



## **Contingency & Agency in the Holocene Anthropization of Mountain Landscapes of the Western Pyrenees**

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Mounting evidence indicates that mixed forests of the humid-temperate western Pyrenees mountains were converted by human agency to managed grasslands by at least the late Neolithic. We first realized major ramifications of the conversation process from pronounced differences we observed between soil profiles of ancient pastures and old-growth forests in otherwise similar landscape positions. Subsequently through radiocarbon dating of colluvial deposits we established a chronology for anthropic manipulation of the biotic factor of pedogenesis resulting in the creation of new soil materials, processes and functions. Regional- and biome-scale paleoecological analyses and archaeological syntheses suggest that it was Neolithic agropastoral land use that initiated anthropization of mountain landscapes of the western Pyrenees. However, such macroscopic views of human behavior cannot reveal the contingency and agency on which human causality rests. We have thus followed a complementary place-based investigative strategy that couples geoarchaeological, biophysical and socio-ecological factors spatially and temporally to arrive at the coevolutionary processes of human-environment interactions and landscape history. The results often contrast sharply with conventional narratives about human landscape degradation in agropastoral systems.

For the last 2000 years, the western Pyrenees mountains were spatially removed from regional centers such as Pamplona and Bordeaux, and economically and politically peripheral to continental social and governmental processes. This marginality favored a macroscopic and time-invariant interpretation of agropastoral production in the western Pyrenees as the result of unambiguously enforced social norms exacted by intense solidarities of kin and neighbors. However, anthropization of the western Pyrenees was a spatially and temporally heterogeneous process in which land transitions appear to precede intensification. Radiocarbon dating shows three temporal clusters for archaeological features that fall broadly within the Bronze Age, the Iron Age, and the late Medieval/Early Modern period. The first two clusters coincide with the onset and the culmination of the transition from forest to pasture (ca. 4000-2200 cal yr BP) while the latter relates to strategic colonization from the lowlands to the north and south of the Pyrenees mountains. By integrating high-resolution geoarchaeological, biophysical and socio-ecological data we are able to go beyond discovering the onset of anthropization to examine human causality and environmental resilience as they relate to sustainability of mountain landscapes of the western Pyrenees over medium to long time intervals.