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CHANGE DETECTION OF LAND USE AND LAND COVER OF NORTH EASTERN PART OF JALGAON DISTRICT BY USING REMOTE SENSING AND GIS TECHNIQUES

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ABSTRACT

The growing biotic pressure coupled with increasing human demands exerts pressure on the available land resources all over the country. Therefore information on the existing land use / land cover, but also to monitor the dynamic land use resulting from the increasing demands arising from the growing population. Under the Disaster Management Information System (DMIS), in order to understand the current land utilization pattern, it is necessary to map the area for land use/land cover taking advantage of the available modern, in order to optimally use the land, it is not only necessary to have the technology like remote sensing. According to this criterion the aim of this project is that, study the changes detection of North Eastern part of Jalgaon district i.e.Yawal, Bhusawal, and Raver & Muktainagar tehsils using Remote Sensing & GIS. For this task multi-sensor remote sensing data of year 2000 and 2007 (IRS-P6 LISS-III) has been used. Various land-use classes delineated include settlement, agriculture, forest, water bodies, open / barren land. Supervised classification techniques used for major land use/ land cover detection using satellite image (IRS-P6 LISS-III) of the year 2000 & 2007.

KEY WORDS: GIS (Geographic Information System), Remote Sensing, Retrieval, Capturing, GPS (Global Positioning System)

INTRODUCTION:

The terms "land use" and "land cover" (LULC) are often uses simultaneously describe maps that provide information about the types of features found on the earth's surface (land cover) and the human activity that is associated with them (land use). Land is an important input parameter for a

number of agricultural, hydrological, and ecological models which constitute necessary tools for development, planning, and management of natural resources in the territory. In order to use the land optimally, and to provide as input data in modeling studies , it is not only necessary to have information on existing land use/land cover but also the capability to monitor the dynamics of land use resulting out of changing demands. If the site is small, and easily accessible, a suitable land cover may be based on ground observations and surveys. However, such method quickly becomes less feasible, if the site is larger or difficult to access, toposheets may be useful for reference, but are generally outdated and too coarse for detailed analysis. With improvements in software, hardware and decrease in the cost of imageries, satellite remote sensing is being used for more and more studies particularly at the landscape level. The characterization of land cover from satellite data has conventionally provided a means of assessing large geographical area limited time and resources. However, satellite images do not record land cover directly; rather they measure the nature and strength of solar energy being reflected from each small area, or pixel of the scene. The amount of multispectral energy in multi wavelengths depends on type of the material at the earth's surface. And the objective is to associate particular land cover with each of these reflected energies. This is generally achieved using either visual or digital interpretation method.

Aim and Objectives:

Aim:

• To study the change detection of Land use & Land Cover of North Eastern part of Jalgaon district i.e.Yawal, Raver, Bhusawal, and Muktainagar, Tehsils using Remote Sensing & GIS techniques.

Objectives:

