Geophysical Research Abstracts
Vol. 14, EGU2012-13141, 2012
EGU General Assembly 2012

Modelling Landscape Dynamics in a Highland Mediterranean Catchment: Establishing the impact of Climate Variation and Human Activity

L.P.H. van Beek (1), H. Feiken (2), T.W.J. van Asch (1), and M.F.P. Bierkens (1)

(1) Utrecht University, Physical Geography, Utrecht, Netherlands (r.vanbeek@geo.uu.nl, + 31 (0) 30 253 1145), (2) Groningen Institute of Archaeology, University of Groningen, Netherlands

The close link between human occupancy and the Mediterranean landscape has long been recognized. Through the exploitation of the various but fragmented resources that these landscapes have to offer, man has been able to secure a living. However, these activities are often marginal and small shifts in population pressure, corresponding land use patterns or climatic variability can have large consequences on the redistribution of water and sediment in these areas.

The meso-scale landscape dynamics model, CALEROS, has been developed to simulate the interactions between climate, soil production and erosion, vegetation and land use on geomorphological to human time scales in Mediterranean environments. Starting from an initial landscape consisting of a DTM, soil distribution and underlying lithology, the landscape is free to develop in response to the imposed climate variability and seismicity. In addition to changes in soil distribution and bedrock lowering, this includes the establishment of vegetation as conditioned by a selection of plant functional types and, optionally, population and land use dynamics as conditioned by land use scenarios specifying technological and dietary constraints for different periods. As such CALEROS is well-suited to investigate the relative impacts of climate, land cover and human activities on the hydrological catchment response and the associated sediment fluxes due to soil erosion and mass movements.

Within the context of a geo-archeological study on the conservation potential of settlement history in the Contrada Maddalena (∼14km2, Calabria, Italy), we apply CALEROS to investigate the relative contributions of climate and man from Neolithic times onwards (5000 BP-present). Model results allow to establish when human impacts become significant over natural variations and to discern shifts in catchment functioning as a result of sudden or climatic variations (e.g., Little Ice Age) as reflected in vegetation patterns and water and sediment fluxes within the catchment and at the outlet (sedi-, hydrographs). Preliminary results indicate an early divergence in catchment behaviour after the introduction of agriculture and marked shifts in catchment response to both variations in population pressure and climatic variations at the local and catchment scale. In order to establish the veracity of these results we compare model outcome at the local scale with land cover attributes, distributions of landscape characteristics (soil depth, slope) and archeological remains and we relate the findings to evidence from literature at the regional scale. Although the results are clearly constrained by past land use and climatic variations, the resulting trends and shifts in landscape dynamics provide an analogue for possible impacts in regions that experience similar developments.