



Water erosion in Mediterranean Spain at different temporal and spatial scales. A review.

A. Solé-Benet (1), Y. Cantón (2), R. Lazaro(1), J.Puigdefábregas(1)

(1) Estación Experimental de Zonas Áridas, Consejo Superior de Investigaciones Científicas, Almería, Spain (albert@eeza.csic.es / Fax +34 950 277 100), (2) Department of Soil Science, University of Almería, Almería, Spain.

In Mediterranean semiarid Spain, erosion is produced as the result of a set of processes over a variety of territories (forming a finer mosaic than in more humid areas). Centuries of anthropogenic action have resulted in large areas of highly erodible, shallow soils with low organic matter content. Land use changes and disturbances (urbanization of range and forested land, road construction on hills, forest fires, abandonment of land, especially in terraced areas) have been reported as main causes of severe erosion. Reforestation of sensitive deforested areas has also been described as causing significant erosion.

The role of extreme events in long term soil loss is specially significant. A statement by Wise et al (1982) about the difficulty of establishing contemporary rates of erosion “events are not only of high magnitude and infrequent occurrence, but also spatially discontinuous and greatly influenced by human activities”, applies to most Mediterranean Spain. There, erosion is more a collection of individual, local problems than a general one, as is many times considered.

Moreover, as most present erosion rates have been obtained from the measurement of single gullies, small plots or small catchments, quantitative assessments of large areas should not be done by extrapolation. This effect of scale in erosion rates is extremely important: runoff is generated discontinuously on slopes so that fluxes of water transporting sediment from the top to the bottom rarely exist except in badlands, artificial taluds, roads, highways and urban zones. Sediments undergo a constant redistribution process in which plants play a fundamental role. Therefore, erosion is a slow process, although it can be accelerated under extreme events.

In spite of the initial alarm because of the high erosion rates estimated by the USLE, after 20 years of studies in Spain, it has been confirmed that, while there are erosion problems, severe erosion is restricted in space (specific zones of the territory such as badlands, slopes of highway earthworks, restored zones) and in time (after fires, after agricultural abandonment, after ploughing). However, this does not mean that a broader perspective should not be considered in addressing soil erosion over all Mediterranean Spain: soil erosion should be considered for a broad range of landscapes and relationships established for different land uses and management practices.

Erosion from rills and ephemeral gullies use to be more important than interrill erosion. At agricultural plot scale, erosion along plot discontinuities (drainage paths, pathways, plot boundaries) and natural drainage pathways use to be much more important than erosion within plots, where most sediments remain. At catchment scale, effective areas of sediment production use to be only a small percentage of the total catchment area.

Soil conservation and protection measures should be applied following specific criteria for every major environmental condition, taking into account physical and socio-economic factors, and considering spatial and temporal scales (recurrent torrential storms and droughts). The magnitude of soil loss tolerance for different environments and the capacity of such environments to withstand different soil losses should also be considered (a loss of 20 cm of soil over hard limestone is not comparable to the loss of a similar soil thickness over a soft parent material which is several metres thick).

Finally, the study of soil erosion should not be dissociated from the essential study of soils (precise characterisation, formation processes and behaviour under different land uses and managements) nor from the present and potential uses of the best soils, especially those from coastal plains which are being sealed by urbanization and roads. Regional characterisation allowing soil conservation and a sustainable soil use should be a priority.