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Estimating soil erosion on hiking trails in the Sierra Mariola Natural Park in southern Spain

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Natural parks and protected natural areas provide excellent recreational opportunities for outdoor activities through the richness of the natural environment and the abundance of walking trails. Hiking, mountain biking and running have rapidly gained popularity over recent years increasing concerns about the erosion and degradation of hiking trails caused by (over)use.

This is also the case in the Sierra Mariola Natural Park in southeast Spain, which is a popular destination for tourists due to its diverse fauna and flora. The increasing number of tourists together with the negative impacts of climate change necessitates a better understanding of the key soil erosion processes impacting hiking trails. There are 4 scenic trail routes in the Natural Park amounting to 21 km plus an additional network of unofficial trails. Apart from the heavy touristic traffic on the trails there are large trail running events with up to 1000 participants becoming increasingly popular, however local park authorities have voiced concerns about the impacts of these activities on the trails.
Despite the popularity of walking trails around the world, there is a paucity of research exploring soil erosion from these features. Therefore, the aims of this study are: 1) to ascertain the amount of erosion that occurs on trails in the Sierra Mariola Natural Park, and 2) determine the key factors that influence soil erosion. Some 100 km of trails were evaluated (both official and unmarked trails), with route segments ranging between 2 and 10 km. A trail classification system was developed to group trail segments based on their surface characteristics (bedrock, gravel, mixed sediment, soil or man-made) and specific erosion features (rills, ditch-shaped, tilted). For each class, the average erosion rate was calculated which ranged from 262 t/ha for soil-based trails to 2006 t/ha for heavily eroded, ditch-shaped trails. The spatial distribution of the different erosion rates and trail types were mapped using ArcGIS to provide an overview of the most affected areas. A DEM model of the park was also used to assess the relative influence on erosion of various factors such as slope, geology, aspect and elevation.

Slope, aspect, vegetation and geology are the key variables influencing the erosion rate of trails. Also, the amount and type of trail use also influence trail erosion. Further studies are recommended to explore the carrying capacity and threshold limits of trails.