Report of the Comptroller and Auditor General of India

Performance Audit on Administration of National Parks and Wildlife Sanctuaries in Karnataka

Government of Karnataka
Report No. 6 of the year 2017

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Appendices

PREFACE

1. This Report of the Comptroller and Auditor General of India for the year ended March 2016 has been prepared for submission to the Governor of Karnataka under Article 151 (2) of the Constitution of India for being laid before the State Legislature.

2. The Report covering the period 2011-16 contains the results of Performance Audit of 'Administration of National Parks and Wildlife Sanctuaries in Karnataka'.

3. Audit has been conducted in conformity with the Auditing Standards issued by the Comptroller and Auditor General of India.

Executive Summary

Biodiversity loss is a global phenomenon today. Rapid loss of biodiversity has been mainly attributed to anthropogenic activities. Habitat destruction in the name of development like hydel projects, encroachments of forest lands, expansion of agricultural activities, fragmentation of forests, *etc.*, leading to human wildlife conflicts, poaching, invasion of alien weed species, *etc.*, are the chief causes for biodiversity loss. Habitats can either disappear completely or they may become degraded/fragmented, both causing serious impact on species as well as ecosystem processes.

India has a forest cover of 21.34 *per cent* and Karnataka has 19 *per cent* of forest cover. Western Ghats region running through six states of (Southern) India including Karnataka is identified as one of the 35 Biodiversity hotspots in the world for its high degree of endemism. It has also been inscribed as a World Heritage Site by United Nations Educational, Scientific and Cultural Organisation in 2012. Further, the Nilgiri Biosphere Reserve is one of the oldest Biospheres of the Country and in Karnataka, the Nilgiri Biosphere is interspersed with Western Ghats in the southern part of the State. These regions are home to wide variety of flora and fauna including endemic and endangered species. The State boasts of the highest number of tigers and elephants in the country. However, increased human population coupled with fragmentation and degradation of forests is causing pressure on these fragile ecosystems, which is evident from increase in Human Wildlife Conflicts, regular occurrence of forest fires, proliferation of invasive weed species, *etc.*

A Performance Audit on "Administration of National Parks and Wildlife Sanctuaries in Karnataka" was conducted by focusing on 14 sampled National Parks and Wildlife Sanctuaries of Western Ghats-Nilgiri Biosphere Reserve region to assess the impact of intrusive activities and study the role and efforts of the management in minimising the same. Major audit findings are given below:

Human Wildlife Conflicts continued to be of major concern and the mitigation measures undertaken by the Forest Department did not have any major impact. Elephants require large feeding ranges and use specified migration paths for movements which are affected by fragmentation. The increased agricultural/ developmental activities also contributed to Human Wildlife Conflicts. To reduce such events and as a long term measure, corridors connecting forests is the need of the hour. Five such corridors were identified for strengthening in the Western Ghats-Nilgiri Biosphere Reserve region, more than a decade ago, but their strengthening had not fructified.

(Paragraph 4.2.1)

Expansion of three Protected Areas approved by National Board for Wildlife between 2011 and 2013 had not been notified.

(Paragraph 4.2.2.1)

In and around six Protected Areas, 51 resorts and hotels and 50 homestays were operating, out of which, 44 resorts / hotels and 15 homestays had not

received approval of the Forest Department. Of this, four resorts were located in the elephant corridor and five resorts / hotels were found to be functioning inside enclosures contrary to Wilderness Tourism Policy. A coffee plantation located inside Biligiri Ranganathaswamy Temple Tiger Reserve was operating beyond the lease period.

(Paragraph 5.3)

The encroachment of forests in Karnataka increased from 42,518 *acres* to 2,04,442 *acres* between 1995 and 2014. In 14 selected Protected Areas, 4,393 families had encroached upon an area of 9,524 *acres* as of March 2016 but only 1,384 forest offence cases were booked. In respect of Bandipur and Nagarahole Tiger Reserves, it was noticed that extent of encroachment was short reported by 1,686 and 148 *acres* respectively.

(Paragraph 6.1.1)

Though an action plan had been submitted to High Court of Karnataka to evict encroachments to an extent of 1,041 *acres* by July 2015, the encroachment cleared was 469 *acres* only. Against a total of 2,510 applications received for rehabilitation / relocation in four Protected Areas, 1,357 families had been rehabilitated. The delay in rehabilitation in Bhadra Tiger Reserve was mainly on account of non-availability of funds.

(Paragraph 6.1.3 and 6.3)

As per National Tiger Conservation Authority, out of 26 tigers poached in the country during 2011-16, nine were reported from Karnataka. However, the details furnished by the Divisions indicated only one case of tiger poaching during the same period.

(Paragraph 7.1)

A total of 50 road-kills were recorded during the five year period in the fourteen sampled Protected Areas of which no recordings were noticed in five Protected Areas. This stood in sharp contrast to the fact that a 45 day monitoring by the Kudremukh Wildlife Division indicated 1,338 road-kills.

(Paragraph 7.3)

For the forest fires which occurred during 2012 in Bandipur and Nagarahole Tiger Reserves, it was noticed that burnt area assessment done by the Divisions was very conservative as compared to the reported assessment of Principal Chief Conservator of Forests. The under assessments were also observed in Nagarahole Tiger Reserve during 2014 where the initial assessment of 60 hectares was later enhanced to 179 hectares based on ground truthing. The revised assessment was almost equal to the satellite based assessment of 172 hectares.

(Paragraph 8.1.1)

Though invasive alien weed species like *Lantana camara, Parthenium, Eupatorium, Chromolaena odorata* had become major threats in six Protected Areas, no major initiatives were taken to address the problem.

(Paragraph 8.2)

Research, being an important activity for better maintenance of Protected Areas, was not given adequate importance. In respect of permissions accorded for research / studies inside Protected Areas, as against 129 permissions including 18 ongoing projects, reports were received in respect of only nine projects. Though data on some species like tiger, elephants, leopard and lion-tailed macaque were available, the Protected Areas did not have data on other lesser known mammals.

(Paragraph 9)

There was delay in preparation of Management Plans / Tiger Conservation Plans in seven Protected Areas. While deficient coverage of issues relating to Human Wildlife Conflicts was noticed in four Management Plans / Tiger Conservation Plans, areas / locations for implementation of strategies were not identified in Management Plans / Tiger Conservation Plans.

(Paragraph 10.1.1)

The forest area per personnel was higher for other Protected Areas than the Tiger Reserves. Out of 401 arms supplied to Protected Areas, 156 were not functional and out of 1,187 wireless equipments supplied, 355 were not functional.

(Paragraph 11.2 and 11.4)

Performance Audit on Administration of National Parks and Wildlife Sanctuaries in Karnataka

Chapter 1

Introduction

Karnataka has 36,421 square kilometers (sq km) of recorded forest area which is 18.99 *per cent* of its geographical area (1,91,791 sq km)[1]. The Western Ghats which includes Nilgiri Biosphere Reserve adds up to 84 *per cent* of forest cover of the State. Western Ghats (WG) is a chain of forested mountains running along the western coast of the Peninsular India from Tapti river in Gujarat to the Southern tip of India at Kanyakumari in Tamil Nadu passing through six[2] States and covering an area of 1,60,000 sq km. Being close to the Arabian Sea and with varying altitudes between 900m and 2,400m above sea level, they receive heavy South-West monsoons with an average rainfall of 1,000-6,000 mm a year. While the western slopes and the ridges contain primarily tropical evergreen rain forests, the eastern slopes, which are in the rain shadow area, contain deciduous and scrub forests. This unique matrix of landscapes with wide array of vegetation types and microhabitats available in the hill system harbour a high diversity of flora and fauna.

The mountain chain of the WGs represents geomorphic features of immense importance with unique biophysical and ecological processes and is identified as one of the 35[3] biodiversity rich hotspot regions of the world and has been inscribed as a World Heritage Site by United Nations Educational, Scientific and Cultural Organisation (UNESCO) since October 2012. Karnataka is home to 4,500 species of flowering plants, 650 species of trees, 508 species of birds, 150 species of mammals, 156 species of reptiles, 135 species of amphibians, 694 species of fish, 330 species of butterflies and 1,493 species of medicinal plants[4]. The State has 406[5] tigers and 6,500[6] elephants in the wild which is the highest for the country.

The WGs contain exceptional levels of plant and animal diversity and endemicity for a continental area. The level of endemicity of 4,000-5,000 plant species recorded in WG is very high. Of the 650 tree species found, 352 are endemic. The region also has a very high degree of animal diversity; 85 *per cent* of amphibians, 62 *per cent* of reptiles, 41 *per cent* of fishes and 12 *per cent* of mammals[7] found in the region are endemic. The WG region is also home to globally threatened flagship mammals like Asian Elephant, Indian Gaur, Tiger, along with the endangered and endemic species like Lion-tailed Macaque, Nilgiri Thar and Nilgiri Langur.

[1] State of Forest Report 2015, Forest Survey of India
[2] Gujarat, Goa, Karnataka, Kerala, Maharashtra and Tamil Nadu
[3] http://www.bsienvis.nic.in/Database/Biodiversity-Hotspots-in-India_20500.aspx
[4] Exploring biodiversity & ecology of central Western Ghat, Sahyadri Conservation Series 13
[5] 2014 Tiger Census
[6] 2012 Elephant census
[7] Exploring biodiversity & ecology of central Western Ghat, Sahyadri Conservation Series 13

Fig 1.1: A pristine patch of Western Ghats in Dandeli-Anshi Tiger Reserve
Source: Image taken during audit field visit

In 2012, the UNESCO inscribed WGs on the World Heritage list and adopted the statement of outstanding Universal Value on the basis of the facts that "The Western Ghats is an Evolutionary Ecotone illustrating 'Out of Africa' and 'Out of Asia' hypothesis on species dispersal and variance". The property recognised as a World Heritage Property has 39 sites spread across four States, of which 10[8] are in Karnataka. The sites in Karnataka include five Protected Areas [9] *i.e.,* Pushpagiri Wildlife Sanctuary (WLS), Brahmagiri WLS, Talacauvery WLS, Someshwara WLS and Kudremukh National Park (NP). Interspersed along with this is the "Nilgiri Biosphere Reserve" (NBR), which covers an area of about 5,520 Sq km in the states of Karnataka, Tamil Nadu and Kerala. NBR is the first and the largest biosphere reserve in the country and was recognised as one of the Heritage sites by UNSECO in 1986.

In Karnataka, the WGs pass through 11 districts[10] which contribute a forest cover of 30,573 sq km out of the geographical area of 62,795 sq km covered by these districts. Against the total area of 9,576.88 sq km covered by the 35 National Parks and Wildlife Sanctuaries in the State, 16 are located in the WG-NBR region cover an area of 8,485 sq km constituting 88 *per cent* of area under Protected Areas in the State.

Once a contiguous forest, the WG-NBR region has fragmented over a period of time to fulfill the needs of ever growing human population in the premise of agriculture, tea and coffee estates, construction of hydro projects, deforestation, encroachments, forest fires, *etc*. These intrusive anthropogenic activities have threatened the very existence of this fragile ecosystem which needs utmost importance in conservation and protection.

[8] Agumbe Reserve Forest (RF), Balahalli RF, Brahmagiri WLS, Kerti RF, Kudremukh NP, Padinalkad RF, Pushpagiri WLS, Someshwara RF, Someshwara WLS, Talacauvery WLS

[9] Any area notified as a National Park or Wildlife Sanctuary or a conservation / community reserve is generally termed as a Protected Area

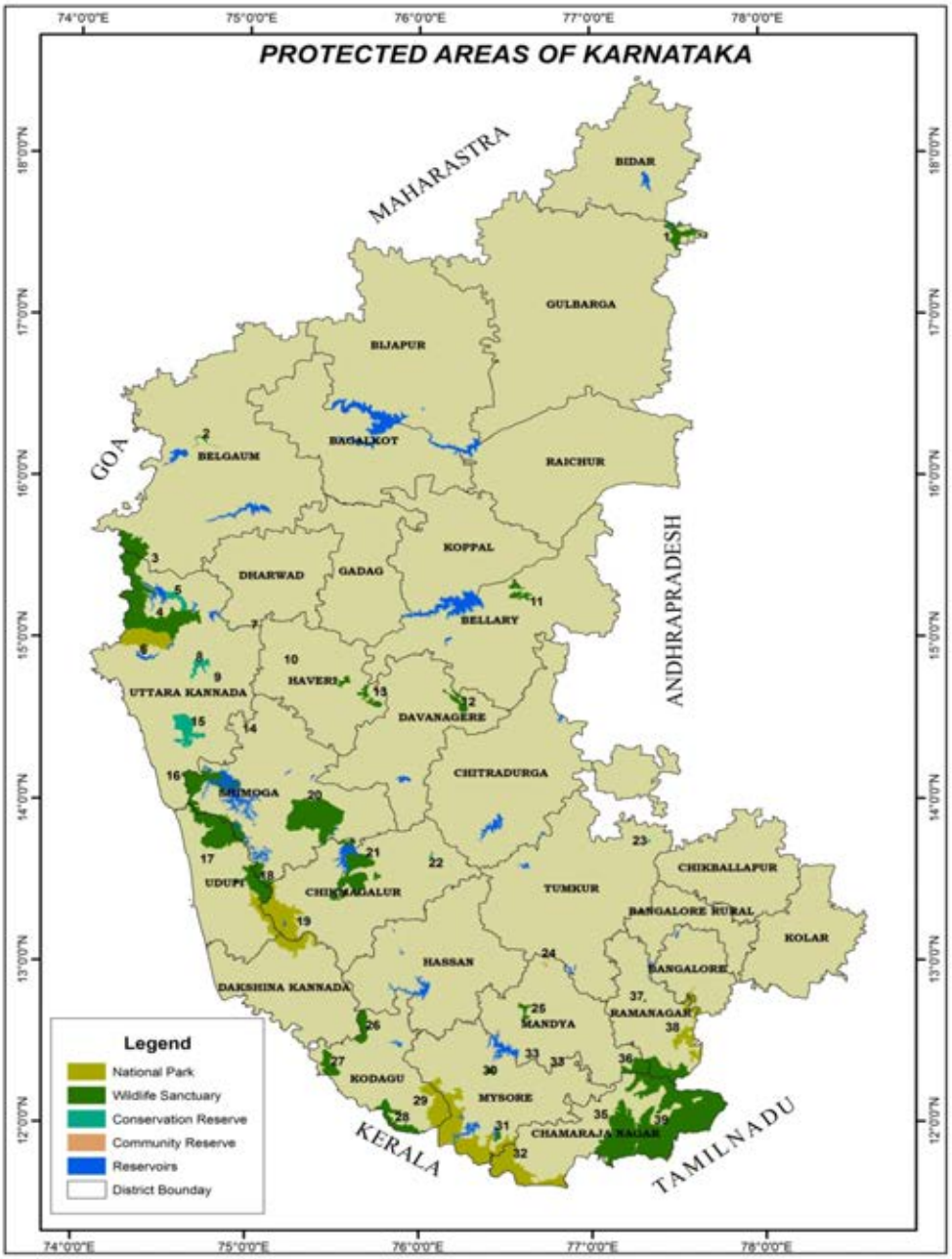
[10] Belagavi, Chamarajanagar, Chikkamagalur, Dakshina Kannada, Dharwad, Hassan, Madikeri, Mysuru, Shivamogga, Udupi and Uttara Kannada

Fig 1.2: Malai Mahadeswara Hill ranges which forms part of Nilgiri Biosphere Reserve
Source: Image taken during audit field visit

The Wildlife (Protection) Act, 1972 was enacted with the objective of effectively protecting the wildlife and for matters connected therewith or ancillary or incidental thereto. In pursuance of this objective, the State Government, under this Act, can declare any area of adequate ecological, faunal, floral, geo-morphological, natural or zoological significance, as a National Park, Wildlife Sanctuary, Conservation Reserve or Community Reserve for protecting, propagation or developing wildlife or its environment. Further, an area with significant number of tigers would be declared as a Tiger Reserve (TR) with the approval of National Tiger Conservation Authority. There are five National Parks, 30 Wildlife Sanctuaries, 13 Conservation Reserves and one Community Reserve in the State spread across an area of 10,222.19 sq km, out of which, five[11] NPs / WLSs have been declared as Tiger Reserves. In view of the rich biodiversity found in the region, the Performance Audit has focused on the Administration of the National Parks and Wildlife Sanctuaries of WG-NBR region in an attempt to assess the impact of such intrusive activities and study the role and efforts of the Karnataka Forest Department (Department) in minimising the same. The map of Protected Areas of the State is given at **Fig 1.3** below:

[11]Bandipur NP, Bhadra WLS, Biligiri Ranganathaswamy Temple WLS , Dandeli-Anshi and Rajiv Gandhi (Nagarahole) NP

Fig 1.3: Map indicating Protected Areas in Karnataka



Map Id	Name of the Protected Area
1	Chincholi (WS)
2	Ghataprabha (WS)
3	Bhimghad (WS)
4	Dandeli (WS and TR)
5	Hombill (CR)
6	Anshi (NP and TR)
7	Attiveri (WS)
8	Bedthi (CR)
9	Shalmala (CR)
10	Bankapura (CR)
11	Daroji (WS)
12	Rangayyanadurga (WS)
13	Ranebennur (WS)
14	Gudavi (WS)
15	Aghanashini (CR)
16	Sharavathi (WS)
17	Mookambika (WS)
18	Someshwara (WS)
19	Kudremukh (WS)
20	Shettihalli (WS)
21	Bhadra (WS and TR)
22	Basur Amruth Mahal Kaval (CR)
23	Jayamangali (CR)
24	Adichunchangiri (WS)
25	Melkote (WS)
26	Pushpagiri (WS)
27	Talacauvery (WS)
28	Bramhagiri (WS)
29	Nagarahole (NP and TR)
30	Arabithittu (WS)
31	Nugu (WS)
32	Bandipur (NP and TR)
33	Ranganathittu (WS)
34	Kokkare Bellur (Com. R)
35	Biligirirangaswamy Temple (WS and TR)
36	Cauvery (WS)
37	Ramadevarabetta (WS)
38	Bannerghatta (NP)
39	Malai Madeshwara Wildlife Sanctuary

Source: Karnataka Forest Department

Chapter 2

Audit approach

2.1 Audit Objectives

Objectives for this Performance Audit are to assess whether:

- **Protection and Conservation of Wildlife, including their habitats, were adequately planned for and implemented in the administration of the Protected Areas, by examination of**
  - Management Plan / Tiger Conservation Plan, its implementation and impact assessment of measures implemented,
  - Consolidation of boundaries, status of encroachments and rehabilitation of persons living inside Protected Areas,
  - Research and implementation of research findings done by the Department and other agencies, and
  - Management of Resources (Manpower and Financial)
- **Adequate measures were taken to address issues relating to biotic interference[12] and anthropogenic threats in the Protected Areas with reference to**
  - Human Wildlife Conflict and Corridors,
  - Forest fire, unnatural deaths and road-kills,
  - Patrolling, anti-poaching camps and poaching,
  - Tourism, resorts and other commercial activities.

2.2 Audit coverage and Methodology

The Western Ghat / Nilgiri Biosphere Reserve region is home to several endemic and endangered species and contributes a great degree to the forest cover of the state. Because of its ecological importance, Western Ghats has been inscribed as a World Heritage Site. In view of the endemism / importance of the region, it becomes necessary to conserve these Wildlife Habitats. Therefore, 14 Protected Areas of the region were selected for Performance Audit.

Review of records relating to three National Parks and 11 Wildlife Sanctuaries[13] situated in the Western Ghat and Nilgiri Biosphere Reserve for the period 2011-12 to 2015-16 was carried out by test check of records at the

[12] The pressure of foreign biological organisms like cattle, weeds, human, *etc*., on the forest species

[13] Bandipur, Kudremukh, Nagarahole NPs, Dandeli-Anshi, Bhadra, Biligiri Ranganathaswamy Temple (BRT), Brahmagiri, Cauvery, Malai Mahadeswara Hills, Mookambika, Pushpagiri, Sharavathi, Someshwara and Talacauvery WLSs.

offices of Secretariat, Principal Chief Conservator of Forests (Wildlife) and the field level offices relating to the selected National Parks and Wildlife Sanctuaries. Data were collected through analyses of documents, response to audit queries / questionnaires / proformae. These were supplemented by information furnished by other stakeholders. In addition, satellite based assessment of land use land cover analysis in and around sampled Protected Areas and encroachments in them were got done through Indian Institute of Science. For this purpose, maps and satellite imageries were obtained from Karnataka Forest Department, Karnataka State Remote Sensing Applications Centre and National Remote Sensing Centre.

An Entry Conference was held with the Additional Chief Secretary to Government, Department of Forest , Ecology and Environment to discuss the audit objectives, criteria and scope on 25 April 2016. The audit findings were discussed in the Exit Conference held with the Additional Chief Secretary to Government, Department of Forest, Ecology and Environment on 23 March 2017. Government responses have been suitably incorporated in the report.

2.3 Audit Criteria

The following were used as sources of audit criteria for this Performance Audit:

1. Wildlife (Protection) Act, 1972,
2. Forest (Conservation) Act, 1980,
3. Environment (Protection) Act, 1986,
4. National Wildlife Strategy, 2002,
5. National Wildlife Action Plan 2002-2016,
6. Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006,
7. Supreme Court, National Green Tribunal and High Court orders and other directions,
8. Codes and Manuals of Karnataka Forest Department,
9. Guidelines issued by Wildlife Institute of India, National Tiger Conservation Authority for preparation of Management Plan / Tiger Conservation Plans,
10. Scheme guidelines and other orders, instructions, action plans, strategies issued by Government of India, Government of Karnataka, Karnataka Forest Department, and
11. Research / study reports of Indian Institute of Science (IISc), Wildlife Institute of India, Salim Ali Institute for Conservation of Nature, Nature Conservation Foundation, Convention on International Trade in Endangered Species, International Union for Conservation of Nature, Wildlife Conservation Society, *etc*.

2.4 Acknowledgement

Audit acknowledges the co-operation extended by the staff of Karnataka Forest Department, Indian Institute of Science, Karnataka State Remote Sensing Agency, Karnataka State Survey and Land Records Department and Non-Government Organisations in conduct of this Performance Audit.

Audit Findings

The ever increasing human population coupled with various development activities have fragmented the very habitat of wildlife leading to Human Wildlife Conflicts (HWC), encroachment, poaching, forest fires, *etc.*, which in turn have become the biggest challenges to the department to contain and find a solution. Though the Department has done well to stabilise the populations of tigers and elephants in the State, the preparedness to tackle these increased populations was absent which has resulted in increased HWC. The Department has also failed to notify certain areas which were approved by National Board for Wildlife (NBWL) for expansion of Protected Areas (PA), which could have connected other PAs and reduced HWC. Commercial activities were observed in eco-sensitive zones and corridors of PAs which will have negative impact on the wildlife and its conservation. Research is one of the main component of PA development, however, the lack of approach by the Department in this regard could be observed from the fact that the basic data of many lesser known species were absent and though many scientists and researchers are recording new species especially the amphibians and birds, these were not mentioned in Management Plans (MP) / Tiger Conservation Plans (TCP). The progress regarding action taken on encroachment and rehabilitation was slow and needs to be intensified. It was observed that there were differences in Department and Divisional data regarding the extent of forest fires and this need to be verified by ground truthing. Some of the MP / TCPs were not prepared in time which needs to be prepared well in advance of the expiry of the old MP / TCPs.

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.

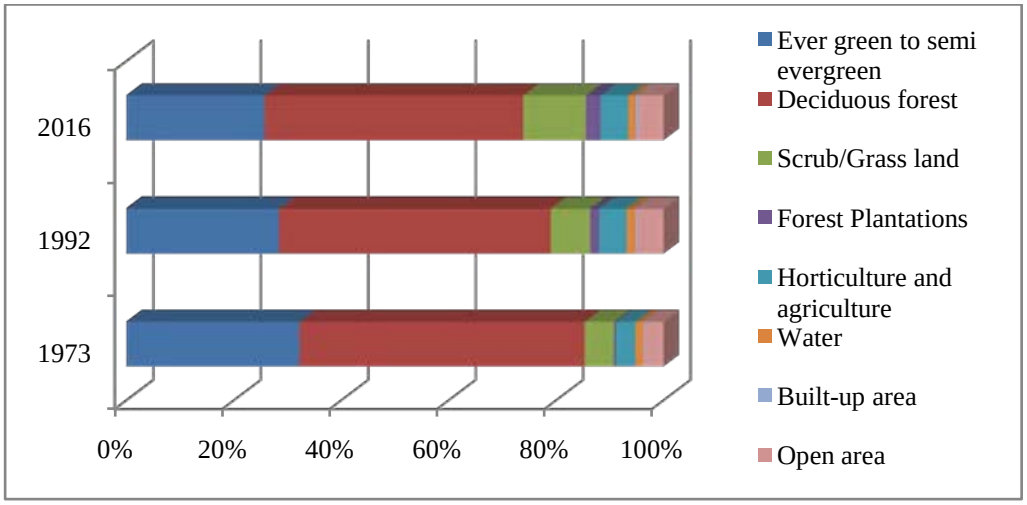
The boundary maps[14] were obtained from the Department while the cadastral maps[15] were obtained from Karnataka State Remote Sensing Applications Centre (KSRSAC). These maps were super imposed on satellite imageries (obtained from National Remote Sensing Centre and Google Earth data) relating to different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

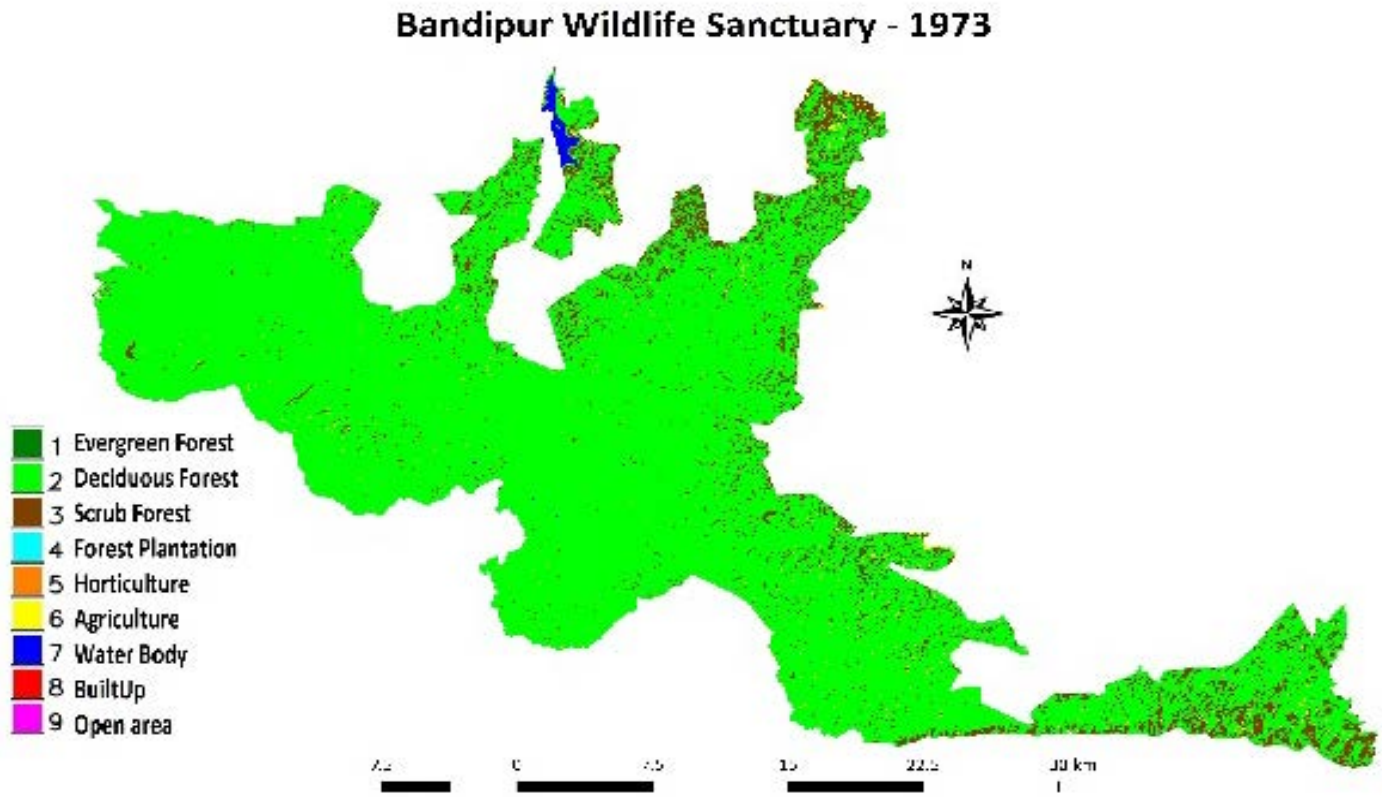
[14] Maps indicating the external boundary of the Protected Area

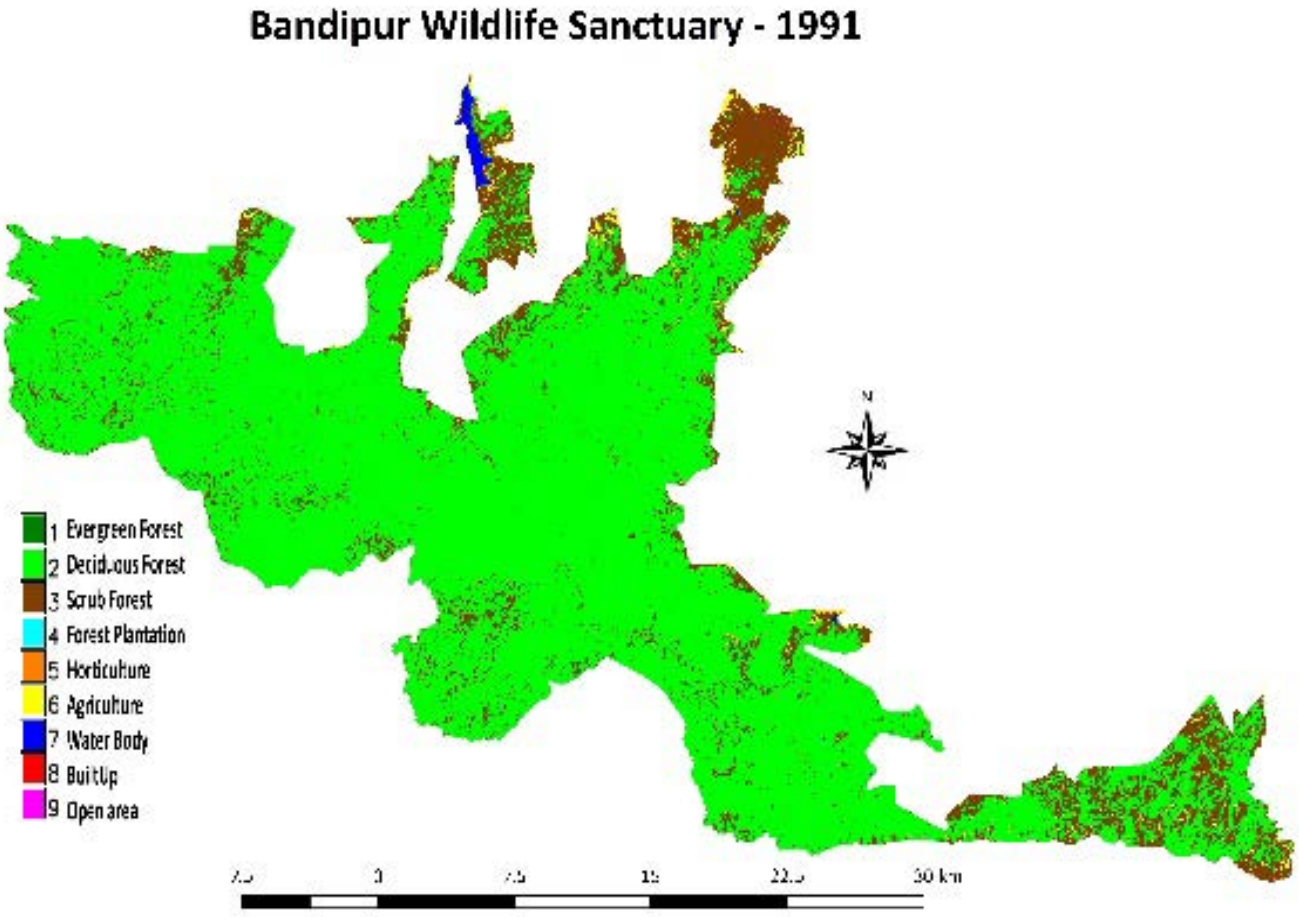
[15] Revenue maps relating to the enclosures / villages situated inside Protected Area

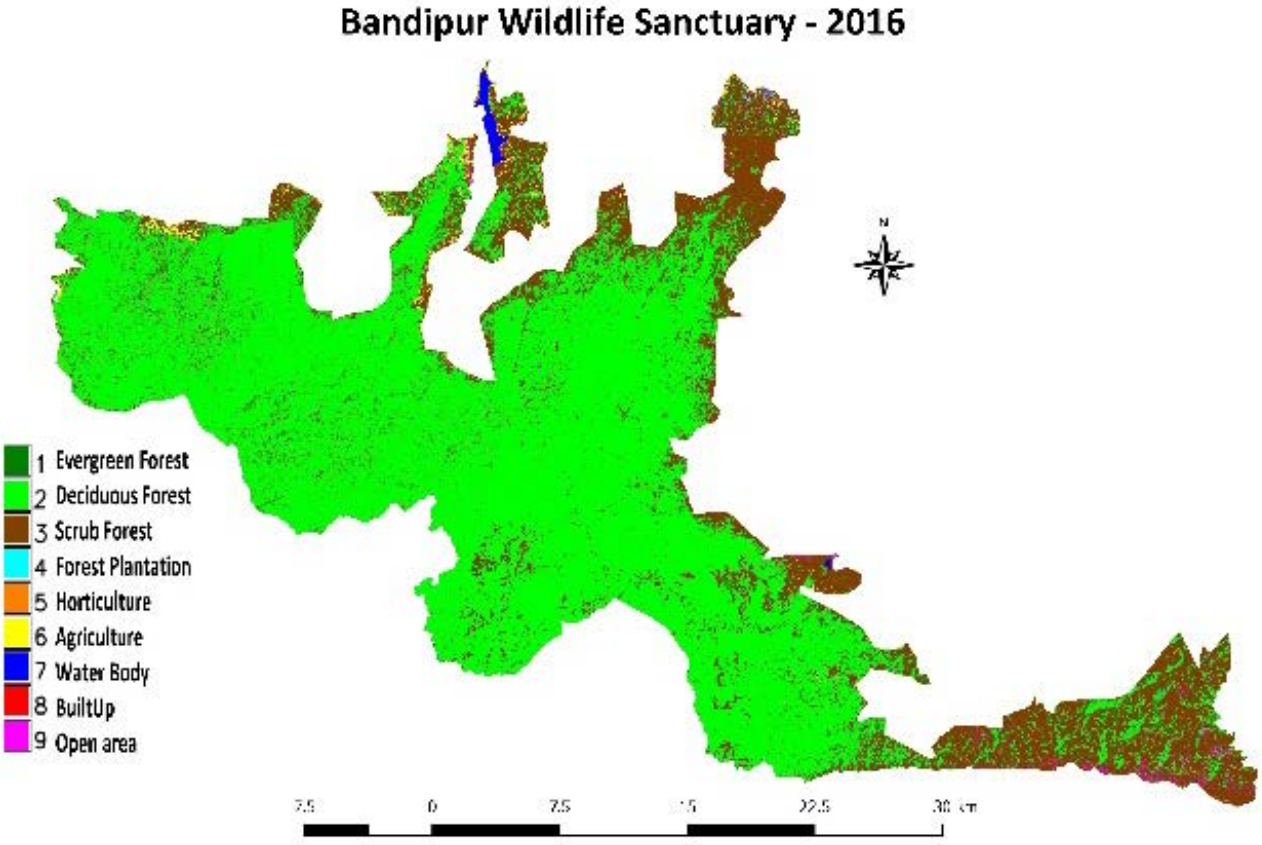
[16] Topographic maps provided ground control points to rectify remotely sensed data and scanned paper maps (topographic maps). Survey of India (SOI) topo sheets and vegetation map of South India developed was digitized to identify various forest cover types and analysis over different time periods to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

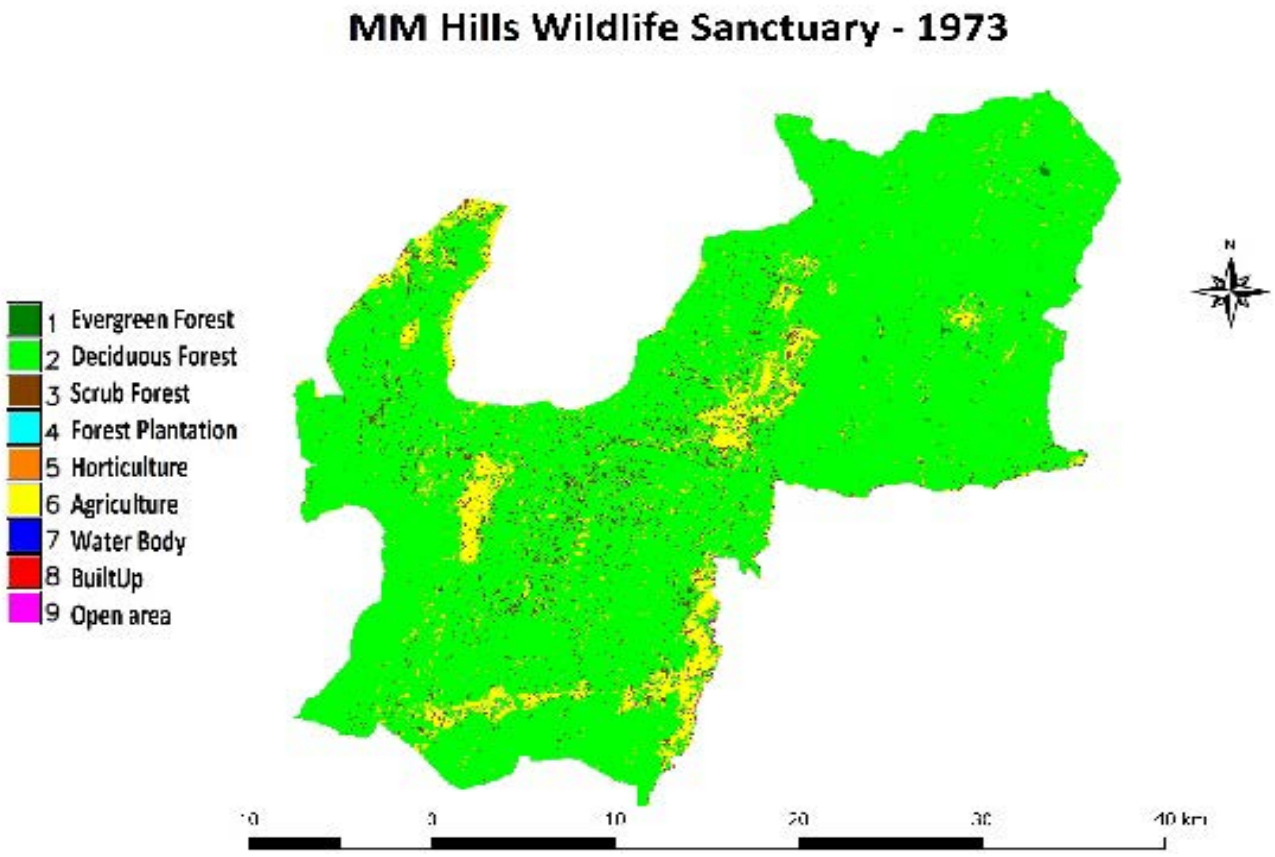
[17] Dandeli-Anshi, Bandipur, Bhadra, BRT, Brahmagiri, Cauvery, Kudremukh, Malai Mahadeswara, Mookambika, Nagarahole, Pushpagiri, Sharavathi, Someshwara

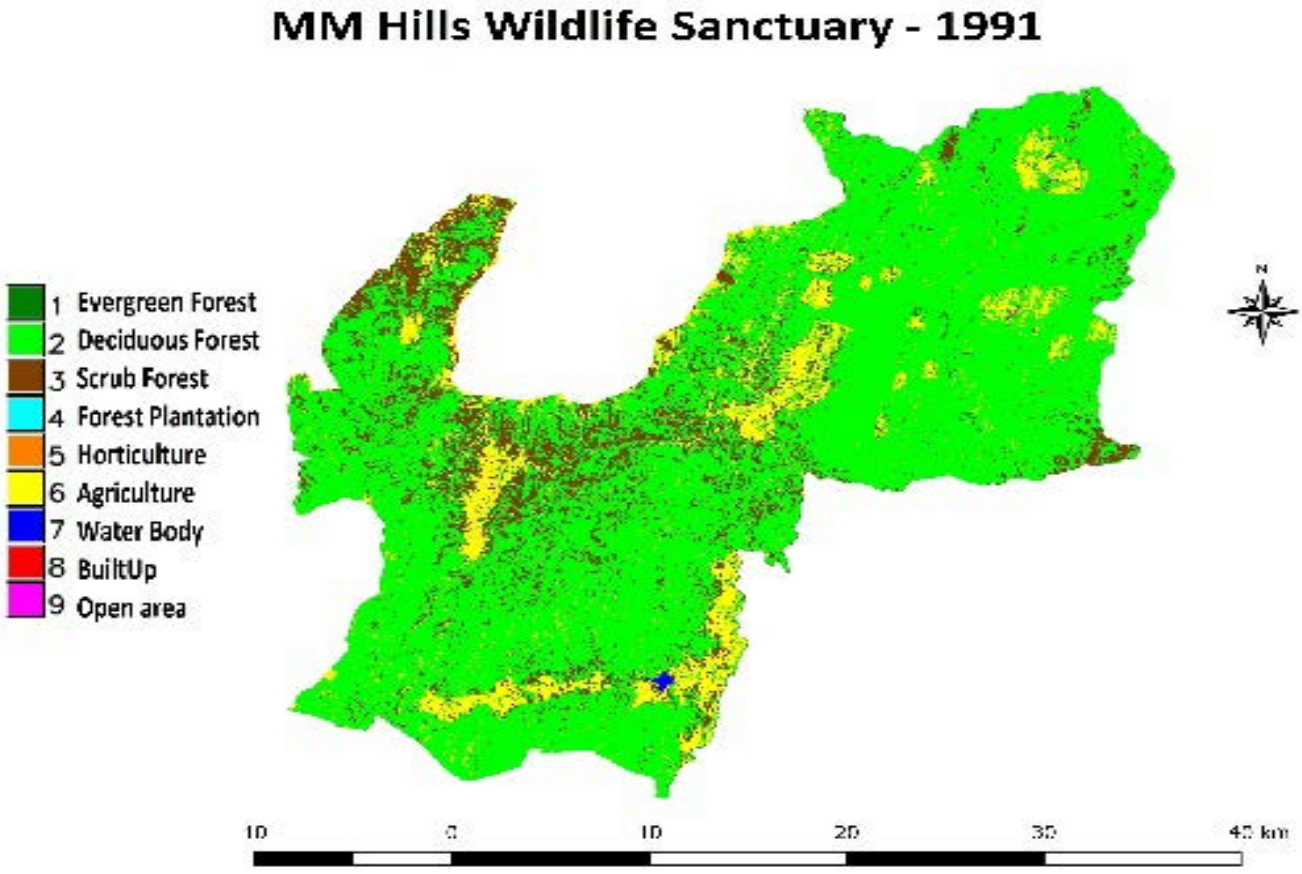
Chart. 3.2: The LULC changes noticed in Bandipur Tiger Reserve and Malai Mahadeswara Wildlife Sanctuary as of 1973, 1991 and 2016

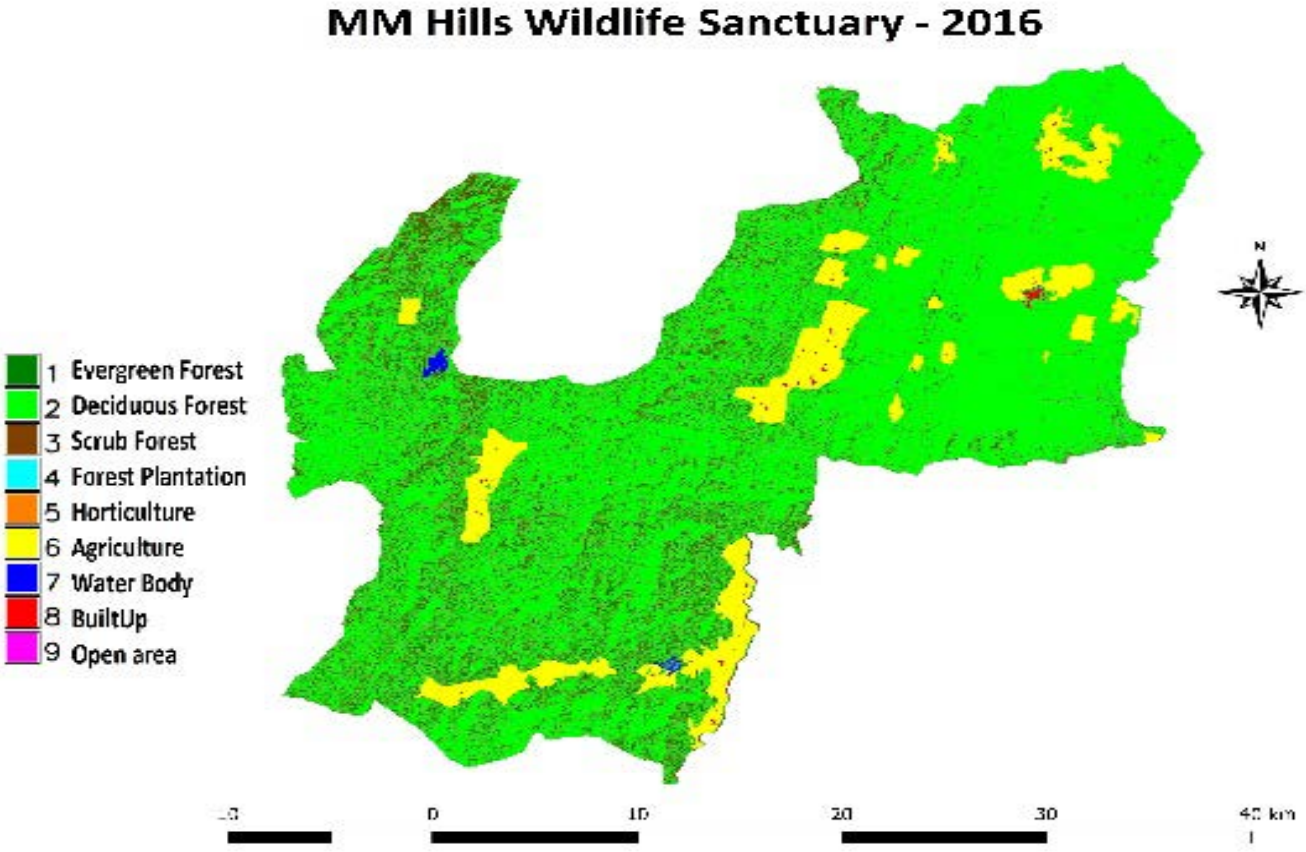



Bandipur Wildlife Sanctuary - 1991
1 Evergreen Forest
2 Deciduous Forest
3 Scrub Forest
4 Forest Plantation
5 Horticulture
6 Agriculture
7 Water Body
8 Built Up
9 Open area
N
0
15
22.5
30 km


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
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.

Chapter 4

Human Wildlife Conflicts and Wildlife Corridors

4.1 Human Wildlife Conflicts

Expansion of agricultural fields leads to fragmentation of forests all around the globe. Increasing human population lead to development activities like hydel projects, irrigation canals, coffee estates, road and railway network and urbanisation. Loss of tropical forests coupled with fragmentation lead to decrease in ecosystem services of great value to humanity such as carbon storage in biomass and soils, watershed regulation and rainfall, modulation of climate and river flows, spread of infectious disease and also reduction of the feeding ground of many species. The animal populations look for alternative sources towards human settlement areas and finally end up in Human Wildlife Conflicts (HWC) at fringe areas of Protected Areas.

The fragmentation of forests has created a discontinuity of forests and has become a major hurdle for the movement of wildlife including the elephant and tigers from one forest to another. During such movements, the wild animals crisscross human habitation and come in contact with people who have settled / encroached on their prehistoric migration paths, thus ending up in HWC.

Some of the major species involved in HWCs are the mega herbivores like elephant and carnivores like tigers and leopards. Apart from these major flagship species, even wild boar, gaur and sambar can inflict damages to standing crops, human life and their property. However, elephants stand out as a key conflict species as they cause high economic losses and are also responsible for a high number of human fatalities. It is estimated that nearly 400 people are killed annually in elephant conflict related incidences in India and they cause damages approximately up to 5,00,000 families through crop depredation. Similarly, 100 elephants are killed due to retaliation by farmers in a bid to remove 'problem' animals. During the period 2008-09 to 2010-11, 91 people were killed by elephants while 101 elephants were killed in retaliation in the State of Karnataka[18].

4.1.1 Overall conflict cases

There are about 956 fringe villages around the selected PAs with vast agricultural fields and encroachment of up to 9,512 *acres*. To mitigate HWCs the Department has taken up short term measures like excavation of Elephant Proof Trenches (EPT), solar fencing, special structures, deployment of Elephant Depredation Camps etc. A total of 26,685 cases of compensation events[19] have been registered and an amount of ₹ 11.43 crore has been incurred on the same in the 14 test checked PAs between the years 2011-12 to 2015-16 as shown in the **Table 4.1:**

[18] An Elephantine challenge- Human Elephant Conflict distribution in the largest Asian Elephant population, Southern India- Sanjay Gubbi *et al*- Biodiversity Conservation (2014) 23:633–647

[19] Instances of crop, cattle and human depredations, human injuries and loss of property

Table 4.1: Protected Area-wise details of compensation events and amount paid during 2011-16

(Amount in ₹)

Protected Area/ Division	No of crop compen-sation cases	Total amount spent on crop compensation	No of human death	Compen-sation amount paid	Human injury	Compen-sation amount paid	No of property damaged	Compen-sation amount paid	No of Cattle killed	Compen-sation amount paid
Bandipur TR	7171	15626821	9	4500000	82	1273482	35	71840	544	1814682
Bharda TR	882	5438532	1	500000	1	20000	0	0	22	90500
BRT Tiger Reserve	2635	9440211	15	7200000	34	324401	0	0	49	242000
Cauvery WLS	995	3006250	8	4000000	8	111983	0	0	75	472000
Dandeli Anshi TR	736	2299857	3	150000	12	201085	0	0	399	2133095
Kudremukh Wildlife Division (3 PAs)	322	1098546	1	500000	0	0	0	0	54	196983
M.M. Hills	559	1812221	7	3200000	14	167221	20	83455	10	38000
Madikeri Wildlife Division (3 PAs)	4495	13630548	1	500000	6	74500	40	266450	47	210800
Nagarahole TR	6477	25506707	8	3850000	27	351241	23	108900	532	2138800
Sharavathi WLS	258	1262840	0	0	1	4049	0	0	67	394520
Total	24530	79122533	53	24400000	185	2527962	118	530645	1799	7731380

(Source: Details furnished by the Department)

Out of the total amount of ₹ 11.43 crore, ₹ 7.91 crore was paid towards crop loss, ₹ 2.44 crore towards human death and ₹ 25.28 lakh towards human injury (caused by elephant, tiger / leopard). The number of crop raids (**Table 4.2**) and compensation incidences showed an increasing trend across the years. A total of 50 persons have been reported to be trounced by elephants and three persons mauled to death by tigers during 2011-12 to 2015-16 in the selected Protected Areas and ₹ 2.44 crore was been paid as ex-gratia.

Thus, it can be seen that the mitigation measures deployed being of short term nature, were inadequate to control or minimise the incidences of HWCs. The solution therefore lies in exploring and executing long-term measures like expansion of wildlife areas, securing animal corridors, rehabilitation of human habitations which were, however not prioritised.

