



Holocene climate evolution, human occupation, soil erosion and vegetation cover change in southeast Spain

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The Mediterranean region is commonly reported as the European region that is most affected by soil degradation. The degradation of Mediterranean soils has often been linked to inappropriate agricultural practices during the last decades besides its typical semiarid conditions. The present-day landscape in Southeast Spain is the result of a long occupation history. To have a better understanding of the impact of human societies on soil degradation, the main shifts in vegetation cover, climate and human occupation have to be taken into account.

Recently published paleo-environmental data from continental pollen sequences, high-resolution marine cores, and estimations of the past Sea Surface Temperature (SST) of the Alborán Sea provide new insights in the evolution of the Mediterranean climate and vegetation during the Holocene. These data allow overcoming some of the shortcomings of previous studies on the interaction between humans and the landscape that were mainly based on extrapolations of site-specific information from continental deposits and archeological sites and large-scale regional correlations.

Our compilation of multi-continental proxies from the Iberic Peninsula indicates that environmental conditions are strongly related to climatic oscillations and strongly correlated with the North Atlantic changes. By use of a vertical approach, several aridification episodes were detected from marine and continental records at 12000-11600 (H), 11100-10800 (G), 10300-9900 (F), 8600-8000 (E), 5500-4600 (D), 4000-3400 (C), 2700-2400 (B), 1800-1300 (A) cal. years BP. The data suggest that those severe aridification phases were most likely climatically induced, not human-driven and well correlated with the Bond events.

We observe a clear association between climate, vegetation cover and sediment fluxes for the period from 12000 to 4600 cal. years BP. In contrast, during the last 4600 years, the reconstruction of various eco-historical periods indicated a weak to low association between sediment fluxes and climatic shifts. Periods of improved climatic conditions were associated with both low (end of Post Argaric-Omeya-Nazarene) and high (Chalcolithic-Roman-Early Phoenician I) erosion rates. Various prosperous civilizations (such as Agarics, Phoenicians and Romans) defined by a demographic explosion and associated with an overexploitation of natural resources, are accompanied with higher sediment fluxes. At the moment, we cannot exclude the possibility that the weak association observed between sediment fluxes and human-climatic factors for the last 4600 years is an artifact resulting from the low temporal resolution of soil erosion data from local sites compared to the high-resolution climatic data. It is clear that high-resolution data on sediment fluxes are required to test these hypotheses further.