Chapter 3

Forest Cover Dynamics

3.1 Land Use Land Cover in and around Protected Areas during the period 1973-2016

Forests play a vital role in social, cultural, historical, economic and industrial development of any country and in maintaining its ecological balance. They are the resource base for sustenance of its population and a storehouse of biodiversity. Other vocations of land use, such as agriculture and animal husbandry, are dependent on forests and forest lands. Forests not only maintain and improve the moisture regime and provide clean air but also produce humus and maintain soil fertility.

With increasing human and developmental activities forests have been severely fragmented and at several places degraded, causing threat of local extinction to many species of flora and fauna. The current status of forests is not too satisfactory (as the forest cover in Karnataka is 19 *per cent* which is less than the national average of 21 *per cent*) and degradation will have an adverse impact on various ecosystems. The land management policies, population, agricultural production and urban expansion are considered as main drivers of "Land Use Land Cover" (LULC) change.

In this regard, LULC information of any region serves as a basis for understanding bio-geophysical processes and anthropogenic pressures. The land cover is referred as biophysical attribute of the earth's surface and land use as human purpose or intent applied to effective usage of these biophysical attributes.

LULC is an important indicator of changes happening in and around the Protected Areas which have a bearing on the conservation and protection of wildlife and their habitat. As no Departmental study / data was available in this regard, the study on these changes was entrusted by the Office of the Accountant General, (Economic and Revenue Sector Audit), Bengaluru, Karnataka to Centre for Ecological Sciences, IISc, for analysing the satellite data.

3.1.1 Method of study

The analysis relating to changes in LULC in and around (10 km radius) selected Protected Areas, which is a specialised study requiring analysis of satellite imageries and related data. Centre for Ecological Sciences, IISc is one of the premier institutes involved in the study of LULC changes and encroachments. The IISc had done study on the LULC cover dynamics in Uttara Kannada district and also assessed the extent of encroachments in Bannerghatta National Park by using satellite based imageries. Considering this expertise and experience, this work was entrusted to IISc.

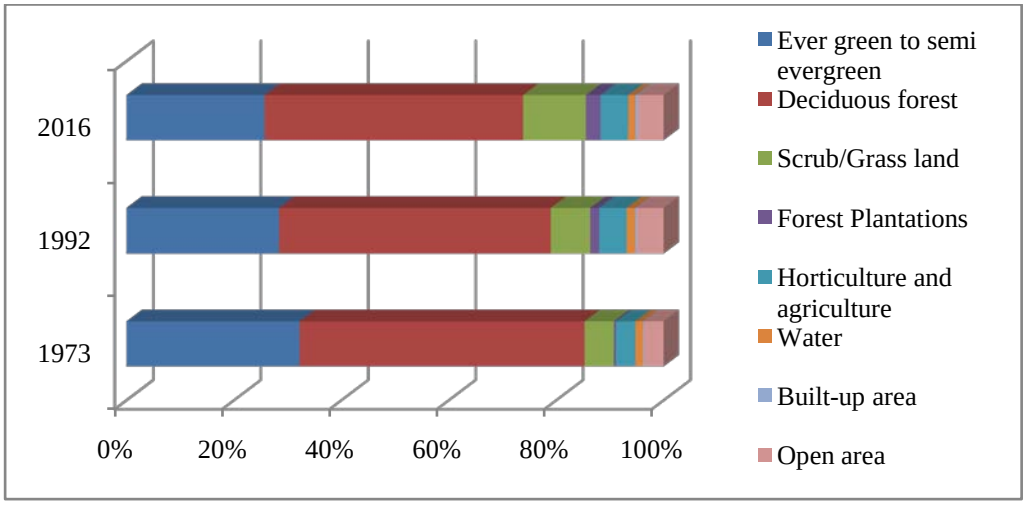
The boundary maps[14] were obtained from the Department while the cadastral maps[15] were obtained from Karnataka State Remote Sensing Applications Centre (KSRSAC). These maps were super imposed on satellite imageries (obtained from National Remote Sensing Centre and Google Earth data) relating to different time periods to ascertain the change in LULC.

