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SPATIOTEMPORAL LANDCOVER CHANGE ANALYSIS IN PEPPARA WILDLIFE SANCTUARY, WESTERN GHATS, INDIA

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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 .Vegetation is a vital component of the natural environment. Terrestrial vegetation includes natural ecosystems, such as native forests and woodlands, shrub lands, grasslands and wetlands. Information on land cover is fundamental to many national/global applications including watershed management and agricultural productivity. 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 Landcover change in the Peppara wildlife sanctuary for a period of forty years using GIS and Remote sensing techniques.**

Keywords: **GIS, Remote sensing, vegetation, wildlife sanctuary.**

1. INTRODUCTION

The composition, diversity, and structure of vegetation are the key determinants in assessing biological diversity of forest ecosystems. Vegetation is the source of primary production which plays a direct role in water and nutrient cycling, and interacts strongly with other biotic components. Vegetation has also been identified as a specific target for the calculation of critical loads/levels. The composition and structure of vegetation can serve as bio-indicators for environmental changes to ecosystems that echo the interactions between human activity and the natural environment (Zhang *et al*., 2008). The land cover and landscape change in semi-arid and arid environments often reflects the most significant impact on the environment due to excessive human activity (Zhou *et al*., 2008a and Zhou *et al*., 2008b). 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). 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). Vegetation 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 (Nafeesa*et al*.,2010, Lillesand and Kiefer, 1999). Forest cover change detection techniques have been developed for monitoring land cover dynamics from remotely sensed imagery (Coppin *et al.*, 2004; Lu *et al.*, 2004, Roy and Roy, 2010). 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.

2. 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 undergoRadiometric corrections, Geometric corrections, Image analysis andAccuracy 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 correctobvious 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.

3. RESULTS AND DISCUSSION

The land cover map of 1973, 1992, 2000 and 2009 and area matrix of Peppara wildlife sanctuary is shown in the Figure and Table. The dominating land cover of Peppara wildlife sanctuary is southern dry mixed deciduous forest and followed by southern moist mixed deciduous forest. The map from 1973 to 2009 shows that there is decrease in the extent of west coast semi evergreen forest and there is increase in the extent of southern moist mixed deciduous forest by consecutive years and there is a sharp increase in water body in 1973 - 1992 it is due to the construction of Peppara dam.. This reveal that the forest of Peppara wildlife sanctuary is undergo degradation. Land cover change analysis map of 1973 – 2009 is shown in the figure and change area matrix is shown in the table. The positive value in the change matrix table indicates that the area of the corresponding land cover is increased by consecutive years. The negative value in the change matrix table indicates that the area of the corresponding land cover is decreased years.

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 Peppara wildlife sanctuary from1973 – 2009 the rate of change of west coast tropical evergreen forest is -3.447%, west coast semi evergreen forest is -7.062%, southern moist mixed deciduous forest is 1.521%, southern hilltop tropical evergreen forest is -1.192%, southern dry mixed deciduous forest is -0.290%, grassland is 1.388%, water body is 8.117% and encroachment / settlement is 0.943%.The percentage of increase in water body is due to the construction of Peppara dam.

Land cover change assessment for a period helped to identify the rates and characteristics of forest type transformations. Two major and divergent trends, positive and negative were observed in the study. The positive trend indicates that the area of forest type is increased and the negative trend of forest type shows that there is decrease in the extent of that type of forest. These changes can be attributed to a number of causes, principally livelihood dependence, agricultural expansion and infrastructure development resulting from population growth in and around the area, tourism activities, forest fire and uncoordinated policies of the different government agencies. A Geographic understanding of land use change processes can be achieved by analyzing a temporal database for spatial patterns, rates of change and trends.

