Generation of Land use Land Cover Map and its Significance in Ground Water Dynamics: For Part of Hyderabad City

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Abstract: ***Withfocus on the impacts of urbanization on the groundwater, land use land cover mapping, anchor's a central component, provide strategies for monitoring and managing natural resources. Land use land cover is the major dynamic process in developing countries and developing cities, whereurbanization cause land degradation thereby increases in management of water resources for growing urban population. Shaikpet is part of Hyderabad city, which has experienced a rapid urbanization and turned from rural community to urban establishment within a span of two decades. The study aims at investigating the dynamics of land use land cover over the water quality monitoring for a period of five years 2015 to 2020 taking in to consideration of the watershed area were Shaikpet is geographically located. As the land use land cover, change detection using RESOURCESAT –LISS IV satellite data is used for application, in observing the significance of ground water dynamics of the study area by taking water sampling and its analysis. Water samples collected at nine different locations and analysis has been done for testing physical, biological and chemical properties of the samples.***

Keywords: Remote sensing, land use landcover, GIS, ArcGIS, Water Sampling, Drainage

1. Introduction

Although the terms "land use" and "land cover" are frequently used interchangeably, each term has a distinct definition. The term "land cover" describes the material that covers the surface of the ground, vegetation, urban infrastructure, water, bare soil, etc. Land cover identification creates the baseline data for tasks like thematic mapping and change detection analyses. The term "land use" describes the function that a piece of land performs, agriculture, wildlife habitat, or recreation.

When the terms "Land Use" and "Land Cover" are used combined, they refer to the grouping or classification of human activities and natural elements on the landscape throughout a certain period of time using recognised scientific and statistical methods of analysis of pertinent source materials. Change detection is a crucial stage in keeping track of urban development. It enables quantitative examination of the area of interest's spatial distribution.

1.1 Study area

Telangana is a state in India, and Hyderabad is its capital and most populated city (17°21′42″N 78°28′29″E). With 9.7 million people living in the municipal zone and 6.9 million people living within the city limits, Hyderabad is India's fourth - most populated city and the sixth - most populous metropolitan area, 2011 Census of India. Hyderabad has the fifth - largest economy in India, with a GDP of $74 billion. Shaikpet area is geographically located

1.2 Study Objectives

To prepare the digital thematic maps namely Base map, Transport network map, Land use/ Land cover, Drainage map etc. using satellite data, collateral data and field data on ARC/INFO GIS platform. This constitutes the spatial database.

2. Conventional approach of LULC Mapping

The traditional method of gathering LULC data in the nation has been compilation from revenue records by the Directorate/Bureau of Economic and Statistics (DES/BES) of the relevant states. A nine - fold classification system is available for the land use data that was "derived" from the individual plot - level agricultural inventory. Without any mention of spatial locations, these data are provided as statistical records. Another source of LULC data is Survey of India's topographical maps, which provide very broad land use classifications that were plotted mostly from ground data at scales between 1: 50, 000 and 1: 25, 000. However, this data on land use does not reflect the state of land use today or any recent changes.

2.1 Remote Sensing based Approach

The development of remote sensing, primarily accomplished through aerial photography, resulted in the mapping of land cover. Due to the advantages it provides (wide area coverage, frequent revisits, multispectral, multisource, storage in digital format to facilitate subsequent updating, compatibility with GIS technology), remote sensing technology has proven to be a very useful and affordable method for an accurate classification of land cover. The parameters of land cover information produced by remote sensing data are determined by a number of crucial factors.

There isn't a single best category for describing land use and cover, and it's unlikely that one could ever be created. Even when an objective numerical approach is utilised, there are various points of view in the classification process, and the process itself has a tendency to be subjective. Given that patterns of land use and land cover fluctuate to meet changing demands for natural resources, there is no logical reason to assume that a single thorough inventory should be sufficient for more than a short period of time. Every classification is created to meet the requirements of the user. One of the most utilized applications in remote sensing LULC classification. The methods that are most frequently employed include:

2.2 Base Map

Base Map of the Study Area Satellite Data: Base map of the study area were derived from Survey of India Toposheet of 1: 50000 scale. All the settlements, road network, water bodies and forest areas are taken into consideration. By comparing the Survey of India topographic maps with that of the satellite image the size of all the settlements are increased and updated.

2.3 Drainage Map

There are dry and wet patches in each water body. The

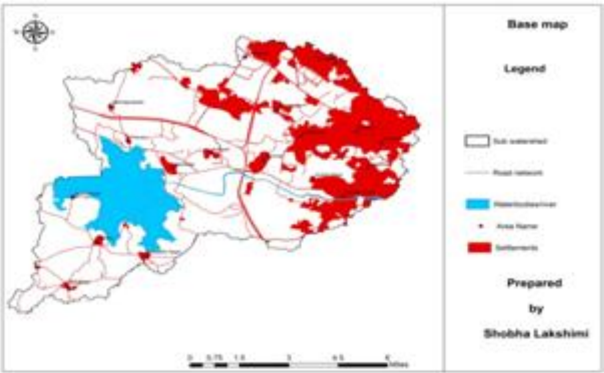

Figure 1: Showing the Base Map of the study area

satellite photographs show that these wet (water spread) areas fluctuate periodically and contain some fresh tanks. The drainage map is updated as a result using satellite data. Dendritic Drainage Pattern is the current drainage system.