The study[16] was conducted in selected 13[17] Protected Areas (PA) as well as the Buffer Areas, considering a length of 10 km radius from the PA boundary. A three period time interval (*i.e.*, 1973, 1991/92 and 2016) imageries were analysed to get the status and loss of forest cover. Nine categories viz., evergreen to semi-evergreen forests, deciduous forests, scrub forests, forest plantations, agriculture, horticulture, water, open areas and built-up areas were considered as indicators of status and loss of forest.

3.1.2 Results of study

The cumulative changes noticed in LULC analysis of the 13 Protected Areas have been brought out in the **Chart 3.1**:

Chart 3.1: Changes in land use land cover during the period 1973-2016



As may be seen from **Chart 3.1**, there had been a steady decrease in evergreen to semi-evergreen forests and deciduous forests, while there is an increase in agriculture, horticulture, built-up area (buildings, roads and infrastructure) and open areas (thinning of forest tree canopy due to various anthropogenic pressure). This shows a steady degradation in forests and increased anthropogenic pressure on the Protected Areas which is clearly visible through Satellite imageries. Imageries of two PAs for three different time periods have been depicted in **Chart 3.2** below:

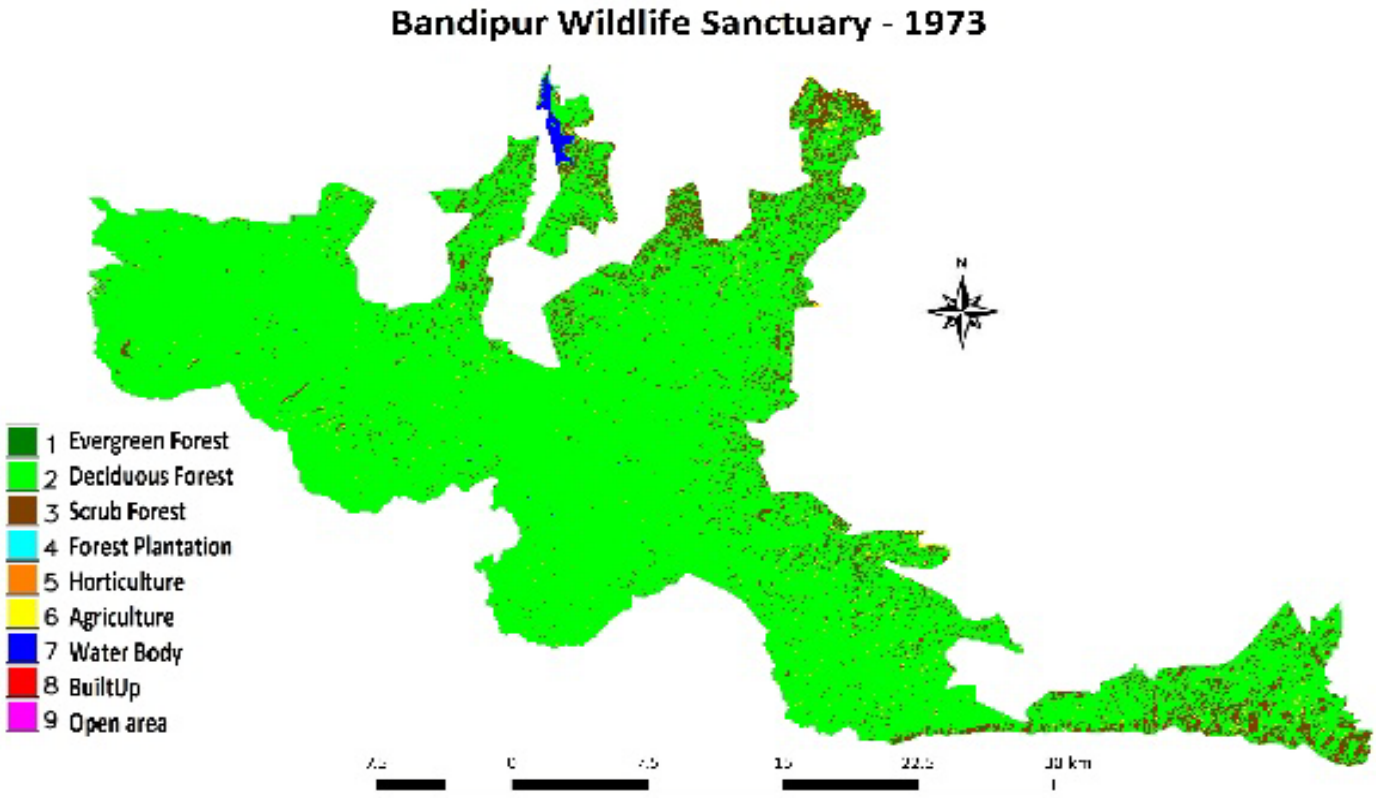
[14] Maps indicating the external boundary of the Protected Area

