Natural Resource Database Generation for Parts of Raebareli, Districts of UP

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Abstract- *The financial advancement of any nation depends ashore assets and water assets. Because of increment in populace, these assets are over extended regularly prompting asset exhaustion. There is consequently need to wisely deal with these fragile assets. Remote Sensing and GIS systems can be connected compelling measure to produce information and data for reasonable advancement. After more than a quarter century of satellite-based land remote detecting experimentation and advancement, these innovations achieved all areas of Earth science application. The utilization of remote detecting information and subsidiary data has ever guarantee of going into standard of representing at neighbourhood and territorial level. The article identifies the mapping and administration of normal asset utilizing Remote Sensing and GIS Techniques. Remote detecting is the science (and to some degree, workmanship) of gaining data about the Earth's surface without really being in contact with it. This is finished by detecting and recording reflected or produced vitality and handling, breaking down, and applying that data. In other hand, A geographic data framework (GIS) catches, stores, investigations, oversees, and shows information, which is connected to areas or having spatial conveyance. Guarantee Data utilized for GIS investigation topographic guide, cadastral guide geography guide, soil and vegetation outline, delineate. Consequently, paper exhibits a diagram of the GIS and remote detecting applications in common assets administration in India and the data were taken from optional sources.*

Keywords- Remote Sensing, GIS, Natural Resource, Database, Geomorphology

I. INTRODUCTION

The evolution of Information and Communication Technologies (ICTs) in India has created a technological divide between the haves and have-nots. As many of India's companies and well educated enjoy the benefits of the ICTs, these technologies are still not accessible or affordable for the majority of the population. The divide is exacerbated by the deeply ingrained disparities of gender and social class, which determine who can or cannot use technology. Despite recent deregulation and decentralization within India since the 1990s, which has strengthened the voice of the poor and role of the NGOs; there remains wide spread poverty. Developments of initiatives, especially in rural areas, are hampered by weakness in technological infrastructure, language barriers and a lack of suitable content and applications in local languages. The ICTs in rural areas can create an important knowledge base and can best be used to further development in India and elsewhere in the world. Natural Resources - Resources occurring in nature that can be used to create wealth. Examples include oil, coal, water, and land called natural resources [1-6].

Natural resource database will be generated on 1:12,500 scales for the four block/taluk of Raebareli Dist, U.P. namely Lalganj, Raebaeli, Tiloi, and Unchahar. The geographical location of the study area is latitude 25°49'N and 26°36'N and longitude 80°41'E and 81°34'E. In this study, Individual layers will be prepared on map showing ground water prospects/recharge, suggestive measures for agriculture and water resources (arrived at by integrating peoples aspirations understood through Participatory Rural Appraisal - PRA) will also be provided. thematic maps will be generated using IRS LISS III and LISS IV data. All the layers along with other information will be part of the GIS database of particular taluk/block.

II. STUDY AREA

The present study has been carried for four VRCs established Raebareli town, Unchahar, Lalganj and Jayas area of Raebareli district in Uttar Pradesh. The district is irregular in shape but fairly compact. It forms a part of the Lucknow division and lies between latitude 25°49'N and 26°36'N and longitude 80°41'E and 81°34'E. The district has an area of 1748 km². The general aspect of the district is slightly undulating, and the country is beautifully wooded. The Raebareli district is divided into 7 different taluks namely: Raebareli, Tiloi, Maharajganj, Lalganj, Unchahar

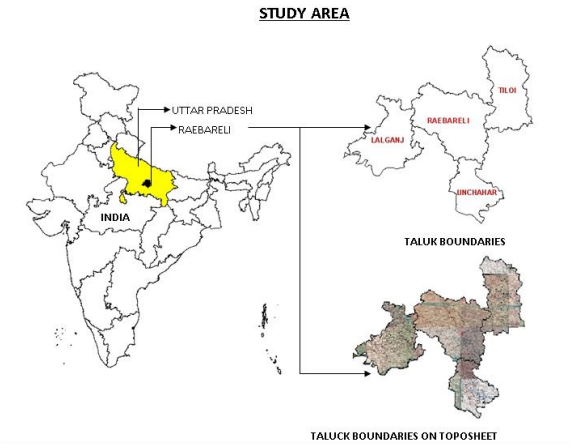

Figure 1. Study Area

The district forms a part of the Gangetic plan, which is of recent origin according to geological chronology and belongs to Gangetic alluvium. The district being a part of the alluvial plain, conform to the same geological sequence as the plain itself. The district, as a whole, is fairly compact tract of gently undulating land. The elevation varies from about 120.4 m above sea level (MSL) in the north-west to 86.9 m MSL in the extreme south east, on the banks of the Ganga. The district is drained by the Ganga, the Sai and their tributaries although some of them join the main stream after passing the confines of the district. As stated earlier this district lies in the vast Gangetic plains of north India at an elevation of 100 to 120m, sloping gently to south east. Relief from the summer heat arrives with the monsoon in second half of June, though the weather may often remain sultry. The winter sets in November and last up to February, generally (Figure.1).

