MAPPING LAND USE/ LAND COVER OF WEST GODAVARI DISTRICT USING NDVI TECHNIQUES AND GIS

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ABSTRACT

The present study shows that satellite remote sensing based land cover mapping is very effective. The high resolution satellite data such as LISS III data and Landsat TM are good source to provide information accurately. Under the utilization of potential land, increased population, and land conversion are the major driving forces for the change in land use during the past 10 years. This research work demonstrates the ability of GIS and Remote Sensing in capturing spatial-temporal data. Attempt was made to capture as accurate as possible five land use land cover classes as they change through time. From the temporal trajectories statistics, 60% of the study area was not changed, and 40% was changed by manmade processes due to Deforestation, increasing of Aquaculture and commercial activities. However, it should also be noted that since 1990s, the area of aquaculture has increased up to 2000 and the same trend continued up to 2009.Forests area has decreased from the year 1990 to 2009.In 1990 forest area is 16% and it is decreased to 12% in 2000 and 5% in 2009.This is mainly due deforestation. Due to increase in population agricultural area has been converted in to commercial area. The results suggest that in terms of affected area, the human impact on the environment was still relatively minor in this area, but if the same trend continues our future generations will be in threat due to scarcity of resources.

KEYWORDS

Land use, land cover, NDVI, West Godavari.

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1. INTRODUCTION

Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. The advancement in the concept of vegetation mapping has greatly increased research on land use land cover change thus providing an accurate evaluation of the spread and health of the world’s forest, grassland, and agricultural resources has become an important priority. Therefore, attempt will be made in this study to map out the status of land use land cover between 1972 and 2001 with a view to detecting the land consumption rate and the changes that has taken place in this status particularly in the built-up land so as to predict possible changes that might take place in this status in the next 14 years using both Geographic Information System and Remote Sensing data. West Godavari district in Andhra Pradesh state has witnessed remarkable expansion, growth and developmental activities such as building, road construction, deforestation and many other anthropogenic. This has therefore resulted in increased land consumption and a modification and alterations in the status of her land use land cover over time without any detailed and comprehensive attempt (as provided by a Remote Sensing data and GIS) to evaluate this status as it changes over time with a view to detecting the land consumption rate and also make attempt to predict same and the possible changes that may occur in this status so that planners can have a basic tool for planning.

2. STUDY AREA

The study area is of West Godavari district located in Andhra Pradesh. West Godavari district occupies an area of approximately 7,742 square kilometres lying in between 81°20' to 81°50' E longitude and 16°5' to 16°35' N latitude. The study area is in between the delta regions of the Krishna and Godavari rivers. The region mostly has a tropical climate like the rest of the Coastal Andhra region. The summers (March–June) are very hot and humid while the winters are pleasant. The rainy season (July–December) is the best time to visit the district with the fields brilliantly green with paddy crops, rivers flowing with water and the relatively cool climate. It is bounded by Khammam district on the north, Krishna district on south west and Bay of Bengal on the south. In 2009, west Godavari had population of 3, 934, 782 of which male and female were 1, 963, 184 and 1, 971, 598 respectively. In 2000 census, west Godavari had a population of 3, 803, 517of which males were 1, 910, 038 and remaining 1, 893, 479 were females.

Fig.1: Location Map of study area

3. METHODOLOGY

Multi-temporal satellite data set observed by LANDSAT, Thematic Mapper (TM), and Multi Spectral Scanner (MSS), IRS P6 LISS III and Survey of India Taluk map drawn on 1:63,360 scale were used for the analysis shown in Table. 1.

Table1: Satellite Datasets used for Study Area

Data	Month of Observation
Landsat 4	2009 - April
Landsat 4	2000 - August
Landsat 4	1990 - November
West Godavari District Shape File (Vector)	-----------

3.1 Software and Platforms

Multi temporal satellite da6taset Digital land use land cover classification through supervised classification method, based on the field knowledge is employed to perform the classification. Arc GIS 9.3 and ERDAS Imagine 9.2 are used for extracting the land use land cover layer from taluk map and satellite imageries. Using ERDAS software, image interpreter module, utilities, layer stack where is available. After using layer stack all the individual bands of thematic mapper combined and get the FCC image. The classification is performed based on the classification scheme of National Remote Sensing Centre (NRSC) Department of Space, Govt of India.

