Geophysical Research Abstracts
Vol. 20, EGU2018-5314, 2018
EGU General Assembly 2018

Drought triggers oak decline and mortality in a temperate floodplain forest in Northwest Italy

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The causes and mechanisms underlying mortality events on forest species are still far from being fully understood, overall under Mediterranean environmental conditions. Few studies have jointly examined the roles played by drought and pathogens, these latter often associated with decline cases reported in oak forests across Europe. Whilst, very few other studies have investigated the role played by drought on tree death and dieback in floodplain forests, characterised by high water availability for most of the year. Here we focused on a mortality event affecting a native oak (*Quercus robur*) and a non-native black locust (*Robinia pseudoacacia*) in a floodplain forest, this latter considered rather invasive species, able to replace native species, to discern if these species are similarly affected by drought. We related growth trends with climate data and drought severity and compared them with changes in water table depth. Then, we focused on oak by: (i) evaluating the presence of pathogens of the genus *Phytophthora* in dead trees, and (ii) comparing vessel diameter and C (δ^{13}C) and N (δ^{15}N) isotope discrimination in wood of living and dead trees. The radial growth of living and dead oaks and black locust started diverging in the early 1990s in response to a severe drought, i.e. about 25 years prior to the death of most affected trees, and this did not correspond to abrupt changes in water table depth. The pathogen *Phytophthora cinnamomi* was only detected underneath one dead oak. Moreover, dead oaks formed smaller xylem vessels than living oaks and also more negative δ^{13}C values, and higher δ^{15}N values. We conclude that a climate shift from wet to warm-dry summer conditions in the early 1990s triggered forest dieback and induced tree mortality in both tree species in the floodplain forest. Indeed, as dead oaks were not predominantly attacked by *P. cinnamomi*, it seems unlikely that they were physiologically predisposed to drought damage by the pathogen. We show that drought seems to be the most plausible trigger of the dieback, as the presence of *Phytophtora* was almost absent, and that both species were similarly affected by drought.