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SPATIAL DISTRIBUTION OF WATER EROSION USING STOCHASTIC MODELING IN THE SOUTHERN ISFAHAN PROVINCE, IRAN

ABSTRACT: ZAKERINEJAD R., SOMMER C., HOCHSCHILD V. & MAERKER M., *Spatial distribution of water erosion using stochastic modeling in the Southern Isfahan Province, Iran.* (IT ISSN 0391-9838, 2021).

Soil erosion is often regarded as one of the main processes of desertification. Many parts of the world have been affected by soil erosion, resulting in major environmental problems and causing land degradation, loss of agricultural land, destroyed villages and infrastructure as well as historic places. Soil erosion particularly affects arid and semi-arid regions due to long dry periods and often-intensive precipitation events. The soil particles washed off by surface and subsurface runoff are the biggest pollution factor in terms of amount and volume. Our case study is located in the Southern Isfahan province, Central Iran. The area is severely affected by water erosion such as gullies, rills and badlands. The main aim of this study is to predict the spatial distribution of the different water related erosion types and their susceptibilities using a probabilistic Maximum Entropy Model approach based on the following environmental layers: lithology, soil textures, land use, precipitation, Normalized Difference Vegetation Index and topographic indices derived from an SRTM DEM with 30 m spatial resolution. An inventory of the erosion forms and features such as gully erosion, rill erosion and badland erosion was determined based on Google Earth images (GE), aerial photos and a field campaign conducted in 2018. In order to validate the stochastic modelling approach, we divided the entire sample in a train (70%) and test (30%) dataset. We validated the model performance using the Area Under Curve (AUC) value. The model yields good (rill and gully erosion) to excellent (badland) results for both train and test data. The spatial prediction of susceptibilities for rill, gully and badland erosion show that in total more than 40% of the study area is affected by water erosion processes (4.8% rill erosion; 23.4% gully erosion and 17.9% badland erosion). The knowledge of susceptible areas is crucial for a proper land management and related soil conservation measures to guarantee a sustainable land use.

KEY WORDS: Gully erosion, Badlands, Rill erosion, Maximum Entropy Model, Iran.

INTRODUCTION

In 1983, according to the evaluations made by FAO worldwide an area of 5-7 million hectares of agricultural land were lost due to degradation processes such as soil erosion, soil salinization, urbanization, etc.. Soil erosion processes may act on very short time scales but can also last over tens and hundreds of years. Particularly, effects of soil erosion attract special attention if they become disastrous. Soil loss becomes often critical if socioeconomic and political factors favor erosion (man-induced erosion).

In arid and semiarid regions, with scarce vegetation and particularly in areas with low infiltration capacity, e.g. due to soil compaction, stormflow is capable to effectively erode the soil. In other words, areas with low vegetation and overgrazing in large parts of the world are more exposed to water erosion and land degradation.

Many parts of Iran face various types of land degradation of which water erosion is one of the most important (Masoudi & *alii*, 2006; Masoudi & Zakerinejad, 2010; Shahrivar & *alii*, 2012; Zakerinejad & Maerker, 2014; Zakerinejad & *alii*, 2018; Zabihi & *alii*, 2018; Arabameri & *alii*, 2019a,b; Hosseinalizadeh & *alii*, 2019a). Recently large areas of arid and semiarid landscapes in Iran have been destroyed and converted to bare land by the effects of gully erosion, rill erosion, landslides and badlands (Arabameri & *alii*, 2019b). The channel type erosion (rill and gully) occur where concentrated water flows with high velocity eroding the highly erodible soils especially in the plateau areas (Masoudi & *alii*, 2006; Rahmati & *alii*, 2016). Overland flow,

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