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Evaluation of Land Use/Land Cover Changed Detection Using RS & GIS A Model Study From Vijayawada, AP

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Abstract: - Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. Urban expansion has brought serious losses of agriculture land, shrub, barren land and water bodies. Urban sprawl is responsible for a variety of urban environmental issues like decreased air quality, increased runoff and subsequent flooding, increased local temperature, deterioration of water quality, etc. In this project an attempt is made to study the changes in land use and land cover in Vijayawada region over period of time i.e. from 2002 to 2012. The study has been done through remote sensing approach using Land Sat imageries of this region. GIS software is used to prepare the thematic maps of the region.

I. INTRODUCTON

Land use refers to man's activities and various uses, which are carried on land. Land cover refers to natural vegetation, water bodies, rock/soil, artificial cover and others resulting due to land transformation. Although land use is generally inferred based on the cover, yet both the terms land use and land cover are closely related and interchangeable. Information on the rate and kind of change in the use of land resources is essential to the proper planning, management and regulation of the use of such resources. Knowledge about the existing land use and trends of change is essential if the nation is to tackle the problems associated with the haphazard and uncontrolled growth. A systematic framework is needed for updating the land use and land cover maps that will be timely, relatively inexpensive and appropriate for different needs at national and state level. The rapidly developing technology of remote sensing offers an efficient and timely approach to the mapping and collection of basic land use and land cover data over large area. The satellite imageries are potentially more amenable to digital processing because the remote sensor output can be obtained in digital format. Land use data are needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to e improved or maintained at current levels.

II. OBJECTIVES

- To prepare a land use/land cover thematic maps for the study area during the period from2002-2012
- To calculate and compare the lands use/land cover statistics to predict the urban sprawl of Vijayawada City.

III. DISCRIPTION OF STUDY AREA:

A. Back ground

With the 74th amendment of the Constitution of India in 1992, municipal authorities in the country have been recognized as a third tier of government. The 12th schedule of the Constitution has laid down the functions envisaged to be performed by the municipal authorities one among those functions is solid waste management. It is an obligatory duty of municipal authorities in the country to keep cities/towns clean and provide a good quality of life to the citizens. However, the services provided by the municipal authorities are outdated and very inefficient. Problems of solid waste management are growing with rapid urbanization and change in the lifestyle of the people. The situation is becoming critical with the passage of time. The urban population in India has gone up five times in the last six decades. As per 2012 census, 285.35 million people live in urban areas in the country which accounts for 27.78% of India's population.

B. Existing conditions

The climate of Vijayawada is tropical in nature with hot summers and moderate winters. The months of April to June are the summer months with the temperature ranging from a minimum of 27^0 C to 45^0 C. The temperature during winter months ranges from 28^0 C to 17^0 C. The average humidity ranges from 68% to 80% during summer season. The annual rainfall in the region is about 965mm and is contributed by the south west monsoons.

C.Geology

The region forms a part of Eastern Ghats comprising of Khondalites, Charnockites, Quartiles and Quartz Veins, Minerals like Khandalites and Charnackites are predominantly found in the region of the Vijayawada, Guntur, Tenali Urban Development Area. Three types of soils namely, Alluvial, Black, Reger and Red ferruginous are predominantly found in the area with fertile alluvial soils in the Krishna delta area of Vijayawada.

D. Topography

The Northern, North-Western and South-Western parts of this region are covered by a low range of hills while the Central, South-Western and South-Eastern parts are covered by rich fertile agricultural lands irrigated by left and right canal systems under the Krishna barrage constructed across the river. The prominent hills in this

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region are Kondapalli, Indrakiladri and Mogalrajapuram hills.

E. Hydrology

The city is located on the bank of river Krishna of which one rivulet passes through the city. Also 3 canals network systems provide water for drinking and farming to rich fertile agricultural lands to the algometry area.

F. Demography

The city has witnessed a rapid growth over the past two decades with an average decennial growth rate of 43.15%. During the period 1971-81 the net growth has been about 57.57% attributed to a large influx of the rural population to the city. However, during the past decade 1981-91, the growth has stabilized with a decadal population growth of 29.16%. The development of the town has largely been confined to few of the central wards comprising of wards 4 to 21 and wards 26 to 35. On the other hand 15 of the total 50 wards are sparsely populated. There are over 27500 persons per square kilometre in developed areas and the trend is towards further consolidation and concentration of these densities. While the wards 1, 2, 49 and 50 exhibit a high rate of growth, the central wards like 15, 16, and 17 exhibited a rather low growth rate. Vijayawada city has a density of about 12,000 persons per square kilometer.