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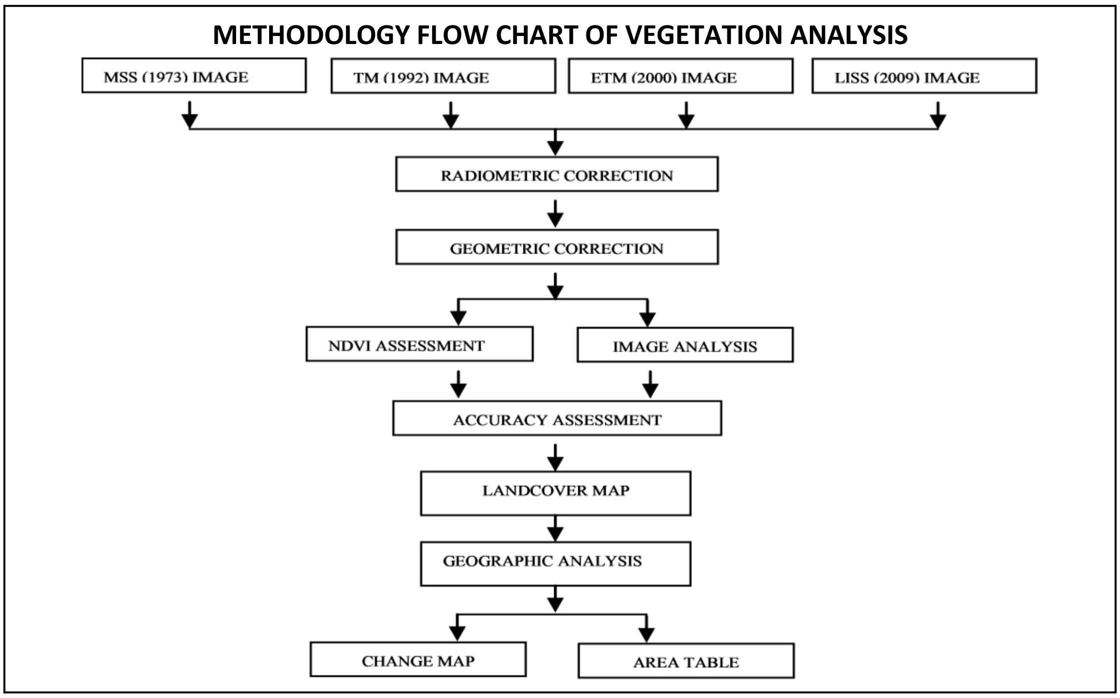
APPENDIX – A

List of Figures:



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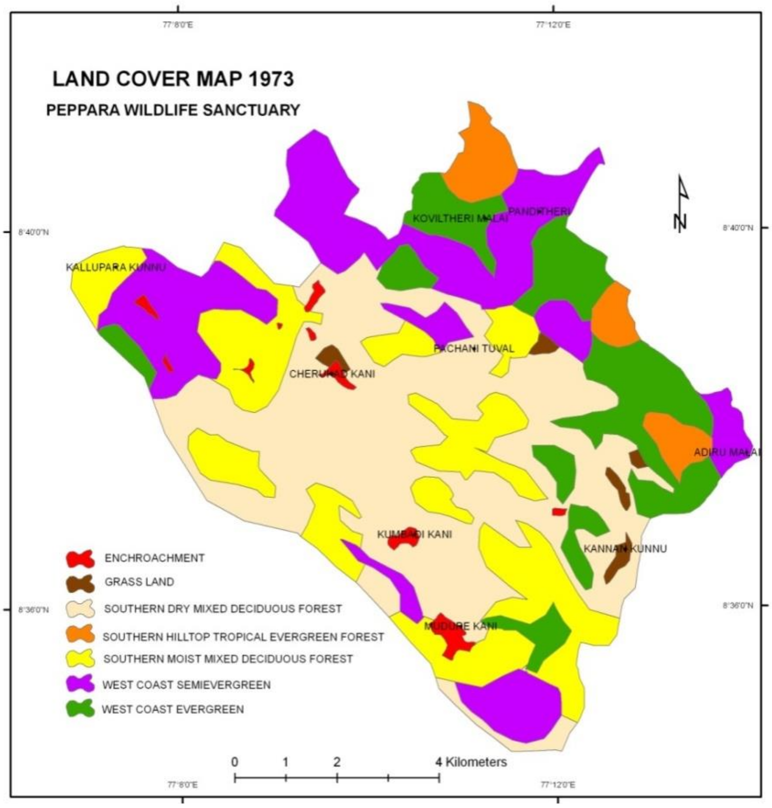