III. MATERIALS AND METHODS

In the last three decades, hundreds of satellites are put into orbit and all of these satellites have specific role to play, i.e. each satellite data products have its own applications. Depending upon their temporal, radiometric and spatial resolutions it is necessary to choose a correct data type to carry out the desired work. Some data products are useful in land use/ land cover studies; some are useful in water resource application etc. In the present study, IRS-P6 LISS-3, LISS-4 and Cartosat PAN Nadir data products have been used to derive various theme maps. Information regarding the corresponding satellite systems has also been elucidate.

a) Remote Sensing Data

Remote Sensing data have been analyzed for preparing various natural resource databases. Initially, various data products have been digitally geo-referenced. Then, the enhanced images have been interpreted or digitally classified in conjunction with the existing maps, Survey of India (SOI) topographical maps and field surveys. The interpreted maps have been digitized in the GIS environment and the database on the following themes is prepared: drainage, land use/ land cover, geology, geomorphology and ground water prospects, etc. Other information e.g., watershed, well locations, transport network, total population and literacy have been derived from ancillary sources. Table 3.1 shows Indian Remote Sensing Satellite IRS-P6 Linear Imaging Self-Scanning Sensor (LISS III-IV) Data and Cartosat data products used in the study: The human resources information have been drawn from census maps and census data. Some of the information has also been drawn from web resources.

Table 1. Satellite data products used in the study

Satellite	Sensor	Path	Row	Date of Pass
IRS-P6	LISS IV	102	44	03 February 06
IRS-P6	LISS IV	102	45	03 February 06
IRS-P6	LISS IV	102	47	03 February 06
IRS-P6	LISS IV	102	52	07 April 05
IRS-P6	LISS IV	102	56	10 January 06
IRS-P6	LISS IV	202	53	05 January 05
IRS-P6	LISS III	100	53	04 March 06
IRS	LISS III	101	53	28 January 06
IRS-P5	CARTOSAT	548	276	06 February 07
IRS-P5	CARTOSAT	549	276	17 February 07
IRS-P5	CARTOSAT	547	276	26 February 06
IRS-P5	CARTOSAT	549	277	04 February 06
IRS-P5	CARTOSAT	550	276	24 January 06

b) Ancillary Data

Following ancillary data have been used in the present study:

- Natural Resource Information System (NRIS) data from Remote Sensing Application Centre, Lucknow, UP
- Survey of India (SOI) Topographical maps at Scale 1:50,000 used in the study have been shown in table 2.

Table 2. Topographical sheets used in the study

63B/12	63F/11	63F/08	63F/06
63B/03	63B/15	63G/01	63F/10
63F/07	63F/04	63B/16	63G/05

c) Satellite Data Processing

The methodology encompasses the activities starting from collection of the spatial and non- spatial data, scanning paper maps, putting that in a common reference system for seamless mosaic, digitizing error elimination, assigning ids or codes and names, non-spatial data standardization and computation, spatial and non-spatial data integration, accuracy and quality check, and finally the report generation. The overall methodology adopted for the study is depicted in fig.1.

d) Digital Image Processing

Digital image processing is a technique for analysis by manipulation of the various digital numbers in the image by the computer. As the term implies, digital image processing is not only a step in the remote sensing process, but is itself a process, which consist of several steps. The ultimate goal of digital image processing is to extract information from an image that is not readily apparent or is not available in its original form. There are three general steps in processing a digital image: pre-processing, enhancement, and information. (Jenson, 1996)

e) Pre-processing

Before digital images can be an analyzed, they usually require some degree of pre-processing. This may involve radiometric correction. Which attempt to remove the effects of sensor errors and / or environmental factors. Geometric correction is also very common prior to any image analysis. Geometric rectification is the process by which points in an image element in their proper planemetric (X and Y) positions. In the present study, following reference system has been used: Projection-UTM, Spheroid-WGS 84, Datum-WGS 84, UTM: Zone 44, North.

f) Image rectification

The rectification process creates a new image in which the distortion has been removed with the help of the deformation model: The inverse deformation is calculated and applied. This is a very much time consuming task since every point must be recalculated.

g) Image Classification

The intent of the classification process is to categorize all pixels in a digital image into one of several land cover classes, or "themes". This categorized data may then be used to produce thematic maps of the land cover present in an image. Normally, multispectral data are used to perform the classification and, indeed, the spectral pattern present within the data for each pixel is used as the numerical basis for categorization [7-13]. The objective of image classification is to identify and portray, as a unique gray level (or colour), the features occurring in an image in terms of the object or type of land cover these features actually represent on the ground.

h) Natural Resource Database Generation

Natural resource database will be generated on 1:12,500 scales for the block/taluk wherein the VRC is located. Individual layers will be prepared on map showing ground water prospects/recharge, suggestive measures for agriculture and water resources (arrived at by integrating peoples aspirations understood through Participatory Rural Appraisal - PRA) will also be provided. The above said thematic maps will be generated using IRS LISS III and LISS IV data. Cadastral data will be georeferenced and it will be superimposed with the above layers to enable survey number wise queries (figure. 2).