G. Occupational pattern

As per the 2012 census over 30% of the total population comprises of the city work force and the occupational pattern of Vijayawada indicates that it is a major centre for tertiary activities. While 69.37% of the total workers in 1991 belonged to the tertiary sector, the proportion has increased to 71.81% of the total work force in 2012. On the other hand there has been a decline in the proportion of workers in the secondary sector from 27.57% to 21.64% during 1991 and 2012 respectively.

H. Trade and Commerce

The city of Vijayawada is traditionally the main agricultural market centre for Krishna basin. It acts as a major commercial centre to a host of wholesale and retail activities dealing in consumer goods, textiles, automobiles, industrial products etc. It is also a major trading, place for processed Virginia Tobacco, Cotton and Turmeric. The agricultural commodities produced in this part of Andhra finds its market in Vijayawada both for local consumption and export. Vijayawada is also known for its Mango exports, generating Crores worth to turnover, annually.

I. Industries

Agro based industrial activity is predominant around the city. The industrial base consists of solvent extraction plants, rice mills, oil and dal mills etc. There are two Industrial Estates under the influence of the city. Autonagar Industrial Estate, located in the Eastern part of the city, near Patamata, covering 340 acres, houses industrial units which are mostly small and medium in nature. The other estate is located at about 16 Kms from the city at Kondapalli. The total extent of the estate is 439 acres and comprises of 620 plots. The proposed developments in this estate are storage facilities for major oil companies and the land acquisition for the same is in progress. Other areas where industrial activities are concentrated, is on the periphery of the city, near Kanuru, with large units like solvent plants and other agro industries establishing base in the area. The presence of a Super Thermal Power Station near Vijayawada has a bearing on the industrial development of the region. The diverse economic activities have increased rapidly over the past few decades in various fields manifested in the influx of work force and a consequent growth in population. Table enumerates the employment and number of industries in Vijayawada

IV. METHODOLOGY

Many diverse types of spatial data are needed to monitor and understand dynamic process, as well as to develop the environmental simulation models that are needed for scientific assessment of environmental problems, including the effects of human interactions and effects of land use changes on water quality. Multi-disciplinary data sets of land surface/subsurface characteristics are essential inputs to such models. The models require data on the multitemporal behavior of land surface properties, as well as the parameterization of spatially heterogeneous and complex, landscape characteristics. Such spatial data sets are needed to support environmental simulation models that are cross-disciplinary and increasingly use an integrated/coupled systems approach to water quality modeling process across multiple time and space scales. This rich set of spatial data requirement forges fundamental links between GIS, remote sensing and environmental models. Remote sensing technology is essential to the development of many spatial data sets for the study of environmental process. GIS complements remote sensing by providing the framework for integrated spatial analysis of diverse data structures in order to help understand and parameterize land surface processes. GIS also has a role in developing and tailoring integrated spatial data sets, including remote-sensing-derived thematic layers, for input to models. This chapter introduces spatial data issues involving data collection strategies, the use of cartographic and remote sensing products as sources of digital data, digital characteristics of spatial databases, and archival sources.

A.CAPTURING MAPPED DATA

In order to enter mapped data into a digital data base, it is necessary to convert the graphic points, lines, and area into a representation based on a specific digital data structure. Usually, the lines and points representing features on maps are digitized directly, producing a vector model of the map. Here, an operator moves a hand – held cursor over the map, clicking a button whenever the cross-hairs on the cursor are centered over locations

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for which coordinates must be stored. Manual digitizing is often considered to be a tedious and error-prone activity, but with practice, maps can be digitized efficiently. It is also possible to scan a map optically and produce a colored or grey-tone pixel –based representation similar to a satellite image. The colors or shades in the image must be related to the map legend, and manual interpretation of linear features like roads is necessary. Depending upon the quality of the original maps, the scanner, and the automatic editing capabilities of the software, considerable editing may be required to make meaningful databases out of scanned maps. For large projects with sizeable budge4ts for data input, combination scan digitizing systems now exist in which digitized lines are extracted automatically from scanned images. Choosing the appropriate method of capturing mapped data depends on the final data structure required and the size of the project. If a project requires the input of large quantities of mapped data, it my be preferable to contract the services of one of the many GIS service companies specializing in data conversion.

