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GEO-ENVIRONMENTAL RESOURCE MANAGEMENT IN MAHESH RIVER BASIN IN AKOLA AND BULDHANA DISTRICTS, MAHARASHTRA USING REMOTE SENSING AND GIS TECHNIQUES

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Abstract: In present study describes the aspect of geo-environment resources management of a Mahesh river situated in Akola and Buldhana District (MH), India, using remote sensing and GIS method. Firstly, based on satellite imagery, topographical, drainage, geomorphological and soil depth features, an area of about 328.25 sq.km was delineated as a favourable zone for groundwater exploration site in area. The problem of the study is a representative case of less rainfall of groundwater resources, leading to the continuous exhaustion of the grained as well as the groundwater aquifer. In such conditions topographic, landuse, geology, liniment hydrogeological and geomorphological features provide useful signs for the selection of suitable areas of soil and water conservation. The study area is characterized by the presence of nearly 200 to 250 m. thick horizontal basaltic lava flows showing Cretaceous to Eocene age with a mantle of recently formed soil. The lava flows can be grouped into massive basalt showing limited water resources. In the present study mapping was done in LISS-III satellite images with the help of Arc GIS 10.3 software.

Keywords: Geomorphology mapping remote sensing and GIS, geology, LISS-III satellite image.

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INTRODUCTION

Ground water condition is the last component of the hydrologic cycle to realize the benefits of remote sensing. Ground water experts have been late to embrace satellite data for an obvious purpose :ground water lies in the subsurface, and current air- and satellite-based radar and radiometers can normally penetrate only a few centimetres into the ground. Previous remote sensing determinations that are applicable to groundwater systems are reviewed in this paper. Ways in which remote sensing can be more successfully used for future groundwater studies are suggested. The fast increasing human population, large scale changes in land use / land cover and growing development project and improper use of watersheds has all caused a substantial decline of natural resources of the country (Alaguraja P.et.al.(2010), Hemapriya R et.al. (2010). Remote Sensing (RS) and Geographic Information System (GIS) techniques are now providing new tools for advanced environment management. The collection of remotely sensed data helps the synoptic analyses of Earth - system function, patterning and change at local, regional and global scales over time such data also provide an important link between intensive, localized ecological research and regional, national and international conservation and management of natural diversity (Wilkie and Finn, 1996). Increasing population and modern industrial and agricultural activities are not only creating more demand for groundwater resources due to the inadequate availability of surface water resources but are also polluting groundwater resources by releasing untreated wastes. Consequently, these activities have resulted in an increase of research, not only with regard to groundwater resources, but also with an emphasis on locating groundwater of good quality for human consumption (Magesh N.S. et. al. 2011 and Mondal N.C. et. al. 2010). Geomorphological mapping and necessary supporting data are crucial to developing countries that are usually under severe environmental and demographic strains. Approaches and methods to map the variability of natural resources are important tools to properly guide spatial planning. In this paper a comprehensive and flexible new geomorphologic combination legend that expands the possibilities of current geomorphologic mapping concepts. The structural control could be active structures whose form is directly impressed on the modern landscape or ancient structural features whose influence on a modern landscape is primarily due to differential erosion. (Khadri s. f. r et. al. 2013 and Khadri, S. F. R. and Chaitanya B. Pande 2014) Now, new trends have emerged that integrate field work with modern technologies such as GIS, GPS, remote sensing and elevation models, which further strengthens the study of relationship between the land-forms and the processes that created them. Geomorphologic studies were carried out through detailed remote sensing analysis and detailed geomorphologic of the study area with the aim to establish the elevation or geomorphic parameters to those of watershed management Morphometric analysis of the Mahesh river basin was used Remote Sensing and GIS technology. In this paper the geomorphological map of the Mahesh river basin in Akola and Buldhana district is presented. The map is the result of the interaction of different datasets, both traditional and innovative in geomorphology.