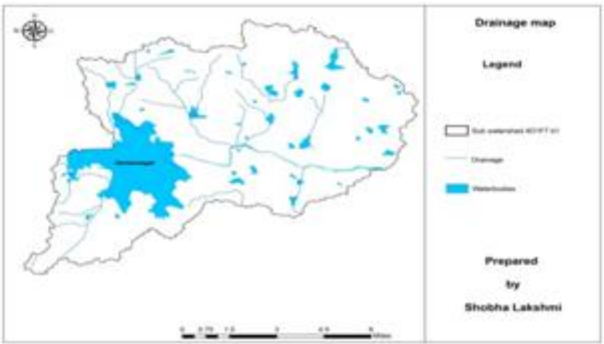

Figure 2: Showing the drainage map of the study area

3. Criteria For Land Use/ Land Cover Classification

In the context of developing a new classification system, it is essential to consider certain criteria and limitations of satellite data and study area particularly to Indian conditions, as the classification system using satellite data should provide a framework to satisfy the needs of the majority of users. For these certain guidelines and criterion for evaluation established.

Land use/ land cover classification should be comprehensive, scientifically sound, practical and applicable over large areas.

- It should meet the needs of a variety of users.
- The classification should be flexible, which can be used at different scales and at different levels of detail.
- Land use / land cover categories should be described with the minimal set of classifiers (less the classifiers used in the definition, less the errors expected and less time and resources necessary for field validation).
- The classification should be amicable for use of multi - seasonal satellite data
- To decide on an appropriate classification or data level within a classification an arbitrary decision made. One must decide on imagery scale or on the scale of representation of data. Satellite data based on scales of 1: 250, 000; 1: 50, 000; 1: 25, 000; 1: 10, 000 and 1: 5, 000 will serve to represent Level - I; Level - ll, Level - Ill, Level - IV and Level - V categories.
- The minimum interpretation accuracy and reliability in the identification of land use / land cover categories from satellite data should be85 - 95 per cent based on the scale of mapping.
- Due to certain limitations of satellite data, some of the similar categories may be generalized, forest and wooded land, put together under main head "Forest".

3.4 Methodology

Showing the methodology adopted for land use/land cover mapping. For analysis and interpretation two types of data are needed that is basic data and ground data.

Basic data includes:

- Satellite data Toposheets Local knowledge
- Area map on any scale to transfer details
- Reports and other literature of the study area

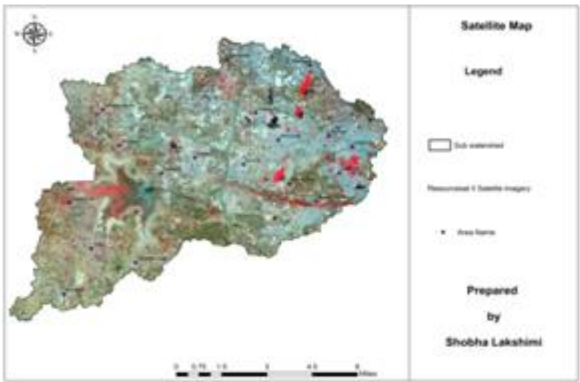

Figure 3: Showing Satellite Imagery of the Study area

1) Ground data: Ground data is very much essential to verify and to increase the accuracy of the interpreted classes and also to minimize the field work.
2) Data analysis: For analysis and interpretation of satellite data, the study can be divided into three parts:
   a) Preliminary work
   b) Field work

c) Post field work

Preliminary work includes:
- To see the limitation of satellite data
- To lay down the criteria for land use classification to be adopted
- To fix the size of mapping units, which depends upon the scale
- Interpretation of different land use/land cover classes
- Demarcation of doubtful areas
- Preparation of field land use/land cover map

Field work:
- Type of ground data to be collected
- Selection of sample area for final classification
- Checking doubtful areas
- Change in land use/ land cover due to wrong identification, fresh development, nomenclature.
- General verification

Post field work:
- Reinterpretation and analysis or correction of doubtful areas
- Transfer of details on base map
- Marginal information
- Preparation of final land use/land cover map

4.0 Water Sampling

By examining the quality of the groundwater and surface water bodies in the study area, the proposed research effects on the aquatic environment were evaluated. Nine different water samples—five from the surface, four from the ground, were collected and examined for a variety of physico - chemical and bacteriological characteristics. The details of the surface water, ground water and effluent sampling locations are given in Table Nos.1 and shown on the figure 5 location map.

