PREFACE

The last Management Plan, for the Protected Area, expired in March 2005 and as such, the writing of a new Management Plan was overdue. The present Management Plan is for the period 2005-2015 and has focussed on Wildlife management.

A draft preliminary Management Plan was prepared by January 2005. This also involved detail perambulation of the Sanctuary, updating the field realities and supplementing the details on the map prepared by Survey of India (1971). A summary of the draft preliminary Management Plan in English was prepared, and circulated among the officers. Discussions were held with them, and their suggestions taken into consideration while preparing the draft Management Plan. Majority of the management prescriptions, have evolved through this process.

The management efforts so far in this reserve have been on the protection and development of habitat for biodiversity conservation without looking into the problems of surroundings villages. The reserve cannot survive with more than one lakh biomass dependent people and an equal number of cattle head exerting tremendour pressure without developing the multiple use surround through eco-development. The plan has rightly proposed for taking up of eco-development works in the surroundings villages.

Great effort has been made to identify the problems that are faced now in the reserve. The strategies prescribed to overcome the problems are based on area specific requirement of each of the problem.

The Management Plan has followed the “Manual for Planning Wildlife Management in Protected Areas and Managed Forests by V.B. Sawarkar, Wildlife Institute of India, Dehra Dun (1995)”.

EXECUTIVE SUMMARY

"Bhadra Wildlife Reserve" was formally declared a Sanctuary in 1974. It is the 25th Tiger Reserve of India and was brought under "Project Tiger" programme in 1998. The Sanctuary is located in Western Ghats in Karnataka and is unique in every respect, because of its location, altitude, climate, scenic beauty, natural wealth, semi-evergreen, deciduous forests and its majestic and magnificent flora and fauna. Bhadra Wildlife Sanctuary was attained greater significance as it is identified as one of the two ecological and biological hot spots in India and covers an area of 492.30 Sq. Kms.,

The rich, diverse, immense and unique floral and faunal wealth abound in Bhadra Wildlife Sanctuary is to be protected, preserved conserved and re-generated wildlife conservation has received greater impetus and significance since few decades. A large number of endemic and endangered species are widely distributed in these forest. Protection of bio-diversity in its natural habitat and God made environment was the primary objective.

The effective and fruitful management of a Wildlife Sanctuary has several prominent faces, namely, protection of bio-diversity, eco-development, eco-tourism, rehabilitation of displaced people, research work and other related matters. All these aspects are inter-linked and are inter-dependent. Management Plan would be a successful venture only when all these aspects are effectively addressed. Thus planning and management receive greater significance in this context.

The primary objective of declaring the Sanctuary, viz., the conservation of bio-diversity is successfully achieved in the past years. The common hurdles

and barriers like poaching, hunting, illegal felling, wildfires, grazing of cattle, endemic diseases etc., are effectively checked. Meticulous planning and honest co-operation of all concerned was resulted in total conservation of bio-diversity.

The management efforts so far were to protect the bio-diversity without looking into the problems of bio-mass dependencies of the surroundings villages. The present Management Plan emphasis on the management of buffer areas, integration of local population through eco-development program.

Environmental awareness is the direct result of eco-tourism and research work. Man should live in co-operation with nature, because he is nature's child. The forest department considers its prime duty to educate every citizen about man's role in protection of bio-diversity. Thus eco-tourism gains prominence in this context. This management plan has analyzed in depth the modes of educating the citizen through eco-tourism and related research work. The rich diversity of the Sanctuary was thrown open opportunities to develop eco-tourism.

The new proposals proposed in this management plan when executed would help in achieving the primary and secondary objectives of Tiger Reserve and Sanctuary.

FOREWORD

ACKNOWLEDGEMENTS

Management plans are central to anything related to formulations of policies and programmes. Bhadra Wildlife Sanctuary is one of the most valuable and diverse forest wealth in India. It is one of the 24 bio-diversity hot spots in the world. It is one of the two identified in India. It gives me immense pleasure to revise the management plan of Bhadra Wildlife sanctuary.

I wish to acknowledge and thank Sri R.M.Ray, Principal Chief Conservator of Forests & Chief Wildlife Warden for his support, guidance and valuable suggestions to prepare and complete this Management Plan.

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I owe a great deal to all those scientists and academicians of Kuvempu University whose hard work has contributed substance to this management plan.

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PART – I

THE PROTECTED AREA: THE EXISTING SITUATION

CHAPTER – I

INTRODUCTION

1.1 - Name and location:

Bhadra Wildlife Sanctuary is situated in the midst of Western Ghat regions of Chikmagalur, N.R.Pura and Tarikere Taluks of Chikmagalur District and Bhadravathi Taluk of Shimoga District. The Sanctuary is situated between 75°-15′ and 75°-50′ Eastern longitude, 13°-25′ and 13°-50′ Northern latitude. The Sanctuary is well connected to important cities like Chikmagalur, Shimoga, Tarikere and Bhadravathi by road and rail. The sanctuary is a part of Sahyadri hill ranges and constitutes a geographic barrier between the coastal areas and the hinterland. For ages, this has segregated people and has given protection to the coastal areas, its wealth, its culture and traditions from casual invasion by the strong ruling polity of the plain areas.

The tract is replete with fascinating natural beauty. It is clad with thick forests, delightful dales, shining streams and brooks, narrow valleys and glades and abundant iron ore deposits.

1.2 - Jagara Giant:

A huge teak tree which stands as living monument is the centre of attraction in Muthodi Reserves having a mid girth of 5.1 Mtrs., an approximate height of 32 Mtrs., the approximate age of the tree may be 400 years old.

1.3 - Constitution and extent:

The Government of Karnataka Vide Notification No. AFD-25-FWL-74, dated 06-09-1974, **(ANNEXURE I)** declared this sanctuary as **"Bhadra Wildlife Sanctuary"**. Fifteen state forests and two minor forests were brought together to constitute this sanctuary. All the reserved forests themselves were constituted very early in the 20th century as under :

Table - 1 : List of reserved forests :

The State Forests coming under Bhadra Wildlife Sanctuary are as following:

Sl. No	**Block-A**	Extent in Sq.Kms.
1.	Aldhara S.F.	33.57
2.	Gangegiri S.F.	43.39
3.	Hebbegiri S.F	21.15
4.	Hunsekatte M.F	1.34
5.	Kagemanegiri S.F	33.54
6.	Kakanahosodi S.F.	2.02
7.	Lakkavalli S.F. and its extension	174.30
8.	Madhuguni S.F	10.42
9.	Madla S.F.	8.04
10.	Muthodi SF and its extension	97.07
11.	Nandigave S.F.	3.93
12.	Singanamane M.F.	1.29
13.	Teguragudda S.F	20.22
14.	Thadasa S.F.	2.59
15.	Thammadihalli S.F.	11.95
16.	Vaddihatti S.F.	2.19
	Block –B	
17.	Bababudangiri S.F.	22.084

These forests were settled providing for a good number of revenue enclosures and honouring a variety of rights and privileges for the local people. A map of the sanctuary showing different reserved forests and their distribution range-wise is furnished at **Plate – 1**.

1.4 - Approach and access :

The Sanctuary is well connected to important cities like Chikmagalur, Shimoga, Tarikere and Bhadravathi by road and rail. The distances are given below:

	By Road	By Rail	By Air
Muthodi	33 Kms. From Chikmagalur	73 Kms from Kadur	213 Kms from Mangalore 273 Kms from Bangalore
Lakkavalli	30 Kms from Shimoga	22 Kms from Tarikere 30 Kms from Shimoga	260 Kms from Mangalore 260 Kms from Bangalore

Good number of historical places, hill stations and pilgrim centres are situated near the sanctuary.

	By Road	By Rail	By Air
Kemangundi	45 Kms from Chikmagalur	42 Kms from Kadur	225 Kms from Mangalore
Sringeri	90 Kms from Chikmagalur	132 Kms from Kadur	180 Kms from Mangalore
Dharmsthala	100 Kms from Chikmagalur	140 Kms from Kadur	72 Kms from Mangalore
Belur	25 Kms from Chikmagalur	65 Kms from Kadur	180 Kms from Mangalore
Halebeedu	16 Kms from Belur	65 Kms from Kadur	180 Kms from Mangalore
Kudremukha	110 Kms from Chikmagalur	150 Kms from Kadur	100 Kms from Mangalore

The sanctuary can be approached from Chikmagalur or Shimoga or Hassan or from Mangalore / Udupi. It is 33 kms from Chikmagalur; 100 kms from Hassan; 213 kms from Mangalore; 170 kms from Udupi and 40 Kms., from Shimoga. The nearest airport is at Bajpe near Mangalore. Shimoga is the nearest railhead (40 kms). Age-old footpaths, criss crossing the sanctuary existed much before the modern civilization descended. Some of them were pilgrim routes, some haulage routes on the back of oxen, some were adventure routes to the lofty hill peaks and a great majority were routes connecting one settlement to the other. Except the haulage routes, rest of them remain even today and some are regularly used. Almost all tracks connecting the

settlements got upgraded to motorable roads. Some of these roads have fallen into disuse for very long time and many have badly eroded due to heavy rains. Flat surfaces are revegitated. Some are now revived as patrolling tracks.

1.5 - Statement of significance

Bhadra Wildlife Sanctuary has magnificent landscapes and shola-grassland biome. It is a sample of world's major habitat and eco-system. It is a signpost of tropical biological richness. It is a living museum and a natural laboratory. It is the protector and catchment area of Bhadra River, which serves the humanity in diverse ways. The unique eco-system performs many regulatory functions of the biosphere in terms of bio-geochemical cycles. We know very little of the complexity and functioning of this eco-system.

Bhadra Wildlife Sanctuary is a place for man to return to the eve of nature and make him realize that he is just one species among millions and that he should continue to be so for his own well being and survival in perpetuity.

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CHAPTER – II

BACKGROUND INFORMATION AND ATTRIBUTES

2.1 - Boundaries :

Starting from the Northwest corner of Aldhara State forest, the line runs along the Northern boundary of the said forest and Northern boundary of Hunsekatte Minor forest and intersects Shimoga-Lakkavalli-Bhadravathi Road at junction. Then the line turns towards south and runs along the Shimoga-Lakkavalli Road which passes through Hunsekatte minor forest, Thammadihalli State Forests, Singanamane minor forests and upto the South-West corner of Kundur Minor Forest. Then the line runs along the North-Eastern and Southern boundary of Lakkavalli State Forest upto the common junction of Lakkavalli State forest and Nandigave State Forests, and then along the Southern boundary of Hebbegiri State Forest and then North-Eastern boundary of Muthodi State Forest upto South East Corner near Kolgave Village. Then the line runs along Southern boundary of Muthodi State Forest and Western boundaries of Kagemanegiri State Forest upto common junction of Kagemanegiri State Forest, Madla State Forest and Tegaragudda State Forest. Then the line runs along the South-West boundary of Tegaragudda State Forest, and Eastern and Southern boundaries of Gangegiri State Forest and Madhuguni State Forest on the Bhadra River and then along the Bhadra River i.e., Southern Boundary of Madhuguni State Forest. Then the line runs along the Western and Northern boundaries of Madhuguni State forest upto Northern corner on Bhadra River. Then along the Bhadra River and the entire water spread area of Bhadra Reservoir upto Umblebyle, N.R.Pura old road and then along the road upto junction of Aldhara State forest, Kakanahosodi State forest and then along the Southern, Western and Northern boundaries of Kakanahosodi State Forest and then along the N.R. Pura, Umblebyle Road upto junction of old and new roads. Then the line runs towards south and joins the starting point.

With its present boundaries, the sanctuary has the shape of a letter “E”. Because of ‘limb-like’ extensions, the sanctuary has a very long perimeter.

The sanctuary boundaries were maintained in bits and pieces. The sanctuary has a continuum of very similarly composed geo-morphological areas and therefore of similar forests beyond its present boundaries. Some of them have been proposed into extension-reserved forests on its east. Retracing the boundary often proved contentious because of malafide misplacement/ displacement of cairns. A tentative boundary description in the original reserved forest notifications has complicated the issue. The boundary has to be cleared along the entire length and demarcation slabs of the sanctuary have to be planted / erected.

2.2 - Geology, rock and soil :

Lakkavalli State Forest: Successive bands of hornblendic schist, mica chlorite schist, diorite porphyrite, keratophyre and ultrabasic rocks occur in this forest. The soil on hill slopes and valleys is made up of ferruginous loam, resulting from the decomposition of haemetite quartzite, which is the characteristic rock of the Bababudans. The northern portions contain mica chlorite schist yielding a poor clayey soil.

Bababudangiri State Forest: The underlying rocks contain magnetite and haematite, quartzite and iron ores. Ferruginous clay occurs as soil, which in the sholas is mixed with rich humus.

Muthodi State Forest: The forest has a central small belt of keratophyre. This is surrounded by a wider belt of hornblendic schist and trap, composed of both the fine and coarse varieties. Some diorite porphyrite also occurs in the south-east. The outermost ring is one of ferruginous beds.

Kagemanegiri State Forest: The hilly portions contain beds of magnetite and haematite quartzite and iron ores of the Bababudan Type. To their south occurs hornblendic schist of the coarse type with outcrops of quartzite.