B. SPATIAL DATA FROM REMOTE SENSORS

Sensors on satellites and other high-altitude platforms are an increasingly important source of spatial data, particularly for projects on regional and global scales. In contrast to maps as data sources, these sensors record spectral characteristics of the Earth's surface without interpretative bias. Data are both collected and distributed in the raster data structure. Satellite sensor sampling strategies are neutral and exhaustive. As well, it is often possible to get data for a specific region on a number of different dates and, for currently active sensors, to get up-to-date data about the Earth's surface. Numerous different satellite sensors provide data collected from a range of spectral bands (wavelengths) and spatial resolutions (width of the rectangular portion of the Earth covered by one pixel). Data from the Landsat TM (Thematic Mapper-30 and 120 m resolution), Landsat MSS (Multi-Spectral Scanner-80 m resolution), NOAA AVHRR (Advanced Very High Resolution Radiometer-1.1 km resolution) and SPOT HRV (High Resolution Visible Range Instruments-10 and 20 m resolution) are particularly popular for environmental applications.

C. IMAGE PROCESSING

Before they can provide meaningful measurements to user, the raw, unbiased reflectance values received by the satellite sensors require considerable mathematical processing. Manipulations are required both to register the grid of pixels to specific locations on the Earth's surface and to transform the data into useful information. Understanding the various algorithms operating on the raw data is usually beyond the ability o9f nonspecialists, and the resulting spatial data must be accepted on faith. Frequently the result of this manipulation is classified data in which pixel values indicate classes of an attribute (e.g., nominal data such as vegetation type or land use classes) rather than interval or ratio data . classification algorithms and techniques are among the most highly disputed in the discipline (Estes, 1995). Methods for statistically estimating the error resulting from the classification of satellite images have been developed and do provide some quality assurance (Burrough, 1998). The concurrent use of data from different sensors or even different flights of the same sensor requires registration of the images to ensure that the rectangular pieces of the ground surface represented by the pixels cover precisely the same ground locations in all images. It may be necessary to estimate new images from the original ones through a process of resampling in which a new grid having a different size cell or oriented at a different angle is used to estimate new pixel values from the original image. Just as with maps, it is important to consider the relationship between spatial models, data structures, and reality before such data are used. Geographical Information System (GIS), a computer based system capable of assembling, storing, manipulating and displaying geographically referenced information and Remote Sensing, because of its synoptic and repetitive coverage of large areas as well as providing information in a quantifiable manner which enables monitoring and assessment of various natural resources is used for the present study. Database is a collection of facts, a set of data. The software used for the creation of database for the present study is ARC/INFO 3.5.1 version and ARCVIEW 3.1 version. Two types of database are created during the study, spatial and attribute data.

D. GEO-CODING AND GEO-REFERENCING

The LANDSAT data downloaded from GLCF web site is processed for initial corrections like drop outs, stripping and earth rotations etc. Sufficient number of well distributed ground control points is selected both on the maps and corresponding imagery. Care is taken to satisfy the condition on density of GCPs for image registration. Geo-referencing is carried out using ERDAS image processing software. The geo-referenced image is further mosaic ked and then feature matching is carried out. At the end of this process the digital data which is free from all distortions is available for digital image enhancement, classification for Land use/land cover map preparation with the help of Visual image analysis techniques.

E. DIGITAL IMAGE ENHANCEMENT OF DATA

Image Enhancement deals with the individual values of the pixels in the image. The goal of spectral enhancement is to make certain features more visible in an image by bringing out more contrast. Initial display of LANDSAT data through ERDAS software revealed that the features like minor roads, streams and Krishna River are not clear/visible as the contrast of the imageries very dull because of the raw data values fall with in a narrow range. Therefore, an attempt is made to apply linear contrast stretch technique in order to improve the contrast of the image, which can be capable of expanding

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the dynamic range of radiometric resolution of digital data. To perform this technique, Look up Tables (LUT) is created that convert the range of data values to the maximum range of the display device. Based on these LUT's an enhanced image is produced.

