ISSN 2231-5063 Impact Factor : 3.4052 (UIF) Volume - 5 | Issue - 11 | May - 2016

Golden Research Thoughts

MONITORING OF PATHRI RESERVE FOREST USING RS AND GIS TECHNIQUES"

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ABSTRACT:

Multi-temporal assessment of the Forest in terms of either density or type provides the opportunity to monitor the changes in the forest area over a period of time. Various methods of change detection have been used by various workers and reported similar findings. The satellite based study of the Pathri reserve forest dynamics and LULCC were assessed during the 23 years period (1990-2013) using the approach of digital classification. Considerable changes have been observed due to the large scale clearing of forest land for the agricultural practices. Foot Track was easily observed in the parts of open jungle indicates human interventions as well as signs of disturbances. The main business of the villagers is to breed the cattle's and goats and graze them inside the forest which puts more pressure on the forest in the form of unmanaged grazing. The villages are directly or indirectly depends on the forest for the fodder to maintain their livestock.The exercise demonstrated the high potential of remote sensing and geographical information system for the forest ecosystem dynamics assessment.

KEY WORDS: *Multi-temporal assessment , Various methods , forest ecosystem dynamics assessment.*

Introduction

The Forest is the most ancient and biological diverse of the world's ecosystem. As per Forest Survey of India recent investigation highlight that the country's forest meet about 40% energy needs and 70% of the fuel wood is used by households and rest by commercial and industrial units.

Approximately 80% of the rural people and 48% of urban people use fuel wood for households purpose (FSI 1997).

It is now well established that the present day satellite data combined with GIS has lot of potential in the field of preparation and revision of forest working plan.

Remote Sensing (RS) and Geographic Information System are now providing new tools for advanced ecosystem management. Remote Sensing has unique potential of forest cover assessment. Temporal data allows change detection of land cover changes over a period of time (Kushwaha *et al.,* 2002)

Remote Sensing provides potential to improve upon the conventional in site monitoring (George, 2005). The result of different anthropogenic activities the dense forest cover is now depleted drastically. The problem has been further compounded through improper land use practices in these depleted forests. The Pathri R.F. is affected in this process. (Panikkar, 2006).

Detection of the changes, therefore, has to be an important activity in forest monitoring. The types of changes can vary from short-term phenomena such as disease attack to the long term phenomena like successional changes in structure and the density etc. The frequency of change detection depends to a large extent on the nature of the forest under observation.

Dynamic forest areas (undergoing rapid changes) are monitored with frequency (IIRS, FED, 2007). Forests are one of the most valuable ecological resources of global interest. Forests also provide habitat for numerous animal species. People generally consider that product of forest rather than forests themselves as useful.

An analysis of the nature and rates of environmental changes over recent decades is essential for proper understanding of why present environmental problems have arisen. It is also necessary to allow formulation of accurate predictive models of environmental changes. In this respect information on the existing land use/land cover pattern, its spatial destruction and changes in the land use pattern is a pre-requisite for planning, utilization and formulation of policies and programs for making development plans at micro and macro levels (Sahadevan, 2005).

Change detection is important process in monitoring and managing natural resources and urban development because it provides quantitative analysis of spatial distribution of the population of interest. Change detection as land use change analysis (Jegannathan et al., 2010 and Tiwari and Saxena, 2011), vegetation dynamics (Reddy and Roy, 2008), biodiversity conservation (Roy and Srivastava, 2012), monitoring shifting cultivation, assessment of deforestation (Nanday et al., 2011)and sustainable development (Kushwaha et al., 2010) Various techniques have been described for change detection.

The exercise demonstrated the high potential of RS and GIS for forest ecosystem dynamics assessment to predict the forest cover change. The present study has been undertaken to identify the changes in land use/land cover from the year 1990 to 2013 using remote sensing satellite data.

5.Materials and Methods

5.1 Materials Used:

1. Material required

Satellite data (LAND SAT) resolution 30m Resolution

Path 146, Row 39, Path 146 Row 39.

2. Topographic map on 1:50,000 scale

Survey of India Toposheet No. 53 K/1 surveyed on 1966-67

3. Software

(i) ERDAS Imagine 9.3

To register and process the digital data interpretation

(ii) Arc GIS 10

To digitize data
To add attribute data to the shape.
File of digital data
Area calculation of the attributes.