4.1.2 Crop compensation due to Elephants

Elephants are the major cause of crop depredation. The surge in elephant population needs larger feeding ground. However, most of our PAs are infested with weeds like *lantana* and other weeds (dealt in **Chapter 8.2**) which have taken over large chunks of feeding grounds of elephants which are now forced to look for alternative sources of food. The elephants wandering out in search of new feeding grounds are attracted towards the standing cash crops like banana, sugarcane, *etc.*, grown in the fringe villages and end up in conflict with humans safe-guarding their crops. Such reports send alarming signals for the future and highlight the necessity for preparedness of the

Department for ensuring better co-existence of Humans and Wildlife. The Department had taken up various mitigation measures to reduce HWC by installing structures like Solar fencing, EPTs, Cattle Proof Trenches (CPT), Railway barricades, Anti depredation squads, special structures, *etc.* However, the instances of crop depredation have not come down, but have rather increased as can be seen from the **Table 4.2.**

Table 4.2: Protected Area-wise and Year-wise details of incidences of crop damages by elephants during the period 2011-12 to 2015-16

(Amount in ₹)

Protected Areas/Division	2011-12		2012-13		2013-14		2014-15		2015-16		Total	
	No of cases	Amount	No of cases	Amount	No of cases	Amount	No of cases	Amount	No of cases	Amount	No of cases	Amount
Bandipur TR	965	1968827	878	1882375	1371	3262725	1030	2390506	2927	6122388	7171	15626821
Bhadra TR	150	689690	284	2066179	122	931016	240	1219501	86	532146	882	5438532
BRT Tiger Reserve	514	1553158	1411	5209712	440	1592904	210	774824	60	309613	2635	9440211
Cauvery WLS	64	182263	0	0	270	694374	359	1006227	302	1123386	995	3006250
Dandeli Anshi TR	128	324855	110	303345	103	304467	218	894697	177	472493	736	2299857
Kudremukh WLD (3 PAs)	39	92752	64	194112	98	341270	48	196747	73	273665	322	1098546
M.M.WLS	286	885990	175	469654	59	251093	19	102692	20	102792	559	1812221
Madikeri WLD (3 PAs)	645	2027488	1239	3232750	693	2437200	1427	4422820	491	1510290	4495	13630548
Nagarahole TR	1053	4467027	1871	8516171	1302	4801222	1401	4658319	850	3063968	6477	25506707
Sharavathy	7	37500	36	133150	14	78158	63	560830	138	453202	258	1262840
Total	3851	12229550	6068	22007448	4472	14694429	5015	16227163	5124	13963943	24530	79122533

(Source: Details furnished by the Departmental)

As could be seen, except in case of Biligiri Ranganathaswamy Temple (BRT) Tiger Reserve and Malai Mahadeshwara (MM) Wildlife Sanctuary which show a decreasing trend, the rest of the PAs showed varying crop raid incidences in different years. Reasons for the year-on-year fluctuations in the incidences, though generally showing an increasing trend, need to be further investigated and analysed.

The increase in crop depredation can be attributed to the failure on the Department front, in maintaining the EPTs and solar fences properly. It was observed that in many places the solar fences were not functioning and were brought down while in many places EPTs were filled up. It was also seen that many of the fringe villages have grown cash crops like sugarcane, banana, paddy, *etc.*, which attract animals like elephants, gaurs and wild boars. However, the Department failed to convince such farmers to go in for crop pattern change and harvest crops which the wild animals are not attracted to like cotton, turmeric etc. Further, the compensation paid for crop depredation were delayed up to six months, such delay in compensation acts as a threat to wildlife by means of retaliatory killings.

Thus, it becomes necessary to continuously evolve strategies for mitigating conflicts and a major mitigation measure initiated by the Department has been brought out in succeeding paragraphs.

4.1.3 New mitigation measure

One of the latest mitigation methods being adopted is the barricading of the PAs using old railway rails. This is an ambitious project with huge expenditure of ₹ 37.38 crore incurred during 2013-16 and is being tried out in Bandipur and Nagarahole Tiger Reserves. The used railway rails are bought at scrap cost from Railways, transported to work site concerned and a barricade is constructed using these rails. This is based on a success story of a similar structure at Addo National Park of South Africa. In Bandipur and Nagarahole TRs, railway barricade work has been completed to an extent of 3.5 km and 9 km respectively up to March 2016.

Elephants, being one of the most intelligent animals, adapt to new situations easily and had already learnt to cross EPTs and negotiate solar fences. Now, even the newly erected railway barricades are being negotiated by them as shown at **Fig 4.1:**

Fig 4.1: a, b & c An elephant successfully crossing over the Railway barricade at Nagarahole Tiger Reserve. Fig 4 d: An elephant gets stuck in the process of crossing the barricade.
Image source: Karnataka Forest Department

To address this problem, the height of the barricade was subsequently raised to 12 feet. However, this being a new mitigation measure of its kind and still in its nascent stage (12.5 km as of March 2016), it would be premature to assess its efficiency. An elephant herd needs more than 600 sq km of home range[20] while most of the PAs in the State are about 500 sq km range. In this scenario, if PAs are barricaded by rails all around, they hamper the free movement of the elephants which need large feeding grounds and this could have a negative impact on these animals. Therefore, it may be prudent to try out the new mitigation method in one PA on experimental basis and extend it to other PAs only after assessing its success and implications.

4.1.4 Cattle depredation

Cattle are valuable as they are one of the important sources of livelihood for the poor farmers and their loss is of great significance to them. But with increasing population, shrinking and fragmented habitat, wildlife movements have been restricted and resources are limited for carnivores like tigers and leopards. Hence, the cattle of fringe villages and those which are illegally taken to graze in the PAs become an easy prey for them. Therefore, cattle depredation is also an important indicator of Human Wildlife Conflicts. The details of cattle depredation recorded in different PAs during 2011-12 to 2015-16 have been brought out in **Table 4.3:**

Table 4.3: Details of cattle kills recorded in PAs during the period 2011-12 to 2015-16

(Amount in ₹)

Cattle killed in PAs	2011-12		2012-13		2013-14		2014-15		2015-16		Total	
	No of cases	Amount	No of cases	Amount	No of cases	Amount	No of cases	Amount	No of cases	Amount	No of cases	Amount
Bandipur TR	115	259600	49	139411	105	288000	102	292000	173	835671	544	1814682
Bhadra TR	2	5000	5	13500	3	8000	6	18000	6	46000	22	90500
BRT Tiger Reserve	8	23000	9	30500	5	15000	11	68000	16	105500	49	242000
Cauvery WLS	0	0	0	0	1	3000	6	31000	68	438000	75	472000
Dandeli Anshi TR	75	236000	102	305000	55	177000	75	522500	92	892595	399	2133095
Kudremukh Wildlife Division	12	41433	16	44050	5	15000	15	46000	6	50500	54	196983
M.M. Wildlife Sanctuary	8	29000	2	9000	0	0	0	0	0	0	10	38000
Madikeri Wildlife Division	2	6000	24	70800	4	12000	5	22000	12	100000	47	210800
Nagarahole TR	48	140000	138	410000	158	472000	89	790300	99	749500	532	2561800
Sharavathy WLS	3	6850	20	66000	8	30500	13	90670	23	200500	67	394520
Total	273	746883	365	1088261	344	1020500	322	1880470	495	3418266	1799	8154380

(Source: Details furnished by the Department)

As could be seen from **Table 4.3** above, 1,799 cases of cattle depredation have been reported and compensation of ₹ 81.54 lakh paid during 2011-12 to 2015-16. Also, except for Kudremukh Wildlife Division, Bhadra Tiger Reserve and MM Wildlife Sanctuary, there is an increasing trend in cattle depredation during the period 2011-12 to 2015-16.

[20]The IUCN Red List of Threatened Species: Elephas maximus – published in 2008.

4.1.5 Impact of increase in large carnivores

Apart from the above, recent incidences in Bandipur TR and Nagarahole TR about increased Human-Tiger / Leopard Conflict have thrown up alarming situations in these areas. During 2015-16, there were two incidents of human death caused by tigers, in which one tiger was shot down (as it had turned into a man-eater) while the other was captured and kept in Mysuru Zoo. Further, there are many incidents reported by the Department of capturing leopards from various human habitations around the PAs and relocating them back to the wild. Under such instances when these cattle are being preyed upon by wild animals there is a sense of intolerance among the villagers and this is further aggravated by delay in payment of ex-gratia / compensation which leads to retaliatory killings of wildlife by poisoning, gunning down and electrocuting in and around PAs **(Fig 4.2 a, b and c).**

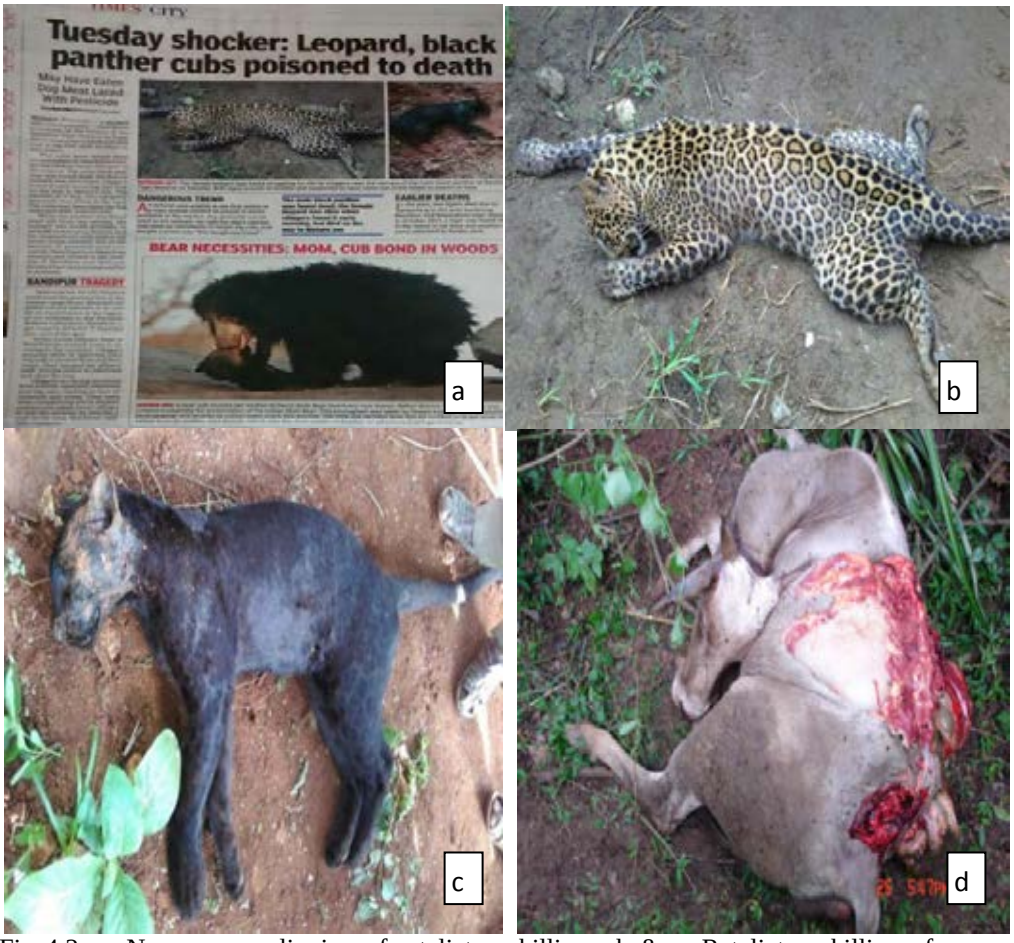


Fig 4.2: a. News paper clipping of retaliatory killings. b & c: Retaliatory killing of young Leopards on the fringe Bandipur Tiger Reserve. d. Cattle depredation by leopard in Nagarahole Tiger Reserve. Image source: Karnataka Forest Department

As per the Status of Tiger in India 2014[21] report, Nagarahole TR, Bandipur TR and BRT TR have an estimation of 10.28, 11.09, 11.29 tigers per 100 sq km against the average of 8.5 to 9.5 tigers per 100 sq km of forest. This overflow of population has pushed many of the older tigers to the fringe areas

[21] Status of tiger in India 2014, K. Ullas Karanth, N. Samba Kumar, Ravishankar Parameshwaran, Arjun Srivathsa, Sushma Sharma, Wildlife Conservation Society – India and Centre for Wildlife Studies

while, younger tigers often wander out looking for newer territory to establish themselves and end up coming in contact with humans. Both scenarios result in conflict. Hence, possibly the only way to address the issue could be to identify the problematic areas with frequent / high incidences of human death / retaliatory killings and take up rehabilitation / relocation of humans from these areas.

Given the seriousness of Human Wildlife Conflict and its extreme gravity, there should be a continuing programme for containing and defusing such conflict. Overall, the Department has spent an amount of ₹ 74.68 crore for mitigation measures and an amount of ₹ 11.38 crore towards compensation during 2011-12 to 2015-16 but with little success. In the Exit Conference, Government stated that the local people would be involved in the maintenance of EPTs and solar fences, though it is not clear to audit how that would improve the effectiveness of these measures.

In such a situation, a long term solution is the only way, with both tigers and elephants needing large home ranges for their survival. Proper corridors which connect forests and fragmented areas needs to be established for easy passage of wildlife which could reduce Human Wildlife Conflict and also play a vital role in improving the gene pool[22] of a given species in the form of blood exchange.

Recommendation 1: The Department needs to maintain an updated database of wildlife movement. Incentivising farmers to grow non-cash crops around the Protected Areas and providing of crop insurance may be taken up. Maintenance of Elephant Proof Trenches, solar fences, special structures and adequate use of Elephant Depredation Camps may be ensured to reduce Human Wildlife Conflicts.

4.2 Wildlife Corridors and expansion of Protected Areas

Under Wildlife (Protection) Act, 1972 areas of adequate ecological, faunal, floral, geo-morphological, natural or zoological significance have been declared as a National Park, Wildlife Sanctuary, Conservation Reserve or Community Reserve for protecting, propagation or developing wildlife or its environment. National Parks and Wildlife Sanctuaries are spread over different parts of the State. Amongst single large or several small PAs, several small models have won over single large PA from the conservation point of view and is the most pragmatic model when human numbers are very large. For several small models to be effective, it is extremely important to link such PAs by means of providing corridors for animal movement to facilitate gene flow. Stretches of habitat that represents ecotones[23] and ecological gradients[24] between the two habitats, must be effectively conserved[25].

[22] Indicates high genetic diversity, increased chances of biological fitness and survival

[23] A region of transition between two biological communities which are often rich in species than either of the two regions (Oxford dictionary)

[24] It is a gradual change in abiotic factors through space or time

[25] Report of the National Forest Commission, 2006

4.2.1 Restoration of Wildlife Corridors

A Wildlife Corridor is a narrow strip of land with native vegetation that connects two or more larger areas of similar habitats or forest fragments and is critical for the maintenance of ecological process including migration, colonisation and interbreeding of plants and animal communities thus enhancing the chances of survival.

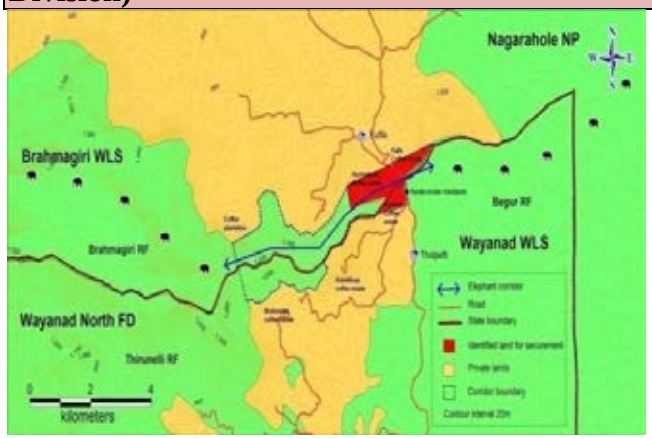
Habitat loss and fragmentation are the two main contributors to continuing biodiversity decline across the landscape. Fragmentation of forest due to rapid human development and encroachment along the paths connecting the two forest patches have resulted in many plant and animal species becoming isolated and also affected the movement of large mammals like the elephants and tigers.

A total of 88 wildlife (elephant) corridors were identified by the Wildlife Trust of India which has been brought out in its report "The Right of Passage" (2005) to conserve the elephants. As far as Corridors of Southern India are concerned, 20 corridors were identified of which seven are in Karnataka. These were reiterated in "Gajah" (2010) a report brought out by the Ministry of Environment, Forest and Climate Change, Government of India (MoEF) Elephant Task Force Committee and "Conservation Plan for securing selected Elephant Corridors in South Western Ghats" (2011) brought out by the Wildlife Trust of India.

Among the seven corridors identified in Karnataka, five fall in the Western Ghat-Nilgiri Biosphere Region *viz.*, Kaniyanpura - Moyar (Bandipur TR), Chamarajanagar-Talamalai (Talavadi-Muddahalli, BRT TR), Chamarajnagar-Talamalai, Punjur (Punjur- Kolipalya, BRT TR), Edayarahalli- Doddasampige (MM WLS) and Brahmagiri- Tirunelli (Madkeri Wildlife Division) which are our prime concern and area of study. Among these, three are considered as high ecological priority and conservation feasibility corridors while two are identified as medium ecological priority and conservation feasibility corridors. The status, ecological priority and conservation feasibility of these corridors have been brought out in **Fig 4.3** below:

Fig 4.3: Status and ecological priority of Corridors

1. Brahmagiri- Tirunelli, (Madikeri WL Division)

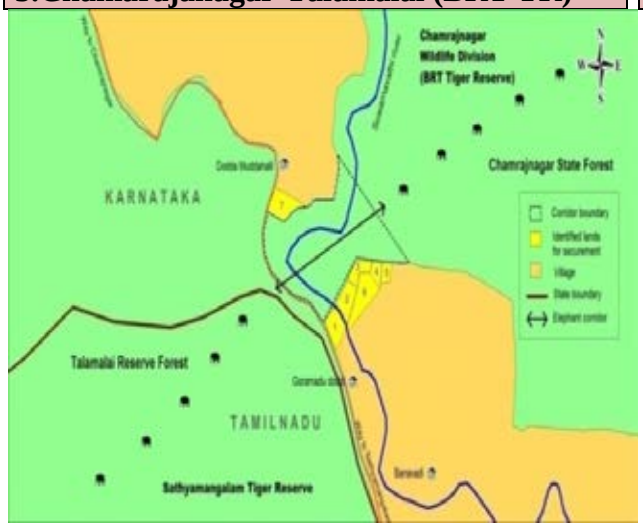


Status: The corridor runs along several tea estates and plantations.
Ecological Priority- Medium
Conservation Feasibility -Medium

2. Kaniyanpura - Moyar (Bandipur TR)

Status: Already a corridor exists of 0.4 km width and one km length, but needs strengthening in the form of widening.
Ecological Priority- High
Conservation Feasibility – High

3.Chamarajanagar-Talamalai (BRT TR)

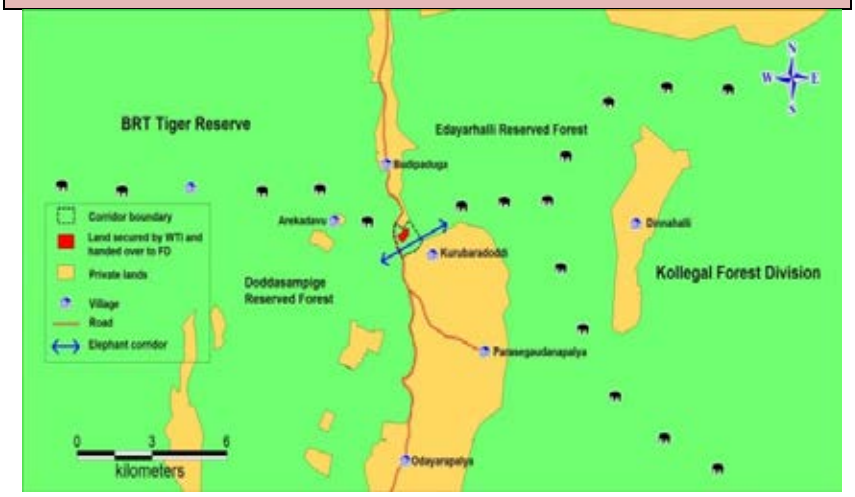


Status: It is an existing corridor of one km width and 1.5 km length which needs strengthening.
Ecological Priority- High
Conservation Feasibility –Medium

4.Chamarajnagar-Talamalai, Punjur

Status: An existing corridor measuring 1.5 km in width and one km in length needs strengthening.
Ecological Priority- Medium
Conservation Feasibility –Medium

5. Edayarahalli- Doddasampige (MM Wildlife Sanctuary)



Status: An existing corridor measuring 0.5 km length and two km width which needs strengthening.
Ecological Priority- High
Conservation Feasibility: -High
Illustration Source: Karnataka Forest Department

The current position with reference to these corridors is given below:

- Most common threats in all these corridors are the presence of villages along with agricultural fields and grazing of cattle in Protected Areas.

- Brahmagiri-Tirunelli corridor of Srimangala Range in Madikeri Wildlife Division is an important one with high elephant movement. This region has recorded 3,047 number of conflicts which includes two human deaths, four cases of human injury, 13 cattle deaths, 2,990 cases of crop loss, 38 cases of property loss during the period 2011-12 to 2015-16 involving payment of ₹ 1.04 crore. Though proposals for acquiring private lands for restoring this corridor were initiated during 2008 and 2012, no breakthrough has been achieved so far.

- Kaniyanpura corridor is located near Kundukere Range in Bandipur TR. This corridor which has high ecological priority and conservation feasibility needs to be restored on priority since it is used by several elephant herds and bulls regularly. Though the villagers are volunteering to forego their lands under compensation and a proposal to acquire lands from the villagers was initiated during 2013. No progress has been achieved in this regard so far.

- In case of Chamarajnagar-Talamalai corridor at Punjur of BRT TR, there was unscientific rehabilitation of tribals during 1990 from Biligiri Ranganathaswamy Hills to this corridor. Since this is an ecologically high priority corridor, these settlements have to be relocated once again to secure the corridor. However, as seen from the Tiger Conservation Plan (TCP), no action has been initiated in the matter.

- Adjacent to Edeyarahalli corridor, 25.37 *acres* of private land has been purchased from local farmers to widen the corridor by Wildlife Trust of India (WTI), New Delhi, an NGO[26], as a first step towards securing path for wildlife movement in BRT TR. This was a pioneering effort in corridor conservation approach in India. Though these lands were purchased and gifted to the Department on 24 December 2009, the Department has failed to notify these areas as forest to bring it under Protected Area till date (February 2017).

Since restoration / strengthening of corridors require acquisition of private / agricultural lands, the quantum of lands required are to be assessed and plan of action to acquire the same had to be initiated. However, though all these corridors were identified as early as 2005 and are vital for ensuring free movement of animals in general and elephants in particular, the extent of lands required for restoring them were not assessed in all these cases. Also, the Management Plan (MP) / TCPs concerned did not contain plan of action for securing these corridors.

In order to bring new blood, establish a strong gene pool of these animals and for better conservation, which also acts as a long term mitigation measure for Human Wildlife conflict, it becomes imperative to find ways to give wildlife the right of way to move freely to the adjoining forests through establishing "Corridors". In this regard, Principal Chief Conservator of Forests (Wildlife) stated (September 2016) that the Government has announced a new scheme with a budgetary provision of ₹ 20 crore for acquisition of private areas occurring in the notified elephant corridors. However, as the acquisition involves crores of Rupees, the Department was doubtful of any outcome in the short run. During the Exit Conference, acknowledging the importance of corridors in reducing HWC incidents in the long run, the Government stated that appropriate action would be taken in this regard.

Recommendation 2: Speedy action may be initiated to work on strengthening of corridors by purchasing private land within a time frame. The Department may consider the implementation of the recommendations brought out in Reports like The Right of Passage" (2005), Gajah (2010), Conservation plan for securing selected Elephant Corridors in South Western Ghats" (2011) and "Report of the Karnataka Elephant Task Force Report" submitted to High Court of Karnataka in September 2012.

4.2.2 Expansion of Protected Areas

Areas of rich and diverse biodiversity need to be identified and conserved. Similarly, areas with rare endemic species with very limited distribution need to be conserved on priority before these are lost. Hence, expansion of Protected Areas by including areas of bio-diversity is extremely necessary.

In the Western Ghat-Nilgiri Biosphere Reserve region of the State during the last five years, the areas of four Protected Areas, among the selected sample, were increased by adding the adjoining areas under approval

[26] Non-Governmental Organisation

(November 2011) of National Board for Wildlife. The details of these PAs like existing area and added area are given in **Table 4.4** below:

Table 4.4: Details of areas added to Protected Areas during 2011-16

(Area in sq km)

Name of the NP/ WLS	Existing area	New Area added	Total
Cauvery Wildlife Sanctuary	526.95	500.58	1,027.53
Dandeli Wildlife Sanctuary	638.34	248.06	886.40
Mookambika Wildlife Sanctuary	247	123.37	370.37
Someshwara Wildlife Sanctuary	88.4	225.85	314.25
Total	1,500.69	1,097.86	2,598.55

Source: Karnataka Forest Department

Thus, a total of 1,097.86 sq km was added to the existing 1,500.69 sq km of these PAs, an increase of 73 *per cent* over the earlier area. Also, one new Protected Area *viz.*, Malai Mahadeshwara Wildlife Sanctuary covering an area of 906.18 sq km was declared during 2013. This has effectively increased the Protected Area network in the region by 2004 sq km. The increase in areas under PAs is one of the positive aspects of administration in the State and stands as one of the best examples in the country to work towards conservation of wildlife.

However, several other issues were observed during audit regarding expansion of Protected Areas which have been detailed in succeeding paragraphs.

4.2.2.1 Failure to notify expansions approved by National Board for Wildlife

A. Kudremukh National Park and Bhadra Wildlife Sanctuary

National Board for Wildlife (NBWL) is a statutory organisation constituted under the Wildlife Protection Act, 1972. NBWL serves as the apex body to review matters related to wildlife and approve projects in and around National Parks and Wildlife Sanctuaries. The approval accorded by NBWL in November 2011 included two more expansions *i.e.*, Kudremukh National Park (201.69 sq km) and Bhadra Wildlife Sanctuary (348.33 sq km) for which notifications have not been issued even after five years in spite of specific instruction of Chief Secretary, Government of Karnataka (July 2014). In a parallel development, the State Board for Wildlife (15 July 2014) discussed the proposal of the Principal Chief Conservator of Forests (Wildlife) (PCCF - WL) for increasing the area of Kudremukh National Park to 938.67 sq km (from the existing area of 600.57 sq km) by adding four Reserve Forests (RF), which included two RFs that had already been approved by NBWL in November 2011. The revised proposal was referred (July 2014) to the Sub-Committee of State Board for Wildlife (SBWL) for field visit, examination and furnishing report. The field visit had not materialised as of March 2016.

However, it was observed that in respect of the expansions already approved by the NBWL, the Government could have issued notification for expansions and pursued further expansion of Kudremukh separately. In reply, PCCF-WL

(September 2016) stated that these expansion proposals are being pursued relentlessly. Thus, though expansion of these PAs was approved by NBWL as early as 2011, the notifications are yet to be issued (February 2017).

B. Pushpagiri Wildlife Sanctuary

Pushpagiri Wildlife Sanctuary was proposed to be expanded by adding 12 Reserve / State Forests[27] by Sri Sanjay Gubbi, Member of SBWL (July 2011). Pushpagiri WLS, Kudremukh NP and Nagarahole NPs fall in the same line and are part of the Western Ghat system. However, these pristine forests are separated due to various human development activities. Further, as per the proposal mentioned above, if these Reserve Forests (RF)/ State Forests (SF) are brought under the PA, then this would ensure connecting northern part of Pushpagiri Sanctuary to the southern tip of Kudremukh National Park, thereby providing an ideal opportunity to link two of the most important Protected Areas *i.e.,* Kudremukh and Nagarahole National Parks[28]. Upgrading these RF / SFs to PA would ensure that elephants have connectivity between southern and northern Western Ghats which would help in reducing Human Elephant Conflict to a large extent. This proposal included adding 433.44 sq km to Pushpagiri Wildlife Sanctuary and was accepted by the State Board for Wildlife in its fourth meeting (July 2011) and forwarded to Government (September 2011). However, this proposal was not forwarded to NBWL, the reasons for which were not on record.

However, in the meanwhile (June 2012) one more proposal was made to add the adjoining RFs of Hassan district to Pushpagiri WLS for providing connectivity to Kudremukh National Park to reduce Human Elephant Conflict. This proposal, which included addition of 213.32 sq km of seven[29] RFs to Pushpagiri WLS, was approved by SBWL (December 2012) and approved by NBWL in June 2013. The notification for expansion has not been issued even after three years of the approval. The major constraints for not notifying was that the area proposed for addition had several Mini Hydel Projects (MHP) and as the RFs had scope for expansion of Yettinahole Project. Further, the notification could also pose difficulties for future expansion of this project and Link Road Project to be taken up by National Highway Authority of India.

Linking Kudremukh National Park with Nagarahole National Park would have been one of the best mitigation measures in the long run to reduce Human Wildlife Conflicts by having corridor connections, as well as helping in conservation of catchment of the river Nethravathi and its tributaries. Though Karnataka has been expanding PAs, the proposal of Pushpagiri WLS expansion has suffered due to various administrative delays which need immediate intervention at the highest level.

With reference to issuing notifications for the expansions already approved by NBWL, the Government stated during Exit Conference that though socio-

[27] Bhagimale, Bisle, Bisle Extension, Kabbinale, Kaganeri, Kanchanakumari, Kempole, Kiribag, Miyar, Shiradi-Shishila and Subramanya,

[28] Letter dated 5/7/2011 of Sanjay Gubbi, Member of State Board for Wildlife.

[29] Bisle, Bisle Extension, Kabbinale, Kaganeri, Kempole, Kenchanakumari and Moorkanagudda

political reasons were mainly responsible for the delay and the objective of wildlife protection could be achieved even without notification.

However, as these areas could be easily diverted for non-forestry purposes and these areas have sufficient scope for MHPs, hydrological projects, *etc*., non-notification would make these areas prone for such activities which would have long-term negative impacts on wildlife conservation. Also, these expansions were approved three to five years ago and any more delay could further complicate the scenario.

4.2.2.2 Linking three Sanctuaries of Kodagu as Greater Talacauvery Wildlife Sanctuary

In a high level meeting of several Environmental Organisations (activists), Senior Ministers and Officers (4 August 2003), the Chief Minister desired to make the Kodagu forests a Biodiversity Zone and instructed Principal Secretary, Department of Forests, Ecology and Environment to submit a detailed report to this effect. The Principle Secretary instructed (19 August 2003) PCCF-WL to examine the same and report. In response, the Conservator of Forests, Kodagu Circle submitted (September 2003) a proposal for extending the areas of three sanctuaries of Kodagu *i.e.,* Brahmagiri, Pushpagiri and Talacauvery by adding 812.14 sq km of six ghat forests[30] of the district (Fig 4.5). As these forests were rich in biodiversity, very fragile and home to Lion Tailed Macaque (LTM), one of the endemic and endangered species, he reasoned that this would not only help in wildlife conservation, but additionally, also in water conservation of the monsoon rains and maintenance of the regional climatic balance.

However, it was observed that no progress has been achieved in the matter. On seeking the reasons for the same, PCCF -WL replied (September 2016) that constituting Greater Talacauvery Wildlife Sanctuary is under consideration. It was also stated that the proposal mooted in 2003 would be very difficult in the present scenario. However, since this would link the three sanctuaries and involves only Reserve Forests without requiring acquisition / notification of new forests, the Greater Talacauvery WLS, backed with necessary Feasibility Study by scientific institution / fraternity, may not be impossible to achieve.

Though Karnataka State is one of the states in the country which has taken up expansions of PAs and has declared many new sanctuaries in the last few years, it has also missed on a few opportunities to secure more areas under the PAs as brought out above which needs immediate attention and secure the place for the better conservation of our wildlife.

Recommendation 3: Notification for expansion of the three Protected Areas (Kudremukh National Park, Bhadra and Pushpagiri Wildlife Sanctuaries) which have been approved by the National Board for Wildlife may be expedited to ensure better connectivity between Nagarahole and Kudremukh National Parks.

[30]Brahmagiri Ghat, Kadamakal Ghat, Kerti, Padinalkad Ghat, Pattighat and Urti

Chapter 5

Commercial activities in and around the Protected Areas and Eco-tourism

Protected Areas being treasure troves of biodiversity, it is of utmost importance to regulate activities which have a negative impact on wildlife habitats. Growing commercial activities like small hydel projects, resorts, homestays, plantations, *etc.*, in and around Protected Areas have become a source of concern and MoEF issued (February 2011) guidelines for declaration of eco-sensitive zones around PAs to minimise the ecological damage from such developmental activities. The guidelines prohibited undertaking several activities (commercial mining, saw mills, setting of industries causing pollution, establishment of major hydroelectric projects, *etc.*,) and brought establishment of hotels / resorts, commercial use of natural water resources, *etc.*, under regulated activities.

Status of declaration of Eco-sensitive Zone

In respect of sampled National Parks and Wildlife Sanctuaries, eco-sensitive zone was notified (2012) only in respect of Bandipur National Park while draft notifications have been issued for other Protected Areas except Rajiv Gandhi (Nagarahole) National Park.

Major commercial activities impacting negatively on wildlife habitats are discussed in the succeeding paragraphs.

5.1 Mini Hydel Projects

Hydro electric projects up to 25 Mega Watt (MW) capacity are classified as Small Hydel Projects. These are built across streams / rivers for generation of electricity and are popularly called Mini Hydel Projects (MHPs). The MHPs are exempted from impact assessments as per Environmental Impact Assessment (EIA) notification, 2006. In the State, Karnataka Renewable Energy Development Limited (KREDL) is the nodal agency for implementation of MHPs. Till the end of March 2015, 92 MHPs had been commissioned while 209 MHPs had received approval for establishment in Western Ghats region, inscribed as World Heritage Site by UNESCO.

Impact caused due to construction of MHPs, as evidenced by independent research / Departmental observations have been brought out in the succeeding Paragraph.

5.1.1 Impact of Mini Hydel Projects

Though MHPs are exempted from EIA studies, they do cause landscape disturbances, disrupt biodiversity and fragment habitats owing to construction of penstock, canals, transmission lines, roads, *etc.*, which cumulatively cause significant disruption of river and forest system during construction in particular and to a lesser extent in the operation phase[31]. A pictorial depiction of a typical MHP is shown in **Fig 5.1**:

[31] EMPRI Study Report(2014) on significant impact of activities not covered by EIA, 2006

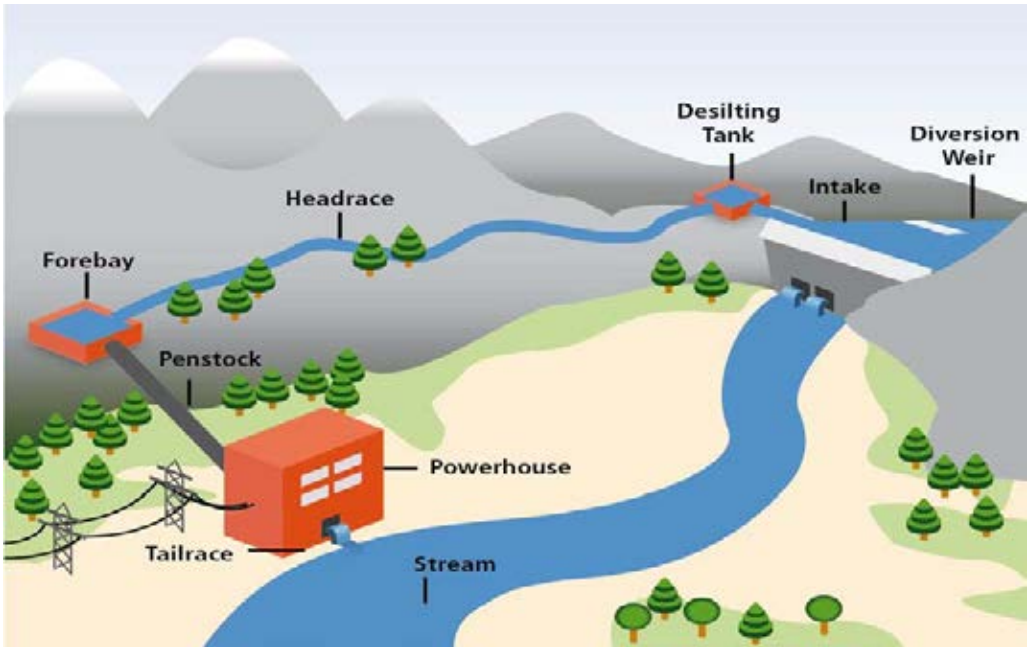


Fig 5.1: Pictorial depiction of components of a run of river Mini Hydel Project
Source: Alternate Hydro Energy Centre, Indian Institute of Technology, Roorkee

We observed that some MHPs are functioning / under construction in or around Pushpagiri, Malai Mahadeshwara and Cauvery Wildlife Sanctuaries. While one is located inside the PA, the others are located within seven km of the PA borders as shown at **Table 5.1:**

Table 5.1: Details of Mini Hydel Projects in and around Protected Areas

Sl No	Name of the Project	Date of commissioning	Distance from PA	Name of the Protected Area
1	Beedalli Mini Hydel Project	13.06.2016	1.50 km	Pushpagiri Wildlife Sanctuary
2	Bhoruka Power Project	14.09.2006	6.76 km	MM Wildlife Sanctuary
3	Pioneer private Ltd. RMHP (24.75MW)	29.07.2007	1.94 km	MM Wildlife Sanctuary
4	Cauvery Hydro power project(3MW)	10.09.1998	1.21 km	MM Wildlife Sanctuary
5	Atria Power Project (6MW),Shivanasamudra	01.08.2001	600 m	MM Wildlife Sanctuary
6	Pioneer Private Ltd(24 MW)	01.07.2005	50 m	Cauvery Wildlife Sanctuary
7	Atria Power Project (24MW), Ganalu	01.11.2001 24.10.2011	50 m	Cauvery Wildlife Sanctuary
8	Limbavali Power Project (12MW)	07.04.2009	Falls within the sanctuary	Cauvery Wildlife Sanctuary

Source: Karnataka Forest Department

Several studies have brought out the negative impact of the MHPs which are stated as under:

- The construction of Kadumane-2 MHP in Western Ghats region has affected the pattern of water flow of streams, tributaries and rivers due to the change in their course of natural flow. This diversion of water flow has a cascading effect on the hydrology of the aquatic system, fish migration, other aquatic life forms and wildlife which are part of this fragile ecosystem. Further, soil erosion / damage occurs due to power evacuation

lines and heavy rainfall (about 5,000 mm/year) on these steep terrains which causes un-repairable damage to this fragile geological area[32].

- Though all the MHPs require ground clearance before commencement of the Project which includes clearing of standing trees, the record of the extent of trees removed was not available in all the cases. In respect of Kadumane-2 MHP, located in the area proposed for expansion of Pushpagiri WLS, 432[33] trees were removed from this biodiversity rich Western Ghat region. In the case of Limbavali MHP, several trees such as Sandal, Mathi, Honge, Karagi and other trees were also removed, though the numbers are not available on record.

- The Mudumalai- Nagarahole- Brahmagiri- Muthodi migratory path is one of the two most important traditional migratory routes in Southern India and this includes Bisle RF, Kaginahare (*i.e*, Kageneri), Kanchankumari and Kempole RF. Elephants move from Mudumalai National Park towards Nagarahole, further via Pushpagiri WLS and Bisle RF up to Muthodi. This rich and diverse patch of vegetation provides ample resources for elephants moving in these routes. The establishment of MHPs in this region has not only fragmented the forest but also disrupted the migratory path, which is now witnessing increased Human–Elephant conflicts.

- Four[34] MHPs located in Kempole, Kageneri and Kanchanakumari RF area which is a very important Elephant Corridor between two high profile wildlife areas of Nagarahole TR and Pushpagiri WLS in the South. These RFs are very rich in biodiversity and are a high centre of endemism including endangered species like elephants and slender lorris, near threatened species like grey-headed bulbul, malabar pied hornbill, etc. Recognising the biological / ecological / social importance of these RFs, they were proposed for inclusion in the expansion of Pushpagiri WLS. Considering the ecological status and sensitivity of the area, the endangered flora and fauna, such area *per se* is not to be diverted for non-forestry purposes[35]."

- The Chief Conservator of Forests and Field Director (CCF & FD), Project Elephant, Mysuru in his letter (26 September 2011) to the PCCF -WL stated that elephants were impacted by the MHPs (Limbavali, Atria, MS Mini Hydel and Pioneer) causing disturbance in their home range and that elephants were straying out in small groups of five to seven elephants for crop raiding, resulting in escalation of Human Elephant Conflict. The CCF & FD had observed that for mitigating Human Elephant Conflicts in the area, it was necessary to take immediate action to make the home range area free from disturbance, non-government / private lands around the Reserved Forest have to be acquired by the Department, growing of crops like banana, sugarcane, maize, *etc*., are to be discouraged (**Appendix 3**).

[32]Central Empowered Committee report on alleged illegal diversion of forest lands for non-forest uses in the Western Ghats region in Karnataka

[33]Report submitted by Deputy Conservator of Forests, Territorial Division, Hassan

[34] Kadumane-1, Kadumane-2, IPCL Kempole and Maruthi Power Gen

[35] Opinion of the PCCF (Head of Forest Force) vide letter dated on 19.3.2014 on the Kempole, Kaganeri and Kanchanakumari Reserve Forest

However, no remedial actions were taken to make the home range free from disturbances.

- A study[36] in respect of IPCL Kempole Project (18 MW) found that the weir was approximately 21 metre in height, higher than 100 MW projects in the country and at least nine metre taller than the 97 MW Tashiding Hydro Electric Project in Sikkim. Diversion of water for the project had left about one km of the river bed almost dry which was bound to affect the wildlife and ecosystem of the area. Audit could not assess the deviations by the project proponents, considering the huge structures constructed, as the Department did not furnish any records in this regard. The matter requires serious investigation.

The above impacts have been observed in respect of other MHPs located in the Western Ghat-Nilgiri Biosphere Reserve region, the cumulative impact of these MHPs could be more severe on the fragile ecology of this biodiversity rich region. Since EIA is not applicable for MHPs, these structures are mushrooming at an alarming rate which needs to be regulated through some means of ecological assessments prior to approval of the project. In reply, the Government stated that a committee has been formed for assessing the carrying capacity of the Western Ghat region with reference to MHPs.

5.1.2 Violations by Mini Hydel Project Proponents

Section 2 of Forest (Conservation) (FC) Act, 1980 requires that no forests shall be diverted for non-forestry purposes without approval of MoEF. Also, conditions imposed at the time of project clearance must be adhered to by the project proponents and monitored by the concerned authorities. Our scrutiny revealed several violations by the project proponents which are discussed below:

5.1.2.1 Mini Hydel Projects not obtaining clearance under Forest (Conservation) Act

a) Beedalli MHP (3 MW) taken up by M/s Kodagu Hydel Project Private Ltd, was approved in April 2006. After substantial completion of work (expenditure of ₹ 13 crore), it was noticed that the project was being carried out in deemed forest area and the project authorities had not obtained clearance as per FC Act. The project, situated in the eco-sensitive area of the Pushpagiri WLS, had broken up the contagious forests in the Western Ghat region and removed a large number of trees. This river bank is incidentally the only location in which *Madhuca insignis*, a critically endangered riparian species once thought to be extinct was rediscovered in 2004 after a gap of 120 years, grows. Substantial damages had already been caused due to construction activities taken up at the site. The opening up of forests and fragmentation of habitat could be seen from the two satellite imageries of the locations as shown in **Fig 5.2 (a) and (b):**

[36] A case study by Green Norms for Green Energy, Small Hydro Power, Centre for Science and Environment 2013 on MHP in Karnataka

Fig 5.2: (a) Imagery dated 26/2/2010 of the site; (b): Imagery dated 7/2/2014 of the site
Source: Google earth

The matter was taken to the Karnataka High Court which ordered (June 2014) for obtaining necessary approval for diversion under FC Act. In reply, the PCCF -WL stated that the PCCF- Head of Forest Force (HoFF) is seized of this issue, the wildlife wing in close association with PCCF-HoFF would follow up this case scrupulously. It was, however, observed that the project had been commissioned in June 2016.

b) Limbavali Power Project: This Project with a capacity of 12 MW is located at Dhanagur State Forest under survey No. 277 of Cauvery Wildlife Sanctuary and at Daballi Survey No. 77 and was in operation since 2005-06 without clearance from FC Act. The project proponent, without obtaining approval of the Department and Chief Wildlife Warden, whose approval is also required for taking up projects in Protected Areas / forests rich in wildlife, commenced power generation though this area was an established elephant corridor. Also, the project proponent had encroached 200 *acres* of forest land in Dhanagur RF. As the Department had failed to take cognizance of the project even though it has been operating on encroached land for more than six years, PCCF-HoFF instructed Conservator of Forests, Mysuru Circle to examine the matter and fix the responsibility. Subsequently, in view of violations of FC Act, 1980, Section 24 of Karnataka Forest Act, 1963 and for operating the MHP without obtaining prior approval of State Board for Wildlife, the premises of the MHP was seized (January 2016) by the Department. Aggrieved by this action, the project proponent filed a Writ Petition in the High Court and obtained stay order (February 2016). The action taken by the Department to get stay vacated has not been intimated.

5.1.2.2 Transmission lines passing through forests without approval

a) Atria Power Project (24MW), Ganalu: The project located on 13.35 *acres* of land adjacent to Basavana betta RF of Cauvery WLS is in operation since 2004. Project proponents had drawn transmission lines in an area of five *acres* in Dhanagur RFs of Cauvery WLS without obtaining necessary approval. This MHP along with other MHPs like Limbavali, Atria, MS Hydro Power Project and Pioneer Mini Hydel projects, were found to be causing accumulated disturbances in the last ten years resulting in increased Human Elephant

Conflicts[37]. Though the project proponents were found to be functioning in violation of provisions of FC Act, no action was taken until January 2016 when notice was issued to the MHP by the Range Forest Officer concerned for violating the FC Act and Karnataka Forest Act.

b) Pioneer Power Corporation Ltd, (Ranganatha Swamy Mini Hydel Project): The Department had approved diversion[38] 4.863 ha of forest land to the project proponent for establishment of MHP of 24.75 MW capacity which was commissioned in 2007. Elephant Task Force set up by the High Court of Karnataka opined (September 2012) that the project should not have been approved as the forest area was an elephant and other wildlife movement path. Hence, required approval of Chief Wildlife Warden (PCCF-WL) as per instructions issued in 1998 and diversion of forest land was accorded without proper assessment.

Karnataka Elephant Task Force[39]in their report (September 2012) concluded that ill-planned commercial infrastructure projects caused fragmentation of forest and termed location of MHPs in Sakleshpur and Malavalli taluks as ill-advised. Karnataka High Court in their order (October 2013)[40] had directed Government of Karnataka to review the non-forest activities in the elephant habitat and corridor and also to take appropriate action where violations had occurred. However, as evident from the encroachments and other violations brought out above, no action has been taken to comply with the above direction which has resulted in continued pressure on these habitats.

PCCF -WL in reply stated (September 2016) that the Department is reviewing all these projects in the elephant habitat and corridors. The reply was general in nature and indicated that no concrete action had been taken by the Department in any of these cases though High Court had passed orders to review all cases and assessment of potential impacts for new projects in 2013 itself.

During the Exit Conference (March 2017), the Government stated that a Committee has been formed for assessing the carrying capacity of Western Ghats with reference to MHPs and no new MHPs would be permitted in the region. However, the Government was silent with reference to the MHPs already existing, appropriate action needs to be taken wherever violations have been noticed.

Recommendation 4: Any new commissioning of Mini Hydel Projects should be subjected to appropriate environment assessment.

[37] Letter addressed on 26/9/2011 by CCF and Field Director, Project Elephant, Mysuru
[38] G.O. No FEE 41 FLL dated 26.10.2005
[39] Karnataka Elephant Task Force constituted by High Court of Karnataka
[40] Para 28 (v) of High court judgment dated 8th October, 2008 n WP No 14029/2008

5.2 Eco-tourism

Eco-tourism activities are promoted inside the Protected Areas for creating awareness / nature education. Department of Tourism is promoting eco-tourism as the thrust area as Karnataka is bestowed with natural forests and home to flagship species. As eco-tourism is gaining popularity over the years, demand for resorts, homestays, recreational activities is increasing. The heavy inflow of tourists in protected area causes disturbances to animals.

5.2.1 Un-regulated tourists inside Protected Areas

The Protected Areas are the nature's repository of various species of flora and fauna and have been so designated by statutory provisions for *in-situ* conservation of these invaluably rich forest resources. The Government had issued (July 2011) instructions to assess and fix the carrying capacity[41], for each Protected Area from time to time.

In Brahmagiri, Pushpagiri and Talacauvery WLSs, the tourist inflow had steadily increased between 2011-12 and 2015-16. In respect of Mookambika, Someshwara, Sharavathi WLSs and Kudremukh NP, the tourist inflow was highest during 2015-16. However, none of these sanctuaries had assessed the carrying capacity. Though the Kudremukh WL Division stated that the carrying capacity had been assessed for various sites of Kudremukh NP and Someshwara WLS and approved by Chief Wildlife Warden and the carrying capacity of Mookambika Wildlife Sanctuary was being worked out, these were not furnished to Audit. Audit could not ensure that utilisation of the tourism potential of these sanctuaries was within the carrying capacity.

5.2.1.1 Operation of tourist vehicles in excess of the assessed carrying capacity in Tiger Reserves

Vehicular movement inside Protected Areas must be restricted as the noise and pollution of the vehicles cause disturbance to the wildlife. The maximum noise level permitted inside PAs was 50 decibels (dB) during day time and 40 dB during night time. The number of vehicles that could be permitted in the PAs for each day was assessed based on the carrying capacity. Audit observed that these restrictions were not followed as discussed below.

In BRT Tiger Reserve, as against the ceiling of 14 vehicles per day (*i.e.* 7 each during morning and evening as per assessed carrying capacity), 32 trips were being operated daily. In Bandipur TR, it was observed that the assessed carrying capacity was 20-22 trips per day which would translate to 660 trips per month. However, it was seen that 1,004, 683 and 853 safari trips were operated during the months of May, August and October 2015 respectively which exceeded the permissible carrying capacity. Further, the details of trips done by Jungle Lodges and Resorts (JLR) were not produced to Audit, in the absence of which the actual number of trips during this period would be higher taking into account the trips operated by JLR.

[41] Maximum number of tourists a site can sustain.

Forests are silence zones wherein the maximum sound limit permissible was 50 dB during day time. It was observed that Bandipur TR was using 18 Departmental vehicles for safari out of which two vehicles were more than 20 years old, three were 12 years old and all these vehicles ran on diesel. A study conducted by CF, Research Wing during 2012[42] had observed that sound level of vehicles of make 2009-11 was in the range of 75 to 80 dB and safari jeeps of 2007 make was 65 dB, all of which were beyond the permissible levels. However, no action was taken to ensure that only vehicles emitting sound within permissible levels were used for safari purposes.

Recommendation 5: Tourist flow needs to be strictly controlled based on the carrying capacity. Online booking for safaris may be explored to control the flow of the tourists.

5.3 Resorts in and around Protected Areas

5.3.1 Commercial hotels and resorts

As per guidelines issued for declaration of eco-sensitive zone, operation of commercial establishment is a regulated activity inside the eco-sensitive zone. In the absence of notification of eco-sensitive zone, this was to be up to ten kms from the boundary of the Protected Area. Further, the Wilderness Tourism Policy, 2004 do not permit establishment of commercial hotels and resorts inside National Park / Sanctuaries and their enclosures. In addition, resorts are also to be regulated by Karnataka State Pollution Control Board and Department of Tourism.

On scrutiny, it was observed that as many as 51 resorts / hotels were found to be functioning in and around six sampled Protected Areas as detailed in **Table 5.2:**

Table 5.2: Resorts functioning in and around Protected Areas

Protected Area	Located at	Total working	Approved by Forest Department
Bandipur Tiger Reserve	Eco-sensitive zone	19	6
Biligiri Ranganathaswamy Temple Tiger Reserve	Inside enclosures	4	0
Kudremukh National Park	Eco-sensitive zone	1	0
Bhadra Tiger Reserve	Around Protected Area	11	1
Cauvery Wildlife Sanctuary	Within PA/enclosure	3	0
Dandeli-Anshi Tiger Reserve	Around PA	13	0
Total		51	7

Source: Departmental statistics and Audit compilation

As can be seen from the above, out of 51 resorts / commercial establishments, only seven were approved by the Department. It was also observed that the lists of resorts furnished by the Department were obtained from Department of Tourism and the Forest Department did not have its own data. As commercial

[42] Environmental Impact conducted in 2012 with reference to Bandipur Tiger Reserve were carried out by Freeda Maria Swarna, Scientist of KETB and Sri Manojkumar, IFS, CF, Research Wing

activity like hotels and resorts needs to be regulated in and around the Protected Areas, the absence of approval / regulation will have an indirect but significant impact on the wildlife and its habitats. Therefore, it is important to enforce strict regulations on these activities in eco-sensitive zone and enclosures.

Further, observations with reference to different PAs are detailed as under:

- **Bandipur Tiger Reserve**: This is the only PA for which eco-sensitive zone has been notified in the State. Out of nineteen resorts / hotels found to be functioning, only six had been approved by the Department. Of the six approved, four resorts *viz.*, the Country Club, Tusker Trails, The Serai and Dhole's Den are in Mangala village located in the Kaniyanapura corridor.

  - Out of the approved Resorts, Tiger Ranch was located in the buffer zone and elephant corridor and was also near the water hole frequented by wild animals. Though the Department had requested (November 2012) the Deputy Commissioner, Chamarajanagar to cancel the permission accorded, the resort is still functioning. The Division stated (November 2016) that the resort is not being operated and the issue is in Karnataka High Court. However, we observed that the resort was functional and bookings were evidenced from the internet and people's opinion on the internet.

  - Ashwini Ayurvedic Jungle Resorts was found to be constructed on land approved for house construction. Even though the allotment was subsequently cancelled (August 2011) by the Deputy Commissioner (DC) who further ordered (March 2012) demolition of the structures, the same could not be enforced due to stay order (May 2012) of the High Court. Though it was replied (September 2016) that action is being taken to close this resort, the fact that stay order has not been got vacated by the Department indicates the contrary position.