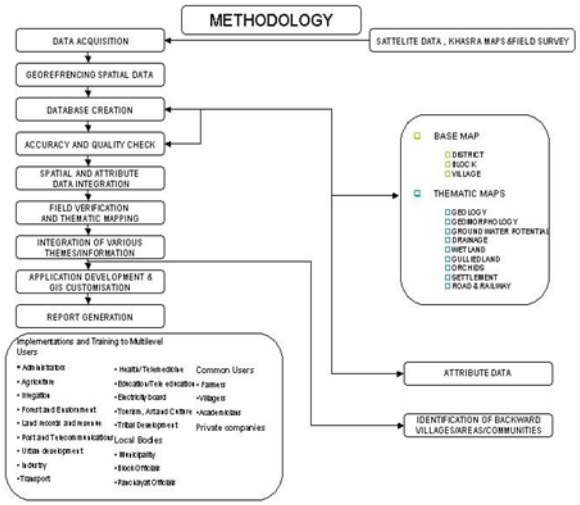

Figure 2. Methodology Adopted

With the comprehensive databases on detailed scales extracted from high resolution satellite images, VRC will not only bring access to spatial information on various themes such as land use/land cover, soil, ground water prospects but also enable the farmers to get query based decision support. GIS databases comprising all thematic layers, cadastral boundaries, road network and drainage network will be created. A simple software package (indigenously developed) will be installed for accessing and querying the natural resource information and related advisories, which will enable farmers to get online decision support at cadastral levels.

i) E-governance services

Services such as governmental schemes on agriculture, poverty alleviation, rural employment, watershed

development, health, sanitation, social safety nets – food for work programme and other basic entitlements, animal husbandry and livestock related services, services related to Self Help Group (SHGs) etc, will also be made available at VRCs [13-21].

j) Ground Water Potential

The studies carried out during last two decade have proved that the satellite data is highly useful in carrying out ground water studies. Initially the coarse resolution data obtain from IRS P6 (LISS III) were used mainly for identifying and mapping the favorable zones for ground water exploration. Figure 2 shows the methodology followed for studying ground water potential.

IV. RESULTS AND DISCUSSION

a. Data Base

The database should be a key product and center of attention during the GIS development effort. Colourful graphic and hardcopy products such as maps may have a powerful visual impact and utility, but the real value of the GIS is determined by underlying data analytical functions, which allow data to be used to make decisions. Besides the spatial data, database should contain attribute information for spatial objects, data on cartographic characteristics such as scale, projection and symbology and appropriate links between tables. Database development ideally should involve the creation of several views and the special needs of different users. Careful structuring of the evolving database scheme can support these views (figure.3).

A database consists of data in many files. In order to access data from one or more files easily, it is necessary to have some kind of structure or organization. In GIS domain, there are number of different ways to organize the data in an information system. The choice of a particular spatial data structure is one of the important early decisions in designing a geographic information system. A database is a collection of non-redundant data, which can be shared by different application systems [22-29]. A database management system is software with one more users to work efficiently with the data. The essential components of the system must provide the means to define the contents of a database, insert new data, delete old data, ask about the database contents and modify the contents of the database. There are different kinds of database structure, which are commonly recognized as follows.

