intensity) for recent (2001–2020) individual lightning fires occurring in Portugal but under a mid-Holocene landscape context, i.e., just before the human-induced Neolithic disturbances, including burning. We selected three study areas (1240–2615 km²) with distinctively high densities of lightning fires (4.4–7.0 per 100 km² per year) and quantified deciduous broadleaved forest, evergreen broadleaved forest and shrubland cover within each area at 6 ka BP (before present) by combining mapped forest cover (from a palynological reconstruction) and potential natural vegetation series. Then, we simulated the unbounded hourly spread of each fire until its natural extinction (determined by fuel moisture) and allowing for smoldering-only periods with subsequent reactivation, using a suite of selected semi-empirical and empirical models and ERA5-Land (ECMWF, Reading, UK) reanalysis weather data for the location and duration of the event. The simulations considered uncertainty in vegetation cover and in the likelihood of fire reactivation after light rainfall. The unbounded fire size exceeded observed fire size by up to four orders of magnitude. Preliminary results for one of the study areas suggest an infrequent and mixed-severity natural fire regime affecting about 1–4% of the landscape every year. The study offers increased understanding of the past regime and ecological role of natural fire in the Mediterranean basin and can inform improved fire management policies in the region.

Keywords: fire history; fire regime; fire activity



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