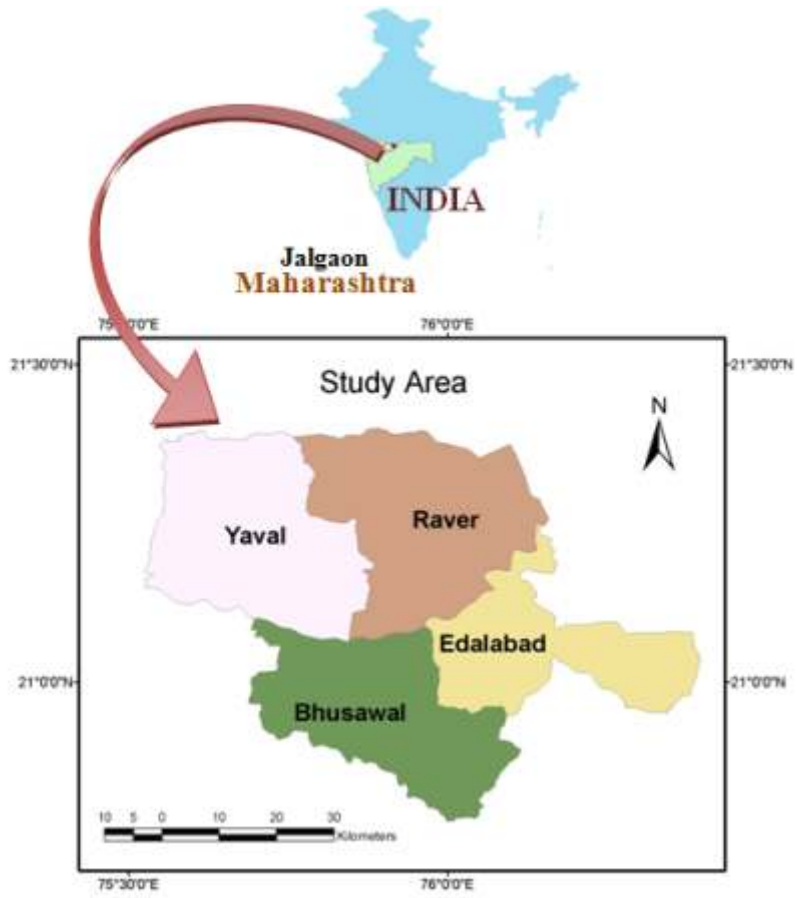
• Monitoring of Land use and Land cover using digital image processing technique for the Study Area
• Change detection of Land use and land cover of study area using 2000 to 2007 images.
• Comparison of Remote Sensing technology with conventional methods

Interpretation of Study Area:

1. Location:

• The selected study area Yawal, Raver, Muktainagar, Bhusawal tehsils is belonging from the JALGAON District which is located in the NORTH MAHARASHTRA (Khandesh). The Study area lies between 20° 53' 19.93" to 21° 23' 38.53" North latitude and 75° 31' 23.06" & 76° 42' 0.47" East longitude. The area bordered by Madhya Pradesh state in the north and Bodwad, Jamner tehsils in the south. Madhya Pradesh again lies to its east while Jalgaon and Chopada tehsils lie to its west. The whole study area has total geographical area i 2953 sq.kms.

4. Location of study area:



5.2. Physical Aspects:

The Satpuda mountain ranges are situated at the northern part. The Satpudas, running east-west, are densely covered with dry mixed deciduous forests and have hills of considerable heights 200 to 900 m.

India's second biggest west-flowing river "TAPTI" is the main river system of this region. The Tapti valley is badly dissected and the banks of the Tapti are high and bare. The Tapti receives many tributaries from both sides. On the right bank are Suki Nadi, Mor nadi, Sur and Bhaunak Nadi which are small and are of little use for irrigation. Purna, Bhogawati are the main rivers in the study area which flow from the south and join the Tapti on its left bank.

The average annual rainfall is approximately 675 mm, which about 87% is received during the monsoon months of June to September. The climate of the study area accept to monsoon is arid and dry. Generally, temperature drops down from October to February and rises steadily from March and by May, the hottest month of the year; the mean daily maximum temperature reaches 46.8°c. With the one set of the monsoon the temperature drops and the weather is becomes pleasant.

The soils of these tehsils are generally derived from the underlying basalt, though older alluvium has a deep cover all along the broad Tapi valley. The soils mainly fall into five categories: medium black soils, deep black soils, forest soils, loamy soils and sandy soils which found in large patches on the slopes of the Satpuda ranges.

5.3. Cultural Aspects:

The economy of the Yawal, Raver, and Mukatainagar tehsils are primarily dependent on agriculture. More than 74% of the main workers are engaged as cultivators and agricultural labourers. Bhusaval is a divisional headquarters of the Central Railway; hence people are mostly surviving on it. Besides the Bhusaval railway station, there is a big locomotive workshop. The workshop and houses for its employees are built on the opposite side of the railway line from the town.