  - The Serai (earlier called as Cicada) was functioning from 2005, i.e., much earlier to notification (2011-12) of Eco-Sensitive Zone (ESZ) of Bandipur National Park. This resort was closed for renovation between June 2011 and May 2012 during which period draft notification of ESZ was issued (September 2011). As per the draft notification, operation of commercial activity is a regulated activity and further expansion required prior approval of National Board for Wildlife. However, though it was stated that only renovation work was being taken up, we observed that the built up area of the resort was expanded. As no approval was obtained, the expansion was in violation of the ESZ notification. In reply, the Department stated that expansion to the resort was not allowed after declaration of draft notification of ESZ. The reply is not acceptable since expansion of the resort was actually taken up and expanded facility commenced operations after declaration of draft notification without taking prior approval of NBWL.

- **Biligiri Ranganathaswamy Temple Tiger Reserve**: Four hotels/ commercial establishments, *viz.*, Gorukana-Champakaranya run by Vivekananda Girijana Kalyana Kendra and other establishments like

Akash, Rajathadri and Giridarshini were functioning inside enclosures[43] contrary to Wilderness Tourism Policy.

- In **Kudremukh National Park**, the Sahyadri Guest House was found to be operating commercially by Kudremukh Iron Ore Company Limited inside the ESZ without approval of the Forest Department.
- Eleven resorts were found to be functioning within 0.5 to 10 km from the Tiger Reserve and all of these did not have the approval of the Forest Department. Since the ESZ of the sanctuary is yet to be notified, the Department needs to regulate the activity up to 10 km. Also, Green Woods Resort was found to be operating in pristine shola forests on the mountain slopes of Jagara valley, which was in complete defiance to observations of National Tiger Conservation Authority (NTCA).
- **Cauvery Wildlife Sanctuary:** Two resorts were found to be operated by JLR at Bheemeshwari and Galibore for which necessary approval under FC Act, 1980 is yet to be obtained. In addition, one private resort *i.e,* Om Shantidhama was found to be operating inside an enclosure contrary to the provisions of Wilderness Tourism Policy, 2004.

5.3.2 Homestays

The Tourism Policy of Karnataka for the period 2009-10 to 2013-14 states that the "Athiti" homestays up to five rooms will be encouraged to be developed across the State which will be treated as a non-commercial activity. Hence, approval of Department of Tourism is necessary for running of these homestays. Audit scrutiny revealed that 50 homestays were found to be operating in and around Bhadra and Dandeli-Anshi TRs of which 35 were approved by Department of Tourism as detailed in **Table 5.3:**

Table 5.3: Homestays in Bhadra and Dandeli-Anshi Tiger Reserve

(In numbers)

	Total working	Approved	Not approved
Bhadra TR	14	5	9
Dandeli Anshi TR	36	30	6
Total	50	35	15

(Source: Details furnished by the Karnataka Forest Department)

Further scrutiny revealed that:

- In Bhadra TR, two homestays were found to be operating with more than five rooms contrary to the provisions of homestay policy and hence were to be reckoned as resorts / commercial activities. However, no action was taken against these homestays by Department of Tourism. Further, with reference to nine homestays located in Muthodi Range, no action was taken to identify the numbers of rooms operated by the homestays.
- NTCA during their inspection (July 2012) observed that many commercial resorts / homestays were being constructed and these would affect the ecology of these pristine forests by means of pollution and their structures

[43] Revenue villages / habitations located inside the Sanctuary / National Park

along the streamlines could affect the flow of perennial water and make them seasonal and needs to be regulated. However, we observed that three homestays, *viz.,* Jari Guest House, Apna Sapna and Misty Mouth Homestays, which were not approved by Department of Tourism, were found to be operating in pristine shola forests of Jagara Valley and their activities were not regulated in spite of specific direction from NTCA.

- The Tiger Conservation Plan of Dandeli-Anshi TR had identified that resorts and homestays are a threat and challenge to the TR. However, it can be seen from **Table 5.3** that six unapproved homestays were operational without approval of Department of Tourism. Forest Department has not taken action to regulate or close the homestays in this Reserve.

Recommendation 6: Forest department in coordination with Department of Tourism, needs to regulate activities of resorts / hotels / homestays, *etc*., in and around Protected Areas.

5.3.3 Coffee Plantations within the core / critical tiger habitat of Biligiri Ranganathaswamy Temple Tiger Reserve

Five coffee plantations *i.e.*, Attikan, Biligiri Rangan, Emerald Haven, Nilgiri and Honna Metti Estates, are present in the core area / critical tiger habitat of the BRT Tiger Reserve. These plantations are functioning on leased lands and are using the forest roads for transportation of timber and labourers and creating pressure on Tiger Reserve which is not conducive for wildlife conservation.

Forest land of 184 *acres* in Doddasampige Reserve Forest was granted (August 1946) on lease for 20 years to Mr R C Morris for coffee cultivation which was transferred (January 1955) to M/s Nilgiri Plantations, owned by M/s Birla Brothers Ltd., Calcutta along with additional 15 acres of Reserve Forest land. Before expiry of lease period (1966) and consequent upon reorganisation of States in November 1956, the forest land where this plantation area is located came under the jurisdiction of State of Karnataka. The Company claimed that the erstwhile Government of Mysore had further extended the lease period by 99 years. However, copy of Government approval in extending lease period was neither furnished by the Company nor available with the Department. However, forest land continued to be under occupation by the Company and Department demanded lease rent despite being aware of the fact that lease agreement was not concluded and Government approval in extending lease period was not available on record. The Department should have taken action to get forest land resumed back as the area was situated in the core area of the Tiger Reserve area but instead demanded lease rent which was injudicious and questionable. The demanding of lease rent was tantamount to regularisation of illegal occupation and thus favouring the Company.

On this being pointed out, Government in Exit conference (March 2017) stated that the matter is in court and legal action would be taken to resume the land back to the Department.

Chapter 6

Encroachment / occupation of forest land and rehabilitation of villagers

The presence of villages and human habitations in and around the Protected Areas is one of the main reasons for fragmentation of habitats. Therefore, it becomes essential to ensure that boundary consolidation of Protected Areas are regularly taken up and demarcated, so that any unauthorised occupancy may be contained. Villages in any PA pose a major threat to the wildlife and also the inhabitants by Human Wildlife Conflicts. In view of this, it is imperative that villagers living inside the PAs are rehabilitated by providing grant of rights to tribals and other traditional forest dwellers. However, it was observed that habitat consolidation has not been ensured as observed from the continued encroachment of forests, slower settlement of rights under Forest Rights Act[44] (FRA), 2006 and sluggish rehabilitation and relocation works as brought out in the succeeding paragraphs.

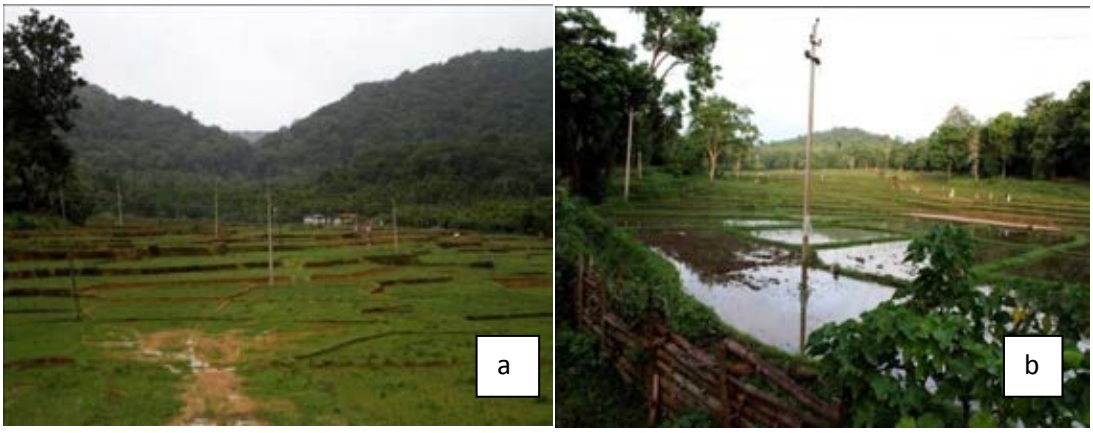


Fig 6.1: a Fringe village with agricultural fields in Dandeli –Anshi Tiger Reserve (DATR).
b Village- agricultural land located inside Protected Area of DATR
Source: Images taken during field visits by Audit.

6.1 Encroachment of Forests

6.1.1 Increasing trend of encroachments over the years

The encroachment of forests in Karnataka showed an increasing trend between 1995 and 2011. The encroachment of forest area in Karnataka which was only 42,518[45] *acre* during July 1995, increased to 1,65,796 *acres* as per June 2011 Report[46]. This further increased to 2,04,442 *acres* by October 2014[47]. Thus encroachment of forest areas increased almost five times in 19 years.

In terms of Government of India (GoI) orders dated 18.09.1990, 15.05.1996, 04.08.2005 and Government of Karnataka (GoK) Order dated 5 May 1997[48], "Steps shall be taken by the State Government to evict all the unauthorised

[44] Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006
[45] Proposal sent to MoEF for regularization dated 15 July 1995
[46] Balusubramanian Report on encroachment of Government lands
[47] Affidavit submitted to High Court of Karnataka in WP No 15511-15514 of 2013
[48] GO No FEE 5 FGL 90 dated 05.05.1997

encroachments that have taken place over forest land after 27.04.1978". Though the orders were issued to evict all encroachments and to avoid further instances, encroachment of forest lands continued unabated as can been seen from the **Table 6.1:**

Table 6.1: Status of encroachments of Forest lands in Protected Areas

Name of the Sanctuary	Number of Forest Offence Cases booked towards encroachment	Total encroachment as on 31 March 2016		Encroachment below three acres		Encroachment above three acres	
		Number of cases	Area	Number of cases	Area	Number of cases	Area
Bandipur TR	159	1,121	4,522	729	1,536	392	2,986
Bhadra TR	21	21	69	14	17	7	52
BRT Tiger Reserve	1	11	19	11	19	0	0
Cauvery Wildlife Sanctuary	821	1,935	3,377	1,854	3,041	81	336
Dandeli-Anshi TR	0	591	239	578	181	13	58
Kudremukh National Park	134	140	305	118	206	22	99
Mookambika WLS		8	19	6	13	2	6
Someshwara WLS		1	1	1	1	0	0
Brahmagiri WLS	1	4	1	4	1	0	0
Pushpagiri WLS	11	11	28	9	20	2	8
Talacauvery WLS	6	7	27	4	12	3	15
MM Hills WLS	199	512	825	500	775	12	50
Nagarahole TR	5	5	30	0	0	5	30
Sharavathi WLS	26	26	62	17	22	9	40
Total	1,384	4,393	9,524	3,845	5,844	548	3,680

(Source: Details furnished by Karnataka Forest Department)

It was observed that the encroachments were for cultivation of food / horticultural crops, constructions of houses, *etc*. The current status of actual encroachments could be still higher for the following reasons:

- **Short booking of offences**: As per the Karnataka Forest Manual[49], any offence have to be booked immediately. Though as many as 4,393 encroachment cases were identified by the Protected Area management, we observed that offences were booked only in 1,384 cases. Since the balance 3,009 cases were not booked, legal action could not be initiated against these offenders.

- **Short accounting of encroachments**

  We observed that there was a difference in the data regarding encroachment provided by the Division and the Ranges. Moliyur, Omkar and Nugu Ranges of Bandipur Tiger Reserve indicated an encroachment of 5,037 *acres*, while the Division statistics stated the encroachments for these ranges was 3,351 *acres*. We observed a short account of 1,686 *acres* in this regard. Further, in respect of Nagarahole Tiger Reserve, we observed from the Departmental records that there was an encroachment of 148 *acres* by *eksali* lease holders in DB Kuppe Range which was not reflected in the Divisional statistics. Such discrepancies in the statistics of the Department have led to a short accounting of encroachment to the tune of 1,834 acres. In writ petition No: 15511-14/2013 filed in the High Court

[49] Paragraphs 63 (1), 64 and 68

of Karnataka relating to encroachment of forest areas in the State, the Department submitted that the total encroachment in the State was 2,04,442 *acres* as of October 2014. However, we observed that this statistics did not include the encroachment of 4,522 *acres* recorded by Bandipur Tiger Reserve. Hence, details furnished to High Court of Karnataka were incorrect.

❖ **Non conducting of periodical survey**

A. Survey and demarcation works are to be taken up regularly to ensure that the boundaries are intact. It was, however, observed that survey and demarcation works to an extent of 87.62 km (2015-16) in Sharavathi WLS and 183 km (2013-15) in Bhadra TR only were taken up. In other sampled PAs such survey and demarcation were not taken up.

B. In Hediyala Range of Bandipur TR, the total area encroached was indicated as 803 acres and 3 guntas without giving the breakup of number of encroachers, extent encroached by each person, *etc.* Survey of this is yet to be conducted. In the absence of survey, the area indicated as encroached may not be factual.

Thus it could be seen that for assessing encroachments, periodic survey was not conducted, offences were not booked for all encroachment cases and there was short accounting of encroachments. The details of encroachments as furnished to audit and Karnataka High Court did not reflect ground realities, as brought out above. Also, the Department is having Information Communication Technology Centre (ICT) which has access to satellite imageries and other spatial information relating to the Forest Department. With the help of satellite imageries available over a period of time, the Department could have taken up GPS[50] survey of the encroachments found in the PAs which would have helped in assessing the extent of encroachments and its monitoring. Thus, the assessment of encroachments recorded by the Divisions was found to be highly doubtful and the technology based tools to assess this were not utilised in spite of their availability.

6.1.2 Satellite imagery based assessment of encroachments

A detailed analysis of spatial data was conducted with the co-ordination of IISc[51], in connection with the extent of encroachments in Protected Areas of Karnataka. The boundary and cadastral maps relating to Protected Areas were obtained from Forest Department and KSRSAC. These maps were superimposed on the satellite imageries by IISc to find out the extent of encroachment of forests in Protected Areas. The spatial analysis conducted by IISc involved (i) base map preparation, (ii) identification of different types of encroachment, data analyses, *etc*., and (iii) changes noted temporally in Protected Areas. The encroachments were marked by overlaying forest boundary with land parcel numbers. The encroachments were identified by different colour patterns of the satellite images, compared to the adjoining forest area. This aided in mapping unauthorised land holdings within the Protected Areas. The marked areas were digitized and extents were computed.

[50] Global Positioning System
[51] Centre for Ecological Studies, Indian Institute of Science

The analysis indicated that large areas have been encroached in Malai Mahadeswara and Cauvery WLSs. The map indicating the encroachments in these sanctuaries has been brought out at **Fig 6.2 and 6.3** below.

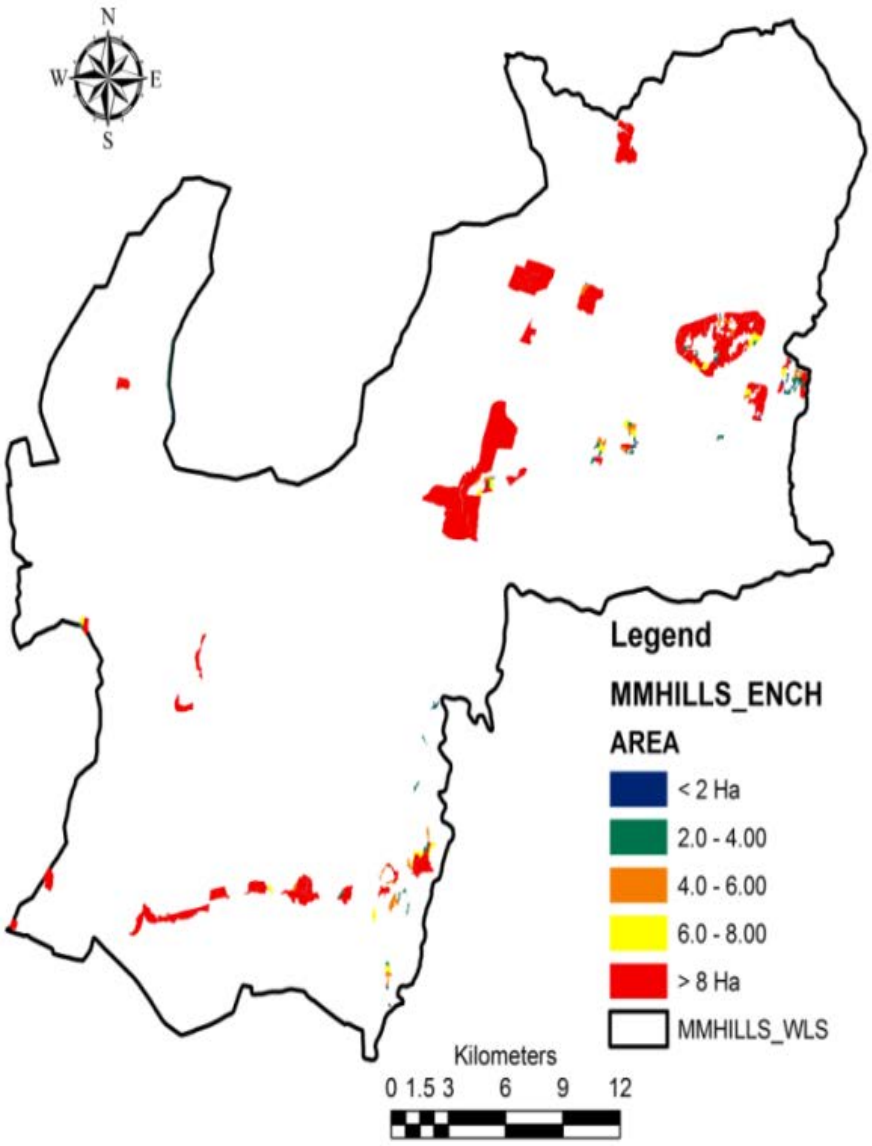


Fig 6.2: Classification of encroachments in MM WLS.

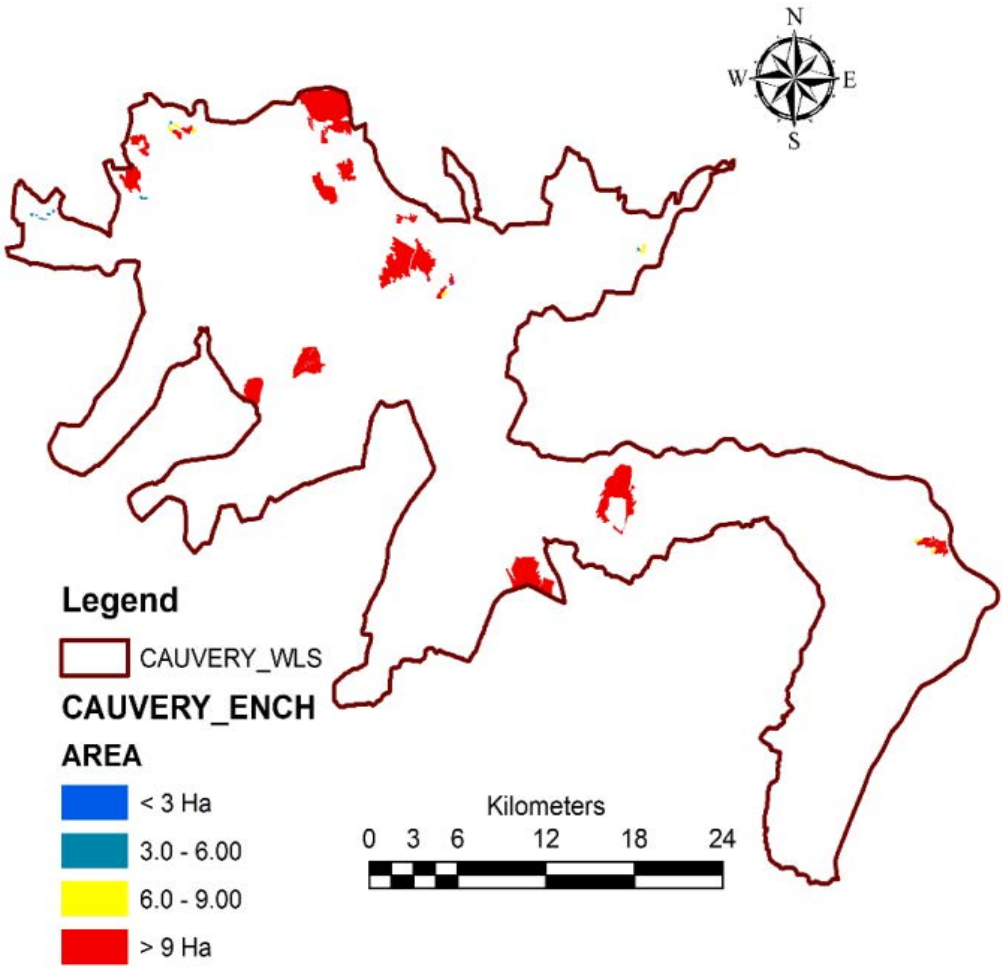


Fig 6.3: Classification of encroachments in Cauvery WLS.

Source: Indian Institute of Science

Further comparison of encroachments as assessed by IISc and those recorded by the Divisions indicated that the encroachments recorded by Department were less than the satellite based analysis as brought out in the **Table 6.2** below:

Table 6.2: Encroachments recorded vis-a-vis Satellite assessments

(Area in acres)

Sl No	Name of the Protected Areas	Area of encroachment as per IISc analysis	Area of encroachment as per Department	Difference
1	Bhadra Tiger Reserve	86.13	69.00	17.13
2	Brahmagiri WLS	72.90	1.00	71.90
3	BRT Tiger Reserve	8,193.18	19.00	8,174.18
4	Cauvery WLS	8,772.95	3,377.00	5,395.95
5	Dandeli-Anshi Tiger Reserve	2,033.25	239.00	1,794.25
6	Kudremukh National Park	325.30	305.00	20.30
7	Malai Mahadeswara WLS	7938.20	825.00	7113.20
8	Mookambika WLS	1,162.35	19.30	1,143.05
9	Nagarahole Tiger Reserve	1,145.03	30.00	1,115.03
10	Pushpagiri WLS	30.83	28.00	2.83
11	Sharavathi WLS	1,357.65	62.00	1,295.65
12	Someshwara WLS	513.03	0.60	512.43
13	Talacauvery WLS	46.20	27.00	19.20
	Total	31,677	5,001.9	26,675.6

Source: Details furnished by Forest Department and Indian Institute of Science

Thus, it could be seen that the satellite based imageries indicated a very high degree of encroachments (six times) as compared to that recorded by the Department, especially in respect of Mookambika, Sharavathi, Someshwara, Cauvery, Brahmagiri, Malai Mahadeswara WLSs and Dandeli-Anshi, Nagarahole Tiger Reserves **(Appendix 4)**. This analysis needs to be applied at ground level to assess the exact area under encroachment for taking appropriate action for clearing encroachments.

The Government stated during the Exit Conference that the difference could partly be due to presence of settlements inside PAs and agreed to examine the same.

6.1.3 Clearance of encroachments

There was very slow progress in clearance of encroachments during the last five years. The details of encroachments evicted in sampled Protected Areas have been abstracted in **Table 6.3**.

Table 6.3: Additions and clearance of encroachments during 2011-12 to 2015-16

(Area in Acres)

Name of the Protected Area	Encroachments as of April 2011		Additions during 2011-16		Encroachments cleared during 2011-16		Balance encroachments as of March 2016	
	No. of families	Area	No. of families	Area	No. of families	Area	No. of families	Area
Bandipur TR	306	1,036	815	3,353	0	0	1121	4,522
Bhadra TR	28	108	0	0	7	39	21	69
BRT Tiger Reserve	17	39	0	0	6	20	11	19
Cauvery Wildlife Sanctuary	815	1,237	0	0	157	323	**1,935	3,377
Dandeli-Anshi TR	591	239	0	0	0	0	591	239
Kudremukh Wildlife Division	168	375	1	1	20	51	149	325
Madikeri Wildlife Division	27	59	0	0	5	3	22	56
Malai Mahadeswara WLS	525	858	*18	*35	13	33	512	825
Nagarahole TR	0	0	5	30	0	0	5	30
Sharavathi WLS	26	62	0	0	0	0	26	62
Total	2,503	4,013	839	3,419	208	469	4,393	9,524

Source: Karnataka Forest Department * addition of 18 FOC cases were not added to Closing Balance
**includes 1277 cases involving 2463 acres transferred to Cauvery WL Division from Ramanagara and Mandya Divisions

As per Action Plan submitted (October 2014) by the Department to the High Court of Karnataka in Writ Petition relating to encroachment of forests, 1,041[52] *acres* of encroachments relating to the above PAs were to be cleared by July 2015. However, it was observed that this could not be achieved as only 469 *acres* of encroachments were reclaimed till date.

In addition, as per the orders and instructions issued by GoI dated 15.05.1996, 3.5.2002, 4.8.2005 and Orders dated 10.10.1991 and 05.05.1997 issued by GoK, action has to be taken to clear all the encroachments that took place after 27.04.1978. On scrutiny of records, it was however observed that out of the encroachments outstanding as of March 2016, except 69 families involving 40

[52] The action plan targets for eviction of encroachment submitted by the Department did not include Nagarahole and Bandipur NPs

acres in Dandeli, 4,324 families involving 9484 *acres* pertained to the period after 1978 and these encroachments should have been cleared as per GoI instructions. However, only 208 cases involving 469 *acres* were reclaimed during the last five years as aforesaid.

During the Exit Conference, it was stated that delay in settling the rights under FRA was the main reason for non achievement of targets in encroachment clearance. Since encroachment is a serious concern for PAs, the Department has to establish necessary tie up with Department of Tribal Welfare, Revenue Department and local bodies concerned for early settlement of rights under FRA.

6.1.4 Incentivising the encroachers

Government in Order dated 21.09.2015 issued instruction to the Department to prepare and submit Division / Circle-wise proposal to GoI through DCF, CCF & PCCF to relocate and rehabilitate the encroachers who have encroached less than three *acres* (3 *acres* including both encroached land and his own *patta* land).

In this regard, it was observed that:

- As per the GoI orders dated 15.05.1996, action had to be taken to clear all the encroachments that took place after 27.04.1978 and no further regularisation was acceptable. Therefore, the instructions issued by the GoK in September 2015 not to clear encroachments below three acres were contrary to the instructions issued by the GoI.
- Out of total encroachments of 9,524 *acres* recorded in the sampled Protected Areas, it was observed that 3,845 families involving an extent of 5,847 *acres* of forest land were categorised as 'below 3 *acres*' by considering only the encroached forest land and not the land owned by them. Classifying encroachers as "below 3 *acres*", without conducting joint survey with the Revenue Department, could lead to undue benefit to the encroachers.

The act of not evicting the persons who encroached forest lands after 1978 as per GoI guidelines and rehabilitating "below three *acres*" encroachers is tantamount to incentivising these encroachers.

Recommendation 7: Survey and demarcation along with Global Positioning System (GPS) and satellite imageries of all the Protected Areas should be done on priority basis. Department's Information Communication Technology Centre may update its database of encroached area so that appropriate action can be taken to reclaim these areas.

6.2 Allowing Rights under Forest Rights Act

Forest Rights Act, 2006, is an Act to recognize and vest the forest rights and occupation in forest land to forest dwelling scheduled tribes and other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recorded. FRA also provides for a frame work for recording the forest rights so vested and the nature of evidence required for such recognition and vesting in respect of forest land.

The Act provides that the forest rights recognised under this Act in critical wildlife habitats of National Parks and Sanctuaries may subsequently be modified or resettled, provided that no forest rights holders shall be resettled or have their rights in any manner affected for the purposes of creating inviolate areas for wildlife conservation. This act applies to forest dwelling scheduled tribes and to other traditional forest dwellers who had occupied forest land before 13 December 2005. The role of Forest Department is limited in this regard and the Grama Sabha plays a vital role in settlement of FRA. The details of applications received under FRA, applications accepted, survey conducted and applications pending have been abstracted in **Table 6.4.**

Table 6.4: Progress achieved in settlement of Rights under FRA

Name of the Division/WLS	Applications received	Applications rejected	Application pending	Rights granted
Bhadra Tiger Reserve	8	-	8	-
BRT Tiger Reserve	2171	630	1541	-
Cauvery WLS	300	10	83	207
Dandeli-Anshi TR	453	-	453	-
Kudremukh Wildlife Division	83	-	83	-
Madikeri Wildlife Division	155	130	17	8
MM Wildlife Sanctuary	381	1	72	308
Nagarahole TR	1282	-	411	871
Sharavathi WLS	2103	-	2103	
Total	6936	771	4771	1394

(Source: Details furnished by Karnataka Forest Department)

The delay in recognition of rights would result in occupation of forest lands by these applicants, including those not eligible, which would only add to the fragmentation of Protected Area habitat. Since the right holders are eligible for rehabilitation and relocation, delay in settling would result in occupation of both eligible and ineligible applicants contributing to degradation of Protected Area habitats. The constraint in eviction of encroachments were stated[53] to be implementation of FRA, dispute about boundaries, inadequate staff, absence of legal assistance to Forest Divisions, stay orders of Courts, law and order linked with encroachment eviction, *etc*.

Since encroachment is a serious issue requiring immediate attention and action, it is necessary to conduct joint survey of forest land, speedy implementation of FRA, deployment of adequate manpower, better co-ordination with Revenue, Police and other related Departments to address the issue.

Recommendation 8: Forest Department may coordinate with Revenue, Police and other related Departments to expedite the grant of Forest Right to eligible right holders and evict encroachers.

6.3 Rehabilitation and relocation

As per the National Wildlife Action Plan, 2002 "It is well recognised that the local communities are put to a lot of hardship after notification of any area as National Park or Sanctuary. They are also susceptible to the threats from wild

[53] Action Plan for eviction of encroachments in Karnataka State submitted by Forest Department to High Court of Karnataka in October, 2014

animals to life and property. A conscious effort should be made by the Government to ensure that as far as possible the relocation and rehabilitation should be made in a participatory manner taking the concerned people into confidence particularly with regard to the selection of new sites." The inputs given by the Government for relocation / rehabilitation should include civic amenities to be created at the new site and all the facilities should be provided to the people who volunteer to move outside National Parks and Sanctuaries. The rehabilitation and resettlement of people living inside the Protected Areas would reduce competition between villagers and species living inside the PA as also minimise the impacts of anthropogenic activities on the endemic / endangered species.

Rehabilitation and resettlement is being implemented in three Tiger Reserves, *i.e.,* Bhadra, Nagarahole and Dandeli-Anshi as per NTCA guidelines which gives following two options to the villagers residing in the Protected Areas.

Option 1: Payment of the entire package amount (₹ 10 lakh per family), in case the family opts so, without involving any rehabilitation / relocation process by the Forest Department.

Option 2: Carrying out complete relocation / rehabilitation of village from Protected Areas by the Forest Department.

The rehabilitation works are executed based on the applications and options exercised.

With reference to Kudremukh National Park, voluntary rehabilitation is implemented under a GoK scheme which includes payment of compensation for the assets held by the applicant. The compensation would include compensation fixed as per Land Acquisition Act for their land, structure and *malki* [54] existing in their land, cash *in lieu* of free house plot, house construction grant, lump sum grant for transportation, subsistence grant, land purchase grant, *etc.*

Under the above programmes, the applications received would be processed by the PA managers and payment would be made under the approval of District Committee headed by the Deputy Commissioner of the District.

While State funds are being used for rehabilitation in Kudremukh NP and Dandeli-Anshi TR, both Central and State funds are being used for rehabilitation in Bhadra and Nagarahole NPs. The details of progress achieved in rehabilitation have been abstracted at **Table 6.5** below:

[54] All the standing trees in the land

Table 6.5: Details of families rehabilitated in Protected Areas

(₹ in crore)

Name of the Protected Area	Year in which process commenced	No. of families inside PA	Applications received	No. of families rehabilitated	No. of families yet to be rehabilitated	Expenditure incurred	Fund required to rehabilitate remaining families
Bhadra TR	2000-01	736	514	431	83	16.04	4.01
Dandeli-Anshi TR	2013-14	6,316	629	101	528	7.44	52.8
Kudremukh National Park	2009-10	1,382	536	190	346	51.67	121.5
Nagarahole TR	1998-99	1,974	831	635	196	22.94	*NA
Total		10,408	2,510	1,357	1,153	98.09	174.3

*Rehabilitation works have been taken up departmentally under option-II
(Source: Details furnished by the Department)

Thus it could be seen that:

- Out of the 10,408 families living inside the above PAs, 2,510 families have voluntarily applied for rehabilitation, out of which only 1,357 families could be rehabilitated.
- In Kudremukh National Park, 21 families covered under Special Component Plan (SCP) and 86 families covered under Tribal Sub Plan (TSP) have opted for relocation. Though the funds (₹ 1.6 crore and ₹ 5.49 crore) are available under SCP / TSP components, no action has been taken to conduct valuation of property which has resulted in slowing up of the process.

During Exit conference the Government accepted that fund constraint was the reason for slow progress and intimated that Compensatory Afforestation Fund Management and Planning Authority (CAMPA) funds would be used for the same. It was also stated that a new package with a lump sum payment of ₹ 15 lakh and a plot per family has been offered and is receiving good response.

Thus, it is evident from the above information that, though the families are willing to come out of the Protected Areas, the process of rehabilitation is delayed due to delay in acquisition of land for rehabilitation and non-completion of valuation by Revenue authorities. The delay in the process of rehabilitation would further delay the consolidation of habitat of key species like tiger and elephants, besides requiring developmental activities like maintenance of roads, power lines, schools and other infrastructure inside Protected Areas, the cost of which could be more than that required for onetime payment towards rehabilitation / relocation of these villagers outside Protected Areas.

Box 1

Success story of rehabilitation in Bhadra Wildlife Sanctuary[55]

Relocation and Resettlement Project in India's Bhadra Wildlife Sanctuary was analysed during 2002 and 2006 by examining the relocation experience of 419 households who moved to two villages located outside the reserve. Out of 419 households, 61 *per cent* of relocated households were interviewed in 2002 and 55 *per cent* relocated households in 2006. In 2002, 71 *per cent* of households were satisfied with the relocation effort and their quality of life. In 2006, 52 *per cent* of households were satisfied with their quality of life. Four years after relocation, all households were found to have access to electricity, water, schools, health care, transportation, and communication facilities and many households had increased their income and assets. The relocation of villages will cause an overall decrease in forest disturbance, as well as diminished impacts of grazing, hunting, and collection of forest products. It is expected that, this will promote regeneration of several plant species, and recovery of animal populations.

Even though relocation has been attempted in many Indian PAs, (Gir National Park, Sariska Wildlife Sanctuary, Kanha National Park, Nagarahole National Park), the relocation was successful only in Bhadra Tiger Reserve.

Figure 6.4: (a) Rehabilitated house, (b) park, (c) Anaganavadi centre and (d). agriculture field a t M C Halli rehabilitation village of Bhadra Tiger Reserve
Image Source: Karnataka Forest Department

Recommendation 9: Forest Department may consider framing a policy to employ one person from each displaced family as an incentive to encourage speedy rehabilitation.

[55] Making Resettlement Work: The Case of India's Bhadra Wildlife Sanctuary by Krithi K Karanth-2007

Chapter 7

Poaching, anti-poaching operations and Road-kills

7.1 Poaching

Poaching is one of the major threats to Protected Areas, as this has the capacity of depleting the populations of selective species of flora and fauna. Section 9 of Wildlife (Protection) Act, 1972 prohibits hunting any wild animal specified in Schedule I, II, III and IV.

Snares are traps laid by local village community to capture wild boar, small herbivores, *etc*. In view of incidences of tiger / leopard deaths by these snares, the Bandipur Tiger Reserve authorities intensified the anti-snare drive. During this operation conducted during 2011-13, which was done in association with two NGOs, *viz.* Wildlife Trust of India and Voice of Wildlife, 747 snares were removed by patrolling 1,415 km. The quantum of snares removed indicates that large scale poaching for bush meat of smaller herbivores and other species was going on in the Reserve.

Figure 7.1: Confiscated pelts of leopard and spotted deer along with antlers and tusk at MM Hills Division, Kollegal
Image Source: Karnataka Forest Department

On a scrutiny of details of unnatural deaths of wild animals furnished by the Divisions, it was noticed that 92 cases of poaching / hunting were recorded in the sampled Protected Areas during the period 2011-16. This involved 99 animals and the Protected Area-wise cases recorded have been brought out in **Appendix 5.**

It was observed that more than fifty percent of poaching / hunting cases were recorded in MM WLS which accounted for 49 animals. This was followed by Nagarahole TR with 18 animals and Dandeli - Anshi TR with 17 animals. The details furnished by the Divisions included only one tiger. Information furnished by the PCCF-WL for the period 2011-16 indicated two poaching cases relating to tigers and four cases relating to elephants in the sampled PAs. This was at variance with the Divisional details which indicated seven poaching cases of elephants during the same period.

It was, however, observed that during the period from 2011-16, out of 26 tiger poaching cases recorded in the country, nine were from Karnataka contributing to 35 *per cent* of tiger poaching cases in the country[56]. Out of these, two were from Territorial Divisions and seven were from tiger Reserves of the State which included five from Bandipur, one each from Nagarahole and BRT Tiger Reserves. The above position clearly indicates that poaching continues as a serious threat to the wildlife in Karnataka despite the anti poaching operations that have been taken up by the Protected Area management and deployment of Special Tiger Protection Force in Bandipur and Nagarahole Tiger Reserves.

7.2 Working of Anti Poaching Camps

Foot patrolling is considered as one of the most important and very basic strategy for protecting the wildlife and its habitat from poaching, illegal timber cutting, firewood collection, *etc*. This is one of the old but very crucial strategies for the effective protection of Protected Area from poachers and other forest / wildlife offenders. Every day forest watchers / guards walk along the designated path, combing for unwanted elements and eradicating them if found. These foot soldiers are spread out all over the Protected Areas and at strategic points. Camps with basic facilities are built for them to stay and these are called Anti Poaching Camps (APC). The APCs are permanently manned by protection staff like Forest Watchers / Forest Guards along with temporary staff. Since the personnel deployed in APCs stay continuously in the camp, it becomes necessary to provide basic infrastructure like a building, drinking water, all weather jackets, beddings, monthly ration, solar power, wireless communication, *etc*.

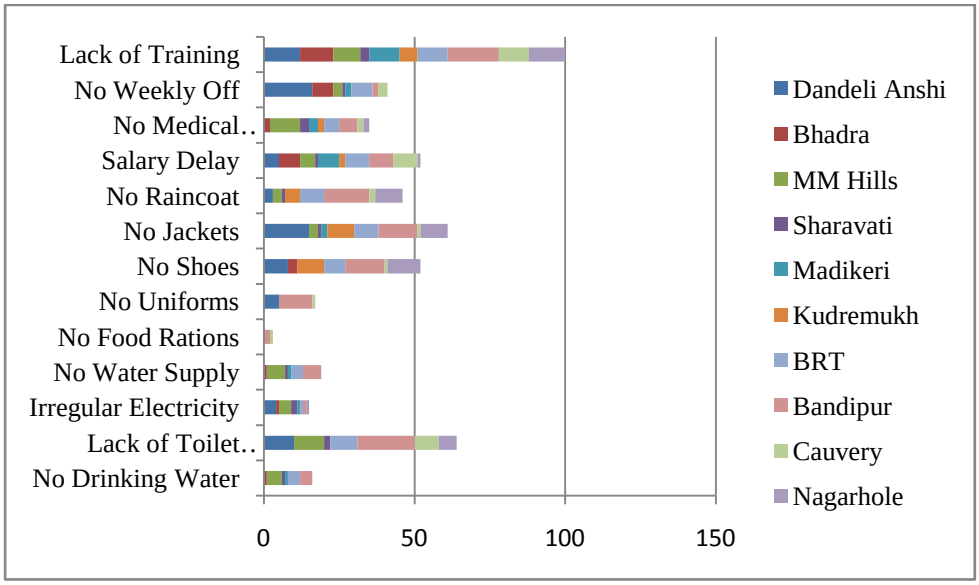
[56] The official database of National Tiger Conservation Authority, a statutory body under MoEF

Figure 7.2: Images of some Anti Poaching Camps at (a) Dandeli-Anshi TR, (b) Bandipur TR (c) Kudremukh WLD Source: Images taken during field visits by Audit.

Since the APCs are crucial for management of Protected Areas, joint inspection was conducted by Audit in the APCs to obtain responses from the temporary staff deployed on different aspects of these units like facilities / protective equipment provided, extent patrolled, frequency of animal / poacher attacks, frequency of salaries getting delayed, coverage of medical facilities, weekly off, training provided and training requirement. Temporary staff were chosen as the facilities of permanent staff are not applicable for them. The responses were obtained through interview and the responses revealed the following:

Responses from 119 temporary APC staff were obtained in Audit (**Chart 7.1)**. Most the staff at the APC highlighted non availability of drinking water, toilet facilities, water supply, medical insurance facility in MM Hills and Sharavathi WLSs. Weekly off was not being given at Dandeli-Anshi Tiger Reserve, BRT Tiger Reserve and Bhadra Tiger Reserve. The responses indicated that 84 *per cent* of temporary staff working in APCs were not given any training, which number rose to 100 *per cent* at Sharavathi and Madikeri WLSs, BRT Tiger Reserve and Nagarahole TR.

Chart 7.1: Responses of the Anti Poaching Camp staff on various facilities



Source: Responses as furnished by the staff and compiled by Audit

Further, suggestions on the topics on which trainings were found necessary were sought through responses from Anti poaching staff. The responses indicated that in most PAs, the APC staff assessed training in use of weapons, GPS and first aid as requirements for them.

Thus, the responses indicated that amenities like drinking water, toilets, water supply, power supply, protective gear were yet to be provided, salary was not being regularly paid, weekly holiday was not being allowed, staff deployed were mostly not trained and felt acute need for training for discharging their duties.

During the Exit Conference, the Government agreed to provide amenities wherever required.

Recommendation 10: Adequate amenities and training may be provided to temporary Anti Poaching Camp staff to increase the effectiveness of patrolling.

7.3 Monitoring of road-kills in Protected Areas

Though, roads and traffic are the central features of human development, they pose severe threat to forest and wildlife[57]. Roads alter landscape spatial pattern and strongly interrupt horizontal ecological flows. The great impact on animal population includes road-kills, limiting population, road avoidance causing home-range shift, modification of movement pattern and barrier effect, subdividing habitat and populations.

Wildlife casualties are higher than ever before because roads dissect all forest patches rendering them to much functional fragmentation. There is no

[57] Road kills: Assessing insect casualties using flagship tax on, R Shyama Prasad Rao and MK Saptha Girish

International or National statistics documenting these events. In India, major roads, more commonly Highways, and heavy traffic pass through almost every National Park and Wildlife Sanctuary which are the last remains of fragile wild habitats, but their impact in the form of road-kills are unrecorded.

Road-kills, in simple terms, means wild animals run over by speeding vehicles in their natural habitat. Further, road-kills can be of two types:

i. **Impact road-kills:** Here the animal is hit by the speeding vehicle and is injured internally and survives the hit initially, but might succumb later to its internal injury. Such road-kills cannot be accounted for most of the times and go unnoticed.

ii. **Crushed or run over road-kills:** These are road-kills which are very evident as the wildlife is run over and flattened on the road and can be accounted for if monitored regularly (though some may be scavenged).

On a check of records, it was seen that 50 road-kills were documented from the selected Protected Areas as listed in the **Table 7.1** below:

Table 7.1: Recorded cases of animals killed in road accidents in Protected Areas during the period 2011-12 to 2015-16

Species	Bandipur Tiger Reserve	Nagarahole Tiger Reserve	BRT Tiger Reserve	Dandeli Anshi Tiger Reserve	Kudremukh Wildlife Division
Tiger	0	0	0	0	0
Elephant	1	0	0	0	0
Leopard	0	0	1	0	0
Gaur	0	0	0	0	0
Spotted deer	10	2	1	2	2
Sambar	2	1	0	0	0
Wild dog	0	0	0	0	0
Civets	1	1	0	0	1
Lion Tailed Macaque	0	0	0	0	2
Barking deer	0	0	0	0	1
Bonnet macaque	2	0	1	0	8
Snakes	0	0	0	0	0
Mongoose	0	0	0	0	1
Amphibians	0	0	0	0	0
Wild boar	3	0	0	0	0
Black-napped hare	1	0	0	0	0
Porcupine	0	0	0	1	0
Common langur	0	2	0	0	0
Leopard cat	0	1	0	0	0
Jackal	0	1	0	0	0
Python	0	1	0	0	0
Total	20	9	3	3	15

(Source: Details furnished by Karnataka Forest Department)

From the **Table 7.1** above, it is seen that only a few PAs have recorded road-kills and most of the road-kills recorded were of flagship species and vertebrates like elephant, leopard, lion tailed macaque, *etc*. Many of the sensitive areas like Sharavathy Wildlife Sanctuary, Madikeri Wildlife Division, MM Wildlife Sanctuary, Cauvery Wildlife Sanctuary and Bhadra Tiger Reserve did not even record a single road-kill in their areas.

Fig 7.3: Images of animals killed in road accidents (a) Toad, (b) Common Langur, (c) Russels Viper and (d) Jungle Cat Source: Images taken during field visits by Audit.

Research on wildlife road casualties and ecology is limited and the existing literature is largely focused on vertebrates, mostly large mammals.

Further, in case of Dandeli-Anshi Tiger Reserve, as per Department records, there were only three reports of road-kills during 2011-16. However, as reported in the dailies "The Hindu" dated 6/1/2016 and "Daily Mail" dated 4/6/2015, about 50 wild animal casualties in the form of road-kills were noticed in the last six years in Aurad-Sadashivgad Road, State Highway 34, passing through the Reserve. The animals killed in this road included an astonishing number of six king cobras (last two years), and eight leopards. Similarly in the case of Kudremukh NP, 15 animals have been recorded as road kills by the Department during 2011-12 to 2015-16 including civet cat and barking deer, as well as the rarest primate of the globe (which is also listed under International Union for Conservation of Nature (IUCN) as endemic and endangered), the lion-tailed macaque, protected under Schedule-II of Wildlife (Protection) Act. A total of 70 km of roads including National Highway 169 and other roads pass through Kudremukh National Park. Many lesser mammals, reptiles and amphibians of which many are endemic to Western Ghats and are nocturnal in nature criss-cross these roads and many a times end up as road-kills. None of these reptiles and amphibians were recorded in road-kills and included in the list produced to audit. However, these road-kills could be seen documented in newspapers[58] one of which indicated about animals killed in NH 13 of Kudremukh National Park. A total of nine snakes including the endemic malabar pit viper were reported killed on the road by speeding vehicles on a single day. Since reptiles are coldblooded in nature, during winters and monsoon it is quite common to find them spending more

[58] Daily O dated 21.09.2015

time on asphalted roads as roads emit radiation and reptiles use these as thermo regulator as the temperature is relatively high compared to the immediate surroundings and hence are more prone to road-kills.

In response to audit observation made in this regard, the Deputy Conservator of Forests (DCF), Kudremukh Wildlife Division conducted a short survey of road-kills in three roads of the Division during June-July 2016 the results of which have been brought out in the **Box No 4**. Further, the DCF also proposed short term measures like putting up of sign boards at important crossing points, providing passage to the lesser fauna crossing at vulnerable points and campaigning for public awareness on road-kills and following of speed limits. As a long term measure, ban of night traffic on these roads could also be considered.

From the above statistics, it is very evident that road-kills happen on all the roads passing through any wildlife area and it is also an irony that most wildlife areas are criss-crossed with roads. It is a tragedy that we are losing some of the ecologically important species without our knowledge. Amphibians, reptiles, invertebrates (especially butterflies) and lesser mammals are most susceptible to road-kills and also the ones which easily go unnoticed. It is shown from research publications that many such lesser known wildlife find it difficult to cross highways made in Protected Areas and many a times their populations consequently get isolated. Further, it is also noticed that there could be huge sex ratio difference as many of the males in search of females end up as road-kills. Such differences in male-female sex ratios can affect the viability of population in a given area. Especially, Western Ghats being the major home for many endemic species of frogs and snakes, it becomes even more imperative that certain research and documentation on these issues are taken up so as to avoid future road-kills. Infrastructure like animal underpass and overpass (see **Fig 7.4** below) can be laid, as in many foreign PAs, to safeguard threatened species from going locally extinct.

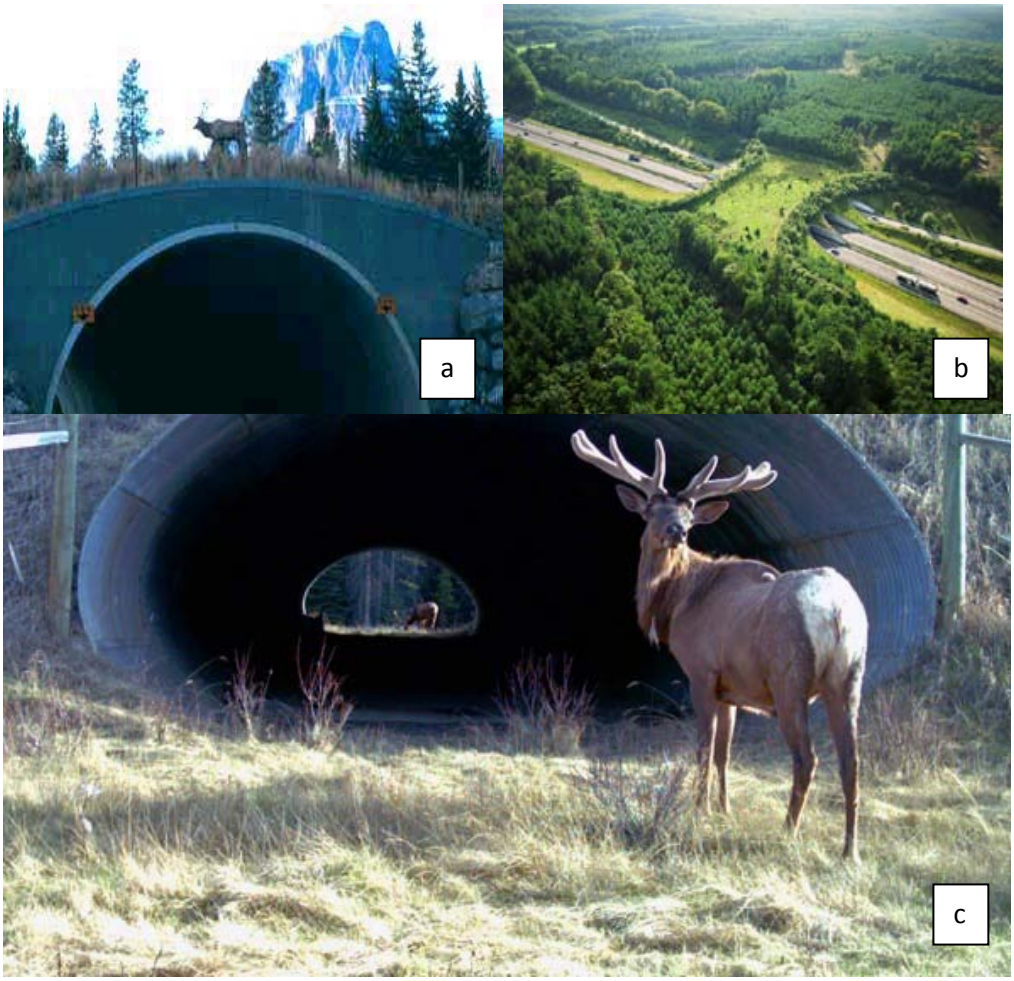


Fig 7.4: Construction of Animal Overpasses (a & b) and underpasses (c) for avoiding road-kills Source: b. http://ecodemica.blogspot.in/2011/01/wildlife-bridge-or-ecoduct.html

In response to the observation, during Exit Conference, the Government stated that the staff would be sensitised about the issue and proper monitoring of all the road-kills would be taken up. It was also stated that wherever necessary, building of underpasses and overpasses for movement of animals would be taken up.

Box 2

Impact of Monitoring of Road-kills

As per details furnished, 15 road-kills were recorded during the period 2011-16 in the three Protected Areas coming under the jurisdiction of Kudremukh Wildlife Division. In this regard, an audit observation was made (May 2016) at Kudremukh Wildlife Division on improper monitoring of road-kills by the Protected Area management. In response, the management, which is in charge of three Protected Areas viz., Kudremukh National Park, Mookambika Wildlife Sanctuary and Someshwara Wildlife Sanctuary, took up monitoring of road-kills on National Highway 169, State Highway 66 at Kudremukh National Park and Kollur-Kattinahole road in Mookambika Wildlife Sanctuary between 15 June, 2016 and 31 July, 2016. This monitoring revealed an astonishing 1,338 road kills in this short period and the major road-kills observed were of frogs and snakes as shown in the Table 7.2.

Table 7.2: Details of the road-kills recorded by Kudremukh Wildlife Division during June-July 2016

Species	Day monitoring	Night monitoring	Total
Snakes	64	231	295
Frogs	130	709	839
Mammals	1	11	12
Birds	6	1	7
lizards	6	10	16
Insects	24	103	127
Others	15	27	42
Total	246	1,092	1,338

Analysis to identify individual road-kills to species level will give an insight into the species being affected in the road-kills in that particular area. Thus, such monitoring helps in understanding the effects of roads on local species of which any could be endemic / endangered and especially in a fragile ecosystem like the Western Ghats. Thus monitoring of roads becomes an important tool which enables the Protected Area managers to identify vulnerable points and take appropriate steps to avoid road-kills and preserve our wildlife from going locally extinct. The initiative taken up by the Deputy Conservator of Forests, Kudremukh Wildlife Division to monitor roads for road-kills is one of the best exercises in recent times in this regard and has thrown light on how a short-time monitoring too can bring out such a data. This needs to be emulated by other Protected Area Managers for better conservation of Wildlife.

