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Analysis of Change Detection using Land Use Land Cover Analysis, Satara District, Maharashtra, India

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Abstract – Many human activities as well as continuous natural processes are responsible for many changes in land. Any change that is positive or negative has large importance in human life. It has great impact on various strategic planning, decisions and it shows the trend in future. So analysing such changes using geospatial techniques are necessary. Geospatial techniques like Remote Sensing & GIS are important tools in this. This paper illustrates such changes for Satara District of Maharashtra, State over the period 2012 to 2021. Area is subdivided in 5 categories viz. scrub land, natural vegetation, fallow land, waterbodies, agricultural land. The knowledge of changes in this areas will help us to take necessary actions or remedial measures.

Key Words: Land Use, Land Cover, Change, Remote sensing & GIS, Decision making, Planning

1.INTRODUCTION

Human activities, industrial revolutions, increase in the populations and their tremendous requirements as well as their standard of livings are the things which are responsible for the changes in land use. Humans continuously alters the land as per their needs. The large construction activities, continuous mining for roads, minerals, petroleum products, residence needs as well as requirement of water to serve population also their need of foods are some factors responsible to cause change in land use. The natural processes like volcanic eruptions, earthquakes, floods, landslides etc. are also responsible for changes in land cover.

Hence the sufficient information about this haphazard & uncontrolled development is necessary to decide nation's policy. Government spends tremendous money on various schemes like housings, irrigation, planting of trees etc. So such a change detection is helpful for any government to review their policies and take corrective actions.

Satara is one of the important district in Maharashtra state of India. It has an area about 10475 km^{2}.. It comes under Pune region. It has situated in Sahyadrians mountain ranges. It has 11 Tehsils out of these Mahabaleshwar tehsil has heavy rainfall above 6000mm annually. On the other hand, tehsils like Man has scanty of rainfall about 350 mm annually. The Koyana, Venna, Nira, Krishna, Tarali are the rivers in this area. Koyana wildlife sanctuary is the biggest forest area present over here. The District has jowar, maize, sugarcane, turmeric, bajara etc. as its main crops. The population of Satara district is 30,03,741 as per census 2011 of Government of India.

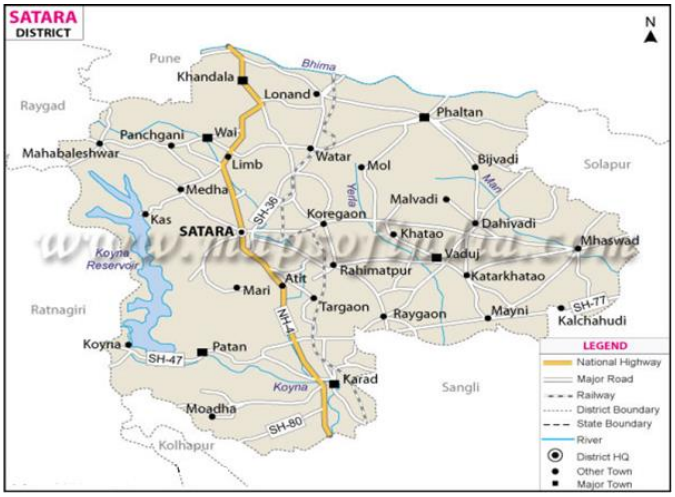

Fig -1: Satara District Map
(Source-Survey of India)

Remote Sensing becomes a vital tool to observe such changes over the period. Digital change detection techniques are helpful to analyze the changes and its percentage. ERDAS Imagine 2010 is used to make classification of land. GIS tool like ARCGIS 9.0 is used to draw a map of the area. The satellite data is collected from BHUVAN-online geostationary platform developed by ISRO.

2. Problem Statement

Satara district in Maharashtra state, has witnessed remarkable expansion, growth and developmental activities such as building, road construction, deforestation and many other anthropogenic activities.

It is therefore necessary for a study such changes carried out in Satara district. It will avoid the associated problems of a growing and expanding city like many others in the world.

