



## **What is a natural wildfire regime in the Mediterranean? A comparison of Holocene and Eemian fire history at Ioannina, Greece**

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Wildfire is an important element of the Earth system, responsible to a large extent for determining vegetation structure, contributing to global carbon cycling, and destructive of human life and property. Understanding wildfire behaviour can help us to predict how fire regimes are likely to change in future and to devise appropriate management strategies. One challenge in studying wildfire is to unpick the relative importance of human activity as a factor; in many densely-populated areas of the world, such as the Mediterranean, the majority of vegetation fires are thought to be started accidentally or deliberately by people. This makes it difficult to establish whether the fire frequency and/or intensity experienced today are unusual, in historical terms; whether ecosystems are in equilibrium with modern fire regimes, or are in the process of adjusting to them; and it makes it difficult to determine what an "appropriate" level of burning should be, given that complete elimination of fire is likely in the long run to be detrimental to plant communities that have evolved in environments where burning occurred naturally.

Here we present new data from a lake sediment sequence from Lake Ioannina in NW Greece. The sequence contains varying amounts of charcoal, which can be interpreted as a proxy for the intensity and/or frequency of burning in the lake's catchment. Sub-fossil pollen allow us to reconstruct past vegetation communities, and stable isotope data provide some indication of local variations in past climate, supplemented by regional syntheses of other palaeoclimatic data and results of climate modelling experiments. The sediment sequence spans several interglacial-glacial cycles. Here we compare the charcoal, pollen and stable isotope records of the present interglacial, the Holocene, with the last interglacial, the Eemian. Although there are some known climatic differences between the two periods, the overwhelming difference between them is that hominin activity is thought to have been much more limited during the Eemian: the archaeological record from Greece before c. 40,000 years ago is exceedingly sparse, suggesting very little human activity. We argue therefore that the Eemian record can be used to give a reasonably good indication of what modern vegetation and fire conditions might be like without human influence. A detailed interpretation of the interaction between climate, vegetation and fire regime, informed by insights from the fire modules of the LPJ dynamic global vegetation model, provides further assessment of the main controls on Mediterranean fire regimes both with and without significant human influence.