Recommendation 11: All road-kills need to be monitored and not only those of flagship species in all Protected Areas. Wherever there is an alternative road, night ban of traffic inside the Protected Areas may be enforced. Underpass and overpass for wildlife may be built in sensitive areas after identifying animal paths in Protected Areas.

Chapter 8

Forest Fires and Weed Management

8.1 Forest Fire and its management

Forest fires require the forest management's intense attention due to its effects on biodiversity. Inappropriate fire regimes can lead to major changes in community structure, including substantial risk of extinction. As per the National Institute of Disaster Management, 95 *per cent* of forest fires are caused by human beings. Forest fires and fire management are therefore increasingly recognised as important factors in biodiversity conservation and natural resource management[59].

Fig. 8.1: An image of forest fire at Bandipur national park
Source: Images taken during field visits by Audit.

8.1.1 Forests burnt by fire and different assessments for the same forest fire

Since forest fire is a threat capable of causing extensive damages to the forests, all the PAs are taking precautionary measures like maintenance of fire-lines and engagement of fire watchers during fire season *i.e.*, between February and May every year. The details of extent of forests burnt by fire in Protected Areas between 2011-12 and 2015-16 have been brought out in **Table 8.1** below:

[59] Fire management for Biodiversity Conservation: Key research questions and our capacity to answer them- Don A. Discoll et al, Biological Conservation- September 2010

Table 8.1: Details of forests burnt by fire in Protected Areas during the period 2011-12 to 2015-16

(Area in hectares)

Protected Area	2011-12	2012-13	2013-14	2014-15	2015-16
Bandipur Tiger Reserve	650.00	972.62	548.500	216.460	219.360
Bhadra Tiger Reserve	-	-	-	50.000	-
BRT Tiger Reserve	60.00	49.04	166.590	24.060	20.000
Cauvery Wildlife Sanctuary	1.75	262.40	571.000	386.000	-
Dandeli-Anshi Tiger Reserve	1.70	3.50	0.704	0.600	-
Kudremukh National Park	307.94	240.60	194.500	167.950	553.000
MM Wildlife Sanctuary	111.60	111.60	-	200.000	418.030
Madikeri Wildlife Division	61.25	-	2.000	8.900	8.090
Nagarahole Tiger Reserve	698.12	24.28	198.900	6.849	44.506
Sharavathy Wildlife Sanctuary	10.00	-	-	50.000	2.020
Total	1,902.76	1,664.04	1,682.194	1,110.819	1,265.006

(Source: Details furnished by the Department)

It could be seen that forest fires have caused substantial damages (*i.e.*, more than 100 hectares) in Bandipur TR, Kudremukh NP and Malai Mahadeswara Wildlife Sanctuary during the audited period. Also, Nagarahole NP had serious fires during 2011-12 and 2013-14. Though the total forest area affected by fire in all the sampled Protected Areas decreased between 2011-12 and 2014-15, it was observed that in certain forest fire cases, the area burnt by fires could have been under-stated by the Department, as brought out in the succeeding paragraphs.

- A major forest fire occurred during February - March 2012 involving both Bandipur and Nagarahole TRs. The PCCF and Managing Director, Karnataka Forest Development Corporation had assessed the forest area burnt in the Protected Areas which was, however, found to be different from the assessments done by these Tiger Reserves, as brought out in the **Table 8.2.**

Table 8.2: Assessment of forest area burnt by forest fires during 2012 by Department

(Area in hectares)

Protected Area	Burnt area as per PCCF letter	Burnt area recorded in the Division
Bandipur TR	973	650
Nagarahole TR	1,961	698.12

(Source: Details furnished by the Department)

Based on the request of 'Wildlife First' an NGO, Indian Space Research Organisation assessed[60] the forest area burnt in Nagarahole National Park by this fire to be 24.5 sq km *i.e.*, 2,450 hectares. The huge difference between these assessments indicates that Departmental assessments were highly conservative and lesser than the actual loss.

- One more major fire had occurred in Nagarahole NP during March 2014. The area burnt was initially assessed at 60 hectares. The area damaged by this fire in adjoining Virajpet Territorial Division was 172 hectares and

[60] Resourcesat-2 AWiFS based Rapid Forest Fire Burnt Area Assessment

hence, the total area burnt was assessed at 232 hectares. However, the assessment of ICT cell of the Department had indicated the total area burnt as 383 hectares. Therefore, PCCF had directed the Reserve management to do the ground truthing which revealed that the burnt area was 179 hectares. The fact that the second assessment had more than doubled the initial assessment clearly establishes that there is no scientific / systematic method in place to assess the forest area burnt by fires even though forest fires are very common, especially in Bandipur and Nagarahole Tiger Reserves. As a result, the possibility of under-reporting in these cases cannot be ruled out.

- In Dandeli-Anshi Tiger Reserve, the details furnished indicated that no forests were burnt by fire during 2015-16. On the contrary, a newspaper report[61] indicated that one fire incident had happened on 23/3/2016 and there were instances of forest fires earlier too, each of which had burnt an area of an *acre* or so.

The above position / illustration clearly indicate that all the forest fire incidences are not being recorded, and even those recorded might be getting under-reported. Hence the actual loss could be still higher.

The incorrect assessment of forest area burnt is liable to lead to faulty planning and insufficient management strategies, leading to unpreparedness of the Department to deal with forest fires in their actual scale. Such a scenario would then render the Department's interventions to fight forest fires inadequate, causing widespread damages to forests and wildlife by forest fires in future. In addition, it was observed that major forest fire incidences were reported in Bandipur, Nagarahole and BRT Tiger Reserves during 2016-17.

The Government stated (March 2017) that all the fire incidences were man-made and presence of *Lantana* was adding up to the increase in forest area burnt by fire. With reference to differences within the Departmental figures, it was stated that the matter would be examined.

8.1.2 Non-preparation of fire management plan

Fire is a major concern in all the Protected Areas and the spread of fire depends on the landscape features such as gradient and other aspects. Hence, a fire management plan should be in place to deal with any eventuality caused by these fires. Further some PAs share borders with other PAs or PAs / forests in neighbouring States like Tamil Nadu and Kerala, the possibility of one forest fire causing damages to more than one PA / State cannot be ruled out. Therefore, a PA level / landscape level fire management plan would be required to be prepared to address such eventualities.

Even though chances of occurrence of forest fires cannot be totally eliminated, frequency and magnitude of fire can always be regulated by adopting proper management measures. Therefore, these measures should have been included in the Management Plans (MPs). Out of six[62] PAs where high incidences of

[61] The Hindu, Belagavi edition dated 24/3/2016
[62] Bandipur TR, Nagarahole TR, BRT TR, Kudremukh NP, Cauvery WLS and MM WLS

forest fires were reported, it was noticed that the MP of Kudremukh National Park (2003-13) does not include Fire Vulnerability Map (FVM), while new MPs for Cauvery WLS and MM WLS were under preparation. Further, compartments / beats vulnerable to fire incidents are not listed in the MP. Such deficiency in planning is liable to result in tardy reaction to forest fires, if and when they occur, as well as prevent the management from drawing up suitable mitigating measures in advance.

Since the forests in India are prone to forest fire incidences which are manmade, it becomes necessary to take preventive measures, prepare action plans and institutional readiness to address major events. It also becomes important to identify fire prone areas and maintain proper data on fire incidences so that proper Management Plan can be drawn up in future to reduce this threat and conserve wildlife better.

Recommendation 12: Satellite based analysis should be linked to ground truthing to assess the exact extent of forest fires. Protected Area specific Action Plans for fire fighting must be made a mandatory component of Management Plans concerned so that the Department is better equipped to mitigate fire.

8.2 Weed Management in National Parks and Wildlife Sanctuaries

Invasive Alien Species (IAS), in the context of Convention on Biological Diversity (CBD), for which India is one of the signatories, means an "alien species whose introduction and / or spread threatens biodiversity of a given area". In Protected Areas, as elsewhere, impacts from alien species take the form of impacts on ecosystem function, ecosystem structure and impacts at the level of species communities or habitats as well as the level of species. CBD recognises the importance of this global issue and calls on contracting parties to: "*prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitat and species" {Article 8(h)}.* Further, the "Invasive Alien Species and Protected Areas - A Scoping Report"[63], done in 2007 by IUCN, had observed that the threat of alien species to PAs would increase in future. The report also observed that the priority is to apply prevention, early detection and rapid response. The scoping study found that key impediments and challenges to dealing with IAS in PAs include lack of capacity for mainstreaming IAS management into overall PA management, lack of capacity for site based effective IAS management, lack of awareness of the impacts of IAS on PA values, as well as lack of awareness of options for management especially the importance of prevention and early detection, lack of practical management information at site level, *etc.* Thus, it is obvious that IAS is a proven threat to biodiversity and PA management should take priority actions towards this threat by way of prevention, early detection and rapid response.

[63] Scoping the scale and nature of Invasive Alien Species threats to Protected Areas, Impediments to IAS Management and means to address those impediments produced for the World Bank as a contribution to the Global Invasive Species Programme – March 2007

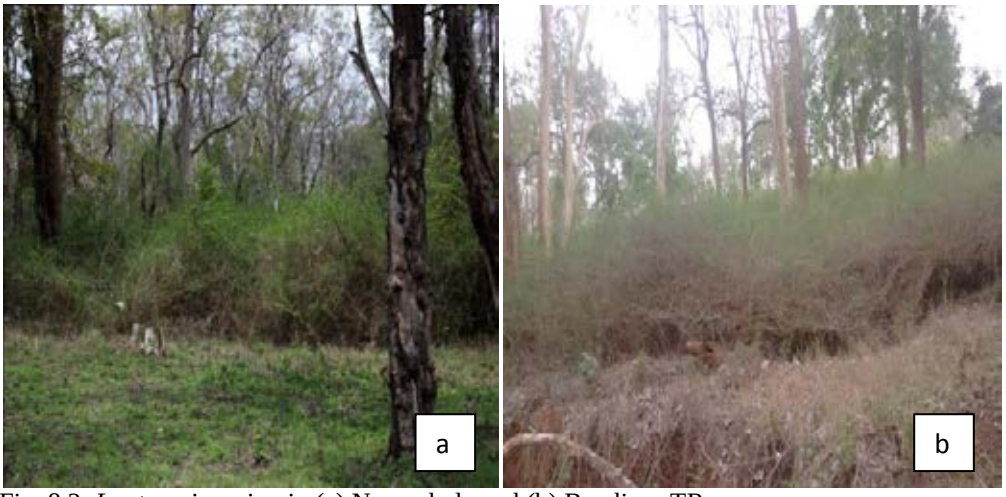


Fig. 8.2: *Lantana* invasion in (a) Nagarahole and (b) Bandipur TRs
Source: Images taken during field visits by Audit.

Further, invasion by exotic species is considered a leading cause for decline of native species and habitat degradation. The invasion of natural communities, particularly conservation areas, by introduced plants constitutes one of the most serious threats to biodiversity and has been shown to profoundly alter ecosystem structure, function and aesthetic value of many habitats around the world.

Though IAS had become a major threat in BRT Tiger Reserve, Bandipur TR and Nagarahole TR, no departmental research was conducted to assess its impacts and address rapid response to this threat. It was, however, observed that independent researches were conducted at Bandipur (2006) [64] and BRT (2008)[65] Tiger Reserves which revealed that:

- *Lantana* invasion in BRT had increased from 41 *per cent* of (inventoried) plots (1997) to 81 *per cent* (2008) during 11 years. However, no further assessments regarding the extent of infestation were made. As a result, PA management was not even aware of the level of the problem.
- In a study conducted at Bandipur TR (2006), it was observed that *lantana* had invaded a large portion of the TR with very dense *lantana* in 1 *per cent* of the Reserve and between 13 and 50 *per cent* of the Reserve under moderate levels of invasion.
- *Lantana* clearly reduced species richness of native understory species while also causing compositional changes in the herbs, shrubs and tree seedlings in Bandipur.
- *Lantana* was found to be the most dominant of the species in BRT (2008) and *lantana* invasion was accompanied by reduction in evenness in the native community and evidence for drastic reduction in regenerating size classes of trees, suggesting population declines in the future.

[64] Impact of *Lantana camara*, a major invasive plant, on wildlife habitat in Bandipur Tiger Reserve, Southern India by Ayesha Prasad, 2006
[65] Patterns and processes of *Lantana camara* persistence in South Indian tropical dry forests submitted by Bharath Sundaram and research carried out at ATREE,

- In Bandipur TR[66], four horned antelope occurrence was negatively related to the alien weed *lantana* leading to decline of its population in the PA.

Thus, it is evident that *lantana* had taken over in BRT TR, while Bandipur and Nagarahole NPs may also follow suit as no interventions have been programmed in the Tiger Reserves to address the problem. In Bandipur NP, currently (October 2016) *lantana* infestation was found to be to an extent of 81,141 hectares[67] of which 36,210 hectares (41[68] *per cent* of the Reserve) were densely infested. When compared to the earlier assessment (Ayesha Prasad-2006) which had observed that one *per cent* of Tiger Reserve was densely infested, it could be seen that within 10 years, the dense infestation had spread over 41 *per cent* of the Tiger Reserve.

In addition to *lantana*, other invasive species like *eupatorium, parthenium, cromolaena, etc.,* were also observed in the Protected Areas. The details of major weeds assessed and measures proposed to address this threat in MP/TCP of the PAs have been brought out in **Appendix 6.**

Though the MP / TCP identified *lantana* and *eupatorium* as major weeds, measures taken to address the issue were too marginal. During the period 2011-16, it was observed that *lantana* / *eupatorium* were manually removed in Bandipur, BRT, Bhadra and Dandeli Anshi Tiger Reserves without adopting any scientific methods to address the issue. The areas so tackled are brought out in **Table 8.3** below:

Table 8.3: Area covered and expenditure incurred on removal of weeds during 2011-12 to 2015-16 in Protected Areas

(Area in ha and amount in ₹ lakh)

Protected Area	2011-12		2012-13		2013-14		2014-15		2015-16		Total	
	Area	Amt	Area	Amt	Area	Amt	Area	Amt	Area	Amt	Area	Amt
BRT TR	0	0	0	0	15	2.25	20	3.0	0	0	35	5.25
Bandipur TR	NA	0.27	0	0	0	0	100	6.48	0	0	100	6.75
Bhadra TR	165	2.94	0	0	0	0	0	0	30	1.19	195	4.13
Kudremukh NP	0	0	0	0	0	0	0	0	0	0	0	0
Dandeli- Anshi TR	0	0	0	0	0	0	80	2.19	0	0	80	2.19
Nagarahole TR	0	0	0	0	0	0	0	0	0	0	0	0

(Source: Details furnished by the Department) NA: Not accounted

However, no scientific methods like Prof. C R Babu method (cut root method) or other methods were taken up and only manual removal on smaller scales was attempted. Thus, it is clear that no major interventions have been made in these PAs during the last five years to address this serious issue.

[66] Habitat factors affecting site occupancy and abundance of four horned antelope at Bandipur
[67] Excluding Nugu range which is a different sanctuary
[68] (36,210 ÷ 87,224) × 100

Fig 8.3: Elephant being dwarfed by *lantana* cover at Bandipur Tiger Reserve
Source: Images taken during field visits by Audit.

Though infestation of *lantana* in Bandipur Tiger Reserve has reached alarming situation and the seriousness of the issue was brought out in the independent research in 2006 itself, the Tiger Conservation Plan of the Tiger Reserve merely proposed conducting scientifically designed field experiments for assessing further efforts to be made and also to assess its positive impacts. However, these too have not been carried out yet. The absence of departmental studies / measures to address this serious problem could only worsen the situation.

The Department stated that Prof C R Babu method had been tried in Bandipur TR in the year 2010-11, but this effort did not yield any concrete results, hence the same was not pursued. However, no other method was attempted thereafter. Commercial use of *lantana* for making furniture, household goods and toys by using locals and other ways of using this abundant weed for manufacture of Wood Polymer Composite as brought out in the **Box 3** could be some ways of addressing the issue as this would not only ensures removal of *lantana* but also address the socio-economic issues of locals. However, since it is very difficult to eradicate weeds, especially *lantana*, concerted efforts have to be in place for IAS management so that the habitat integrity is ensured by safeguarding it against degradation, which sadly is lacking currently, throwing the whole ecosystem to jeopardy.

The Government agreed during the Exit Conference that *lantana* was a major threat to the wildlife and about 50 *per cent* of the PA area was infested by it. It was also stated that action would be taken for mechanical removal of the weed and commercial exploitation could be attempted based on availability of market for *lantana* products.

Box No. 3

Commercial use of *lantana*

***Lantana* Craft Centre, a registered society was established in 2004 by Ashoka Trust for Research in Ecology and the Environment (ATREE). This centre has trained more than 350 persons from different parts of South India in crafting toys, household goods, and furniture from *lantana*. It has also been used as an alternative raw material for making Channapatna toys, which are otherwise, made from *Wrightia tinctori* wood, which is fast depleting. Further, Institute of Wood Science and Technology, has developed Wood Polymer Composite from *lantana*[69] which would further increase the demand for commercial use of *lantana*. In addition, in Mudumalai Tiger Reserve, a local Non Governmental Organisation, "The Shola Trust" had worked with tribal communities to help them make furniture out of *lantana*. This works as an economic driver which makes it viable for communities to earn their living and also effectively controls spreading of *lantana* [70].**

Fig 8.4: Images of furniture made out of *lantana*

Use of *lantana*, by local communities in Southern India and possible causes and consequences of its use were analysed[71] in a study done (December 2013) at three places in Southern India including Malai Mahadeswara Hills area of Karnataka. The study observed that one of the strategies to address Invasive Alien Species should be a greater inclusion of local communities in local management programmes or foster increasing use of Invasive Alien Species.

Recommendation 13: Department needs to strengthen its research activities to control weeds.

[69] http://www.thebetterindia.com/62268/bengaluru-scientists-lantana-wood-polymer-composites/

[70] Examining the spatial spread of *lantana camara* in the Mudumalai Tiger Reserve, report submitted to Tamil Nadu Forest Department, June 2014 by Tarsh Thekaekara with help of others

[71] Invasive alien species as drivers in socio-ecological systems: local adaptations towards use of *lantana* in Southern India by Ramesh Kannan, Charlie M Shackleton and R Uma Shanker

Chapter 9

Research and Monitoring of species

Research and monitoring is one of the critical components to form a strategy for maintaining and improvising any system. Scientific research and monitoring of biodiversity in a PA is a prerequisite for wildlife management involving conservation and sustainable development. The resultant scientific research and monitoring is very critical in the form of generating information (data) which is vital from a management point of view and to take decisions in solving day to day or long term management problems. While all research may not be important from a management point of view, certain amount of research inputs becomes inevitable while preparing a proper Management Plan/Tiger Conservation Plan for better conservation of the biodiversity.

9.1 Non-monitoring of research activities

As natural habitats and populations of wild species are being fragmented and are dwindling country wide, Protected Areas and Reserve Forests are the only areas where our flora and fauna species are thriving and appropriate research is the call of the hour to save these. This includes a wide array of fields such as ecology (of individuals, populations, communities, ecosystems, and landscapes), animal behaviour and cognition, evolution and biological diversity studies, systematic and taxonomy, natural history, conservation biology, restoration biology, *etc*. Further, these landscapes have also been important foundries of traditional knowledge from which many of these scientific disciplines continue to draw value. Such research is invaluable not only in documenting and understanding our rich natural heritage for its own sake, but also for problem-solving applications particularly relevant to their conservation[72].

The Sawarkar guidelines[73] states[74] that management in time draws support and authenticity from research. The planning and management systems need to encourage research, experimentation and monitoring and use the generated information to the advantage of management. The National Wildlife Action Plan 2002-2016 (NWAP) states that Research and Monitoring are very crucial for understating nature and is an essential tool in evaluating the conservation status of species and their habitats. Project Tiger, 1972 also enlists research as one of the major agenda / issue.

Wildlife research is taken up in Karnataka at regular intervals and many Non-Government Organisations (NGO) and individuals take up these research works using external funding.

[72] Science in the wilderness: the predicament of scientific research in India's wildlife reserves, M.D. Madhusudan et al, Current science, Vol 91, No 8, 25 October 2006.

[73] A guide to Planning Wildlife Management in Protected Areas and Managed Landscapes by Vishwas B Sawarkar, Wildlife Institute of India – based on which the MPs are prepared

[74] in Paragraph 5.5.5 (140)

PCCF-WL grants permission for undertaking research or studies. It is mandatory that a copy of the research report be submitted to the Department on completion of study / research. It was observed that during the period from 2011-12 to 2015-16, permission was accorded to conduct research in 129 cases. The details of permission accorded, reports received and on-going studies are shown in **Table 9.1:**

Table 9.1: Protected Area-wise details of permissions accorded for Research, Reports received, on-going Projects and Reports yet to be received during the period 2011-12 to 2015-16

Name of the PA	Permission accorded	Reports received as on date	On-going research projects	Reports yet to be received
Bandipur TR	23	5	5	13
Bhadra TR	3	0	0	3
BRT Tiger Reserve	40	0	0	40
Cauvery Wildlife Sanctuary	6	3	3	0
Dandeli Anshi TR	11	0	3	8
Kudremukh Wildlife Division (3 WLS)	13	0	1	12
Madikeri Wildlife Division (3 WLS)	17	1	2	14
Malai Mahadeswara WLS	0	0	0	0
Nagarahole TR	16	0	4	12
Sharavathy WLS	0	0	0	0
Total	129	9	18	102

(Source: Details furnished by Karnataka Forest Department)

Against 129 permissions accorded for research / studies, only nine reports have been received by the Department while 18 research activities were still on-going. Reports in respect of 102 cases had not yet been submitted to the Department and status of these cases had not been monitored by the Department. We observed that there were substantial delay in submission of research reports and details of which are given in **Table 9.2.**

Table 9.2: Period of delay in submission of Research Reports

Delay in submission of research reports			
One year	Two years	Three years	Four years
36	47	14	05

(Source: Details furnished by the Department)

Non-submission of reports in large numbers cast doubt about whether research activities permitted were taken up at all by the concerned individuals or were completed as stipulated. The Department was also not making use of the relevant research outcomes for better management of PAs, wherever Study Reports were submitted.

Unlike as mentioned in the NWAP and Management Plans, there was no formation of the Research Advisory Committee for scrutinizing, evaluating, approving and monitoring the research activities. PCCF-WL, in reply stated that a State Level Research Advisory Committee has been constituted

(October 2012) for monitoring research activities. However, we noticed that the Committee had met only twice (November 2012 and February 2015) since its inception and only issues related to trees and seeds were discussed. The committee neither scrutinised the reports, nor evaluated the findings. Accordingly, there were no suggestions for their application or any monitoring of the progress in submission of reports, wherever they were completed.

It was generally seen that most of the Protected Areas have readily available information on large mammals, common birds and reptiles, *etc*. However, except for major flagship species like the tiger, elephant, and to some extent the lion-tailed macaque and some ungulates, there was inadequate or no information on species distribution, population trends or densities, and habitat requirements in case of many lesser known mammals, amphibians, reptiles and butterflies.

The basic criteria to draw a Conservation Plan or a Management Plan for a given area are the availability of the checklist of flora and fauna of that area. However, on scrutiny of MP / TCPs of the 14 selected PAs, we observed that only six PAs have recorded amphibians and butterflies and their checklists were provided in their MP / TCPs. Of the six PAs, Sharavathy WLS, BRT and Bandipur TRs have listed 6, 14 and 25 amphibian species respectively (**Table 9.3**) which indicates that data gathering was inadequate since these PAs fall under WG-NBR region which is home to 227 amphibian species and hence does not reflect the true picture of the given habitat.

Table 9.3: Statement on inclusion of amphibians and butterflies in the Management Plan/Tiger Conservation Plans

Sl No	PAs	Amphibians			Butterflies		
		Recorded	Listed	Checklist	Recorded	Listed	Checklist
1	Bandipur TR	25	--	Ab	--	--	Ab
2	DATR TR	138	27	Ab	--	41	P
3	BRT TR	--	14	P	--	115	P
4	Nagarahole TR	--	--	--	--		--
5	Bharda TR	--	--	Ab	--	52	P
6	Kudremukh NP	--	35	P	--	149	P
7	Someshwara WLS	--	--	Ab	--	--	Ab
8	Mookambika WLS	--	--	Ab	--	--	Ab
9	Sharavathy WLS	--	06	P	--		Ab
10	Talacauvery WLS	--	35	P	--	104	P
11	Pushpagiri WLS	--	35	P	--	104	P
12	Brahmagiri WLS	--	--	Ab	--	--	Ab
13	M.M. WLS	--	--	Na	--	--	Na
14	Cauvery WLS	--	--	Ab	--	--	Ab

Source: Details furnished by the Department
Legend: Ab-Absent, P-Present, Na-Not applicable (MP not prepared yet)

Many of these lesser known species are important bio-indicators and they play a vital role in ecological balance and also play an important role in assessing the health of the forest. Such incomplete recordings of these lesser known fauna, which are as important as any other charismatic species (like tiger or elephant), show the lack of attention of the Department in conserving the PAs at landscape level.

Further, the Management Plans had identified areas of research, but to what extent these were taken up is not on record. Many of the research areas identified in the MP / TCPs are problems associated with management issues like socio-economic issues of human habitation in and around the PAs, land use pattern, assessing invasion of exotic weeds and developing strategies for its control, man animal conflicts, public roads and safety of wildlife, *etc*. However, we observed that most of the research works prescribed by the Management Plan were not taken up which could have helped in better management and conservation. Further, none of the PAs had in-house research labs even to address the basic requirements such as soil analysis, pathogens, to store culture etc., Research involving complex problems like animal behaviour and cognition, evolution and biological diversity studies, systematic and taxonomy, natural history, conservation biology, restoration biology or community studies needs special skills and expertise and thus there is need for linkages with organisations possessing such research capabilities. The Protected Area management can use all available expert agencies, local institutions, local universities and NGOs, *etc.,* for research, investigations, survey and even for monitoring. Some of the prominent wildlife research institutes are Wildlife Institute of India, Zoological Survey of India, Botanical Survey India, Forest Survey of India, Forest Research Institute, ICFRE[75], IISc, SACON[76] and NCBS[77], *etc*. However, we observed that except in few cases, none of the other PA managements had tied up with any research institute to get better inputs and new perspectives to conserve the PA better.

We observed from the MP / TCPs that research area is one of the most neglected areas in the Protected Areas which needs immediate attention. In most of the Protected Areas, research and monitoring have suffered in the past mainly due to lack of policy, poor infrastructure for research, lack of training to front line staff, inadequate funding, attaching low priorities, weak coordination between wildlife managers and research institutes, differences in the research priority of the Protected Area and research institutes and misuse of research permissions by some individual researchers / research organizations etc. If research activities were given priority, these are carried out regularly and properly implemented, many management issues like arresting the spread of *lantana* and other invasive weeds, mitigation of human wildlife conflict, changing of socio-economic status of fringe villages / enclosures, rehabilitations, clearance of encroachments, *etc.*, could have been dealt with better and more scientifically.

Recommendation 14: Department should ensure that all pending research reports are submitted and examined. Research on lesser known fauna may be promoted. Research areas mentioned in Tiger Conservation Plans and Management Plans may be taken up immediately. Department may consider linkage with expert agencies like researchers, ecologists, wildlife scientists to take up research in an integrated manner.

[75] Indian Council of Forestry Research and Education
[76] Salim Ali Centre for Ornithology and Natural History
[77] National Centre for Biological Sciences

9.2 Monitoring of Species

Monitoring is critical to determine trends in biological diversity over space and time with an emphasis on evaluating the effectiveness of management actions and policies. In any PA, monitoring of various aspects like population estimation of flora and fauna, tree cover, human wildlife conflict incidences, crop raiding, *etc*., gives out the actual status of species and incidences which helps the Department in formulating strategies for better conservation and management.

Monitoring is both short-term and long-term, involving biotic or abiotic parameters so as to assess the status of the entity. But what requires to be monitored has to be established and depending on analytical tools, the techniques and procedures need to be suggested. Monitoring may have several aspects to it, but the central function of monitoring is establishing trends and change. Trends will be revealed by analysis of a time series data, their interpretation and evaluation.

The taxonomic monitoring forms the basis of the full inventory of life on earth. Research and monitoring plays a very important role in understanding population dynamics and the status of any given species in an area and throws light on how to conserve these species for future. In most of the PAs, monitoring of tigers and elephants are carried out regularly and a trend is understood and certain measures are taken to conserve them. This is evidenced by the trend of their increasing numbers. Similarly, to some extent the prey base of tigers, *i.e.* the ungulates are also monitored and their estimates are available. However, as per the Department's records, the rest of the diversity are not being monitored regularly in the PAs. In the absence of this, status of many endangered and endemic species like the lion-tailed macaque (*Macaca silenus*) (LTM), Nilgiri langur (*Semnopithecus johnii*) and many more lesser-known species could not be ascertained. Further, some of the individual research outputs[78] have shown alarming declining trends of some endemic species while some have reported new species from this biologically rich hotspot as detailed below.

Lion-tailed macaque is one of the endemic species of primates in the world - found only in Western Ghat forests of Southern India covering three States -- Karnataka, Tamil Nadu and Kerala. Because of its highly selective feeding habits, limited range of occupancy (c. 2,500 sq km), delayed sexual maturity, long inter-birth interval, low turnover and small wild population, it is categorized as endangered on the International Union for Conservation of Nature (IUCN) - Red List, 2008. Habitat loss coupled with fragmentation and hunting, has severely affected their population and globally their estimated total population is between 3,500-4,000 individuals.

[78] Kumara H.N and Anindya Shina (2009) Decline of the endangered lion-tailed macaque Macaca silenus in the Western Ghats, India. Oryx 43(2),

Fig 9.1 Lion tailed macaque in its habitat
Source: Image taken during field visits by Audit.

In the state of Karnataka, LTMs are recorded from Kudremukh NP, Mookambika WLS, Someshwara WLS, Sharavathi WLS, Brahmagiri WLS, Pushpagiri WLS and Talacauvery WLS. As per the estimates recorded by various scientists working in this field in Karnataka, a total of 116 groups[79] of LTMs were recorded during 1985 but had declined sharply to 61 groups as recorded during 2008[80]. Though regarded as one of the most endangered species globally and endemic to Southern India, no proper monitoring was taken up by the Department to properly assess the population. In the absence of this, there was no plan of action in place to protect LTMs, which is on the brink of extinction. Similarly, another primate endemic to this region and endangered is the *Nilgiri langur* which also faces the same situation and their numbers are yet to be estimated.

Further, there are lesser known fauna like amphibians, bats, butterflies, etc. which are a neglected lot. They are natural bio-indicators of a forest's well-being, playing an important role in pollination and as natural insect controllers. Even with slight alterations in their habitat, their population can either decline or may be wiped out locally from that habitat. Today many scientists / researchers are finding new species in the Western Ghats, especially amphibians. As per research / study reports[81], Western Ghats have 227 amphibian species out of the total 412 species found in the country, accounting for 55 *per cent* of the country's amphibian diversity. Out of the 227 species, 212 species (93.4 *per cent*) are endemic to the Western Ghats.

[79] Group size varies from 8 to 32 individuals

[80] Kumara H.N and Anindya Shina (2009) Decline of the endangered lion-tailed macaque Macaca silenus in the Western Ghats, India. Oryx 43(2)

[81] Amphibians of Western Ghats 2016 and Frost et al (2006) entitled The Amphibian Tree of Life

Based on IUCN criteria, 17 species are critically endangered, 31 are endangered, 17 are vulnerable, 5 are near threatened and 33 are least concern species. The status of remaining 124 species is either data deficient or not evaluated. Since the year 2000, out of 227 amphibian species, 118 new species have been found in the Western Ghats.

In response, the Government, during the Exit Conference, accepted the absence of a mechanism to monitor research projects and agreed to mark a day annually for discussion and presentation of papers on the research activities taken up in the PAs. Further, it was also proposed that a compilation of the proceedings / research papers would be brought out for use in better management of PAs.

Departmental research should be "problem solving studies", based on a consultative process involving PA management, local people and overall ground reality prevailing in our tropical setting. The research, monitoring and training aspects should cover the overall habitat management and should be focused at landscape level in Protected Areas. In the absence of scientific data, it would be inappropriate to draw effective strategies for long term goals and prepare a Management Plan for better conservation of biodiversity. Research and monitoring of biodiversity is an essential prerequisite for its conservation, management and sustainable utilisation. Thus the failure to take up research by the Department and non-monitoring of Research done by others clearly indicates the lack of application of the Department in this regard. With lack of research input and proper monitoring, major problems like increased human wildlife conflicts and that of invasive species like *lantana* continued to be a major threat in our Protected Areas till date. Lack of institutional setup to coordinate research progress was also noted by the DCF, Kudremukh Wildlife Division.

Recommendation 15: All endemic species need to be monitored so that appropriate conservation plan can be drawn for better management at landscape level. Government may consider establishing basic research laboratory in each of the Protected Areas.

Chapter 10

Preparation of Management Plan and Tiger Conservation Plan

A Management Plan is a document, prepared by a planning process, which sets out the values and objectives of management for a Protected Area. By presenting strategies and operational schedules, the plan shows how these objectives can be achieved within a time bound framework[82]. The National Wildlife Action Plan 2002-16[83], provides that each Protected Area should have its own Management Plan, based on sound scientific and ecological data. Further, the Management Plans are being prepared based on guidelines issued by Wildlife Institute of India *i.e.*, "A Guide to Planning Wildlife Management in Protected Areas and Managed Landscapes" generally referred to as Sawarkar's guidelines. Further, in respect of Wildlife Sanctuaries and National Parks which were notified as Tiger Reserves under section 38 V of Wildlife (Protection) (Amendment) Act, 2006, the management of these Protected Areas are to be in accordance with Tiger Conservation Plans (TCPs) approved by National Tiger Conservation Authority (NTCA). Detailed guidelines for preparation of TCP were issued by NTCA during 2007.

10.1 Preparation of Management Plans

As per the Sawarkar's guidelines, Management Plans should broadly include Protected Area status, boundaries and landscapes, strategies, results of previous management practices, and proposed / prescribed management practices for the current plan, considering thematic and zonal requirements of the Protected Area, duly incorporating the year-wise plan of operations / proposed budget. Tiger Conservation Plan should have different chapters for core and buffer areas including SWOT[84] analysis with plan objectives, plan for corridors, *etc*. The core and buffer plans should have different theme plan[85] based on the requirements.

In Karnataka, the Management Plans are prepared by the PA managers and approved by PCCF-WL who is also the Chief Wildlife Warden for all the Protected Areas except Tiger Reserves (TRs). With reference to TRs, the TCPs prepared are forwarded by PCCF-WL and got approved from NTCA.

10.1.1 Shortcomings in Management Plans

The deficiencies and observations noticed in MP / TCPs of sampled Protected Areas are given below:

[82] Para 4, page 3 of A Guide to Planning Wildlife Management in Protected Areas and Managed Landscapes by Vishwas B Sawarkar
[83] Para 1of Chapter II
[84] Acronym for Strengths, Weaknesses, Opportunities and Threats and is a structured planning method that evaluates those four elements of a project or plan.
[85] Separate sub-plans developed for azonal components.

- Out of 14 sampled PAs, there was a delay in preparation of MP/TCP in seven[86] PAs for the period beyond the previous plan periods. Also, in MM Hills which was declared as a Sanctuary in May 2013, approved MP was not in place even after three years. In reply, PCCF-WL stated that wherever there was delay in preparation of new MP, earlier MPs were being implemented. PCCF-WL also stated that in respect of newly declared Sanctuaries, appropriate scientific reports are being solicited from scientific community / institutions and preparations of sound Management Plans are underway. The reply is not acceptable since the wildlife habitats are constantly being affected by different factors, and the current Management Plan should be based on these factors which might not have been foreseen in the earlier Plan. The preparation of subsequent plan should have been started well in advance and been in place before expiry of current plan, something which has not been done.

- In respect of three[87] PAs wherein additional areas were included to the Wildlife Sanctuaries during 2011, no indicative plans / revised plans were prepared so as to address the issues relating to these areas. Since the plans are drawn up for ten years, this process provides for any mid-course corrections that could be found necessary during the implementation of Plan. However, it was observed that except Management Plan of Kudremukh NP (2003-13), none of the MPs had provision for mid-term revision. However, mid-term revision of MPs was not conducted in any of the PAs. In reply, PCCF-WL stated that in respect of Someshwara WLS, the newly approved MP covers extended area and new MPs are being prepared for Cauvery and Mookambika Sanctuaries.

- Control forms, are forms to record events and management activities, problems and their magnitude, events that are important from management standpoint and track management activities[88]. Control forms would be a source of management reference during revision of plan / management review / mid-course corrections. However, it was observed that control forms were not provided for in the MPs of five PAs. Further, in respect of eight sanctuaries / NP / TR, though the MP / TCP provided maintenance of control records, these were not maintained.

- Compartments are the smallest units of forests and compartment histories are valuable in monitoring a wide range of activities and events which in turn contribute to evaluation of natural / man induced impacts, efficiency of management prescriptions, planning of management actions. Compartment histories provide a repository of management history[89]. It was, however, observed that only MP of Kudremukh National Park provided for maintenance of compartment history to be maintained for recording habitat elements, events and management aspects relating to a compartment. Unfortunately, this was also not maintained even at Kudremukh.

[86] Bandipur, Brahmagiri, Dandeli- Anshi, Kudremukh, Nagarahole, Pushpagiri, Talacauvery
[87] Cauvery, Mookambika and Someshwara Wildlife Sanctuaries
[88] Para 39, Executive summary, Sawarkar's guidelines
[89] Para 40, Executive summary, Sawarkar guidelines

- Sawarkar's guidelines provide that MPs are to provide for maintenance of Record of Deviations and implemented targets for indicating the record of targets implemented and changes adopted in Management Strategies. However, only three[90] MP / TCPs provided for maintenance of Record of Deviation and implemented targets and this record was not maintained even in these Divisions.

The issues brought out above indicate the system deficiencies in the planning process.

10.2 Deficient coverage of issues relating to Human Wildlife Conflicts

As per Paragraph 25 of Sawarkar guidelines, the concerns relating to Human Wildlife Conflicts (HWC), also known as man-animal conflicts, are to be drafted in the Management Plan. Mitigation of HWC is a major challenge to a PA Manager as they consume much of their time and resources. Hence, the Management Plans should identify causes behind HWC for adoption of appropriate mitigation measures as a Theme Plan, sub plans reflecting the common interests of all zones of Management Plan, identifying causes such as cropping pattern, encroachments, *etc*., and identify locations / beats / compartments prone to HWC, and adoption of mitigation measures (EPT, solar fencing, *etc*). This is necessary in view of increased HWC as detailed in **Paragraph 4.1**.

We noticed that MPs of Pushpagiri, Brahmagiri and Talacauvery Wildlife Sanctuaries had not identified the causes for HWC in their Theme-Plan for mitigation of HWC and also not identified locations / beats / compartments prone to HWC.

In the MPs of Pushpagiri, Brahmagiri, Talacauvery sanctuaries and Nagarahole Tiger Reserve, Theme Plan had not identified locations for deployment of mitigation measures like EPT, solar fencing, location of elephant depredation camps.

TCP of Nagarahole TR prescribed construction of service road around Protected Area to monitor the various measures such as EPT / Solar Fencing. However, the same was not executed in the PA. Since these PAs are part of a landscape with very high incidences of HWC, detailed plan should have been prepared.

10.3 Rehabilitation / Resettlement and status of encroachments

Rehabilitation / resettlement is the viable solution for reducing the human wildlife interface thereby reducing anthropogenic pressure on the wildlife and their habitats. Since delay in rehabilitation would not only increase the cost but also would lead to higher incidences of HWC, it is necessary that rehabilitation is taken on priority as planned. The current status of progress of rehabilitation is deliberated in **Paragraph 6.3.**

[90] Kudremukh National Park, Nagarahole and Bhadra Tiger Reserves

During scrutiny of Management Plans and progress of rehabilitation, it was noticed that rehabilitation and resettlement were not taken up as planned. The MP / TCP targets for rehabilitation, and families actually rehabilitated in Kudremukh NP, Nagarahole and Dandeli Anshi tiger Reserves, are shown in **Table 10.1**:

Table 10.1: Achievement of MP / TCP rehabilitation of targets in Kudremukh National Park, Dandeli- Anshi and Nagarahole Tiger Reserves

(Number of families)

Year	Kudremukh National Park (2013-23)		Dandeli Anshi Tiger Reserve (2014-24)		Nagarahole Tiger Reserve (2014-24)	
MP/TCP targets and achievements →	Target	*Ach*	Target	*Ach*	Target	*Ach*
2014-15	90	45	300	104	100	69
2015-16	102	53	300	58	100	4
Total	192	98	600	162	200	73

(Source: Details furnished by the Department)

As per the above table, a total of 992 families were planned to be rehabilitated during 2014-16. However, only 333 families were rehabilitated which indicates a shortfall of nearly 66 *per cent* in achievement of MP / TCP targets.

Further, MPs of Kudremukh NP and TCPs of Dandeli-Anshi and Bandipur Tiger Reserves contained Theme Plans for preventing / addressing encroachments by consolidation of boundaries, demarcation of boundary on the ground, periodic inspection, *etc*. We observed that the progress in eviction of encroachments in these PAs was very slow which had been discussed in **Paragraph 6.1** of this report.

PCCF-WL in reply stated that rehabilitation is a complex issue and that there are no easy and short term solutions. PCCF-WL, also, stated that in Nagarahole TR, for balance of around 1,200 families, no lands are available for rehabilitating them. We feel that though rehabilitation is a complex phenomenon and land available for rehabilitation is limited, in Kudremukh NP and Dandeli-Anshi TR, where cash compensation is being paid, allocating more funds could speed up the process. Further, in Nagarahole TR, in spite of availability of land and funds, the relocation of 195 applicants is still under progress indicating slow progress in the matter.

10.4 Deficient Fire Management Theme Plan in the Management Plans

Fire protection is a measure common to all zones where fire is a recurrent problem affecting habitat and ecology of protected areas. It becomes necessary that the issue is adequately addressed in the MP / TCP for taking preventive measures. Sawarkar's guidelines (Paragraph 96) provide that theme plans, sub plan of management of specific issues, are included in the Management Plan for problems like fire protection, maintenance of water resources, *etc.*

We observed that there were no theme plans for fire on scrutiny of MPs relating to six [91] Protected Areas. We also noticed that vulnerable compartments / areas were not identified and vulnerability maps not prepared. This map would be handy to focus on areas which require regular attention for taking appropriate preventive measures like location and quantum of firelines to be maintained, location and numbers of fire watchers to be deployed, period of deployment, *etc*. Thus, vulnerability map helps in containing destruction of more area due to fire incident.

10.5 Anti-poaching operations

Poaching is one of the major threats for decrease in number of wild animals on account of killing for their meat and body parts. Management Plans should adequately chalk out a plan to protect wildlife from poaching by drawing separate Action Plan. The planning should include identification of vulnerable areas / species, deployment of anti-poaching staff, planning beats, usage of latest technologies, *etc*.

We noticed that Management Plans of Sharavathi WLS, Madikeri and Kudremukh Wildlife Divisions did not provide for GPS based monitoring measures such as use of *Huli* / *Hejje* software[92] to monitor the patrolling activities conducted by Anti-poaching Camps. Further in Kudremukh NP, floating / temporary camps were not established despite being provisioned for in MP. Several incidents of poaching were reported as brought in **Paragraph 7.1.**

10.6 Theme plan for *Hadlu* (Wetlands) Management

*Hadlu*s are marshy swamps surrounded by open grass lands and are a unique feature of Nagarahole Tiger Reserve. The soil is clayey, perennially moist and support luxuriant growth of sedges[93] and grasses round the year. Therefore, this habitat is most suited for mega-herbivores like Asian elephants and Indian gaurs and also supports other ungulates like chital and sambar. However, the TCP has observed that these special habitats are being overtaken by woody vegetation and weeds like *Chromolaena odorata, Lantana, etc.*

*Hadlu*s also play a vital ecological role in the prey-predator relationship and these remain as one of the preferred hunting grounds for the tigers. Many times in the past it has been observed that tigers use these *hadlu*s to hunt their prey and also hide the kill for many days. As per management objectives proposed for *hadlu*s, these have to be preserved through periodic weeding, wood cutting and fire line tracing in order to arrest the process of natural succession. Further, *hadlu*s should be monitored through satellite data so as to maintain the ecological services of the *hadlu*s to the wild animals on a long-term. Though it was stated in the TCP, that the area under *hadlu*s is coming down but the extent of decrease was not assessed.

[91] Pushpagiri, Brahmagiri, Talacauvery, Someshwara and Mookambika WLS and Kudremukh National Park (2003-13)

[92] These are software loaded to GPS enabled instruments which will be with watchers and help in assessing the area patrolled, uploading images of animals sighted etc.

[93] Sedges are grass like plants growing in the marshy area.

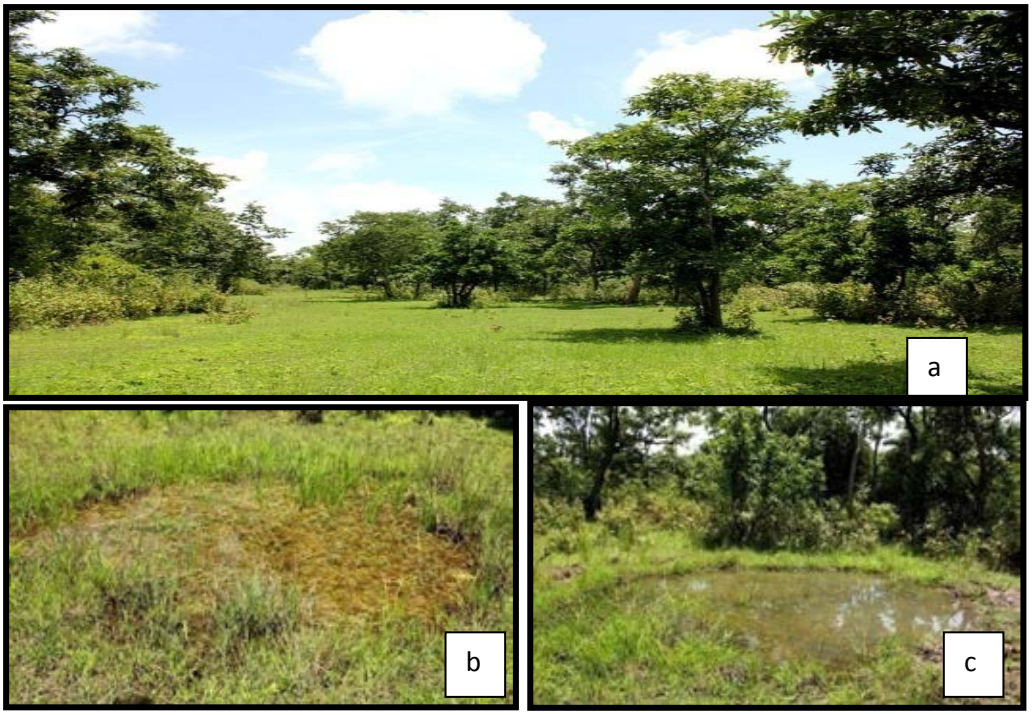


Figure 10.1: (a) Images of *Hadlu* in Nagarahole Tiger Reserve. (b) & (c) close up of *Hadlu*
Source: Images taken during field visits by Audit.

However, scrutiny of records revealed that as per TCP 5 *hadlus* per annum were to be maintained and specific efforts for preserving *hadlu*s were not taken up by means of periodic weeding, wood cutting and fire line tracing during the years 2014-15 and 2015-16. Also, preparation and monitoring of inventory of vegetation profile in *hadlus*, and their satellite based monitoring have not been taken up, though provided for in the TCP.

Though the importance of *hadlus* and the necessity of their management had been specifically assessed in the TCP, no measures were taken during 2014-16 to address the issue which could lead to loss of this magnificent ecological entity.

Box No .4

Best Practices

Management Plan of Kudremukh National Park (2013-23) consists of a Theme Plan for eco-restoration of habitat through soil and moisture conservation and assisted natural regeneration (Water Management Plan - Para 6.4.6, page 219 of Management Plan). This is one of the best Theme Plans related with habitat improvement.

Following are the main features of this Theme Plan:

- **Three major rivers, three minor rivers and 176 water holes have been identified in the Theme Plan, giving proper coverage to drainage basins.**
- **Details of water holes and tanks which were de-silted in previous years (2003-12) have been included in the Theme Plan which will provide a better insight about execution of de-silting works in future.**
- **The Theme Plan has identified and delineated the micro water sheds in Kudremukh National Park showing the existing water bodies / water holes and drainages in the National Park.**
- **The Theme Plan has identified 30 water holes and 15 check dams / culverts which have to be created / constructed during the next 10 years citing the beats / ranges where these have to be created.**

10.7 Monitoring and Evaluation

The prescriptions of TCP of Nagarahole Tiger Reserve (2014-24) with reference to monitoring and evaluation in respect of different parameters, and their implementation have been brought out in **Table 10.2** below:

Table 10.2: Evaluation of issues identified in the TCP of Nagarahole TR

Issues	Remarks
Monitoring of biological parameters like flora, fauna indicating health of whole Nagarahole ecological system	Not done
Monitoring the status of species, such as four-horned antelopes, wild dogs, avian fauna	No species except tigers and elephants were assessed
Annual monitoring of water resources, invasion of weeds, regeneration of native species, availability of fodder	Not done
Assessment of socio-economic parameters of tribals living inside Protected Area	No socio-economic parameters were assessed regarding tribals
GIS based monitoring system to identify encroachments	Not evolved

Thus it could be seen that except for estimation of elephants and tigers which are being done at all India levels, no other monitoring works, though prescribed in the TCP, were taken up by the PA Management.

Moreover, it was noticed that the Management Plans of other sampled National Parks / Wildlife Sanctuaries did not include any monitoring mechanism related with biological parameters, status of species, annual monitoring of water resources, assessment of socio-economic parameters and GIS based monitoring system to identify encroachments.

In the absence of monitoring of the prescribed parameters, there was no system in place to monitor the status of the above indicators of health of the wildlife habitat in any of the National Parks / Wildlife Sanctuaries.

10.8 Climate Change and its impact on Western Ghats

The Management Plans and Tiger Conservation Plans are to include strategies for addressing the site specific / landscape level threats and challenges in addition to issues of global importance since all the factors affecting the habitat are to be addressed in it. Climate change is one of the major issues relating to environment in recent years and has affected rainfall patterns in many parts of the globe[94]. The Western Ghat region is also affected on account of climate change.

Climate change in Karnataka has already had its effect on the rainfall pattern and the average rainfall in Madikeri, Mysuru, Hassan, Dakshina Kannada and Chamarajanagar had reduced during the period 1971-2005 as per the report of Karnataka State Action Plan on Climate Change -1st Assessment. The report has also projected change in rainfall pattern during the period 2021-50 As Kudremukh NP, Nagarahole NP, Bhadra WLS, Bandipur NP, MM WLS, BRT

[94] Intergovernmental panel on Climate change report 2013, Available at https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/drafts/WG1AR5-TS_FOD_All_Final.pdf

WLS and parts of Cauvery WLS are situated in the Western Ghat region, they are bound to get impacted by the reduced rainfall. Further, scientists of Centre for Ecological Sciences, Indian Institute of Science also have forecasted decreasing trend in the rainfall pattern over Western Ghats between 2013 and 2020 as detailed in **Box No. 5**.

Box No. 5

A study was conducted in 2016 by Energy and Wetlands Research Group, Centre for Ecological Sciences, Indian Institute of Science[95] on "Time Series MODIS NDVI based vegetation Change Analysis with Land Surface Temperature and Rainfall in Western Ghats". The study which was also financed by Ministry of Environment, Forests and Climate Change, analysed the trends in rainfall time-series data using statistical methods and modelled using autoregressive integrated moving average which indicated decreasing trend in the rainfall pattern over forest and agricultural / grassland areas from 2013 to 2020 in Western Ghats, revealing the likely grave situation threatening water and food security in peninsular India with the increasing trends in deforestation in the ecologically vital Western Ghats.

Reduction in rainfall will result in reduced availability of fodder and water for wildlife forcing animals to move out of their habitats and stray into human habitations leading to increased Human Wildlife Conflict cases. Already, the increased HWC cases were noticed during the last two years at Bandipur TR as detailed in **Paragraph 4.1.1**.

The other impacts of climate changes are:

- Climate change would cause change in ecology of habitats which may not be conducive to all the floral species found in the WG-NBR region. These changes have the potential to cause species extinction which would be having catastrophic impacts in this species-rich region[96]. Therefore, there is need to establish gene bank / germ plasm[97] banks[98] so as to conserve these species for *ex-situ* conservation and re-introduction into their natural habitats. However, no such efforts have been made even though this was to be done as per Karnataka State Action Plan on Climate Change - 1st Assessment undertaken at the behest of the Government of Karnataka (March 2012).

[95] Ramachandra T V, Uttam Kumar and Anindita Dasgupta, 2016, Time-series MODIS NDVI based Vegetation Change Analysis with Land Surface Temperature and Rainfall in 112 Western Ghats, India, ENVIS Technical Report 100, Sahyadri Conservation Series 53, Energy & Wetlands Research Group, CES, Indian Institute of Science, Bangalore 560012.