3.2 NDVI Process

The Normalized Difference Vegetation Index (NDVI) is a standardized index allowing you to generate an image displaying greenness (relative biomass). This index takes advantage of the contrast of the characteristics of two bands from a multispectral raster dataset. The NDVI process creates a single-band dataset that mainly represents greenery. The negative values represent clouds, water, and snow, and values near zero represent rock and bare soil. The equation ArcGIS Image Server uses to generate the output is as follows:

NDVI = arc tangent ((IR – R)/ (IR+R)).

IR=pixel values from the infrared band

R = pixel values from the red band

This produces a single-band dataset, mostly representing greenness, where any negative values are mainly generated from clouds, water, and snow, and values near zero are mainly generated from rock and bare soil. This index outputs values between -1.0 and 1.0. Very low values of NDVI (0.1 and below) correspond to barren areas of rock, sand, or snow. Moderate values represent shrub and grassland (0.2 to 0.3), while high values indicate temperate and tropical rainforests (0.6 to 0.8).

3.3 Rescale and Recode

Rescale is used to convert negative values to positive values. Recode function is to combine multiple classes of the same land cover type. It involves the assignment of new values to one or more classes. Recoding is used to reduce the number of classes, combine classes and assign different class values to existing classes. When an ordinal, ratio, or interval class numbering system is used, recoding can be used to assign classes to appropriate values.

Table2: NDVI Classification Values

Values	Contents
-ve value	Water bodies
0.01-0.09	Aquaculture without crop
0.10-0.20	Soil
0.20-0.30	Low vegetation
0.31-0.60	Thick vegetation

3.4 Subset and mosaic

ERADAS Imagine software’s subset function will be utilized to create a subset of the NDVI image to reduce the size of the acquired image to that of the study area. Subsetting an image can be useful when working with large images. Subsetting is the process of “cropping” or cutting out a portion of an image for further processing. A mosaic is an assemblage of two or more overlapping images (tiles) used to create a continuous representation of a predefined area. Geo referenced images are used to construct the mosaic and software is used to automatically place each image in its correct position. Hundreds or even thousands of individual images can be mosaicked to produce a single digital image of a large area.