Study area:

The Mahesh River basin is situated in Akola and Buldhana Districts of Maharashtra which is located between 20°40' 36” N latitude and 76° 46'11'' E longitude covered by survey of India Toposheets no 55 D/10 and 55 D/14, 55D/7, 55D/11 on 1:50,000 scale. The area of investigation is characterized by the presence of Deccan Trap lava flows with minor occurrence of alluvial zone. Soils in the area are basically derived from basaltic lava flows and alluvial deposits. The soils in the vicinity of part of Purna River are generally deep black to dark brownish grey in colour with calcareous concretions. Land use / Land cover: vegetations and manmade features and omits bare rocks and water. In the study area agriculture is the main land use. Other than the agriculture the area comprises of wasteland, forest land, water bodies and built up areas.

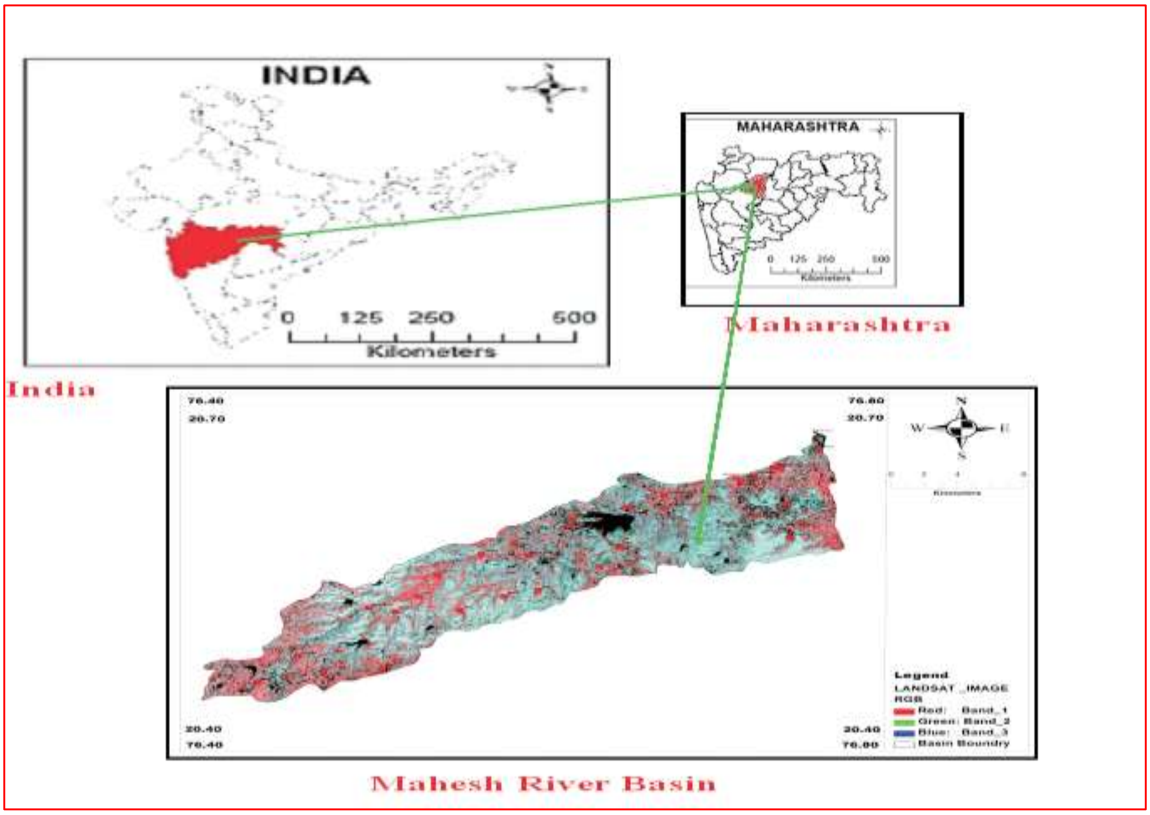


Fig. 1: Location map of Mahesh River Basin

Material and Methods:

The method was used in this study for natural resource mapping geo-environment management and watershed management combined in GIS and remote sensing mapping techniques to association basin features. The study of geomorphological and environmental changes involved a series of different stages study of field-work, observation and direct digitizing on the basis of satellite images (Landsat, LISS 3), topographic Sheet (SOI scale 1:50,000) and geological map (GSI. scale: 1:2, 50,000). All primary data were imported in a Geographical Information System in the Arc GIS environment. Thus a GIS database was developed and updated with data deriving from different sources. Data were analysed quantitative and qualitative, while different aged thematic maps were created. The geomorphological alterations were studied through photo interpretation of satellite image. The stream network map for the study area was scanned from Survey of India (SOI) toposheets and digitized in Arc GIS 10.3 software with the reference of satellite image. Stream network study through the survey of India toposheets at the scale of 1:50,000 and satellite image. The land use land cover mapping, soil mapping and geomorphic maps of the area have been prepared using the above data on a scale 1:50,000. In general fieldwork was carried out for ground checks and verifications of the geological, structural and geomorphicstructures interpreted by the remote sensing data and GIS software.

Result and Discussion:

Geology:

The northern part of the Mahesh River basin is characterized by presence of alluvial deposit and southern part is covered by Deccan trap ,the alluvium deposit belongs to quaternary age and can be broadly divided into older and younger alluvium and it shows graded pattern, the older clay silt and coarse sand grading upward into fine sand silt and clay and unconformably overlies the basaltic lava flows, whereas the younger alluvium consists of fine sand silt and clay deposits with few lenses of pebble beds in between. The alluvial deposits in the area are basically derived from the disintegration and decomposition of the basaltic rocks and are classified into two broad groups. The vesicular and amygdaloidal basalt containing weathered and jointed horizon indicating potential aquifers. The thickness of flows varies from few feet to more than 30 meters, showing both simple and compound nature. They are Atali, Lokhanda and Amdapur Formations.