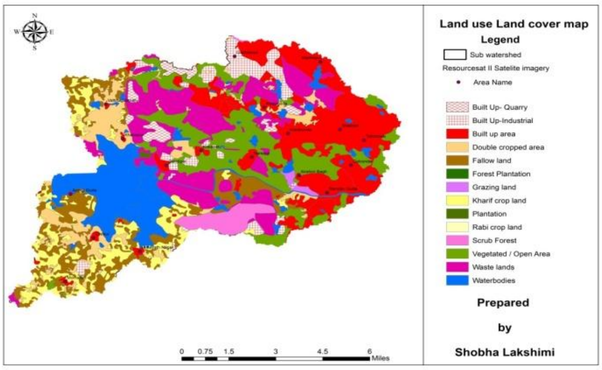

Figure.4 Showing Landuse Landcover of the study area

4.1Water Sampling Methodology

Samples of the surface water from lakes, rivers, streams, and other bodies of water were taken straight into the sample bottle. Water samples were taken from the inner layers of the shallow streams, leaving the surface layers behind, while the sample container was pointed upstream. It is carefully avoided to affect the substrate. Samples were taken below the surface of lakes and other impoundments to prevent surface clutter. To make sure the groundwater to be sampled was representative of the groundwater aquifer, hand pumps were used for 15 minutes prior to the sampling.

Samples were collected in 1 litre widemouth glass bottle for oil & grease analysis, in cleaned 300 ml glass bottle for DO and formetals 1litre Plastic container and for pesticides analysis 2.5 litre amber coloured glassbottle, 5 litre of water sample was collected in a prewashed plastic container without anypreservatives for general parameters. Appropriate preservatives such as Manganesesulphate & Alkali - Iodide – azide for DO, Hydrochloric acid for oil &grease and Nitricacid for metals were added to the samples during sample collection.

In sterilised high - density glass vials, samples were gathered for bacteriological investigation. All of the samples were brought to the lab for thorough physico - chemical and bacteriological investigation and preserved in sampling kits that were kept at 4^{o}C.

Table 1: Showing the water quality properties

S.No	Test Parameters	Unit	Test Method	L-1	L-2	L-3	L-3	L-4	L-5	L-6	L-7	L-8
1	pH	--	4500.HB	7.8	8.0	8.0	7.7	8.0	7.8	7.1	7.8	7.0
2	Temperature	°C	-	24.2	25.1	25.1	25.7	25.2	25.2	27.0	25.1	25.2
3	Colour	Pt-Co	2120.B	20	38	20	25	35	80	75	45	180
4	Turbidity	mg/L	2130.B	3.9	6.4	3.3	4.2	5.2	8.6	7.8	4.7	7.9
5	ElectricalConductivity	mg/L	2510B	1520	1600	1320	1600	1680	1660	1740	1780	2648
6	Ammonical Nitrogen as N	mg/L	4500.NH-C	18	14	55.4	15	12	24.10	36	35	59.4
7	Total Suspended Solids at 105 °C	mg/L	2540.D	44	22	8	50	22	14	68	40	24
8	Total Dissolved Solids at 180 °C	mg/L	2540.C	948	940	762	1000	980	965	1104	995	1568
9	Chemical Oxygen Demand	mg/L	5220.B	138	170	149	180	200	752	490	238	832
10	Biochemical Oxygen Demand (3 days at 27 °C)	mg/L	IS:3025	50	72	56	80	89	289	320	94	340
11	Total Phosphates as P	mg/L	4500.P.D	1.8	0.3	0.74	0.9	0.85	0.5	1.7	0.4	8.42
12	Nitrate as N	mg/L	PDA	2.0	4.0	0.35	2.2	3.65	0.34	2.3	3.3	8.44
13	Total Nitrogen	mg/L	By Calculation	33	26	72.3	22	30	57.5	78	48	75.8
14	Dissolved Oxygen	mg/L	4500O.C	5.0	5.2	5.4	4.6	6.1	NIL	NIL	2.0	NIL
15	Total Coliform	MPN/100mL	9221A&B	79000	94000	35000	17000	28000	170000	230000	540000	790000

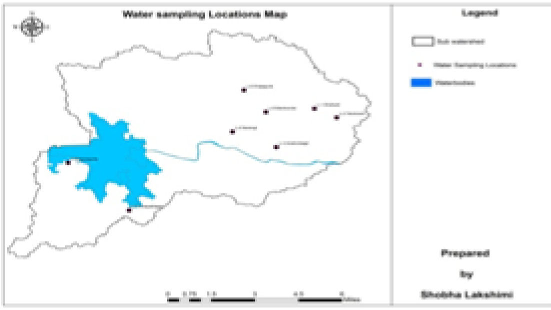

Figure 5: Showing Water sampling locations

4. Conclusion

From the research area, the types of land use and land cover, including developed land, farmland, forests, water bodies, and wastelands, have been identified and mapped. A significant portion of the research area is covered by metropolitan areas. Urban built - up areas have taken up a significant portion of the land and have dramatically increased, while cropping areas have decreased.

Trends of changing cropland in the research region to agricultural plantations, built - up areas for habitations, and much of the land is left as open scrub are identified. The shrinkage of water bodies and scrub forest is also seen in the following table. At 0smansagar Lake, for example, the majority of the full tank level is dispersed by the brush.

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