[96] Report of Intergovernmental Panel on Climate Change, Para 11.21.6. Climate Change 2001: Impacts, Adaptation, and Vulnerability available at http://www.ipcc.ch/ ipccreports/ tar/ wg2/index.php?idp=432

[97] Gene banks are a type of biorepository which preserve genetic material and Germ plasm are living genetic resources such as seeds or tissues that are maintained for the purpose of animal and plant breeding, preservation, and other research uses.

[98] Para 6.9 of Karnataka State Action Plan on Climate Change – 1st Assessment, prepared by EMPRI and TERI

- ❖ Climate change has the potential to increase the number of fire incidences as per studies conducted in United States of America[99] and Canada[100]. Therefore, research and studies need to be focusing more on this issue for taking adequate precautionary measures. However, it was observed that no such research activities were undertaken by the Department.

Even though climate change is a global phenomenon which needs to be taken seriously, its impact has already started to be felt in the PAs. However, climate change and its impact have not been addressed virtually in any MP / TCPs of any of the PAs except in TCP of Nagarahole TR.

In reply, PCCF-WL stated that the Centre for Ecological Science, IISc is working on this aspect and there are no clear prescriptions in this regard.

10.9 Best practices noticed in Management Plans of Protected Areas of other Nations

Detailed milestones and performance indicators are spelt out in the Management Plans of Amboseli ecosystem, Kruger National Park and other PAs of Kenya. In Management Plans of Australia, Kenya, Canada and South Africa, it is observed that the draft Management Plan is put up in the public domain for a short period like two months for soliciting the opinion of the public. The Management Plan would then be finalized after taking into account these opinions. Also, in countries like Australia and Kenya, the locals are included in the Management Committee having a say in the management of the PA.

However, our MP / TCPs neither contained performance indicators nor are the plans finalised involving locals and other stakeholders, as done in other countries. The *modus operandi* followed in the aforesaid countries are worth emulating.

In reply, PCCF-WL stated that the PAs in Karnataka are not comparable in size to the PAs in Africa and efforts are being made with the help of scientific community / institutions to draw the Management Plans indicating some of the key milestones and indicators.

In the Exit Conference, the Government accepted the audit concern about deficiencies brought out in the MP/TCP and stated that remedial measures would be taken.

Recommendation 16: Management Plan / Tiger Conservation Plan may be prepared in advance before the expiry of the previous plan. Management Plan / Tiger Conservation Plan should be drawn covering the issue relating to human wildlife conflict, fire management etc., from a holistic point of view for better management and conservation. Best practices of other countries may be considered for adaptation wherever suitable.

[99] Virginia H. Dale et al, Climate Change and Forest Disturbances, Available at: http://bioscience.oxfordjournals.org/content/51/9/723.full.pdf

[100] Gillette et al (2004) Detecting the effect of Climate Change on Canadian forest fires, Available at: http://onlinelibrary.wiley.com/doi/10.1029/2004GL020876/epdf

Chapter 11

Human Resource Management

11.1 Human Resources, supply of arms and wireless systems

Karnataka ranks sixth in terms of coverage of forest area in India, having an area of 36,421 sq km under forest cover. Management of such vast areas of forest requires trained, qualified, adequate manpower with necessary supporting equipments. Besides, facilities must be provided for the field staff for effective protection of the area. Incentives and awards inspire the staff for more efficient discharge of duties. Shortcomings noticed in manpower management, training, arms and ammunition of the department are discussed below.

Administrative management of Forest area

The forest area is divided into Beats, Sections, Ranges and Divisions for better management. The hierarchy of the field staff of the Forest Department responsible for its management is as shown in the **Chart 11.1** below:

Chart 11.1 Hierarchy of the field staff

The officials in charge of the Section and Beat are called as front line staff as they are the ground staff responsible for conservation and protection of forests.

11.2 Forest area per personnel

For effective management of forest areas, adequate front line staff is essential. Scrutiny of records revealed that there were vacancies in these cadres which were not filled up. The sanctioned strength and vacancy position during 2015-16 in respect of the front line staff are as given in the following **Table 11.1:**

Table 11.1: Vacancy position in Front line Staff

Cadre	Sanctioned strength	Vacancy	Percentage
DRFO	206	79	38
Forest Guard	580	181	31
Forest Watcher	350	85	24

(Source: Details furnished by the Department)

It was observed that up to 40 *per cent* vacancies in the front line staff were noticed in Malai Mahadeswara and Talacauvery WLS. In addition, it was observed that no norms existed for deploying these front line personnel. As a result the number of sanctioned posts for different Protected Areas was different irrespective of their size as evident from **Table 11.2**:

Table 11.2: Front line personnel per square kilometre of forests in Protected Areas

Protected Area	Area in sq km	Total sanctioned strength of front line staff	Forest area per personnel Sanctioned (sq km)	Working strength as of March 2016	Forest area per personnel – working as of March 2016 (sq km)
Bandipura TR	872.240	233	4	158	6
Bhadra TR	500.160	107	5	88	6
BRT Tiger Reserve	539.520	112	5	79	7
Dandeli Anshi TR	1,303.740	138	9	99	13
Nagarahole TR	643.390	221	3	155	4
Brahmagiri WLS	181.290	25	7	14	13
Cauvery WLS	1,027.530	63	16	42	24
Kudremukh NP	600.570	60	10	39	15
MM WLS	906.187	85	11	49	18
Mookambika WLS	370.370	16	23	13	28
Pushpagiri WLS	102.920	9	11	8	13
Sharavathi WLS	431.230	14	31	14	31
Someshwara WLS	314.250	30	10	21	15
Talacauvery WLS	105.590	9	12	5	21
Total	7,898.987	1,122		784	

(Source: Details furnished by the Department)

As may be seen, while each of the sanctioned front line staff had an area of three to nine sq km in the Tiger Reserves for managing and patrolling, the per personnel forest area ranged between seven to 31 sq km in other non Tiger Reserve Protected Areas. In addition, it was observed that in BRT Tiger Reserve with an area of 539.52 sq km had a sanctioned strength of 112 front line staff while Kudremukh National Park with 600.57 sq km area had only 60 front line staff which shows a stark difference in allocating manpower.

Since front line staffs are the foot soldiers of forests and their proper management ensures better protection of the forests, adequate manpower is necessary for all the Protected Areas as these are home to several endangered and endemic species. Therefore it becomes necessary to evolve rational norm for deployment of front line staff in these Protected Areas. However, though a proposal has been submitted to Government for fixing the beat area at 10 sq km and section area at 30 sq km, the same has not been approved so far.

Box No. 6

Positive Aspects

Hardship Allowance

Government in order dated 04.05.2016 has sanctioned a Hardship Allowance ranging from ₹ 2000 to ₹ 3500 per month to all the officers / staff working in Wildlife Divisions in the cadres of Group D Employees, Forest Guard, Deputy Range Forest Officer and Range Forest Officers with immediate effect. Considering the locations and challenges faced by these staff, the sanction of Hardship Allowance would not only work as compensatory allowance but also act as motivating factor in lower cadres to work in these difficult terrains.

11.3 Utilisation of Special Tiger Protection Force

A "Special Tiger Protection Force" (STPF) has been sanctioned and is in place for Bandipur and Nagarahole Tiger Reserves. This elite Force, was to be raised, armed and deployed by the States having Tiger Reserve as a specialized force for tiger protection. STPF has a total strength of 112 members with one Assistant Conservator of Forests, three RFOs, 18 DRFOs, 63 Guards and 27 Forest Watchers. On scrutiny of current position, it was observed that out of 112 posts sanctioned, 108 were filled up. However, six had resigned / were absent and 31 personnel were deputed for office works in Bandipur and Nagarahole TRs. Thus, the personnel currently working on purely STPF related works has effectively come down to 71 against 112 posts sanctioned.

This Force was to be armed with state-of-the-art arms like 5.56 mm Rifles, carbine 9 mm IAIDP, *etc*. It was, however, observed that these were not procured for the STPF. On the other hand, 4 rifles had been issued to STPF from the arms supplied to the Reserve. As such, STPF has not been armed as intended.

The duties of STPF are to collect and analyse past crime data, intelligence details in respect of vulnerable areas / villages and offenders, and data on illegal / legal fire arm details, as well as patrol the high risk areas of the Reserve, participate in anti-snare operations, detect illegal drawing of power for energising the fence around the agricultural fields, map areas vulnerable for straying of wildlife in the human dominated landscape, handle the straying cases of tigers / leopards, monsoon patrolling, *etc*. However though the force is in position since 2011-12, there has been persistent high number of instances of Human Wildlife Conflicts in the two Reserves (7,841 for Bandipur TR and 7,067 for Nagarahole TR), death of elephants due to gunshots (four instances), instances of electrocution (11 elephants) and death of tigers due to poisoning (two cases). In addition to STPF personnel, special monsoon patrolling was taken up at a cost of ₹ 81.03 lakh at Bandipur TR during the period 2011-16. All these facts indicate that STPF is not being utilised effectively. Also, Nagarahole TR recorded the highest number of poaching cases amongst the Tiger Reserves in the State during the period 2011-16 as brought out in **Paragraph 7.1** and has been consistently recording poaching cases in the last five years.

We also observed that the STPF, which was divided into three platoons consisting of 13 teams of four members each, was not provided with vehicles for carrying out their assigned tasks. Further, the periodical reports required to be furnished by the Field Director were also not furnished.

As a result, the STPF though officially in place, is not working as a Tiger Protection Force since over 25 *per cent* of the staff was deputed for other duties and arms as required were not procured and provided. The expected benefits from continued deployment of STPF, which should have by its presence and professional approach identified the problematic areas of the Reserve, as well as proposed and implemented strategies for better co-operation between the Department and locals, do not seem to be happening

as could be seen from the continued instances of Human Wildlife Conflicts, poisoning of tigers / leopards, electrocution of elephants and killing of elephants by gunshots as aforesaid.

11.4 Status of arms

Arms and ammunitions are very vital for management of Protected Areas as they would be handy for countering the armed attacks of poachers and other offenders in addition to safeguarding against sudden attacks of wild animals. Since the protection works are similar to policing, functional and adequate arms would therefore be required for the Protected Areas.

We observed that no need analysis was done in the first place for assessing the requirement of arms, in the absence of which it could not be ensured whether adequate arms were in place. Further, the details of arms and ammunitions supplied to different Wildlife Divisions for management of National Parks and Wildlife Sanctuaries and their status have been abstracted at **Table 11.3** below:

Table 11.3: Status of arms in Protected Areas

Protected Area	Double Bored Barrel Gun		Slide action guns		0.315 Rifles		Total	
	No.	In Working condition	No.	In Working condition	No.	In Working condition	No.	In Working condition
Bhadra TR	22	12	30	29	6	6	58	47
BRT TR*	52	17	26	8	24	2	102	27
Cauvery WLS	32	26	12	1	10	7	54	34
Kudremukh NP	15	14	4	4	10	10	29	28
MM Hills WLS	37	27	21	18	25	16	83	61
Mookambika	4	2	1	1	1	1	6	4
Nagarahole TR	40	31	0	0	16	9	56	40
Pushpagiri WLS	2	0	1	1	2	0	5	1
Someshwara WLS	1	0	1	1	1	1	3	2
Talacauvery WLS	2	1	1	0	2	0	5	1
Total (% working)	207	130 *(63)*	97	63*(65)*	97	52*(54)*	401	245*(62)*

(*does not include K Gudi Range as the working status of arms was not furnished)
(Source: Details furnished by Karnataka Forest Department)

As could be seen, out of 401 arms supplied to 10 Protected Areas, 216 arms (54 *per cent*) were with three Tiger Reserves while the balance 185 was with seven non-TR Protected Areas. Amongst Tiger Reserves, BRT had the highest number (74 *per cent*) of non-functional arms. Amongst other PAs, Malai Mahadeswara and Cauvery Wildlife Sanctuaries were supplied with more arms and also accounted for maximum number of non-functional arms. Since Malai Mahadeswara Sanctuary accounted for maximum number of poaching cases during the last five years, it would be necessary to ensure that at least all the arms supplied present were in working condition for effective protection. However, 27 *per cent* of the firearms in MM WLS were non-functional.

In addition, two Wildlife Sanctuaries in the Madikeri Division, Pushpagiri and Talacauvery, had only one functional gun against five supplied. In view of the rampant HWCs in Madikeri region, the absence of working arms would always be an impediment in taking effective protection measures in this region. Further, in the absence of any need analysis, it could not even be assured whether the number of guns provided overall was adequate for their purposes or not.

11.5 Position of wireless equipments

Wireless is a communication network established in all the Forest Divisions for effective all weather communication amongst the staff. The different wireless equipments are Static sets, Mobile sets, Wallkie Talkies, Repeaters, chargers for Repeaters, *etc*. A wireless network to be effective requires that all the units / equipments are functional and not under repair.

The status of wireless equipments in the sampled PAs has been abstracted in **Table 11.4** below:

Table 11.4: Details and status of wireless equipments supplied to Protected Areas

Protected Area	Static sets		Walky Talky		Mobile sets		Total instruments		Repeater	
	No.	In Working condition	No.	In Working condition	No.	In Working condition	No.	In Working condition	No.	In working condition
Bandipur TR	22	22	184	184	24	24	230	230	--	--
Bhadra TR	70	60	115	92	9	9	194	161	4	4
Brahmagiri WLS	2	2	13	10	0	0	15	12	2	1
BRT TR *	13	3	88	8	11	5	101	86	2	1
Cauvery WLS	22	17	82	60	8	6	112	83	2	1
Dandeli Anshi TR	26	26	97	55	8	8	152	94	3	3
Kudremukh NP	8	8	36	32	3	3	47	43	2	1
MM Hills WLS	10	8	94	19	6	6	110	33	2	2
Mookambika WLS	1	1	8	8	1	1	10	10	--	--
Nagarahole TR	37	32	122	68	15	15	119	102	0	0
Pushpagiri WLS	3	2	17	10	1	1	21	13	2	2
Sharavathy WLS	2	2	10	10	2	2	14	14	1	1
Someshwara WLS	1	1	4	4	1	1	6	6	--	--
Talacauvery WLS	1	1	9	5	1	1	11	7	1	1
Total (% working)	218	185 *(85)*	879	565 *(64)*	90	82 *(91)*	1187	832 *(70)*	21	17 *(81)*

(*does not include K Gudi Range as the working status of equipments was not furnished)
(Source: Details furnished by the Department)

As against the total number of 1187 wireless instruments supplied, 832 (70 *per cent*) were in working condition. Further, it was also observed that:

- Only four Protected Areas *viz.*, Bandipur National Park, and Someshwara, Sharavathi and Mookambika Sanctuaries had 100 *per cent* functional wireless instruments. One of the repeaters in Kudremukh Division which covers three Protected Areas was non-functional during 2015-16.
- In Dandeli-Anshi Tiger Reserve, the wireless network was not functional during 2012-13 and 2015-16.

We observed that in most of the PAs the batteries of wireless sets were not replaced periodically and handsets were not maintained through periodical servicing. Since wireless is a key communication device, it is necessary to ensure that the network is functional throughout for ensuring round the clock protection of these preserved habitats.

The Government accepted the shortage of staff in PAs and stated that new arms have been provided to staff in the PAs. However, they were silent on non functional wireless system in PAs.

Recommendation 17: Government needs to fill up staff vacancies and provide adequate arms and wireless equipments. Practical requirements need to be worked out and norms for deployment of front line staff, arms and wireless equipment need to be fixed.

Conclusion

Karnataka has forest area of 18.99 *per cent* of the geographical area and 84 *per cent* of which is located in the Western Ghat Region, a world acclaimed biodiversity rich hotspot and home to several endemic and endangered species. Western Ghat region, once a contiguous forest has increasingly become fragmented due to intrusive anthropogenic activities. This has consequently threatened the very existence of this fragile ecosystem and demands heightened conservation and protection measures. The forest areas which are declared as Protected Areas enjoin higher degree of protection and Karnataka has 49 Protected Areas.

Data on land-use-land-cover changes, a key health indicator of the forests in the Protected Areas was not available with the Department. An analysis for the period between 1973 and 2016 was done by Indian Institue of Science, Bengaluru at the instance of Audit in 13 sampled Protected Areas for the period between 1973 and 2016 through remote sensing techniques which showed decrease in evergreen / decidious forest area while areas under cultivation, built-up and open areas had increased.

Audit Objective 1: Protection and Conservation of Wildlife, including their habitats, were adequately planned for and implemented in the administration of the Protected Areas

- There was delay in preparation of Management Plans and Tiger Conservation Plans in seven Protected Areas and the Management Plans of six Protected Areas had deficient fire management plans

- Encroachments as per Department were 5,002 acres while it was 31,667 acres as per remote sensing data analysis by Indian Institute of Science as of 2016 in 13 Protected Areas.

- Rehabilitation of people from Protected Areas is beneficial from conservation point of view and it would be easy in case villagers had volunteered for rehabilitation. However, poor progress was noticed in four Protected Areas where 1,357 families were rehabilitated against 3,653 families volunteering to be relocated outside Protected Areas.

- Department permitted research activities by the Non-Governmental Organisations, individuals but no mechanism was in existence to monitor submission of these reports. Further, Department was not making use of findings brought out by these reports. Invasive species, and particularly growth of *lantana*, in many Protected Areas has become rampant and widespread. Intervention by the Department has become necessity rather than passive approach hitherto practiced. Though the Department was facing challenges on account of rampant invasion of *lantana* and other weeds, no research activity was commissioned to find a solution to this menace.

- Protection of wildlife being primary objective and having adequate front line staff in place is utmost important to guard against poaching, fire protection and detection of encroachments. We observed that vacancies in

front line staff persisted during 2012-13 and 2015-16 and 44 *per cent* vacancy existed in front line cadres in two Protected Areas.

Audit Objective 2: Adequate measures were taken to address issues relating to biotic interference and anthropogenic threats in the Protected Areas

- Given the high percentage of forest cover of the State and the high number of Protected Areas, one of the major management issues confronting the Department is the Human Wildlife Conflict. There are 956 villages in and around the Protected Areas, several of which intrude upon the animals' migratory paths. Along with illegal encroachments, these are the flash points for Human Wildlife Conflicts as animals move out of the forests into these villages, and their contiguous crop fields, in search of food and water. The 53 human deaths, 1,799 cattle deaths and 24,530 cases of crop loss during the audited period brings into stark focus the inability of the short term Human Wildlife Conflict mitigation measures which have, at best, yielded mixed results. However, possible long-term mitigation measures, like securing animal corridors by acquisition of private lands and relocation of villagers, have not received the deserved importance from the Department. Further, the expansion of Protected Areas by adding new areas cleared by NBWL have been held back by the Department citing administrative reasons which is indicative of external socio-political forces acting against issue of such notification.

- Sustained conservation measures by the Department have borne fruit in certain areas as witnessed from the increase in elephant and tiger populations, but similar focused programme was absent in respect of nearly extinct and endangered endemic species like lion-tailed macaque and Nilgiri langur. However, the increase in elephant and tiger population has given rise to new challenges in the form of ensuring sufficient home range which an animal needs for its continued sustainability. The ever increasing anthropogenic pressure on the forests and shrinkage, degradation and fragmentation of their habitats on one hand and increased population of flagship species on the other hand throws up new types of challenges, which calls for management of abundance as against conservation measure hitherto followed. Unscientific management of these issues may prove costly and counter-productive. As on date, no action plan appears to be in place to address such challenges head on before they spiral out of control.

- Department has no system of compiling data on animal kills except for elephants and tigers. Apart from poaching of animals, many animals get killed due to vehicular movement for which no data is available. At the instance of Audit, Kudremukh Wildlife Division recorded 1,338 road-kills in 45 days, whereas only 15 road kills were reported during the last five years, which is indicative of under-reporting of road-kills.

- The cases of poaching for bush meat could be more rampant in Bandipur and Nagarahole Tiger Reserves, where, as many as 834 snares were recovered during occasional anti-snare operations.

- Developmental and commercial activities in and around the Protected Areas are also the factors adversely impacting wildlife and particularly by Mini Hydel Projects, which are exempted from conducting environmental impact assessment. The natural water course or stream gets altered on account of Mini Hydel Projects and collectively they impact local ecology and environment. Further, many Mini Hydel Projects had violated the lease conditions but still operating by obtaining Stay Orders from the Courts against departmental action.

BENGALURU **(BIJIT KUMAR MUKHERJEE)**
THE 9 June 2017 **Accountant General**
(Economic & Revenue Sector Audit)

COUNTERSIGNED

NEW DELHI **(SHASHI KANT SHARMA)**
THE 14 June 2017 **Comptroller and Auditor General of India**

Glossary	
APC	Anti Poaching Camp
ATREE	Ashoka Trust for Research in Ecology and the Environment
BRT	Biligiri Ranganathaswamy Temple
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CBD	Convention on Biological Diversity
CEC	Central Empowered Committee
CCF	Chief Conservator of Forests
CF	Conservator of Forests
DATR	Dandeli-Anshi Tiger Reserve
DC	Deputy Commissioner
DCF	Deputy Conservator of Forests
DRFO	Deputy Range Forest Officer
EIA	Environment Impact Assessment
EMPRI	Environmental Management & Policy Research Institute
EPT	Elephant Proof Trench
ESZ	Eco-Sensitive Zone
FC Act	Forest (Conservation) Act, 1980
FD	Field Director
FRA	Forest Rights Act
FVM	Fire Vulnerability Map
GoI	Government of India
GoK	Government of Karnataka
GPS	Global Positioning System
HWC	Human Wildlife Conflict
IAS	Invasive Alien Species
ICT centre	Information Communication Technology Centre
IISc	Indian Institute of Science
ISRO	Indian Space Research Organisation
JLR	Jungle Lodges and Resorts Limited
KFD	Karnataka Forest Department
KNP	Kudremukh National Park
KREDL	Karnataka Renewable Energy Development Limited
KSRSAC	Karnataka State Remote Sensing Applications Centre
LTM	Lion Tailed Macaque
LULC	Land Use Land Cover
MHP	Mini Hydel Projects
MoEF	Ministry of Environment, Forest and Climate Change
MM	Malai Mahadeswara
MP	Management Plan
NBR	Nilgiri Biosphere Reserve
NBWL	National Board for Wildlife
NGO	Non Governmental Organisation
NH	National Highway
NP	National Park
NTCA	National Tiger Conservation Authority

NWAP	National Wildlife Action Plan (2002-16)
PA	Protected Area
PCCF	Principal Chief Conservator of Forests
PCCF-WL	Principal Chief Conservator of Forests (Wildlife)
RF	Reserved Forests
RFO	Range Forest Officer
SBWL	State Board for Wildlife
SF	State Forests
STPF	Special Tiger Protection Force
Sq km	Square kilometre
SWOT	Strength, Weaknesses, Opportunity and Threats
TCP	Tiger Conservation Plan
TR	Tiger Reserve
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WLD	Wildlife Division
WG	Western Ghats
WG-NBR	Western Ghat- Nilgiri Biosphere Reserve
WII	Wildlife Institute of India
WLS	Wildlife Sanctuary
WTI	Wildlife Trust of India

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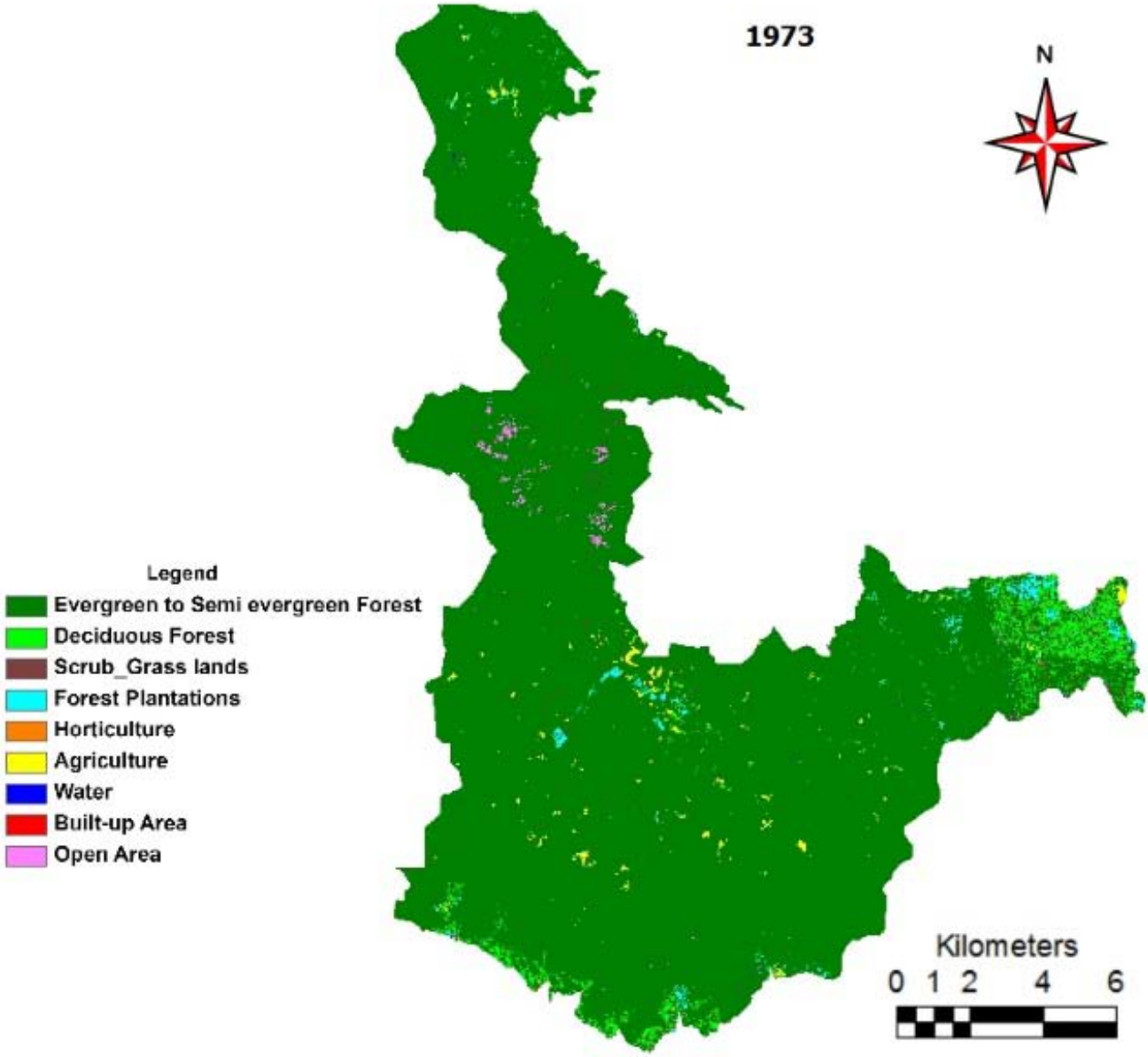
Appendices

Appendix 1
(Reference: Paragraph 3.1.2, Page 16)

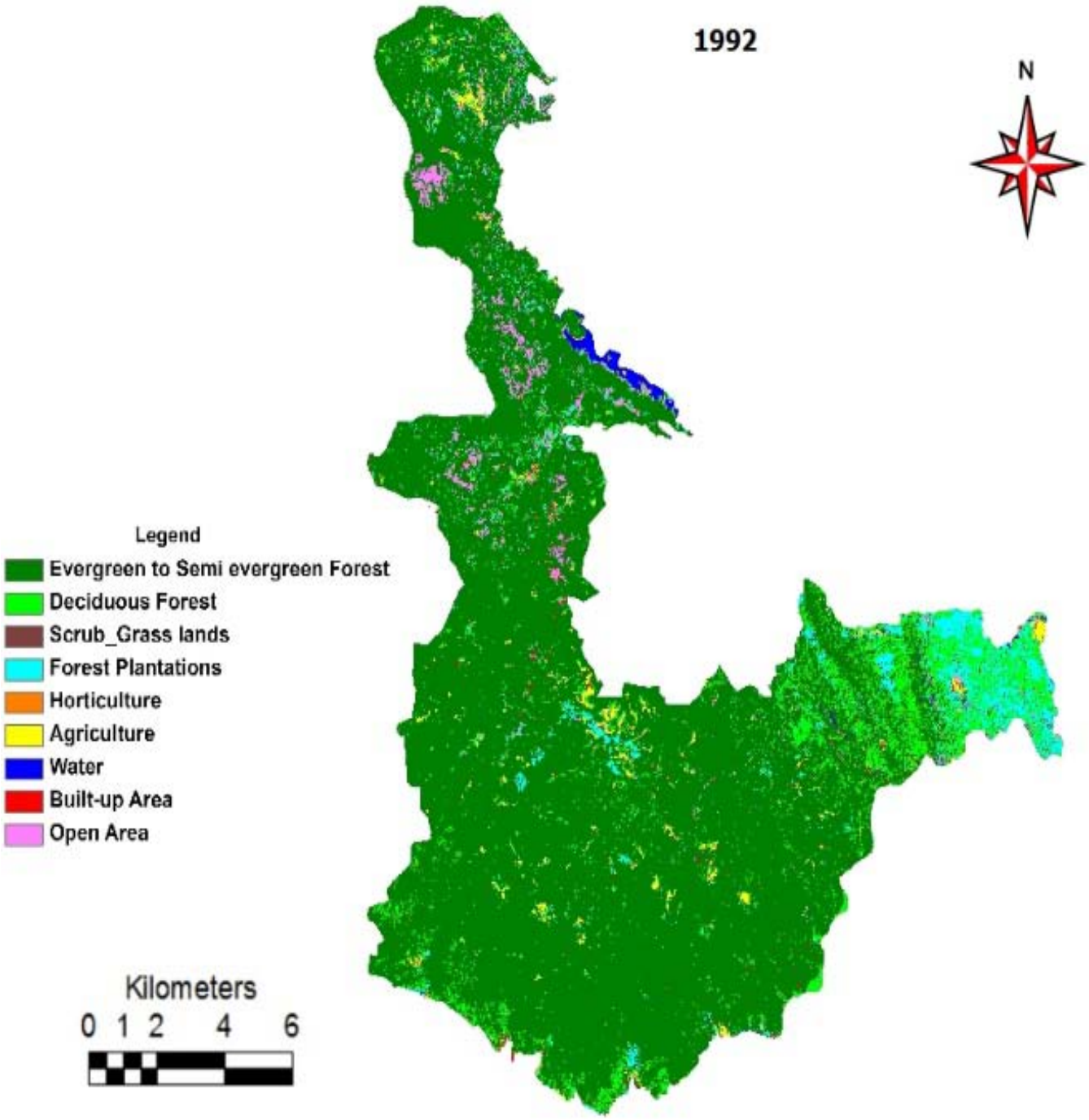
Imageries indicating Land Use Land Cover changes in Protected Areas during 1973-2016

Imageries indicating Land Use Land Cover changes in Protected Areas during the period 1973-2016:

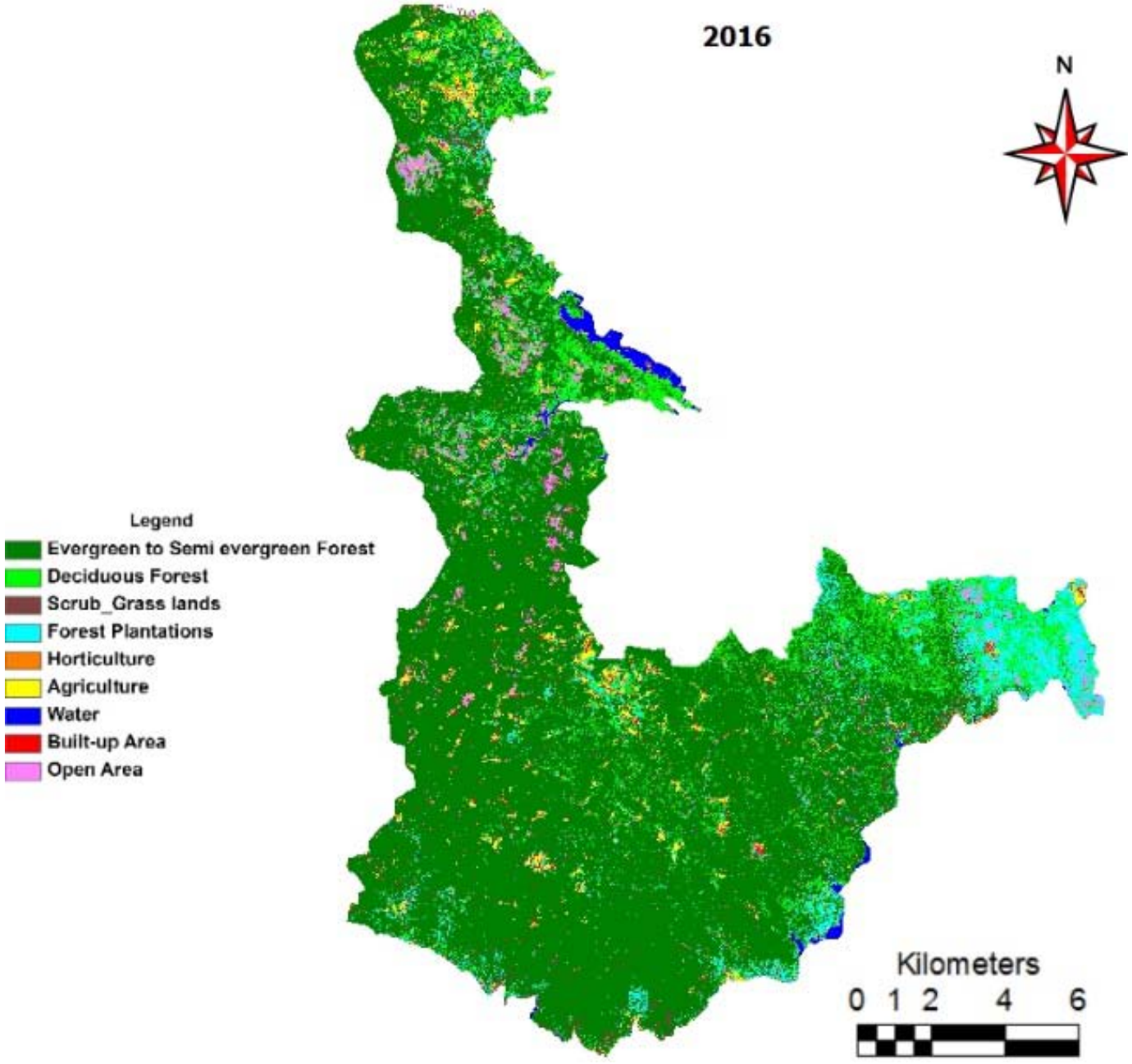
1. Dandeli Anshi Tiger Reserve



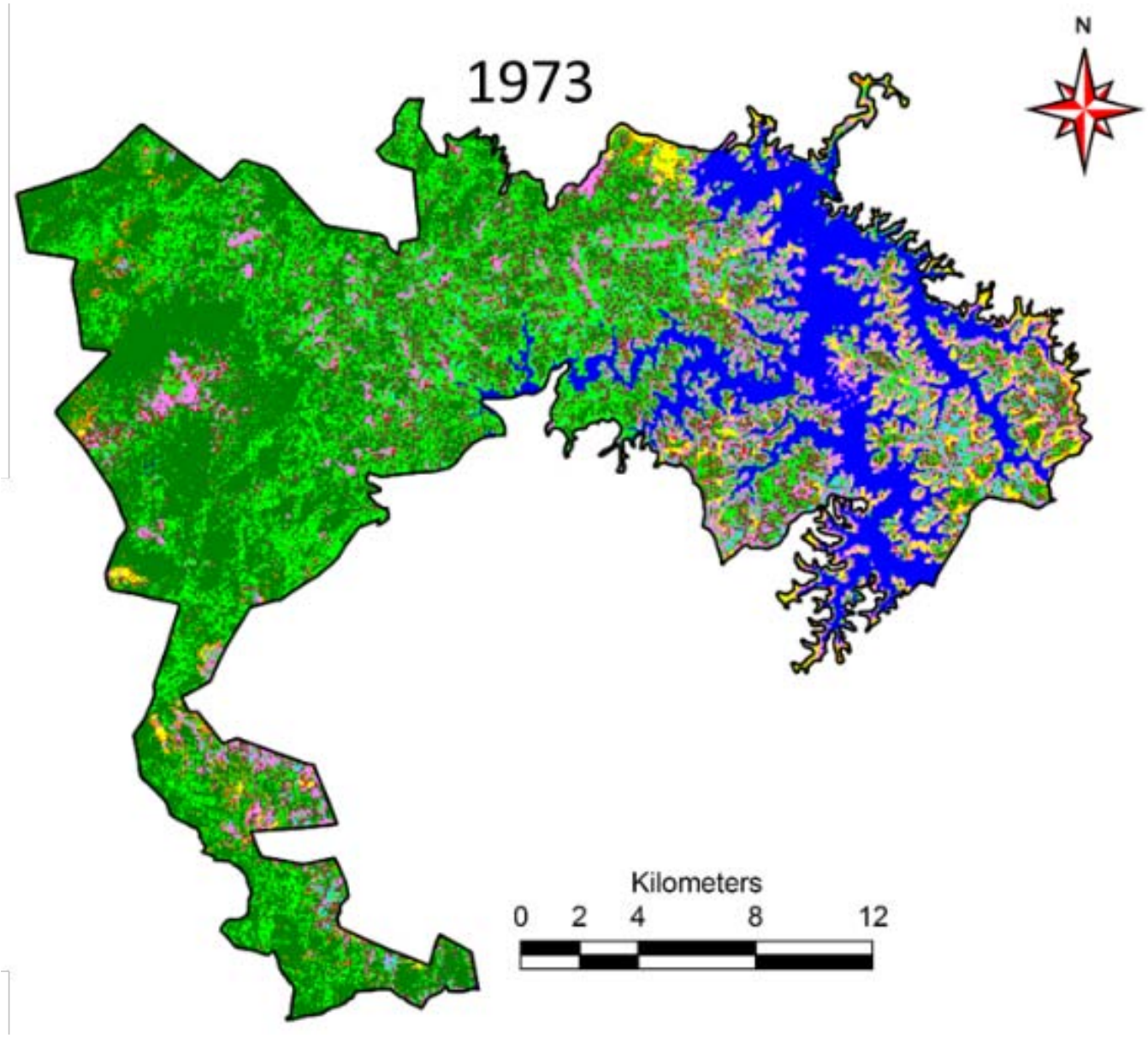
Dandeli Anshi Tiger Reserve



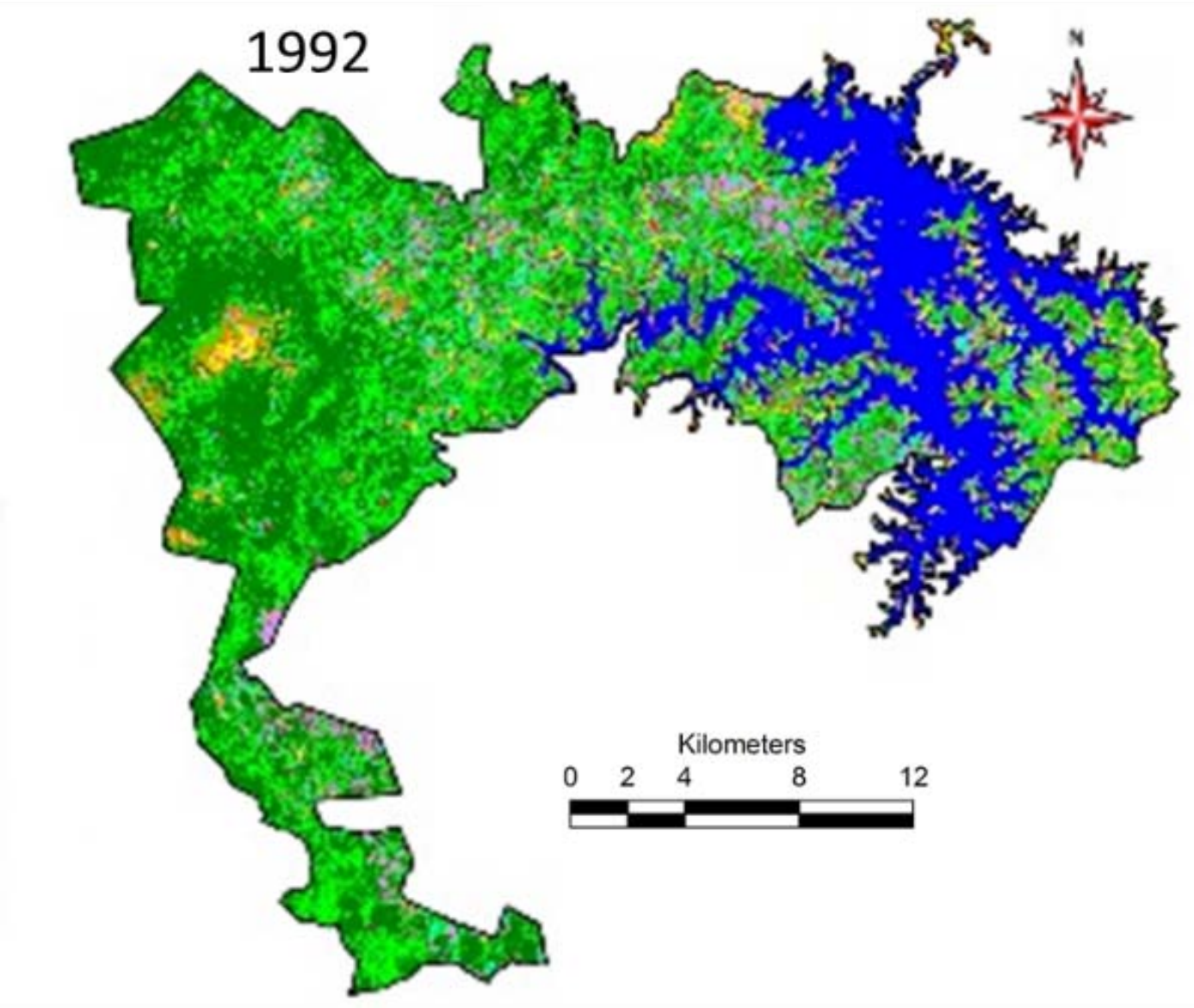
Dandeli Anshi Tiger Reserve



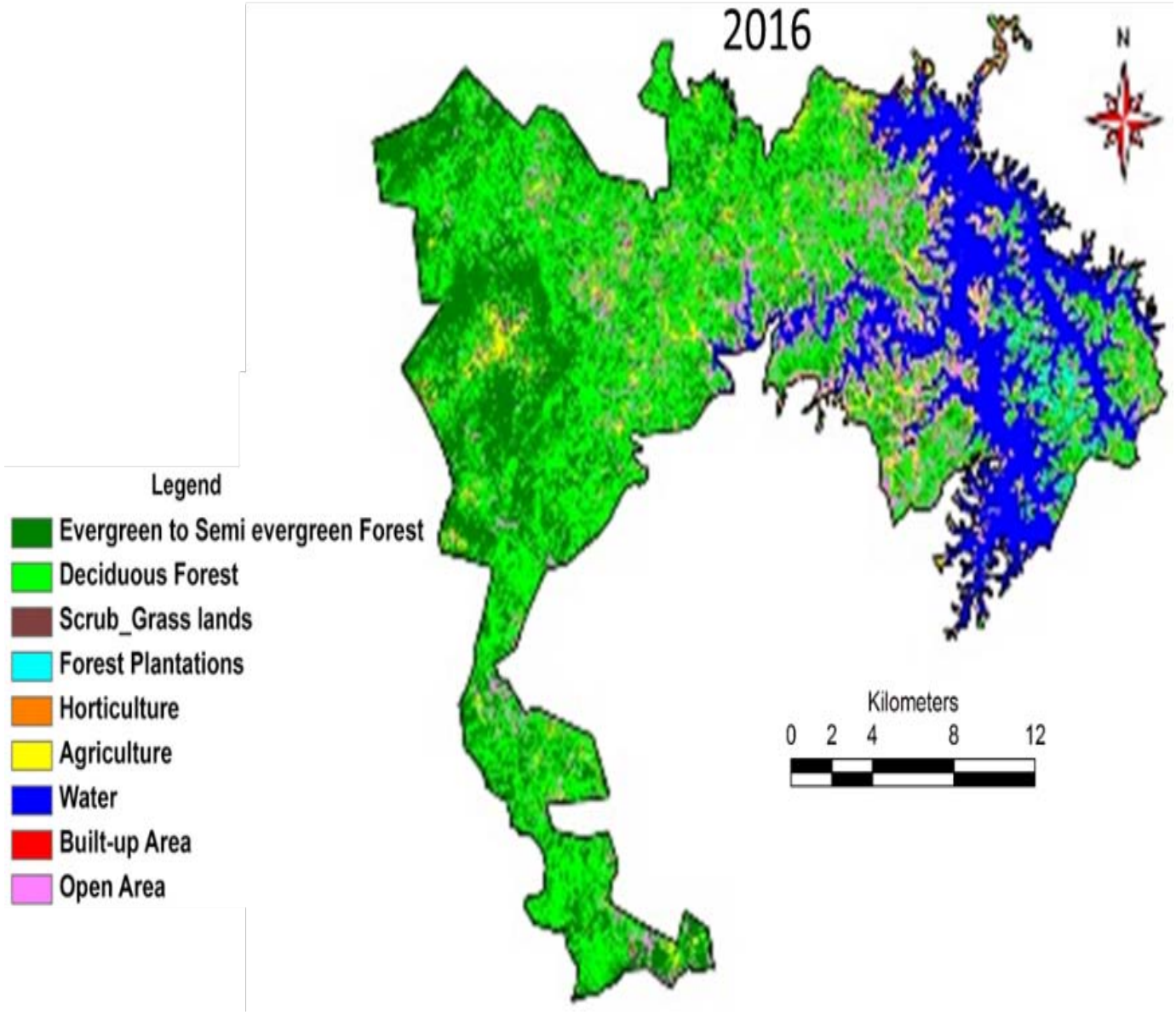
2. Sharavathi Wildlife Sanctuary



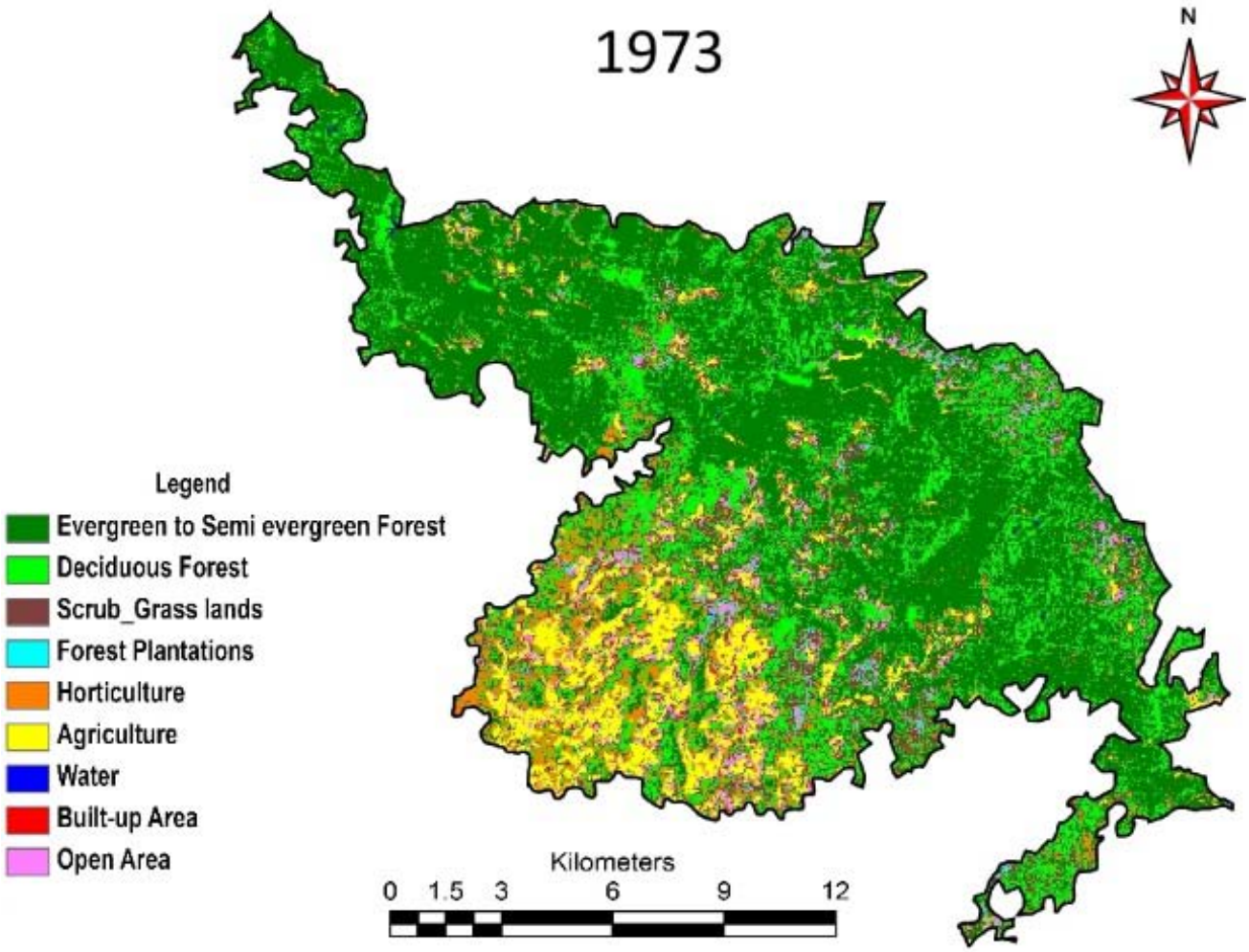
Sharavathi Wildlife Sanctuary



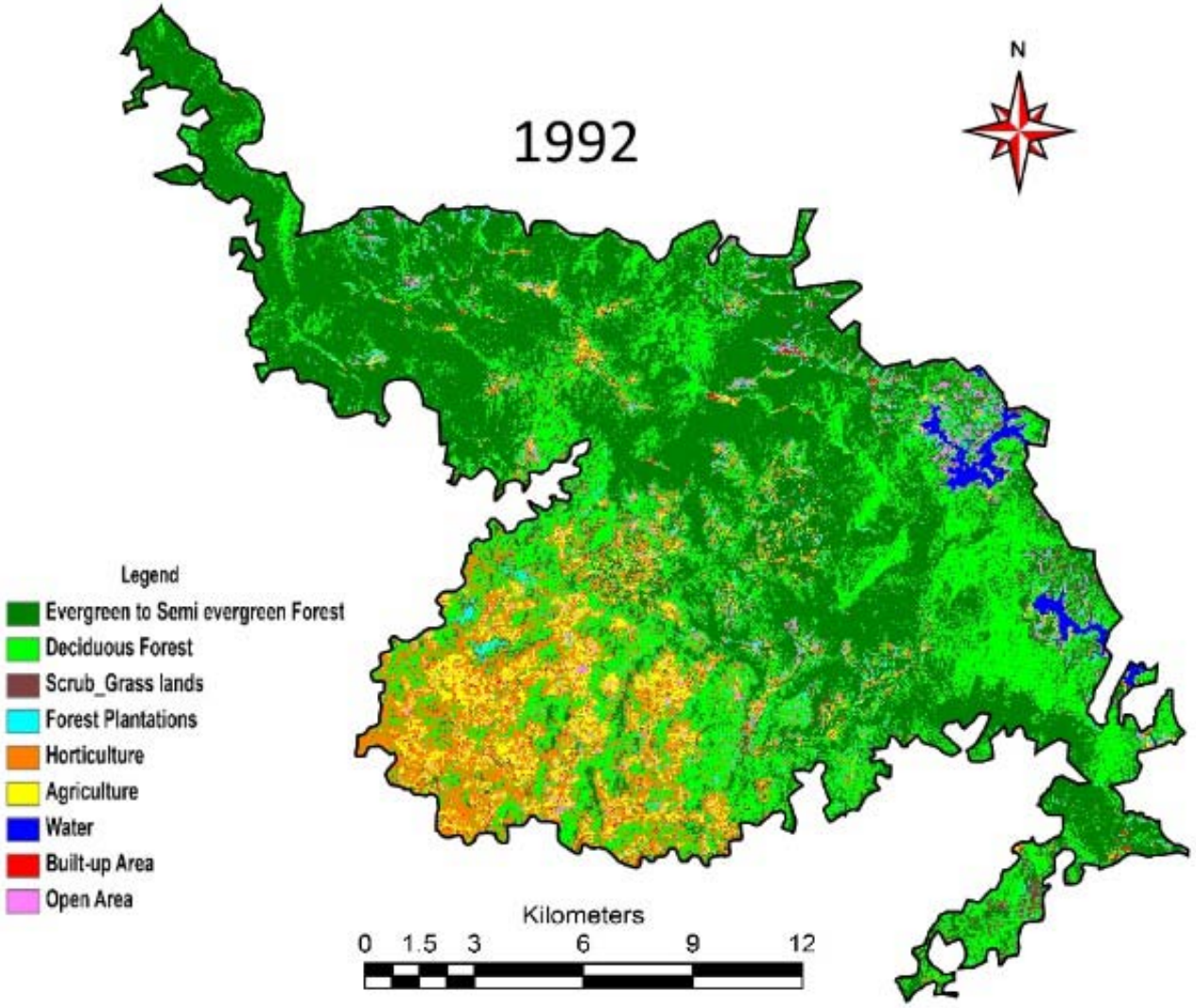
Sharavathi Wildlife Sanctuary



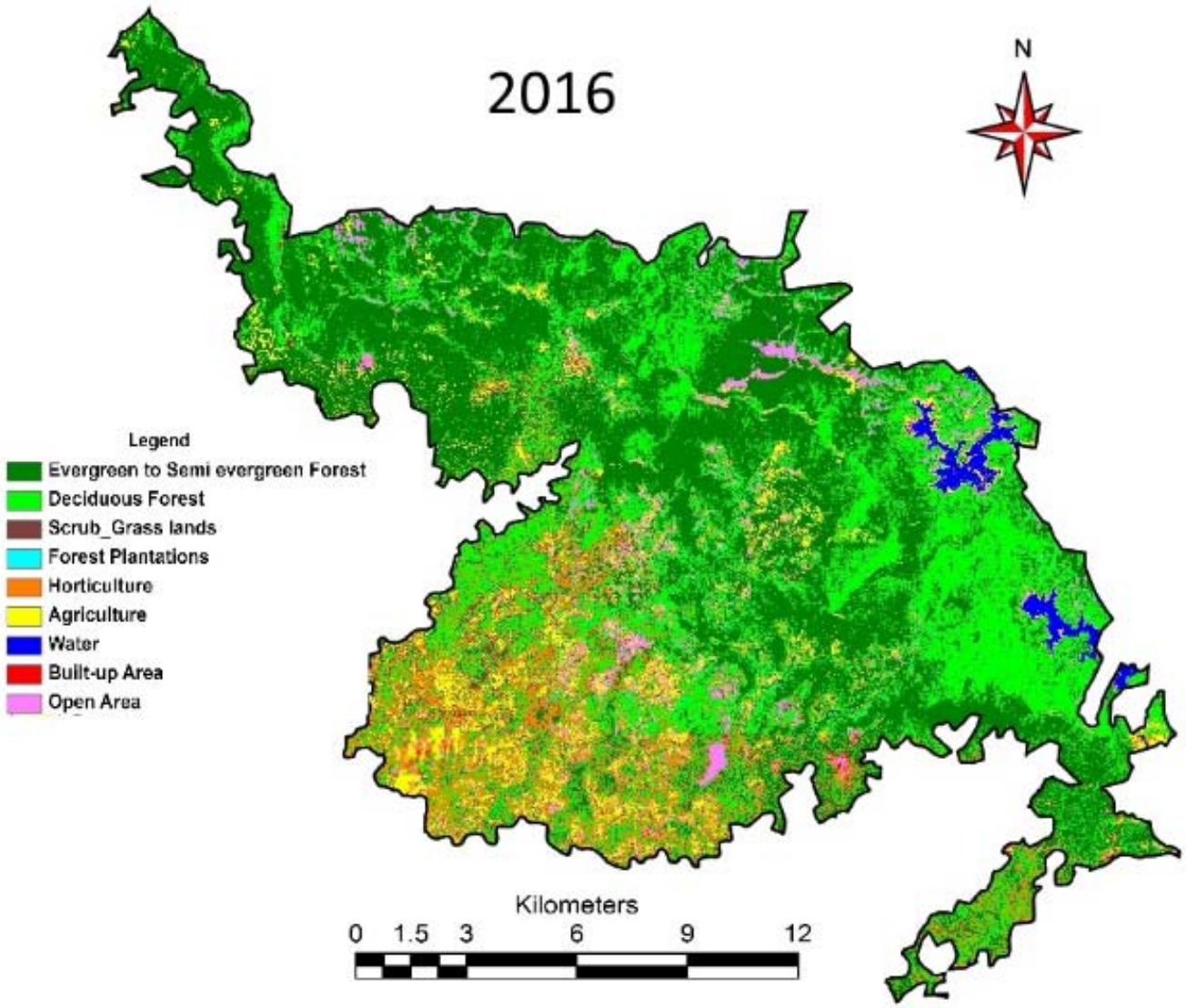
3. Mookambika Wildlife Sanctuary



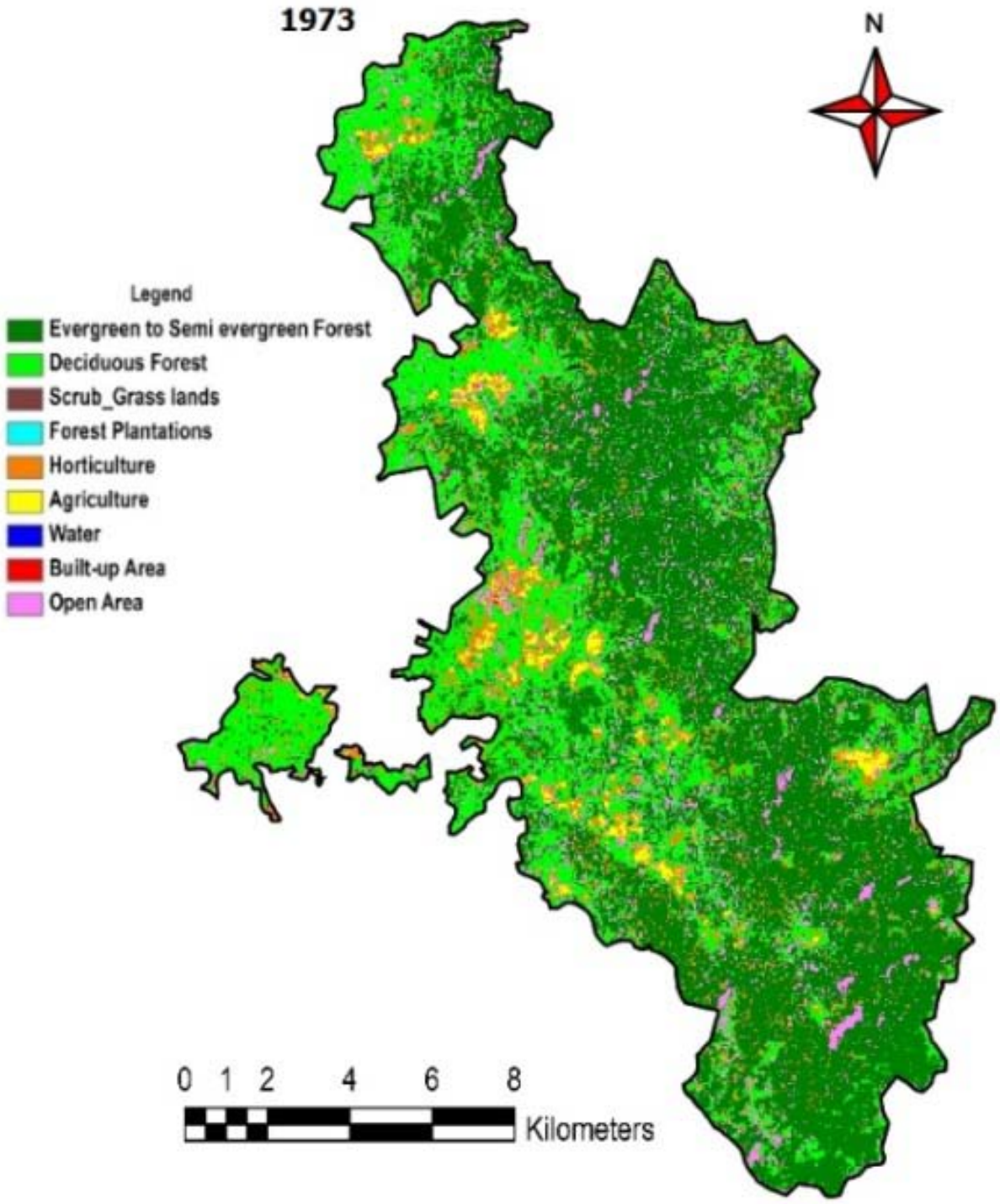
Mookambika Wildlife Sanctuary



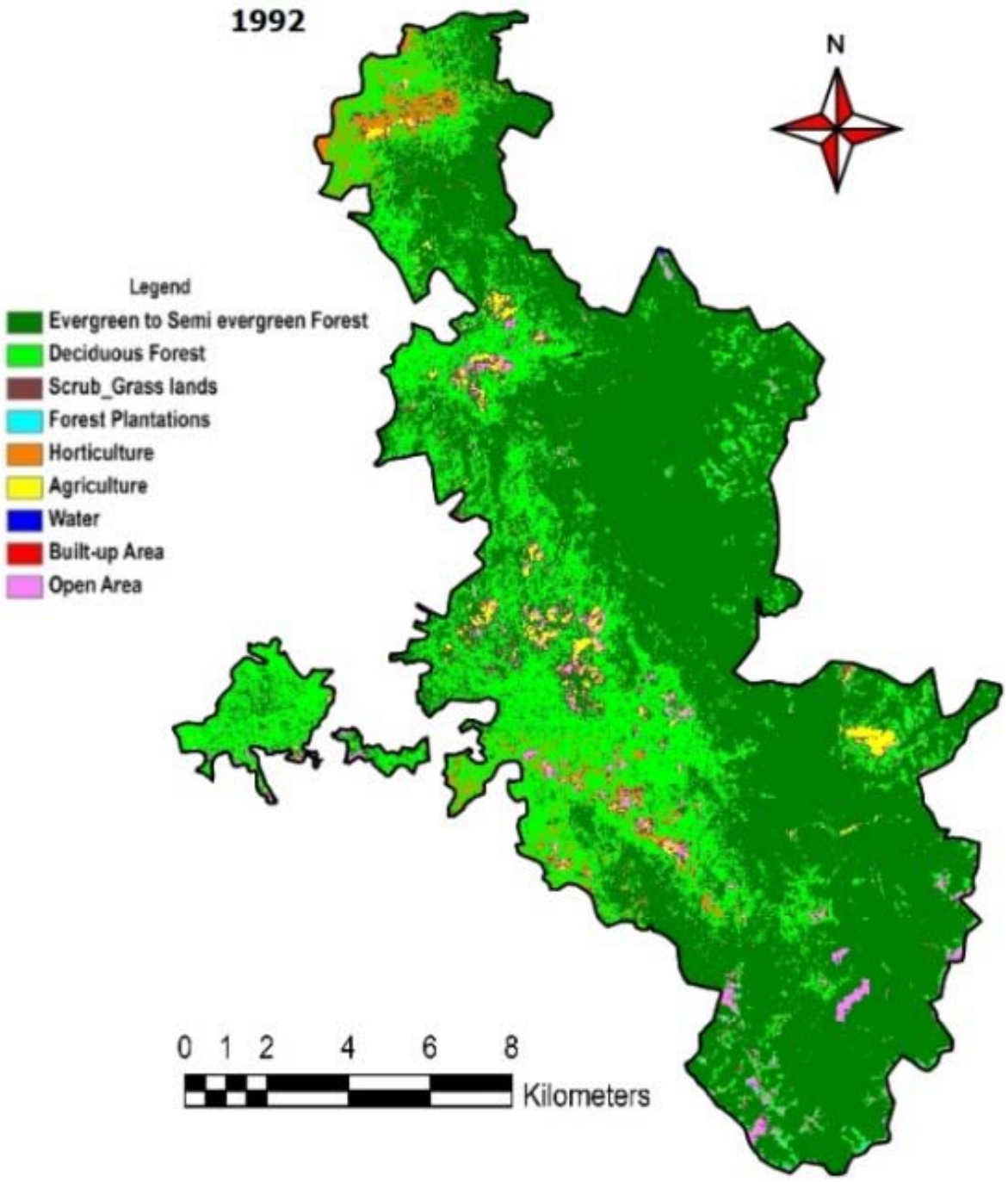
Mookambika Wildlife Sanctuary



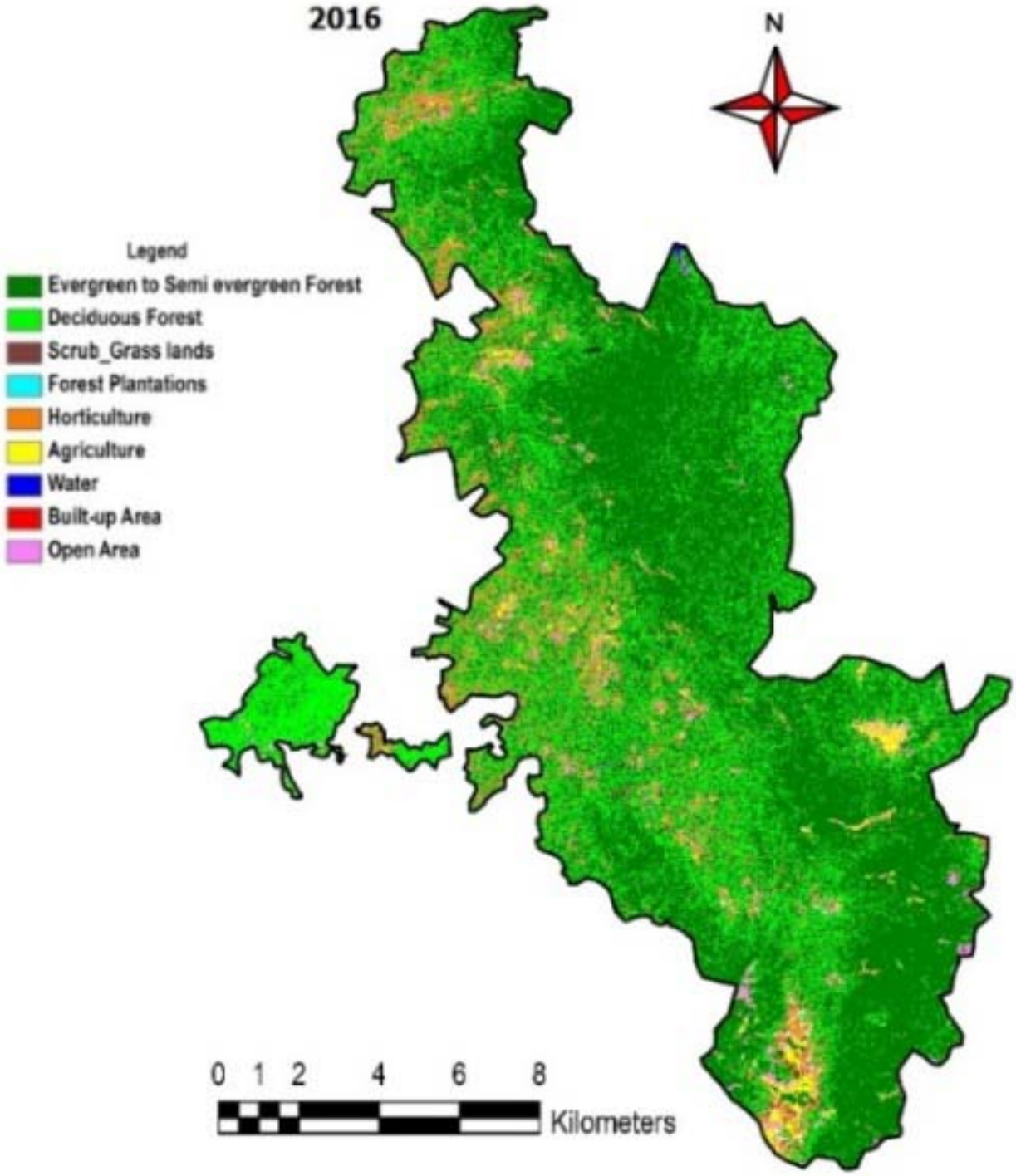
Someshwara Wildlife Sanctuary



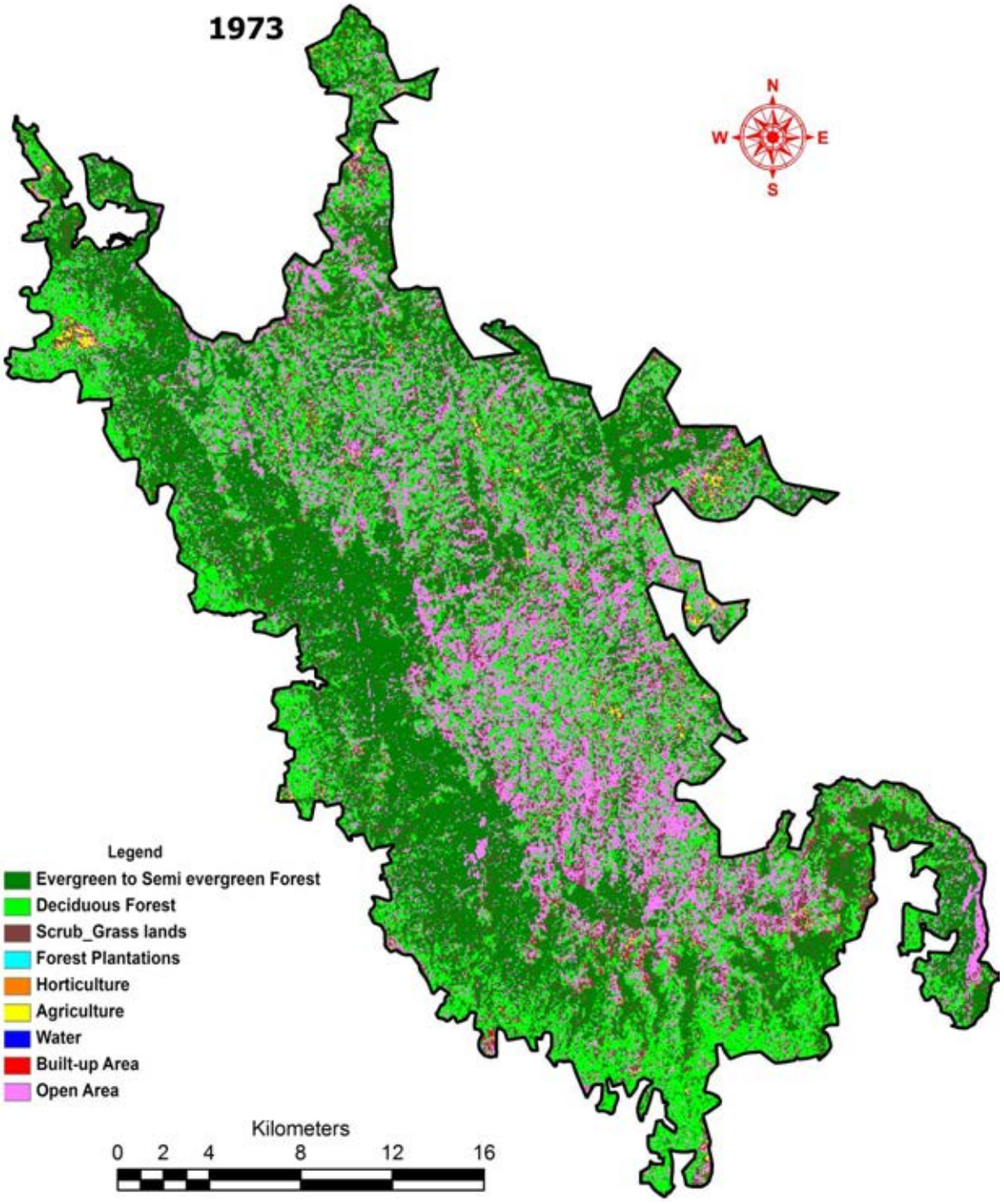
Someshwara Wildlife Sanctuary



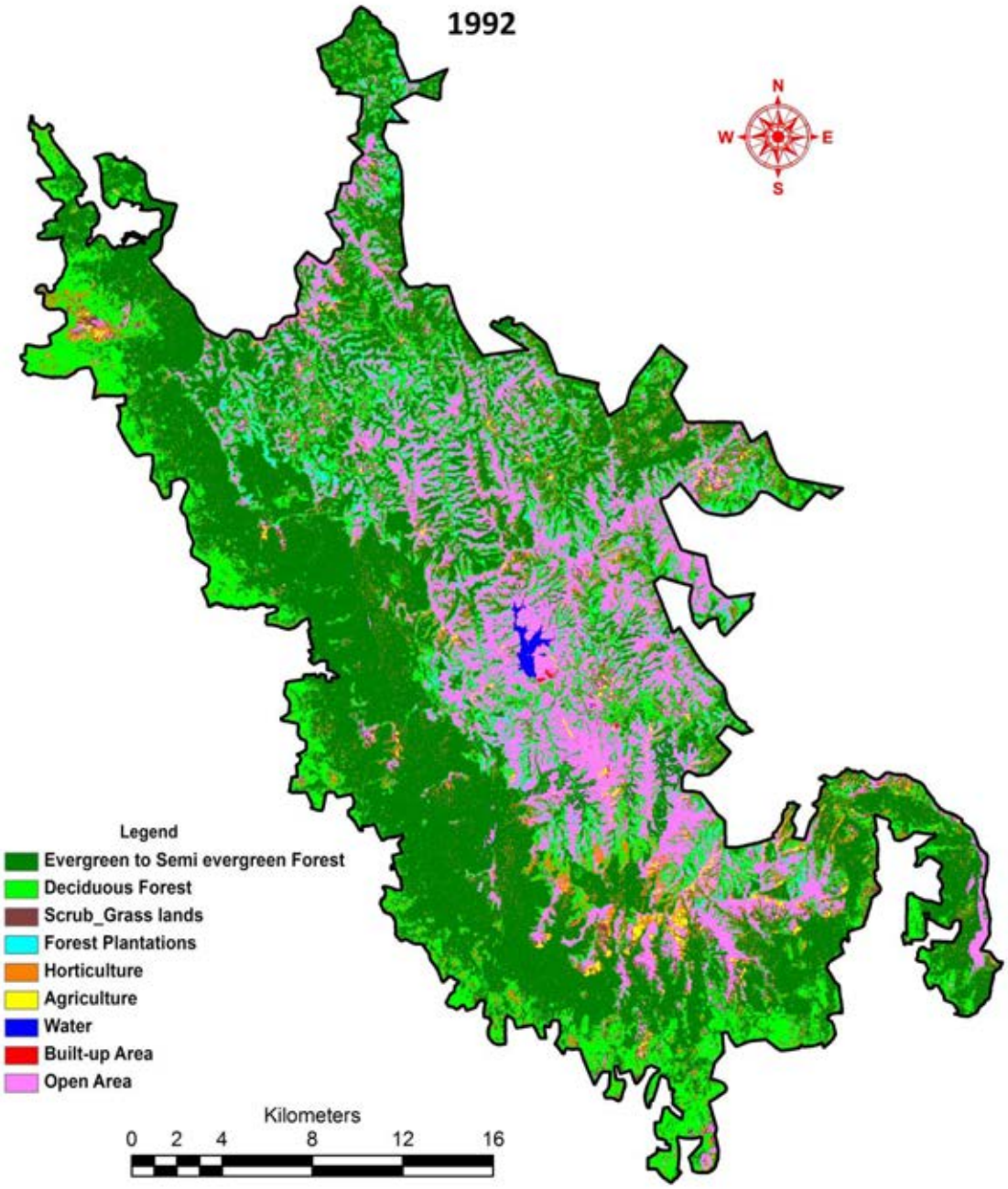
Someshwara Wildlife Sanctuary



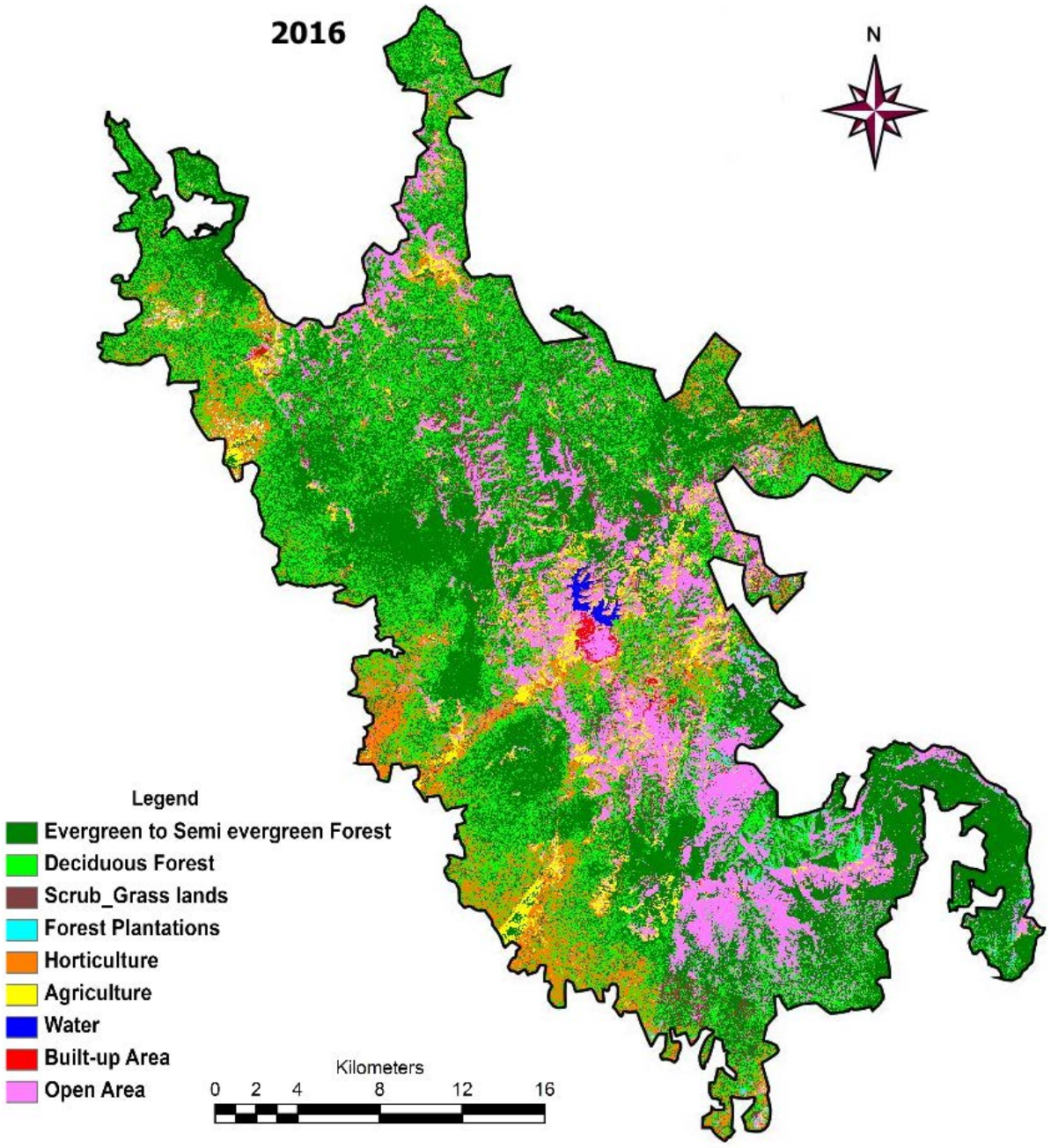
Kudremukh National Park



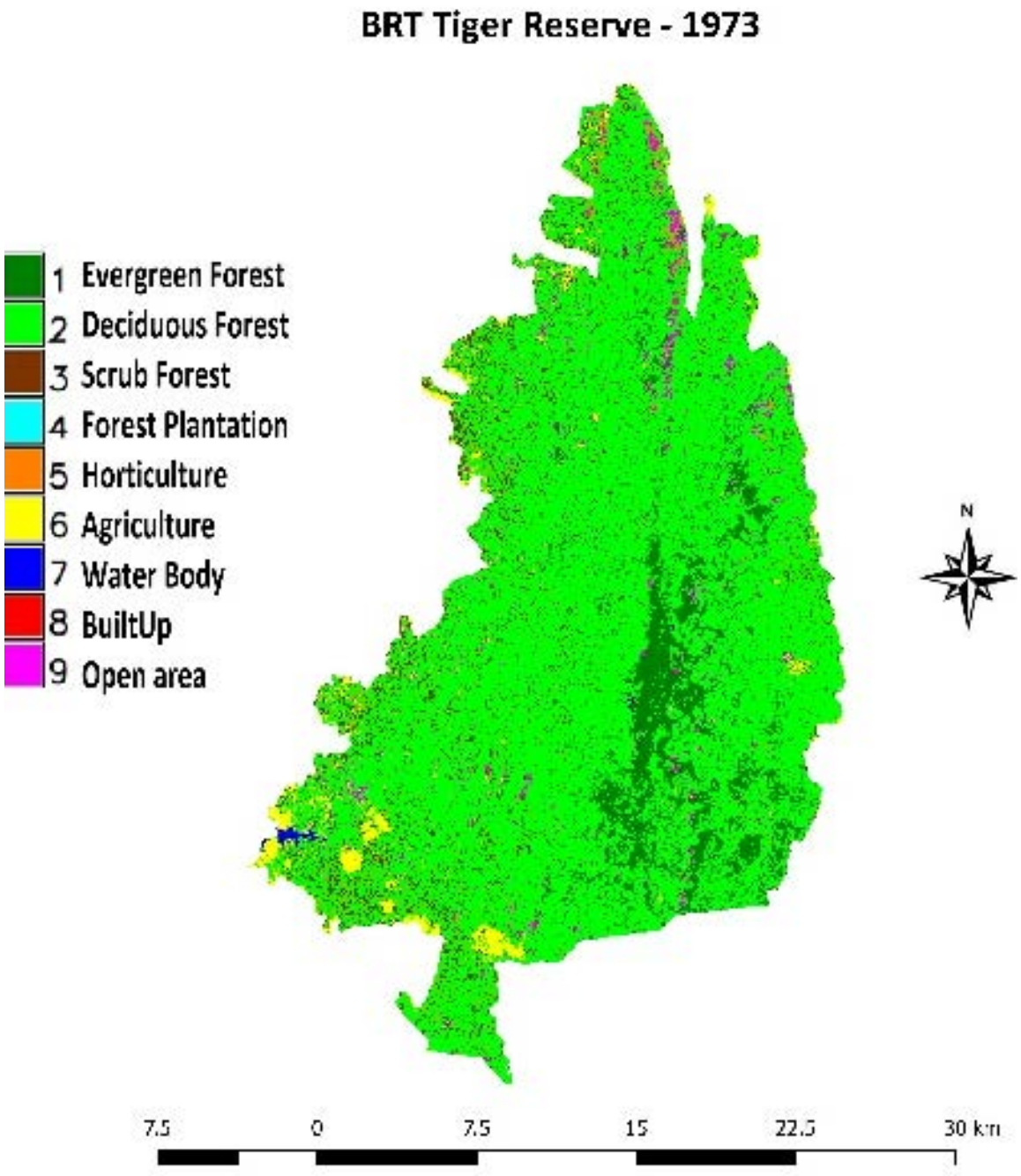
Kudremukh National Park

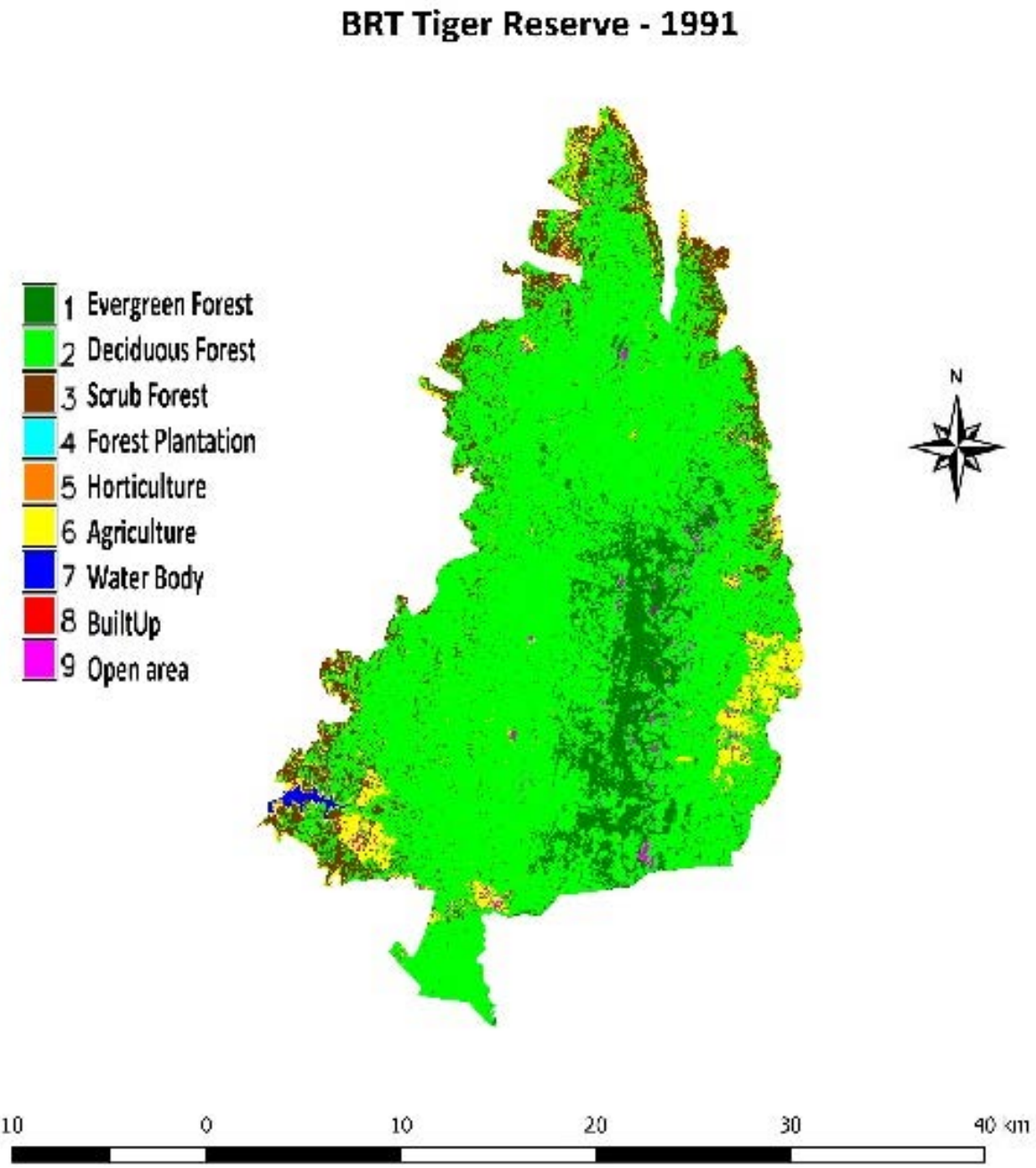


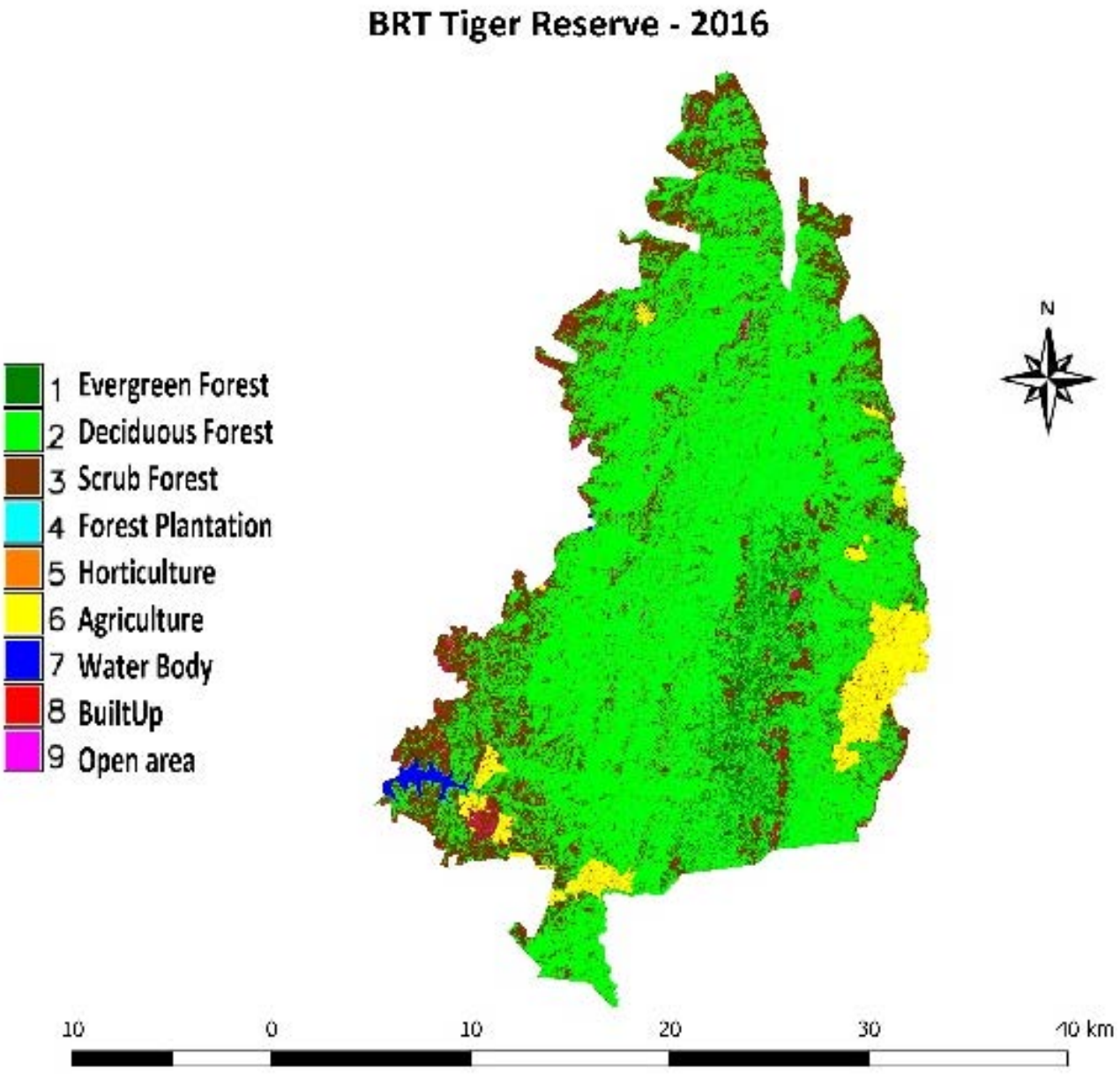
Kudremukh National Park



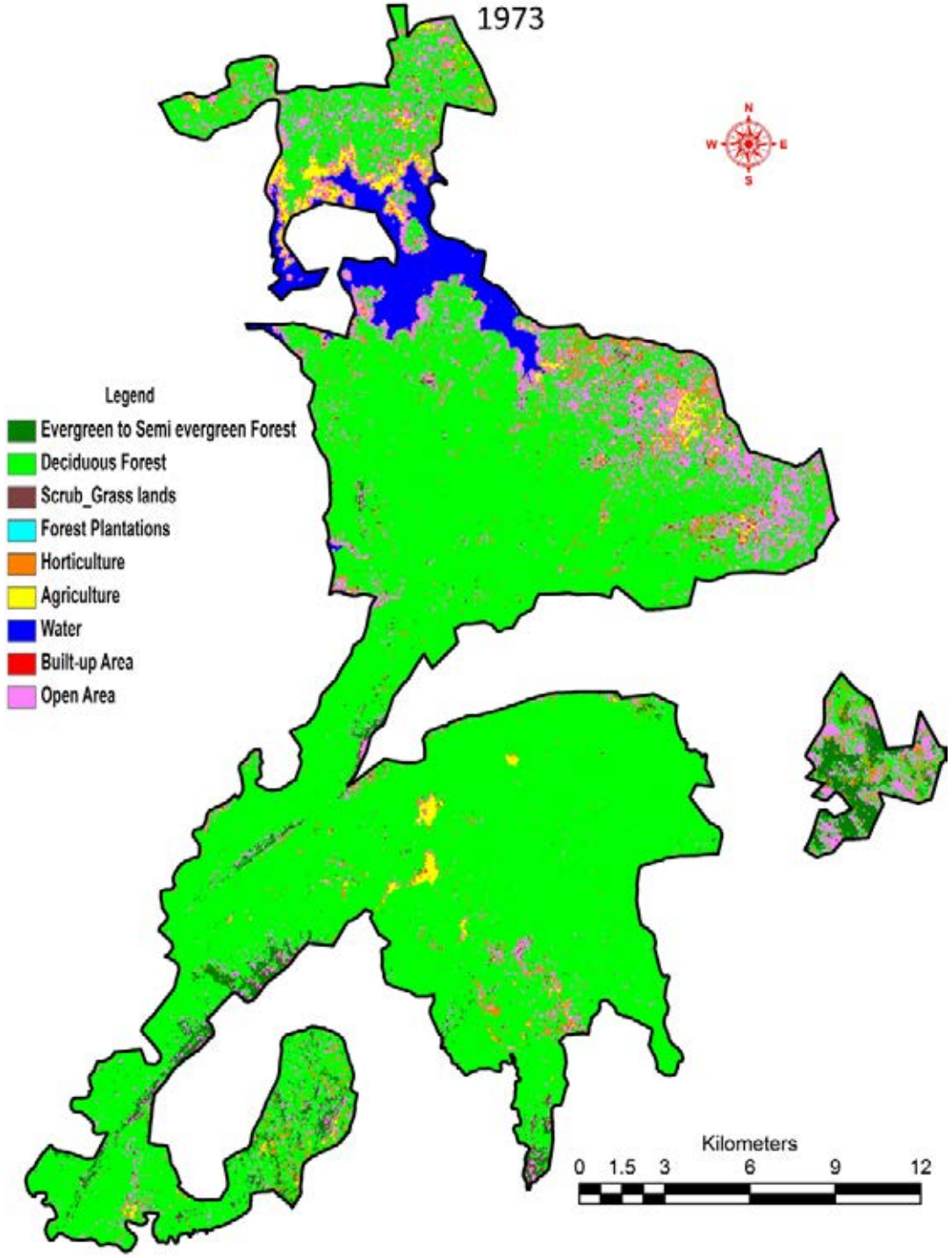
6. BRT Tiger Reserve



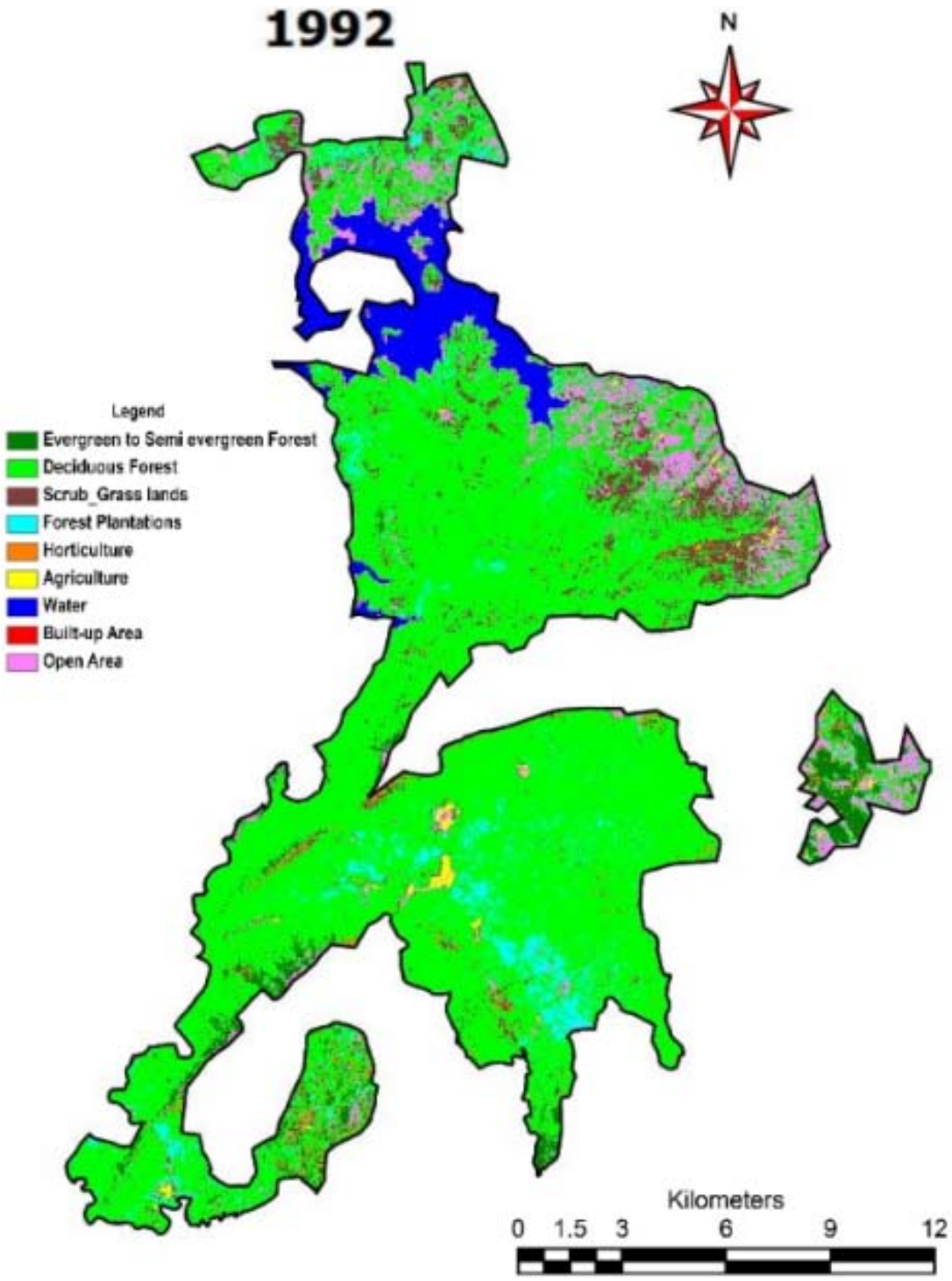

BRT Tiger Reserve - 1991
1 Evergreen Forest
2 Deciduous Forest
3 Scrub Forest
4 Forest Plantation
5 Horticulture
6 Agriculture
7 Water Body
8 BuiltUp
9 Open area
N
10 0 10 20 30 40 km


BRT Tiger Reserve - 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
10
0
10
20
30
40 km