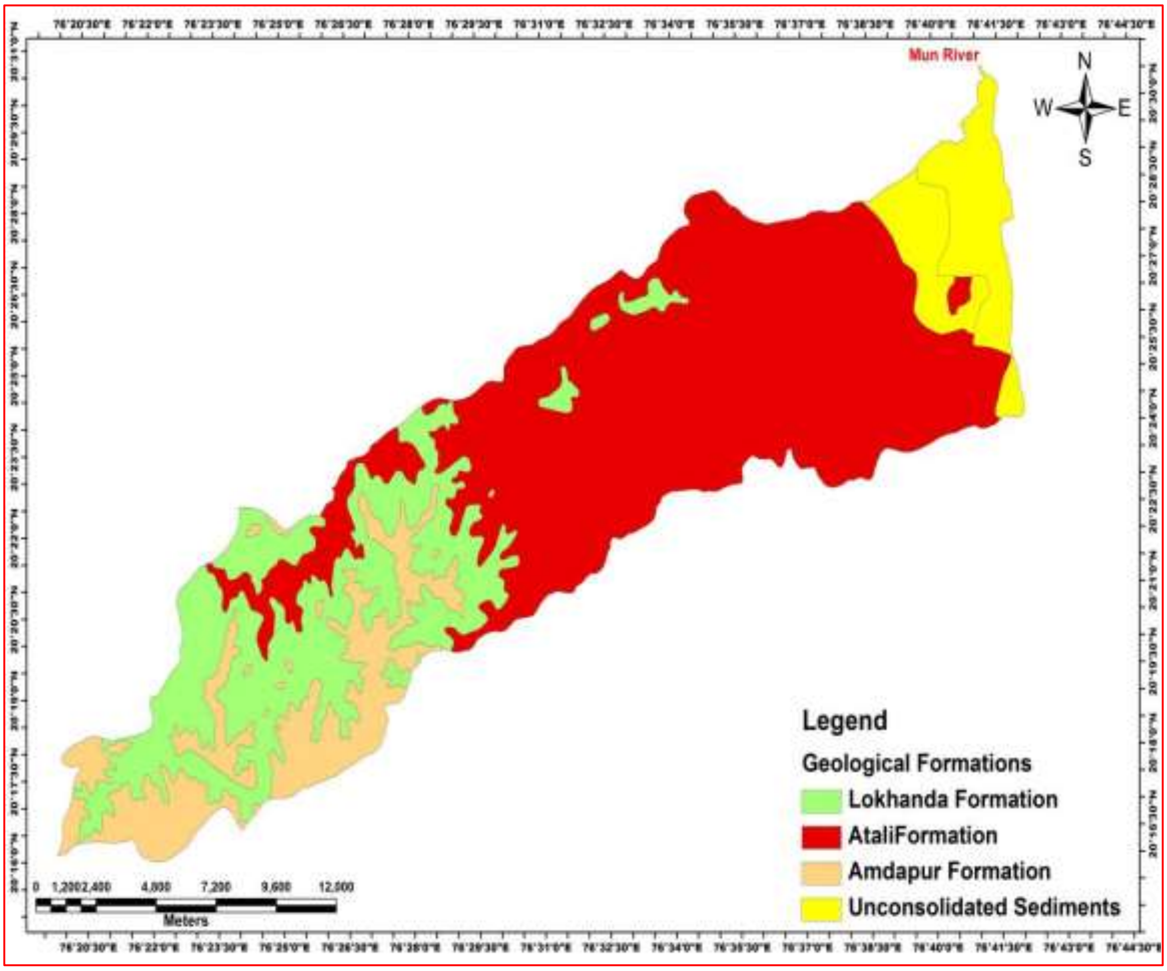


Fig. 2 Geological map of Mahesh River Basin

Soil Depth

The depth of the soil is of vital importance for plant growth. Cultivation, soil utilization, results in important and often dramatic changes in profile conditions. Soil depth defines the root space and the volume of soil from where the plants fulfil their water and nutrient demands. Depth is measured from the soil surface. The depth to a horizon or layer boundary commonly differs within short distances, even within a pedon. The variation in the depths of the boundaries is recorded in the description of the horizon or layer.

Table: Soil Depth Classes of Mahesh River Basin

Soil Depth(cm)m)	Series
<10	Extremely shallow
10-25	Very shallow
25-50	Shallow
50-75	Moderately shallow
75-100	Mod. Deep
100-150	Deep
150+	Very deep