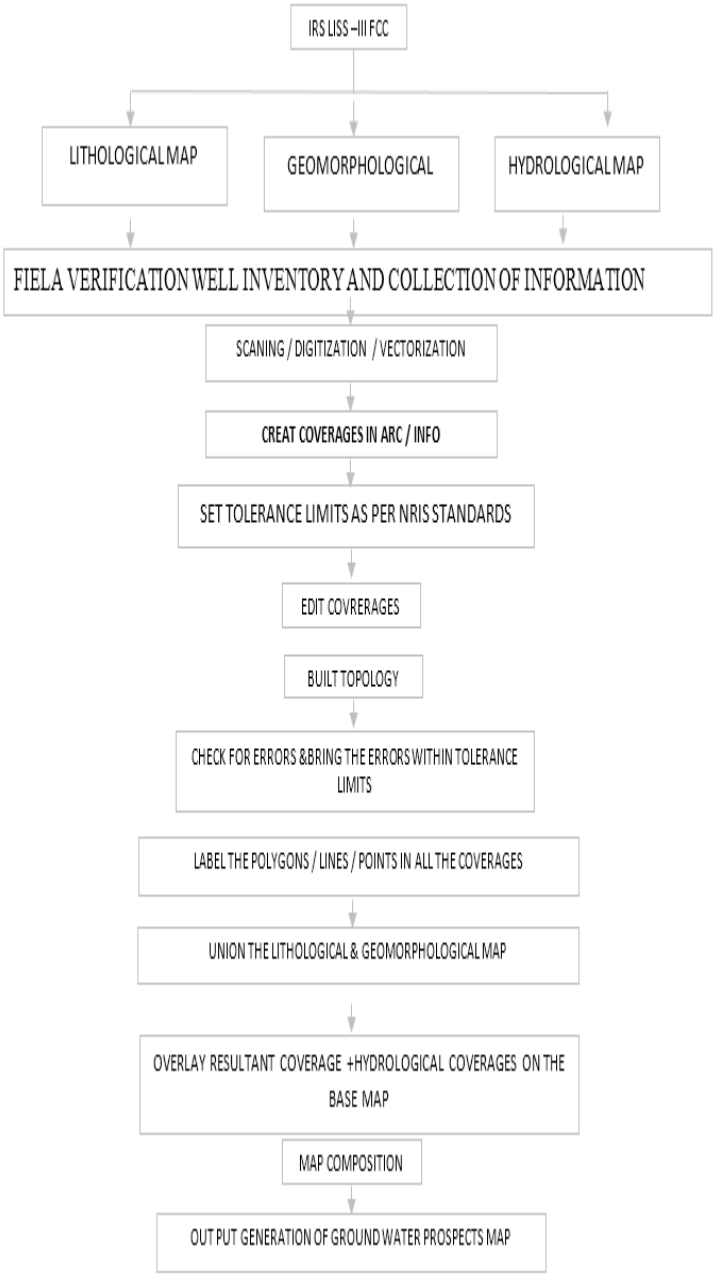

Figure 3. Methodology for preparing ground water prospects map

b. Spatial Database Creation

Spatial data have been captured in digital format on the themes such as topography, geology, soil, land use/land cover, transport network, revenue wards, cadastral boundary of corporation, well location and pond location etc [30-34]. The thematic layers are extracted from the LISS-IV data and Survey of India (SOI) topographical sheet of 1:50,000 scales.

c. Satellite Data of Raebareli District

Raebareli, Dist (Lalganj, Raebareli, Tiloi-Jayas, and Unchahar taluk) is selected as a study area. It forms a part of the Lucknow division. The geographical location of this area is latitude 25°49'N and 26°36'N and longitude 80°41'E and 81°34'E. The district has an area of 1748 km². The false colour composite data of IRS LISS-3 is shown in figure 4.

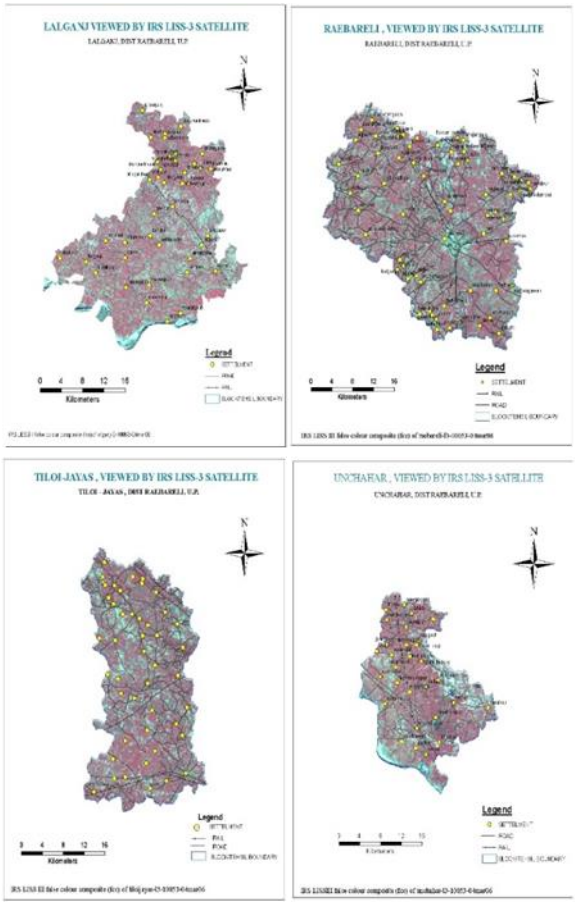

Figure 4. Raebareli viewed by IRS LISS-3 Satellite

d. USED DATA OF PART OF RAEBARELI (CARTOSAT-1 AND LISS – IV)

Part of Raebareli district viewed by IRS LISS-4 and Cartosat data are shown in figure. 5, 6 and 7.

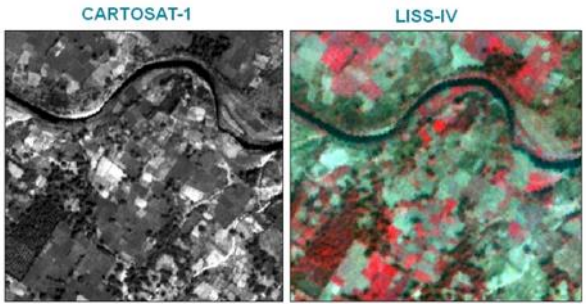

Figure 5. Raebareli viewed by CARTOSAT-1 and LISS – IV

Figure 6. Fused data of part of Raebareli (CARTOSAT-1 AND LISS – IV)

e. Water Body map of Raebareli District

The map below shows the canals present in the study area. The canal map has been prepared using IRS-P6 LISS IV image. The main canal is shown in dark blue colour, the branch canal is shown in blue colour, which is connected to the canal. Wetland is also shown in dark blue colour (figure.7).

f. Settlement and Transport Network Map of Raebareli, Uttar Pradesh

The below map shows transport network present in the study area. This is generated using IRS-P6 LISS IV imagery. The road networks are shown in red colour, which includes metalled national highways and district roads. The rail network is broadguage single track. The settlements are shown as a black colour points (figure.8).

