

## THE HUMAN FACTOR: DEPOSITIONAL PROCESSES IN MEDITERRANEAN WATERSHEDS DURING THE ANTHROPOCENE

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Large changes in the hydrological and biogeochemical cycles and surface processes dynamics have been documented during the last centuries, greatly affecting landscapes structure and depositional processes in watersheds. Through changes in land uses, natural resources exploitation and an intense urbanization, humans have become significant erosion, transport and depositional agents. In Mediterranean regions, the occurrence of a summer drought and large variability in water availability are primary forcings controlling hydrological regimes, vegetation covers and depositional dynamics. Humans come close.

The Iberian Peninsula showcases how humans have interacted with the landscape and contributed to change the depositional dynamics. Transformations from “pristine” to rural and finally urban landscapes have left a strong signature in watersheds, slopes, rivers and lakes during the last millennia. Although first impacts could be traced to the Neolithic, fluvial and lacustrine environments were largely unaltered. Iberian and Roman imprint in the landscape resulted in the first large-scale soil erosion and sediment accumulation phases and heavy metals atmospheric deposition, both documented with varied intensity all over the Iberian Peninsula. Fluvial deposits and lake sequences show large depositional transitions during the last millennia related to hydroclimate variability (e.g., mid Holocene transition, Iberian Roman – Humid period, Medieval Climate Anomaly, Little Ice Age) and to intense anthropogenic impact in the watersheds (Iberian- Roman, Middle Ages, the 19<sup>th</sup>-20<sup>th</sup> century). Intensification of soil erosion and sediment fluxes occurred both during more humid periods (stronger rainfall) and more arid periods (increased storminess, higher soil erodibility when vegetation cover was reduced). Synergetic effects between phases of increased human pressure and rapid climate change occurred during the onset and demise of the Little Ice Age and caused increased sediment fluxes in watersheds and changes in flood intensity and frequency.

Most watersheds - even those located in remote areas and considered more “pristine” - have been transformed during the previous centuries of intense land use and climate change. Some showed stronger resilience to historical land use than to hydroclimate changes. Others were altered forever through deforestation. Recent changes, both in the mountains and in the lowlands, have been even more dramatic. Climatic and anthropic are responsible for some trends starting in the mid 1970s: diffuse contamination due to industrial development of intensive agriculture; recent eutrophication in aquatic systems in more touristic areas; lower sediment fluxes from watersheds where significant land abandonment occurred since the 1950s, changes in erosion patterns in slopes and channels in mountain rivers. Human – induced climate change has a global impact, already seen in coastal dynamics, floods and droughts dynamics.

Anthropocene signatures in Mediterranean depositional systems are varied, as the watersheds during the last centuries have witnessed phases with strong human impact (Medieval times, late 19<sup>th</sup> century and early 20<sup>th</sup> century) and periods with decreased human activities (Little Ice Age, economic and population crises during medieval times, rural exodus after mid 20 century). Climate variability, particularly in rainfall amount and seasonal distribution, has also played a determinant role. Synergies, resilience and hysteresis interactions have occurred in the past and should be expected in the near future. Evaluation of hazards and risks (floods and droughts, slope activity, landslides, soil erosion, sediment and geochemical fluxes) and adaptation strategies should include humans as active agents of change, not only as passive receptors. Sedimentology provides holistic tools to understand surface processes from slope to watershed scales and from daily and event monitoring to decadal trends. Past and recent human activities have to be considered to understand current depositional systems and landscapes dynamics in the Mediterranean region with a long history of human activities.