GULLY EROSION MAPPING USING ASTER DATA AND DRAINAGE NETWORK ANALYSIS IN THE MAIN ETHIOPIAN RIFT

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1. INTRODUCTION

Gully erosion occurs at different scales and rates of development, as a natural process and a landscape feature. The causes, processes, prediction and control of gully erosion have aroused the interest of many researchers in different environments [1]. Gully erosion enforces various negative impacts on soil features, crops and water resources across the world. The Main Ethiopian Rift (MER) which is characterized by large elevation differences and the occurrence of Precambrian basement rocks and post-Miocene volcanic rocks [2] is severely affected by wide gullies, dynamically expanding into agricultural lands at an alarming rate. A spatial mapping and assessment of the gullies in this region is required to fully describe and understand these processes. The objectives of this paper are to describe the potential contribution of ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) data and drainage network analysis to discern the gully erosion in the main Ethiopian rift and to estimate the gully erosion rates.

2. DATA AND METHODOLOGY

Different methods are proposed for the extraction and classification of gully erosion [3], [4]. A methodological framework in the context of remote sensing and geographical information systems (GIS) techniques was considered to carry out this study.

A maximum likelihood classification (MLC) with two classes, gullies and non-gullies, was used to extract different shapes and patterns of gullies. ASTER data were preferred for their good spatial resolution (15 m) in the three visible and near infrared (VNIR) bands, in combination with considerable spectral information, including six 30-m resolution bands in the shortwave infrared (SWIR). Each combination of bands is discussed and evaluated depending to their potential for showing the eroded surfaces by gullies. The present study evaluates the joint classification of ASTER stereogrammetric Digital Elevation Models (DEMs) and the Shuttle Radar Topography Mission (SRTM). ASTER DEM is generated from 3N (nadir) and 3B (backward) bands at level 1b image. The drainage network extraction process is done automatically [5]. In this paper the accuracy of SRTM and ASTER drainage networks are compared. The drainage network analysis of SRTM and ASTER DEMs is used to describe the geometry of the gullies, their linkage with the drainage system. Geometric and geomorphic parameters are then input in a GIS query analysis to refine the gully extraction. The general methodological procedure is presented in the Figure 1.

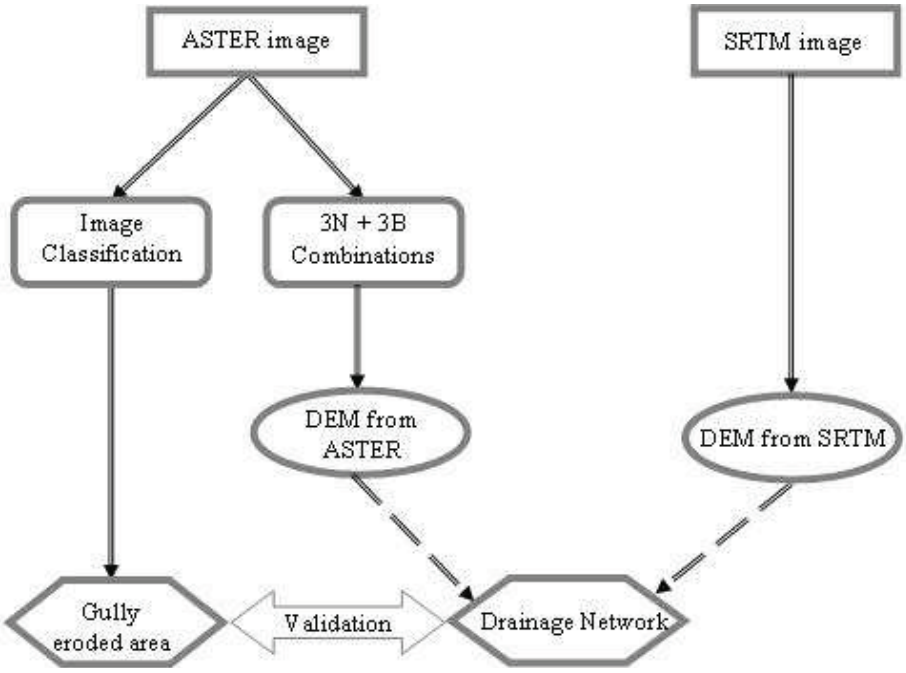

Fig. 1. Diagram of mapping the gully erosion at regional scale

Maps derived from such analysis allow the identification and description of forms and patterns of gullies that was encountered in the region of study at the catchment scale. The proposed methodology to discern the gully erosion at catchment scale on the basis Digital DEM from both ASTER and SRTM images, and Geographical Information Systems (GIS) was shown that MLC with ASTER data is a valuable technique to discriminate gullies. This work, based on a local case study, allows the development of a new approach which is transferable to other areas.

3. REFERENCES

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