Madla State Forest: The underlying rock contains hornblendic schist which is decomposed. There is an extensive deposit of alluvial material on the surface.

Tegurgudda and Waddihatti State Forest: Adjoining the Bhadra River occurs a belt of gneissic complex and gneissic granite. To its south occurs hornblendic schist and trap. The ferruginous beds are much the same as those of the Bababudans and constitute the out runners of the northern limb of the Horse shoe range. The hornblendic schist and amphibolites of the Bababudans have been converted into gritty, reddish brown, earthly material, which resembles ferruginous sandstone. The good drainage, abundant rainfall and alluvium in the soil account for the luxuriant vegetation characteristic of these forests.

Gangegiri State Forest: The northern and southern portions contain hornblendic schist of the coarse type, while the central ridge contains ferruginous beds of the Bababudan Type. The extreme south contains gneissic granite. The remarks made with regard to the vegetation of Tegurgudda Forest apply equally well to this forest also.

Madhuguni State Forest: The underlying rock and soil confirm to that of Gangegiri with hornblendic schist, magnetite, quartzite and haematite quartzite. The easternmost portions of the forest contain gneissic granite. Deposits of alluvium occur along the river.

Kakanahosudi, Aldhara and Thammadihalli State Forest: The principal underlying rock is gneissic granite. The eastern portion of Aldhara contains granitic gneiss. Hornblendic schist, chlorite schist and mica chlorite and trap schists are found deposited on the base of gneissic granite in parts of Aldhara, Thammadihall forests. To the occurrence of hornblende and serpentine in parts of Aldhara is due the deep red loam found in certain localities. Teak seems to thrive well in such places. Honne seems to prefer granite in parts Kakanahosudi and Aldhara. These forests have shallow soil, with coarse grass, coming up in water-logged areas.

Tadasa, Nandigave, Hebbegiri State Forest: The first two and the northern portion of third have mica chlorite schist as the principal underlying rock. The southern portions of Hebbegiri contain hornblendic schist and trap of both finer and coarser varieties as well as diorite porphyrite. Outcrops of quartzite occur in all the three forests, though rarely in Tadasa. Quartzite and iron ores, being a

west ward continuation of the northern limb of the Bababudan Horse shoe range. The soil is rich, being the weathered product of the schists.

The underlying rocks and soil of the Singanamane and Hunsekatte Minor Forests dealt with in this report confirm in general to those of the State Forests to which they lie adjacent.

2.3 - Terrain :

The area consists of most undulating terrains with valley and steep hillocks. The altitude varies from 650 metres to 1875 meters above M.S.L. The highest peak in the sanctuary is the Kallathigiri peak with an height of 1875 meters. Mullaiangiri, the highest peak in Karnataka and also the second highest in South India with the height of 1914 Mtrs., touches the northern boundary of Muthodi SF of the **Sanctuary.**

Jagara Valley is also popularly known as ***"SAUCER SHAPPED VALLEY"***

Table - 2 : List of hill peaks :

Sl. No.	Name of the peak	Altitude (in meters)	Sl. No.	Name of the peak	Altitude (in meters)
1	Hebbegiri	1329	6	Bababudangiri	1700
2	Kagemanegiri	1102	7	Seegekhangiri	903
3	Kallathagiri	1875	8	Kumbalmanegudda	1002
4	Gangegiri	1412	9	Tegurgudda	1044
5	Jenukallugiri	1040	10	Rasikalgudda	1124

2.4 - Climate :

2.4.1 – Relative Height, Position and General Topographical Features.

The north eastern portion of the area under report are comparatively less hillier than the south-west where Bababudan Hill Range occurs. In the

south-west, the precipitous Bababudans and their neighbours frequently rise two to three thousand feet above the surrounding table – land. The country is cut up into high hills and gorgeous valleys traversed by perennial streams, with picturesque mountain scenery and moist hot shoals. The central region, connecting the north-eastern with the south-western hilly portions, exhibits a transition between these two extremes. There is a belt of comparatively flat land free from hills in this region along the course of the Bhadra River.

2.4.2 – Seasons

The year has three well defined seasons, the autumn which begins in June and lasts till October, the winter which starts in November and lasts till the end of January and the summer which starts in February and ends in June. The entire area under report enjoys both the south-west and the north-east monsoon rains. The former South West monsoon lasts from June to the middle of September. It sets in, in earnest, in the last week of June and slows down at the end of August. The latter – north-east monsoon – sets in, in the later part of September and lasts till the end of October. Overclouded skies, sudden heavy downpours accompanied by thunder and lightning and strong winds are characteristic of the south-west monsoon, while brighter weather, gentle and more steady precipitation characterize the north-east monsoon. The monsoon period is also the time of the most rapid growth and development of forest vegetation in the year. The temperature is pleasantly cool and the climate fairly healthy.

Winter begins in November. The coldest time of the year runs from the middle of December to the middle of January. The late evenings and more frequently the early mornings experience the fall of dew in December and January.

The winter passes on gradually into the summer in February. March, April and May are the hottest months of the year. The sky is usually clear from January to April. In March, the danger of forest fires is most severe. The jungle streams generally dry up during the hot weather and the want of drinking water

is often keenly felt. Forest operations, which are most vigorous during this season, become trying owing to the hot summer sun and scarcity of shade and water. The vegetation, which slows down the growth in November, and sheds its vegetative parts – the leaves – at the onset of the dry season, now awakens into activity. The first shoots appear during the pre-monsoon showers in April and May, and by June, when again the monsoon rains start, the forest which remained leafless and unsightly till now, clothes itself fully with its assimilating organs and is again ready to make the best use of the rainy season, as it gets its nourishment of mineral salts from the soil. The ascent of sap, which starts in April, gradually gets more vigorous during May and June, remains practically stationery in July and August and begins to slow down from September onwards to end in the shedding of leaves again in December and January.

In the forest covered in this report it is observed that the lesser the rainfall and more open the country, the longer is the period during which the trees are leafless in the year, and *vice-versa.* The greater the rainfall and greater the protection to the vegetation from desiccation owing to the presence of hills which afford protection from the western sun, the shorter is the leafless time in the year. Accordingly, it is often observed that on the eastern slope of a hill, the forest trees retain their foliage longer in the dry season than on its western slope, and correspondingly, the trees blossom in spring season earlier on the eastern than on the western slope.

The shedding season is consequently most pronounced in the Aldhara forests, is less in the Lakkavalli and its neighbouring forests, and is least in the Tegurgudda, Gangegiri and their adjoining areas.

The humidity is highest during the rainy season – June to October – moderate during the cold season and lowest during the hot weather. The period of minimum atmospheric humidity is from March to May and curiously enough, this is also the season during which the majority of trees in the forests flower and pollinate.

2.4.3 - Rainfall pattern and distribution:

Rainfall is quite heavy and is not evenly distributed in the sanctuary area. Muthodi and Hebbe ranges receive higher rainfall than Lakkavalli and Thanigebyle ranges. Almost 80% of the rain is received from southwest monsoon. Northeast monsoon becomes very weak by the time it traverses the Deccan Plateau. A slight gradation in the rainfall can be felt from the highest rainfall at Khandya across the main direction of monsoon winds as one moves towards east with least amount of rainfall at Aldhara. Monsoon winds from the Arabian sea, which come saturated with water vapour, cool on ascending the steep hill slopes and call forth during the rainy season almost incessant precipitation. July and August months receive highest precipitation. The average rainfall in the Division is 1500 M.M – 1700 M.M. Gangegiri receives a max rainfall of 2000 M.M – 2500 M.M. Aldhara receives a low rainfall of 1000M.M.

On an average, there are about 98 to 104 rainy days in an year. There are records of as much as 85 M.M. of rain being received on a single day.

2.4.4 - Temperature :

There are very few stations where temperature is recorded within the sanctuary area. Generally temperature is within agreeable and pleasant limits. Southwest monsoon season is the coolest part of the year especially during day while night temperature is the lowest in the cold season in December and January. Temperature rises rapidly from mid January but gets attenuated by the frequent pre-monsoon showers by mid April. The highest day temperature in summer hardly crosses 36^0 C while the lowest winter temperature is around 10^0 C. The mean daily temperatures hover around a minimum of 18^0 C and a maximum of 30^0 C for grater part of the year. Drop in the night temperature is very appreciable throughout the year in the hilly areas.

2.4.5 - Humidity :

Air is humid during the rainy season. During rainy season, water drips from the leaf surface of trees constantly and the humidity of atmosphere remains almost at the point of saturation. Atmospheric water vapour does not swerve far from the saturation point at any time of the day or night. Early morning precipitation arising out of condensation of the excessive moisture on the leaf surface due to fall in temperature is quite heavy and at times results in continuous drip on the forest floor during November, December and January. Fall in night temperatures in the uplands results in wide spread formation of dense mist, especially in the valleys. Mist is common even at the height of summer and is greatly helpful in subsiding fire in the grasslands.

2.4.6 - Wind :

The prevailing wind direction from March to September is from the west during day time. During October and November, it is from the east. From December to February the air is frequently quite sill, or a light wind comes down from the hills on to the plains varying in direction according to the run of the hills and valleys.

2.4.7 - Drought, and its periodicity :

Monsoons are generally steady. Annual fluctuations are common but not very large compared to the quantum of rainfall received. Belated monsoons and long breaks in the monsoons are recorded but complete failure of monsoon is unknown.

2.5 - Water sources :

Water resources, though relatively abundant, start dwindling from December. Most of the small streams and rivulets go dry by March. Springs are confined. This is the only time when animals would be found covering considerable distance for water. All the higher elevations, especially the grasslands go totally dry.

The sanctuary is well drained by Bhadra River and its tributaries. Bhadra is the main river with the perennial tributaries like Somavahini, Thadabehalla, Hiplahalla, Vatehalla, Odirayanahalla, Jenuhalla, Hallalla, Anegundihalla, Shivanehalla, Nayisathahalla, Neerahalla and Mavinahalla

which are the main sources of water besides, the Bhadra back water spread. The entire western side of Bhadra Wildlife Sanctuary is surrounded by Bhadra River and its water spread. During summer, waste water discharged from coffee estate as a bi-product of pulping is let into Somavahini and Thadabehalla which contaminates water with chemicals and the water becomes non-potable.

During monsoons, all the rivers and streams become swollen and occasionally over-flow the banks. A great volume of water is discharged at high speed. Consequently they have all rocky beds on the slopes inside the sanctuary. Small leaps of water locally are consequently common in the sanctuary.

There are marshy patches of abandoned paddy cultivated areas. Tanks and check dams exist in small numbers throughout the sanctuary which form the water holes for the animals during the summer season.

Measurements of stream and river discharges are not available. However, water resources are an important by-product of the sanctuary, which is strategically located in one of the highest rainfall regions of the state. Part of the net worth of the sanctuary can be easily realised in the long run from the water resources, which serve a great number of causes down stream within the state of Karnataka and also outside.

2.6 RANGE OF WILDLIFE, STATUS DISTRIBUTION, AND HABITAT :

2.6.1 VEGITATION : (FLORA)

The biotic factors and edaphic variations have played a dominant role in determining forest growth in the sanctuary area. The prevailing type of forest is climatic climax mainly constituting southern moist mixed deciduous forest of type ‘3BC 2’ in Muthodi and Lakkavalli and southern dry mixed deciduous forests of type ‘5AC3’ in Aldhara and Kundur area as per Champion and Seth’s classification.

The forests of Semi evergreen type ‘2 AC 2’ are found in Bababudangiri State forest, which are called ‘Sholas’. The sholas are found even outside the

hill slopes of Bababudangiri SF., some of which are owned by Revenue Department. The sanctuary has swampy patches with pure tall grass which are called 'Hadloos'. Repeated fire incidences have opened up some of the areas in the Sanctuary and eupatorium has suppressed natural regeneration and grass in many such openings.

The area is rich with bamboo, both Dendrocalamus strictus and Bambusa arundinacea, through out the sanctuary. Big bamboo shrubs occur all along the river and valley portions. Big bamboo's grow very tall to a height of 18 to 24 Mtrs., and are identified as Bambusa arundanacea variety gigantia. In higher altitudes and dry patches, small bamboos and seebu are found. There are extensive Teak plantations in the Sanctuary which were raised in the past by clear felling of forests.

The shola forests are a treasure of medicinal plants. A medicinal plant conservation plot has been identified and maintained in Bababhudangiri S.F. The shola forests in Bababudangiri State Forest are shrinking year by year due to annual repeated fires and large scale grazing. The Teak Plantations raised in the sanctuary during the past, give a monotonous appearance of monoculture due to which some of the areas have lost their originality. There are more than 120 tree species, the economically important timber species being Teak, Rosewood, Mathi, Honne, Nandi, Kindal etc. A number of important medicinal plants are also available in the sanctuary.

Forest types:

For an untrained eye, the forests are of moist deciduous type throughout the sanctuary. On a close scrutiny, the forests reveal themselves and one can easily distinguish several forest types.