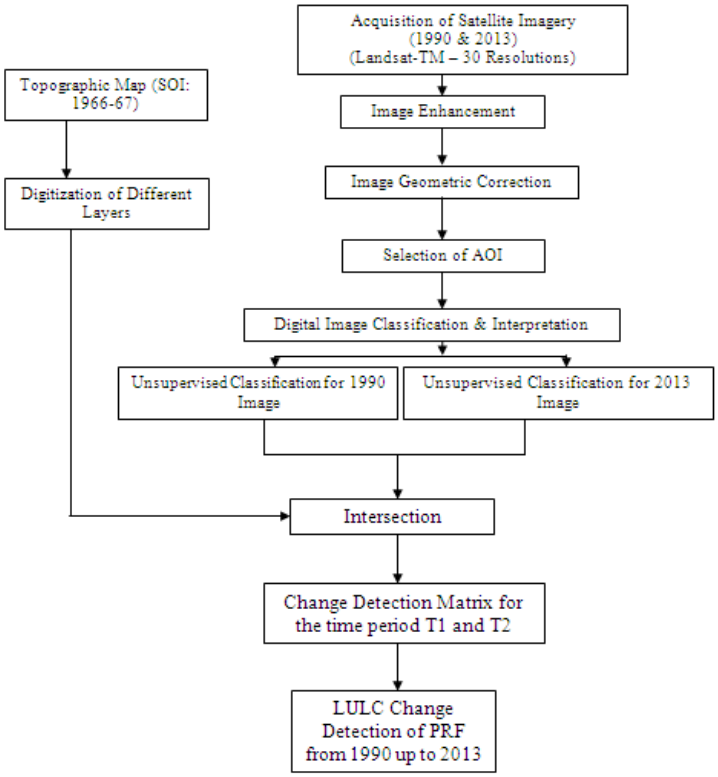
(iii) MS Office Excel.

Calculation of area under different classes.
Change matrix calculations

(iv) MS Office – Word

To analyze results
Project compilation
Hardware used
PC with Core Quad processor
HP Scanner
HP Laser Printer

Flow chart



METHODOLOGY

Acquisition of Satellite Imagery (1990 and 2013) Landsat-TM 30 m resolution Path 146 Row 39.Image Enhancement using histogram equalization, standard deviation stretch, contrast and brightness enhancement etc.Geometric correction of satellite image and match the projections of

satellite image and digitized map.Subset image has prepared by using area boundary prepared by using toposheet.Digital image classification technique was used for the interpretation of the satellite images. The unsupervised classification of the T1 and T2 image was prepped by using same technique.The T1 and T2 classified images were intersect with each other for the preparation of change detection matrix.The change matrix table waste prepared by using MS-Excel Pivot table.The results were interpreted by using land cover land use map of T1 and T2 images. Landsat TM satellite imageries of different years (1990 and 2013) were acquired for forest cover assessment. The false color composites (FCC) were generated from the downloaded data NIR, Red and Green in RGB color guns. Subset of image preparation of the study area was done for each data and the study area was extracted by using Pathri Reserve Forest Boundary layer.Visual interpretation of multi temporal image composite and on screen tone, shape, size and patters of the images are key elements useful for identification of land cover land use through visual and digital image classification. The unsupervised classification method was employed to separate the different forest and non forest categories using 60 class intervals. The features class like dense forest, open forest, marshy land and river bed, grassland areas, settlements, agricultural areas and water bodies. These 60 classes were recorded according to the class and clump together in ERDAS.

The classified T1 and T2 images then converted in the grid file by using GIS conversion tools. In ERDAS these files were converted into thematic file format using model maker tool. Then these two time thematic images were club together in matrix for the change detection.

The change detection matrix table was prepared by using Pivot table in MS-Excel. The results were interpreted by using land cover land use map of T1 and T2 images.

RESULT AND DISCUSSION

LU90 / LU13	Dense Forest	Open Forest	Marshy Land	Grassland	Settlement	Agriculture	Water Body	**Grand Total**
Dense Forest	4.46	3.21	0.20	0.84	0.04	0.61	0.01	**9.38**
Open Forest	1.76	2.26	0.27	2.00	0.06	3.38	0.03	**9.79**
Marshy Land	0.71	1.43	0.03	0.87	0.19	8.62	0.02	**11.90**
Grassland	0.07	0.14	0.01	0.17	0.03	3.39	0.003	**3.77**
Settlement	0	0.01	0	0	0.03	0.09	0	**0.13**
Agriculture	0.03	0.31	0.01	0.34	0.12	2.26	0	**3.07**
Water Body	0.15	0.21	0	0.04	0.01	0.07		**0.49**
Grand Total	**7.2036**	**7.578**	**0.5184**	**4.2192**	**0.5184**	**18.4464**	**0.0792**	**38.56**

Table No.1 Showing land use land cover change in Pathri Reserve Forest during time period 1990 to 2013.