The selected area well connected with each other by road ways and railways. Yawal tehsil has not railway station excluding to 'Dushkeda' village.

This area is famous for production of Bananas and cotton. The bananas have great quality are exported to most of the districts of the State and Delhi as well as some foreign countries also. The other food crops are jowar, bajra, wheat, maize, groundnuts.

Yawal tehsil include 93 villages and 4 towns; Raver tehsil include 118 villages and 2 towns; Muktainagar villages include 84 villages and 1 town; Bhusawal tehsil include 55 villages and 3 towns.

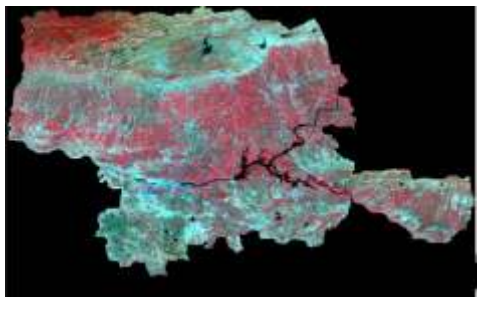
Methodology:

Database

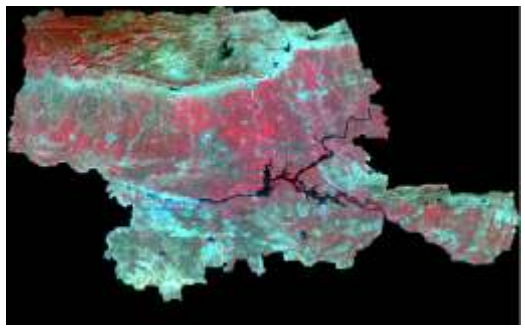
Primary Database:

"Primary database is information that has to be collected through field surveys to fill data gaps and data obtained for the first time and used specifically for the particular problem or issue under study."

The two FCC (false colour composite) satellite images (2000 & 2007) combining three spectral band 1, 2, & 3 with 23.5mts. resolution are used to classify the image in six land classes by supervised classification: 1) agriculture, 2) forest, 3) water body, 4) settlement, 5) barren/open land, 6) harvested land



Satellite Image (IRS - P6 LISS - III) 2000



Satellite Image (IRS - P6 LISS - III) 2007

Secondary Database:

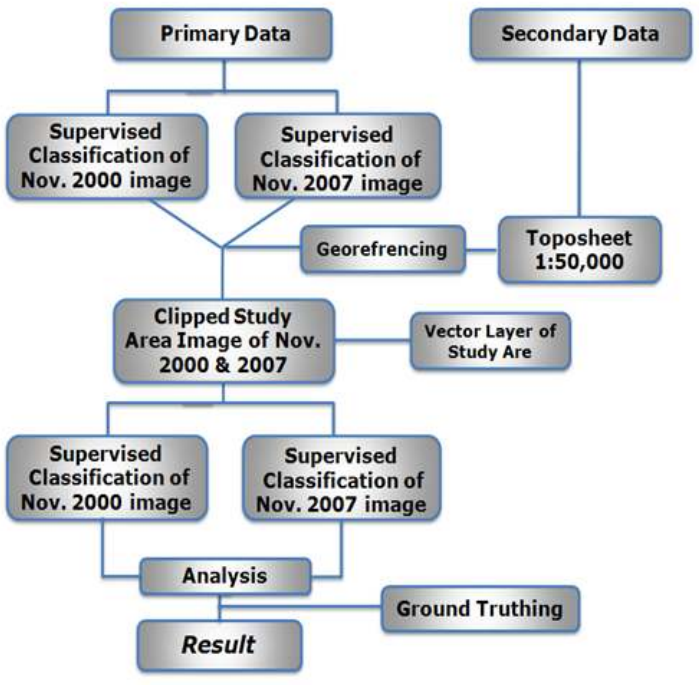
According to M.M. Blair, "Secondary data are those already in existence for some other purpose than the answering of the question in hand." It refers to the statistical material which is not originated by the investigator himself but obtained from some one else's records, or when Primary data is utilised for any other purpose at some subsequent enquiry it is termed as Secondary data. To georefrence to the both FCC satellite images SOI (Survey of India) toposheet has been used. Other statistical and published data like District handbook also utilized for more detailed knowledge. The whole work depend upon the visual interpretation of the satellite images the various interpretation elements helps to identify the training areas such as shape, size, tone, texture, pattern and so on.