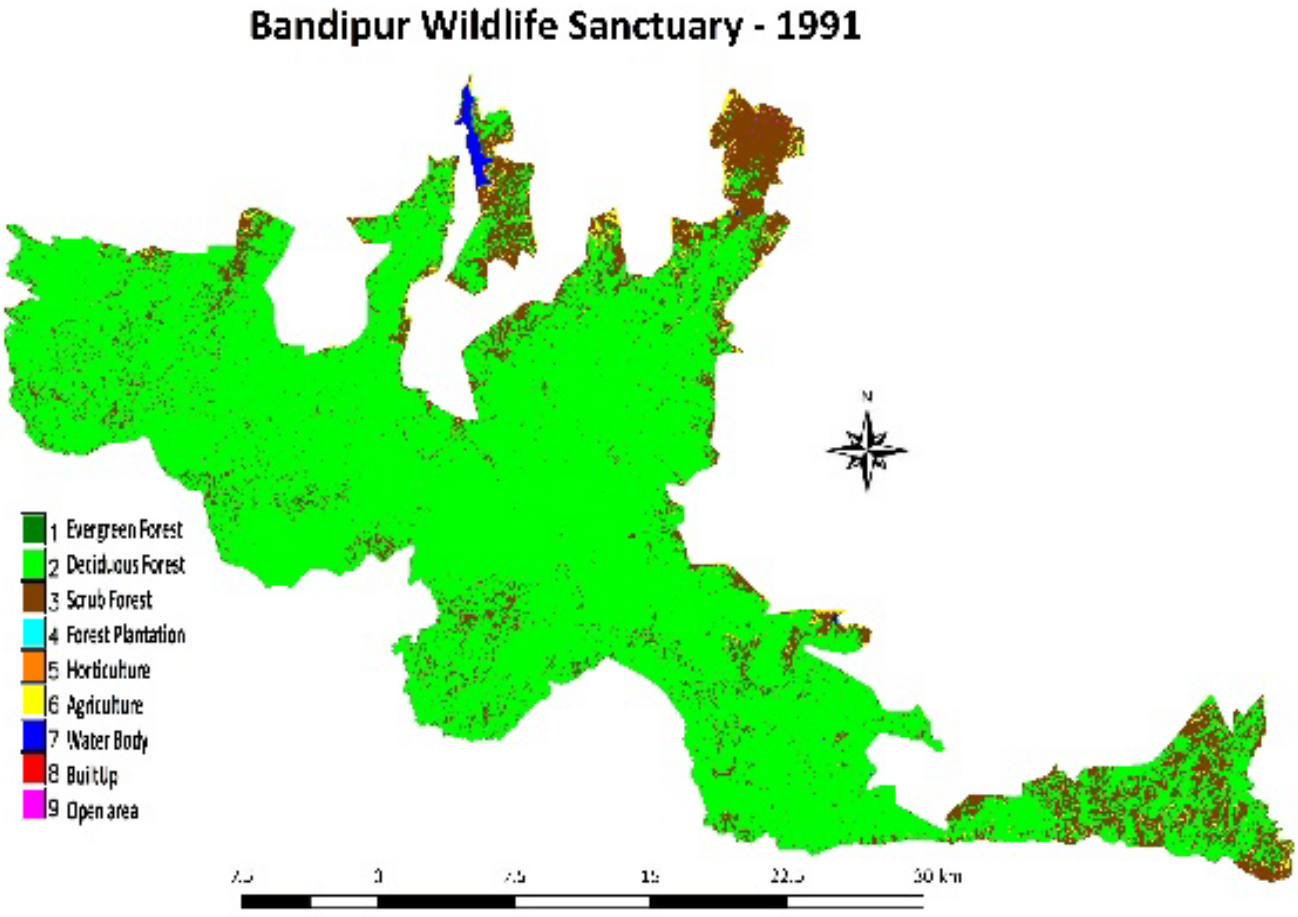
[15] Revenue maps relating to the enclosures / villages situated inside Protected Area