3. Objective

1. To prepare Land Use & Land Cover maps of Satara District for 2012 & 2021.

2. To determine the changes over the decade in various classes of the Land.

Table -1: Data type, Source & Utility

Sr. No.	Source	Source	Use
1.	Research Papers	National/ International Journal Papers	To define our Project Objectives
2.	Satellite imagery	National Remote Sensing Centre, Hyderabad, India.	Land Use/ Land Cover Analysis

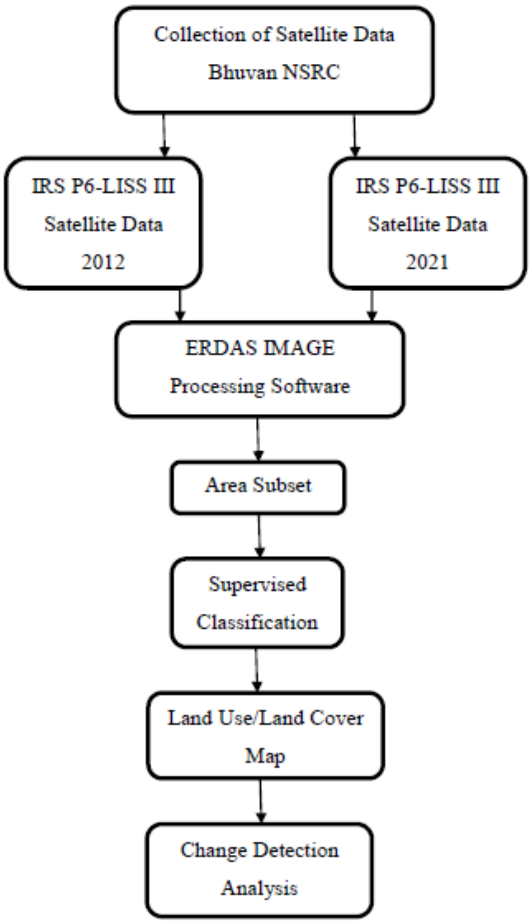

Fig -2: Flow Chart of Methodology

4. Land Use Land Cover Analysis

To determine the changes between LISS-III satellite image of 2012 & 2021, data is collected from Bhuvan website developed by NRSC, India. It has spatial resolution of 30m. Multispectral & Multi-temporal images are chosen for study because their resolution is suitable for classification.

4.1 Pre-processing of Images

Before analysis pre-processing of the image is carried out. It contains image stacking, sub setting, mosaicking. LISS III image consists of four bands (Red, Green, Blue & Violet). All of these processes are carried out with the help of ERDAS IMAGINE 2010 software.

4.1 Land Cover Classification

In this process pixels of continuous raster image are applied to predefined land cover classes. The land cover classes generated are waterbodies, natural vegetation, open scrub land, Fallow land, Agricultural land.

Table -2: Land covers Colour assignment

Sr. No.	LULC Classes	Colour Assigned
1.	Water Bodies	Blue
2.	Natural Vegetation	Quetzal Green
3.	Open Scrub Land	Ginger Pink
4.	Fallow land	Mars Red
5.	Agricultural Land	Fir Green

The False Colour composite image and its LULC classification image of the subsequent year 2011 and 2021 are generated by using above said procedure and presented in Fig. no. to Fig. no.

