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Impact on wheat production of anthropic soil erosion by recent gully filling at the Campiña landscape in Southern Spain

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Gully erosion is one of the main drivers of environmental degradation on intensively managed agricultural fields in Southern Spain. Ephemeral and permanent gullies develop after intense rainfall events, which leads to significant loss of arable land. In the study area, productivity is also affected atn gully surroundings since gully filling (by using the top soil scraped from the vicinity of the gully) is a common practice among local farmers.

The aim of this communication is to analyze the impact of gully filling practices on wheat production during two growing years (2017 and 2019) in a medium-sized catchment (94 ha) at the Galapagares watershed. The study area is close to the city of Córdoba (Spain) and belongs to the Campiña landscape (rolling landscape on vertic soils). The catchment under study is divided in five subcatchments, two of them not affected by gully filling in the last eight years while in the other three, the soil was scraped and displaced into the gully within the study period (last two years).

Firstly, a series of topographic and spatial factors (insolation, topographic index, slope, aspect, drainage area, distance to the gully) and a soil-related variable calculated prior to the growing season (soil color from the Sentinel-2 visible band) were selected as posible explanatory factors for remote sensing-based Vegetation Indexes (VI) derived from Sentinel-2 (the Normalized Difference Vegetation Index - NDVI and Enhanced Vegetation Index - EVI). Both indexes were considered potential proxies for crop yield for 2017 and 2019 campaigns. Furthermore, the differences in VI were compared between potentially affected areas by soil scraping close to gullies and non-affected areas. At last, a field survey on crop production (kg of wheat grain per ha, 15 % moisture) was carried out during the harvest period to determine the relation between vegetation indexes and crop yield.

Results show that the most relevant explanatory factors for NDVI and EVI variance were solar irradiation, topographic index, aspect (positively correlated), soil colour (inverse correlation) and distance to the gully (positive correlation), in this order of importance. A general linear model explained 40% of NDVI and 55% of the EVI variances Nevertheless, when gully adjacent (<30m to the gully) and non adjacent (>30m) areas were analyzed separately, significant diferences were detected. Non-adjacent areas presented higher VI values and homogeinity pixelwise. Moreover, the distance to the gully became the second most significant explanatory factor for VI in adjacent areas (with higher VI values for more distant locations), whereas it remained non significant for

non-adjacent pixels. In addition, those subcatchments impacted by recent gully filling showed larger variability in VI values before and after the operations as compared to non-affected subcatchments.