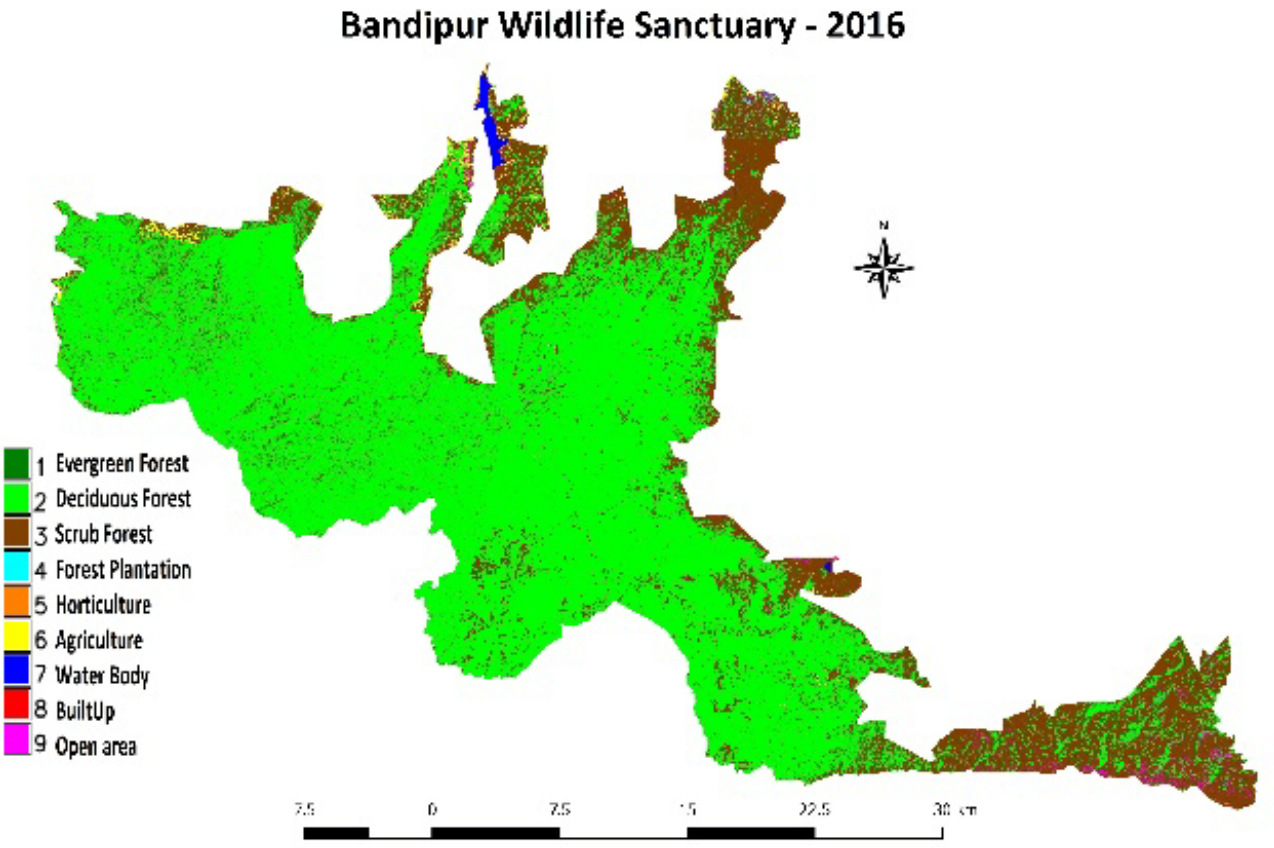
[16] Topographic maps provided ground control points to rectify remotely sensed data and scanned paper maps (topographic maps). Survey of India (SOI) topo sheets and vegetation map of South India developed was digitized to identify various forest cover types and analysis over different time periods to find out the changes in vegetation.