Image 7 Toposheet of study area

Software Used

- ERDAS Imagine 9.1
- Microsoft Office 2003

Flow diagram of methodology:



Tab 2: Frame work of land use/land cover classification Level of classification of classes

Level I	Level II
1. Forest land	1.1 open
	1.2 scrub
	1.3 dense
2. Agriculture	2.1 cropland
	2.2 plantation
3. Harvested	3.1 Fallow land
4.Waterbodies	4.1 dam , lake
	4.2 canal
	4.3 stream, river
5.Open/barren land	5.1 sandy, dry
	5.2salt affected
	5.3 mixed barren land
	5.3 stony ,rocky
6. Settlements.	6.1builtup,residential
	6.2commercial,industrial
	6.3 mix urban or transportation area

7 Procedures:

1) As per image understanding capabilities and time permitted for this project, I decided to follow the NRSC, Hyderabad's land use / land cover classification scheme and the number made is six. Those classes are as follows:

1. Water-body.

2. Settlement.

3. Agriculture.

4. Forest.

5. Open/Barren Land.

6. Harvested Land.

2) For the change detection of present land use / land cover, two FCC (False Colour Composite) satellite imageries (primary database) by combining three spectral bands 1,2,&3 with 23.5 m. resolution

selected in each year respectively, 2000 & 2007 for the month of November.
3) SOI (Survey of India) toposheet is used as secondary database in the preparation of the base map into which the interpreted thematic details are transferred and it was the source of satellite image geo-rectification.
4) After applying all the above mentioned commands, finally imageries are ready to classify by the supervised classification method.

Supervised classification:

An important part of image analysis is identifying groups of pixels that have similar spectral characteristics and to determine the various features or land cover classes represented by these groups. This form of analysis is known as classification. Visual classification relies on the analyst's ability to use visual elements (tone, contrast, shape, etc) to classify an image.

"Supervised classification can be defined normally as the process of samples of known identity to classify pixels of unknown identity."

Steps in Supervised Classification:

1) A supervised classification is performed when some earlier or acquired knowledge of the classes in a scene is used to identify representative samples of different surface cover types. These samples, known as training sites, are set up to identify the spectral characteristics of each class of interest. The determination of training sites is based on the analyst's knowledge of the geographical region and the surface cover types present in the image.
2) Once the training sites have been established, the numerical information in the entire image's spectral bands are used to define the spectral "signature" of each class.
3) Once the computer has determined the signatures for each class, it will compare every pixel to the signatures and label it as the class that it is mathematically closest to.
4) Thus, in a supervised classification, the analyst starts with information classes and uses these to define spectral classes. Each pixel in the image is then assigned to the class which it most closely resembles.

Results:

Table 3
Results of Land Use & Land cover in 2000

Class	Color Represented	Area in ha (2000)	Area in %
Forest Area	Dark Green	47248	16
Water body	Blue	20671	7
Settlement	Red	8859	3
Open /Barren Land	Brown	73825	25
Agriculture	Yellow	112214	38
Harvested Land	White	32483	11
Total		**295300**	**100**

