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Research Paper

Monitoring and Modeling of Baghin River Basin part of Uttar Pradesh Using Remote Sensing and GIS Techniques

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Abstract: The study of satellite images topographic maps supported by ground truth survey revealed that the study has a network of interlinked subsurface fractures. In according with the nature, potential and problem with the bet amount of interference, watershed management approach is aimed to make entire development. For surface water resources and ground water resources, the proper evaluation of water potential helps in additional exploration at optional level. The river basin objective of watershed management involves geological, hydrological consideration and economic, political, financial aspect. For the formulize of proper management program, a reliable and up to date information about various factor, viz. size and shape of river basin, topography, soil, slope, elevation and their characteristics, land use/land cover, drainage parameters etc. are required. To obtain a synoptic view of respective coverage, Remote sensing and GIS techniques provide a powerful input media, unbiased reproduction of the natural features in the form of photography/ imagery and their by economizing the process of multi-disiplinary approach for planning and decision of land and water resource in a watershed for integrated development. Resource information system is makes in a stabile GIS environment for the selected area. In this system evolves a subsistence plan for optimum development of the water resources and for finding solutions for different management problem related to natural resources.

Keywords: Remote Sensing, GIS, GPS, DEM, Land use, Modeling, Water resources, Slope.

Introduction

Recently there has been overall development in various fields such a agriculture, industry and urbanization in the Asian countries particularly in India. This has lead to increase in the demand of water supply which I met mostly from exploration of ground water resources. In hard-rock semi-arid terrain that occupies almost two-third of India, ground water is the largest fresh water resource. The purpose of present study search to the probable sites of buried and abandoned channels in the inter-drainage areas to provide a complete hydrogeomorphological picture of the area. For a proper visualization and study the influence of subsurface configuration and its effect on the geological and hydrogeological status of the area, a three dimensional picture is essential. The use of spatial analysis, DEM for 3D visualization and terrain draping, slope map, thematic map overlays can be very helpful in the interpretation of remote sensing data. Since, most of the geological features extend deep down into the Earth, as well as across it, the three dimensional spatial nature of geological features needs special attention. The subsurface morphology of the basin and the tectonics are the factors, which influenced the sedimentation pattern and guided, the channels of Yamuna river system.

Water in the basin arrives in the form of precipitation a part of the hydrologic cycle. Some precipitation returns to the atmosphere, having been intercepted by vegetation and evaporated from the surface of level and branches. More is lost to evaporation from the ground surface and transpiration by plants. In arid and Simi-arid climates all of the precipitation may be consumed in this way of the most way of the time, basin run-off occurs only occasionally, following intense storms. Where precipitation exceeded losses to evapo-transpiration, the excess water makes it way through the drainage systems. However, water may be stored in lakes, soils and as ground water to considerable periods before it eventually arrives at the outlet, or basin channels, as basin run-off.

Remote sensing provides land resource data in the form of digital magnetic types and in different bands of the electromagnetic spectrum. Availability of such a data in different bands makes it very useful for delineation of land use/land cover classes distinctly. Land use/land cover mapping both by visual interpretation and digital analysis is possible by satellite remote sensing techniques. The land use / land cover categories can be expanded or reduced to any degree and be made more responsive to the information the user needs. In order to secure uniformity for the whole country a master land use/land cover classification system must be adopted after very careful consideration of all the factors drawn up. The classification system facilitates the planners and researchers to study the spatial difference and distinction between various lands are types, from multi temporal satellite data.

Study Area

The Study area Bundelkhand Region in Chitrakoot and Banda districts. The Baghin River flow with in two state viz. Madhya Pradesh and Uttar Pradesh. The study area is confined to latitude 24°58' N to 25°33' N and longitude 80°17' E to 81°02' E (Survey of India Toposheet No 63C/8, 63C/11, 63C/12, 63C/14, 63C/15, 63C/16, 63D/5, and 63G/2, 63G/3) in the part of Uttar Pradesh, India. (Figure 1).

Material and Method:

The data acquired for the present study comprised topographic map and satellite imagery details. For mapping the extent of the Baghin river basin part of Uttar Pradesh as it stood at the 1971 level, Survey of India Topographic map 63C/8, 63C/11, 63C/12, 63C/14, 63C/15, 63C/16, 63D/5, and 63G/2, 63G/3 was used. Modis, Landset and SRTM data made freely available under NASA sponsored Global Land Cover Facility (GLCF). For Modis and Landset satellite data was used to land use and land cover mapping and SRTM 90 Meter Digital Elevation Model (DEM) data was used slope map. The available FCCs are combination of bands 742(Band 7: 2.08-3.35 μm ; Band 4: 0.76-0.90 μm ; Band 2: 0.52-0.60 μm).