Table - 3 : Types of forests :

(Area in Sq. Kms)

No	Name of Forest	Evergreen type	Sub-deciduous type	Mixed-Typically deciduous type			Grass Land	Total
				Sub-type A	Sub-type B	Sub-type C		
		$2A/C_2$		'3BC 2'		5AC3		
1	2	3	4	5	6	7	8	9
1.	Aldhara S.F.	-	-	15.00	18.57	-	-	33.57
2.	Gangegiri S.F.	-	22.22	-	-	21.17	-	43.39
3.	Hebbegiri S.F	-	-	10.70	10.45	-	-	21.15
4.	Hunsekatte M.F	-	-	-	-	1.34	-	1.34
5.	Kagemanegiri S.F	-	-	33.54	-	-	-	33.54
6.	Kakanahosodi S.F.	-	-	1.00	1.02	-	-	2.02
7.	Lakkavalli S.F. and its extension	-	-	70.54	62.44	41.32	-	174.30
8.	Madhuguni S.F	-	10.42	-	-	-	-	10.42
9.	Madla S.F.	-	-	8.04	-	-	-	8.04
10.	Muthodi SF and its extension	-	-	86.83	10.24	-	-	97.07
11.	Nandigave S.F.	-	-	3.29	0.64	-	-	3.93
12.	Singanamane M.F.	-	-	-	1.29	-	-	1.29
13.	Teguragudda S.F	-	20.22	-	-	-	-	20.22
14.	Tadasa S.F.	-	-	1.59	1.00	-	-	2.59
15.	Thammadihalli S.F.	-	-	11.95	-	-	-	11.95
16.	Vaddihatti S.F.	-	-	2.19	-	-	-	2.19
BLOCK - "B" EXTENSION								
17.	Bababudangiri S.F	17.664	-	-	-	-	4.42	22.084
	Total:	**17.664**	**403.18**			**63.83**	**4.42**	

Each of the forest types is briefly described hereunder :

The forests of West Coast semi evergreen forest type known as "SHOLAS" (2A/C_2)

The Bababudangiri State Forest is the solitary example of this Type. The vegetation is typically evergreen resulting from the abudance of percolation water in the soil (perennial streams) and the shelter afforded by the high hills all round. The evergreen vegetation is however by no means homogeneous. Both the species and the size of trees vary considerably according to the elevation and aspect.

The distinct regions of vegetation are recognizable controlled by the elevation. They are :-

(i) ***The region of the bare hill tops over 1500 Meters*** The vegetation consists of Grass, Pteris aquiline with its tenacious runners which serve to bind the soil and send up off-shoots at short intervals, species of Potentilla (P. Monian Wendlandia notoniana, Osbeckia chinensis, the rchids Habenaria longicalcarata and Habenaria species – (probably suseni), Launea species – (a member of the compositae – much resembling the Alpine Rose – Leontopodim alpinum) etc.

(ii) ***The region of stunted vegetation between 1200 Meters to 1500 Meters*** The trees here are usually stunted, low crowned and profusely branchy. The size of the leaves is also dimished. The commonest trees are Litsaea wightiana, Litsaea species, Cinnamomum zeylanicum, cinnamomum species, Eugenias – 3 species, Mimusops species and the climbers Hibiscus furcatus, Wild Pepper and Wild Jasmine. The dwarf trees end in bushes of Strobilanthes, Pteris, and Potentilla towards the bare hill tops. The dwarfing of the trees seems to be an adaptation to the high winds, isolation and insufficient soil in these localities.

(iii) ***The region of luxuriant evergreen vegetation below 1200 Meters*** The vegetation in this region is typically evergreen, resulting from moist heat and shelter. The trees attain heights of 30 Meters or more, with tall cylindrical stems reaching easily a height 25 Meters and upwards. The principal evergreen trees are Mysristica magnifica, Mysristica malabarica, Cinnamomum iners, Cinnamomum zeylanicum, Mimusops elengi, Eugenia jambolana, Eugenia corymbosa, Eugenia laeta, mangifera indica, Lagerstroemia, lanceolata, Artocarpus hirsuta, Artocarpus integrifolia, Cedrela toona, Ficus carica, Ficus species, Ficus asperima, Oroxylum species, Lophopetalum wightianum, Machilus macranta, Michelia champaka, Melia species, Hopea wightiana, etc., Among smaller trees are Macaranga Roxburghii, Vernonia species, Putranjiva Roxburghii, Calcicarpa lanata, etc., Among shrubs and undergrowths are Psychotria species, Solanum species, Strobilanthes species, Atlantia racemosa, Launga scandens, Myrsine capitellata Melastoma malabathricum and species of Ixora, Pavetta and Gardenia. Among ferns the common ones are the tree fern – Alsophila glabra, the Silver Fern, Pteris geranifolia Pteris quadriaertia, Gluichenia dichotama, Lycopodium cernnum and Blechnum oreintale. Among orchids the genera Vanda and Habenaria are common.

The evergreen forest, particularly in the lower zone, is of great beauty. With luxuriant growth and dark foliage coupled with the presence of tree ferns, it comes up nearly to the high beauty of typical tropical evergreen rain forests. The superabundant moisture, the high temperature and favourable soil, shave united here to form a type of vegetation which can be compared to the most luxuriant which nature can produce.

The Foundation for Revitalisation of Local Health Tradition [FRLHT] have conducted Floristic studies in Kemmangundi MPCA during 1996 for an area of 310 hectares. The list has been appended in **ANNEXURE – VI**

South Indian Moist Deciduous Forests (3B/C_2) :

The forests of this type are of a semi-deciduous nature and are characterized by the presence in the crop of a number of species which are evergreen or nearly so. The shedding season, which is very conspicuous in the typically deciduous forest type, is here wither short, or often even absent in sheltered ravines and on the north-eastern aspects of hills facing valley which run from North to South. Invariably, a broad and conspicuous belt of evergreen vegetation clings to the banks of rivulets and perennial streams. Another, no less important feature of this type is, that in the case of deciduous species, a large number of which are common to both the typically deciduous and the sub-deciduous types, the period during which the trees are entirely leafless in the year is considerably shortened. In other words the deciduous trees shed later and sprout considerably shortened.

Owing to the abundance of moisture the forest is not subjected to disastrous fires. The characteristic features of these forests are :-

(1) The occurrence of a good number of perennial jungle streams, indicating the presence of abundant moisture in the soil all round the year.

(2) Fairly heavy annual rainfall, which usually ranges from 1700 M.M to 2500 M.M.

(3) The presence of a number of species which are always evergreen or are characteristic of typically evergreen forests.

By far the commonest species in these forests is Jambe (Xylia xylocarpa), especially on the slopes of hills, where it frequently forms pure patches in the Tegurgudda, Gangegiri. The other common species are Terminalia paniculata, Terminalia tomentosa, Lagerstroemia lanceolata, Pterocarpus marsupium, Adina cordifolia, Stephegyne parviflora, Eugenia jambolana, Dalbergia latifolia, Eugenia species, Dillenia indica, Schleichere

trijuga, Kydia calycina, Grewia titaefolia, Litsaes zeylanica, Terminalia belerica and Dalbergia lanceolarica.

Teak is present though rarely, in this type, its distribution being confined to localities where incompletely disintegrated laterite does not occur, such localities having been practically monopolized by Xylia xylocarpa.

Evergreen species which frequently occur in this type are:-

Artocarpus hisuta, Cedrela toona, Garcinia xanthochymus, Cinnamomum iners, Cinnamomum zeylamicum, Saraca indica, Hopea wightiana, Hydnocarpus wightiana, Holigarna arnottiana, Actinodaphne Hookereii, Hopea glabra, Eugenia gardeneri, Eugenia species, Calophyllum elatum, Carallia intigerrima, Vateria indica, Alstonia scholaris, Artocarpus integrifolia, Macaranga indica, Tabernaemontana dichotmia, Olea dioeca, Olea species, Litsaea wightiana, Macaranga Roxburghii, Artocarpus lakucha, Sterculia species, Memcylon edule, the wild Mango, Michelia champak, Glochindion zeylanicum and rarely the White Cedar.

The shrubs and herbs that occur here are; Clerodendron infortunatum, Pogostemom plectrancthoides, Pandanus furcatus (along streams), Solanum species, Psychotria species, Flemmingia strobilifera, along with Wild Cardamom, Wild Turmeric, Wild Ginger, Wild plantain and a few ferns of the Plolyporaceae, all indicating abundance of moisture in the soil. Strobilanthes frequently occupies the glades.

Among Palms, Caryota urens is common, while Arenga Wightii is rare.

Among climbers are commonly seen Gnetum scandens and Spatholobus Roxburghii.

In spite of the large number of evergreen species mentioned above, the number of individuals of these are much smaller than those of the typically deciduous ones.

On flat land, or where almost pure alluvium occurs, or where drainage is not so complete, Xylia xylocarpa rapidly diminishes in numbers, its place being claimed by Terminalia tomentosa, Lagerstroemia lanceolata, Terminalia panicultata, Careya arbora, etc. Teak often tries to assert itself at spots where the drainage is fair.

The big bamboo is an additional feature of this type, especially along streams, though this bamboo is by no means so abundant as in the typically deciduous forest. The Small Bamboo is rare or even absent. The Reed Bamboo occurs frequently along streams.

Taken altogether, the seedling regeneration (natural regeneration) is generally unsatisfactory judging from the large number of species present. Xylia xylocarpa alone however regenerates itself profusely wherever it occurs, provided the overhead canopy is fairly open. Of the other valuable species, Rosewood regenerated itself well. The regeneration of Terminalia paniculata and T. Tomentosa is disappointing considering the preponderance of these species in the crop and the case of the other valuable species is not much better.

It seems almost certain that, in these semi-deciduous forests, the size or quality of the resultant growth is mainly dependant upon the depth of soil and aspect, of which the latter factor has a natural tendency to affect the former, especially on steep slopes.

The following forests belong to the sub-deciduous type:-

(1) Tegurgudda

(2) Gangegiri

(3) Madhuguni

Space does not permit of detailed description of each of these forests here. A few remarks which are intended to point out the individual peculiarities of growth of each cannot however be avoided.

Tegugudda – The vegetation contains the best quality of Jambe growth. The forest confirms quite closely to the type described above. Teak is found only on the northern side of the Tegurgudda hill ridge i.e., in the northern half of the forest. Big Bamboo abounds along the lower hill slopes and on flat land. Jalary seedling regeneration is common in the north-eastern portions. Almost pure patches of Jambe are frequently seen, especially on the hill slopes, on insufficiently disintegrated laterite soil, whose appearance reminds one of a well-kept. Teak plantation containing advanced age classes, or a well-thinned oak forest of Central Europe. The regeneration of Jambe is profuse. That of Beete is fair and of the other species meager. The canopy frequently approaches completion and stands usually 15 Meters to 18 Meters in height or more (up to 25 Meters) in sheltered valleys.

Gangegiri – The vegetation confirms in general to the second quality of growth with Jambe and deteriorates further towards the extreme south and east which is very hilly and rocky. The general growth simulates the type described above. The principal species is Jambe on the hill slopes, followed by Hunal and Nandi. The canopy stands usually 15 Meters to 20 Meters in height, but frequently more especially in sheltered localities, where it is in no way less luxuriant in growth to that of Tegurgudda.

Apart from the evergreen species already mentioned, those found are Elaeocarpus tuberculatus and Grewia laevigata; Wild pepper is seen in patches as also Murraya koenigii and Clerodendron infortunatum as undergrowth. Not infrequently Helictres isora has appeared in open or burnt patches.

Teak is entirely wanting. In the lower hill slopes adjoining the Bhadra River, Mathi or Hunal predominate, and are associated with Jambe, Kendala and Neral. Species of Randia and Careya arborea occur especially at spots with insufficient drainage and occasionally species of Zizyphus and Flacourtia are seen accompanying the above.

Garte Bamboo (Oxtenanthera monostigma) occurs on the lower hill tops and spurs, while the high hill-Gangegiri is precipitously rocky and devoid of tree growth.

Madhuguni –The growing stock is of the sub-deciduous type with Jambe as the principal species. The canopy stands 18 Meters to 20 Meters in height and is often nearly complete, but the trees get more stunted on the tops of hills or on exposed western slopes, while they develop longer holes and better crowns on the lower slopes of hills with eastern or northern aspects. In addition to Jambe occur principally Hunal, Nandi Mathi and Bite. Teak is absent. The evergreen species already mentioned in the type description occur.

Among undergrowths are in addition to those mentioned for the type, Callicarpa lanata, Murraya Koenigii and in open situations Atlantia racemosa and Thoddalia aculenta. Among climbers are, in addition to those mentioned, the Wild Jasmine and the highly thorny Caesalpinia species (Badubakka).

The mixed typically deciduous forest type general – The nature of the vegetation comprised in this type is well indicated by its name. The trees are typically leafless during a certain part of the year and the onset of the dry season is foreboded by heavy shedding, resulting in the forest soil being covered with a thick layer of fallen leaves. The annual mean rainfall ranges from 10 Meter to 20 Meter. The luxuriance of vegetation cannot equal that of semi-deciduous type, but invariably falls short of it owning to the presence of breaks which admit almost light on the soil. As a natural consequence thereof the seedling regeneration is more or less abundant and the more tenacious species, or those for which the growth factors confirm to the optimum required, invariably establish

themselves, with the result that the age classes of such are richly represented in the growing stock.

