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Combined effect of soil erosion and climate change induces abrupt changes in soil and vegetation properties in semiarid Mediterranean shrublands.

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Semiarid Mediterranean ecosystems are experiencing major alterations as a result of the complex interactions between climatic fluctuations and disturbances caused by human activities. Future scenarios of global change forecast a rapid degradation of these ecosystems, with a reduction of their functionality, as a result of changes in relevant vegetation and soil properties. Some theoretical models indicate that these ecosystems respond non-linearly to regular variations in the external conditions, with an abrupt shift when conditions approach a certain critical level or threshold. Considering these predictions, there is an urgent need to know the effects that these alterations might have on semi-arid ecosystems and their components.

In this study, we aim at analyzing the consequences of climate change and increasing soil erosion on soil and vegetation properties and the functional dynamics of semiarid Mediterranean shrublands. We predict that the combined effect of both drivers will be additive or synergistic, increasing the negative effects of each one.
We compared vegetation and soil properties of flat areas (low erosion) and steep hillslopes (high erosion) in two climatic areas (484 mm and 10.3ºC, and 368mm and 11.9ºC, respectively) that reproduce the predicted climate change in temperature and precipitation for the next 40 years. Species richness, vegetal cover, plant life-form composition were determined in 20 m2 plots and soil was sampled in the same plots to determine bulk density, aggregate stability, fertility and water holding capacity.
All soil and vegetation properties were negatively affected by soil erosion and climate change. However, contrary to our hypothesis, the joined effect of both drivers on all soil and vegetation properties was antagonistic, except for the vegetal cover that showed an additive response to their interaction.

Our results evidence that soil erosion affects more negatively the soil and vegetation properties in the cooler and wetter climatic area than in the warmer and drier one, and support moreover the idea that a functional threshold has been crossed between the two climatic areas.