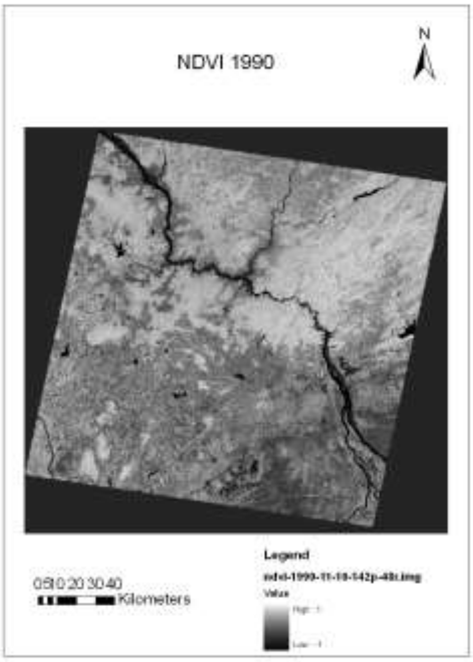

Fig. 2: NDVI 1990

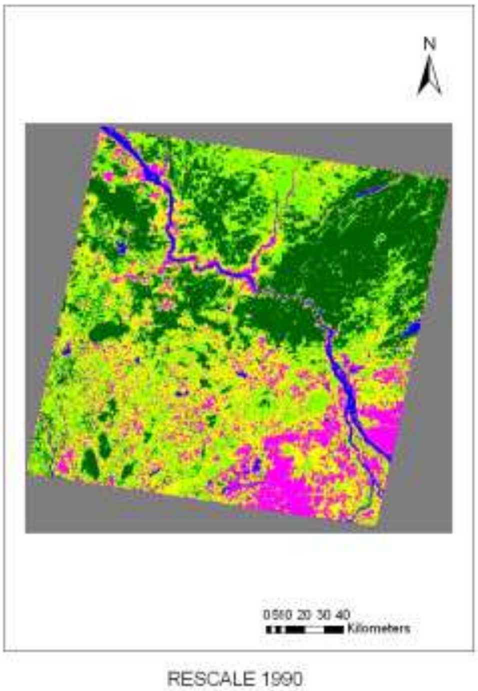

Fig. 3: Rescale 1990 of the Study Area

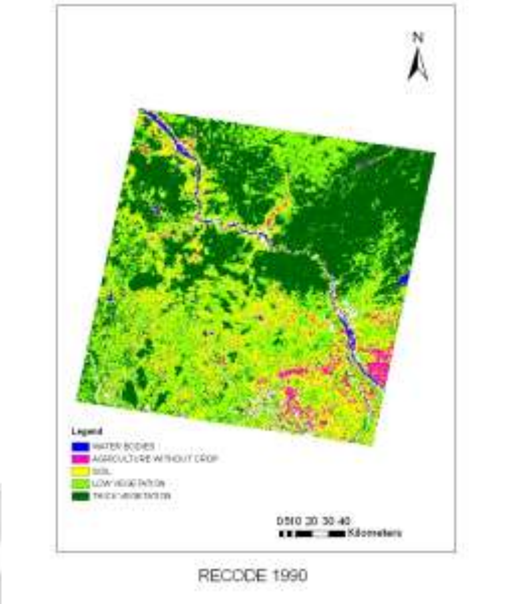

Fig. 4: Recode 1990 of the Study Area

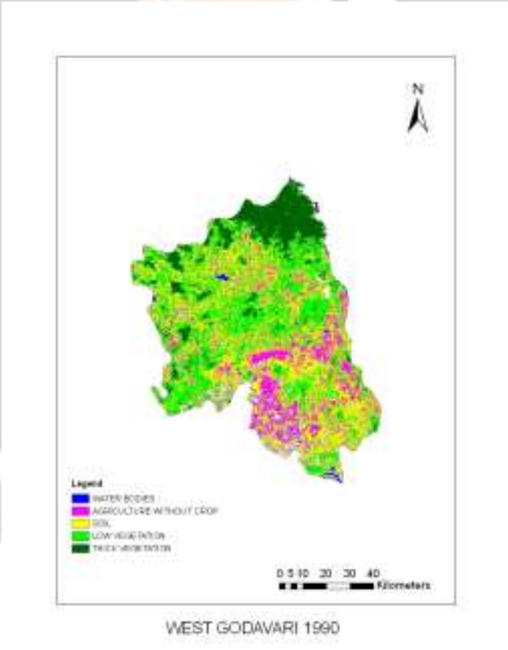

Fig. 5: Subset of the Study Area

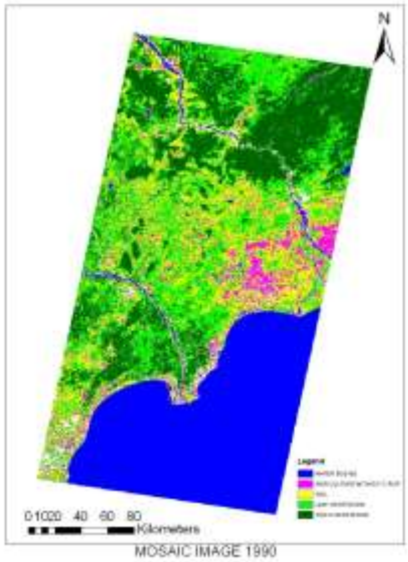

Fig. 6: Mosaicking of the Study Area

4. RESULT AND DISCUSSION

in the year 1990 thick vegetation occupied the major class and this class has been reduced to 0.49% over the decade and this trend has been continued up to 2009.Water bodies including Aqua bodies has been tremendously increased from the year 1990 to 2009.Developing area has been increased from the year 1990 to 2000 and also continued up to 2009.