Fig. No. 2 Graph of LULC of Pathri Reserve Forest (1990)

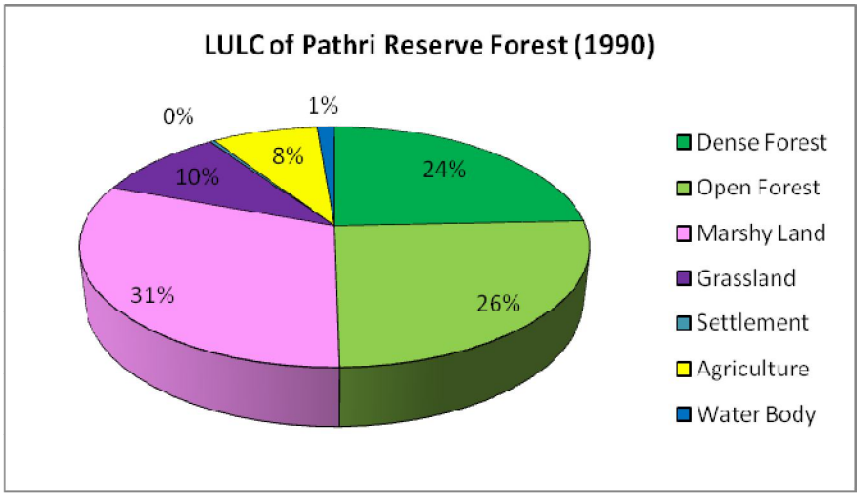


Fig. No. 3 Graph of LULC of Pathri Reserve Forest (2013)

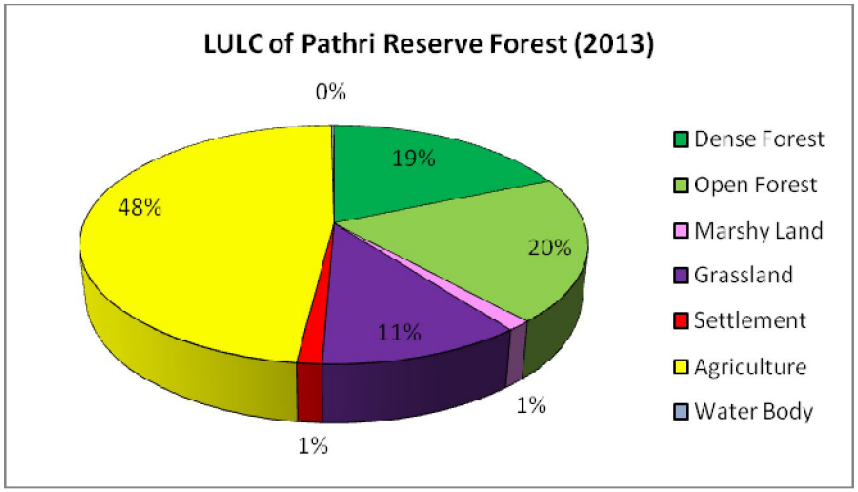
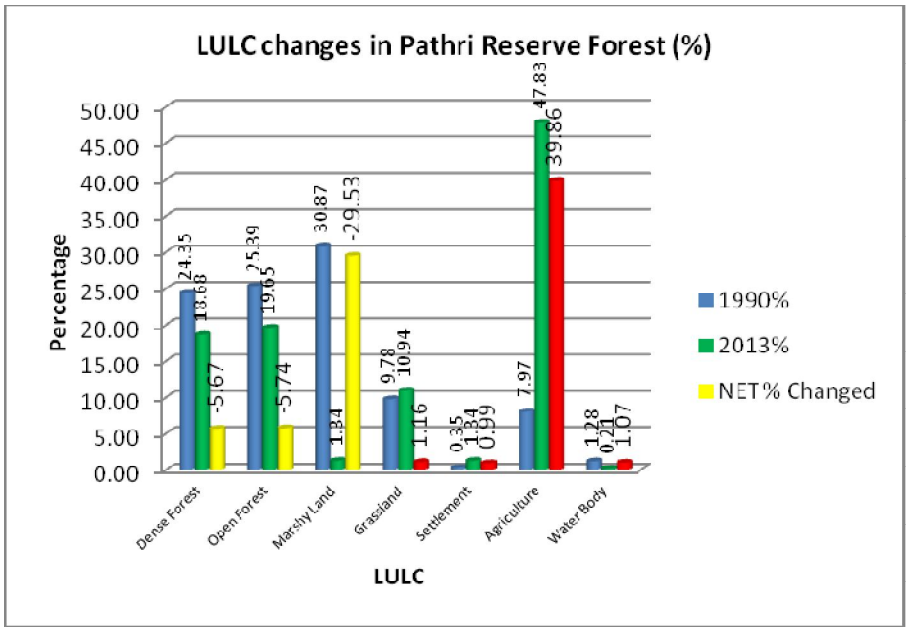


