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Early to mid-Holocene climate changes on the Italian Peninsula: a pollen-based reconstruction

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Pollen-based temperature (T_{Jan} and T_{Jul}) and precipitation (P_{win} and P_{smr}) reconstructions are used to determine climatic changes between 11,500 and 4,500 cal yrs BP at Lago dell'Accesa (central Italy). The lake is located at low elevation in the northern Mediterranean borderlands, that are characterized by a present-day mediterranean climate (mild winters, summer drought) and is subject of a multi-proxy and multi-archive palaeoecological study. Reconstructions were obtained using modern pollen-climate relationships based on a 79-sample training set collected throughout the Italian Peninsula and Sicily. The regression and calibration models for temperature and precipitation were developed using the weighted average-partial-least squares (WA-PLS) regression technique. The pollen-based reconstructions are characterized by a high between-sample variability that has been reduced by the timeseries in order to highlight the major centennial-scale signals.

At Lago dell'Accesa, pollen-inferred (P-I) vegetation changes reveal that the early-Holocene summergreen-oak forest collapsed during two phases (8.5-7.7 ka and after

6 ka) when drought-resistant evergreen oak expanded. Our quantitative climate reconstructions indicate that during these two phases T_{Jan}, T_{Jul}, and P_{win}increased, while P_{smr} decreased. In fact, evergreen oaks are at present-day dominant in regions with clear summer drought and mild, wet, winter. On the other hand, summergreen oak are abundant in regions with moist summers and cool winters.

In an attempt to independently validate the pollen-inferred precipitation reconstructions, they were compared with a lake-level record from the same lake. An excellent coincidence between the two P-I climatic shifts (8.5-7.7 ka and after 6 ka) and two centennial-scale lake-level lowstands are observed. This suggests that summer hydrology was strongly affected, even if P_{win} increased. During the second lowstand phase, short highstand events occurred but were not depicted in the P-I reconstruction highlighting the differences in sampling resolution of the records. The timing is also coincident with phases of strengthened winter/spring atmospheric circulation over the North Atlantic and Siberia. This clearly indicates climate teleconnections between high and low latitudes.