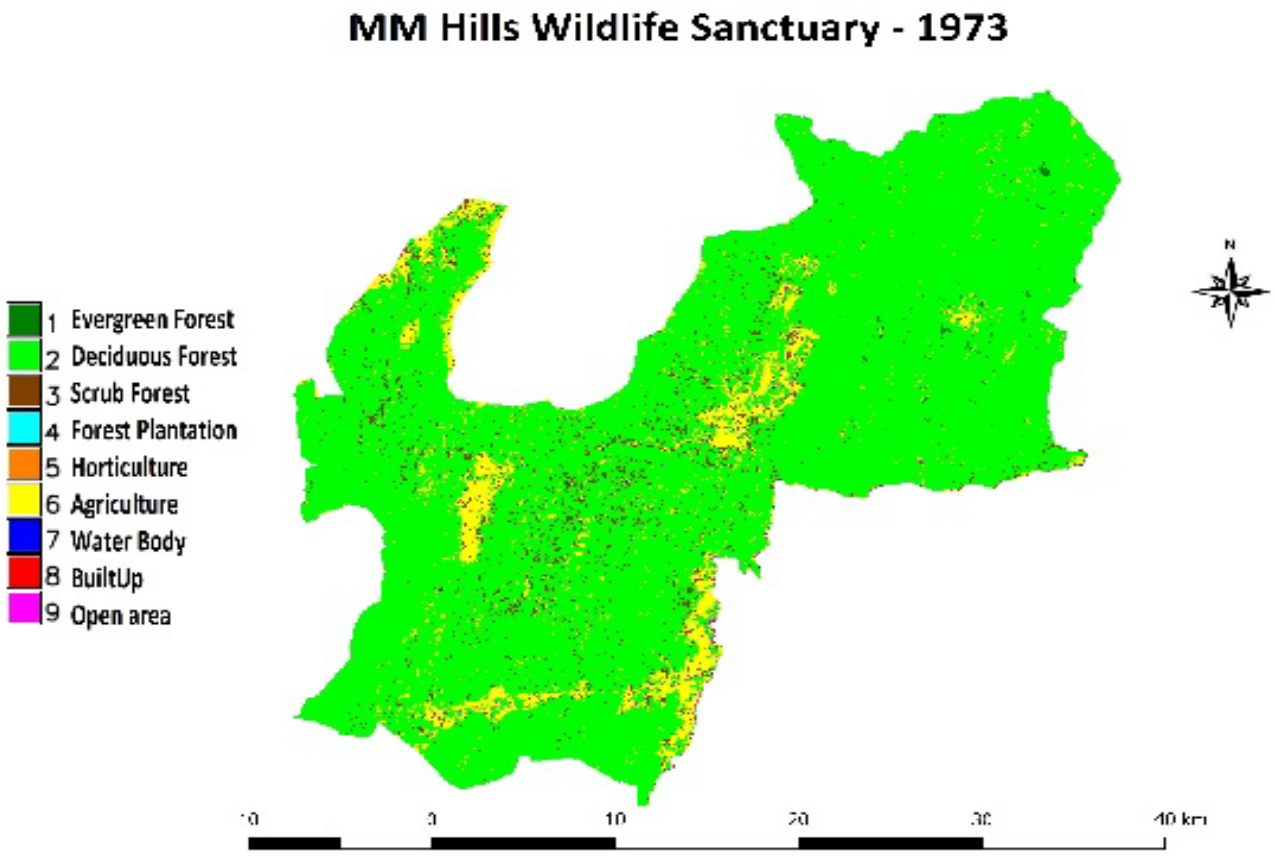
[17] Dandeli-Anshi, Bandipur, Bhadra, BRT, Brahmagiri, Cauvery, Kudremukh, Malai Mahadeswara, Mookambika, Nagarahole, Pushpagiri, Sharavathi, Someshwara