Table No.2 Land Use Changes in Pathri Reserve Forest (Percentage)

	1990%	2013%	NET % Changed
Dense Forest	24.35	18.68	-5.67
Open Forest	25.39	19.65	-5.74
Marshy Land	30.87	1.34	-29.53
Grassland	9.78	10.94	1.16
Settlement	0.35	1.34	0.99
Agriculture	7.97	47.83	39.86
Water Body	1.28	0.21	-1.07

Fig. No. 4 Graph of LULC Changes in Pathri Reserve Forest (Percent)



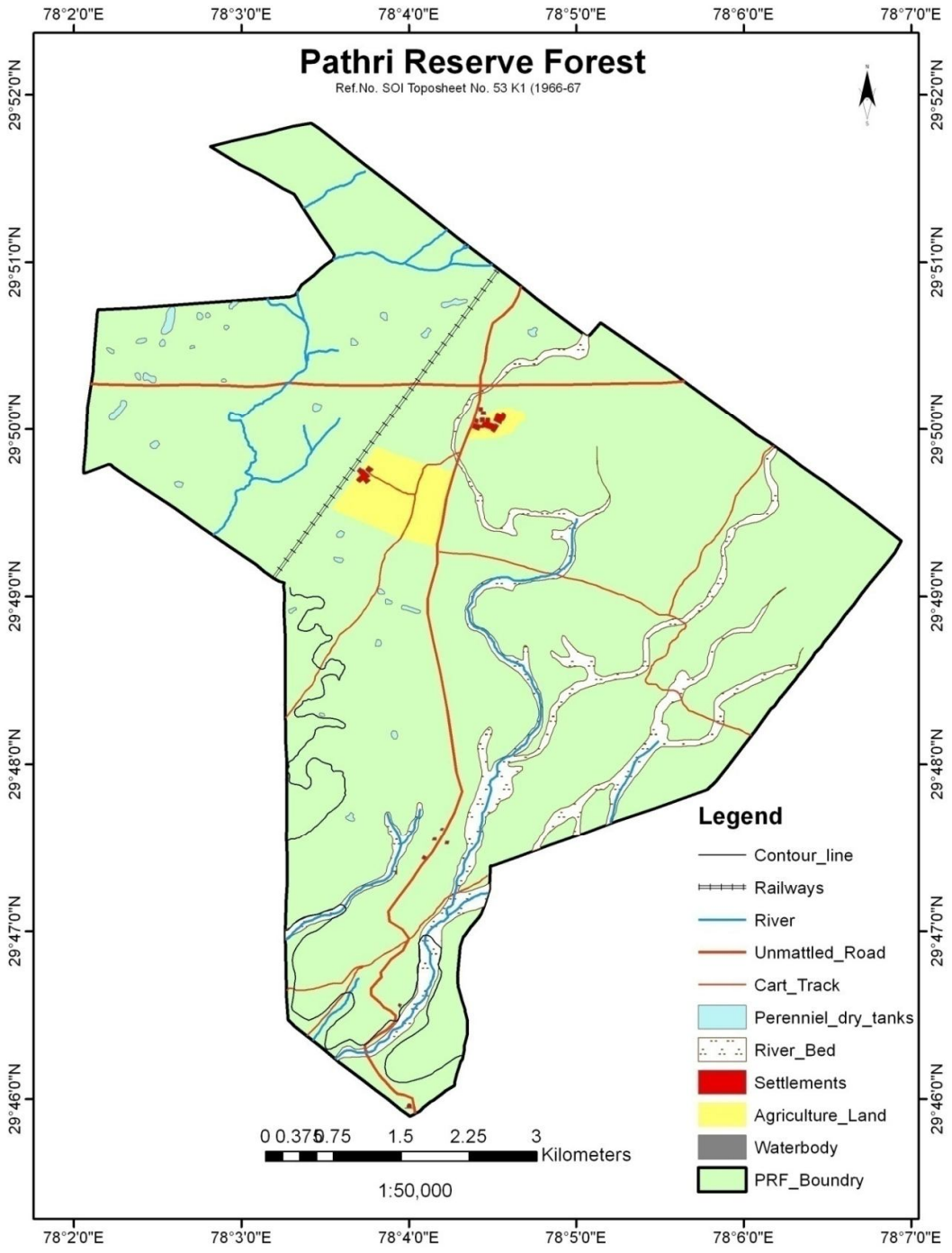


Fig. No.5 Digitized map of Pathri Reserved Forest

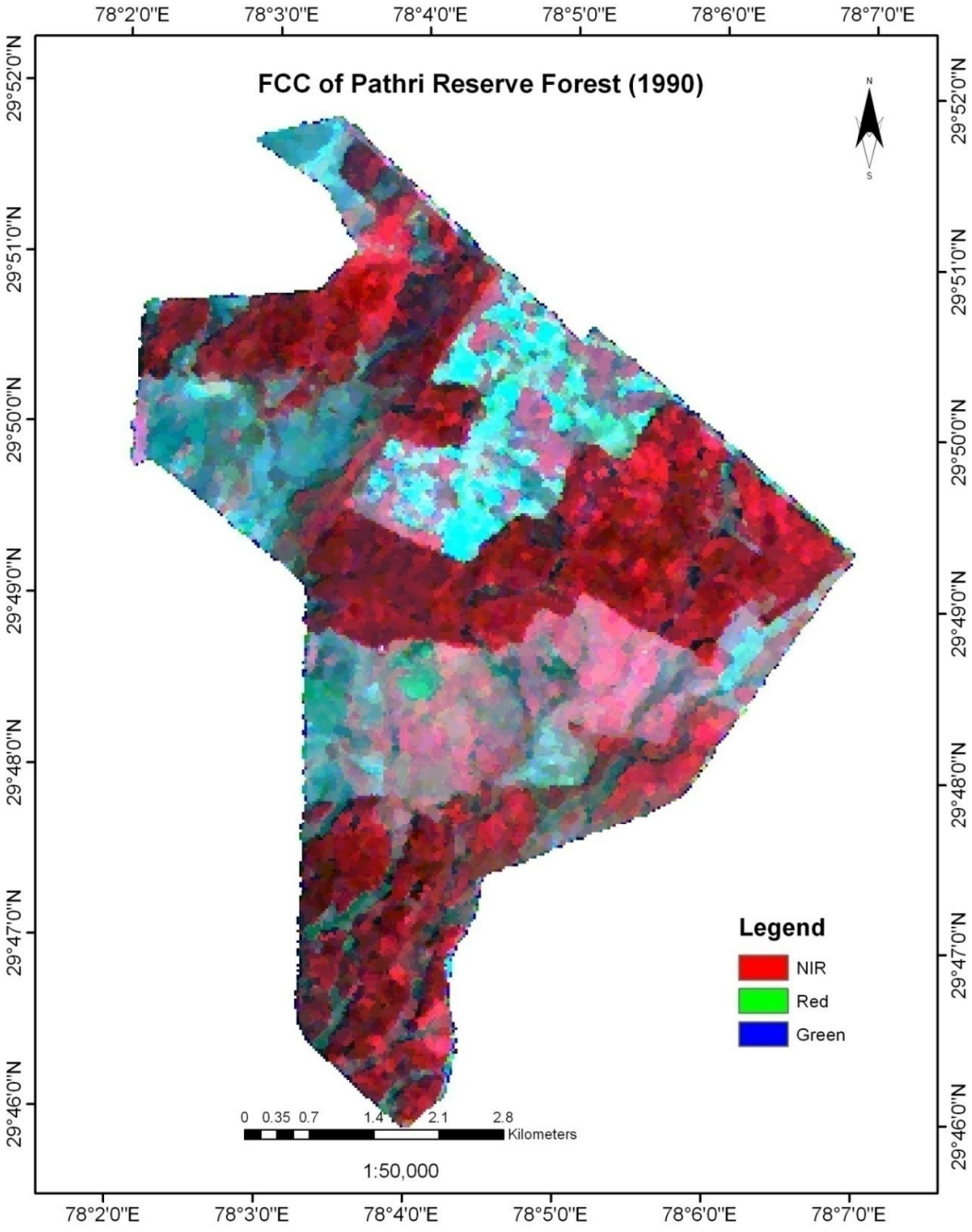


Fig No.6 FCC of Pahtri Reserve Forest (1990)

