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Impact of climate change on Mediterranean forests: acclimation or vulnerability?

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Observational climatic data and models are already indicating that rainfall patterns are changing in the Mediterranean region as a consequence of climate change, with a marked reduction in precipitation mainly occurring during growing season (IPCC 2007, Intergovernmental Panel of Climate Change). This is particularly relevant, because forest ecosystems have already to coop with frequent hot and dry summers(.). Thus, there is a great need to study how Mediterranean forests may behave and what is the response in terms of acclimation or vulnerability under the new climatic scenario.

Although the plant response to drought has been extensively studied in the last decades, very few investigations have been carried out in a natural forest at stand/ecosystem level in the long-term. To simulate a drought scenario, the rainfall pattern has been altered in a two subsequent years experiment by a system of rain gutters (-20% of precipitation) and sprinklers (+20% of precipitation) on Dry and Wet replicate plots in a evergreen forest close to Rome (Italy). The experimental manipulation resulted in a realistic simulation of the reduction in soil water availability. Drier conditions during summer period, had strong effect over the short and long-term on functional and structural activities.

Significant acclimation was observed, as a result of the increase in hydraulic resistance in the soil-plant continuum, that persisted even after the return to full water availability during the fall and winter. The down-regulation of photosynthesis and the summer accumulation of photo-protective pigments prevented the onset of any run-away damage

and reduced the forest vulnerability.

Further, the imposed drought induced slight or no changes in water-use efficiency, as a result of the parallel increase in stomatal and non-stomatal limitations. This behaviour prevented forest to maintain a positive carbon balance under dry conditions, resulting in a negative feature under climate change scenarios which may reduce further growth and productivity.