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Reconstructing past climate using a multi-specific 13C-approach

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Carbon isotope composition (δ^{13}C) in tree-rings has become routinely used in palaeoclimatic research for the assessment of changes in water availability in seasonally dry climates. Long tree-ring chronologies, however, are relatively scarce, whereas the original climate signal of wood δ^{13}C is usually well preserved in fossil charcoal [1, 4] Accordingly, charcoal δ^{13}C records are an alternative to classic dendroclimatology to characterize past changes in water availability (e.g. precipitation). In this work, we explore the potential for palaeoenvironmental research of two co-occuring Mediterranean species with contrasting strategies to cope with drought [2]: Aleppo pine (*Pinus halepensis* Mill.) and holm oak (*Quercus ilex* L.). We hypothesize that the differential sensitivity of pine and oak to climate variables can be exploited to refine palaeoclimate reconstructions based on δ^{13}C in wood or charcoal. For this purpose, we put together published tree-core-δ^{13}C data from 40 sites across Spain [2, 3] and new δ^{13}C data from 15 sites where both species co-existed in mixed stands. The sites were selected to represent the range of variation in thermal and precipitation regimes for these species, while avoiding any correlation between precipitation and temperature across sites. Five dominant or codominant trees were selected per site, and microcores including the most recently formed tree rings were obtained with a Trephor tool [5]. Fragments were oven-dried at 60 ˚C for 48 h and milled separately to a fine powder using a ball mill (Retsch MM301, Haan, Germany) for δ^{13}C analysis. Current meteorological data (monthly estimates of air mean temperature (minimum, mean and maximum), precipitation and solar radiation) was obtained from the Digital Climatic Atlas of the Iberian Peninsula (http://opengis.uab.es/wms/iberia/index.htm) (spatial resolution of 200 m). A family of models (either linear or exponential) best predicting monthly and annual precipitation from δ^{13}C records was identified, and a leave-one-out cross-validation process was applied to the multi-specific data in order to improve accuracy of climate inferences. In general, Aleppo pine and Holm oak showed a complementary response to precipitation, being more sensitive to spring-summer and autumn-winter periods, respectively. As a case study, the resulting predictive model was applied to charcoal remains of both species recovered from a set of archaeological sites from the Mid Ebro Depresion (North-East Spain) in order to reconstruct aridity changes during the last 4,000 years for this region.

(1) Ferrio JP, Alonso N, López JB, Araus JL, Voltas J (2006), *Global Change Biol.* **12**, 1253-1266.

(2) Ferrio JP, Florit A, Vega A, Serrano L, Voltas J (2003), *Oecologia* **137**, 512-518.

(3) Ferrio JP, Voltas J (2005), *Tellus* **57B**, 164-173.

(4) Ferrio JP, Voltas J, Alonso N, Araus JL (2007), In: Dawson TE, Siegwolf R (Eds.), *Isotopes as Indicators of Ecological Change*, Elsevier Academic Press, New York, pp. 319-332.

(5) Rossi S, Anfodillo T, Menardi R (2006), *IAWA J.* **27**, 89-97.