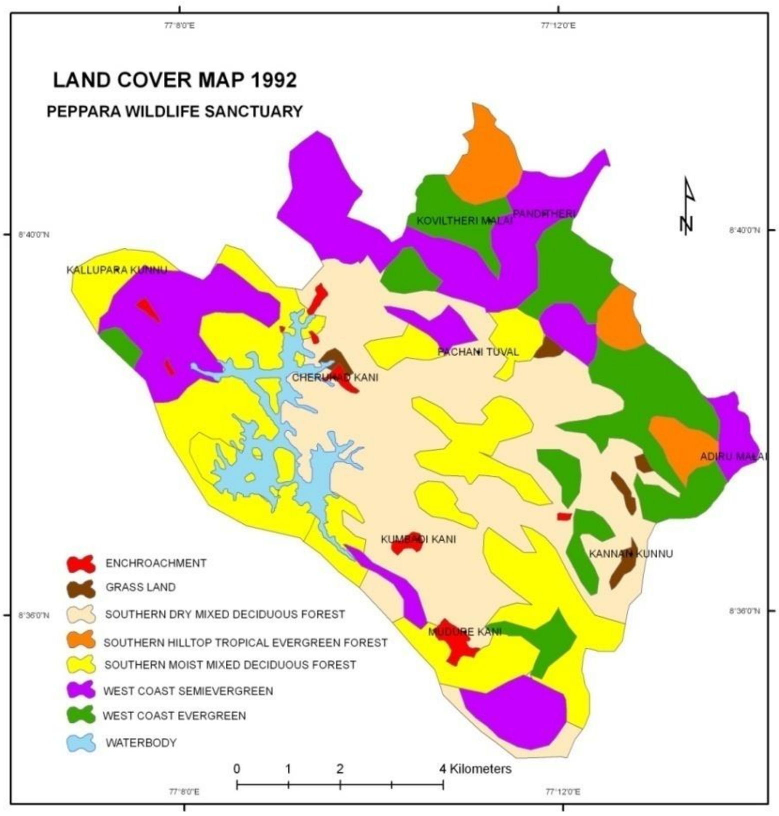

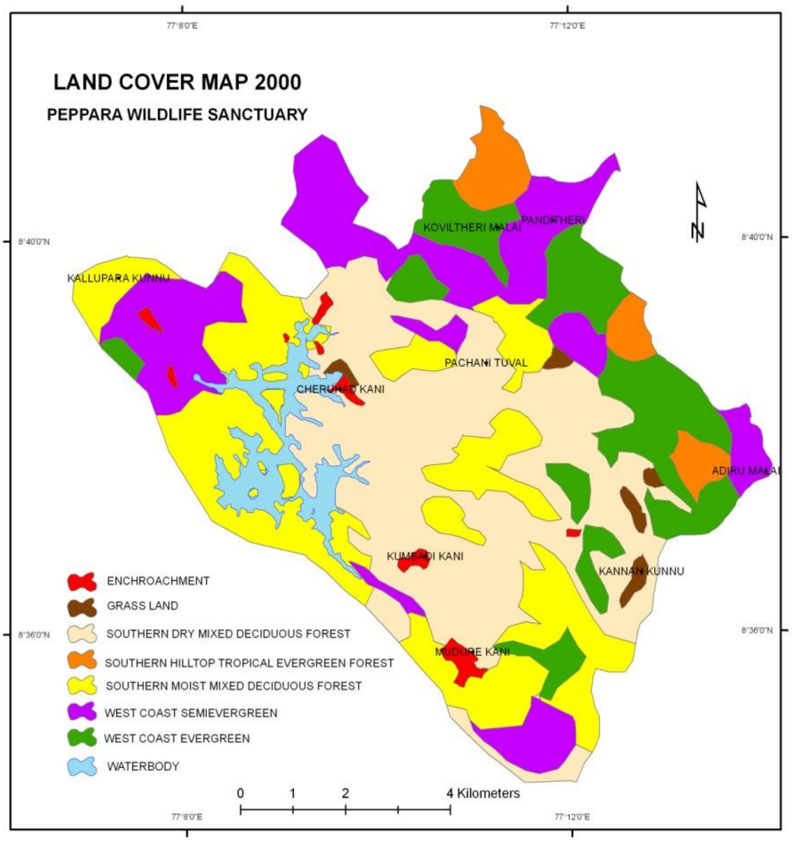
LAND COVER MAP 2000
PEPPARA WILDLIFE SANCTUARY
77°8'0"E
77°12'0"E
8°40'0"N
8°36'0"N
KOVILTHERI MALAI
PANDITHERI
KALLUPARA KUNNU
PACHANI TUVAL
CHERUNAD KANI
ADIRU MALAI
KUMBADI KANI
KANNAN KUNNU
MUDURE KANI
ENCHROACHMENT
GRASS LAND
SOUTHERN DRY MIXED DECIDUOUS FOREST
SOUTHERN HILLTOP TROPICAL EVERGREEN FOREST
SOUTHERN MOIST MIXED DECIDUOUS FOREST
WEST COAST SEMIEVERGREEN
WEST COAST EVERGREEN
WATERBODY
0 1 2 4 Kilometers