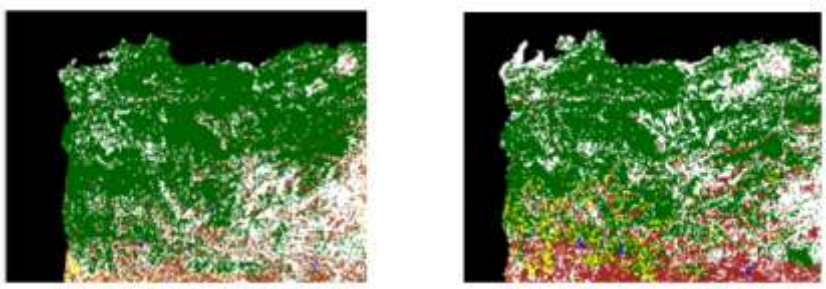
Table 4 Results of Land Use in Year 2007

Class	Color Represented	Area in ha (2007)	Area in %
Forest Area	Dark Green	41342	13
Water body	Blue	23624	8
Settlement	Red	11812	5
Open /Barren Land	Brown	64966	22
Agriculture	Yellow	106308	36
Harvested Land	White	47248	16
Total		**295300**	**100**

Comparison of Results:

9.1 Forest Area:

The Satpuda mountain ranges are situated at the northern part of the study area, which is densely covered with dry mixed deciduous forests; some reserved forests also lie at the muktainagar like Hartala forest. The difference between forest land use in 2000 & 2007 can easily identify in following supervised classification images.



Forest Area in 2000 Forest Area in 2007

As per supervised images in year 2000 the forest covered area is about 47248 hectares (16 %); in the comparison of it because of deforestation the forest area decreases by 3% (41342 hectares, 13%) in year 2007.

Water Body:

The water body includes the rivers, lakes, dams, canal, which represented by blue colour in supervised classification. The whole area enclosed by water in year 2000 was about 20671 hectares (7%) which increased by 23624 hectors (8%) because of more rainfall in year 2007 than year 2000.

Settlement:

Tremendous change appears in the settlement, which is shown in following images:

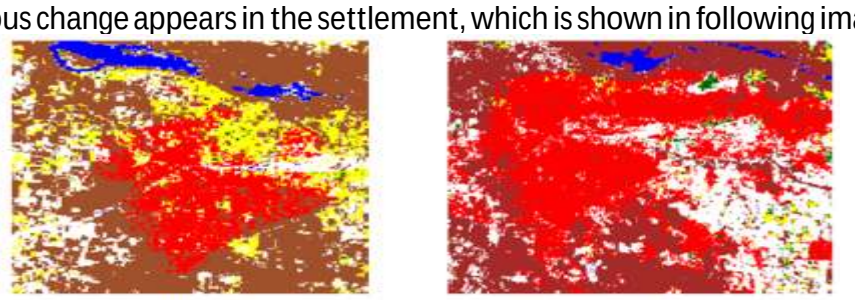


Image in 2000 Image in 2007

The above images illustrate the change of 'Bhusawal' City area, which is increase on large scale and as per all study area settlement increased by 2% in year 2007 as comparison to year 2000.

Open/ Barren Land:

This area found mostly around along the railway line, highways area between forest land and agricultural land. The open land enclosed the area in year 2000 was about 73825 hectares (25%); which is decreased by 3% in year 2007, it is about 64966 hectares (22%). Mainly lot of area of Barren land converted into Agriculture or settlement.

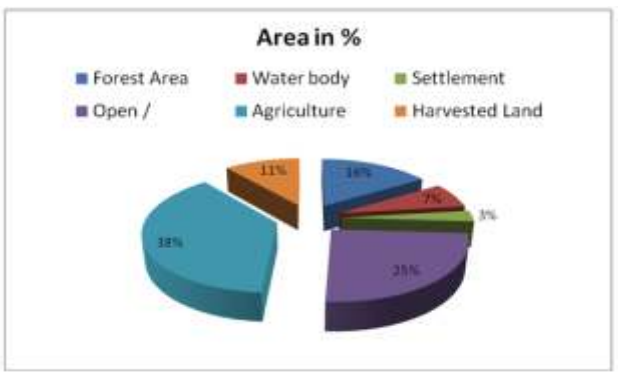
Agriculture:

The economy of the Yawal, Raver, and Mukatainagar tehsils is primarily dependent on agriculture. More than 74% of the main workers are engaged as cultivators and agricultural labourers. Hence, a very large area covered by the agricultural land in both years. In year 2000 the agricultural land enclosed area about 112214 hectares (38%); because of the season of harvesting the area decreased by 2% in year 2007.

