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Impacts of climate change on soil erosion in Portuguese watersheds with contrasting Mediterranean climates and agroforestry practices

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Climate change in Mediterranean regions could lead to higher winter rainfall intensity and, due to higher climatic aridity, lower vegetation cover. This could lead to increasing soil erosion rates, accelerating ongoing soil degradation and desertification processes. Adaptation to these scenarios would have costs and benefits associated with soil protection but also agroforestry production and water usage. This presentation will cover project ERLAND, which is studying these impacts for two headwater catchments (<1000 ha) in Portugal, located in distinct climatic conditions within the Mediterranean climate area, and their land-use practices are adapted to these conditions.

The Macieira de Alcoba catchment in northern Portugal has a wet Mediterranean climate (1800 mm/yr, but with a dry summer season). The high rainfall allows the plantation of fast growing tree species (pine and eucalypt) in the higher slopes, and the irrigation of corn in the lower slopes. Forest fires are a recurring problem, linked with the high biomass growth and the occurrence of a dry season. Potential impacts of climate change include less favorable conditions for eucalypt growth, higher incidence of wildfires, and less available water for summer irrigation, all of which could lead to lower vegetation cover.

The Guadalupe catchment in southern Portugal has a dry Mediterranean climate (700 mm/yr, falling mostly in winter). The land-use is montado, an association between sclerophyllous oaks (cork and holm oaks) and annual herbaceous plans (winter wheat or pasture). The region suffers occasional severe droughts; climate change has the potential to increase the frequency and severity of these droughts, leading to lower vegetation cover and, potentially, limiting the conditions for cork and holm oak growth.

Each catchment has been instrumented with erosion measurement plots and flow and turbidity measurements at the outlet, together with surveys of vegetation and soil properties; measurements in Macieira began in 2010 and in Guadalupe they began in 2011. These datasets will be used to parameterize, calibrate and validate the SWAT ecohydrological model, in order to ensure the appropriate simulation of the most important hydrological, vegetation growth and erosion processes which could be impacted upon by climate change. The model will, in turn, be the main tool to study future climate and land-use scenarios.

The presentation will focus on the data collected so far, the modeling structure, and preliminary results coming for the work.