Annual recurring fires are a characteristic feature of these forests, because the forest floor abounds in large quantities of heavily inflammable material during the dry season. The fires, when they occur, are capable of causing the greatest damage by practically destroying all the natural seedlings or crippling them to such an extent as to make them unfit to yield timber and of destroying the bark and cambium of trees in the pole stages and making them quite unsound right from the beginning.

Bamboos have practically their home here, as this type provides the optimum growth factors required for them. They form a very important factor in the vegetation and influence frequently the conditions of growth and distribution of other species. The periodical large sale flowering of Bamboos, apart from upsetting the balance of seedling regeneration in these forests by suddenly laying fires which at such times often sweep the forests through, spreading large sale destruction before them. Also, the fall of Bamboo leaves is an important factor in causing ground fires. There is often little doubt that but for the presence of Bamboos, the seedling regeneration and the quality of the growing stock would considerably improve in a short time.

These deciduous forests have been worked heavily in the past and large quantities of Teak timber and fuel have been removed from them without sufficiently effective efforts at regeneration. There is little doubt that, in the past the proportion of teak in the growing stock was considerably greater than it is now. This is to be expected, since species other than Teak have regenerated themselves in place of the removed Teak.

Chief Species – As indicated above the forest is of a mixed deciduous type with large quantities of Bamboos (Bambusa arundinacea and

Dendrocalamus strictus) scatted through it. The principal tree species are:-

Tectona grandis (Teak), Dalbergia latifolia (Rosewood), Terminalia tomentosa (Mathi), Terminalia paniculata (Hunal), Lagerstroemia lanceolata (Benteak), Pterocarpus marsupim (Honne), Grewia tilaefolia (Tadasal), Adina cordifolia (Yethaga), Stephegyne parviflora (kadavala), Stereopsernum chelonoides (Lingadri), Anogeissus latifolia (Dindia), Dillenia pentagyna (Kannagalu), Eugenia jambolana (Nerlu), Albizzia odoratissima (Bilwara) and Terminalia belerica (Tare).

The accessory species are :- Schleichera trijuga (Kendala), Xylia xylocarpa (Jambe), Diospyros Montana (Balagane), Saccopetalum tomentosum (Hesare), Bassia latifolia (Hippa), Gmelina arborea (Sivane), Alseodaphne semecarpifolia lanceolaria (Hasarugani), Dalbergia paniculata (Pachali), Garuga pinnata (Godda), Phyllanthus emblica (Nelli), Hymendodictyon excelsum (Doodathoppe) and a host of others. A list of species is appended to this report.

When compared with the sub-deciduous type the following differences are noticeable:-

1) The evergreen species are almost completely absent from the forests.

2) The forest streams are mostly periodical and dry up more or less completely in the hot weather.

3) The shedding season is very pronounced, and the trees become almost completely bare.

4) The forest is very inflammable during dry weather.

SUB TYPES.

Three distinct sub-types can be distinguished in the mixed, typically deciduous forest, controlled primarily by edaphic factors:-

(1) The sub type on deep soil with good quality of locality – (Sub-type A).

(2) The sub type on shallow soil with poorer quality of locality (Sub type B).

(3) The dry and frequently rocky sub-type (Sub type C).

Apart from these three distinct types, occurs frequently a fourth, the *Swamp Type,* which consists of water logged open grassy areas with occasional trees of Careya arborea, Butea frondosa, Randia uliginosa, Zizyphus xyloprus and stunted Terminalia tomentosa. This type is found locally distributed in all the three sub types mentioned above.

THE FIRST SUB TYPE (A)

This is characterized by having good height and well-formed canopy containing a limited number of species and good proportion of well grown Big Bamboo. Flowing water persists in most of the smaller jungle streams only up to the beginning of March, but a few large streams are perennial or nearly so. The mean annual rainfall ranges usually from 50 to 70 inches.

The principal species are: - Teak, Dalbergia latifolia, Lagerstroemia lanceolata, Terminalia tomentosa, Terminalia paniculata, Schleichera trijuga, Dillenia pentagyna and less frequently Adina cordifolia, Stephegyne parvifolia, Pterocarpug marsupim, Grewia tilaefolia, albizzia odoratissima and little else. Anogeissus latifolia is practically absent from this sub type, while Xylia xylocarpa, the principal species of the semi-deciduous type, is either absent or only confined within local limits here

The undergrowth is usually scanty where the canopy is dense and consists of various herbaceous weeds with little grass. On hill tops Ochalandra travencoriana (Garte Bamboo) is common.

The forest areas included here are:-

Lakkavalli : - Lakkavalli has one of the most valuable Teak forests in Karnataka and was once famous as one of the finest Teak producing regions. All the southern and western portions of the forest belong to this sub-type. Towards the extreme west of the forest occurs a belt of Jambe growth from which Teak is absent.

The principal species are Teak, Mathi, Nandi and Hunal along with others mentioned a characteristic for this sub-type. There occur in addition small numbers of Tare, Hesare, Kaladri, Nerlu, Massi, Bende, Toon (Gandhargarige), Neral and a few others. Very close to perennial streams and almost confined to their banks are found occasionally a few evergreen species like Hopea wightiana, Hydnocarpus wightiana, Artocarpus lakucha, Artocarpus integrifolia, Mimusops elengi, Olea dioeca and Eugenia species. On the top of exposed hillocks where the soil is shallow, one finds species of Erythrina, Dyospyros montana, Bombax malabaricum and occasionally Bucanania latifolia.

The natural regeneration of valuable species is scanty.

The Jambe belt mentioned above extends from the western demarcation line of the forest eastwards over a width varying from 2.50 Kms. to 4.00 Kms. near Jambematti. Its eastern limit is formed by an imaginary line drawn from Kowlapur to the south-west corner of Salbakkegudda and on along the Jambematti to the southern limits of the forest. The belt seems to be still slowly spreading eastwards and encroaching upon the Teak areas. Bite occurs associated with Jambe in this zone and next to Jambe, its seedling regeneration is quite fair.

Muthodi:- The growing stock of the whole forest confirms in general to the first sub-type, except for a small patch at the extreme eastern end of the forest not far from Jagar Village, where it passes on to second sub-type mentioned above. The most abundant species is Mathi, accompanied by Nandi, Hunal, Yethiga, Tadasal, Bite, Teak, Massi, Kadavala, Tare and others. The canopy is uniform and fairly dense. On hill tops or high saddles the height growth of trees is often considerably diminished and their branching correspondingly increased.

Teak Belt :- Teak occurs in the forest but confines itself to a belt, a little over two miles broad, following closely the Hebbe- Chikmagalur Road from the Hebbegiri Forest limits in the west as far south-east as mile 20 of the Hebbe – Chikmagalur Road, some distance beyond Muthodi.

Non-Teak belt:- The rest of the forest is almost homogeneous in its vegetation with Mathi being the most common species, and Honne, Bite Nandi, Tadasal and Hunal accompanying it. This belt is the hone of Mathi and more less also of Honne and Hunal. South of Tadavehalla the quality of the growing stock deteriorates, Hunal takes the place of Mathi as the principal species and Dindiga makes its appearance in the mixed forest crop, indicating increased poverty and aridity of the soil. Some portions of the non-teak belt contain Honne of very high quality.

The natural regeneration of Teak, Mathi and the other principal species is astonishingly meagre. Contrary to expectations, that of Massi, Neral, Madle and Balagane is frequently seen on the soil although the mother trees are seldom seen in the canopies

As undergrowths frequently occur Cipedessa fructioosa, Gentiana species, Clerodendron infortunatum, Flemmingia strobilifera, Helicares isora, Kydia calycina, Acacia intsea and Cacia species, all of which are coming up in gaps, caused by the death of the Small Bamboos kydia calycian is abundant in the under wood of some compartments.

Evergreen species:- Their occurrence is, as in Lakkavalli Forest, confined to the banks of perennial streams. In addition to those found in that forest, Cedrelatoona, Vatria indica, Saraca indica and Carallia intigerrima are found here.

The Principal species are Nandi, Mathi, Jambe, Hunal, Honne and Bite, along with many other accessory ones. The pole crop of Jambe is a conspicuous feature of the vegetation. It often forms by itself a separate second tier in the growing stock. Solitary specimen of well grown Teak occur mixed up with Jambe a somewhat unusual combination for these forests.

The Natural Regeneration of Teak is very poor. That of Jambe is copious, all age classes from the seedling to the pole being richly represented. Next in abundance is the regeneration of Bite.

Garte Bamboo is usually found on hill tops and ridges and Pannangi (Oxtenanthera Stocksii) along streams.

Hebbegiri and Nandigave:- The growing stock to the south-east of Gurgidibba in the Nandigave State Forests and over long narrow strip of forest running north-south and comprising the eastern half of the Hebbegiri State Forest belonging to the first sub-type. The forest here simulates that of Lakkavalli already descried and confirms typically to the first sub-type. Mathi, Hunal, Jambe, Nandi, Kanagal and Bite are among the principal species along with other accessory ones like Yethyaga, Kadvala, Massi, Bilwara, Kendala, Honne, Tadasal and stray Jalari. In addition to other evergreen species already mentioned, Calophyllum elatum occurs occasionally.

The Jambe belt mention for the Lakkavalli Forests is continued along the Hebbegiri chain of hills down to the southern end of the forest and contains good seedling and root sucker regeneration and all age classes from the sapling to the mature tree.

Teak is present but scarce. Big Bamboo is common along the streams.

In the north-west of Nandigave and the western half of Hebbegiri, which are comparatively non-hilly, the vegetation belongs to the second sub-type (B) to be presently described.

The Second Sub-Type (Sub-Type B), or the Poor Locality Type is characterized by the following:-

(1) ***A great variety of species,*** almost all of the deciduous ones mentioned in the first sub-type along with a large number of others being found.

(2) ***A presence of large quantities of Dendro calamus Strictus*** of good quality growth.

(3) ***A mean annual rainfall*** ranging from 900 MM to 1200 MM"

(4) The soil is mostly the product of decomposition of the chlorite and other schists and consequently shallow and poor.

(5) ***The jungle streams*** run dry from the middle of January onwards with rare exceptions.

(6) ***The bole length*** of trees usually ranges between 10 Meters and 12 Meters and the girth at breast height of the principal species between 10 Cmtr and 15 Cmtr. The boles are neither so straight nor so clean as in the first sub-type.

(7) The canopy in the optimum for this type is only partially complete and cannot even at its best approach completion. Light consequently enters in large patches, and this accounts for the richness of the forest in species.

The principal species of this sub-type are-

Terminalia paniculata, Teminalia tomentosa, Pterocarpus marsupium, Adina cordifolia, Stephegyne parviflora, Schilichera trijuga, Terminalia belerica, Dalbergia latifolia, Tectona grandis, Xylia xylocarpa, Angeissus latifolia, Phyllanthus emblica and Albizzia odoratissima.

Among the accessory species, of which there are a very large number and too numerous to mention here, are Dalbergia lanceolaria, Dalbergia paniculata, Garuga pinnata, Bauhinia species, Bassia latifolia, Sterospermum species, Grewia tilaefolia, Eugenia jambolana, Codia myxa, Bombax malabaricum, Cordia macleodii, Careya arborea, Erythrina species, Odina wodies, Hymenodictyon excelsum, Steranlia villosa, Zizyphus oenoplea, Zizyphus species, Kydia calycina, Vitex altissima, Albizzia lebbeck, Bucanania latifolia, Diospyros Montana and others.

The undergrowth has typically more or less grass along with Holarhoena antidysentrica, Wrightatinctoria, Flemmingia strobilifera, Chloroxylon sweitinia, Randia species, Zizyphus species, Gardenia species and such others. Phoenix humilis (Kirichalu) occurs in open places along with grass.

Sandal comes up fairly well in this sub-type, as it gets the required light, in addition to moisture and suitable soil, though it does not grow to its best here.

Teak occurs in the forests of this sub-type, often in large quantities, but its quality is inferior to that of the first sub-type. It is able to attain girths of 10 Cmtr to 15 Cmtr in a sound state.

The Natural Regeneration of Teak is poor; that of Jambe is excellent and of Beete, Nandi, Yethiga, Hunal and Mathi fair. The natural regeneration of Beete and Jambe is commonly found together.

Kakanhosudi:- The principal feature of the vegetation is the rich distribution of Small Bamboo which frequently forms and under storey and the abundance of Jambe. Teak is very scarce, but present as solitary specimen, with little or no seedling regeneration.

Areas worked for Firewood:- In these areas singled out large trees of a number of species stand admist Small Bamboo.

The Natural Regeneration of Jambe is coming up vigorously and abundantly, and occurs mixed with that of Bite whose regeneration is also excellent. This constant association of a copious regeneration of Jambe and Bite, both existing side by side and competing for light is a remarkable and constant feature of the vegetation of the worked out areas. Judging from the way Jambe is progressing with Bite in this forest, one could fortell that when left to nature, the canopy will be formed chiefly by these two species alone in about 30 years. Bassia latifolia is also putting forth excellent coppice regeneration in the areas worked for firewood.

Aldhara – The western and northern portions of this forest have been placed in the second sub-type and the rest of the forest in third. Teak is scarce. Jambe is present and in abundance, all over this sub-type. The western portions and a fringe in the north have been worked in the past for firewood. The observation made regarding the regeneration of Jambe and Bite in the Kakanhosudi State Forests applies equally well to this forest. The distribution of the Small Bamboo is dense and even.

