Land Cover Change Analysis in Shendurney Wildlife Sanctuary, Western Ghats, India Using Geoinformatics

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Abstract: **Land cover, defined as the assemblage of biotic and abiotic components on the Earth's surface, is one of the most crucial properties of the Earth system . Land cover plays a major role in the carbon cycle and acting as both sources and sinks of carbon. In particular, the rates of deforestation, a forestation and re growth of plant play a significant role in the release and sequestering of carbon and consequently affect atmospheric CO_2 concentration and the strength of the greenhouse effect. Thus, the need to monitor land cover is derived from multiple intersecting drivers, including the physical climate, ecosystem health, and societal needs. Tropical forests have undergone rapid land cover changes especially in the last few decades. Terrestrial forest is one of the major factors in the global carbon balance, and therefore in global climate change. Change in forest cover may also have affected past climates on regional or sub-continental scales. Forest cover change accelerates the climate change and global warming. The present study analyses the land cover change in the Shendurney wildlife sanctuary for a period of forty years using GIS and Remote sensing techniques.**

Key words: GIS, Remote sensing, vegetation ,wildlife sanctuary

I. INTRODUCTION

Terrestrial forest is one of the major factors in the global carbon balance, and therefore in global climate change (Francey *et al.,* 1995; Fang *et al*., 2001). Change in forest cover may also have affected past climates on regional or sub-continental scales. Forest cover change accelerates the climate change and global warming (Ruddiman, 2003). Anthropogenic activities such as agriculture, mining, deforestation and construction have profound influence on shifting patterns of land use. Land use and land cover (LULC) change is gaining recognition as a key driver of environmental change in recent time. Changes in LULC are pervasive, increasingly rapid, and can have adverse impacts and implications at local, regional and global scales (Yang, 2001). Land use/land cover is a fundamental variable that impacts the forest fragmentation and isolation of habitats, which is being linked with human and physical environments (Giriraj *et al*., 2010). Forest cover changes may have been important consequences for natural and forest landscapes through their impacts on soil and water quality, biodiversity, and global climatic systems (Chen *et al*., 2001). Forest cover changes are the most common cause of loss of biological productivity and biodiversity in aquatic and terrestrial ecosystems. (Harris, 1984; Armsworth *et al*., 2004; Matsushita *et al.,* 2006).

Land cover mapping is a product of the development of remote sensing, initially through aerial photography, remote sensing technology, because of the benefits it offers (wide area coverage, frequent revisits, multispectral, multisource, and storage in digital format to facilitate subsequent updating and compatibility with GIS technology) proved very practical and economical means for an accurate classification of land cover. The Remote sensing and GIS approach for land cover dynamics is now a widely accepted tool because of its ability to examine spatially referenced objects over time (Lo and Shipman 1990). However, the GIS overlaying forest change detection technique has been found to be superior (Malila, 1980; Ludeke *et al*., 1990; Lambin, 2003; Roy and Tomar, 2001). Land use and land cover change are perhaps the most prominent form of global environmental change since they occur at spatial and temporal scales immediately relevant to our daily existence . Technically, land use and land cover change mean quantitative changes in areal extent (increase or decrease) of a given type of land use and land cover respectively. Land use and land cover change are a manifestation of forces both anthropogenic and environmental – climate driven factors (Liu *et al*, 2009). The present analysis of land use and land cover change involves a quantitative estimation of land use and also reveals the periodic change that occurs in the forest vegetation in the area and its extent in detail.

II. MATERIALS AND METHODS

Present study adopted GIS and Remote sensing based approach for the analysis of vegetation change , the data used for the analysis including Landsat Multi Spectral Scanner (MSS) image 1973, Landsat TM (Terrain Mapper) satellite imagery 1992 , Landsat ETM + (Enhanced Terrain Mapper) imagery 2000 and IRS-1C Linear Imaging Self Scanner (LISS)-III satellite data of 2009. The digital number (DN) values of the Landsat MSS , Landsat TM , Landsat ETM+ and IRS P6 LISS III data were converted into radiance values using the corresponding satellite sensor parameters for analysis. Then the images undergo

Radiometric corrections, Geometric corrections, Image analysis and Accuracy assessment. A hybrid approach combines the advantages of the automated and manual methods to produce a land cover map that is better than if just a single method was used. One hybrid approach is to use one of the automated classification methods to do an initial classification and then use manual methods to refine the classification and correct obvious errors. The software used for the analysis includes Arc GIS 10, and ERDAS Imagine. Classified and accuracy assessed satellite images are used for the change detection analysis. For change detection analysis the raster image is converted in to corresponding land cover polygon by using ESRI Arc GIS software. In Arc GIS, geographic analysis extension is used for change detection analysis, in this 'Union' operation is used. Based on the change detection analysis cover change of the year 1973 to 1992, 1992 to 2000, 2000 to 2009 and1973 to 2009 was generated and area statistics were calculated. In change table positive value indicates that the area of land cover is increased with previous year and negative value indicates that the land cover area of specified class is decreased compared to previous land cover image.