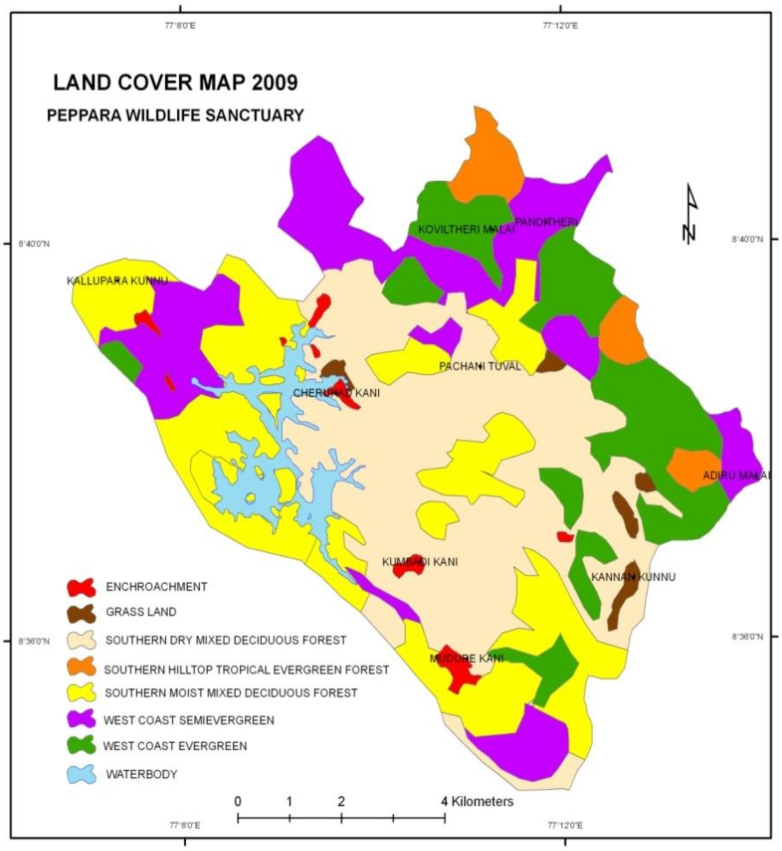
LAND COVER MAP 2009
PEPPARA WILDLIFE SANCTUARY
77°8'0"E
77°12'0"E
8°40'0"N
8°36'0"N
KOVILTHERI MALAI
PANDITHERI
KALLUPARA KUNNU
PACHANI TUVAL
CHERUNAD KANI
ADIRU MALAI
KUMBADI KANI
KANNAN KUNNU
MUDURE KANI
ENCHROACHMENT
GRASS LAND
SOUTHERN DRY MIXED DECIDUOUS FOREST
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TABLE

Land cover change (peppara wildlife sanctuary)	**1973(MSS) (sq.km)**	**Area %**	**1992(TM) (sq.km)**	**Area %**	**2000(ETM) (sq.km)**	**Area %**	**2009(LISS) (sq.km)**	**Area %**
Grassland	1.775	3.349	1.722	3.249	1.781	3.360	2.511	4.738
Southern dry mixed deciduous forest	16.359	30.866	13.908	26.242	14.572	27.494	16.205	30.575
Southern hilltop tropical evergreen forest	2.584	4.875	2.574	4.857	2.510	4.736	1.952	3.683
Southern moist mixed deciduous forest	13.238	24.977	13.323	25.138	14.452	27.268	14.044	26.498
Waterbody	0	0.000	3.434	6.479	3.829	7.225	4.302	8.117
West coast semievergreen forest	11.025	20.802	10.353	19.534	8.167	15.409	7.282	13.740
West coast tropical evergreen forest	6.831	12.889	6.686	12.615	6.291	11.870	5.004	9.442
Settlement/ plantation	1.200	2.264	1.000	1.887	1.400	2.642	1.700	3.208