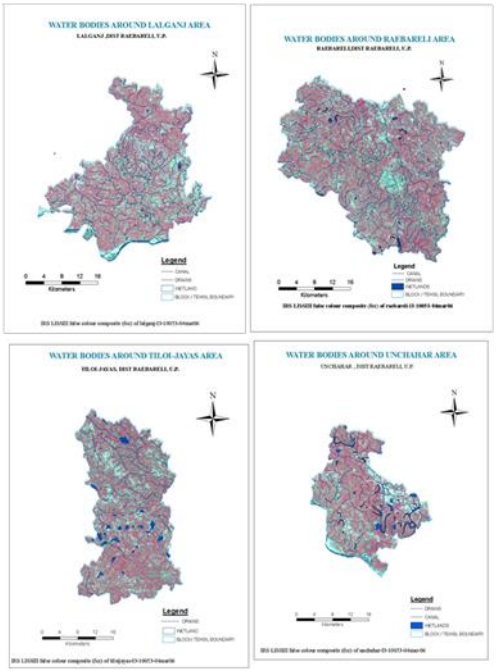

Figure 7. Water Bodies around Raebareli (U.P.)

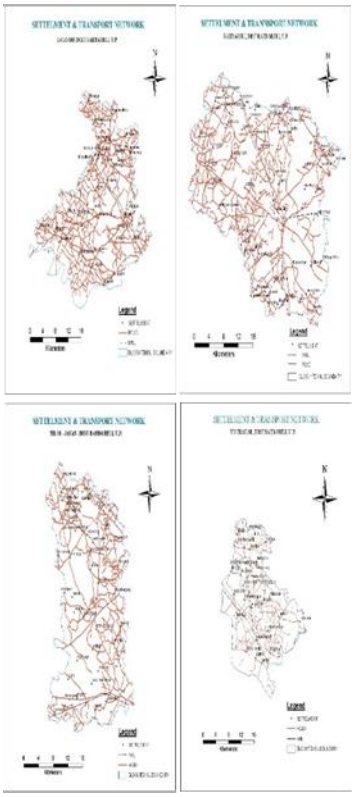

Figure 8. Transport network around Raebareli (U.P.)

g. Geomorphology of the Study Area

Geomorphology (from the Greek words Ge = earth, morfe = surface and logos = study) is the science of surface features and landforms including the forces and processes that create them. Geomorphology is the study of landforms, including their origin and evolution, and the processes that shape them. This is to understand landform history and dynamics, and predict future changes through a combination of field observation, physical experiment, and numerical modeling. Landforms evolve in response to a combination of natural and anthropogenic processes [35-38]. The landscape is built up through tectonic uplift and volcanism. Denudation occurs by erosion and mass wasting, which produces sediment that is transported and deposited elsewhere within the landscape or off the coast. Landscapes are also lowered by subsidence, either due to tectonics or physical changes in underlying sedimentary deposits. These processes are each influenced differently by climate, ecology, and human activity. Practical applications of geomorphology include landslide prediction and mitigation, river control and restoration, coastal protection, and assessing the presence of water on Mars.

On the basis of visual interpretation and digital enhancement techniques the following geomorphic units have been identified in the study area:

- Alluvial Plain
- Old Meander
- Paleo Channel
- Salt affected land
- Waterlogged Area

Alluvial Plain: An alluvial plain is a relatively flat and gently sloping landform found at the base of a range of hills or mountains, formed by the deposition of alluvial soil over a long period of time by a rivers coming from the mountains.

Old Meander: A meander is a bend in a river, also known as an oxbow loop. A stream or river flowing through a wide valley or flat plain will tend to form a meandering stream course as it alternatively erodes and deposits sediments along its course. The result is a snaking pattern as the stream meanders back and forth across its floodplain. When a meander gets cut off from the mainstream body, an oxbow lake is formed (figure.9).