III. RESULTS AND DISCUSSION

The land cover map of 1973, 1992, 2000 and 2009 and area matrix of Shendurney wildlife sanctuary is shown in the figure and change are is shown in the table .The dominating land cover of Shendurney wildlife sanctuary is west coast tropical evergreen forest and followed by west coast semi evergreen forest. The map from 1973 to 2009 shows that there is decrease in the extent of southern moist mixed deciduous forest and there is drastic increase in the extent of water body and grassland. The drastic change or increase of water body from 1973 – 1993 is because of the construction of Kallada dam in Shendurney wildlife sanctuary. This reveal that the forest of Shendurney wildlife sanctuary is undergo degradation. The result indicated that the forest type during the study period was degrading that means the extent of west coast tropical evergreen forest and west coast semi evergreen forest is decreasing and the extent of southern dry mixed deciduous forest and grass land is increasing.

In Shendurney wildlife sanctuary from1973 – 2009 the rate of change of west coast tropical evergreen forest is -3.440.5267%, west coast semi evergreen forest is -7.060.7642% , southern moist mixed deciduous forest is -4.766%, southern hilltop tropical evergreen forest is 0.177% , southern dry mixed deciduous forest is -0.260%, grassland is 2.085% ,water body is 4.726%, meristica swamp is -0.474 and encroachment / settlement is -0.943198%.The percentage of increase in water body is due to the construction of Shendurney dam. There is a slight decrease in encroachment / settlement this is due to the loss of settlement area during the construction of dam. The forest cover type change analysis indicate that the forest area of these sanctuaries area under degradation.

The spatial location of land cover change indicated that most of these forest cover transformations have occurred on the fringes of the sanctuary or near to settlements inside the sanctuary. These changes could generally be attributed to different clusters of causes: livelihood dependence of local people, infrastructure development, agricultural expansion and forestry operations and forest fire. It has been observed that there is a high population growth rate in the settlements that are inside the sanctuary and their economic condition is far below satisfactory (Sajeev *et al*., 2002). The major demands of the population on the forest of the sanctuary are timber for building construction, small timber for agricultural implements, huts and fencing purposes, firewood for domestic consumption, grasses for rearing goats and cattle and for roofing of houses. In addition, infrastructure developments like construction and maintenance of roads arid buildings for the support of people who are residing inside the sanctuary and associated movement of machinery are contributing to the degradation of a system which was already under pressure. Another major threat is grazing, the number of livestock that graze in the forests (Kumar *et al*., 2002) and this is probably playing an important role in the degradation of undisturbed or intact forest. Soil erosion and forest fire also accelerate the process of forest degradation. It has been widely recognized that population growth or pressure is a significant driver and often the primary underlying cause of deforestation (Wibowo and Byron, 1999). Importantly, there have been uncoordinated development policies of the various government agencies which have conflicted with conservation efforts.