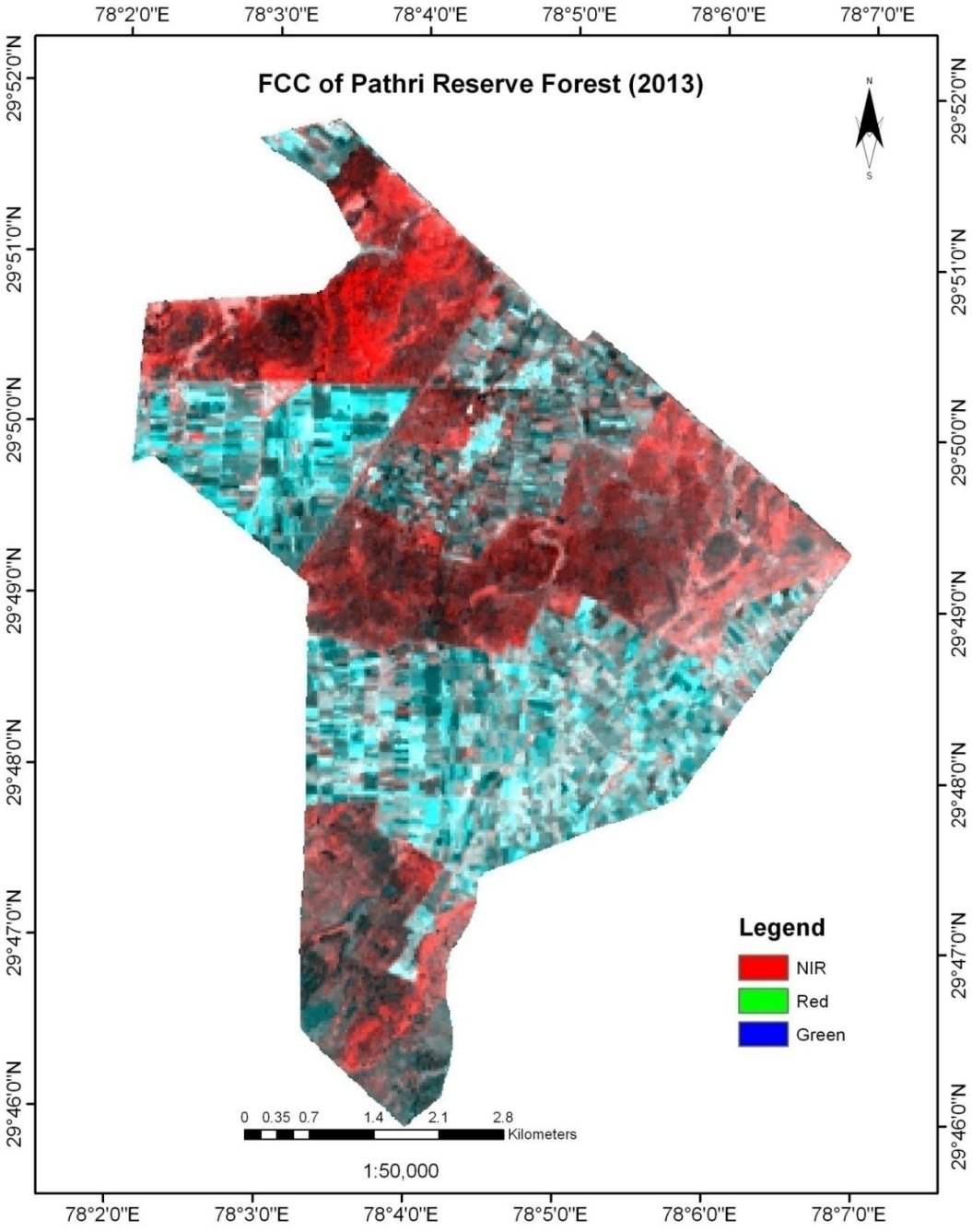


Fig No.7 FCC of Pahtri Reserve Forest (2013)