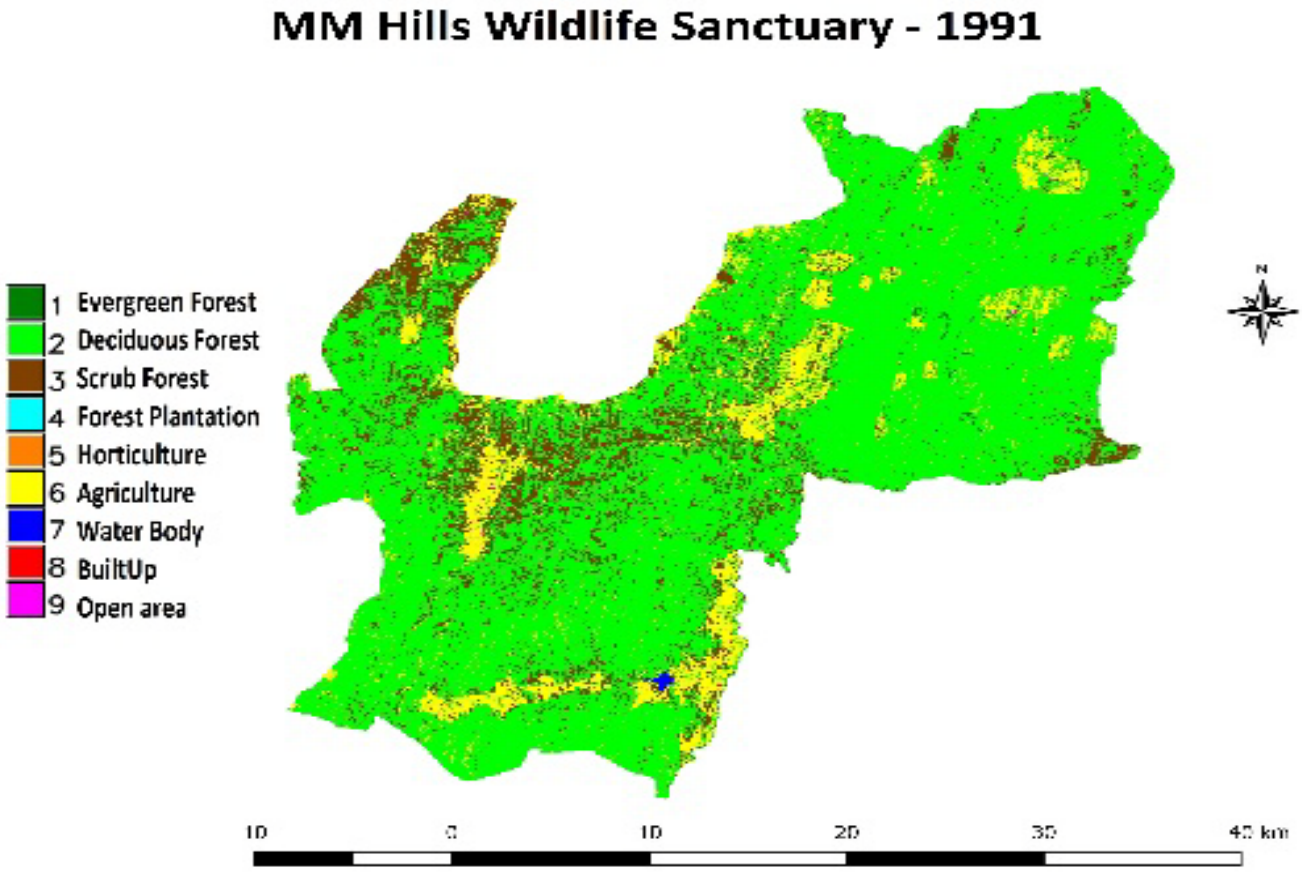
Chart. 3.2: The LULC changes noticed in Bandipur Tiger Reserve and Malai Mahadeswara Wildlife Sanctuary as of 1973, 1991 and 2016