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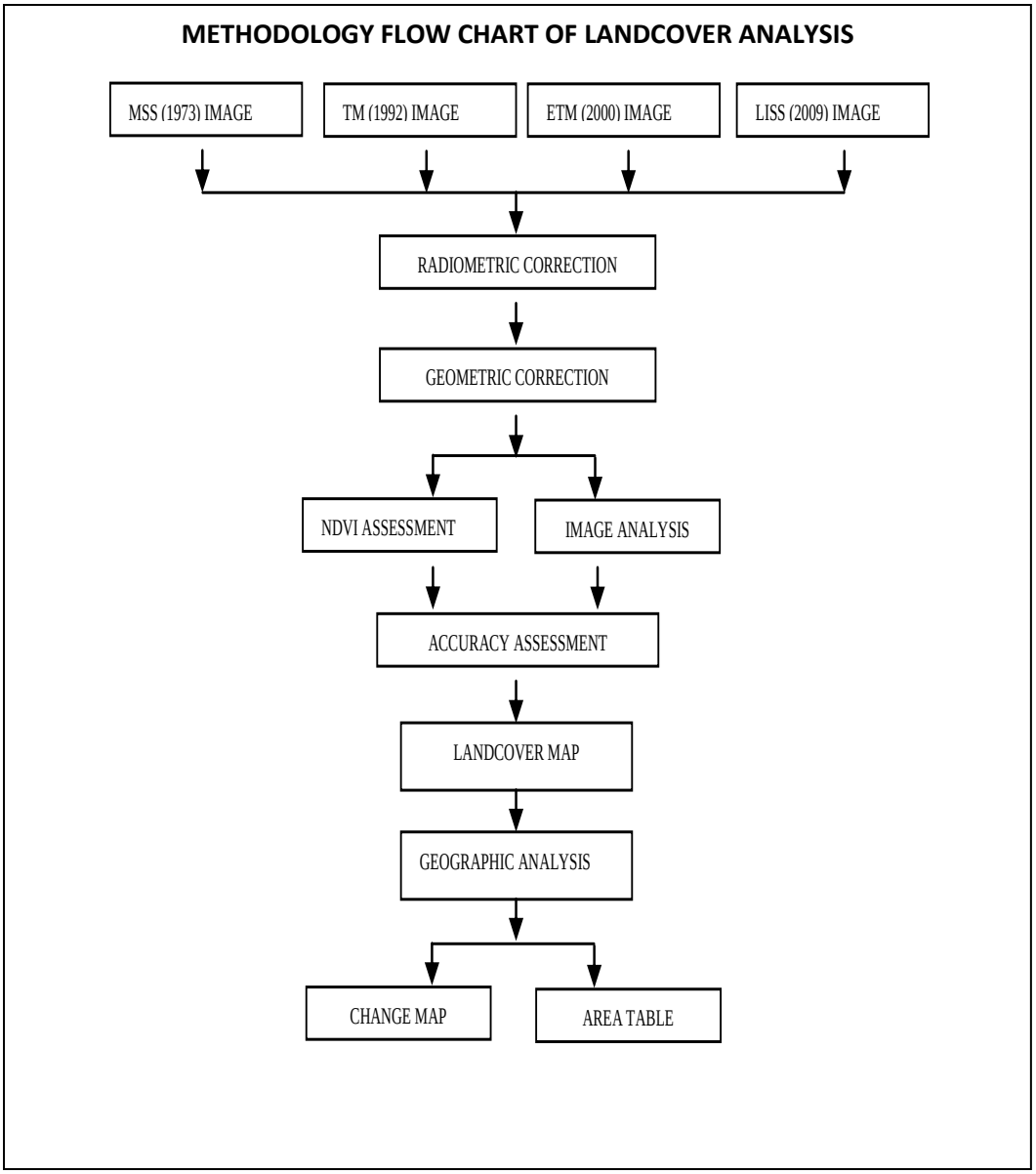
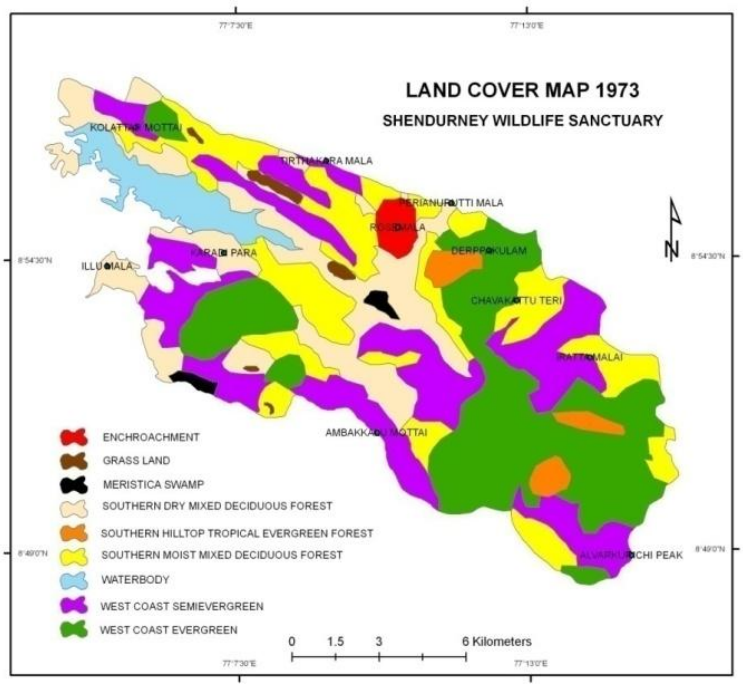
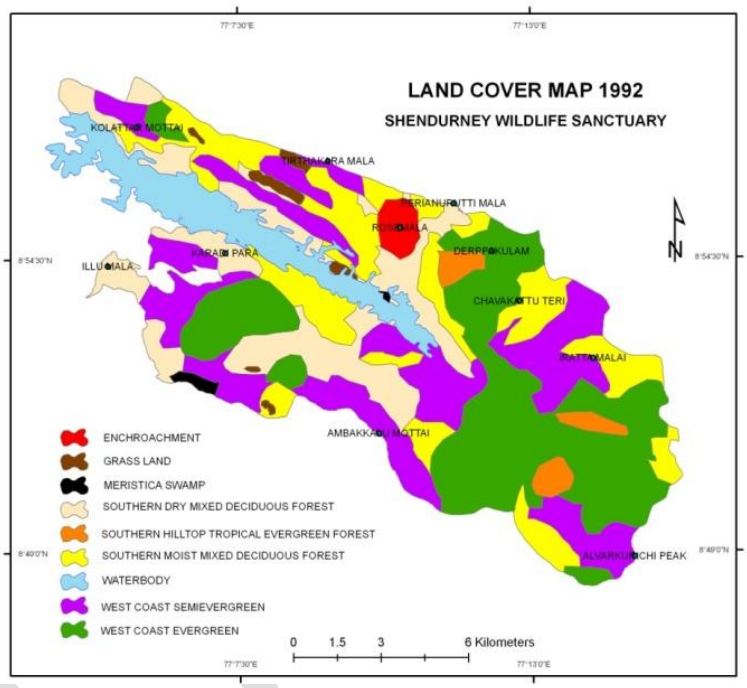



