MONITORING OF DEGRADED LANDS IN PADERU MANDAL USING GIS TECHNIQUES

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ABSTRACT

Monitoring the degraded lands of Paderu Region is done by using GIS Techniques. To achieve the objectives of the study and monitoring of environmentally degraded lands, multi-temporal Resourcesat-1 LISS III data of 2009-15 acquired during Kharif (Aug –Nov), Rabi (Jan- Mar) seasons were used to derive information on the spatial and temporal variability of different land use / land cover categories. The multi-temporal datasets were geo-referenced with LCC / TM projection and WGS 84 datum. Ancillary data consisted of base details viz., administrative boundaries (state, district, and village and forest boundary), major roads, railway, drainage, settlements, etc. were taken from available sources. Similarly, available ancillary information on forest that was generated earlier was also referred during mapping. The methodology adopted consists of satellite data preparation, interpretation (on-screen visual), and Map- finalization, quality checking of final maps and databases and database organization as per NNRMS standards. GIS, Remote Sensing and Digital Image Processing Techniques were used for the study. The study was carried out specifically for the years 2009, 2011 and 2013. Report of Analysis made on monitoring of degraded lands that are degraded from one form of land to another during the period of 2009-2013 is done by various categories of classification as follows. Major Land of Forest is Degraded and Converted into Built-up of 17.52 Sq. km and to Agriculture land of 9.022 Sq. Km. Fallow Land is changed to Built-up land of 15.23 Sq. Km, to Forest land of 40.66 Sq. Km and to Agriculture of 13.26 Sq. Km.

KEYWORDS: *Land Degradation, Land use, land cover, GIS, Paderu*

1. INTRODUCTION

Degraded lands are major problem in India and affect the way of life for its inhabitants. The problem is more severe in the hilly areas, deserts, arid lands of the country (Rawat et al., 2013; Tripathi et al., 2012). The advent of Remote Sensing (RS) and Geographic information systems (GIS) has opened new vistas in the monitoring of degraded lands (NRSA, 1981). The satellite data have become valuable tools in studying the spatial extent of degraded lands and for monitoring the changes that have taken place over a period of time while the GIS technology proved to be an effective tool in handling, rainfall, temperature etc. and socioeconomic data to perform integrated analysis of data on various resources of any region and to arrive at optimum solutions for various problems (Pickup et al., 1986). Land Degradation causes due to many factors and affects the land in various aspects. To monitor the nature and status of degraded lands in Paderu Region, the satellite data is collected and observed for LULC. The GIS Techniques are in need to monitor these degradation processes to identify various classes of degradation (Dwivedi et al., 1997). Many changes have taken place as years pass on, the various changes occur from one year to another year are monitored using Change Detection Technique (Gajbhiye et al., 2012). In the present study, investigating the efficacy of preferred change detection methods, selected based on existing case studies, availability of resources and target of the work, to fulfil the objectives is one of the major Degradation statistics of lands in Paderu.

2. STUDY AREA

Paderu is a village and a Mandal in Visakhapatnam district in the state of Andhra Pradesh in India (Fig. 1). Paderu is the most important town in the Manyam area of Visakhapatnam district. Paderu is the centre of Visakha agency. Integrated Tribal Development Authority (I.T.D.A) is located in Paderu. Paderu Mandal is located in between latitudes 17°54'0"N– 18°10'0"N and longitudes82°36'0"E– 82°54'0" E. Paderu mandal in Visakhapatnam district is a hilly landscape engulfing 26 villages in its ambit, completely inhabited by tribal community. The Paderu agency area is situated within the range of Eastern Ghats. The elevation of the agency varies from 3000' to 4000' feet from above mean sea level. The soil accounted for in general under textural classification constitutes poor gravel to sandy loams, clay loams to heavy loams with varying volumes of soil. Depth in generally of 5' to 10' and the soil is poor in nitrogen and phosphorous. The range of Eastern Ghats forming the hilly region of Visakhapatnam district with an average altitude of about 900 meters is dotted by several peaks with a height exceeding 1,200 meters. The highest mountain is named Sankaram which scales 1,615 meters height. Rainfall depends on seasonal changes, usually the south-west monsoon starts from third week of April every year and the north-east monsoon starts from the October. The average annual rainfall in this tract is 1,234 MM according to annual reports of ITDA, Paderu. Hail storms in summer and extremely cold climate in winter are common.