The topographic map of Baghin River basin on 1:50,000 scales was georeferenced using Erdas Software. The extent of the urban area of Baghin River basin as it stood in 1971 was Vectorized from the survey of India topographic map, Cultural features viz., roads and drainage were also vectorized. Various Classifications of the Modis and Land set Satellite data, in conjunction with comprising of several units field checks in the core and fringe areas, provide the basic for identification and delineation of basin areas. For delineation of Land use / Land cover Mapping used Modis and Land set Satellite data were enhanced in different ways using Erdas Software. All images were Georeferenced using coordinate of well established GCPs from the survey of India toposheets on scale of 1:250,000 and 1:50,000.

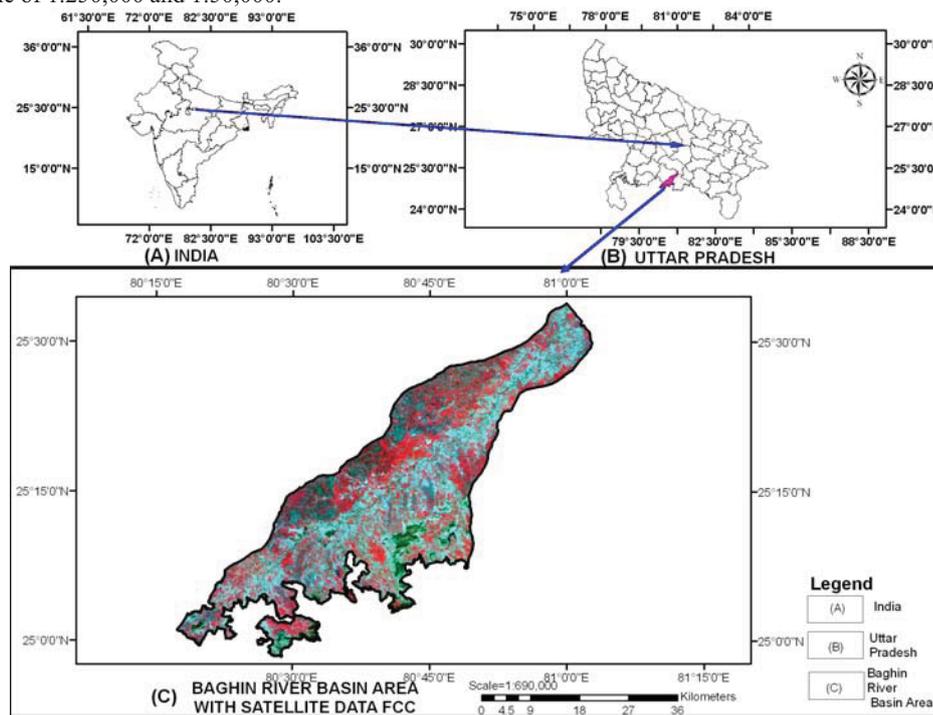


Figure 1: Location map of the Baghin River Basin Part of Uttar Pradesh, India

The purpose of classification was aimed at identification of the geomorphological, river meandering, urban and rural structure and its evolution rather than mapping of typical land use/ land cover classes, slope, Elevation of basin area and watershed management. Visual interpretation techniques of satellite data were used to interpret and delineate the land use classes. Due consideration was given to delineate the broader levels of land use areas within the Baghin River Basin part of Uttar Pradesh. For classification of land cover, ground data collection was considered an essential exercise, where by relationships between different ground features and their corresponding spectral signature was established. A handheld GPS receiver was used for determining the location of different land cover classes in the field and relating these with pixel clusters in image to identify their spectral characteristics. In addition to relating spectral signatures with land use type, ground data collected through field surveys provided the basic for determination of accuracy of manual classification and identification of empirical relationships between surface properties and satellite observations. Hence, the collection of an unbiased data set for ground information was imperative for successful image classification and interpretation.