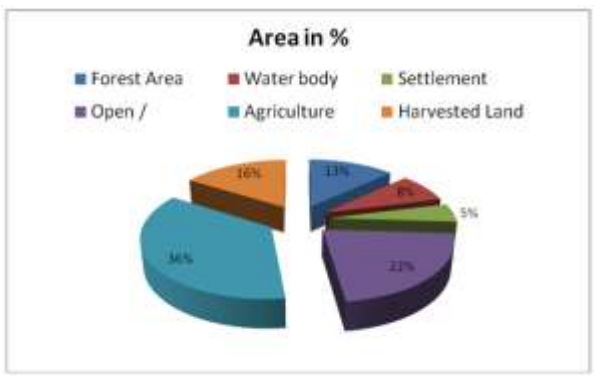
Harvested Land:

It appears yellowish green to dark green in color generally depend upon the topographic nature of soil moisture content which bring variation in texture and smoothness and brightness. The satellite images are in harvesting period. The total coverage of harvested land in year 2000 was about 32483 hectors (11%) which increased in year 2007 by 16% (47248 hectares).

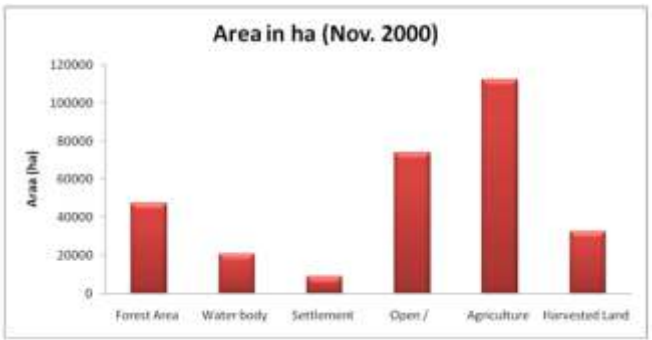
Graphs: Pie Graph of Land Use in 2000:



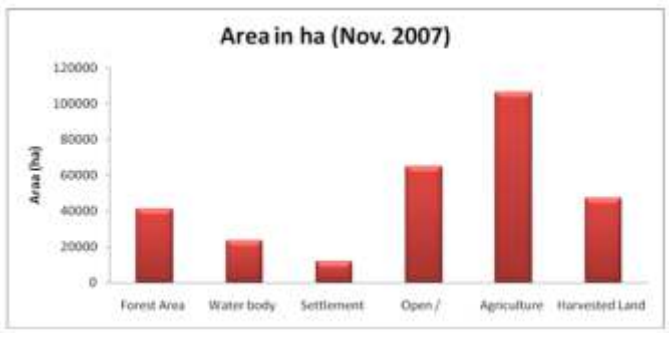
Pie Graph of Land Use in 2007:



Bar Graph of Land Use in 2000:



Bar Graph of Land Use in 2007:



CONCLUSIONS:

1. Population explosion and limited resources force to do such land use / land cover study, which in turn help to manage and best utilization of our available resources.
2. Remote Sensing and GIS enable us to map a larger area within a short period,
3. We can easily identify various classes of land use \ land cover and thus generated maps are simple to read then satellite imagery,
4. This study provides change detection between 2000 and 2007 image using supervised classification techniques in ERDAS Imagine software and
5. These types of Land use and Land Cover maps are very useful for urban planning, Watershed management, Agriculture Study, and Forest Departmen

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