Madla – The whole forest belongs to the second sub-type. Jambe is confined to its western limits and to the south bank of the Somavahini. Teak is thinly and evenly distributed practically all over. The forest has also been frequently combed for Teak and Mathi timbers in the past. It has however not been worked for firewood. Big Bamboo occurs is fairly abundantly and Small Bamboo has seeded and died recently. Natural Regeneration of Jambe is fair, and that of other species poor.

Kagemanegiri – The growing stock belongs to the second sub-type. the growth deteriorates rapidly on the higher hill slopes and a fair amount of Dindiga makes its appearance here, indicating its transition to the third sub-type.

A belt of Teak is found along the Hebbe-Chikmagalur Road, being the counterpart of the same present in the Muthodi Forest. Other species are Mathi, Honne, Beete, Nandi, Tadsal and Hunal accompanied by Yethiga, Kadavala, Dindiga, etc.,

Small Bamboo has seeded and died and in the open patches caused by its death, Helictres Isora, Thespesia Lampas, Eupatorims Blumeas and such other annuals have found berths. Teak and Mathi timber has been extracted from this forest in the past. In moist protected localities a few evergreen species occur.

Hebbegiri, Nandigave and Tadasa – In the whole of Tadasa lying to the south of the Tarikere – Narasimharajapura Tramway, in the north-western portions of Nandigave and in the western half of Hebbegiri the growth belongs to the second sub-type. The growing stock is almost similar throughout this area, its principal feature being the presence of Jambe with its vigorous coppice and seedling regeneration. Teak is present, thinly and evenly distributed all along the western fringe of these forests. Tadasa has been repeatedly worked in the past both for fuel and timber, and practically the whole forest has been worked over. Hebbegiri has also been exploited though to a much more limited extent.

The valley of the perennial Savehalla contains the best quality of growth within Nandigave Forest.

Big Bamboo occurs in these forests, especially towards their western limits close to the Bhadra River. Small Bamboo, which was fairly abundant all over these forests, seeded and died about three years ago and its regeneration is coming up fairly profusely.

Lakakvalli – The second sub-type extends over the whole of this forest as a broad zone from its western limits, eastwards, up to within a short distance of its eastern boundary. The first sub-type lies to the south of this zone as already described, while the rest of the forest belongs to the third sub-type.

At the extreme west this sub-type les in the Jambe Zone already mentioned for this forest.

Big Bamboo is found in this sub-type in patches in moist localities, especially in the western half of the forest, while small Bamboo which was fairly abundant has seeded and died recently, and its seedling regeneration is fast coming up. Teak is found practically all over but with insufficient natural regeneration.

The Third Sub-Type (Sub-Type C)

It is characterized by –

(1) Very poor quality of soil, the ground surface being frequently covered by rocks and boulders.

(2) A mean annual rainfall below 900 MM

(3) A canopy almost open, with large gaps admitting abundant sunlight on the soil.

(4) Trees with bole heights ranging between 6 Meters and 9 Meters and having poorly developed crowns and foliage, which often so spares as to admit much sunlight through it. (The girths of sound trees at breast height range between 8 Cmtr and 12 Cmtr).

They are leafless for no less than four months in the year during the shedding season.

The jungle streams dry up mostly by the end of December and the atmosphere is comparatively dry and hot during summer.

The principal species found in this sub-type are –

Anogeissus latifolia, Teak, Terminalia tomentosa, Terminalia paniculata, Adina cordifolia, Choloroxylon swietenia, Lagerstroemia parviflora, Pterocarpus marsupium, Stephegyne parviflora, Dalbergia latifolia, Sterospermum chelonoides, and Bucanania latifolia.

The accessory species are Zizyphus zylophyrus, Zizyphus oenoplea, Diospyros tupra, Soymedia febrifuga, Strychnos potatorum, Bombax malabaricum, Erythrina suberosa, Erythrina stricta, Bauhinia, recemosa, Flacourtia, Montana, Garuga pinnata, Oroxylum indicum, Gmelian arborea, Mallotus phillippenensis, Sterculio villosa, Sterculia urens, Hymenodictyon excelsum, Gardenia latifolia, Cassisa fistula, Ficus hispida, Cochlospermum gossypium, Givotia rottleriformis and a host of others.

Xylia xylocarpa is not found in this sub-type while the Big Bamboo is rare and where found is confined to the banks of rivers or other water. Small Bamboo is frequent and often abundant, but grows less luxuriantly than in the second sub-type.

Sandal occurs abundantly in this sub-type and has here its optimum requirements with respect to light.

The forests included in this sub-type are the following - The northern and eastern limits of Lakkavalli, the southern and eastern portions of Aldhra, the north-western portion of Kakanhosudi, the whole of Umblebyle and Thammadihalli.

Tyagadabagi State Forest and Extension- A bit in the north-west and only the western portions, south of Haddinmatti have been worked in this forest for firewood.

As their name indicates, the principal species in these forests is Teak. It is accompanied by Dindiga. In the exploited areas the canopy is completely open and similar to what has been described for Gurupur. Coppice shoots only occur. The undergrowth contains grass and Flemmingia. A few seedlings of Honne are seen on the soil. the unexploited portions contain a mixture of Dindiga and Teak along with accessory species like Yethiga, Kadavala, Honne, Kaladri, Acaciaas and stray Bite. Small Bamboo is found all over the forest.

Lakkavalli: The third sub-type is found stretching as broad band along the northern and eastern boundaries of this forest.

As the major portion of the forest included in this sub-type has been heavily indented upon for firewood, the canopy has been completely opened out and nothing but coppice and stool shoots of fuel species along with Dindiga an softwoods commonly meet our eyes. In the unworked portions the crop is fairly dense with Dindiga, Mathi, Hunal, Yethiga, Kadavala etc., and young regeneration of the Small Bamboo and a small quantity of teak.

Aldhara – The eastern and southern portions of this forest are included in this sub-type. The canopy is open, as is typical of this sub-type and the growing stock is studded with a uniform, fairly dense distribution of Small Bamboo. The principal species and Dindiga, Mathi and Hunal, along with others like Bite, Honne, Yethiga, Kadavala, Jalari, Murklu, Channangi, Hippe, Godda, Bende Boorga and Pahali.

Thammadihalli – Both these confirm in every respect to the third sub-type. The northern half of Thammadihalli have been worked for firewood in the past. Here the growing stock consists of almost even aged coppice shoots of Mathi, Dindiga, Teak, Hunal, Yethiga, Channagi, Kadavala, Murklu, Chilla, Kaladri, Tumre etc., Among soft woods Booraga and Bettadavare (Cochlospermum gossypim) are common. In Thamamdihalli Forest Teak is found in an almost pure patch on the slopes.

In the southern half of Thamamdihalli the growing stock improves slightly in quality, probably because this area has been better protected. Teak is practically absent from here. Dindiga is the most prominent composite of the mixed growing stack; other species are Mathi, Hunal, Yethiga, Kadavala, Honne, Nandi, Sivane, Boorga, Tare, Godda and others. Jambe makes its appearance in the extreme south eastern portion of the forest. Small Bamboo is abundant. A sprinkling of Sandal is present all over this forest.

Plantations: Teak plantations have been formed in the past, in selected areas of the Mixed Typically Deciduous Forest, in all the three Sub-Types. Apart from a few older experimental areas, namely the Somahvahini Plantation of 1870-71 which is about five acres and the Oswald, Ratwaladhalla, Valagutti and other Plantations the oldest of which belongs to 1862-63 and lies on one side of the Lakkavalli – Narasimharajapura Road. Teak planting as regular measure was started only in the year 1903, under the guidance of ***Rao Bahadur M. Muthannah,*** the first Indian Conservator in Erstwhile Mysore State.

Honne plantations:- Seven acres and eight guntas of plantation of Pterocarpus marsupium was formed during 1887-88 along the bank of Bhadra, seemingly as an experimental measure. The quality of locality then chosen being unsuitable for Honne, owing probably to the sub-soil water level being too high during the greater part of the growing season, the condition of this plantation cannot be stated to be satisfactory.

Productivity :

Stocking in these forests range from 18 to 25 sq. meters to about 45 Sq. meters of basal area per ha. The above growing stock is of the order of 150-250 Cmtr/ha. The mean annual increment is about 2%. The net primary productivity ranges from 4 tons to 5 tons per ha. per year. Leaf litter itself ranges from 1 tons to 2 tons per ha., per year.

Flora of the sanctuary is furnished at **ANNEXURE – III**

2.6.1.2 - ***Parts of some species, used as food by wild vertebrates:***

1. *Albizzia sp (leaf)*
2. *Bambusa arundinacea (leaf, shoots)*
3. *Careya arborea (fruit)*
4. *Dendrocalamus strictus (leaf, shoots)*
5. *Emblica officinalis (fruit)*
6. *Eucalyptus hybrid (bark)*
7. *Gmelina arborea (fruit & flower)*
8. *Grewia tiliifolia (leaf)*
9. *Helicteres isora (stem)*
10. *Kydia calycina (bark & leaves)*
11. *Mangifera indica (fruit & leaves)*
12. *Tamarindus indica (fruit)*
13. *Tectona grandis (bark, leaves & tender stem)*
14. *Ziziphus xylopyrus (fruit, bark & leaves)*

Grasses:

1. *Cymbopogan flexuosus / caesius*
2. *Eragrostis gangetica, E. unioloides*
3. *Themeda cymbaria*
4. *Themeda triandra*

Vertebrates, especially elephants, while feeding on trees, shrubs, eat both leaves and twigs of species like Acacia, Albizia, Grewia, Zizyphus, teak and ficus. They also feed on bark of Grewia tiliifolia, Kydia calycina, Helicteres isora, Tectona grandis, Eucalyptus hybrid and Zizyphus sps. Fruits of certain plants like Tamarindus indica and Careya arborea are eaten while the deer sps do feed on Emblica officinalis fruits which fall to the ground.

2.6.2- Fauna:

The Sanctuary is endowed with a rich diversity and abundance of animal life. There are 42 species of larger mammals, over 264 species of birds, 43 species of reptiles, 18 species of amphibians, 7 species of fishes, 56 species of butterflies & 7 species of insects (Annexure IV). They appear in various schedules of the Wildlife Protection Act, indicating their endangerdness.

A casual visitor to the sanctuary will be disappointed by the apparent absence of animals except for the raising and falling resonant trill of cicadas and the blood-sucking leeches in monsoon or the rapacious ticks in summer. Given that travel in the forest is never silent, most creatures are either in hiding or will have vacated the area long before our arrival. In reality, the sanctuary is fabulously rich in animal life. Animals inside such forests are bigger, brighter, stronger and louder. They advertise their presence with unusually ostentatious colours, smells, movements or noises, which will penetrate the wall of the green and distinguish each animal from thousands of other species with which it shares the forest. These fauna, which are susceptible, are celebrated for their extraordinary disguises and camouflages. They use distinctive signals to communicate. Many are adapted to nocturnal life. There is flamboyance of sights, sounds and smell. But the entire forest gets mortified at the presence of any external element - be it man, vehicle, or even a large herd of cattle and restoration of normalcy, at the lowest level, would require at least an hour's uninterrupted absolute silence !

Just as the flora, the fauna is also highly specialized. King cobras are confined to the banks of watercourses and surrounding area. Hornbills are found in old growth forests. Flying squirrels are seen on tall trees in the valleys or on the fruit trees. There are many little known endemic fauna. Insects represent the highest bio-diversity followed by birds. In addition, a large number of fauna which are generally found over a large part of the peninsula like tiger, panther, wild dogs, elephant, gaur, sambar, muntjak, sloth bear, wild pig, hanuman languor, bonnet macaque, giant squirrel, peacock, python etc, are also found here. Numerically sambars are the most important large wild prey species. They are widely distributed throughout the sanctuary both in the open and wooded country. They subsist on a variety of plants and tender green grass, which are not regularly frequented by domestic cattle. One will be able to see a good number of 'sambar stamping' grounds – circular bare patches, 1.5 Meters to 3 Meters in diameter, devoid of all vegetation in the open grounds along the high hill ridges. Presumably they are the signposts communicating the stag's presence to other stags and hinds. These grounds

are used for wallowing by the stags as well as wild boar towards the end of rainy season. Stray domestic dogs hound and cause considerable loss to the sambar population including their fawn.

Herds of guar can be seen in throughout the sanctuary. They are commonly sighted as herds of calves and females with or without bull, or as single/paired bulls. Territoriality is very pronounced in these animals. Some herds are known to frequently visit and raid selected agricultural fields that abound in soft fleshy grasses especially close to forests and cause extensive damage to the standing crop. Both sambars and gaur frequent recently the burnt grasslands either to lick the ashes or to mow the new flush. Both the species avail themselves of the man made salt licks regularly. Spotted deer are found only in the low land forests and flat open country. Since this kind of forest is very negligible within the sanctuary, the population of spotted deer is very low. Elephants are present and distributed throughout the sanctuary.