F. IMAGE INTERPRETATION

The procedure consists of a set of image elements or characteristics like color / tone, texture, pattern ,size, shape and so on, which help in the recognition or interpretation of various land use /land cover features systematically on the enhanced satellite imagery during the classification of features (Lillesand, 2000) . The land use/ Land cover classification system used in this project is the system which is pioneered by United States Geological Survey (USGS) and is modified by National Remote Sensing Agency(NRSA) according to Indian conditions. The details of this LU/LC system is beyond this report and one can be referred NRSA LU/LC book. A preliminary image classification key is prepared for the fussed pictorial data and is used during interpretation process. Using the image interpretation key, preliminary interpretation of satellite imagery is carried by transferring the features from base map on to the transparency. This transparency with base line data features is then overlaid on the satellite imagery . Then the features of LU/LC are extracted and transferred from the satellite pictorial data. The final land use/land cover classes are separated by assigning standard colors with respect to each one of the land use/land cover classes.

V. RESULT

Present land use/land cover map showing the spatial distribution of various categories and their aerial extent is vital for the present study. The spatial distributions of various land uses are interpreted based on satellite data Landsat-7. The different land use. land cover classes existing in the area over space and time are briefly discussed here in their dimension.

2002-Unsupervised classification

CLASS	AREA (hec.)
Settlement	17965.7
Agricultural land	250875
Scrub/Fallow land	14075
River	15761.5
Dry River	6134.11

2012- Unsupervised classification

CLASS	AREA (hec.)
Settlement	19689.82
Agricultural land	128193
Scrub/Fallow land	11311.7
River	131998
Dry River	8837.28

2002-supervised classification

CLASS	AREA (hec.)
Settlement	58991.4
Agricultural land	78038.4
Scrub/Fallow land	226692
River	44061.6
Dry River	9814.58

2012-Supervised classification

CLASS	AREA (hec.)
Settlement	14202
Agricultural land	10891 .7
Scrub/Fallow land	308660
River	2848.72
Dry River	23704.7

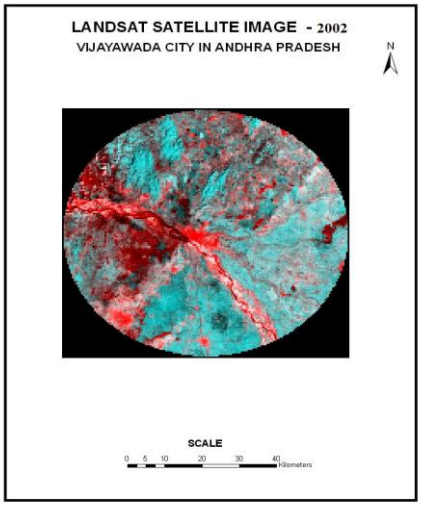

Fig.2: Satellite Image-2002

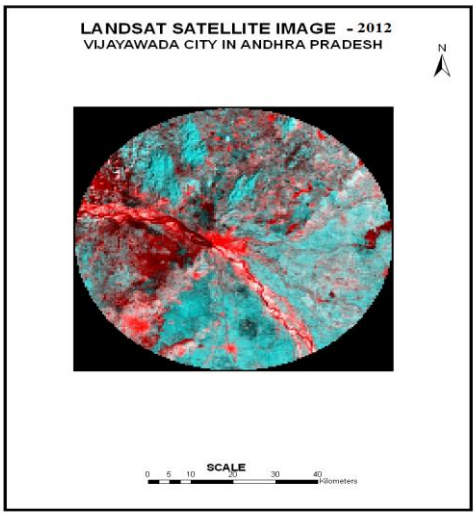

Fig.3: Satellite Image-2012

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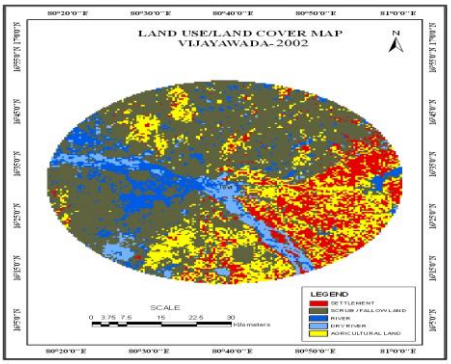

Fig.4: Land use/Land Cover Map-2002(Supervised)

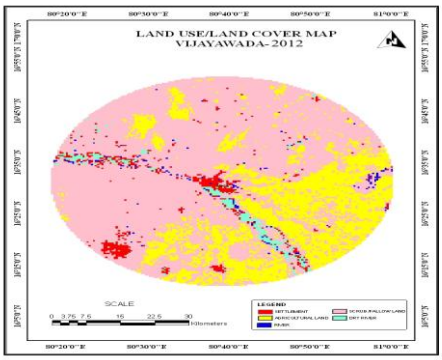

Fig.5: land use/land cover map-2012(supervised)