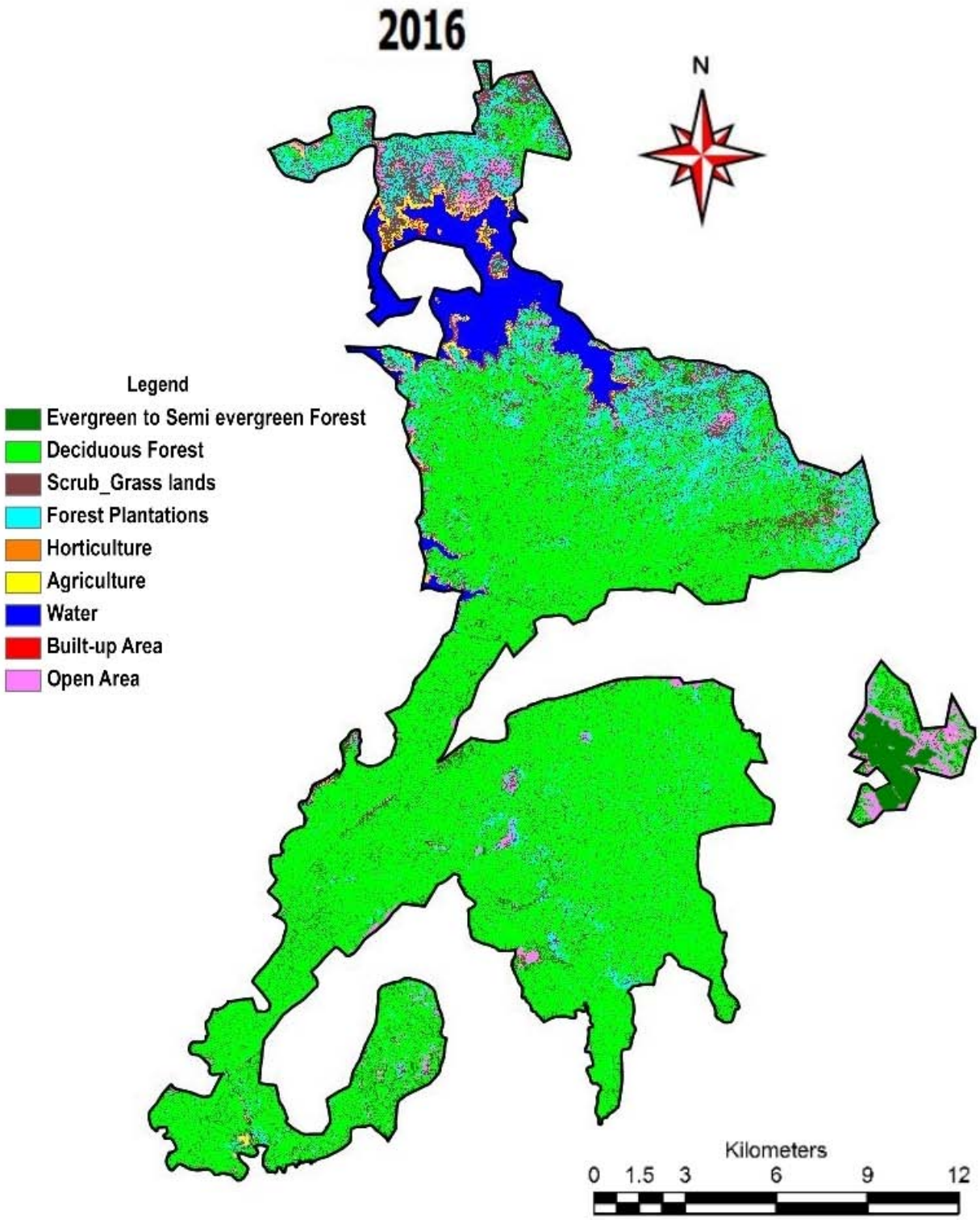
7. Bhadra Wildlife Sanctuary



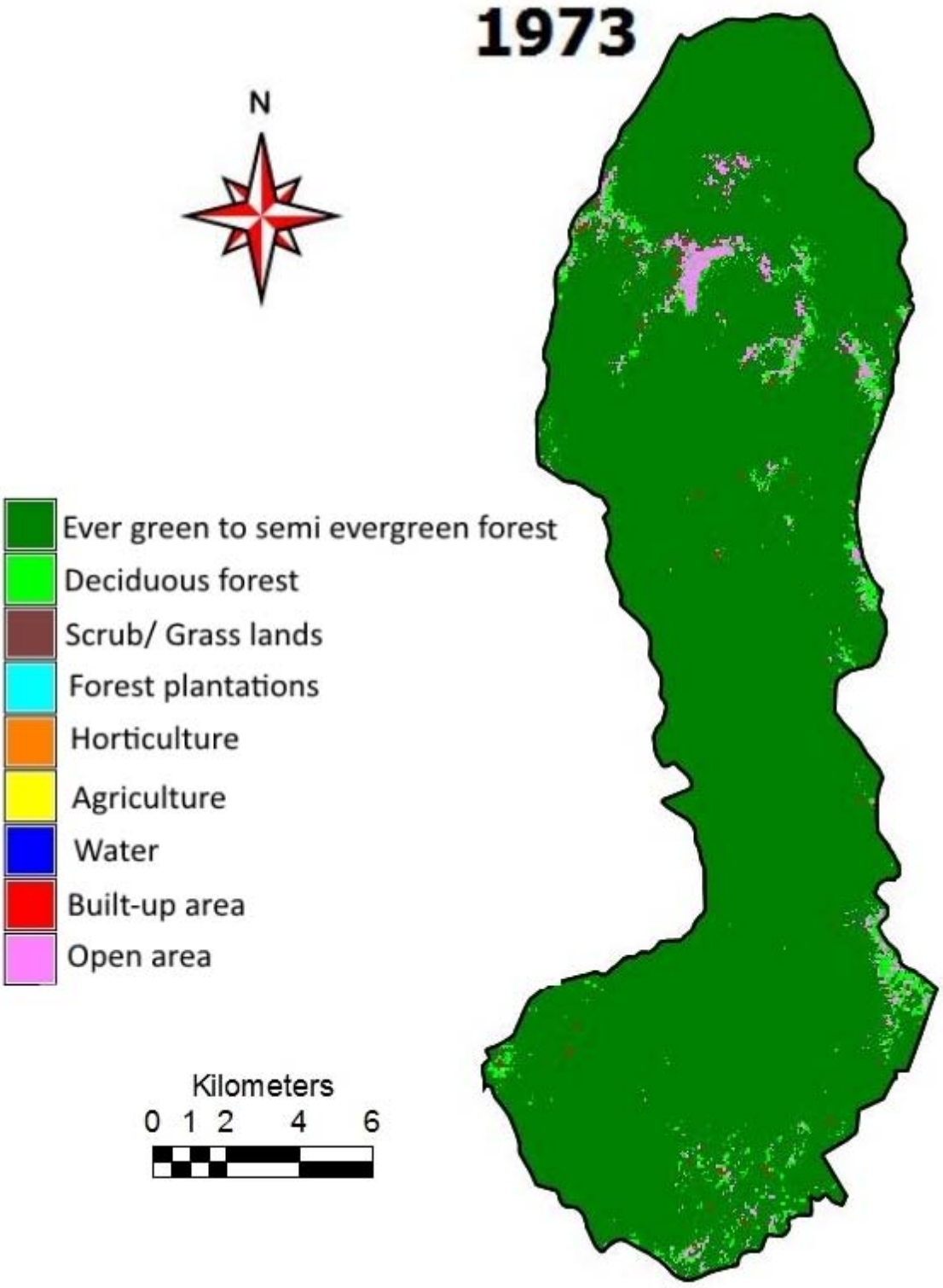
Bhadra Wildlife Sanctuary



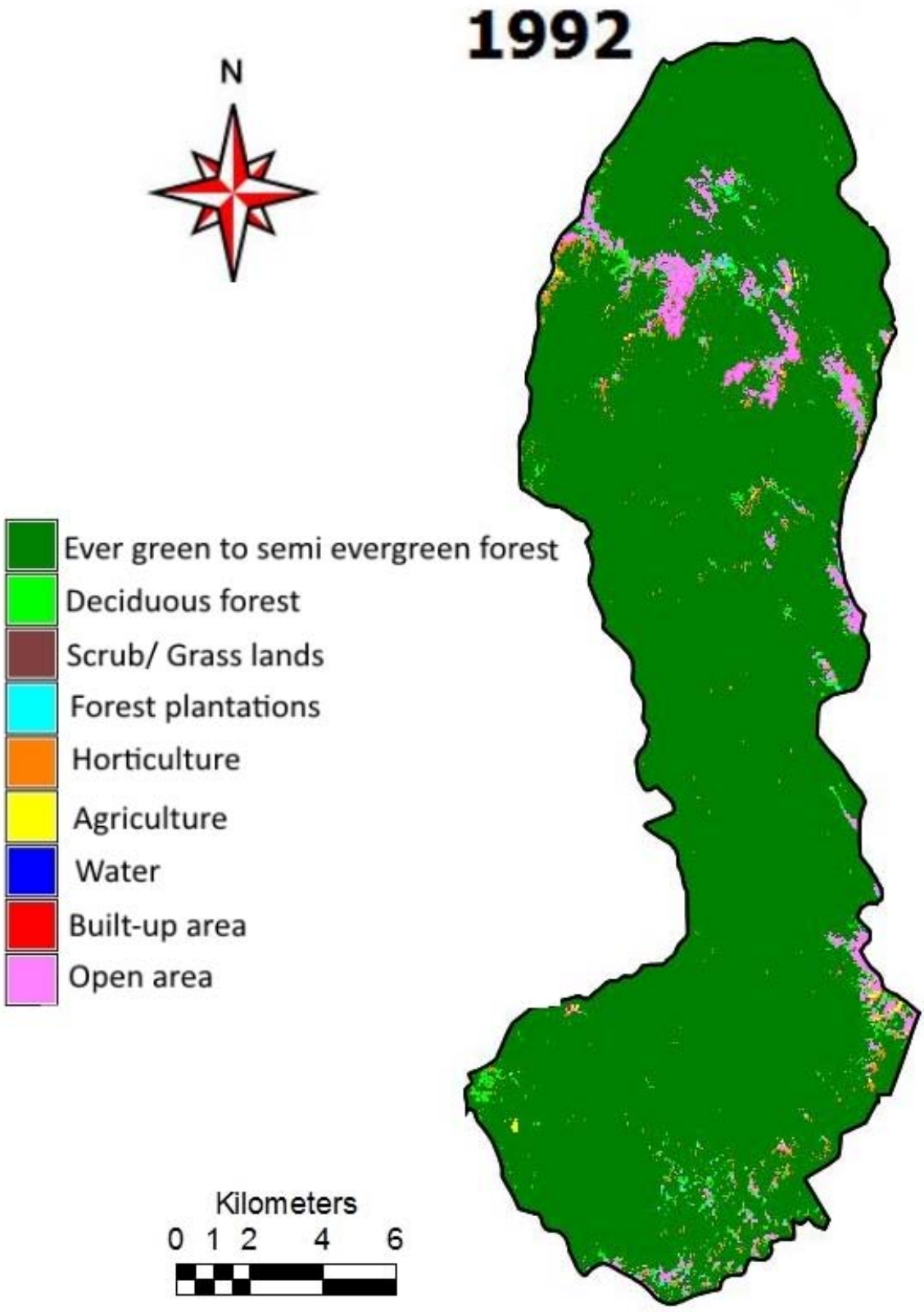
Bhadra Wildlife Sanctuary



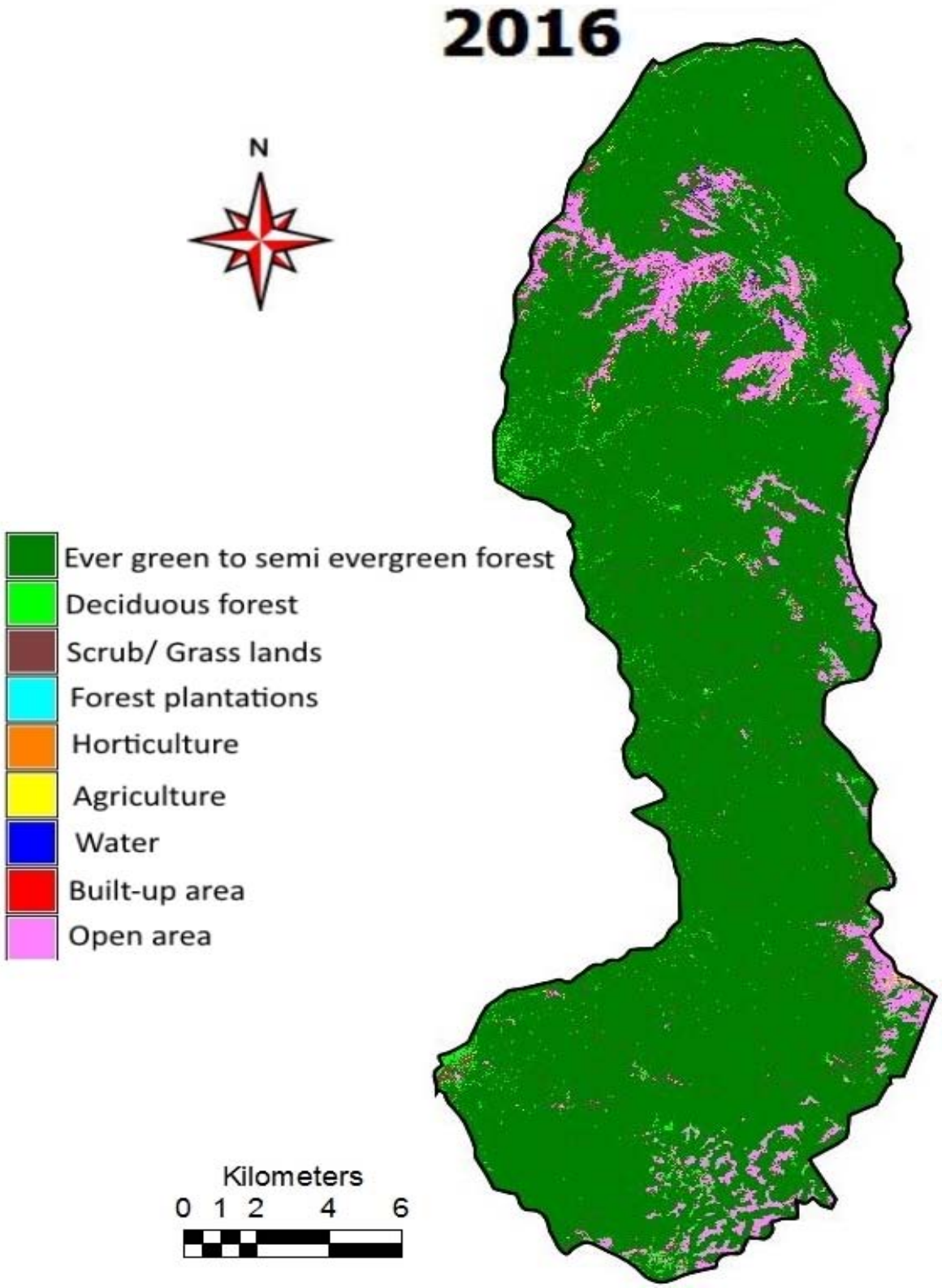
8. Pushpagiri Wildlife Sanctuary



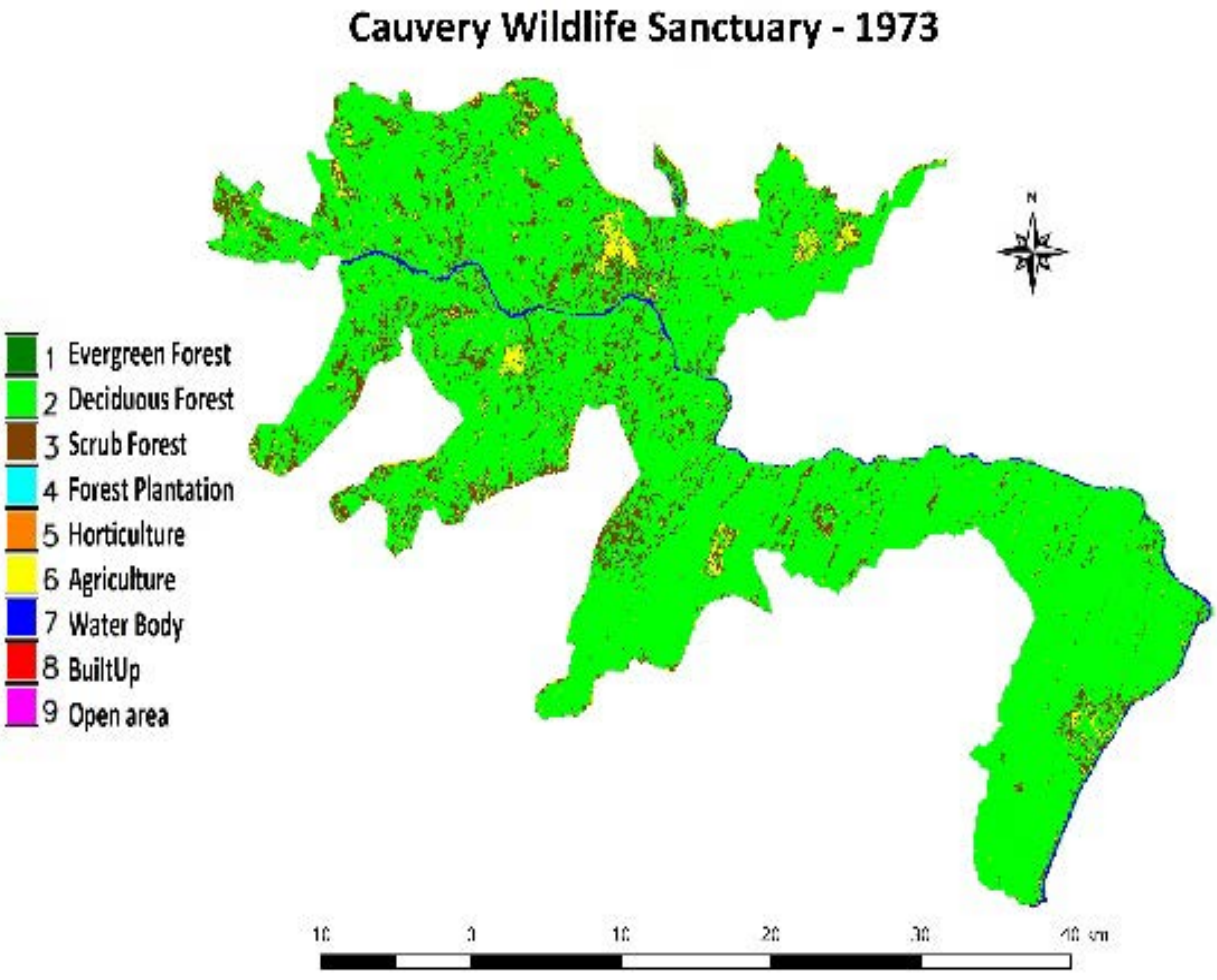
Pushpagiri Wildlife Sanctuary

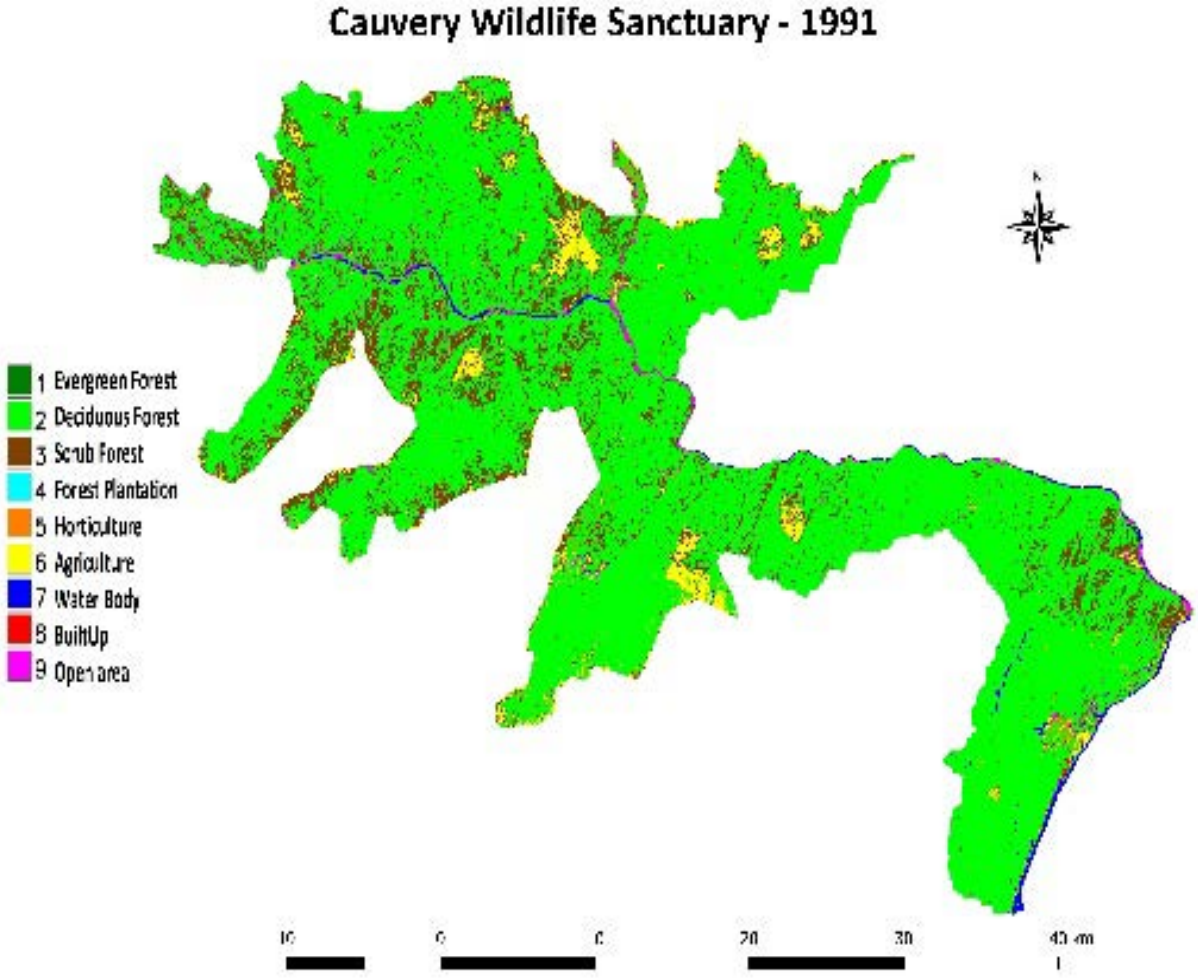


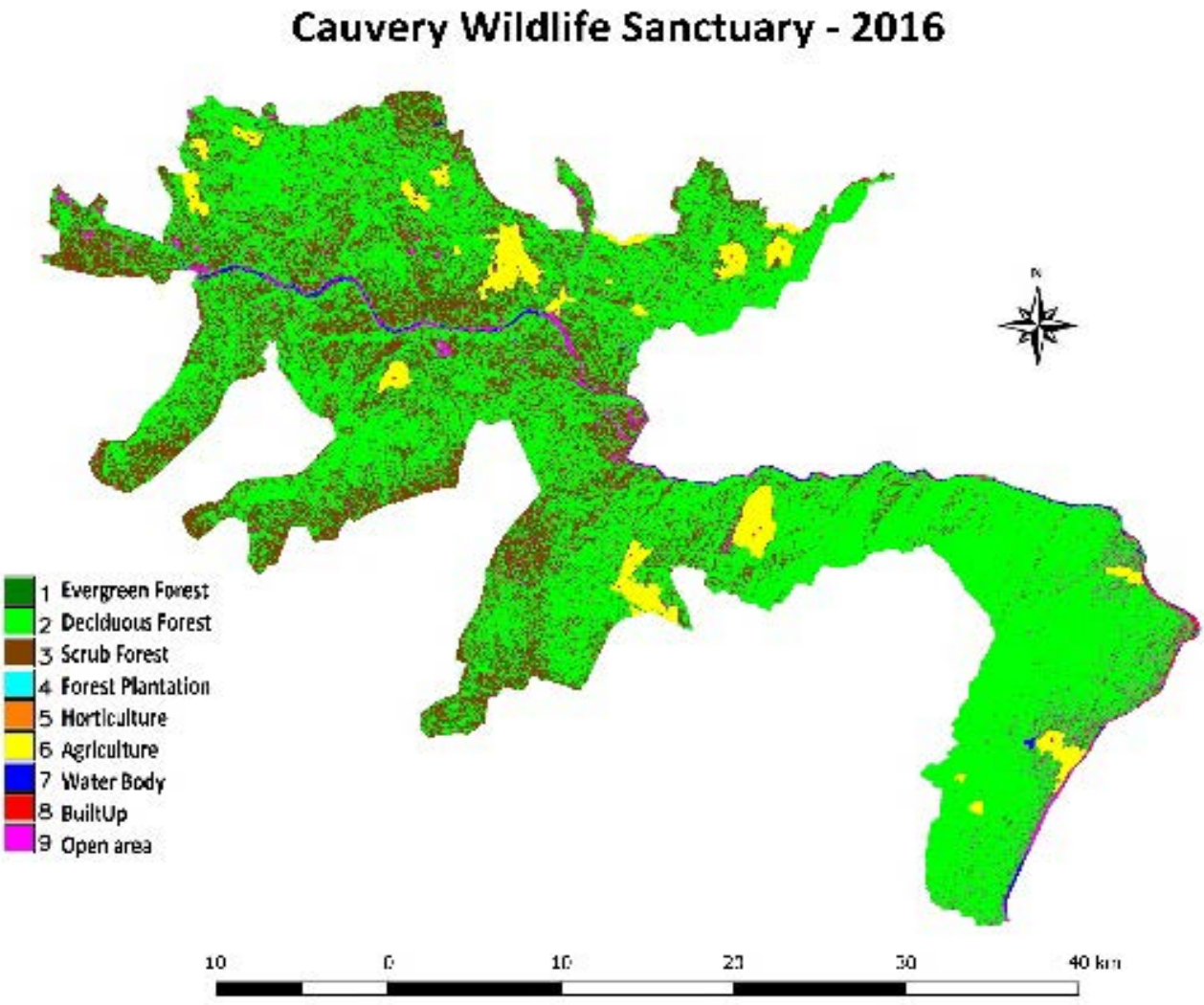
Pushpagiri Wildlife Sanctuary



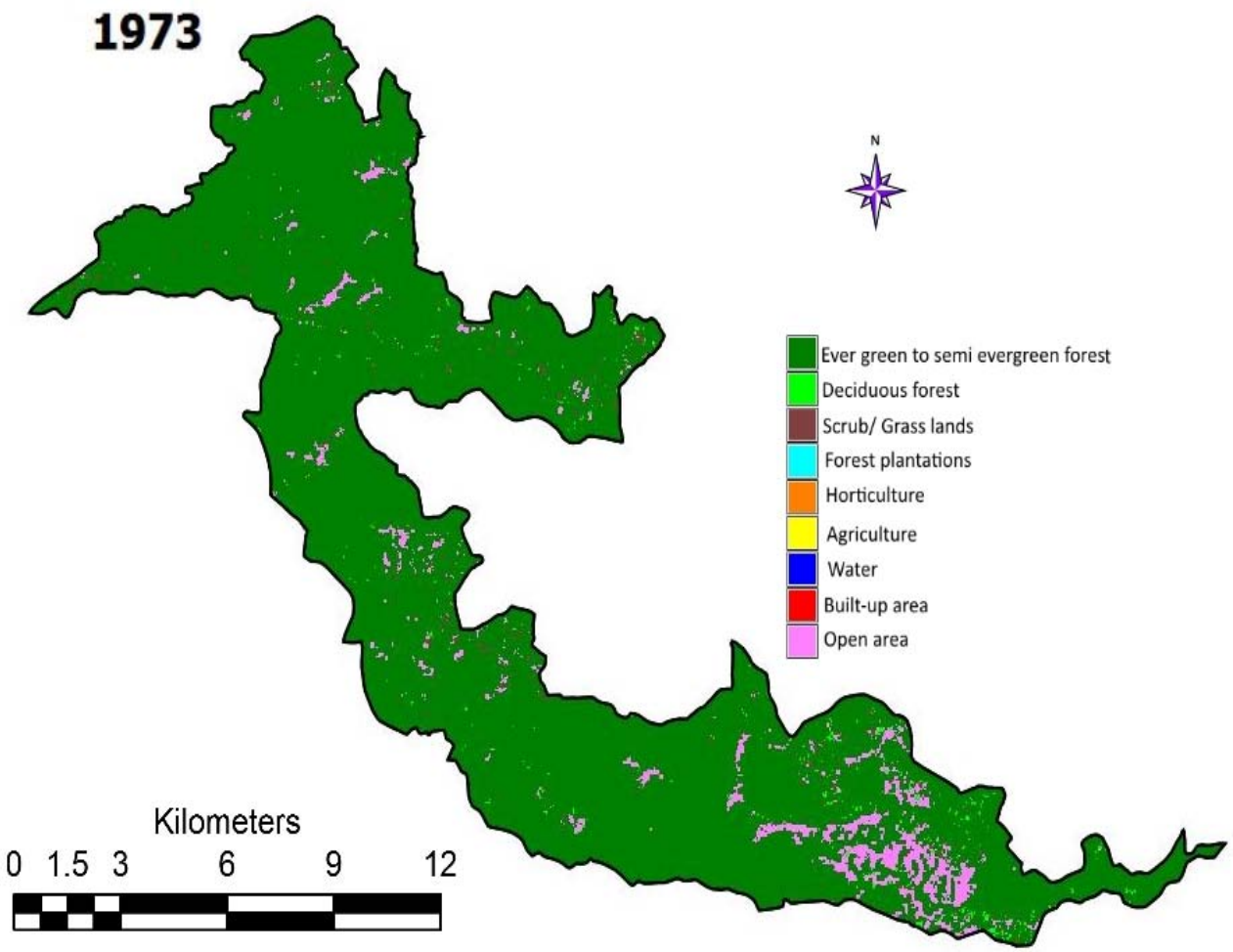
9. Cauvery Wildlife Sanctuary



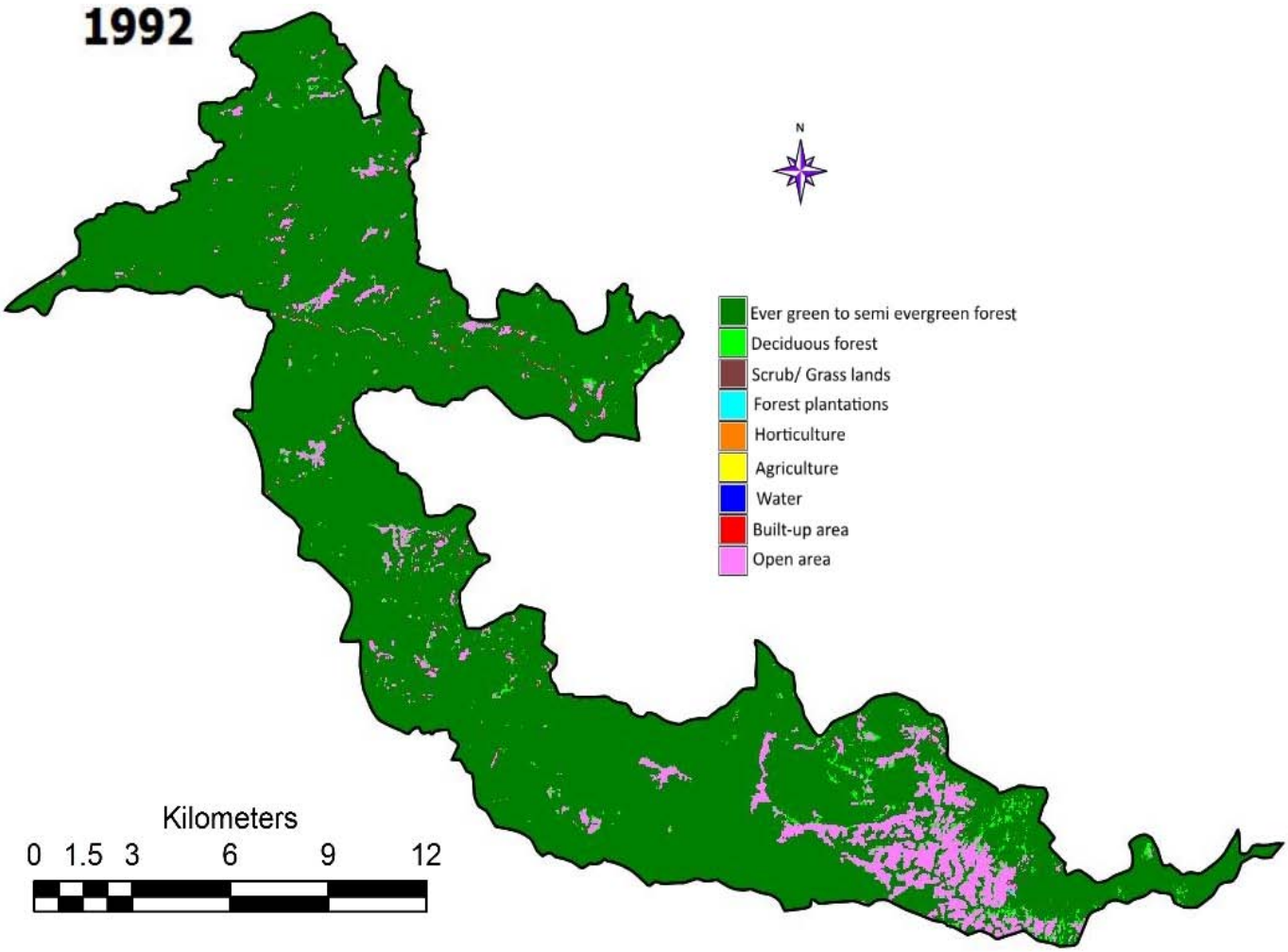

Cauvery Wildlife Sanctuary - 1991
1 Evergreen Forest
2 Deciduous Forest
3 Scrub Forest
4 Forest Plantation
5 Horticulture
6 Agriculture
7 Water Body
8 BuiltUp
9 Open area
N
10
0
0
20
30
40 Km


Cauvery 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
10
0
10
20
30
40 km

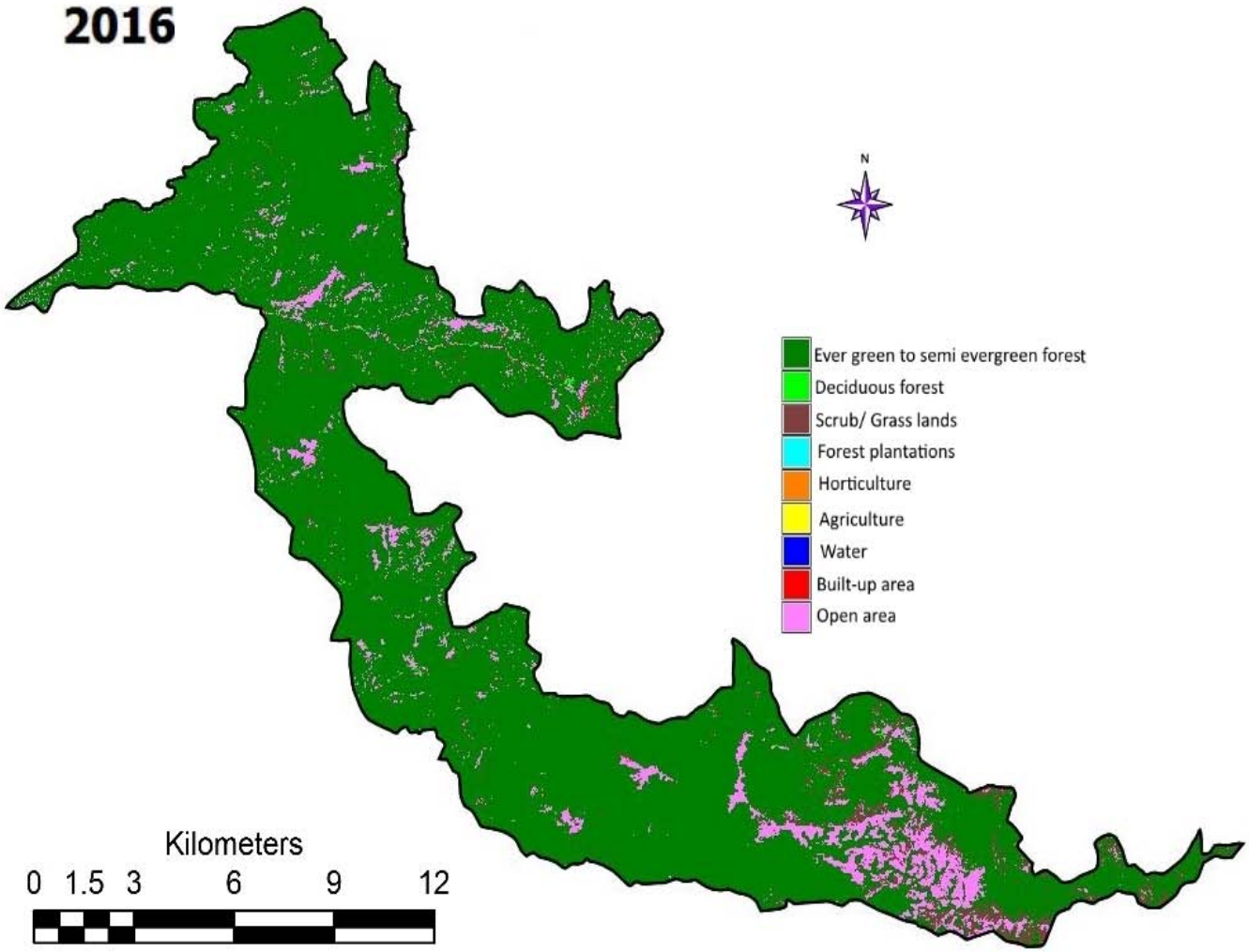
10. Brahmagiri Wildlife Sanctuary



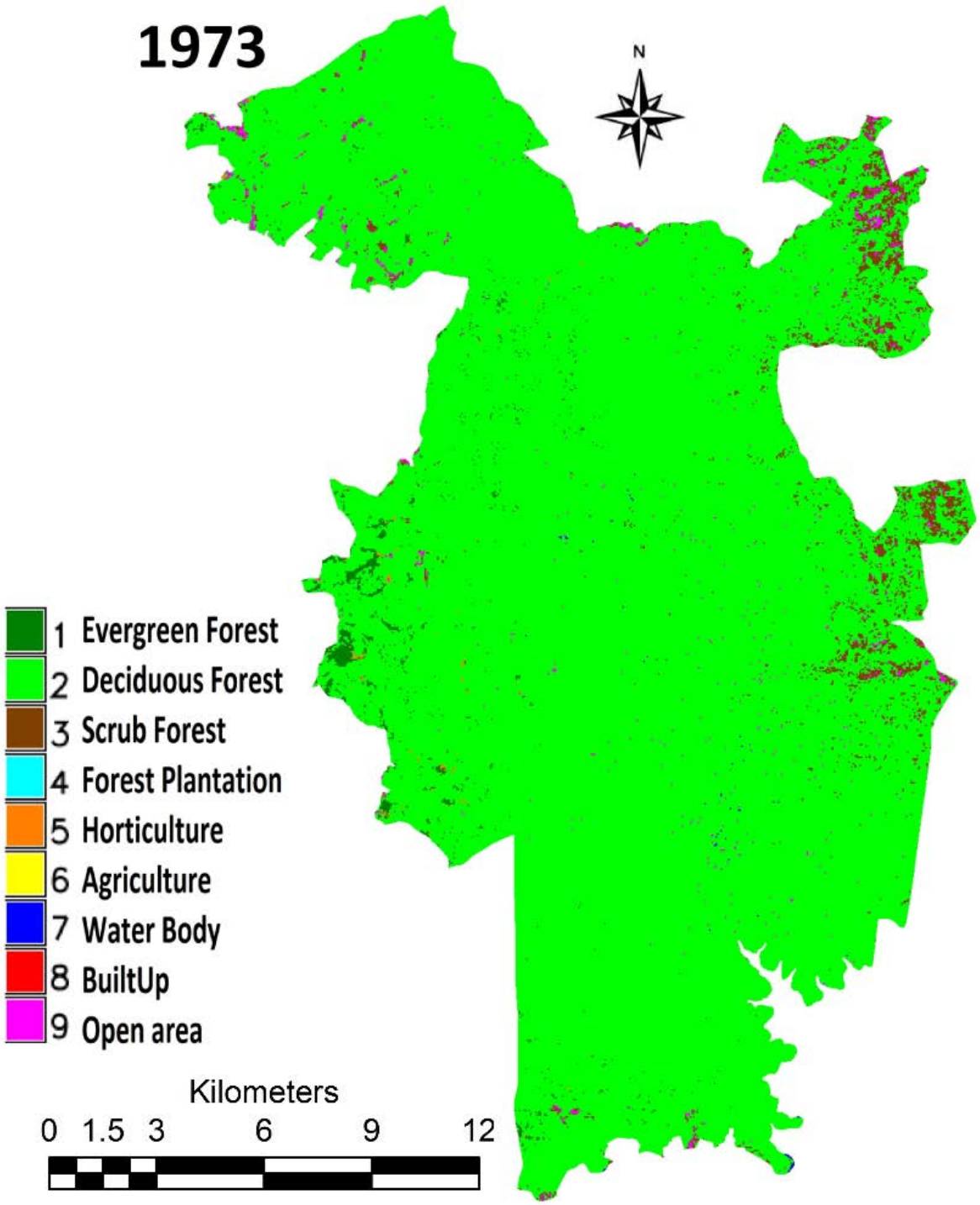
Brahmagiri Wildlife Sanctuary



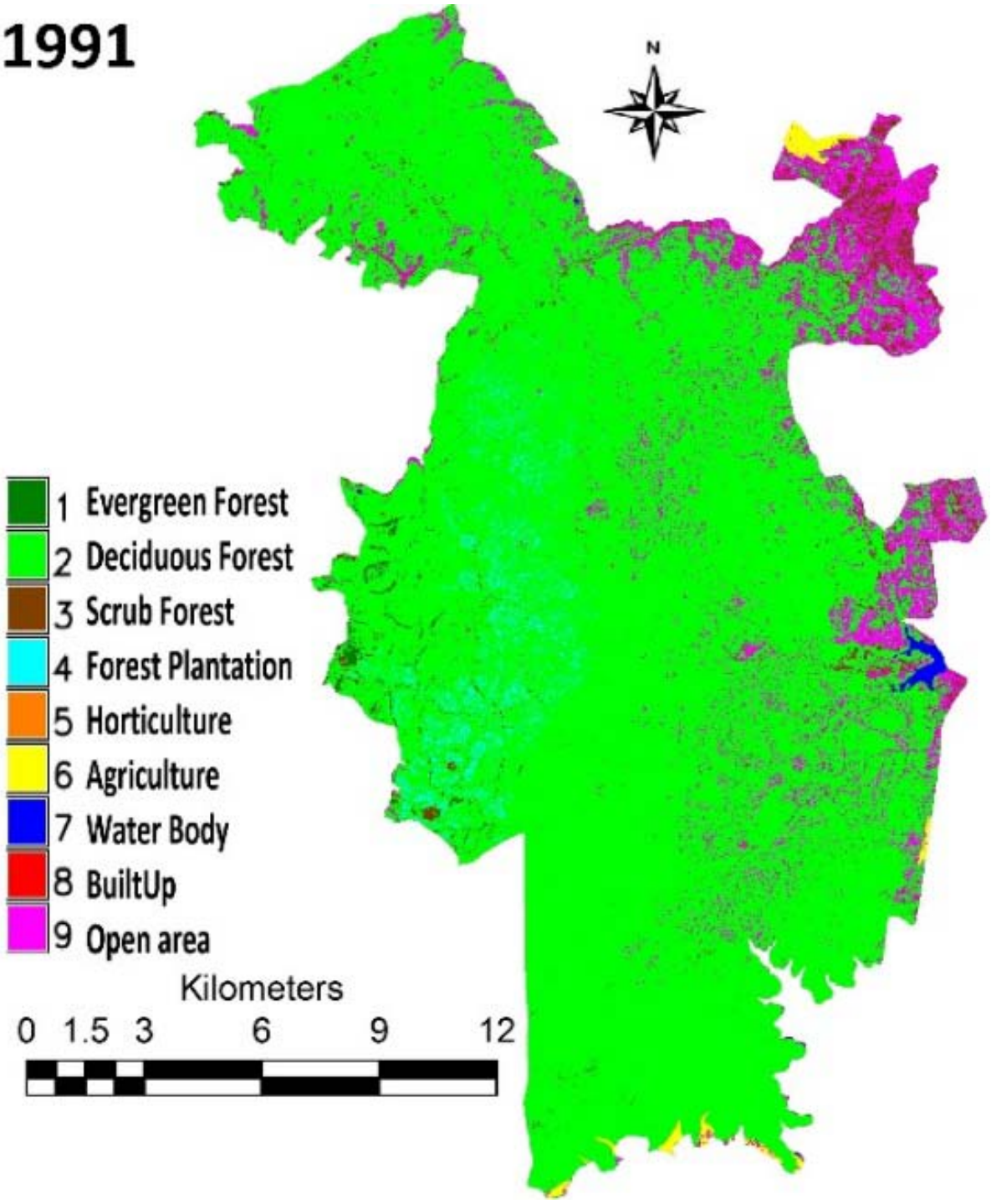
Brahmagiri Wildlife Sanctuary



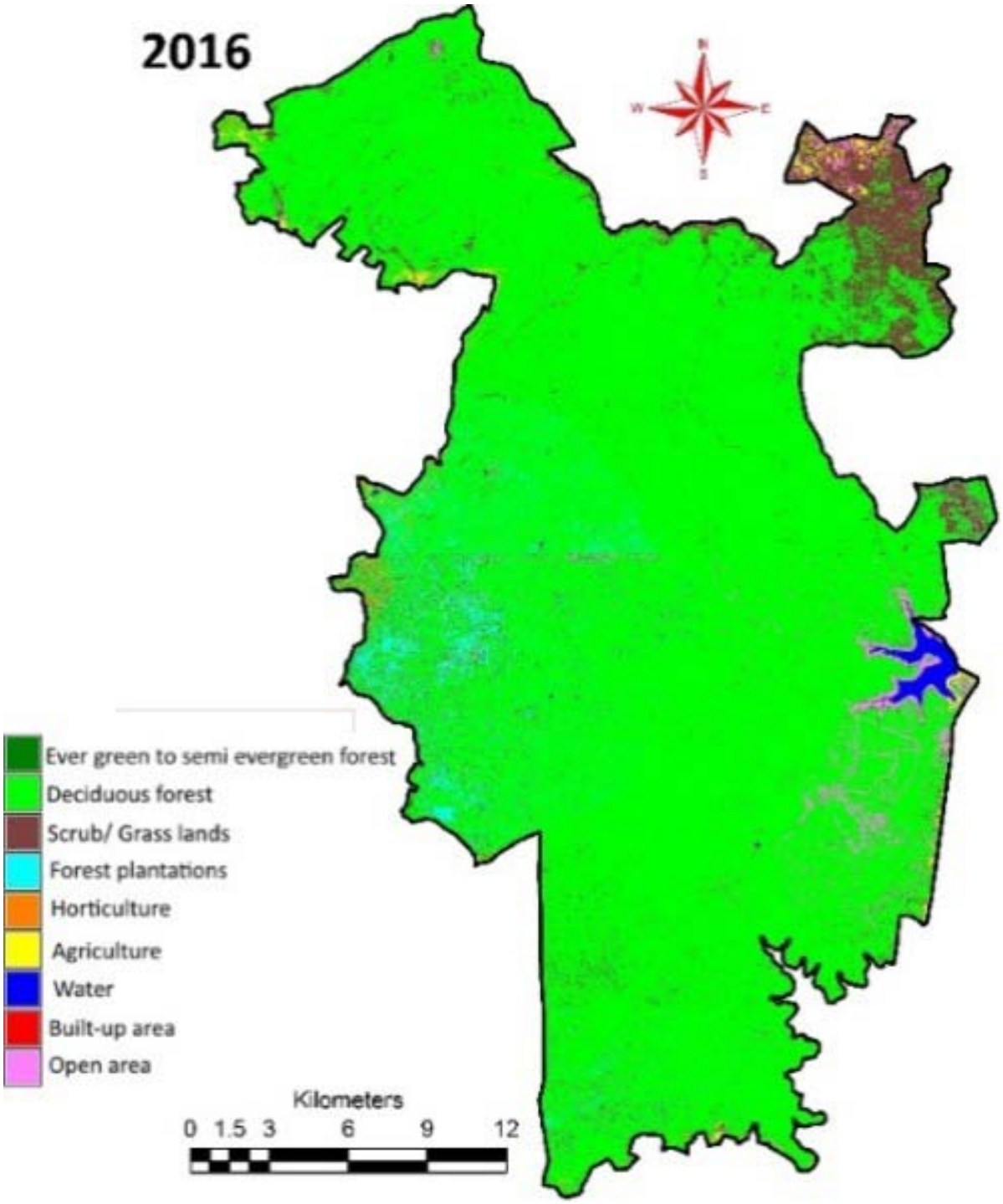
11. Nagarahole Tiger Reserve



Nagarahole Tiger Reserve



Nagarahole Tiger Reserve



Appendix 2

(Reference: Paragraph 3.1.2, Page 16)

Land Use Land Cover changes between 1973 and 2016 in and around the Protected Areas

Category	Bhadra WLS			Pushpagiri WLS			Cauvery WLS		
	1973	1992	2016	1973	1992	2016	1973	1991	2016
Ever green to semi evergreen	28,712.33	25,761.00	23,319.88	80,159.29	75,552.49	63,841.17	0.00	0.00	0.00
Deciduous forest	110,052.20	96,652.24	82,236.05	10,110.33	11,245.49	13,697.26	268,925.76	238,540.83	197,619.42
Scrub/Grass land	4,168.20	11,952.15	19,921.96	693.65	1,726.27	5,417.84	42,724.80	47,337.38	69,789.38
Forest Plantations	220.22	6,078.06	13,702.54	87.50	464.76	524.12	0.00	0.00	0.00
Horticulture	21,517.56	22,037.61	32,050.55	4,089.87	4,511.79	6,551.82	0.00	14,361.51	7,102.26
Agriculture	18,150.57	16,626.24	10,570.89	613.05	1,242.99	2,857.55	86,332.68	86,657.19	95,303.98
Water	5,645.34	9,922.95	9,955.07	20.00	106.57	320.75	4,768.56	6,470.47	3,266.79
Built-up area	1,005.76	1,278.64	1,430.90	37.79	101.35	133.88	0.00	3,178.81	3,959.89
Open area	30,239.96	29,403.25	26,524.30	3,485.43	4,345.20	5,952.51	3,160.80	9,372.80	28,872.60

Category	Sharavathi WLS			Kudremukh WLS			BRT TR		
	1973	1992	2016	1973	1992	2016	1973	1991	2016
Ever green to semi evergreen	59724.77	55813.81	49578.93	97339.48	84737.33	79188.98	12180.24	11525.58	3895.65
Deciduous forest	57157.66	60015.33	61303.15	68498.74	70095.50	72181.26	116337.24	101572.74	87191.41
Scrub/Grass land	21429.86	17310.41	11356.91	9887.47	17812.70	18747.29	17566.56	28073.34	50613.39
Forest Plantations	5321.46	9280.24	9229.62	0.00	2771.10	2027.64	0.00	0.00	2562.68
Horticulture	17606.25	17552.89	25238.75	60489.62	63461.74	73517.56	2989.44	6685.65	13340.21
Agriculture	20395.77	20852.57	20118.75	18671.58	14351.93	10130.68	61964.28	68722.83	48939.48
Water	13055.49	16190.81	15076.67	1.98	218.16	337.25	1383.12	1178.28	3069.41
Built-up area	4631.88	5121.73	6008.60	1884.69	1939.27	2447.58	0.00	1277.82	5255.93
Open area	17484.96	14670.33	18897.31	34172.68	35558.51	32368.00	10968.12	4356.27	8526.84

Category	Nagarahole NP			Mookambika WLS			Someshwara WLS			Talacauvery WLS	
	1973	1991	2016	1973	1992	2016	1973	1992	2016	1991	2016
Ever green to semi evergreen	4462.74	3553.11	8957.49	57122.22	52055.06	50061.12	71166.22	65496.40	57720.42	41892.48	42113.00
Deciduous forest	127345.05	110151.99	103300.43	47114.94	60336.98	60124.25	45534.88	46000.61	51310.10	12555.90	7305.58
Scrub/Grass land	14091.30	15257.34	17796.61	22562.60	13020.99	11721.44	1569.97	3040.63	3529.16	425.70	1670.29
Forest Plantations	0.00	1244.07	2402.62	2603.84	3956.52	1832.32	0.00	1356.75	174.67	0.00	0.00
Horticulture	37662.12	31224.60	25904.67	28943.25	37433.59	41861.83	34272.36	35186.98	39411.14	23822.37	36796.23
Agriculture	54261.27	54565.47	69447.31	41158.59	27666.27	27375.47	15415.74	13384.44	13563.64	5671.80	2201.86
Water	878.49	5327.28	4861.29	4489.78	9491.01	10667.88	0.72	3281.94	4760.64	0.00	0.00
Built-up area	910.26	2447.10	1770.43	5011.21	7863.62	8904.04	607.50	601.33	938.26	75.06	636.83
Open area	1940.04	17778.06	7109.76	19106.03	16288.42	15564.11	15096.33	15314.64	12255.69	10318.50	4890.98

Category	MM hills			ADTR			Bandipur TR			Brahmagiri WLS		
	1973	1991	2016	1973	1992	2016	1973	1991	2016	1973	1992	2016
Ever green to semi evergreen	2158.92	2541.96	3384.40	260327.70	199410.48	155749.89	2208.24	7163.28	3262.71	71473.14	60861.87	58487.81
Deciduous forest	237871.44	209341.35	202713.27	26189.41	41428.37	49942.13	225672.84	173847.51	173062.99	12747.27	11867.94	9692.00
Scrub/Grass land	12285.36	38673.27	34725.69	5909.50	5990.53	10827.89	25139.16	42196.77	93593.87	5120.55	7058.43	8115.36
Forest Plantations	0.00	0.00	0.00	8105.16	26261.34	42998.74	0.00	0.00	478.36	1407.51	1402.43	1497.71
Horticulture	24.48	17.64	3114.37	0.00	1098.89	3174.08	15908.04	12372.30	10607.78	33894.45	40720.05	39811.75
Agriculture	50473.08	52176.06	54838.09	5469.26	10871.72	14354.82	92278.08	120952.53	65011.30	11261.97	17345.74	21366.30
Water	1295.28	1876.68	1026.68	591.12	10482.68	17247.87	1567.80	4887.72	4992.39	44.79	27.27	320.39
Built-up area	18.00	598.95	1623.19	574.65	3138.52	3710.29	0.00	2842.83	3942.05	555.21	782.91	1302.60
Open area	2394.36	1294.56	5097.91	1167.57	9651.85	10328.67	3029.04	1538.82	10956.82	12722.58	9160.83	8633.55

Appendix 3

(Reference: Paragraph 5.1.1, Page 34)

Letter addressed by CCF, Project Elephant highlighting the increase in Human Elephant Conflicts due to Mini Hydel Projects

Government of Karnataka
Forest Department

No: B1/BUD/CR-9/2011-12

Office of the
Chief Conservator of Forests
& Field Director
Project Elephant , Aranya Bhavana,
Ashokapuram, Mysore
Date: 26-09-2011.

To

The Principal Chief Conservator of Forests
(Wildlife), Aranya Bhavan,
18th Cross, Malleshwaram
BANGALORE-3

Sir,

Sub : Escalation in HEC in the Malavally Range of Mandya division.

Ref : Deputy Conservator of Forests, Mandya letter No. ಉಅಸಂ./ಮವಿಮ//2011-12 ದಿನಾಂಕ: 02/07/2011(Copy enclosed).

* * * * *

In the recent years the intensity of human elephant conflict has increased many fold in the Malavally Range of Mandya division. As already been brought to your kind notice by the Conservator of Forests, Mysore Circle and Deputy Conservator of Forests, Mandya division, the increase in the conflict level in the Range is mainly due to the accumulated disturbances in last 10-12 years in Dhangur Reserved forest due to several mini hydro electric projects and Doddamakali eco tourism camp of JLR. Severe disturbances caused due to the sound, vehicle movements and several other activities of these projects and camp is driving the elephant herds out of forest areas. This has resulted in the frequent straying out of elephants even upto 20-25 kms from the forest boundary. In one of the such incident when a herd of elephant reached to Bannur on the border of Mandya and Mysore district and subsequently though driven back by the forest officials, two sub adult males got separated. These two elephants reached to Mysore City on 08-06-2011.

Recently, again a herd of five elephants moved up to Markal-Aladhally, about 20-25 kms from forests, towards the Bannur after crossing the highways. Though department has taken quick action to drive them back, after the darkness monitoring of their movements became very difficult due to the sugarcane and tree crops in the agriculture fields. In the midnight, elephants reached to the Malavally town. The alert staff took immediate action in driving them back to the forests. It is informed that there are

about 17 elephants in the Dhangur & Basavenbetta R.F's. Due to the disturbance in the elephants home range areas, in and around these reserved forests, the elephants are straying out in small groups of 5 to 7 for crop raiding and some time in their attempt to disperse out, reach upto 20-25 kms. The area on the other side of Cauvery river, the Satyagal Jagir also has disturbance due to the hydel power project, eco-tourism activities at Gagan Chukki/Barchukki falls and encroachments. In fact the core area of elephant home range along the Shimsha river and from Cauvery water falls to down stream, upto Sangam has now lot of disturbance. The list of hydel projects and eco-tourism camp in the area (on the either side of rivers) is given here below.

1) Limbavali Mini hydel project (Mandya Division)
2) Atrea mini hydel project (Mandya Division)
3) M.S. mini hydel project (Mandya Division)
4) Doddamakali JLR camp (Mandya Division)
5) Pioneer mini hydel project (Satyagal, Kollegal division)

The letter of Deputy Conservator of Forests, Mandya and sketch showing the locations of various mini hydel projects in Mandya and Kollegal divisions are enclosed in Annexure-I.

For mitigation of HEC in the Malvally Range it is necessary that:

1. The work of creation and maintenance of barriers on the fringes of the home range areas should be taken up on top priority. The existing anti depredation camps should be strengthened to effectively check the elephants from straying out.
2. Immediate action should be taken to make the home range area, free from disturbance.
3. Non forest government lands and some of the private lands, around the reserved forest, which are the part of elephant home range, may be transferred to forest department/acquired by the government.
4. Discouraging the crops like banana, sugarcane, maize etc. in the fringe areas of elephant home range.
5. Prompt payment of ex-gratia for the crop damage
6. Posts of Deputy Conservator of Forests, Mandya and Range Forest Officer, Malavally, which are vacant, should be filled up immediately with good officers.

The copies are ...

Funds for excavation 7.00 Kms EPT and 13.00 Kms Solar fencing may be provided to Mandya division for creation of barriers (during 2011-12), as requested by him during the presentation, made before the Hon'ble Forest Minister on 23/09/2011. (Copy of the note given by him during the Hon'ble Forest Minister visit is enclosed here with in Annexure II).

Yours faithfully,

Chief Conservator of Forests 26/9
& Field Director
Project Elephant, Mysore.

Copy to Conservator of Forests, Mysore Circle, Mysore and Chamrajnagar Circle, Chamrajnagar for information.
Copy to Deputy Conservator of Forests, Mandya Division, Mandya and Kollegal Division, Kollegal for information.