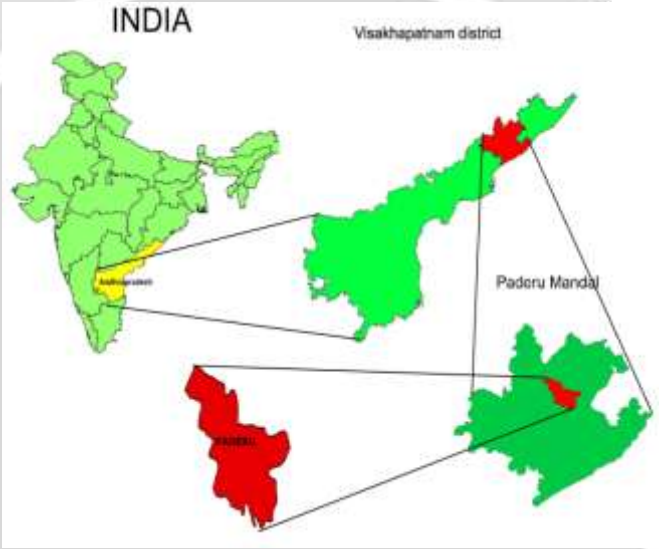

Fig.1: Location Map of study area

3. METHODOLOGY

To achieve the objectives of the study the multi-temporal datasets were geo-referenced with LCC / TM projection and WGS 84 datum. Ancillary data consisted of base details viz.; administrative boundaries (state, district, and village and forest boundary), major roads, railway, drainage, settlements, etc. were taken from available sources. GIS, Remote Sensing and Digital Image Processing Techniques were used for the study.

3.1 Software and Platforms

ARCGIS 10.2.2, ERDAS IMAGINE 9.1, Google Earth and Microsoft Excel are used for the present study.

3.2 Data sets

- Resourcesat-1 Data from LISSIII sensor of 2 seasons pertaining to 2009-13 are used in this study.
- Monsoon Season – Kharif: August - October
- Post-Monsoon – Rabi: December – March

The specific path and row of the satellite data along with date of pass will be displayed when the user is querying the map.

3.3 Base Map Preparation

A map depicting background reference information such as landforms, roads, landmarks, and political boundaries, onto which other thematic information is placed (Fig. 2). A base map is used for location reference and often includes a geodetic control network as part of its structure.

3.4 Topographical Study

The topographical maps are prepared using the toposheets of the study area. The topological study includes various properties of the area are Contours, TIN, DEM, Slope, Aspect, Flow Direction, Flow Accumulation and Drainage Network map (Fig. 3; Fig. 4; Fig. 5; Fig. 6).

3.5 Image Classification

Digital image classification techniques group pixels to represent land cover features. Land cover could be forested, urban, agricultural and other types of features. Here for the study the images are been undergone supervised classification. The Classified image is having 5 classes: Water body, Forest, Agricultural land, Built-Up land, Fallow land (Fig. 7**;** Fig. 8; Fig. 9).

3.6 Change Detection

Change detection analysis was carried out with the help of Change Detection Matrix provided with ERDAS imagine. By giving classified image of two different periods as input, the model automatically find out the area where changes are happened. For knowing changes happened in which type of land use classes statistical analysis were also carried out (Fig. 10; Fig. 11; Table. 1).

4. RESULT AND DISCUSSION

GIS, Remote Sensing and Digital Image Processing Techniques were used for the study. The study was carried out specifically for the years 2009, 2011, 2013.

