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Photosynthetic Potentials of Four Co-occurring Riparian Tree Species in Dependence of Water Availability in a Mediterranean Catchment, Catalonia (Spain)

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The aim of this work was to provide a matrix of photosynthetic parameters and leaf traits of four co-occurring tree species (Populus nigra, Alnus glutinosa, Robinia pseudoacacia, Fraxinus excelsior) in spring and summer and to improve our ecophysiological understanding of species differences concerning distribution and habitat-specific competitive ability in a riparian forest especially under drought periods.
Recent climate change scenarios predict more frequent and extreme drought events in Europe, particularly in the Mediterranean region. Mediterranean catchments represent highly dynamic ecosystems in respect to their nutrient and water cycles with the key element lying in the riparian zone being characterised as hot spots for biogeochemical processes in arid and semi-arid regions. Thereby, the rapid growth rates of the Mediterranean riparian vegetation are strongly linked to water and nitrogen cycles benefiting from both high water and solar energy availability. However, being embedded in an overriding water-limited environment, riparian forests are particularly vulnerable to fluctuations in the water table. It is not fully understood how the frequency and intensity of warm and dry periods interacts with the carbon and nitrogen cycle and in return, how riparian trees in the Mediterranean region are affected by fluctuating water tables and nutrient status. Most of the previous studies have been carried out under controlled conditions, on herbaceous or on young tree species whereas little field work has taken place in riparian forests and if, then mostly in cool temperate ecosystems. The present work extends and complements the field of investigation to a natural mixed, mature riparian forest in a Mediterranean environment aiming at parametrising the photosynthetic potential in spring and summer campaigns in order to provide new insights in temporal, spatial and species specific variations. Therefore, two component processes of photosynthesis were determined to serve as a proxy for the trees' physiological status: the maximum rate of carboxylation (Vcmax) and the potential rate of electron transport (Jmax). Additionally, leaf traits and leaf nitrogen and carbon content were examined. Some preliminary results show that the photosynthetic potentials were higher in the sunlit leaves when compared to leaves from the shaded in all four co-occurring species. Furthermore, the two nitrogen fixing species Alnus glutinosa and Robinia pseudoacacia exhibited the highest photosynthetic potentials and seemed to be the least affected by the summer drought being possibly related to their status as nitrogen fixing species and access to phreatophytic water. In contrast, Fraxinus excelsior seemed to have experienced severe drought stress growing the furthest from the river stream which can be shown by the strong decline in its photosynthetic potentials during the summer period. In some pending analyses leaf traits and leaf nitrogen and carbon contents will be analysed being essential when trying to understand the distribution and abundance of plants and their photosynthetic responses.