LAND COVER MAP 1973
SHENDURNEY WILDLIFE SANCTUARY
KOLATTAI MOTTAI
TIRTHAKARA MALA
PERIANURUTTI MALA
ROSIMALA
KARADI PARA
DERPPAKULAM
ILLUMALA
CHAVAKATTU TERI
RATTAMALAI
AMBAKKADU MOTTAI
ALVARKURICHI PEAK
ENCHROACHMENT
GRASS LAND
MERISTICA SWAMP
SOUTHERN DRY MIXED DECIDUOUS FOREST
SOUTHERN HILLTOP TROPICAL EVERGREEN FOREST
SOUTHERN MOIST MIXED DECIDUOUS FOREST
WATERBODY
WEST COAST SEMIEVERGREEN
WEST COAST EVERGREEN
0 1.5 3 6 Kilometers


LAND COVER MAP 1992
SHENDURNEY WILDLIFE SANCTUARY
KOLATTAI MOTTAI
TIRTHAKARA MALA
PERIANURUTTI MALA
ROSIMALA
KARADI PARA
DERPPAKULAM
ILLUMALA
CHAVAKATTU TERI
RATTAMALAI
AMBAKKADU MOTTAI
ALVARKURICHI PEAK
ENCHROACHMENT
GRASS LAND
MERISTICA SWAMP
SOUTHERN DRY MIXED DECIDUOUS FOREST
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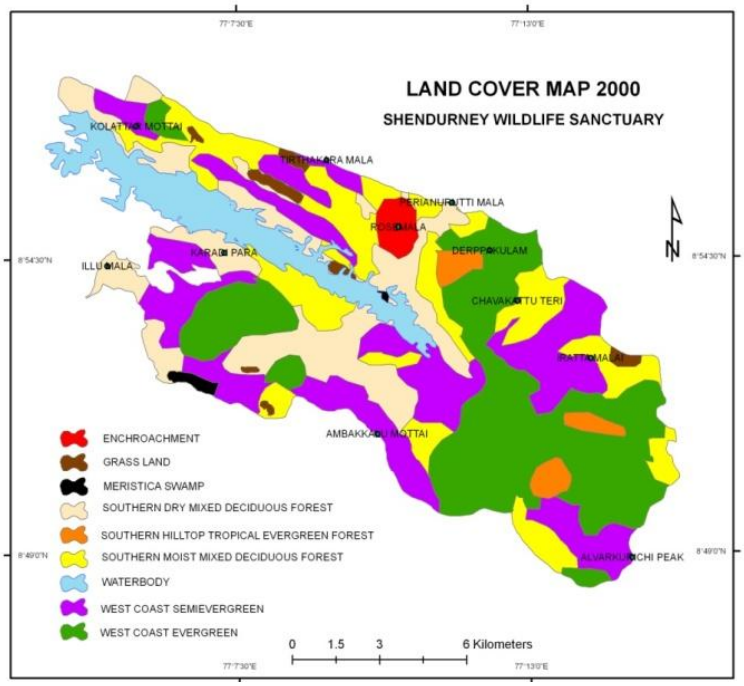
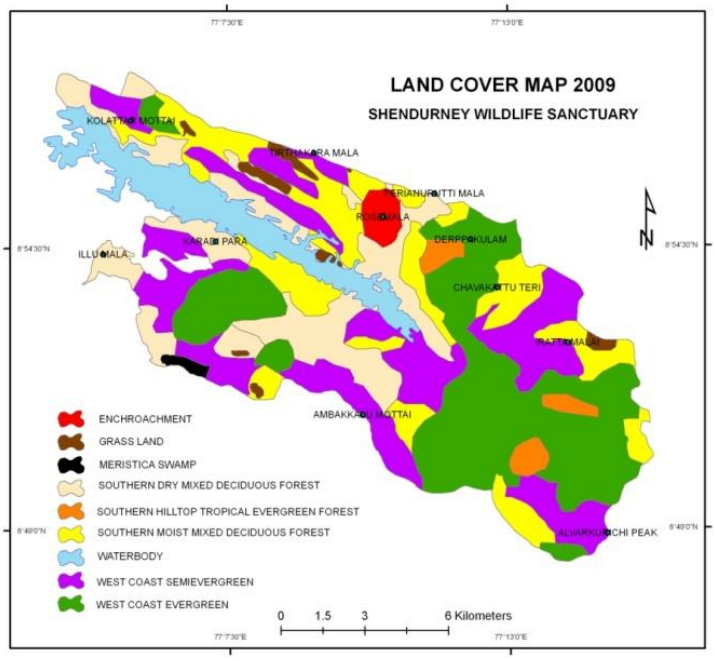
WATERBODY
WEST COAST SEMIEVERGREEN
WEST COAST EVERGREEN
0 1.5 3 6 Kilometers


LAND COVER MAP 2000
SHENDURNEY WILDLIFE SANCTUARY
KOLATTAI MOTTAI
TIRTHAKARA MALA
PERIANURUTTI MALA
ROSIMALA
KARADI PARA
DERPPAKULAM
ILLUMALA
CHAVAKATTU TERI
RATTAMALAI
AMBAKKADU MOTTAI
ALVARKURICHI PEAK
ENCHROACHMENT
GRASS LAND
MERISTICA SWAMP
SOUTHERN DRY MIXED DECIDUOUS FOREST
SOUTHERN HILLTOP TROPICAL EVERGREEN FOREST