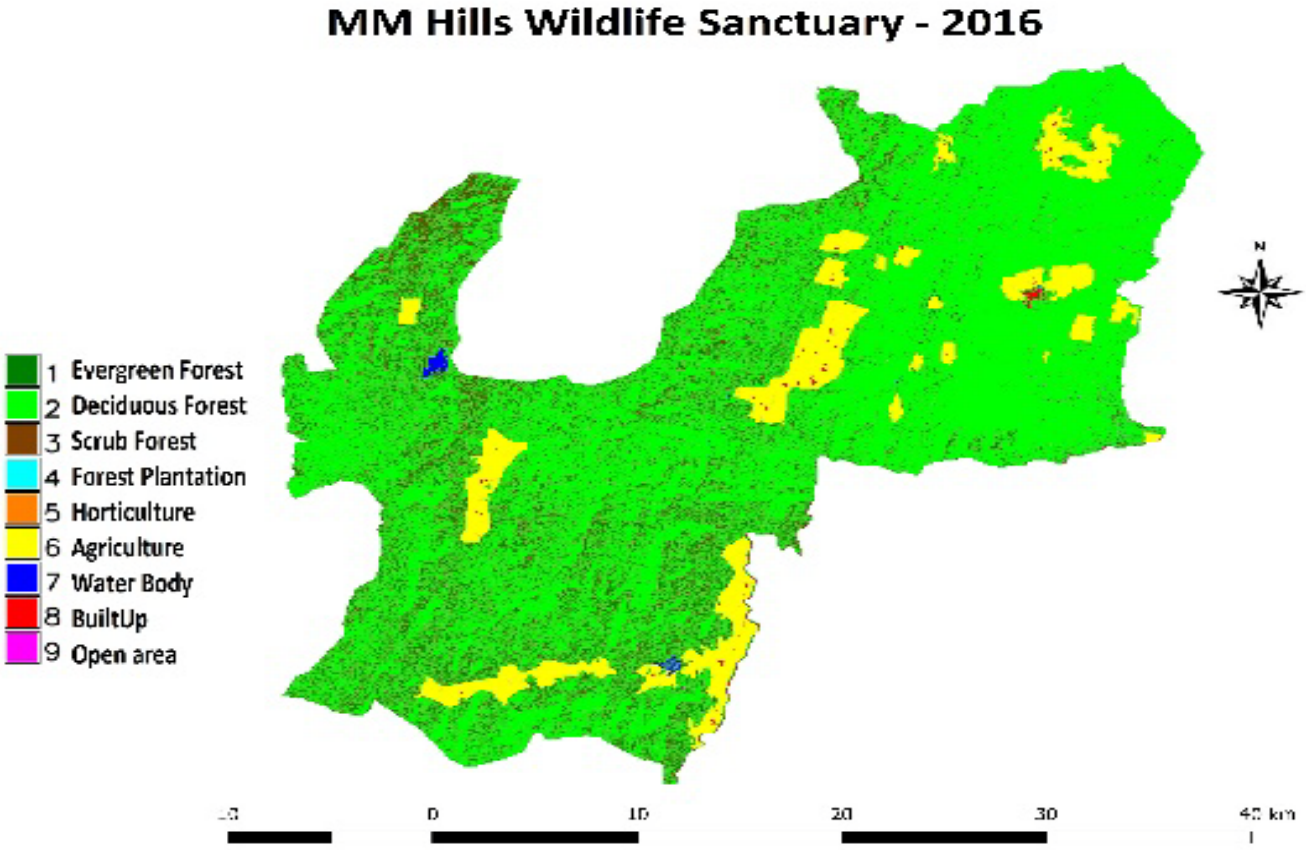



Bandipur Wildlife Sanctuary - 1991
1 Evergreen Forest
2 Deciduous Forest
3 Scrub Forest
4 Forest Plantation
5 Horticulture
6 Agriculture
7 Water Body
8 Built Up
9 Open area
N
30 km


Bandipur Wildlife Sanctuary - 2016
1 Evergreen Forest
2 Deciduous Forest
3 Scrub Forest
4 Forest Plantation
5 Horticulture
6 Agriculture
7 Water Body
8 BuiltUp
9 Open area
N
7.5
0
7.5
15
22.5
30 km


MM Hills Wildlife Sanctuary - 1973
1 Evergreen Forest
2 Deciduous Forest
3 Scrub Forest
4 Forest Plantation
5 Horticulture
6 Agriculture
7 Water Body
8 BuiltUp
9 Open area
N
0
5
10
20
30
40 km


MM Hills Wildlife Sanctuary - 1991
1 Evergreen Forest
2 Deciduous Forest
3 Scrub Forest
4 Forest Plantation
5 Horticulture
6 Agriculture
7 Water Body
8 BuiltUp
9 Open area
N
10
0
10
20
30
40 km