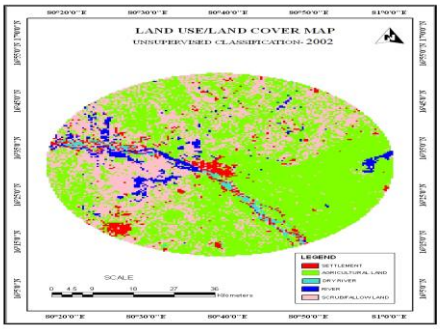

Fig.6: land use/land covers map-2002(unsupervised)

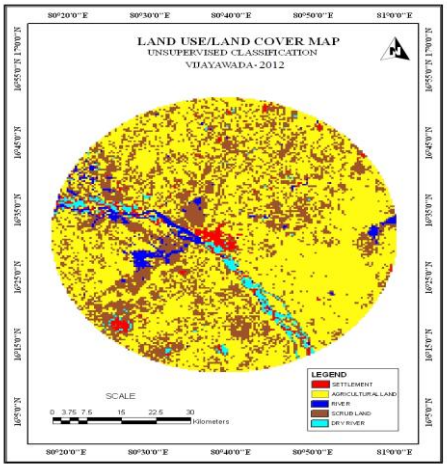

Fig.7: land use/land covers map-2012(unsupervised)

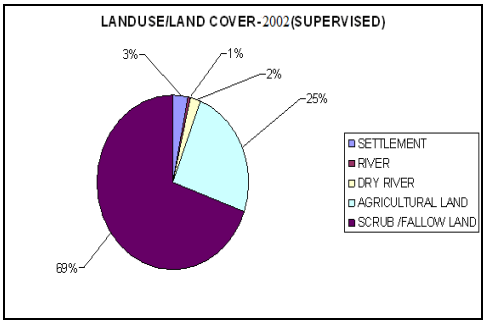

Fig.8: Pie Chart OF LANDUSE/LAND COVER-2002(SUPERVISED)

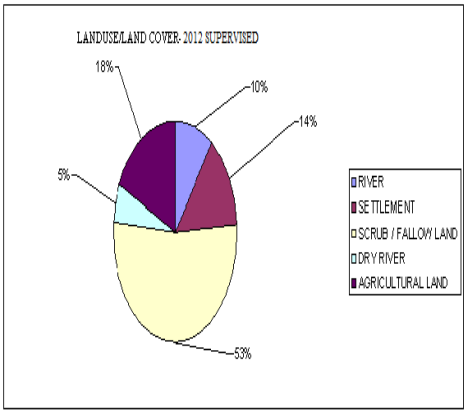

Fig.9: Pie Chart OF LANDUSE/LAND COVER-2012(SUPERVISED)

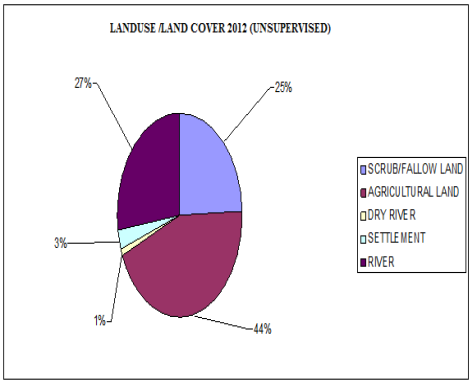

Fig.10: Pie Chart OF LANDUSE/LAND COVER-2002(SUPERVISED)

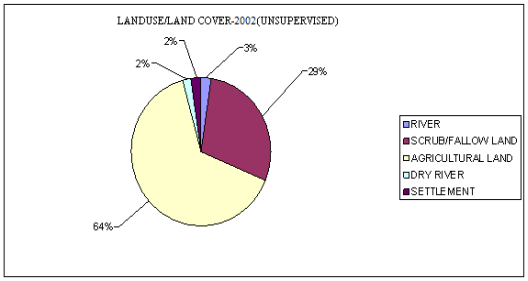

Fig.11: Pie Chart OF LANDUSE/LAND COVER-2012(SUPERVISED)

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A. BUILT UP LAND

It is defined as an area of human habitation developed due to non agricultural use and that which has a cover of buildings, transport, and communication, utilities in association with water, vegetation and vacant lands. Urban or built up land is composed of areas of intensive use with much of the land covered by structures. Included in this category are cities, towns, and areas occupied by commercial complexes, shopping centers, industrial complexes etc. Built up land appears as dark bluish green in the core and bluish on the periphery on satellite imagery. It may be either big or small in size, irregular in shape with coarse or mottled texture. According to the supervised classification 2002, 3% of area is representing and 2012 data 14% of the study area is representing this class based on this its indicating the rapid urban growth in this area. According to the unsupervised classification 2002, 2% of area is representing and 2012 data also representing 3% of the study area.