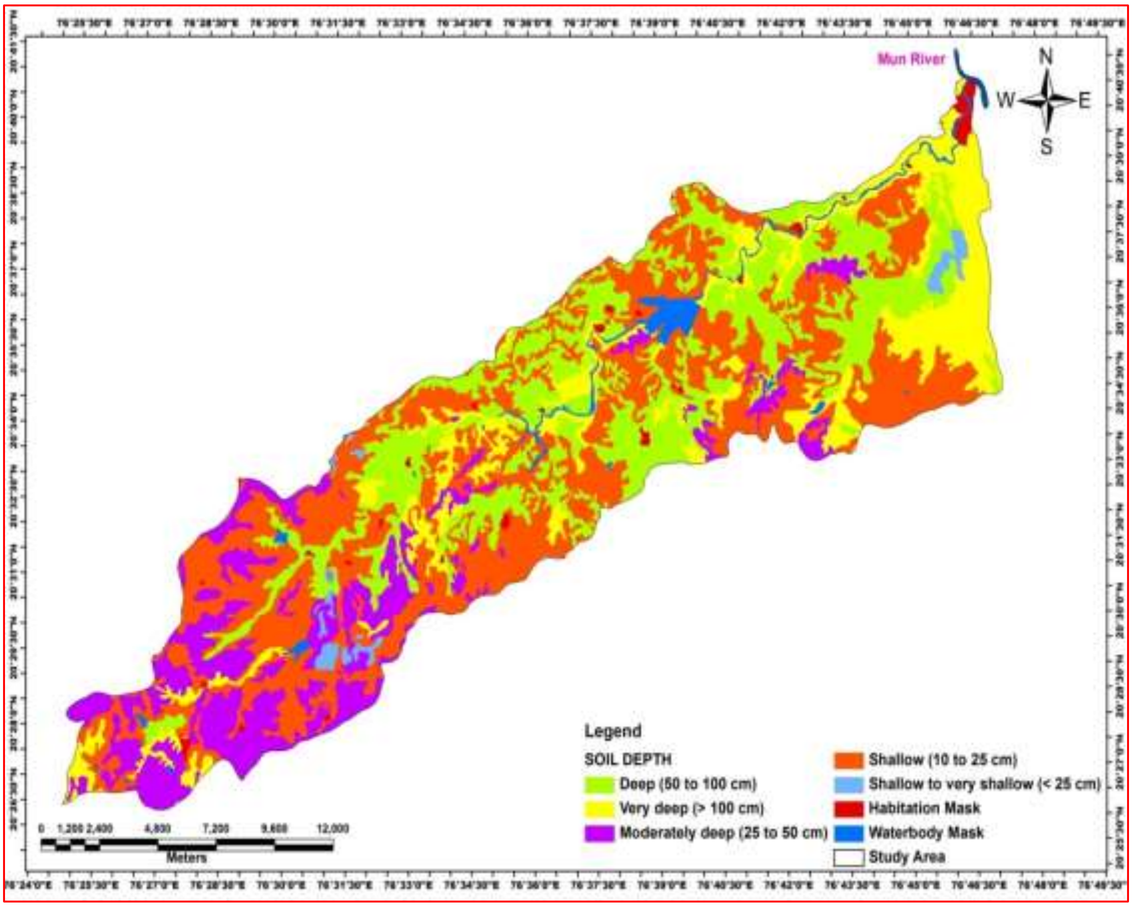
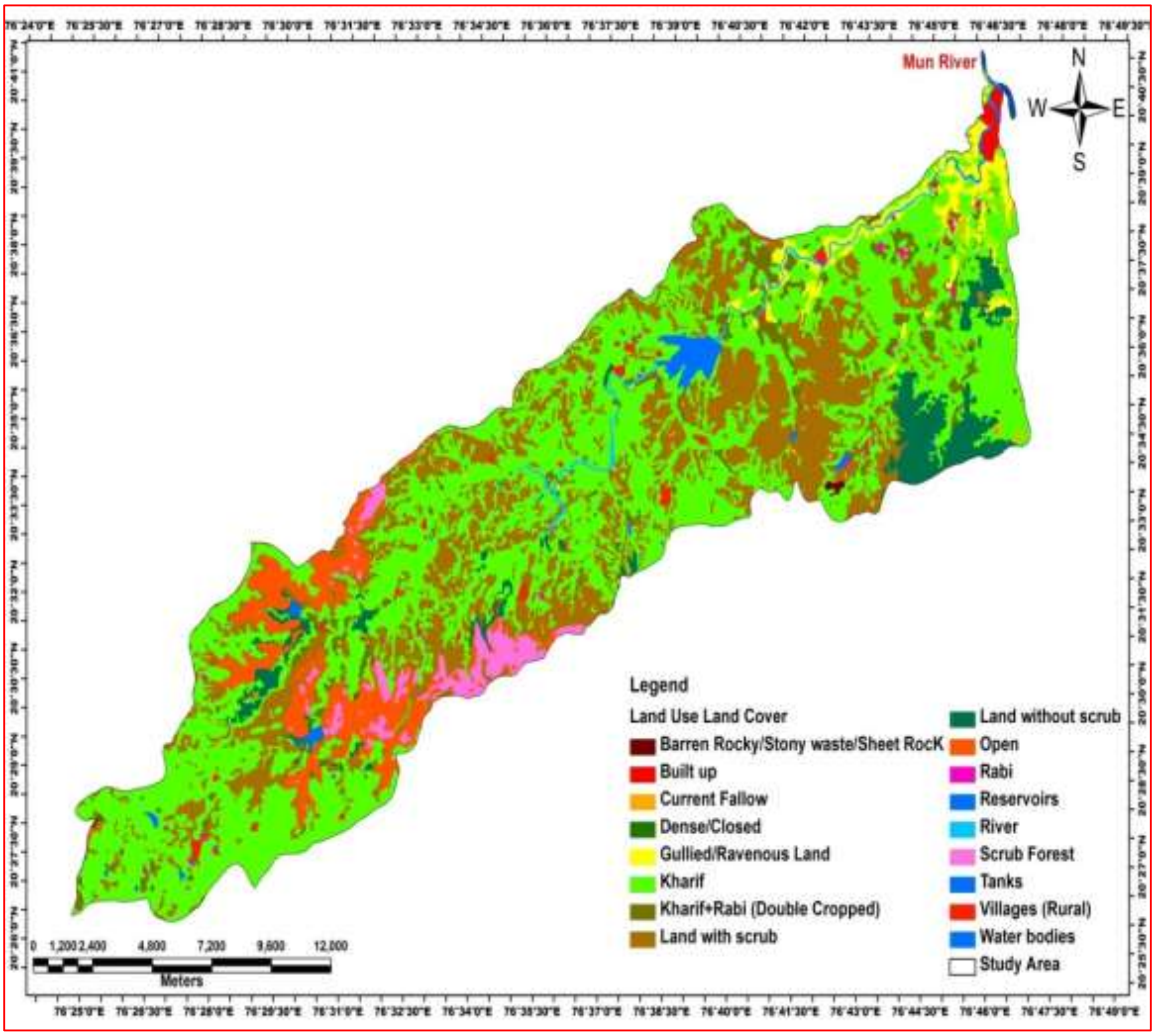