A noteworthy feature of the fauna in the sanctuary is their intimate association with the local flora. Flora and fauna exist as guilds and not as individual species or populations. The fauna population is generally divided between numerous rare species instead of fewer abundant ones. A relatively small number represents each species but the species diversity is large. Each animal species has a highly specialized niche and has a unique functional role. Low population density of animals is because of intense competition for specialized food or living space or due to the constant attention of predators. Adequate forage is available to the ungulates almost throughout the year. Those, which feed exclusively on mast (=seed/fruit), soft or hard, face shortages during August/September months when no species is in fruiting. The evergreen forests are lofty and provide a huge three-dimensional living space supplemented by a wide variety of food to satisfy the needs of all the species. In fact the trees and animals are intimately interconnected in their life cycles. They all co-exist by specialization. Many plants have undergone numerous modifications to elicit the response of an appropriate animal species for pollination or fruit/seed dispersal. Sequential flowering and fruiting (relay floristic) is found when a wide range of common species are depended upon. Plants and their insect predators fight some sort of ‘chemical arms race’

constantly. A large number of faunal species were threatened when the forests were under intensive logging but the balance is fast returning because of a fairly long period of rest given since mid 80's. Present mammalian density of the Sanctuary is hardly one or two animals per sq. km. which compares poorly with other established sanctuaries within the state. So far, scientific census of any fauna is not conducted. Therefore there is a huge statistical void on faunal presence and abundance.

The magnificent birds river turn nest on the islands of Bhadra Back Water during summer for breeding purposes.

2.6.2.1 - Vertebrates, their status, distribution and habitats*:*

2.6.2.1.1 Vertebrates, their status:

As indicated earlier, the Bhadra Wildlife Sanctuary, contains 32 species of larger mammals, of which, most are endangered. The following table shows the population of major vertebrates during the last three censuses.

Table 4: Census of larger mammals in Bhadra Wildlife Sanctuary:-

		1993	**1997**	**1999-2000**
1.	Tiger	21	34	35-40
2.	Panther		21	
3.	Elephant	161	203	
4.	Gaur	139	186	
5.	Spotted deer		780	
6.	Sambar		518	

2.6.2.1.2 - Distribution of vertebrates and their habitat:

As the Sanctuary is dominated by moist deciduous and dry deciduous forests, with patches of semi evergreen and scrub forests, distribution of majority of the animals all over the Sanctuary is seen. However, concentration is noticed where there is abundance of food and water.

2.6.2.1.3 - Carnivores:

1. Tiger (*Panthera tigris*) is one of the most endangered predator in the Country. They play a key role in the ecosystem they inhabit. When tiger populations are healthy, other biological components of their habitat are ecologically robust. This is very true of the population in this Sanctuary. They are well distributed in the Sanctuary. As such, cattle killing is rare and no cases of man eating reported so far. Association between the male and female ends when the cubs are born, but there may be some companionship for a varying period after that. Mating usually takes place after the rains. Gestation is between 15-16 weeks. Usually 2-3 and at times 6 cubs are produced in a litter and the cubs accompany the mother for hunts when 6 months old. They stay with the mother until two years old. Sexual maturity is attained at 3 years age by the tigress and 4 years by the tiger. Life span is estimated at 20 years.

2. Panther *(Panthera pardus)* like the tiger, is distributed all over the Sanctuary. They are also known to prey on sheep and goat in the neighbouring villages as well as from the coffee plantations nearby. Panthers breed all the year round and the female produces the first litter when 2½ to 4 years of age. Gestation period varies from 87-94 days and normally 2 cubs are born per litter. They are weaned at 4 months.

3. Wild dogs (*Cuon alpinus*) is one among the major carnivores of the Sanctuary. Found in packs numbering 5 to 11 and have a home range of 40 sq km and territorial in their core hunting area (AJT Johnsingh, 1982). They are commonly found in Muthodi and Lakkavalli Forests and prey on spotted deer mostly. Their populations undergo a cyclic fluctuation, with the numbers suddenly dwindling as they are prone to diseases.

   Breeding is between November and December and 4-6 cubs are born in January and February either in a cave or, under a rock or cover. When sufficiently strong the young go out with the parents.

4. Jackal (*Canis aureus*), commonly found well distributed in the Sanctuary. It preys on birds and small animals as well as scavenges on left overs.

5. Small Indian Civet (*Viverricula indica*) and Common palm civet (*Paradoxurus hermaphroditus*) also occur. They are nocturnal and feed on smaller animals. They are armed with a defensive device, 'stink glands', the product of the anal glands.

6. Common mongoose (*Herpestes edwardsi*) and striped necked mongoose (*Herpestes vitticollis*) are fairly common.

2.6.2.1.4 - Herbivores:

1. **Elephant (Elephas maximus):** The Sanctuary, is a strong hold for the elephant. With abundant water and fodder within the Sanctuary, their numbers have been increasing. Seasonal movement of elephants within and outside the Sanctuary are also observed. With migratory routes, obstructed by cultivation, hydroelectric and irrigation project and fragmentation of habitat, etc. the elephants tend to move out into coffee estates and agricultural fields, causing damage to life and property. During the summer, there is huge convergence of elephants and other wild animals towards the river Bhadra, and on a single day over 20-30 elephants can be sighted in this area. Main breeding season, is during the hot weather or at the commencement of rains. Gestation lasts about 20 months and only one calf is born at a time.

2. **Gaur** (*Bos gaurus*) are found in the moister regions of the Sanctuary, namely Muthodi and Lakkavalli Reserve Forests, where there is good grass growth as well as bamboo. The populations have recovered very significantly after the Rinderpest in 1989. A number of calves in each herd is indicative of the suitability of habitat. Gaur, ordinarily live in small herds of 8-12 animals. In quest of pasturage or from other causes, several families may unite to form large assemblages. Except, during the mating season, bulls of all sizes, herd together with the cows in perfect amity.

3. **Chital** - Spotted deer (*Axis axis*) are found in abundance in the Sanctuary and well distributed. Concentration, is noticed in the tourism zone as a number of salt licks have been formed and there is abundance of fodder and water. This, forms the major prey species for the carnivore. Pairing of deer takes place during the winter months. Chital are prolific breeders, an interval of 6 months may see the production of a new family.

4. **Sambar** (*Cervus unicolor*) larger than the chital, they are found in all parts of the Sanctuary. They, feed on grass, leaves and fruits. They, come out into the open at dusk or early morning and retire into thick cover during the day. A few years back, they, were found in one's and two's but now fairly large group sizes are found. Pairing, takes place in November - December. Stags harem is limited to a few hinds. After the rut, he deserts them till the return of the mating season. Young are born at the commencement of rains. Young stags remain with the herds.

5. **Barking deer (*Muntiacus muntjak*):** Fairly common and found singly or in pairs. Very shy and alert animals, commonly found on either side of the roads in the tourism zone in Muthodi and Lakkavalli. Breed at all seasons. Rut, mainly takes place in the cold weather and young, usually one, is born, at the begining of the rains.

6. **Wild Boar (Sus scrofa):** Very commonly found all over the Sanctuary, mainly feeding on tubers. Initially, treated as a vermin, before being brought on to the Schedule of the Wildlife Protection Act. Breed profusely and is a source of damage to crops in the neighbourhood of the Sanctuary. Forms the basic prey species along with spotted deer for the carnivores.

7 **Mouse deer (*Tragulus meminna*):** Very much smaller than the spotted deer but without antlers. It is a solitary creature, seclusive and nocturnal in habit. Males live solitarily except during rut from June to July. Females bring forth their young in hides, generally two in number at the end of the rains. A very endangered species.

8. **Sloth Bear** (*Melursus ursinus*) Generally come out at sunset hunt for food all night, and retire in the morning. Food comprises mostly of fruits and insects. Mating is usually in the hot weather and the young are born seven months later. Cubs when sufficiently strong, are carried on the mother's back to and from her feeding grounds. Cubs, stay with their mother for 2-3 years till they attain maturity. Known to live upto 40 years.

9. The Indian Giant Squirrel are found in the better wooded parts of the Sanctuary. Commonly seen, feeding on semul or silk cotton pods and ficus fruits. Live singly or in pairs.

2.6.2.1.5 - Avifauna:

The bird life in the Sanctuary, is abundant and outstanding. The Sanctuary, and the surrounding environs provide the birds a rich and varied habitat. The Bhadra reservoirs and their backwaters are a bird watchers delight.

Some of the colourful birds are the peacock, grey jungle fowl, river tern, parakeet, hoopoe, bee-eaters, paradise flycatcher, whistling teal, Crested hawk eagle, golden oriole, sun bird, etc.

Professional, bird trapping nomadic tribals, called 'Hakki Pikkaru' carry out some illegal trapping in the scrub forests around the Sanctuary. The tribals, in and around the Sanctuary also kill and trap birds, using snares and bows with stones.

In the coffee estates adjoining the Sanctuary, heavy usage of insecticides takes place, which does have an effect on the bird and fish life, resulting in mortality or reduction in the reproductive rate.

2.6.2.2 - Home range and ranging pattern*:*

Sanderson (1878), who captured elephants and introduced the khedda operations in Karnataka, had made observations on their movement in the Biligirirangan hills. According to him "in the dry months i.e., January to April, when no rain falls the herds seek the neighbourhood of streams and shady forests. About June, after the first showers, they emerge to roam and feed on the young grass. By July-August, this grass becomes coarse and the elephants

descend to the lower jungles, where grass is not so far advanced. The elephants, left heavy jungle about October for more open and dry country. About December, when the forests become dry, all the herds leave the low country and are seldom seen out of the hills or forests till the rains".

Sukumaran (1992), of the Centre for Ecological Sciences, Indian Institute of Science, Bangalore, who carried out a study on the elephants, in the Biligirirangan hills, in the late eighties, confirms that the movement pattern of the elephants in this area has not changed even after a century.

The elephants, in Bhadra Wildlife Sanctuary, also follow a similar pattern. In the dry months they congregate towards the backwaters of the Bhadra reservoirs and perennial water holes, where there is abundance of water and grass. After the first showers, they move into the forest. They, are also known to migrate between Kuskal & Arambally of Koppa Division. Elephants, follow a migratory route regularly, but in recent times they have been disrupted by cultivation, dams, etc and the habitat fragmented. This results in crop depredation, with elephants moving away from their normal routes.

The home range according to Sukumar is 100-300 Km^2 as minimum size. Leuthold (1977) found that home range sizes determined by radio-tracking were usually longer than that revealed by visual identification.

Dr. Mc Dougal during his observation and tracking tigers in the Chitvan Sanctuary over sixteen years, indicates that tigers, establish and maintain home ranges. Resident adults of either sex tend to confine their movements to a definite area or habitat, within which they satisfy their needs and in the case of the tigress, those of their growing cubs. In addition, the location must make it possible for the resident to maintain contact with other tigers especially of the opposite sex.

Ecological densities of tigers and other syntopic predators may be governed primarily by how their prey community is structured. According to their studies, where tigers and leopards appear syntopically, if both large and

medium sized prey are abundant, tigers would select large prey, enabling the co-existance of leopards at high densities. Where large prey are scarce, tigers would switch to medium sized prey and reduce leopard densities through competition.

2.6.2.2.1 - Group / Herd size:

Tiger, panther, sloth bear are generally found to be solitary, though they pair during mating season and mother with cubs are observed.

Wild dogs, move in packs of 5-11. Chital occur in large herds over 20-30. Gaur have smaller herds of 8-12 animals. Sambar are found solitary or in small herds of 2-5. Elephants, are found in herds of 10-30 with the mature tuskers normally being solitary. Barking deer is found either solitary or in pairs.

2.6.2.2.2 - Ecological Niches and Habitat use:

Tigers, are generally found to rest during warmer hours of the day in the shade or along the banks of streams. They prefer cover of tall grass, hollow of fallen trees for this purpose. Panthers, also occupy similar niches though they are less dependant on water and more common, around human settlement.

Elephants and gaur, prefer the river bank or water holes, swamps and areas with good bamboo growth. Sambar, prefer thicker cover and are normally found in areas with thick lantana. Spotted deer, prefer open grassland, view lines, and vicinity of habitation. The barking deer, is found along the view lines and thick undergrowth.

Dead, fallen and decaying trees are used as niches by flying squirrels, civets, wild cats, owls, parakeets, mynas, barbets and other species of birds.

2.6.2.2.3 - Predator / Prey relationship:

Tigers, mainly prey upon wild boar, spotted deer, sambar, gaur and other smaller mammals.

Panthers, prey on spotted deer, wild boar, smaller livestock, langurs and smaller animals and birds.

Wild dogs, commonly prey upon spotted deer and sambar. They do not generally attack domestic livestock.

Smaller cats like jungle cat, leopard cat, civets, mongoose, prey on squirrels, birds and reptiles.

Most of the larger birds, prey on insects, small rodents and reptiles. Some act as scavengers also.

Otters & Crocodiles prey on fish and amphibia.

2.6.2.2.4 - Man animal conflict:

With the Sanctuary surrounded by villages, agricultural fields and coffee estates, it is but natural for the wild animals to stray out and deprade crops which are more nutritious. Likewise, during illegal collection of small timber, firewood, N.T.F.P., grass by villagers from within the Sanctuary, or the elephants while deprading crops, does result in the trampling or killing of a few villagers, accidentally.