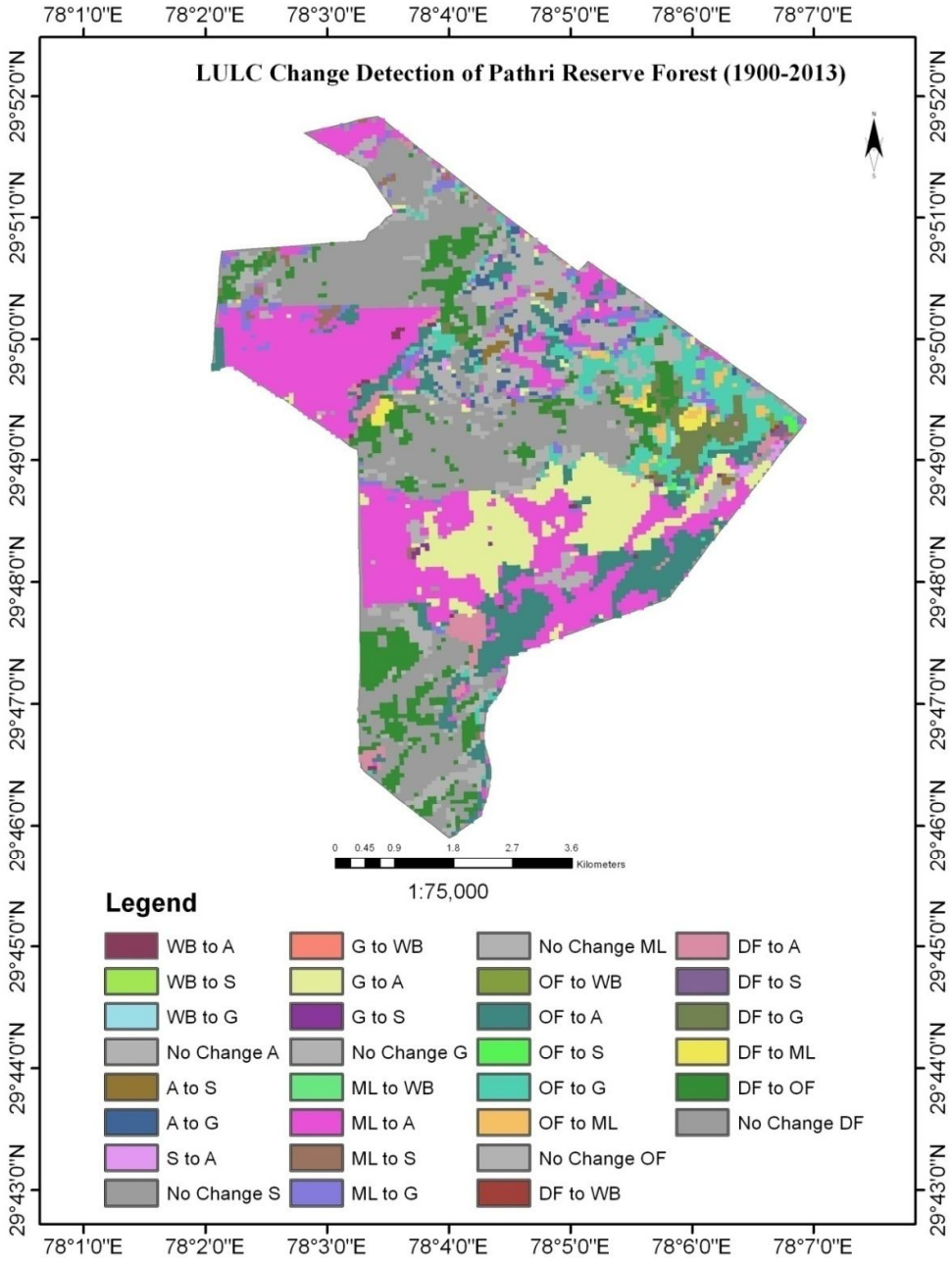


Fig No. 8 LULC change detection of Pathri Reserve Forest (1990-2013)

The selected area of interest (AOI), the Pathri Reserve Forest with the total area of 38.56 (sq.km.) based on the classification the dense forest, open forest, marshy land/river bed, grassland, settlement, agriculture area and water bodies etc., classed was prepared.

Form the change matrix of Pathri Reserve Forest it has been observed that in 1990 out of the total area 24.35% (9.38 sq.km) area is under dense forest, 25.39% (9.7 sq.km) areas is under open forest, 30.87% (11.9 sq.km) area covered with marshy land and dry river beds. While 9.78% (3.77 sq.km), 0.35% (0.13 sq.km) and 7.79% (3.07 sq.km) area covered by grasslands, settlement and agricultural land respectively. Water body contributes up to 1.28% (0.49 sq.km) area in 1990.