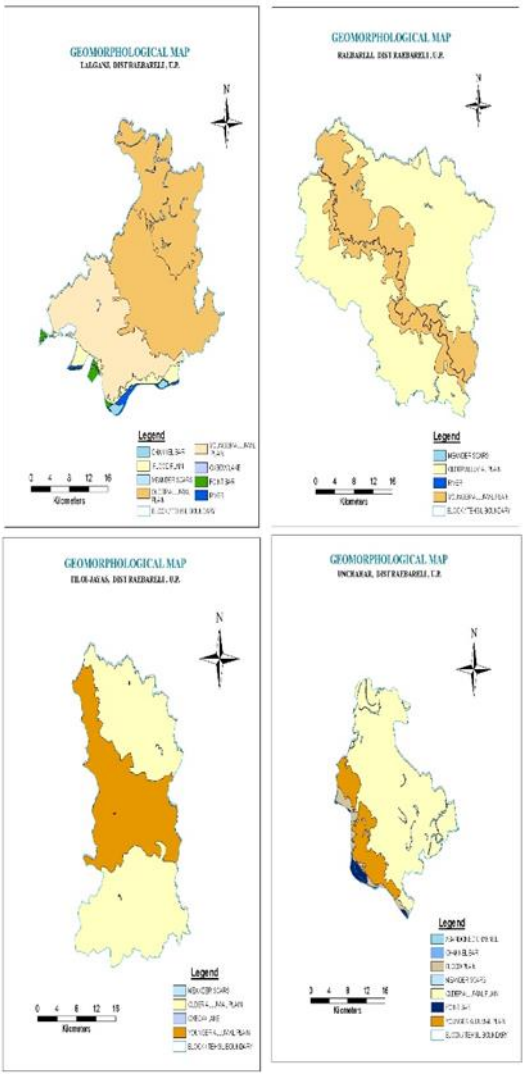

Figure 9. Geomorphological Map

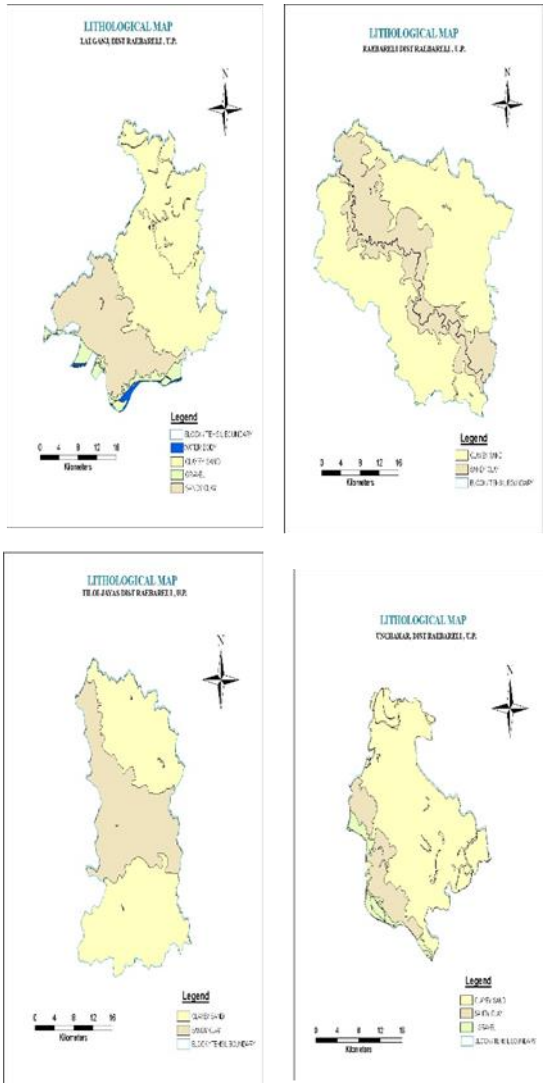

Figure 10. Lithological Map

h. Lithological Map of Raebareli, Uttar Pradesh

Lithology (Litho =rocks, logy = study) is the science of study of rocks. The below map shows Lithology present in the study area. This is generated using IRS-P6 LISS III imagery. In this area, three types of rocks present belong to following group: 1) Gravel 2) Sandy clay 3) Clayey sand. In younger alluvial plain rock type is sandy clay, which have less capacity to holding water as comparison to clayey sand because clay particle is finer than sand particle, in older alluvial plain rock type is clayey sand and rock type is gravel in flood plain areas (figure. 10).

i. Geological Map of Raebareli

The below map shows only one type of geology that is unconsolidated material which is shown by light yellow colour (figure 11).

j. Ground water prospect Map

The below map shows three types of ground water potential zone.the excellent ground water potential zone are shown in blue colour, good water potential zone shown in light blue colour and very good water potential zone are shown in med blue colour. We have divided this three zones according to nearness or the river and alluvial plane and water absorption ability .Younger alluvial plane marked as a good water potential zone, older alluvial plane marked as a very good water potential zone and abundant channels, oxbow lake, Chanel and pit bar marked as an excellent water potential zone (figure 12).

