Assessment of SWC measures influence on erosion dynamics in a semi-arid Tunisian catchment
(Oral)

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ABSTRACT

Due to its physical, geomorphological, and hydro-climatic conditions, Tunisia is experiencing significant soil degradation from water erosion, which affects more than half of the utilized agricultural surface. Such a context justifies the widespread implementation of water and soil conservation measures (SWC) in Tunisian territory to address soil degradation and the siltation of water reservoirs. Despite this, water erosion processes continue to be a problem in many of these areas, and the reason for these poor outcomes remains unknown. This study aims to evaluate the effectiveness of soil and water conservation structures in controlling the expansion of the drainage network in the 1375-hectares Wadi Maiz catchment in Kairouan, central Tunisia, over 60 years (1963–2023), by combining the treatments of historical aerial imagery with systematic field surveys. Using field surveys and orthorectified aerial photographs from 1963, 1989 and 2023, we quantified changes in drainage network density and the extent and nature of soil conservation measures implemented. We also assessed the current level of erosion control measure degradation. The results reveal a gradual implementation of SWC measures, which covered 5% of the total catchment area in 1989 and reached nearly 71% by 2023. The main SWC measures were contour benches, stone bunds and cactus plantations. Between 1963 and 1989, prior to the implementation of large-scale SWC, drainage density increased by 0,18% each year in average. This highlights the high sediment yield, even under limited channel development. Between 1989 and 2023, drainage density continued to increase with a similar rate (0,19% each year in average) despite an significant increase of the area implemented with SWC This result shows that the installation of SWC has not prevented the expansion of the hydrological network in this catchment area. The field observations also indicate that many SWC measures—particularly the contour benches on steeper slopes—are degraded, with a considerable proportion showing advanced deterioration that promotes the retreat of headcuts while maintaining sediment connectivity. These degraded areas reduce the overall performance of the conservation system despite its extensive spatial coverage. These findings demonstrate that SWC measures provide partial and spatially heterogeneous control of erosion. Their long-term performance depends on maintenance, structural durability, and strategic spatial distribution, highlighting the need for adaptive, catchment-scale management in semi-arid environments.

Keywords: Water erosion; Soil and water conservation (SWC); SWC effectiveness; aerial imagery; semi-arid Tunisia.