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Assessment of Land Degradation Hotspots in Upper Savitri River Sub-Basin, Raigad District, India Using Geospatial Techniques and Analytic Hierarchy Process

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Abstract

Due to rapid industrialization and physiography of the western ghat especially the region come into Maharashtra has faces land degradation problem. For understand the reasons of land degradation, Upper Savitri River area has been considered for the present work. Upper Savitri River is one of the main tributaries of Savitri River which originates in the eastern part of Poladpur Taluka (administrative boundary) of Raigad District, Maharashtra, India near the Sahyadri mountain. For this study, remote sensing, geographical information system (GIS) techniques and Analytic Hierarchy Process (AHP) modeling have adapted. For this work total nine thematic layers are considered *viz.,* geology, drainage density, aspect, slope, geomorphology, soil depth, rainfall, normalized difference vegetation index (NDVI) and land use land cover (LULC) have carried out. For study the normalized weight of each of this thematic layer, AHP modeling which is based on comparative matrix have been used. The results indicate that, rainfall and slope have the highest impact, accounting for 53% of the overall weightage. The land cover pattern and soil texture in this region, also point that a significant impact on lad degradation, contributing to 26% of the weightage. The remaining criteria collectively had a weightage of 22% in the analysis. Based on the intensity of land degradation and the extent of its impact, the Upper Savitri River area have classified into four categories i.e. very high, high, moderate and low vulnerability. Approximately 5.90% with 21.43 km^2 of the area is categorized as being under very high vulnerability, while around 74.59% with 271.04 km^2 is highly. Additionally, about 19.47% with 70.74 km^2 of the area is moderately vulnerable, and 0.04% with 0.14 km^2 is classified as low vulnerability. The research finding shows that the degradation of the land has mainly due to the intensity of rainfall in the region. These findings indicate that there is a pressing need to take measures to prevent further land degradation in the region.

Keywords: Analytic Hierarchy Process, Geospatial Techniques, Land Degradation, Savitri River Basin

Introduction

The sustainable development of human society depends on the land availability. However, in recent times, the issue of land degradation has emerged as a pressing concern, posing substantial challenges for human populations (Cowie *et al.*, 2018). According to Dobbs *et al.* (2017) the consequences of land degradation are evident in the decline of ecosystem functions, primarily manifested through the degradation of vegetation. Another study reveals that, anthropogenic disturbances and climate anomalies are the key drivers of land degradation, posing a significant and vulnerable threat to livelihoods and the sustainable development of societies (Fleskens and Sringer, 2014). Similarly, land degradation is influenced by a multitude of factors, including rainfall distribution, wind speed, slope, soil texture, as well as the type and coverage of ground vegetation (Maji *et al.*, 2010). Water-induced soil erosion, particularly during intense rainfall events and in areas with limited vegetation cover on exposed land surfaces, plays a dominant role in soil erosion processes (Aslam *et al.*, 2021).

Pal and Al-Tabbaa (2009) defined as 'soil erosivity refers to the vulnerability of soil to erosion caused by rainfall'. For accurate estimation of soil erosion, intra-seasonal time scales were followed (Grelle *et al.,* 2014). Consequently, this process leads to the detachment and transportation of soil particles via surface runoff (Schmidt *et al.,* 2016). Following the recommendation of Wischmeier and Smith (1978), rainfall maps were utilized to illustrate climatic variations, based on a minimum of 20 years of data as considered. Land degradation has been assessed and modeled based on multiple remote sensing datasets, as demonstrated in distinct as shown in Table 1. Land degradation vulnerability, which refers to in addition to rainfall, climatic dryness and poor soil quality, as well as agricultural intensification and deforestation determine an area's susceptibility to degradation and loss of productivity (Kosmas *et al.,* 2000). Managing natural resources and pursuing sustainable development require the modeling and assessment of land degradation vulnerability (Sandeep *et al.,* 2020).

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