Geomorphology:

Regional and local geomorphology is well depicted in satellite images. False colour composites of the original bands and principal component images have been used for the interpretation of the geomorphic features. Geomorphic features and structural details from Satellite images were interpreted for identifying ground water and facilitated the location of recharge zones and ground water conditions. Various geomorphic features have been identified in the image using remote sensing keys. The area has been divided into major geomorphic units with their associated landforms.

1. Stable alluvial remnants with dense vegetation.
2. Ravinous tract along Baghin River and its tributaries
3. Low structural-cum-denudational hills.

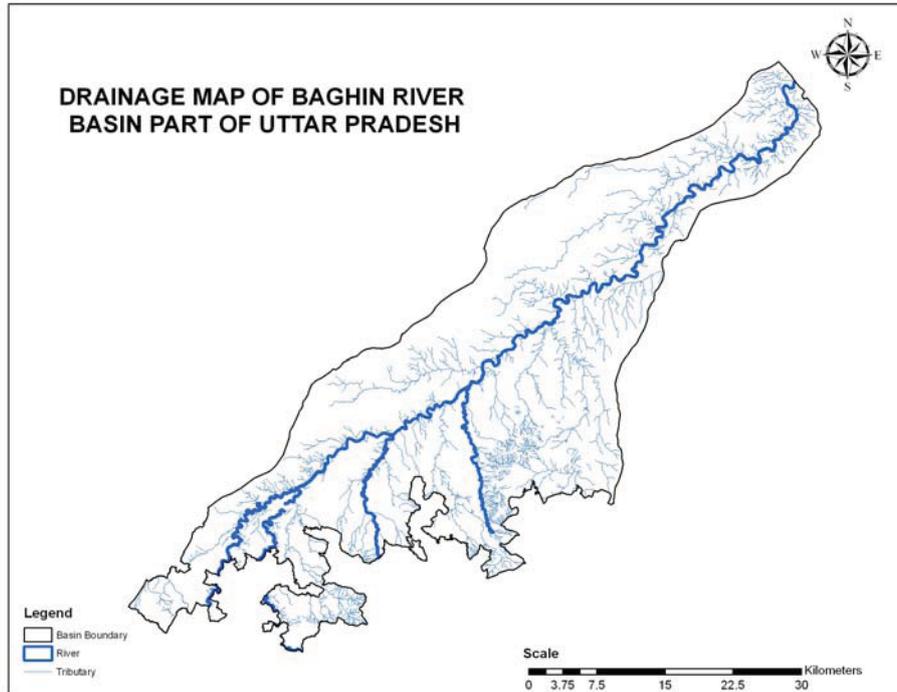


Figure 2a: Drainage map of baghin river basin part of Utter Pradesh

Drainage:

Baghin River is the main river with complete drainage system, draining there water to the whole area and responsible for agro-economic growth, biodiversity, habitation and livelihood. This drainage system is expressive for river basin and watershed management. The drainage system is formed with different streams and streamlets (Figure 2a, b).

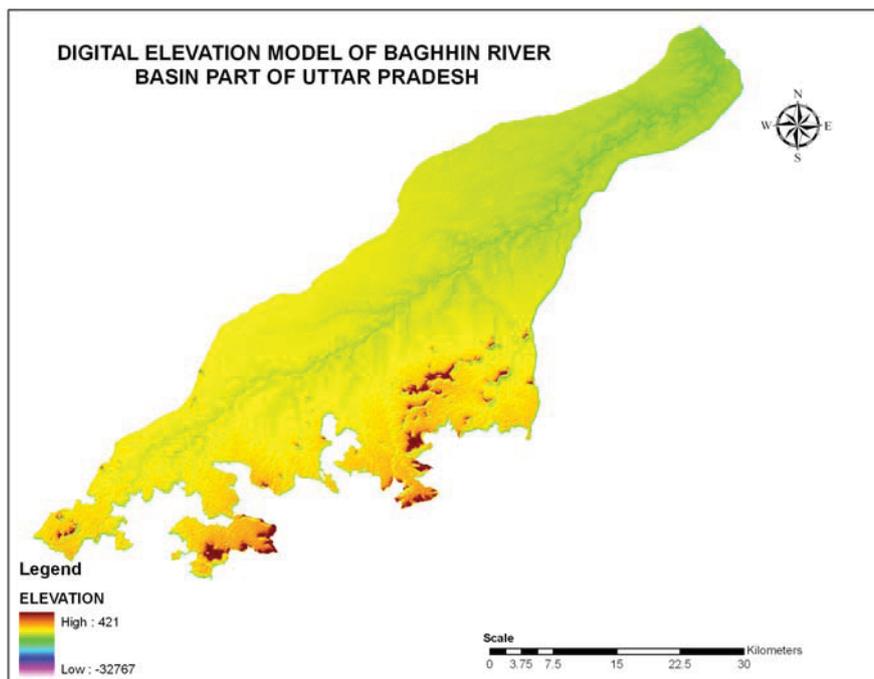


Figure 2b: Digital Elevation model of baghin river basin part of Utter Pradesh, India