Carnivores like tiger and panther, also kill domestic cattle, when they graze in the Sanctuary or when the carnivore move out of the Sanctuary in search of prey. In all the three cases i.e., damage to crops, human death by wild animal and domestic stock killed by wild animals, as well as injury by wild animals, they are compensated for as per Government Orders. (Annexure VII).

As per the Government order at Annexure VII, compensation for loss of human life due to wild animals, has been increased from Rs. 25,000 to Rs. 1,00,000/-. Details of compensation paid to villagers for crop damage, cattle killed, loss of life and injury are given in Table 5.

Table 5: Compensation paid to the villagers for crop damage, cattle killed and loss of life.

Year	Crop Compensation		Cattle Killed		Human beings killed		Human beings injured	
	No	Amount	No	Amount	No	Amount	No	Amount
2000-01	15	13950.00	31	30200.00	-	-	-	-
2001-02	04	3800.00	10	9100.00	-	-	-	-
2002-03	12	13500.00	05	7000.00	-	-	-	-
2003-04	11	11500.00	01	1000.00	-	-	01	15000.00
2004-05	03	4500.00	-	-	-	-	-	-

Table 5(A): Compensation paid by neighbours division > Cattle killed:

Division	2000-01		2001-02		2002-03		2003-04		2004-05	
	No	Amount	No	Amount	No	Amount	No	Amount	No	Amount
Koppa	50	26000.00	15	9000.00	30	21700.00	26	25200.00	15	14100.00
Bhadravathi	02	2000.00	03	2800.00	03	1600.00	01	4000.00	03	6000.00
Chikmagalur	14	13200.00	12	17000.00	13	16050.00	08	14500.00	11	13500.00

2.6.2.2.5 - Poaching and illicit smuggling of timber:

The Sanctuary, being very rich in flora and fauna and surrounded by villages and coffee estates, the temptation of poaching for the pot as well as sale is observed. Details of poaching within the Sanctuary, during the last four years are given in Table 5.

Table 6: Details of poaching cases.

SL. No.	Name of the animal	Year				
		00-01	01-02	02-03	03-04	04-05
1.	Barking deer	-	-	1 No.	2 Nos.	1 No.
2.	Bear	-	-	-	1 No.	-
3.	Civet	-	-	-	-	2 Nos.
4.	Common langur	-	-	1 No.	-	-
5.	Deer	2 Nos.	2 Nos.	1 No.	1 No.	-
6.	Elephant	-	-	-	2 Nos.	-

7.	Gaur	-	1 No.	-	-	-
8.	Kendalilu	-	1 No.	-	-	-
9.	Mongoose	1 No.	-	-	-	-
10.	Monitor Lizard	-	1 No.	1 No.	-	-
11.	Rabit	-	-	1 No.	-	1 No.
12.	Sambar	-	3 Nos.	2 Nos.	3 Nos.	-
13.	Tortoise	-	-	-	1 No.	-

Likewise, as the Sanctuary contains very valuable and rich flora, smuggling of timber both for bonafide use as well as for sale takes place. Details of the forest offence cases related to timber smuggling etc., is shown at Table 6.

Table 7: Details of forest offence cases:

SL. No.	Particulars	Year				
		2000-01	2001-02	2002-03	2003-04	2004-05
		Detected Cases	Detected Cases	Detected Cases	Detected Cases	Detected Cases
1.	Timber	120 Nos. 45.899 Cum	111 Nos. 42.792 Cum	78 Nos. 33.808 Cum	56 Nos. 11.324 Cum	20 Nos. 7.266 Cum
2.	Sandal	08 Nos. 471 Kg	2 Nos. 25.60 Kg	08 Nos. 687 Kg	07 Nos. 707 Kg	08 Nos. 235 Kg

2.6.2.2 - The Limiting factors:

a. **Run off loss:** The average rainfall in the Division is 1500 M.M – 1700 M.M. Gangegiri receives a max rainfall of 2000 M.M – 2500 M.M. Aldhara receives a low rainfall of 1000M.M.

Run off loss, is mainly due to inadequate soil and water conservation measures with the tanks / water holes getting frequently silted up and the water holding capacity getting reduced.

b. **Weeds:** Soil and moisture conditions favour dense growth of weeds like Lantana camera, Eupatorium odaratum, Parthenium hysterophorus, Cipadessa fruiticosa etc.

In all teak plantations, the under growth in forest and forest openings are infested with these weeds. These weeds, normally do not allow any regeneration or grasses to grow under them, duly suppressing them.

c. **Fire:** Fire is common, especially where villages fall on the periphery of the Sanctuary. It is normally a ground fire and is put out, by the fire fighting staff employed from February and until receipt of first showers in May-June. Five fire watch towers, well located in the Sanctuary, help locating the fire, alerting the staff and fire fighting. The standing & dried dead bamboo is a threat for fire protection.

d. **Grazing:** Though grazing is prohibited in the Sanctuary, there is pressure in some parts of the Sanctuary especially from the villagers adjoining the Sanctuary. In addition, the Pattadars within the Hebbe Range of the Sanctuary also rare cattle which do create pressure on the fodder availability.

e. **Insects and fungi**: The important insect causing damage to the teak plantations are the teak skeletoniser Hapalia machaeralis and Hyblea peura. This is an annual feature and no practical remedy to counter the damage is yet discovered. Loss caused by defoliation is considerable as both loss of increment and deterioration of timber quality are involved.

f. **Disease among animals:** The gaurs in the Sanctuary were struck by rinderpest epidemic in 1989. Literally wiping out the gaur population. Since then, as far as possible vaccination of the livestock in the neighbouring villages are carried out with the help of the local veterinarians. The gaur population has since revived.

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CHAPTER – III

PAST HISTORY OF MANAGEMENT AND PRESENT PRACTICES

3.1 - General History:

Western Ghats are known for their luxuriant vegetation and reputed timbers from very early history. Ownership of forests, as a tradition was claimed by the de-facto rulers of the time. From the available historical records, it does not appear that there was a separate establishment any time to look after forest management nor there was any system in operation for in felling of trees until the British time. However valleys are filled with rich soil up to the stream banks.

Ruling classes generally exercising power over selected species of trees by reserving them to the crown and prohibiting public from felling them. Different rulers exercised this prerogative in different ways. The best-known case of this type, pertaining to the tract dealt, is of His Highness the Maharaja of Mysore. He reserved teak and sandal for himself. He put into force a number of restrictions and regulations and enforced them with an iron hand.

At the beginning of the 19th century, an immense, almost unbroken forest covered the Western Ghats from the sea front to the most elevated ridges. The tract was thinly populated by human beings and was abounding with wild animals. All the hills were covered with timber.

A formal department for conservation began to appear around the middle of 19th century - 1864, in Mysore state. Initially the forest department was preparing two lists of reserved trees. The first contained about 15 kinds declared to be the absolute property of state government and to fell which, wherever growing, either the farmer or the trader had to obtain a license on payment of a certain fixed rate. The second list contained more than 25 kinds of trees reserved from the trader but free to the farmer for his own use. Towards the end of this century, a formal forest policy and first Forest Acts were enunciated. As an outcome of this Act, forest conservation began to take shape at the turn of 19th century. Records up to this stage were very poorly maintained and seldom available.

3.1.1 - Management in 20th century :

During this century, forest management came to be organized very systematically. Elaborate reporting by eminent officers about the wasteful destruction of forest wealth preceded this. Reservation of large areas of forest began. Working plans of sorts were prepared for very small and commercially attractive pockets of the reserved forests. Technological developments such as steam engine, the diesel locomotive and two great world wars had debilitating effect on the forests. Government monopolized the timber to the exclusion of local people who had sufficient resources in unorganized forest areas. Every act of the local public including removal of thatch grass, leaf mulch for agriculture, grazing, collection of minor forest produce etc., were closely scrutinized and several unsuccessful attempts were made to bring down the pressure on the forests.

There were detailed studies into the silvicultural aspects of prized timber species. Programs to convert low value forests into high value forests by conversion were taken up in some pockets. Teak was the first to be tried. Later *Eucalyptus*, Bamboo etc., were added to the list. It met with a very limited degree of success on account of mismatch of sites and species. Extensive areas were clear felled for extending agriculture under 'Grow More Food 'campaign following independence. Large areas were also clear felled purportedly for regeneration. Simultaneously selection fellings to feed the open market also continued. Timber extraction was dictated largely by economic and political considerations. Therefore working plans were not strictly adhered to. In spite of this, attempts were made to bring more and more forest areas under working plans and work them under selection, conversion and coppice systems. Very limited scientific data was available on productivity, rate of growth, silviculture of tropical forests etc., and therefore most prescriptions were arbitrary. Areas, which were inaccessible, were relegated to protection working circle. Demand for railway sleepers was the first major Industrial demand on forests. Initially only a few species were tapped for this purpose but the list got expanded to meet the large requirement. Patches of forests, which had a good stock of mature trees, were worked very intensively. Sleeper extraction was really callous. Nearly 60% of utilizable timber was laid waste at the site and

some times the debris took heavy toll of forests in the summer fires. A separate establishment was created to supervise the sleeper works. Railway sleepers were the single largest demand on the forests tract till 1970.

En-route to the 'modern development', a number of new demands for telephone poles, electric poles, ply wood, match wood, pulp wood etc, also got added after independence. Forests were thrown open to private agencies, but forest department did the marking. Many agencies were operating in the forests simultaneously. The same areas were gone over and over again, each time with a different demand, until almost all the standing trees were felled. The agencies were also given several other concessions such as opening of their own depots, formation of roads as required, extraction and utilization of damaged trees etc. Many coupes were allotted annually under schemes, which were prepared outside the working plans by several independent agencies. Supervision on the working of the private agencies was very inadequate. Companies and contractors abused concessions and several forest areas were thoughtlessly destroyed. They also helped many people to get forest land to plough by completely eliminating the vegetation on chosen sites. This attracted many new settlers. As a sanitary measure, woody climbers, old growth forests and bamboos were removed in regeneration areas. Consequently the forests were robbed of their grand growth and high complexity.

There were two bouts of mass flowering of big bamboo - once around 1920s and second time around 1960s and in recent years of 2000. Reeds flowered in 1990.

Two great world wars of the last century did cast a spell of doom on the forests of Western Ghats. Huge extraction was carried out to meet the wartime needs. But records are not available to say to what extent the track dealt with was affected by the wars. The bye-products of war such as the insecticides and pesticides had a terrible impact on the carnivores such as tigers. Later, follidol and other pesticides reached interior areas and were liberally used for poisoning the animal. As a consequence the "King of the Jungles" nearly vanished from the scene. Otherwise tigers were known to roam freely in the wild, often reaching out to human habitations and lifting cattle from the byre.

Realizing the consequences of multiple agencies working recklessly on the evergreen forests, restrictions began to be clamped in the last two decades of the 20th century. Initially ceiling was imposed on the number of trees to be felled per hectare and gradually the leases were phased out. Departmental operations were also restrained and finally the areas were declared as a sanctuary. Extraction of every kind was put to a halt since 2000 AD. Thus the tract went through a century of "organized" and chequered history to achieve what was just the initial objective of forest conservancy.

Extensive damage was done by VISL for charcoal and fuel wood. Again the forests were exploited by MPM for bamboo.

3.2 - The History of the management of forests of Bhadra Wildlife Sanctuary falls into three main periods:-

1. ***The Pre Working Plan Period:*** The period previous to Mr. Y. Sitaramaiah's Working plans of the Tegurgudda State forest, Muthodi State forest etc., which were written and published during the year 1889.

2. ***The period of the Timber Working plans:*** From 1898 up to the commencement of fire wood supplies to the Mysore Iron Works, Bhadravathi during 1919.

3. ***The period of firewood supplies to the Mysore Iron Works :*** From 1919 to 1936

The Pre Working Plan Period:

This period is characterized by the absence of any systematic management of the forests. The Forest Department in Mysore State was formed in the year 1864 and since then the forests were placed under the protection of the Department. Some of the oldest plantations seen today all along Somavahini river, near Tegurgudda, Hebbe and Muthodi forests belong to this period. The exploitation during this period was more in the hands of the

highest bidder than in the hands of the Forest staff and consequently the most accessible portions of important forests were denuded of their stock of valuable species, specially the teak. The need for systematizing the exploitation of the forests was first felt by Col. Campbell Walker, Conservator of Forests, Mysore, who ordered the preparation of working plans for Tegurgudda, Muthodi and other State Forests. The period came to a close with the drawing up of Working Plans by Mr. Y. Sitaramaiah, Assistant Conservator of Forests.

The period of the Timber Working Plans:

In 1902, a provisional Working Scheme based on the principles of silviculture was drawn up and its prescriptions were applied generally to all forests in Muthodi and Hebbe ranges. The scheme prescribed the 'selection method' of felling and the exploitation was on an area basis with a rotation of 40 years. Cultural operations were also recommended. Regular Working Plans for the most important forests were drawn up for the first time in this period by Mr. R.S. Narayana Rao, during 1916 for Tegurgudda and Muthodi State forests. The above Working Plans were replaced by Working Plans reports written by Mr. C. Abdul Jabber in 1918 which also prescribed the selection method by area check on yield with cultural operations. This period came to a close with the inauguration of the Mysore Iron Works factory at Bhadravathi.