Fig. 3: Soil Depth map of Mahesh River Basin

Land use/Land covers:

Land use and land cover is an important component to understand global land status; it shows present as well as past status of the earth surface. Land use and land cover are two separate terminologies which are often used interchangeably. Land cover is a basic parameter which evaluates the content of earth surface as an important factor that affects the condition and functioning of the ecosystem. Land cover is a biophysical state of the Earth surface, which can be used to estimate the interaction of biodiversity with the surrounding environment. Nowadays, land use land cover analysis plays an important role in the field of environmental science and natural resource management. Land use/land cover (LULC) changes are major issues of global environment change.On the basis of remotely sensed data, the Mahesh River Basin is divided into five major land use categories: (i) Land under forest (ii) Waste land (iii) Agriculture land (iv) Built-up land (v) Water body (Fig.3).



Land use/land cover statistics generated using remote sensing techniques for the Mahesh River Basin.

Fig. 4: Land Use Land Cover map of Mahesh River Basin

Geomorphology:

The characteristics feature of Maharashtra lies in the fact that some 80 present of its area is covered by the younger basaltic volcanic rocks is horizontal or near horizontal layers burying beneath it the older rock striate that are several rock hundred million years old. Consequently the topography that dominates Maharashtra is related to erosion mainly by fluvial process acting over the Deccan basalt layers. There distinct levels of plateaus occur at high and low levels corresponding to elevation of 270m to 590m. The Satellite imagery is visually interpreted into geomorphic units/ landforms based on image elements such as tone, texture, shape, size, location and association, physiography, genesis of landforms, nature of rocks/ sediments, and associated geological structures. The topographic information in SOI top maps aids in interpreting satellite imagery. Three major geomorphic units – hills and plateaus, piedmont zones, and plains- based on physiography and relief. Within each zone different geomorphic units are mapped based on landform characteristics, their areal extent, depth of weathering, thickness of deposition etc.