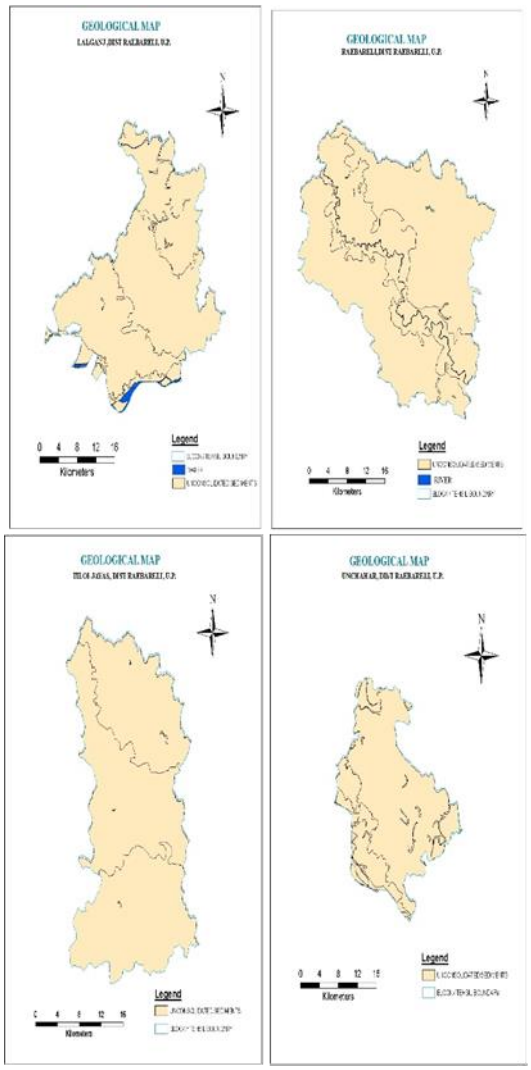

Figure 11. Geological Map

k. Land use/ Land cover

Knowledge of land use and land cover is important for many planning and management activities concerned with the surface of the earth. The term land cover relates to the type of feature present on the surface of the earth, wheat fields, roads, rail tracks, lakes etc are the examples of land cover types. The term land use relates to the human activity or economic function associated with a specific piece of land. As an example, tract of land on the fringe of an urban area may be used for family housing (Thomas M. Lillesand and Ralph W. Kiefer). The study area consists of different landuse/landcover classes. The classes are as follows: agricultural land, wasteland, water, and urban or built-up land. The landuse/landcover classification is based on the Level-I. The maximum landuse/landcover is by agricultural land, the wasteland occupies the second place in classification. After wasteland the third category is water body and followed by Urban or built-up land. The Land use/Land cover is identified in the image by primary recognition element i.e. tone, colour, pattern, shape, association etc [39-41]. Agriculture is identified by smooth texture red colour in standard FCC and also by the shape, pattern and association. Water bodies are identified by tone also wasteland is identified by tone and association. Wasteland shows bright reflectance in the imagery. The rough texture and the shape identify the built-up land (figure. 13).