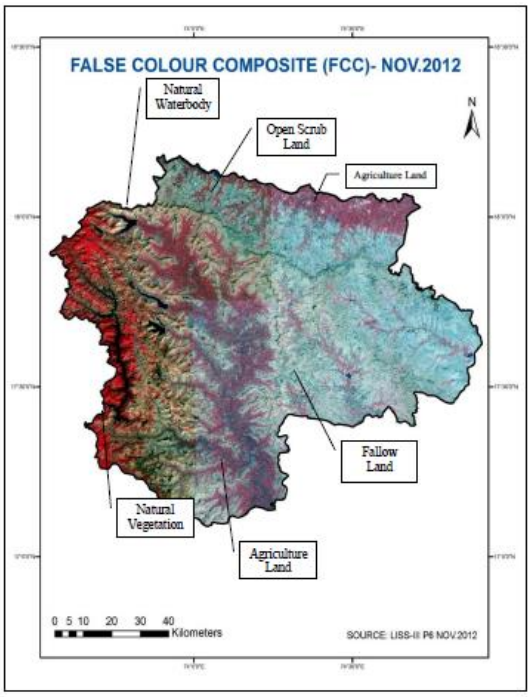

Fig -3: False Colour Composite 2012 Image

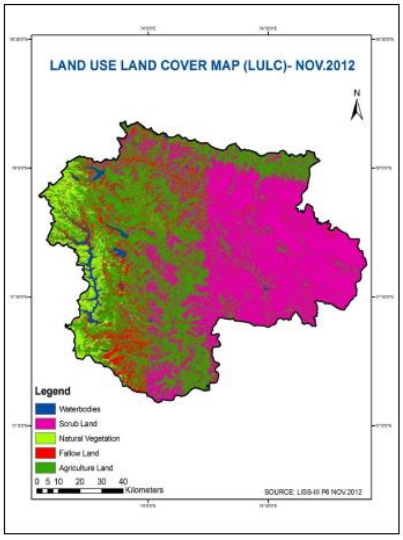

Fig -4: Land Use Land Cover Image of Satara District 2012

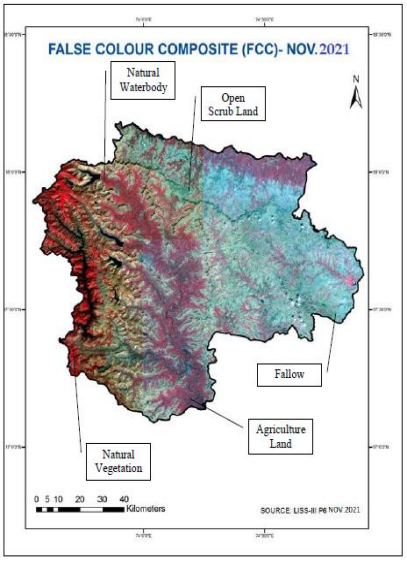

Fig -5: False Colour Composite 2021 Image

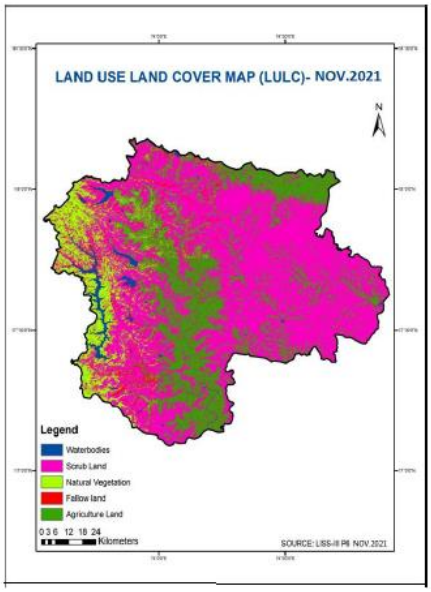

Fig -6: Land Use Land Cover Image of Satara District 2021

5. Change Detection Analysis

The change in land use is identified using geospatial techniques between the period 2012 & 2021 is tabulated in table no. 3 below

Table -2: Land covers Colour classification

Class Name	2012		2021		Change In %
	Area (km^2)	Area %	Area (km^2)	Area %	
Water Bodies	167.60	1.60	188.55	1.8	+0.2
Natural Vegetation	554.1275	5.29	995.125	9.5	+4.21
Open Scrub Land	4678.135	44.66	6228.435	59.46	+14.8
Fallow land	857.9025	8.19	326.82	3.12	-5.07
Agricultural Land	4217.235	40.26	2736.07	26.12	-14.14
Total	**10475**	**100**	**10475**	**100**	**N/A**

Table 2 shows positive & negative changes. Positive change shows increase in the areas while negative shows decrease in the area.

6. Results and Discussions

The efforts taken by the government to improve irrigation shows positive change of +0.2% (+20.95 km^2). Large efforts of trees conservation & planting shows positive change of +4.21% (+440.9975 km^2). At the same time open scrub land also shows positive change of +14.8 % (+1550.3 km^2). Fallow land shows negative change of -5.07 % (-531.0825 km^2). Also agricultural land has negative change of -14.14% (-1481.165 km^2).

7. CONCLUSIONS

The three level hierarchic based configurations reveal that the Scrub land is the major LU/LC category in the Satara area covering 6238.91 km^2 (59.56%), followed by agricultural land, Natural Vegetation, Fallow land and water bodies respectively, contributing 2724.5475 km^2 (26.0115) %, 995.125 km^2 (9.49%), 327.8675 km^2 (3.12%) and 188.55 km^2 (1.80%) of the total geographical area.

The study concludes that in the Satara district area scrub land contributed the highest (59.56%), while the lowest was contributed by water bodies (1.80%) and also finds the driving forces that show the considerable impact on the urban ecosystem.

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