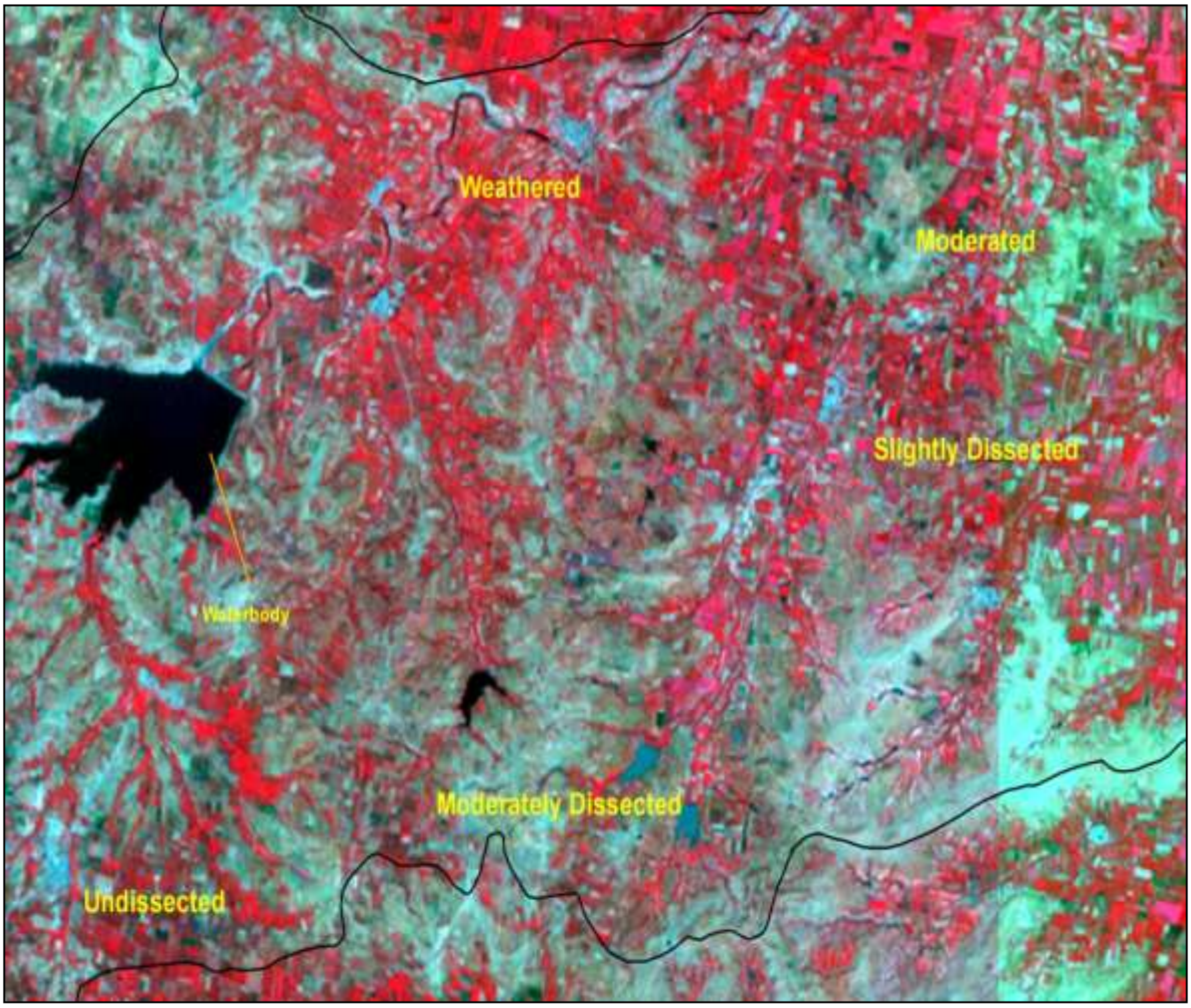


Fig. 3.3: LISS-III Satellite image showing Moderately Dissected and other landform of Mahesh River Basin