SOUTHERN MOIST MIXED DECIDUOUS FOREST
WATERBODY
WEST COAST SEMIEVERGREEN
WEST COAST EVERGREEN
0 1.5 3 6 Kilometers


LAND COVER MAP 2009
SHENDURNEY WILDLIFE SANCTUARY
KOLATTAI MOTTAI
TIRTHAKARA MALA
PERIANURUTTI MALA
ROSIMALA
KARADI PARA
DERPPAKULAM
ILLUMALA
CHAVAKATTU TERI
RATTAMALAI
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WATERBODY
WEST COAST SEMIEVERGREEN
WEST COAST EVERGREEN
0 1.5 3 6 Kilometers

Land cover change (shendurney wildlife sanctuary)	1973(MSS) (sq.km)	Area %	1992(TM) (sq.km)	Area %	2000(ETM) (sq.km)	Area %	2009(LISS) (sq.km)	Area %
Settlement/ plantation	2.421	1.416	2.123	1.242	2.110	1.234	2.082	1.218
Grass land	1.368	0.800	3.567	2.086	4.133	2.417	4.934	2.885
Meristica swamp forest	1.208	0.706	0.516	0.302	0.522	0.305	0.398	0.233
Southern dry mixed deciduous forest	30.544	17.862	30.673	17.937	30.093	17.598	30.100	17.602
Southern hilltop tropical evergreen forest	4.491	2.626	4.053	2.370	4.746	2.775	4.794	2.804
Southern moist mixed deciduous forest	35.319	20.654	29.626	17.325	28.637	16.747	27.169	15.888
Waterbody	9.232	5.399	16.233	9.493	16.660	9.743	17.313	10.125
West coast semievergreen forest	37.313	21.820	36.005	21.056	36.080	21.099	36.006	21.056
West coast tropical evergreen forest	49.104	28.716	48.204	28.189	48.020	28.082	48.204	28.189