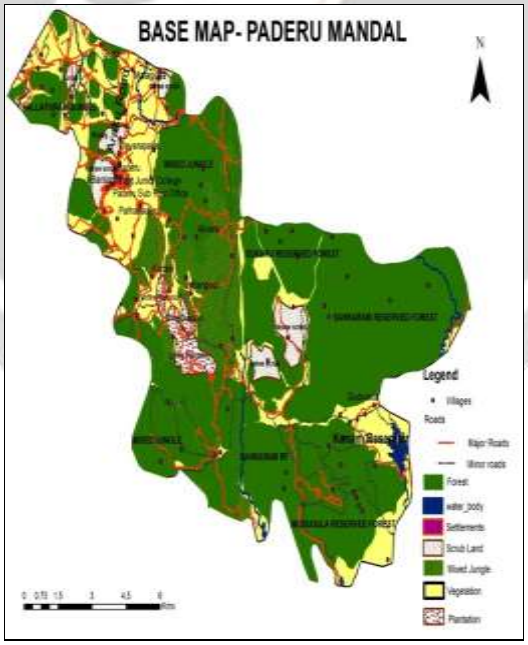

Fig. 2: Base Map of the Study Area

Fig. 3: Contour Map of the Study Area

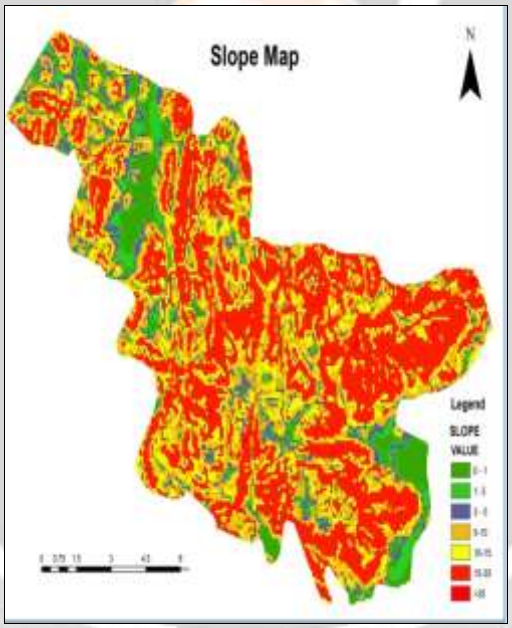

Fig. 4: Slope Map of the Study Area

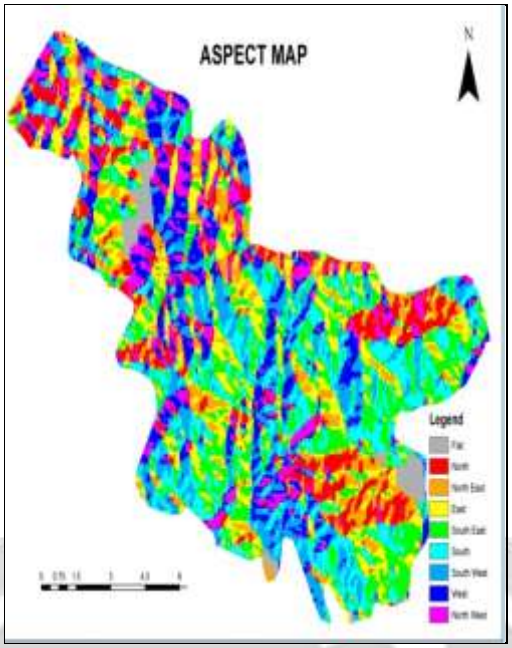

Fig. 5: Aspect Map of the Study Area

Fig. 6: Drainage Network Map of the Study Area

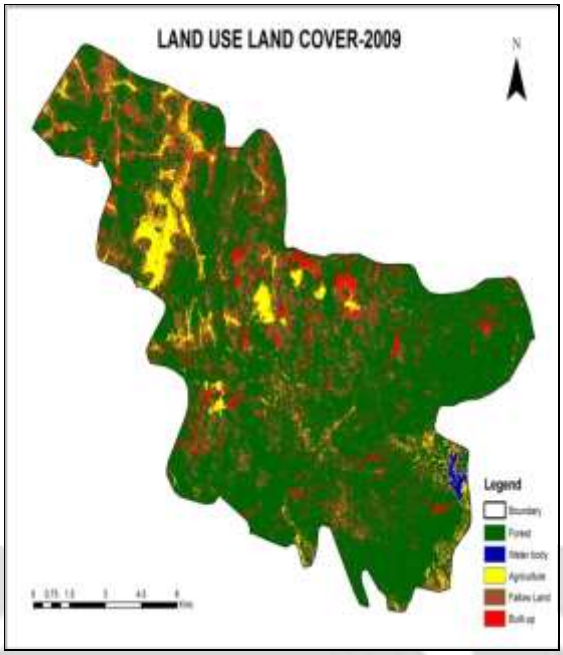

Fig. 7: LULC-2009 Map of the Study Area

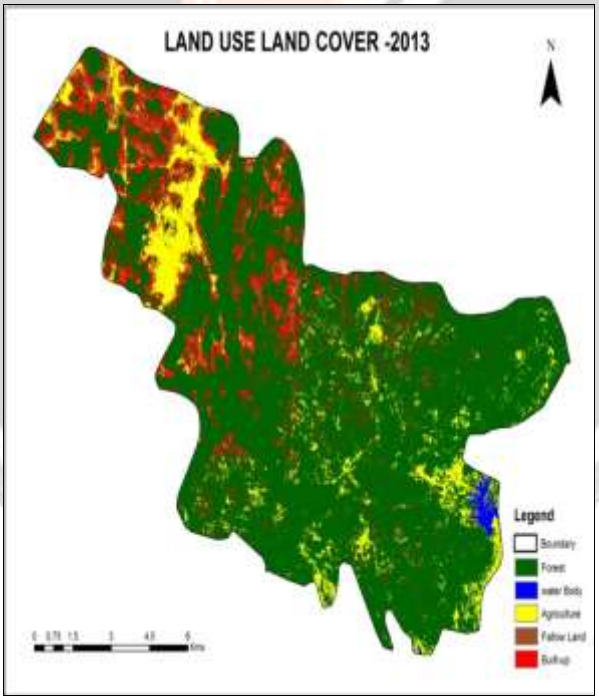

Fig. 8: LULC-2013 Map of the Study Area

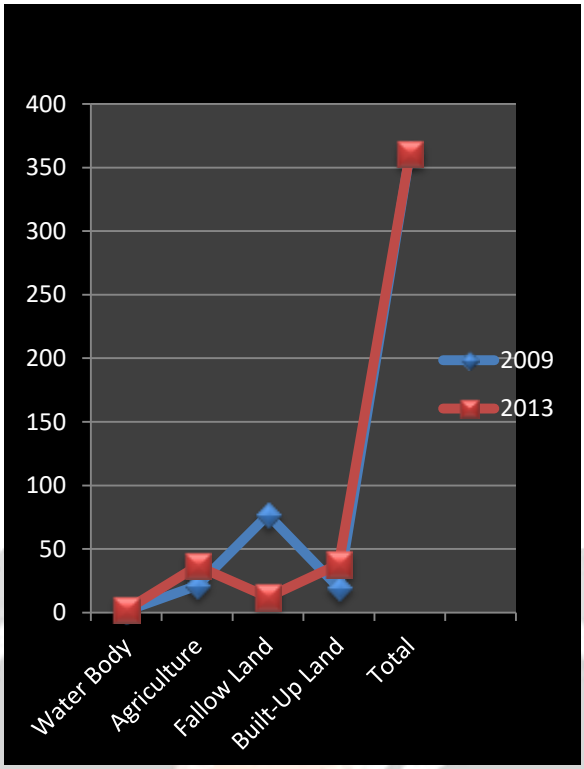

Fig. 9: Comparison of LULC 2009-2013

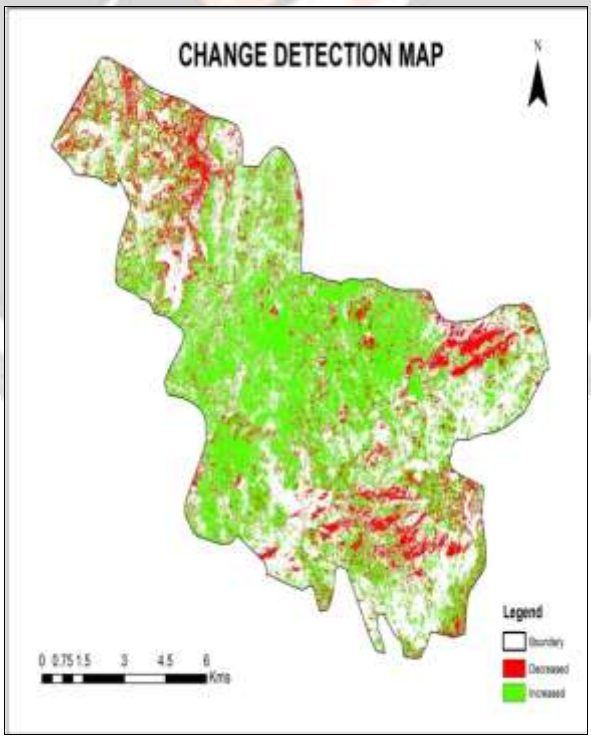

