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CART-based gully types classification: a case study in Sicily (Italy)

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Gulling is a complex process depending on several factors and involving a wide range of sub-processes. Different types of gullies were distinguished and described in literature. Their contribution to soil erosion changes in relation with the typology and their presence is influenced by different controlling factors. Mapping and classifying gullies is crucial for monitoring soil erosion. So far, no systematic definition of morphological characteristics of the different types of gullies and of their controlling factors has been made. The present work aims to suggest an innovative approach to automatically classify gullies by integrating remote sensing, GIS and a classification algorithm. The study was carried out in three sub-catchments (20km²) of the Platani River basin, located in southwest Sicily (Italy). Two gullies inventories (2014 and 2008 years), containing more than 400 erosion features, were prepared by integrating Google Earth and aerial orthophotographs images and further field checks. Once mapped, gullies were classified by using the location in the landscape, the morphology and the dominant erosion process leading to their formation as criteria. Several primary and secondary topographic attributes were selected as independent variables in the classification model. The Classification and Regression Tree (CART) algorithm was used to predict the location of the different types of gullies and describe the influence of the different factors taking part of the model. The results, described in terms of AUC values, show high model accuracy. CART-based gully classification is quicker and more objective than traditional methods. Moreover, the suggested method provided important information about which is the dominant erosion process leading to gullies formation.