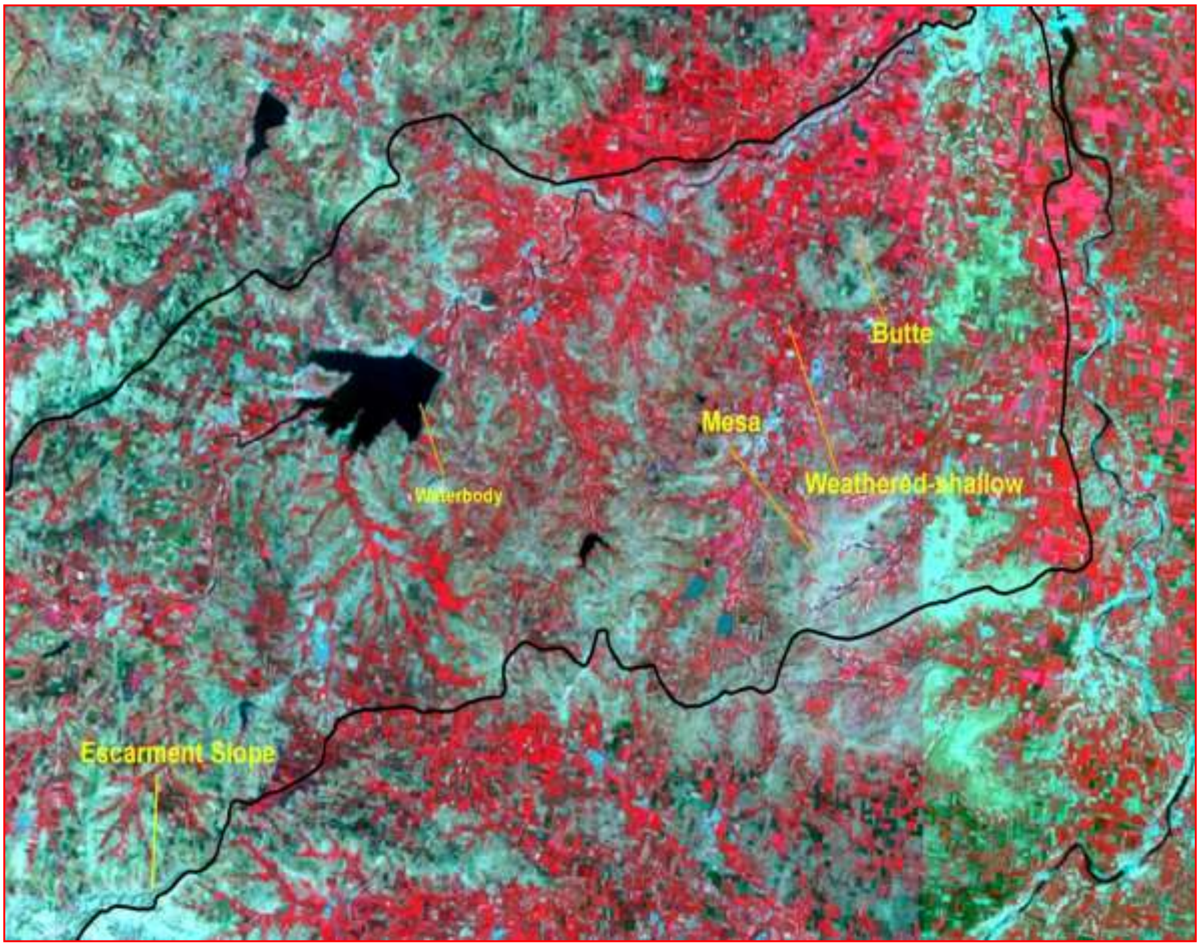


Fig. 3.4: LISS-III Satellite image showing Mesa, Butte or other landform of Mahesh River Basin

Conclusion:

Groundwater identification database needs a big volume of data from many sources. As establishedeffectively in this area that combined remote sensing and GIS techniques can afford the suitable platform for convergent analysis of large volume of multidisciplinary data and decision making for groundwater studies. LISS-III satellite imageries capture geo-environmental management information such as geology, geomorphology and land use land cover will be useful in meaningful the ground water recharge potentiality of different geomorphic landform and land use land cover mapping. In the present area has an integrated remote sensing and GIS established methodology has developed and established for evaluation of groundwater resources management. GIS and remote sensing applications have proved to be indispensable tools in decision making in the case of problem involving soil and water conservation site because of the enormity of spatial data involved. In this present study, illustration of how we can benefit from remote sensing and GIS technologies in watershed management, development and planning. Watershed management is the process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that affect the plant, physical, and socialpublics within a watershed boundary.

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