Soil:

Soil is a natural body consisting of layers of mineral constituents of variable thicknesses, which differ from the parent materials in their morphological, physical, chemical, and mineralogical characteristics. Strictly speaking, soil is the depth of regolith that influence and have been influenced by plant roots. There are four types of soils in the area namely- (i) Clay Lome (ii) Loamy (iii) Silty Loam (iv) Exposed Rocks (Figure 3).

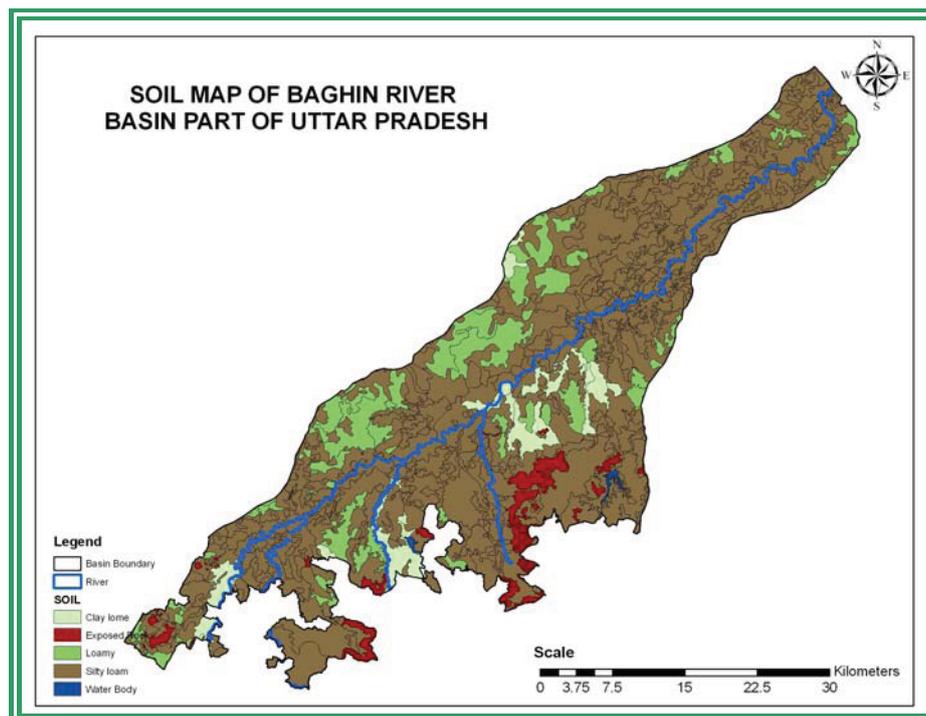


Figure 3: Soil map of Baghin River Basin Part of Uttar Pradesh

Result and Conclusion:

For the Basin planning and management, land use/land cover, drainage and slope map is used as a base map. It provides an idea about the nature of rocks, present in the area, porousness and permeability of the material present in the area. DEM and slope are also responsible for the formulation of streams and streamlets. These form a complete drainage system which provides an expressive role in agriculture, rural and urban areas development of basin. The Baghin river basin a complete drainage system is found, 1st order to the main river. The drainage pattern of the area is dendritic and drainage texture of the study area is medium. The inter related nature of land and water resource calls for a holistic approach toward for urban and rural areas development and watershed management. While formulating proper development programmes, some of trustworthy quality and up to date information are required viz. size and shape of river, topography, land use/land cover, soil and drainage parameters. All these parameters to predict the behavior of river basin. Remote Sensing & GIS has a capability to obtain a synoptic view of area. This technology used effectively and economically in analysis and inventory, for basin area development and management. In this investigation can be integrated into Baghin river basin area management plan aimed at improving the life style of humans and protecting the natural environment.

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