Change matrix of Pathri Reserve Forest for 2013 shows that 18.68% (7.20 sq.km) area is under dense forest, 19.65% (7.58 sq.km) areas is under open forest, 1.34% (0.51 sq.km) area covered with marshy land and dry river beds. While 10.94% (4.21 sq.km), 1.34% (0.51 sq.km) and 47.83% (18.44 sq.km) area covered by grasslands, settlement and agricultural land respectively. Water body contributes up to 0.21% (0.079 sq.km) area in 2013.

Probable reasons for changes.

Due to anthropogenic activities like agriculture development, roads, settlements etc. areas of agriculture, settlements and grassland has considerably increased manifolds. From 1990 up to 2013 the agricultural areas was increased 39.86 %, grassland area was increased by 1.16% and settlement was increased by 0.99% with due course of time.

The habilitation practices make a overburden on the forest areas. The dense forest area reduced by 5.67%, open forest 5.74%, marshy land 29.53% and water body by 1.07% that means the dense forest were reduced approximately from 24% to 19%, open forest were reduced from approximately 26% to 20%, marshy land were reduced approximately from 31% to 1% and water body from 1.08% to 0.21% considerably.

REFERENCES

1. FSI, 1997, State of Forest Survey of India.
2. George, Joseph 2005, Fundamental of Remote Sensing Second edition Universities Press, Ahmedabad – India.
3. Jitendrudu, L.R.B.(2004). Digitial changes detection techniques on Multi spectral imagery. IIRS Human Settlement Analysis group India.
4. Joshi Ritesh and Singh Rambir (2009). Gujjar Community Rehabilitation from Rajaji National Park: Moving Towards an Integrated Approach for Asian Elephant (*Elephas maximus*) Conservation, *J Hum Ecol*, 28(3): 199-206.
5. Kushwaha, S.P.S. (1990). Forest type mapping and change detection from satellite imagery ISPRS Journals of Photogrammetry and Remote Sensing 45, 175-181
6. Kushwaha, S.P.S. and Hazarika, R. (2004). Assessment of habitat loss in Kaneng and Sonitpur Elephant Reserves. Current Science 87 (10) 1447-1453.
7. Kushwaha, S.P.S., Dwivedi R. S. and Rao, B.R.M. (2000). Evaluation of various digital images processing technique for detection of coastal wetlands using ERS-1 SAR data. International journal of Remote Sensing 21 ; 565-579.
8. Kushwaha, S.P.S., Suchismita Mukhopadhyay,V. Hari Prasad and Suresh Kumar (2010). Sustainable development planning in Pathri Rao subwatershed using geospatial techniques current science, vol. 98, No. 11, 10.
9. Nandy, S. ,Kushwaha, S.P.S. and Mukhopadhyay, S. (2007). Monitoring chilla- Motichur wildlife Corridor using geospatial tools. Journal for Nature Conservation 15(4) 237-244.

10. Nandy, S., S.P.S. Kushwaha and V. K. Dadhwal (2011). Forest degradation assessment in the upper catchment of the river Tons using remote sensing and GIS Ecological Indicators 11, 509-573.
11. Panikkar, S. V. (2006). Manager Business Development Mapping / GIS Group Rolta India Ltd.
12. Reddy,C.S. and Arijit Roy (2008). Assessment of three Decade Vegetation Dynamics in Mangroves of Godavari Delta, India using Multi temporal satellite data and GIS Research Journal of Environmental Sciences 2 : 108-115.
13. Roy, A. and V. K. Srivastava (2012). Geospatial approach to identification of potential hotspots of land use and land cover change for biodiversity conservation. Current Science Vol. 102, No. 825.
14. Sahdevan Sunil (2005). Land use / Land cover change analysis in Pampa of Periyar Tiger Reserve, IIRS Forestry and Ecology Division India.
15. Srivastava, S., Singh, T. P., Kushwaha, S.P.S. and Roy, P. S. (2002). Mapping of large scale deforestation in Sonitpur district Assam. Current Science 82(12), 1479-1484.

ACKNOWLEDGEMENT

Authors are grateful to Dr. S.P.S kushwaha,Group Director ,PPEG and Head,Department of Forestry and Ecology, Indian Instiute of Remote Sensing-IIRS(Indian Space Research Organisation-ISRO)Deparment of Space, Government of India,Dehradun, Uttarakand,India for encouragement and to provide facilities.Authors are also thankful to Dr.Hitendra Padalia ,Scientist/SE Department of Forestry and Ecology,IIRS Dehadun for valuable suggestion.