B. AGRICULTURAL LAND:

It is described as an area under agricultural tree crops planted adopting certain agricultural management techniques. It includes Paddy, wheat, cotton, coon, coconut, mongo, citrus, orchards and other horticultural nurseries. Plantation can be seen very prominently on the imagery with a dark red to red tone, regular in shape, sharp edges and coarse to medium texture. Their size varies from small to medium. The area under this category forms according to the supervised classification 2002 data 25% and 2012data 18% agricultural land has been observed .according to the unsupervised classification 2002 data 64% and 2012 data 44% of the study area has been observed in this category. Based on the above observations 2002 data and 2012 data according to the supervised and unsupervised classification the agricultural land has been decreased due to most of area has been converted to the built-up area and due to the decreasing of the rainfall the ground water and surface water resources has been impact and also due to increasing of the human consumption. the farmers also declaring the crop holidays because they are not getting suitable prize. These are the main resins to decreasing the agricultural land in the study area.

C. SCRUB/FALLOW LAND

It is the land, which has an undulating topography with thin soil cover and scattered trees/ scrubs. These lands are being used for grazing and are ideal sites for plantations. According to the supervised classification 2002, 69% and according to the 2012 data 53% of the study area is representing. According to the unsupervised classification 2002 data 29%, 2012 data 25% of the study area is occupied by this pattern of land use. Its indication according to the supervised and unsupervised both classification 2002 to 2012 are indicating the scrub /fallow land has been decreased due to the population density increase in the study area are man made activates increased in the study area.

D. WATER BODIES

Lakes, tanks, ponds and rivers come under this category. There are a few major water bodies present in the study area viz. Krishna river. There are small water bodies located in different parts of the study. These water bodies are identified based on their tone, regular to irregular shape & smooth to mottled texture on the satellite imagery. Surface water spread of the tank or lake varies from season to season. The major river present in the study area includes the Krishna River. It appears as long, narrow to wide feature on the imagery with an irregular shape and a smooth texture. It is usually associated with vegetation along the banks and in the riverbed. Under this category two classes has identified that is River and Dry River area.

1. RIVER:

Krishna river has been identified in the study area according to the supervised classification of 2002 data 1% and 2012 data 10% of the total study area is occupied

2. DRY RIVER:

Along the Krishna River bed the dry river area has been observed in the study area. According to the unsupervised classification of 2002 data 3% and 2012 data 27% of the area has been observed. Based on the above observations according to the 2002 and 2012comparisen of supervised and un supervised classification in the 2012 the dry river area has been increased due to the decreeing of the rainfall in the study area and due to construction of dams in the upstream area the most of the river bed has been converted to dry river.

VI. CONCLUSION

Based on the above observations compared to the 2002 data 2012 data interpretation in supervised classification and un supervised classification both except settlement the remaining all the classes are decrised.According to the supervised classification 2002, 3% of area is representing and 2012 data 14% of the study area is representing this class based on this its indicating the rapid urban growth in this area. According to the unsupervised classification 2002, 2% of area is representing and 2012 data also representing 3% of the study area. The area under this category forms according to the supervised classification 2002 data 25% and 2012data 18% agricultural land has been observed .according to the unsupervised classification 2002 data 64% and 2012 data 44% of the study area has been observed in this category. Based on the above observations 2002 data and 2012 data according to the supervised and unsupervised classification the agricultural land has been decreased due to most of area

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REFERENCES

[1] ARVIND CHANDRA PANDEY & AMITKUMAR&A.T. JEYASEELAN (2012) "Urban Built-up Area Assessment of Ranchi Township Using Cartosat-I Stereo pairs Satellite Images" Journal of Indian society of Remote sensing, DOI 10.1007/s12524-012-0209-4, ISSN 0974 – 3006.