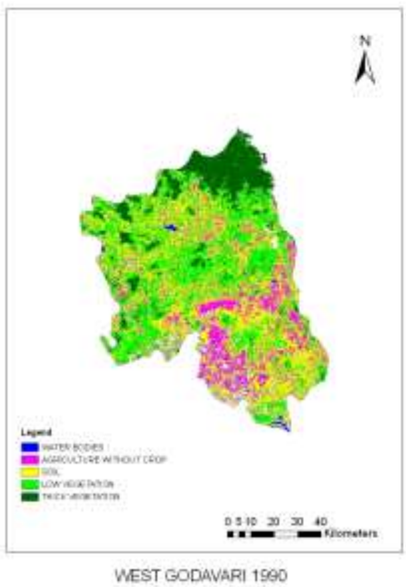

Fig. 7: LULC for the year 1990 of the Study Area

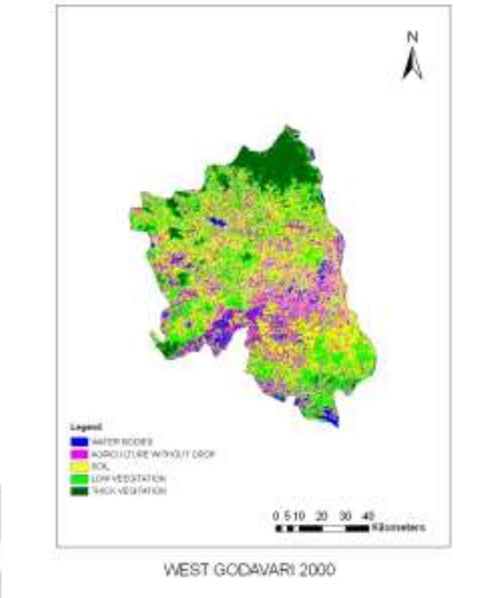

Fig. 8: LULC for the year 2000 of the Study Area

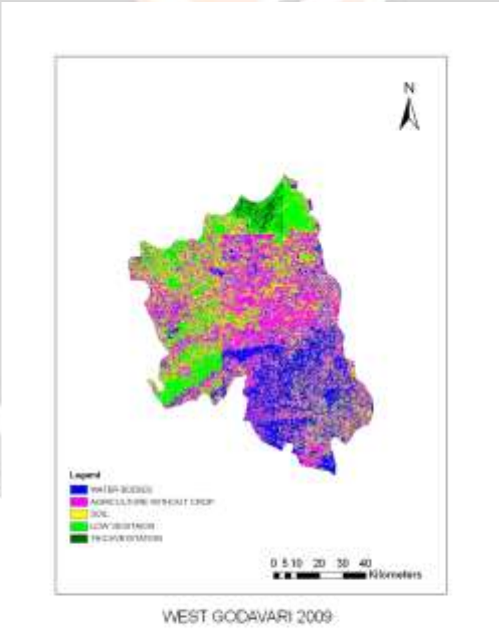

Fig. 9: LULC for the year 2009 of the Study Area

Table 3: LULC classification of the study area in Hectares

LULC Category	1990	2000	2009
Water body	58637	126834	236457

Agriculture	220827	224701	314341
Soil	198269	172072	69379.7
Low Vegetation	159802.7	140870	124312
Thick Vegetation	122542	94299	10723.3

5. CONCLUSION

The present study shows that satellite remote sensing based land cover mapping is very effective. The high resolution satellite data such as LISS III data and Landsat TM are good source to provide information accurately. Due to increase in population agricultural area has been converted in to commercial area. The results suggest that in terms of affected area, the human impact on the environment was still relatively minor in this area, but if the same trend continues our future generations will be in threat due to scarcity of resources.

REFERENCES

1. Eiumnoh, A and Shrestha, P., 2000. Application of DEM Data to Landsat Image Classification: Evaluation in a Tropical Wet-Dry Landscape of Thailand. Photogrammetric Engineering and Remote Sensing, 66(3): 297-304.
2. Gajbhiye, S., and Sharma, S. K., 2012. Land Use and Land Cover Change Detection of Indra River Watershed through Remote Sensing Using Multi-Temporal satellite Data. International Journal of Geomatics and Geosciences. 3(1): 89-96.
3. Hayes J. D, Sader S. A., 2001. Change detection techniques for monitoring forest clearing and regrowth in a tropical moist forest. Photogrammetric Engineering and Remote Sensing. 67: 1067–1076.
4. Laliberte, A., Rango, A., 2004. Object-oriented image analysis for mapping shrub encroachment from 1937 to 2003 in southern New Mexico. Remote Sensing of environment. 93(1-2): 198-210.
5. Lyon J. G, Yuan. D, Lunetta R. S., 1998. A change detection experiment using vegetation indices. Photogr Eng Remote Sens. 64(2): 143-150.
6. Macleod, R. D., and Congalton, R.G., 1998. A Quantitative Comparison of Change-Detection Algorithms for Monitoring Eelgrass from Remotely Sensed Data. Photogrammetric Engineering and Remote Sensing. 64(3): 207-216.
7. Matinfar, H., Sarmadian, F., 2007. Comparisons of Object-Oriented and Pixel-Based Classification of Land use / land cover Types Based on Lansadsat7, ETM Spectral Bands (Case Study: Arid Region of Iran).
8. Tripathi, D., and Kumar, M., 2012. Remote Sensing Based Analysis of Land Use/Land Cover Dynamics in Takula Block, Almora District, Uttarakhand. Journal of Human Ecology. 38(3): 207-212.
9. Yang, X. and Lo, C., 2002. Using a time series of satellite imagery to detect land use and land cover changes in the Atlanta, Georgia metropolitan area. International Journal of Remote Sensing. 23(9): 1775-1798.