MM Hills Wildlife Sanctuary - 2016
1 Evergreen Forest
2 Deciduous Forest
3 Scrub Forest
4 Forest Plantation
5 Horticulture
6 Agriculture
7 Water Body
8 BuiltUp
9 Open area
N
0
10
20
30
40 km

Further, Protected Area-wise changes noticed in LULC analysis revealed the following:

- The evergreen to semi-evergreen forest area decreased in 12 of the 13 selected PAs. The area under this class of forests does not exist in Cauvery Wildlife Sanctuary,
- The area under deciduous forests has increased in six PAs and decreased in seven PAs,
- The total area under cultivation *i.e.*, areas under agriculture and horticulture have increased in all the PAs,
- Further, built up area has increased in 11 of the 13 PAs, while the open areas have increased in nine PAs.

Further, the area falling in 10 km radius of these 13 Protected Areas also indicated changes in land use land cover as could be seen from **Appendix 1** and **Appendix 2**. The difference between the current status and the position as of 1973 and 1991/1992 with reference to different types of forests, cultivated area, built-up and open areas have been tabulated in **Table 3.1:**

Table 3.1: Changes in LULC in and around PAs in a radius of 10 km

Category	1973		1991/92		2016	
	Area (ha)	*Per cent*	Area (ha)	*Per cent*	Area (ha)	*Per cent*
Ever green to semi-evergreen	6,77,773.61	28.79	5,79,550.30	25.46	5,03,914.58	23.10
Deciduous forest	13,43,774.33	36.58	12,20,220.29	33.66	11,51,048.86	31.90
Scrub/Grass land	1,82,488.23	5.13	2,47,767.44	6.82	3,50,842.85	9.37
Forest Plantations	17,658.19	0.56	52,390.51	1.60	76,962.90	2.29
Horticulture	2,53,307.57	8.77	2,82,212.65	9.73	3,15,201.05	10.92
Agriculture	4,75,835.37	13.15	5,04,211.39	13.98	4,51,068.81	12.78
Water	33,722.47	1.06	69,355.25	2.13	75,637.03	2.39
Built-up area	15,199.76	0.52	31,072.73	0.94	41,297.26	1.26
Open area	1,51,901.27	5.44	1,64,880.24	5.68	1,85,687.46	5.99
Total	31,51,660.80	100	31,51,660.80	100	31,51,660.80	100

(Source: Technical Report of Centre for Ecological Studies, IISc)

Evergreen / semi-evergreen forests are some of the pristine forest patches with high rainfall and tall trees. They form a unique ecosystem wherein many species are endemic to these forests and these forests play a vital role in climate moderation. However, from **Table 3.1**, it could be seen that the area under evergreen / semi-evergreen forests have decreased due to gradual degradation by means of tree cover and consequently over a period of time these are converted into deciduous forests. Deciduous forests are broad leaved forests which are much open forests compared to the evergreen / semi evergreen forests with smaller trees and mostly dry through the year. It could also be observed that even these forests are degraded leading to increase in scrub forests and grasslands over a period of time. These changes can be directly attributed to various anthropogenic activities in these areas which is substantiated by increase in the cumulative area under agriculture and horticulture. Also, the areas under built-up and open areas had steadily increased which indicates that degradation of forests is also rampant in the surrounding areas of the Protected Area.

The Department accepted the fact that there is a decrease in evergreen / semi evergreen forests and stated (March 2017) that steps would be taken to control the same.

The degradation of forests coupled with increase in areas under cultivation and built-up areas clearly indicate the increased anthropogenic pressures in and around the Protected Areas. Degradation is one of the major threats to wildlife habitats adversely affecting the wildlife in these areas and the remote sensing assessments validate that degradation had taken place in Protected Areas during the period 1973 to 2016. Since taking up afforestation works in National Parks and Wildlife Sanctuaries are not advisable, adequate protection is expected to check further degradation. The manifestation of these pressures by way of continued occurrence of human wildlife conflicts, uncontrolled commercial activities, increased encroachments and slow progress in rehabilitation works coupled with improper management of invasive weeds, under reporting of forest fires, deficient planning and shortage of manpower have been discussed in Chapters 4 to 11 of this report.