Fig. 10: LULC Change Detection Map of the Study Area

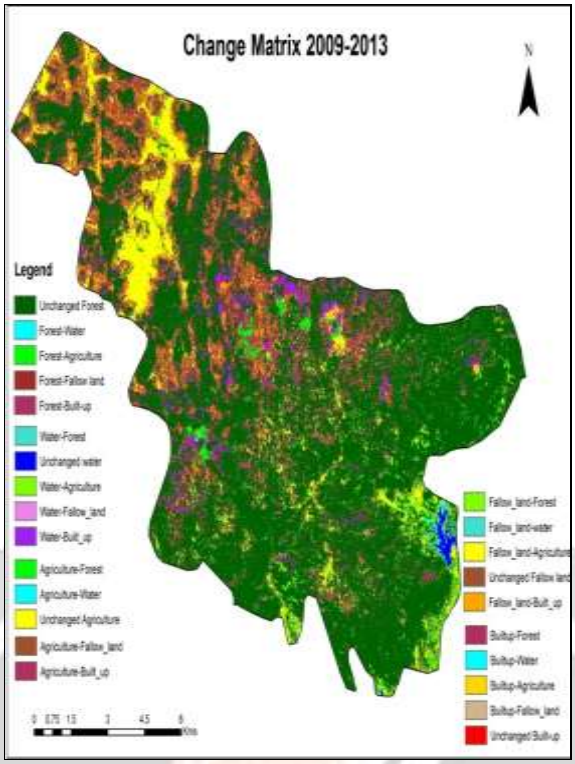

Fig. 11: LULC Change Matrix Map of the Study Area

Table 1: Change Matrix

2009/2013	Forest	Water Body	Agriculture	Fallow land	Built-Up	Total
Forest	214.44	0.14881	9.022	3.0228	17.5243	244.557
Water body	0.079312	1.2706	0.08846	0	0.302957	1.741329
Agriculture	5.6167	0.302957	11.3082	0.9537	3.02715	21.209057
Fallow Land	40.6688	0.2326	13.2695	7.5896	15.2303	76.9908
Built up	9.824	0.049	2.845	0.58	2.43	15.728
Total	272.02	2.0039	36.53316	12.1461	35.487557	360.81

CONCLUSION

Monitoring the degraded lands of Paderu Region is done by using GIS Techniques. LULC of the region is studied. Report of Analysis made on monitoring of Degraded lands that are degraded from one form of land to another during the period of 2009-2013 is done by various categories of classification Major Land of Forest is degraded and converted into Built-up of 17.52 Sq. km and to Agriculture land of 9.022 Sq. Km. Fallow Land is changed to Built-up land of 15.23 Sq. Km, to Forest land of 40.66 Sq. Km and to Agriculture of 13.26 Sq. Km.

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