ರವಾನಿಸಲಾಗಿದೆ
ದಿನಾಂಕ: 26/9/11

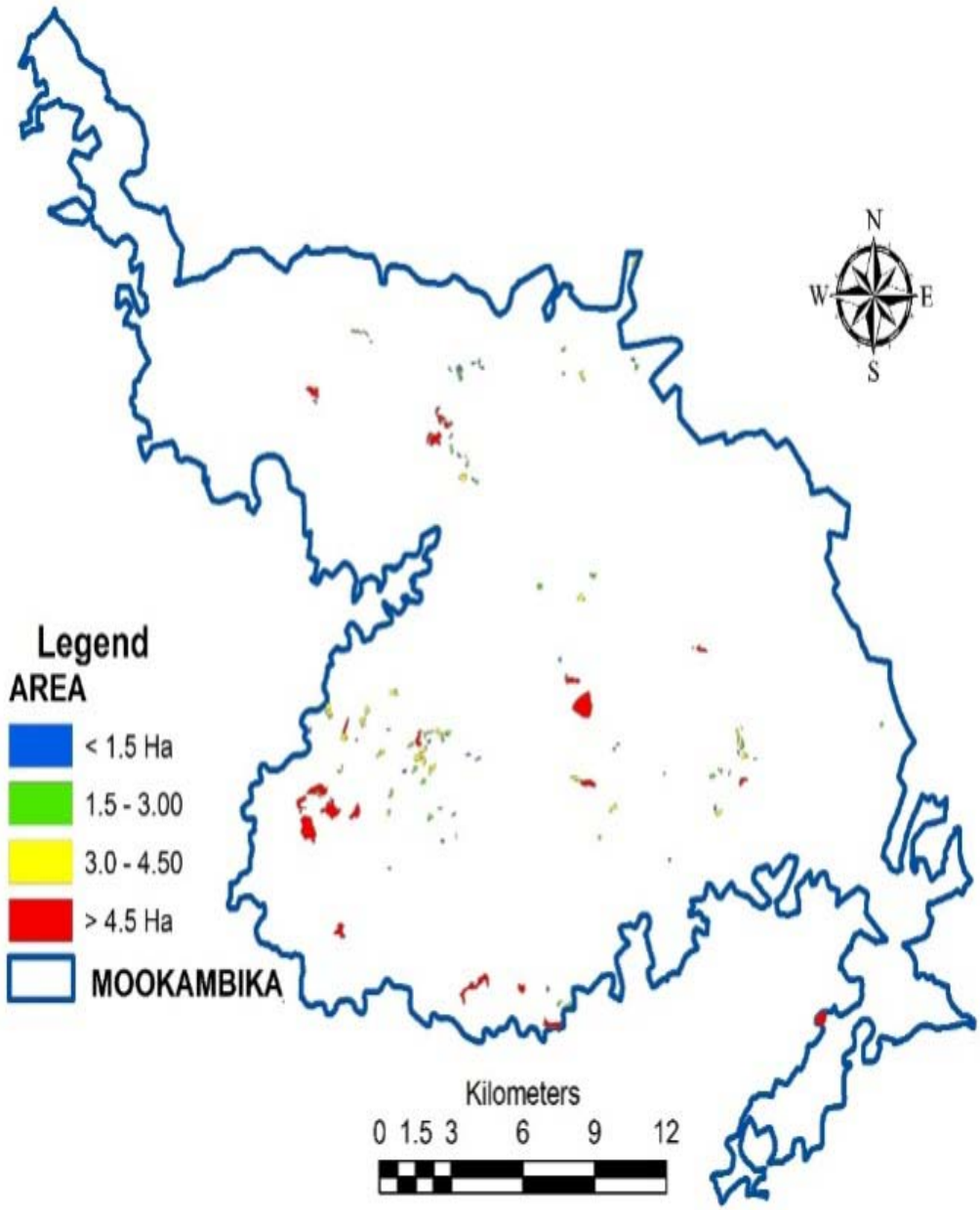
The Copies are Issued u/s RTI Act

Appendix 4

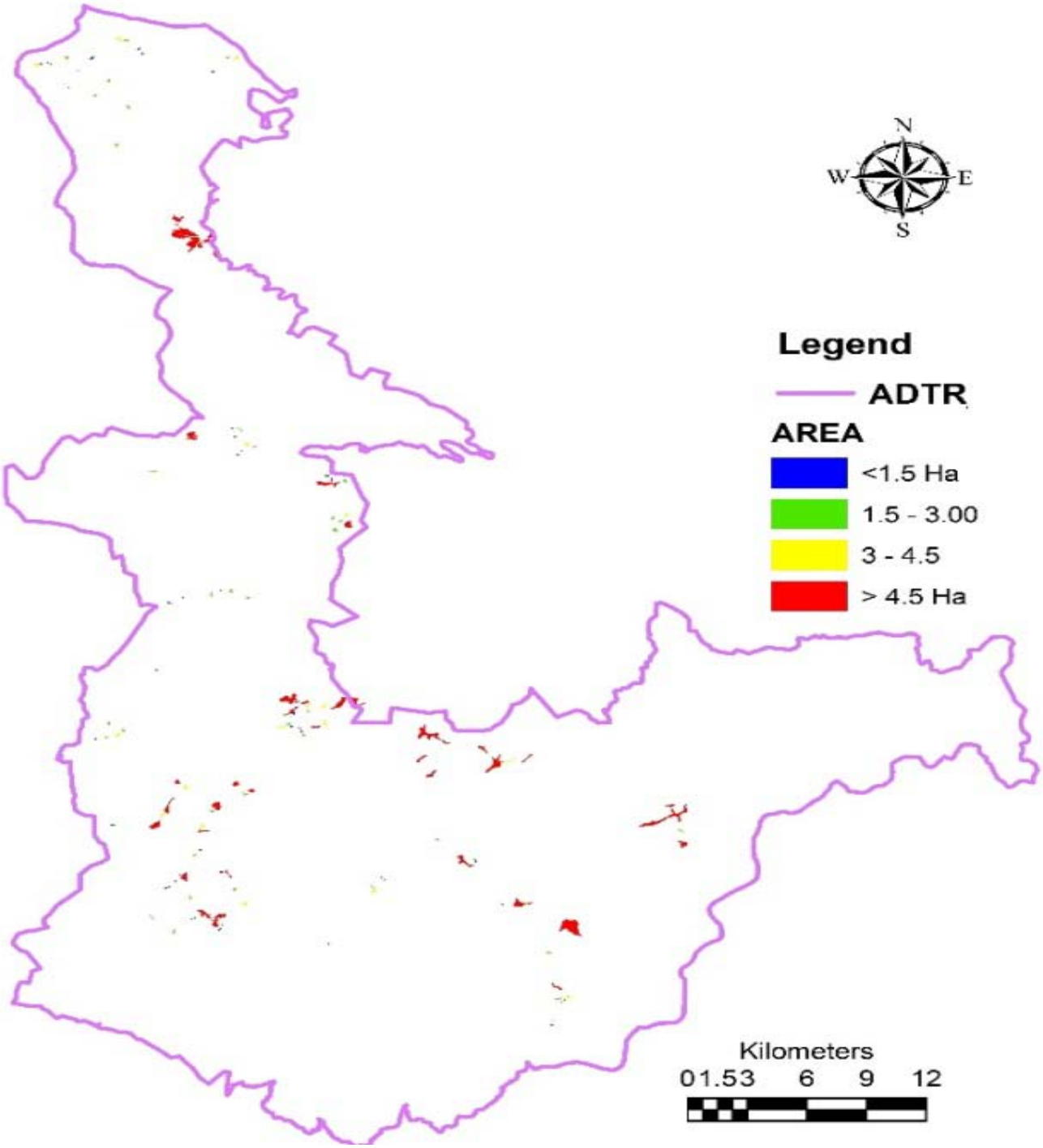
(Reference: Paragraph 6.1.2, Page 48)

Assessment of encroachments in Protected Areas with satellite imageries

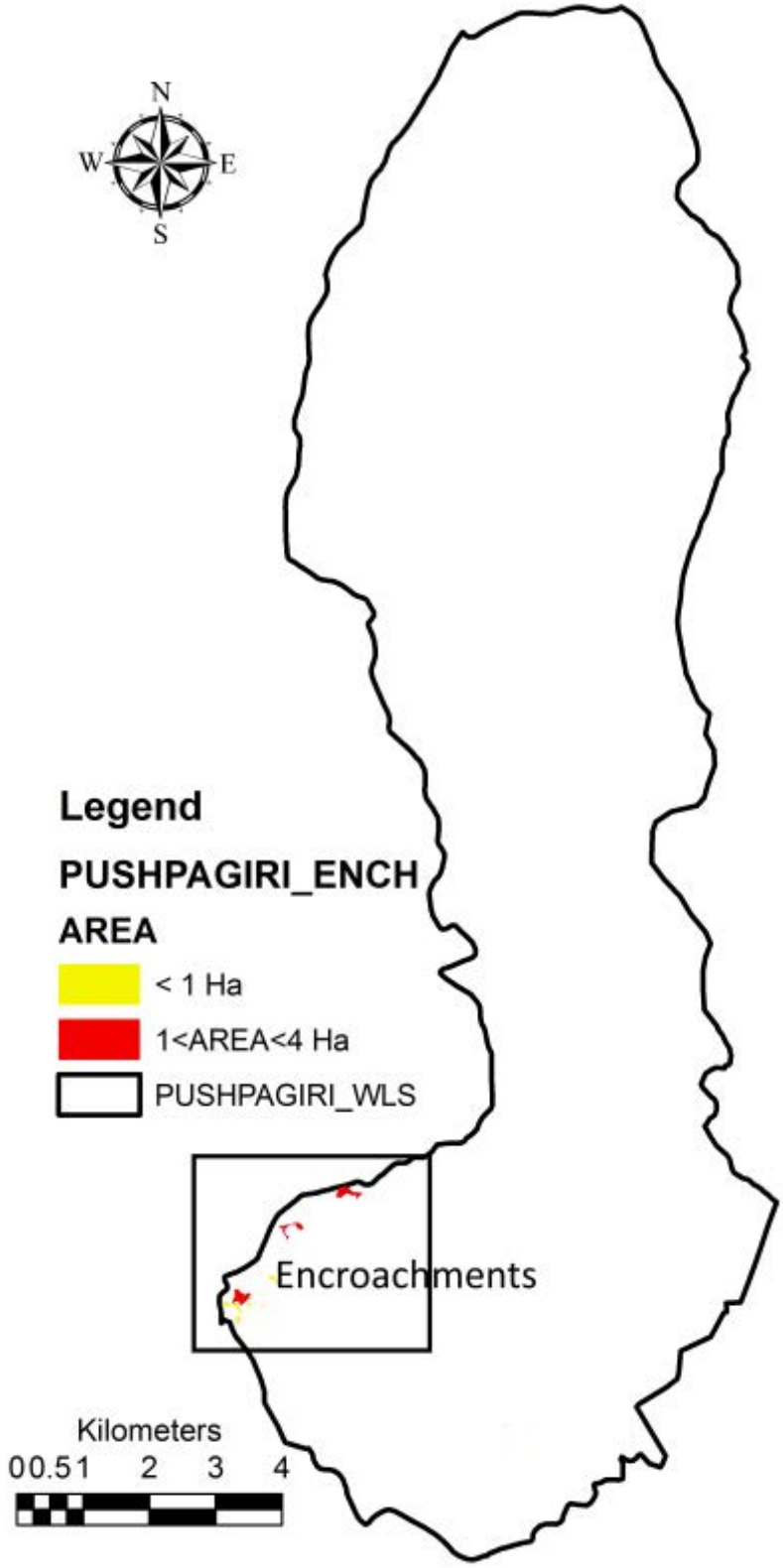
1. Mookambika Wildlife Sanctuary



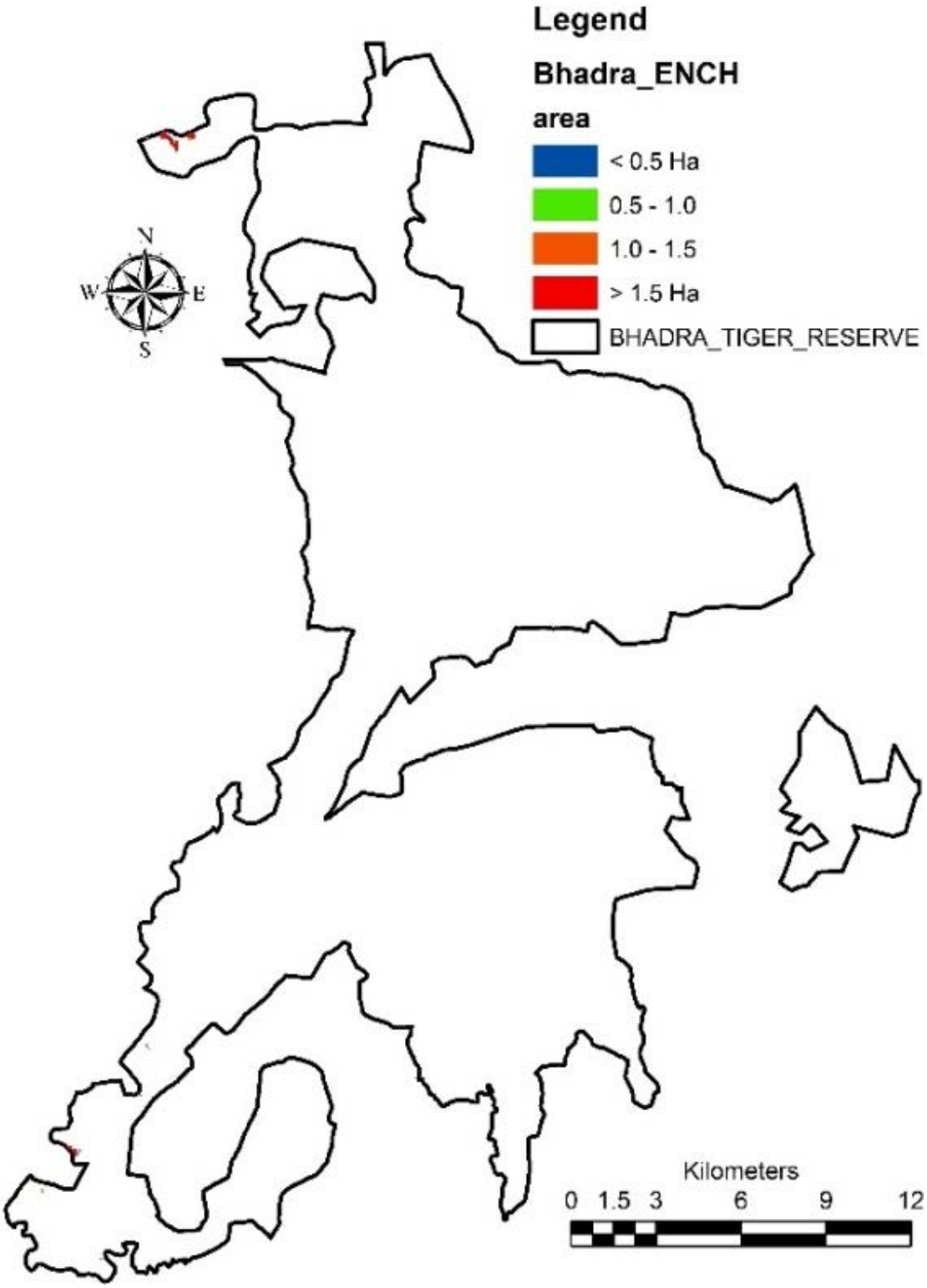
2. Dandeli-Anshi Tiger Reserve



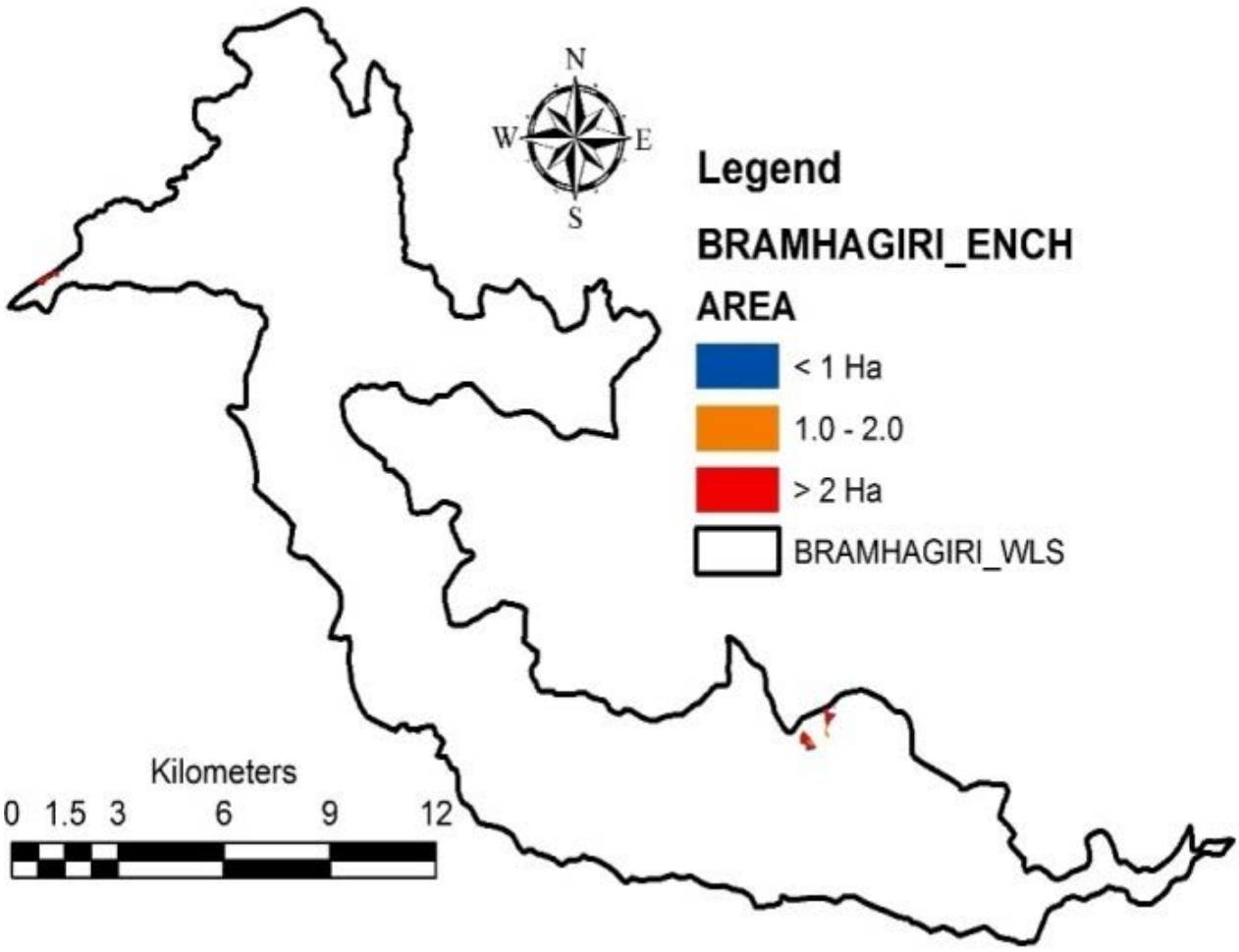
3. Pushpagiri Wildlife Sanctuary



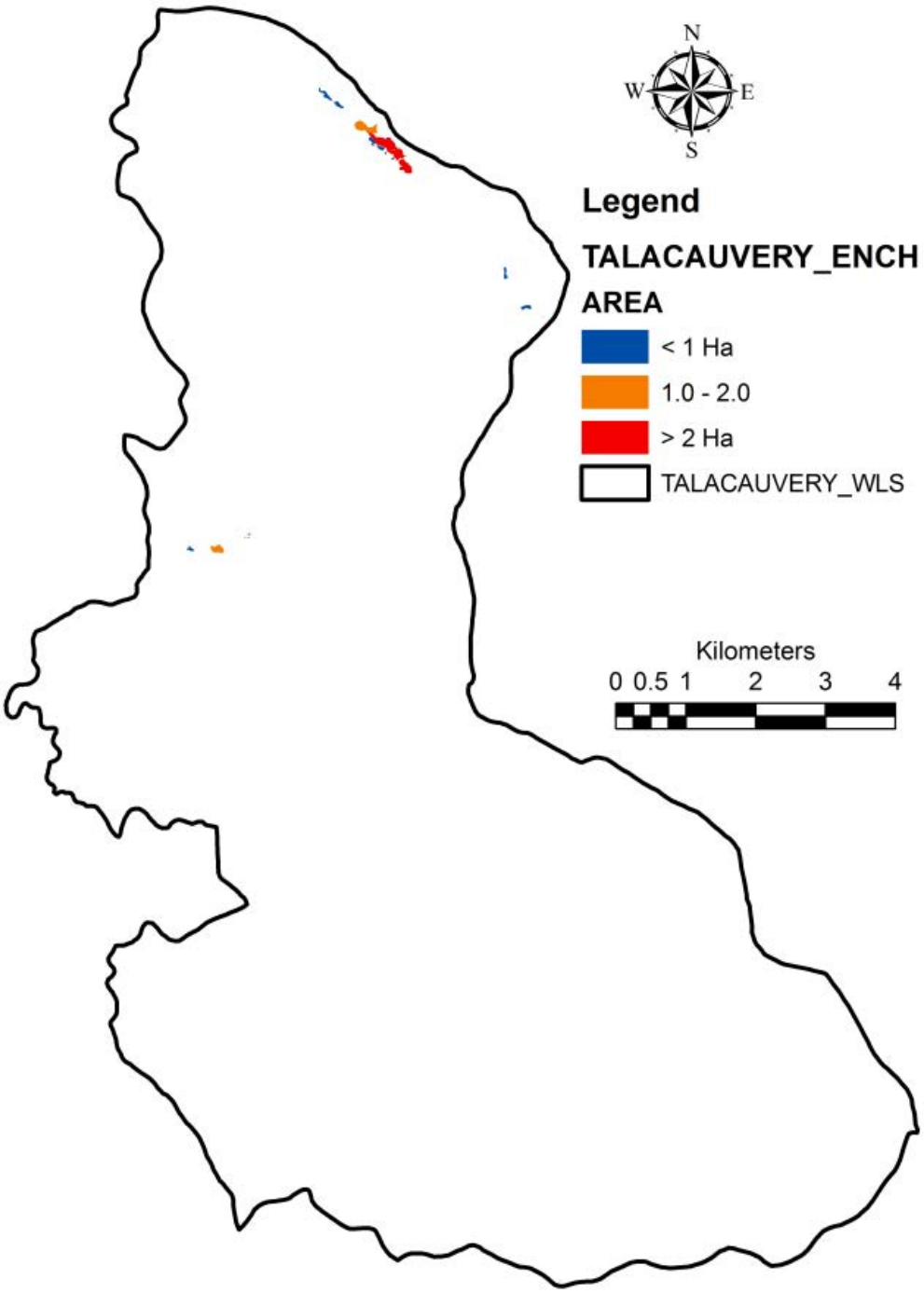
4. Bhadra Tiger Reserve



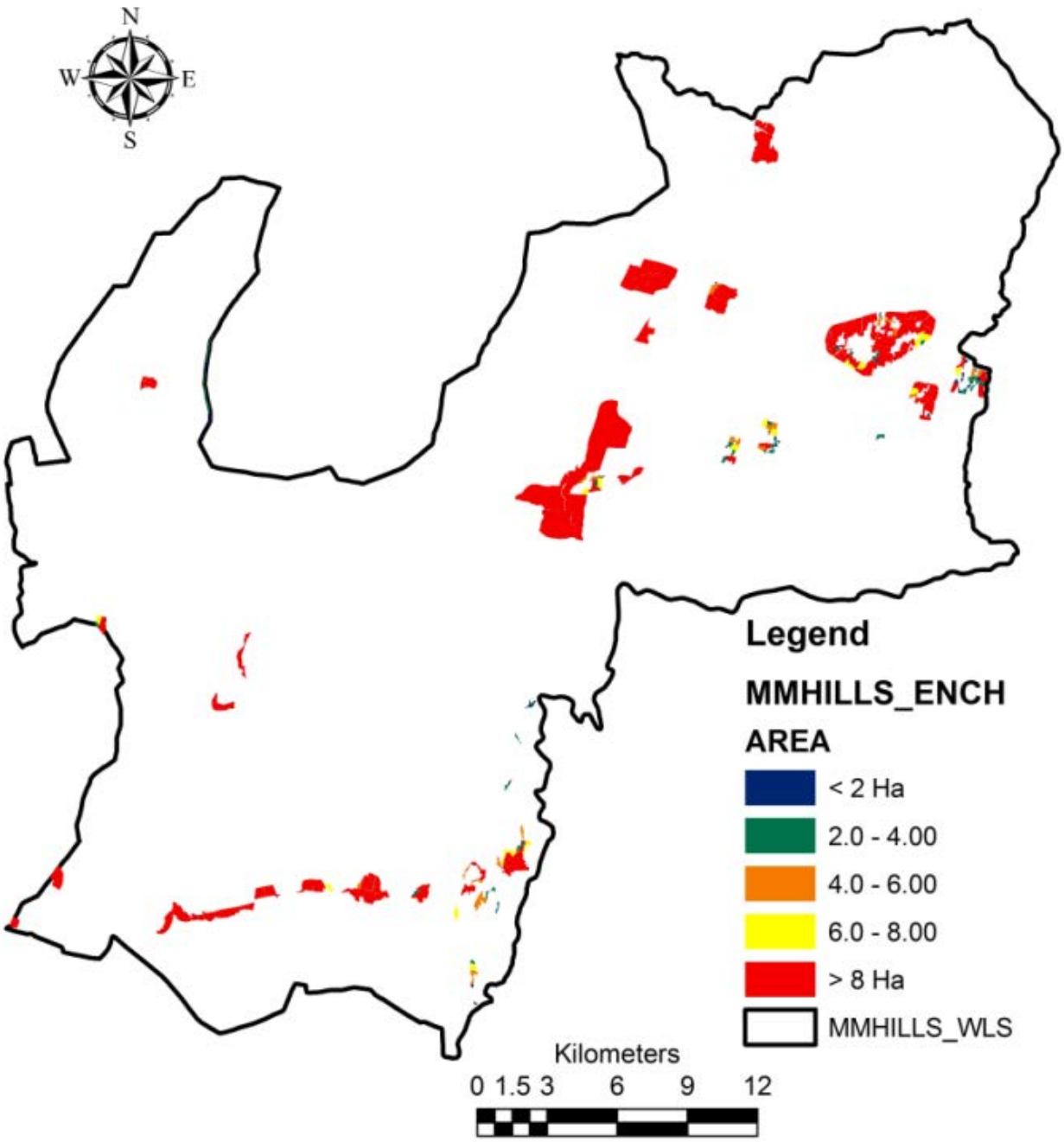
5. Brahmagiri Wildlife Sanctuary



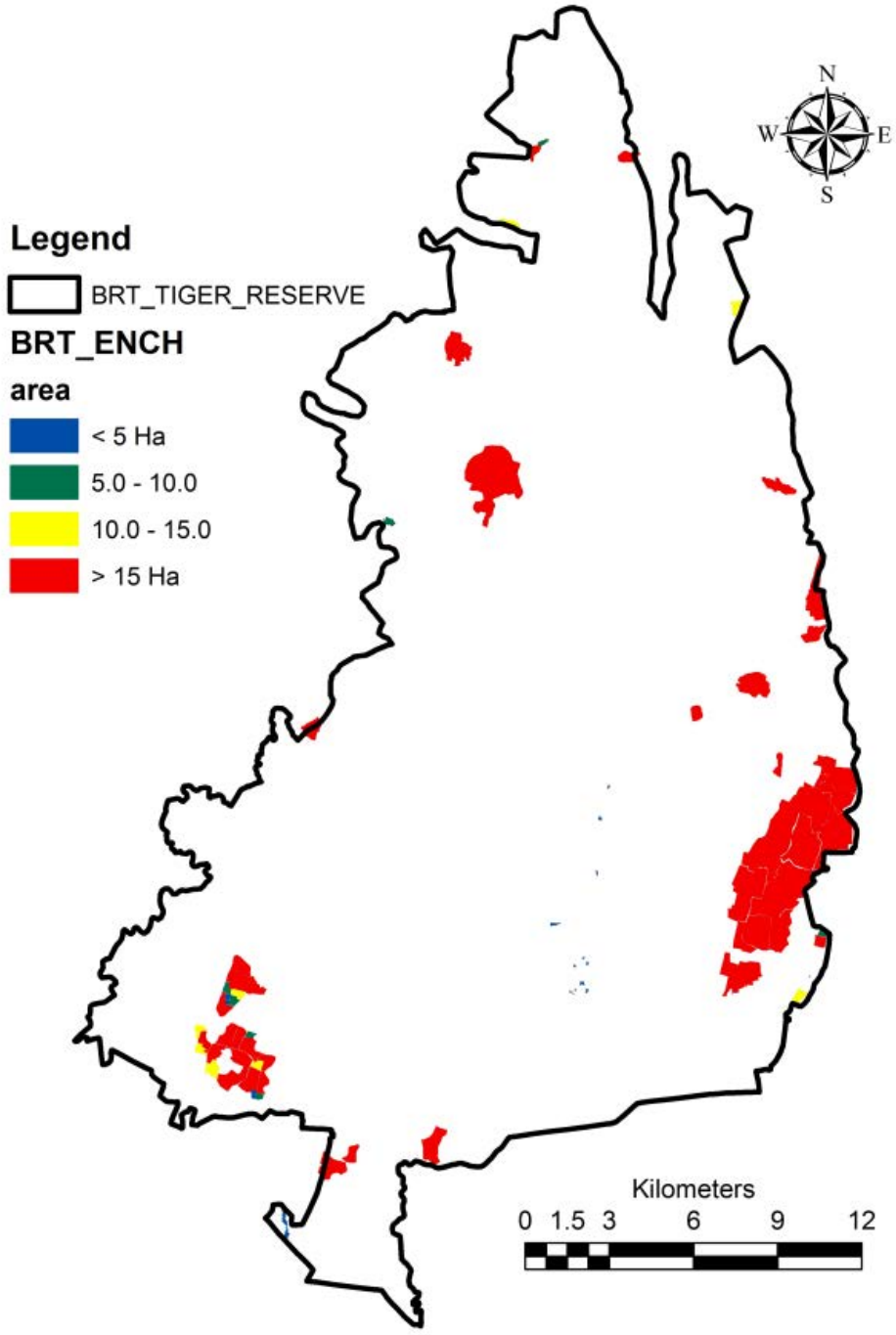
6. Talacauvery Wildlife Sanctuary



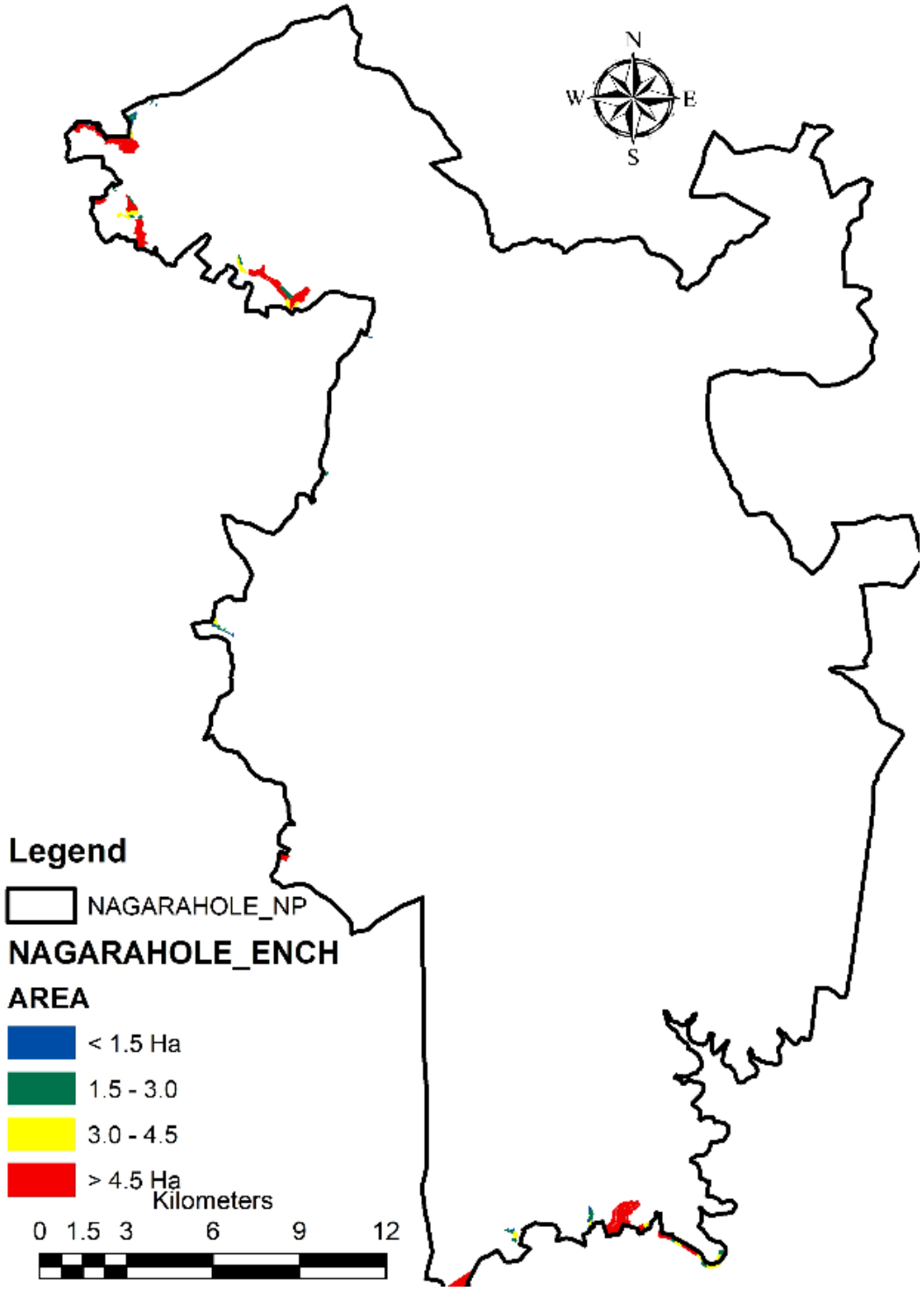
7. Malai Mahadeswara Wildlife Sanctuary



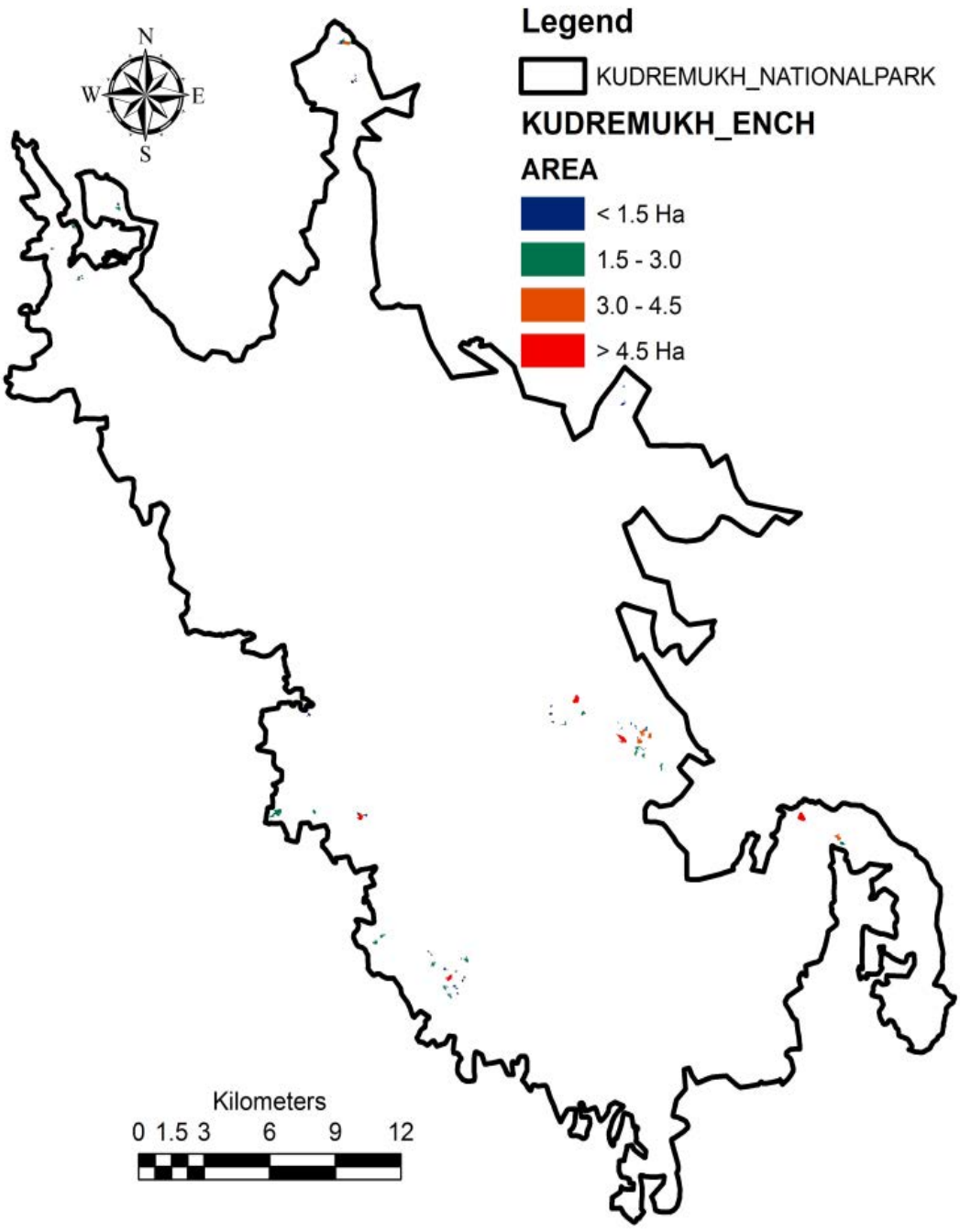
8. Biligiri Ranganathaswamy Temple Tiger Reserve



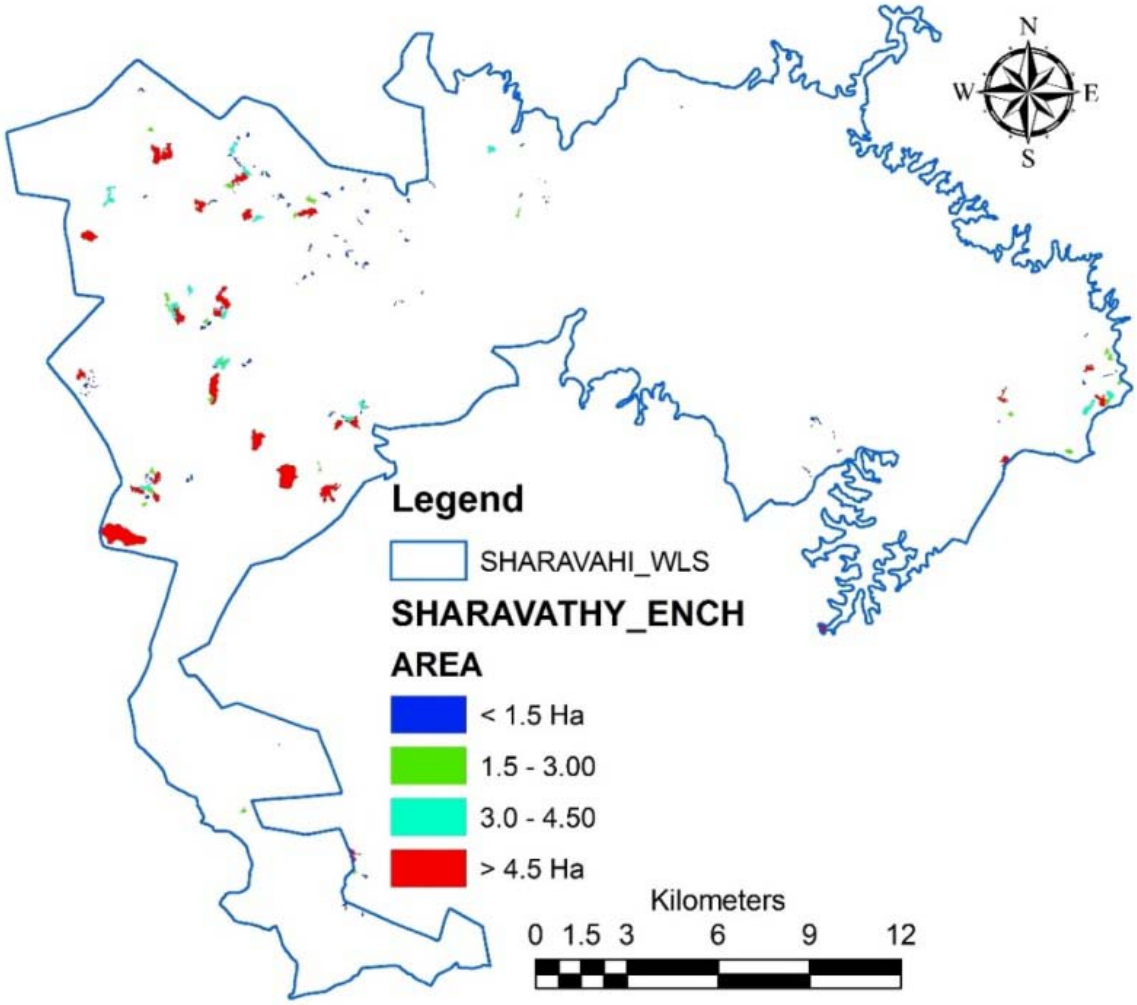
9. Nagarahole Tiger Reserve



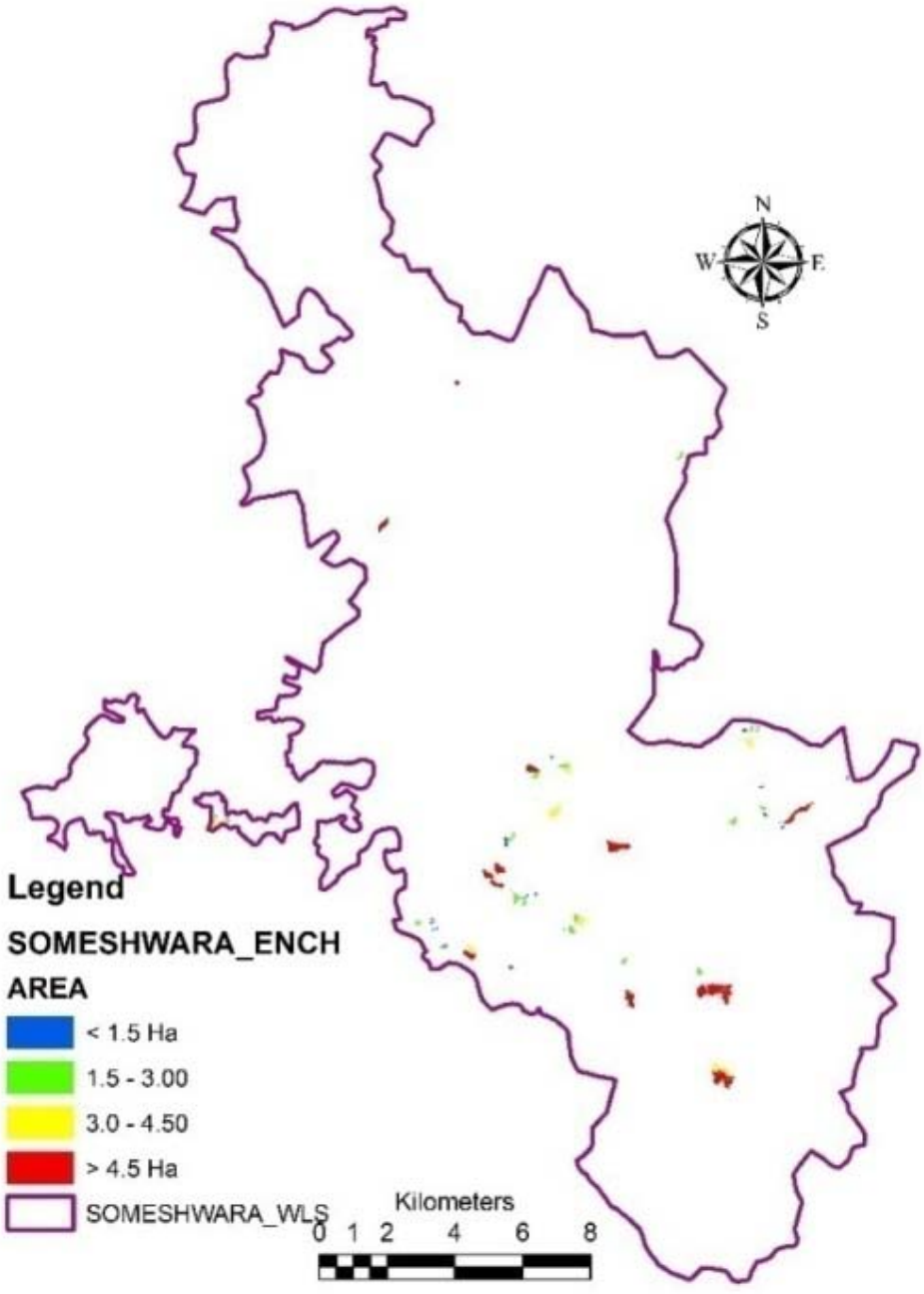
10. Kudremukh National Park



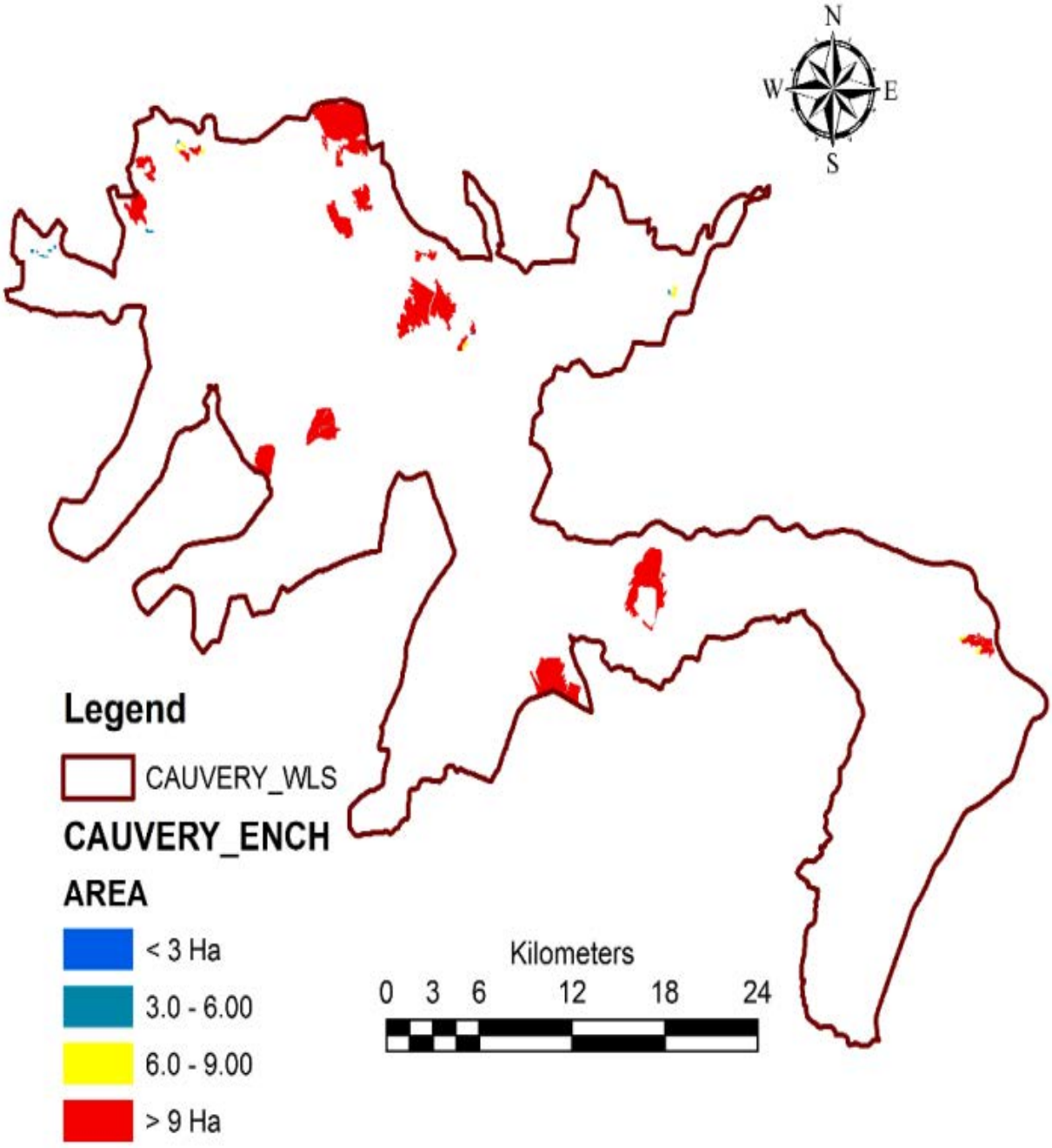
11. Sharavathi Wildlife Sanctuary



12. Someshwara Wildlife Sanctuary



13. Cauvery Wildlife Sanctuary



Appendix 5
(Reference: Paragraph 7.1, Page 54)

Details of poaching cases booked in the Protected Areas during the period 2011-12 to 2015-16

PA	2011-12	2012-13	2013-14	2014-15	2015-16	Total
Nagarahole	Wild boar-1 Deer -1	Deer -5 Gaur -1 Leopard-1 Wild boar-1	Deer-2 Barking deer-1	Leopard- 1 Sambar-1	Deer-2 Wild boar-1	Leopard-2 Wild boar-3 Deer-10 Sambar-1 Gaur-1 Barking deer-1
MM WLS	Elephant 1 Deer - 3 Wild boar-2 Sambar- 2 Not specified-1 Barking deer- 1 Gaur- 1	Sambar-5 Deer – 6 Barking deer-1 Wild boar-3 Not specified- 1 Mongoose-1	Deer- 6 Elephant-1 Not specified – 3 Sambar- 4 Rabbit- 1 Wild boar-1 Gaur-1	Deer-1 Wild boar -1	Elephants-2 Wild boar-1	Elephant-4 Deer-16 Wild boar-8 Sambar -11 Not specified-5 Barking deer-2 Gaur-2 Mongoose 1 Rabbit- 1
Brahmagiri	Gaur – 1	-	Sambar-1	Monitor lizard- 1	-	Gaur- 1 Sambar -1 Monitor lizard -1
Bhadra	Sambar- 1	-	-	-	-	Sambar- 1
Dandeli	Monitor lizard- 1 Pangolin- 1	Black panther-1 Gaur-1 Wild boar-1 Pangolin-1 Malabar giant squirrel- 1	Malabar giant squirrel -2 (1 case)	Wild boar-2 Tortoise-1 Monitor lizard-3 (1 case) Muntjac-1 Sambar-1	Wild boar-1	Black panther-1 Monitor lizard-4 Wild boar-4 Malabar giant squirrel-3 Pangolin-2 Gaur- 1 Tortoise -1 Muntjac-1 Sambar-1
Kudremukh Wildlife Division	-	Sambar-1	Mouse deer-1 Flying squirrel-1 Barking deer-2	-	Sambar-1	Sambar- 2 Barking deer-2 Mouse deer-1 Flying squirrel-1
Bandipur	-	Elephant- 2	Elephant 1 Deer-1	-	Tiger-1	Tiger-1 Elephant-2 Deer- 1
BRT	-	-	Elephant- 1	-	-	Elephant 1
Grand Total	Tiger -1, Leopard-2, Elephant-8, Gaur- 5,Black panther-1,Deer- 27, Sambar-17, Wild Boar-15, Barking deer-5, Malabar giant squirrel-3, Monitor lizard-5, Muntjac-1, Tortoise- 1, Flying squirrel-1, Mouse deer-1, Rabbit-1, Pangolin-2, Mongoose-1, Not specified-5 =102					

Appendix-6
(Para No: 8.2, Page: 68)

Details of Protected Areas, weeds assessed as threats and plan of action proposed in Management Plan/Tiger Conservation Plan

Sl No	Protected Area	Plan and period	Major Weeds as per MP/TCP	Proposed plan of action to address the weeds
1	Biligiri Ranganathaswamy Temple Tiger Reserve (BRT Wildlife Sanctuary)	TCP 2014-24	*Lantana camara, Eupatorium, Parthenium, Chromolaena odorata, Cipadessa fruiticosa*	Lantana eradication needs to be done by involving Soligas (tribals) who have the natural skills in this regard. Government of India schemes like MNREGA etc, may be utilized since large and long term investment is needed for this work.
2	Bandipur Tiger Reserve (Bandipur National Park)	TCP 2014-24	*Lantana camara, Eupatorium and Parthenium*	Only field studies were proposed to be conducted based on which further management would be decided.
3	Bhadra Tiger Reserve (Bhadra Wildlife Sanctuary)	TCP 2014-24	*Parthenium, Lantana, Eupatorium and Cassia spectablis.*	The theme plan proposed scientific investigation to identify, record and prepare distribution map for the weed species creating most damage, establish weed management objectives and goals, prioritise the weeds/patches, formulate Integrated Weed Management, implement it.
4	Kudremukh National Park	MP 2013-23	*Pteridium, Glycopteris and Euptorium*	To assess the extent of weed infestation by reki survey, device strategies to control major weeds.
5	Dandeli Anshi Tiger Reserve	TCP 2014-24	*Chromolaena odorata and Lantana camara*	Lantana is to be eradicated before its fruiting seasons in the month of September. Ideally, this operation should be carried out during the month of July and August after first shower of monsoon when wet soil facilitates its uprooting. The method of uprooting lantana, standardised in Corbett Tiger Reserve shall be employed in DATR (C R Babu – cut rootstock method).
6	Nagarahole Tiger Reserve	TCP (2014-24)	*Lantana camara, Parthenium hysterophorus, and Chromolaena odorata/ Eupatorium odoratum*	Identify the problematic weed species and assess the extent of its spread in the TR. Lantana clearance should be done on first year followed by year round monitoring, recording, and removal of fresh growth in second and third year. However no specific plan for other weeds was stated.