# Ecological and climatic drivers for the fire regime in the Mediterranean under climatic change

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Warmer and drier conditions under climatic change are expected to increase the pressure from wildfires in the Mediterranean.

At low altitudes deep-rooted plants (phreatophytes) survive the Mediterranean dry season by utilizing rainfall accumulating belowground from past rainfall events. This adaptation potentially influences their moisture content when acting as living fuel for forest fires. Other shallow-rooted herbaceous plants (therophytes) survive drought as seeds, acting as very flammable fine fuel because their biomass totally desiccates in summer. We investigated the effects that these ecological adaptations (functional-structural) may have in shaping the fire regime (burnt area; BA; number of fires; NF) in the thermo- and medio-Mediterranean vegetation belts (TMVB-MMVB; the most arid and flammable belts). Spatial scales ranged from provinces of Greece and southern France, to combined data for Greece, Italy, France and Spain.

Clearly, where the TMVB-MMVB prevail precipitation (P) outweighs temperature (T) in determining BA, having a rather equal contribution in explaining NF. In the driest areas increased P accumulating from autumn, but mostly supplied in winter, suppressed BA the following summers, likely because it improved moisture content in pheatophytic vegetation (living fuel). This impact was reduced in more humid regions, where fires suppression was related to increased summer P that makes fuel damp. In contrast, increased late-spring P promoted BA and NF likely by increasing biomass accumulation from therophytic vegetation (fine fuel). Indications for the resistance of pheatophytic plants to fire following wet winters are already evident in the recent fire regime of northern Mediterranean countries. This function may strengthen under a drier climate and could assist early fire-danger prognosis (Sarris and Koutsias 2014).

At higher altitudes, aridity and fuel availability are both expected to increase fire danger, because of climatic and land use changes in mountains of the northern Mediterranean basin. There may already be signs of such effects in the case of the *Pinus nigra* and *Abies cephalonica* forests on Mt. Taygetos (S. Greece). We reconstructed climate (mid to late-fire-season drought) using tree-rings for the last 150 years and compared it with the mountain's fire history reconstructed from *P.nigra* fire-scars. Seven, out of the ten, large fires Mt. Taygetos experienced, were associated with below normal P or above normal T max. The largest fires occurred in late summer of 1879, 1944, 1998 and 2007. However, only the recent fires (1998 and 2007) had both low P and high T max, also confirmed from long-term

meteorological data. The synergy between climate and fuel availability may explain the very high intensity of 1998 and 2007 fires that burned mostly as stand-replacing crown fires (Sarris *et al*. 2014).

Our findings support the prediction that northern Mediterranean areas at both lower and higher altitudes will face a very large threat from wildfires in the 21st Century, especially if socioeconomic changes leading to land abandonment and thus burning fuel accumulation are combined with the drought intensification projected for the region under global warming.

**References**

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