[2] Asadis.S,G.Rajani,B.V.T.Vasanthara,S.K.Sekar(2012)"Creation Of An Export Village Level Land Use/Land Cover Information System Using Remotesensing,Gis And Vb.Net:A Case Study From Prakasam District,A.P,India.".International Journal Of Engineering Research And Applications.Vol. 1, Issue 3, Pp.595-610, ISSN: 2248-9622.

[3] Bhagawat Rimal (2011) "Application Of Remote Sensing And Gis Landuse/Landcovver Change In Kathmandu Metropolitan City, Nepal", Journal Of Theoretical And Applied Information Technology,2005 - 2011 Jatit & Lls.Pp.80-86,Issn:1817-3195.

[4] Daniel Ayalew Mengistu And Ayobami T. Salami (2007) "Application Of Remote Sensing And Gis Inland Use/Land Cover Mapping And Change Detection In A Part Of Southwestern Nigeria" African Journal Of Environmental Science And Technology Vol. 1 (5), Pp. 099-109, December, 2007, Issn 1996-0786.

[5] Karwariya.Sateesh And Goyal Sandip(2011) "Land Use And Land Cover Mapping Using Digital Classification Technique Intikamgarh District, Madhya Pradesh, India Using Remote Sensing" International Journal Of Geometrics and Geosciences. Volume 2, No 2, 519-529,Issn 0976 – 4380.

[6] Prakasam.C (2010)"Land Use And Land Cover Change Detection Through Remote Sensing Approach: A Case Study of Kodaikanal Taluk, Tamil Nadu"International Journal of Geomatics and Geosciences. Volume 1, No 2, 2010 Pp.150-158, ISSN 0976 – 4380.

[7] Qihao Weng (2002) "Land Use Change Analysis in the Zhujiang Delta of China Using Satellite Remote Sensing is And Stochastic Modeling" Journal of Environmental Management"Vol. 64, 273–284, ISSN: 0301-4797.

[8] Suribabu C.R & J. Bhaskar & T. R. Neelakantan (2012), "Land Use/Cover Change Detection of Tiruchirapalli City, India, Using Integrated Remote Sensing and GIS Tools" Journal of Indian Society of Remote sensing, Doi 10.1007/S12524-011-0196-X, ISSN 0974 – 3006.

[9] Saravanan.P, Ilangovan.P (2010) "Identification Of Urban Sprawl Pattern For Madurai Region Using Gis" International Journal Of Geomatics And Geosciences. Volume 1, No 2, Pp.141-149 2010, ISSN 0976 – 4380.

[10] Thanikachalam.M (2010) "Digital And Visual Analyses Of Irs Satellite Data For Zonation And change Deduction Of Coral Reefs In Gulf Of Mannar Marine Biosphere reserve", Internationall Journal Of Geomatics And Geosciences Volume 1, No 3, 2010,Pp.308-326 Issn 0976 – 4380.

[11] Land Use Land Cover Mapping, Change Detection and Conflict Analysis Of Nagzira-Navegaon Corridor, Central India Using Geospatial Technology P. K. Yadav*, Mohnish Kapoor, Kiranmay Sarmauniversity School Of Environment Management, Guru Gobind Singh Indraprastha University Dwarka 16c, New Delhi - 110075, India.

[12] Dynamics Of Land-Use And Land-Cover Change In Tropical Regions Eric F. Lambin,1helmut J. Geist,2 And Erika Lepers2 Department Of Geography, University Of Louvain, Place Louis Pasteur 3, B-1348 Louvain-La-Neuve, Belgium; Email: Lambin@Geog.Ucl.Ac.Be 2lucc International Project Office, Department Of Geography, University Of Louvain, Place Louis Pasteur 3, B-1348 Louvain-La-Neuve, Belgium.

[13] Land Use And Land Cover Changes Around The Rivermouths Of Mangalore, West Coast Of India Gumageri Nagaraj Research Scholar, Applied Mechanics And Hydraulics Department, Nitk Surathkal 575025, Email:Gumageri.N@Gmail.Com.

[14] Land Use And Land Cover Mapping – Madurai District, Tamilnadu, India Using Remote Sensing And Gis Techniques Alaguraja .P 1 , Durairaju.S. 2 Yuvaraj .D 1 , Sekar.M 1 Muthuveerran.P 1 Manivel .M 1.

[15] Modeling Land Use And Land Cover Dynamics To Assess Sustainability in Trinidad And Tobago Terri Richardson And Raid Al-Tahir.

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APPENDIX

Fig.1 Flowchart showing the Methodology adopted for land use/land cover mapping for change detection studies.