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Direct and indirect impacts of climate change on soil erosion and land degradation in Mediterranean watersheds: a presentation of the ERLAND project

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This presentation will describe the recently-approved ERLAND project (2010-2013), whose main aim is to estimate the impacts of climate change on soil erosion in representative Portuguese agroforestry watersheds, due to changes in rainfall, runoff generation and vegetation cover.

Soil erosion is a critical driver for desertification in Mediterranean regions, degrading the soil's capacity to sustain vegetation under marginal climatic conditions. An increase in climatic aridity, caused by global climate change, could lead to increases or decreases in erosion, depending on the interaction between lower rainfall and lower vegetation biomass productivity

The main objective of ERLAND is to characterize the most important impacts climate change could cause on different erosive processes within Mediterranean catchments, and help define the costs and benefits of different adaptation options. The project explicitly addresses important limitations of similar past studies, such as: (i) lack of appropriate downscaling of climate change scenarios; (ii) focus on hillslope or, in rare instances, channel processes, ignoring gully erosion; or (iii) lack of sufficient erosion data for the proper evaluation of the erosion models used in these assessments. The main analysis tool will be a new vegetation, runoff and erosion model, built by joining together existing and widely tested concepts to simulate vegetation, hydrology and erosion. It will aim at the continuous simulation of sediment detachment and transport within catchments, using a detailed simulation of spatial patterns while simplifying the simulation of temporal patterns, allowing for a multi-year application.

The project will focus on two catchments, corresponding to typical combinations of climate and land cover/use under humid and dry climate conditions: in northern Portugal, eucalypt/pine commercial forestry combined with annual cultures or vineyards; in southern Portugal, extensive cork oak forestry (montado) associated with annual cultures or pastures. Data on climate, vegetation, hydrology and soil erosion will be collected at different spatial scales (hillslope, gullies, catchment), to allow for a correct calibration of the model in simulating the most important erosive processes for current conditions. Climate change scenarios for 2071-2100 will be downscaled for the study areas based on existing regional climate models through a statistical approach.

Results are expected to provide insights on the erosive impacts of changes in key erosive factors, i.e.: rainfall regime, vegetation cover (including increased wildfire frequency), soil moisture and hydrological regimes. Impacts will be assessed in terms of soil loss at the slope scale, gully erosion processes and catchment sediment yield. Scenarios for land-use change and agroforestry adaptation due to climate change will also be developed and tested using the model. ERLAND will represent one of the few studies performed for Mediterranean conditions, and explicitly including gully erosion and sediment connectivity.