



## Holocene fires in the central European lowlands and the role of humans

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A major debate concerns the questions of when and to what extent humans affected regional landscapes, especially land cover and associated geomorphological dynamics, significantly beyond natural variability. Fire is both, a natural component of many climate zones and ecosystems around the globe and also closely related to human land cover change. Humans clearly affected natural fire regimes and landscapes in the most recent centuries, acting as prime ignition triggers and later fire suppressors, while Holocene trends in sedimentary charcoal have been mainly associated with climatic factors and partly with Neolithic land cover change. However, little is known since when Paleolithic to Neolithic fire use affected natural landscapes beyond small spatial and temporal scales.

Here, we discuss onset and extent of human-driven fires superimposed on natural Holocene landscape transformation for the central European lowlands (CEL), a landscape of low natural flammability and long human history. We present composites of sedimentary charcoal records as new human impact proxies for periods when natural conditions (climate and vegetation) limited wildfires. Together with climate model output and land cover reconstructions from pollen, we find that fire was naturally important only during the early Holocene. The onset of human-driven fires beyond natural fires appeared scale-dependent. Sub-regional fire maxima indicate fire use by Mesolithic hunter-gatherers, already 8,500 years ago. Regionally, fire marks the Neolithisation onset at ~6,500 years (western CEL) and ~4,000 years ago (eastern CEL). During the last millennium, farming intensification drove fire up to early Holocene levels across all CEL. Fire activity reduced only in the highly fragmented landscape of northern Germany during the last centuries. As compilations of soil erosion records even mirror Holocene fire trends, we conclude that past human land cover change could have affected sub-regional landscapes more and earlier than previously thought.

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