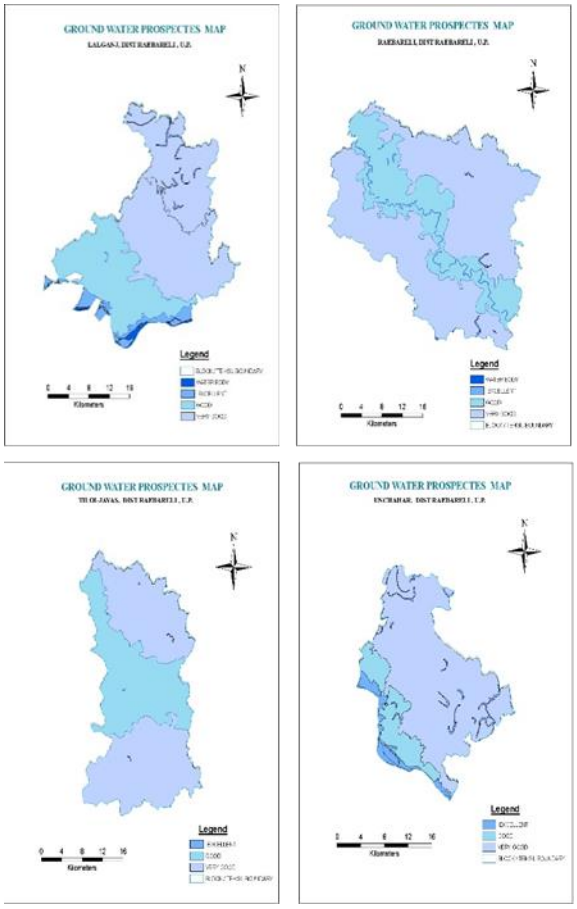

Figure 12. Ground water prospects map

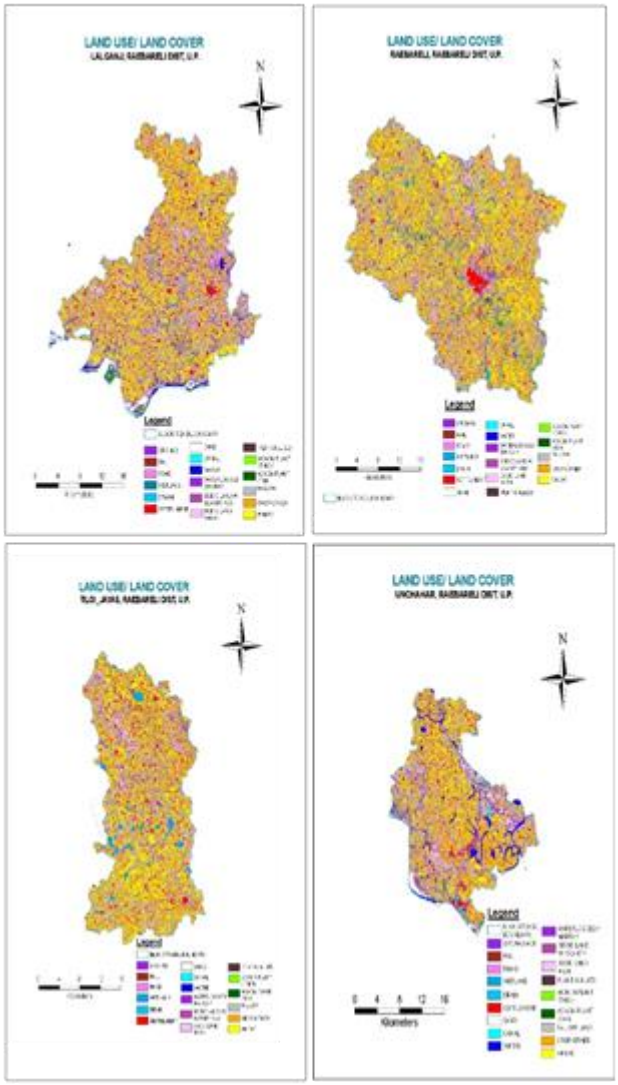

Figure 13. Land use/ land cover map

l. Culturable Land Map

Culurable land means that land, which is, used for any plantation either it is agriculture purpose or forest purpose. The below map shows the % of culturable land according to geographical area of Raebareli Dist. Red colour shows lowest % age and Blue colour shows highest % age of Culturable land (figure.14).

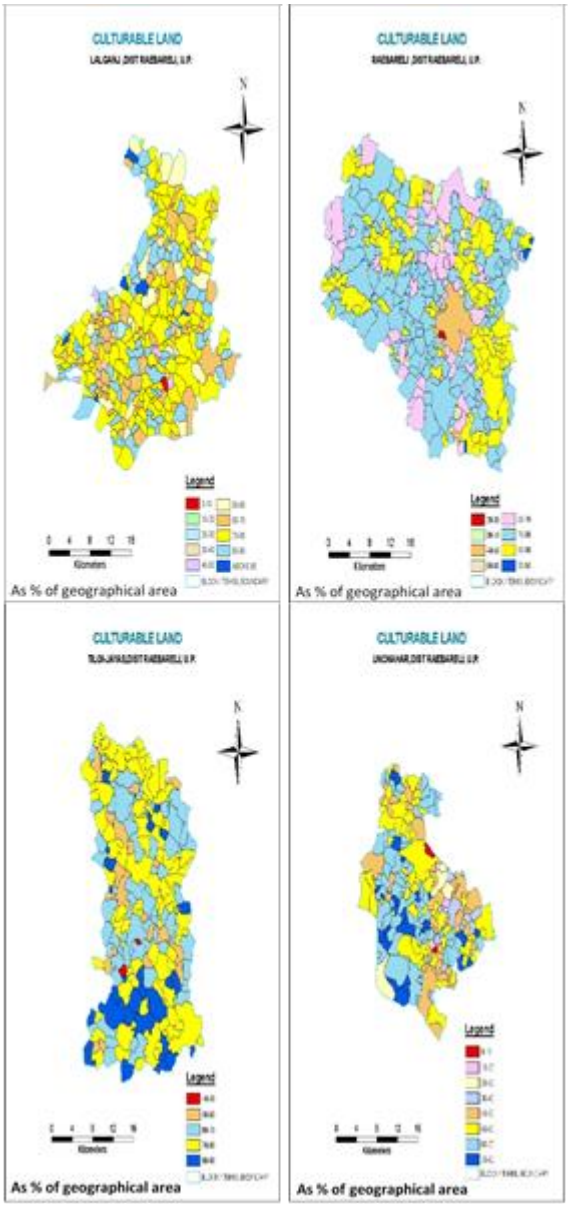

Figure 14.

V. CONCLUSION

This report describes about the natural resource database generation and integration for the Raebareli District in Uttar Pradesh. In this study, following aspects have been covered: drainage-water body, watershed, well locations, transport network, land use/ land cover etc. The geomorphology of the study area shows the characteristics such as alluvial plain, old meandering river, paleochannels, salt affected land and also the waterlogged area. The work is done for the four blocks of Raebareli Dist namely: Jayas, Raebareli, Lalganj, Unchahar. With the help of remote sensing techniques and GIS as a tool, the spatial and non-spatial database is generated. Natural database are precious for life. Over the years, increasing urbanization and expansion in

agriculture has led to the unscientific exploitation of natural resources that has led to the stress conditions. This time alarming situation calls for the low cost and management planning. Integrated approach of remote sensing and GIS with field data is cost effective, less time consuming and produces reliable information for the Landuse/Landcover, geomorphology and land evaluation for the agriculture practices. GIS enables to analyze the field data to give the precise information. Based on the GIS analysis and field observations it was observed that Landuse/Landcover plays an important role in agricultural practices also. The information generated in the present database would be useful to rural mass and planners and decision makers alike for devising sound and feasible land development plans.

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