The period of Firewood supply from 1919 onwards:

This period is marked by various changes in the mode of management of the forests. The need for firewood and the introduction of tramway for facilitating their exploitation and transport to the consumption center, necessitated re-arrangements of the working of the forests. The introduction of tramlines became the guiding factor for arranging the felling series and the annual coupes. This entailed slight modification in the existing working plans during 1919. The extraction of fuel till 1923 was however mainly controlled by the old working plans.

The scheme of working was replaced by the exploitation programmed drawn up for Hebbe State forest by Mr. B.V. Ramaiengar in 1924. The chief merits of the scheme consisted in clubbing the forests into six groups and

making the felling area large so as to facilitate concentration of operations. According to this scheme, Hebbegiri State forest was placed in group III and worked under a rotation of 25 years for both fuel and timber. This was in force till 1929 and was replaced by the working plan report drawn up in 1928, wherein the prescription were to work Hebbegiri State forest under clear felling system.

During 1945, a working plan report for Gangegiri, Tegurgudda Waddihatti, Madla, Hebbegiri, Kagemanegiri, Muthodi and Muthodi extension State forests was written by Dr. Krishnaswamy Kadambi for a period of ten years. The main objective of management was to ensure a continuous supply of the highest possible annual yield of firewood and timber to meet the demand of the industrial undertakings of the state and existing timber markets. The secondary objectives were the prevention of erosion and deterioration of the soil, and to maintain the beauty of the landscape.

To achieve the above objectives, all deciduous forests yielding large size timber were intensively worked in order to realize the maximum yield in perpetuity. An exploitable size of 2 Meters over bark at breast height was fixed for natural teak with a rotation of 110 years. There is no mention about the exploitable girth and rotation for other miscellaneous timber species in Kadambi's Working Plan.

The mixed dry deciduous inferior quality forests were worked to yield small size timber, while other miscellaneous species and coppice shoots, were used to produce the firewood of the required size and charcoal.

The prescriptions contemplated in Kadambi's plan were not strictly adhered to and after the expiry of the plan in the year 1953, the working plan has not been revised till now. Hence, it can be seen that all the previous working plans concentrated only an exploitation of timber and firewood and worked only the forests that contained valuable species.

Lakkavalli State Forests:- Nothing definite is known of Lakkavalli Forest prior to 1864 and even at that date the forest were reported to have been intensively

worked. The contractors, to whom the forest was leased out, seemed to have had a free hand in the extraction of timber. The sleeper operations of 1890-95 seem to have resulted in considerable denudation of teak from all the accessible potions. In 1902, a Provisional Working Scheme was drawn up, and a minimum girth fixed for exploitable trees. The fellings were confined to the annual coupes. The first regular Working Plan was drawn up by Mr. B.V. Ramaiengar for Lakkavalli. Selected felling were prescribed by his Plan for the best areas and improvement felling and thinning for the others.

With the advent of the Iron Smelting Industry at Bhadravathi, the programme of felling had to be altered to suit the course of the tramlines. This modification was approved by Government in their Order No. 4819-24-Ft. 94-19-1, dated 4th November 1919. In 1924, a Quinquennial Programme was drawn up by Mr. B.V. Ramaiengar for the firewood forests of the Bhadravathi Division, and sanctioned in GO No. I.C.5816-18-1-Ft. 24-32-2, dated 26th March 1924. The felling areas were made as large as possible to concentrate the operations and exercise efficient supervision. The scheme was succeeded by the forerunner of this report which was drawn up in 1928, and approved in G.O. No. G.10511-6-Ft. 341-28-7, dated 4th March 1980.

Thammadihalli, Tadasa and Hebbegiri State Forests:- Lying as they do, quite close to the existing tramways, these forests have borne the brunt of fuel supplies to the Iron Works during past years. They were brought under the Provisional Fuel Working Scheme of 1919, which was later replaced in 1924 by the concentrated exploitation scheme got by grouping typical areas, drawn up by Mr. B.V. Ramaiengar. According to this scheme Tadasa and Hebbegiri were placed in Group III, and worked under a rotation of 25 years, for both fuel and timber. Thammadihalli in Group I with a 20 years rotation. The scheme was in force till 1929, when it was replaced by the Working Plan Report, drawn up in 1928. According to this, Tadasa and Hebbegiri were placed in the Clear Felling Working Circle. Thammadihalli in the Coppice Working Circle.

3.3 Timber Operation including Bamboo and Fire wood Harvest:

After the declaration of Bhadra Wildlife Sanctuary/Project Tiger all the activities like extraction of timber, bamboo were fully stopped. As per the Hon'ble Supreme Court's order dt: 14.02.2000 in IA No. 548 in Civil writ petition No. 202/95 removal of dead, dying diseased trees, even the removal of grass has been prohibited from the sanctuary. But in Bhadra Wildlife Sanctuary all over the area since 1999 to 2001-02 the Bamboo clumps were gregariously flowered, dried and become dead. This dried and dead Bamboos are most susceptible for fire occurrences. These Bamboos became the combustible material for the fire during 2004. The fire menace took place mainly in Muthodi. Hence it is advisable to remove the dried and dead Bamboos from the Sanctuary.

3.4 Silviculture System and Tending operation:

Series of Teak plantation were raised in Bhadra Wildlife Sanctuary right from 1903 to 1986. The total number of plantations found in the Division is 149 Nos. and the area is 5846 Acres. The silviculturel thinning were taken up in the older matured plantation and the poles extracted were disposed off in the public auction sale. In the same teak plantation tending operations were carried on before carrying out of thinning.

In Aldhara section of Lakkavalli Wildlife Range, KFDC has handed over plantations to extent 860.30 Acres.

In Lakkavalli S.F. Eucalyptus plantations have been raised but the stocking is not good.

A pure patch of Honne plantations has been raised in Muthodi forest and plantations have been failed.

Since there are series of Teak plantations in the Sanctuary, to improve the habitat it is better to take up silviculturel thinning. In Teak plantation areas no other species has come up and even grass also.

3.5 Evenaged Forests and Un-evenaged Forests :

The periodically raised Teak plantations in the Sanctuary are more or less uniform in growth, but natural regeneration is very poor. In the adjacent area the species like Matti, Nandi, Sterculia, Hunal, etc., all are very good and form the un-evenaged system of crops. The Wildlife are abandoned this area of Teak plantation. Hence to give the importance to the wildlife improvement the teak silviculture thinning shall be taken up.

3.6 Bamboo Working :

As per guidelines issued by the Forest Research Institute, Dehra Dun, in respect of bamboo stands where the number of clumps is less than 50 clumps per hectare, the normal silvicultural practices may be adhered to. In area where the number of culms per hectare is more than 50 and number of healthy culms per clump more than 20, it will be desirable to retain at least 50 best clumps per hectare with about 20 healthy culms per clump, and these clumps should be spread over the entire area. The green flowered bamboos in the clumps in excess of these 50 healthy clumps that have been retained may be felled. This would ensure sufficient seed production for the natural regeneration. The removal of inferior clumps and dead and diseased culms from better quality clumps that are to be retained will ensure production of superior quality seed and the new crop that would come after the regeneration will naturally be of superior quality.

After flowering all the bamboos die irrespective of their age. In view of this the proposed extraction with harvesting cycle as prescribed in the working circle is till the occurrence of gregarious flowering. After the flowering and shedding of seeds, all the left over dead bamboos also have to be removed, as presence of this inflammable material will make the forest extremely susceptible to fire.

The extraction of dead bamboo has to be taken up soon after shedding of seeds in the following year itself. All efforts are to be made to complete it in the same year, but in any case it should not be extended to more than two

years. While doing the extraction care should to taken to avoid any damage to the fresh regeneration or to the clumps which have not flowered.

The Mysore Paper Mills started in 1937 and had an arrangement with forest department for an annual supply of 14000 tons of small bamboo.

As the capacity of the Mysore Paper Mills was enhanced the annual supply of Bamboo was also increased to 20000 tons. As the Mysore Paper Mills enhanced its daily production to 61 tons of paper forest department guaranteed an annual supply of 50000 tons of bamboo. The Mysore Paper Mills were advised to take big bamboo and bulk supplies were being made from 1958.

3.7 - Firewood Harvest and Collection :

Before the declaration of the Sanctuary, Bhadra Wildlife Sanctuary was included in Chikmagalur Territorial Division. During extraction of timber the fire wood was prepared by loft and tops of trees. Such collected fire wood was transported to the concerned depot and disposed in auction sales. There were enclosure villages inside the sanctuary. The villagers mainly cultivated the lands, grew paddy and had Arecanut gardens.

They were using the firewood in large extent for boiling the water and for other domestic purposes. Normally average firewood requirement per family was 20 kgs.,/day.

3.8 - Non Wood Forest Produce (NWP) Collection:

When enclosed villages were located in the sanctuary, the villagers used to collect the Seege and Honey. But after the shifting the villages, it was completely stopped.

3.9 Leases:

As per Government order No. FFD.108 FGL-76 Bangalore, dt: 21.09.1979 an extent of 230 acres of land situated in Singanamane Minor Forest had been leased out to Kuvempu University for a period of 20 years.

And since the lease period is expired and the proposal has been submitted for the removal of the lease in the year 2004.

In Bababudangiri SF an area of 738.55 Acres was leased to VISL in the year1923 for mining of Iron Ore. Then it was under the jurisdiction of Tarikere Range of Bhadravathi Division. During those days they constructed several buildings for their office, residence and guest houses. The area of buildings is about 15 Ha. A correspond was there to sanction 16.5 Ha for mining and 15 ha. of area for their establishment i.e., a total of 31.5 Ha. Subsequently in the year 1998 after the declaration of Bhadra Wildlife Sanctuary the request was turned down and notice was issued to VISL management to vacate the establishment area i.e., 15 ha. Action has been taken by the VISL management to demolish the buildings in the Bababudangiri SF area.

3.10 - Other programmes and activities:

Acquisition and rehabilitation packages have been sanctioned vide G.O. No. RD.69.REH.97 dated 28/03/2001. Rs.13.00 crores for acquisition & Rs.4.65 crores for Rehabilitation. 760.35 Acres of 12 villages were acquired. Acquisition cost for 744 acres had paid. Shri. Divakar Bhatt of Shiragola village has not taken the acquisition cost for 16.35 acres and approach the court against the acquisition order and still living inside the Sanctuary. 418 families have been rehabilitated in two rehabilitation centres i.e., M.C. Halli of Tarikere taluk and Kelagur of Chikmagalur taluk. 20 families of Bogase – Paradeshappana Mutt have to be rehabilitated. Remaining 46 families from 3 villagers are still to be rehabilitated.

3.11 - Forest Protection:

The forests are regularly patrolled to protect both the flora and fauna. At strategic locations, antipoaching and anti- smuggling camps, are set up and vigilance maintained round the clock. D.B.B.L and .315 rifles have been provided along with walkie talkies and mobile sets. Patrolling is carried out on foot, cycle, jeeps and at times on elephant back. The wireless network, is very useful in assisting the officials in protection.

3.11.1- Legal Status:

The Jagara Valley Sanctuary was declared by the Government of Mysore in the year 1951 and was reconstituted as 'Bhadra Wildlife Sanctuary' during the year 1974, vide Government Notification No. AFD-25-FWL-74, Dt: 6-9-1974, with some of the additional areas brought into its fold. This Sanctuary comprises of a number of State Forests namely, Muthodi State Forest and its extension, Kagemanegiri State Forest, Hebbegiri State Forest, Madla State Forest, Tegaragudda State Forest, Gangegiri State Forest, Madhugini State Forest, Vaddihatti State Forest, Lakkavalli State Forest and its extension, Aldhara State Forest, Hunsekatte State Forest, Tadasa State Forest, Singanamane Minor Forest, Thammadihalli State Forest, Kakanahosadi State Forest, Nandigave State Forest and Bababudanagiri State Forest.

The Government of Karnataka has confirmed the initial notification in the year 1998 vide G.O. No.FEE 58 FWL 96 dt. 9-3-98.

3.11.2 - Events of significance to the forest tract :

There are a few historical events, which have altered the course of the forest development of the tract especially in the last 300 years. These events have an overwhelming effect and are very important to the future development of the sanctuary. The details are as under :

3.11.3 - Declaration of Game Sanctuary by the State of Mysore :

The area was declared as **"Jagara Valley Wildlife Sanctuary"** by the Government of Mysore in the year 1951 with an area of 77.45 Sq. miles.

3.11.3.1 Ban and green by the state of Karnataka

Wide Government of Karnataka order No. AHFF.164.FDC.90 dt: 10-10-1990

3.11.3.2 Declaration of Bhadra Wildlife sanctuary by the state of Karnataka

The Bhadra Sanctuary was declared in 1974 Vide G.O.No. AFD-25-FWL-74, dated 06.09.1974, covering an area of 492.30 Sq Kms,

3.11.3.3 Declaration of Bhadra Wildlife sanctuary as Project Tiger area

The 25th Tiger reserve of our Country by Government of India on November 19th, 1999.

3.12. Hunting :

In olden days the were people hunting the wild bores which destroyed the paddy fields in around the Sanctuary.

3.12.1 - Poaching and Other illegal Activities:

There were some elephant poaching cases in this sanctuary. During 2004 two elephants were poached. One was is Muthodi and another in Lakkavalli Range. Culprits were arrested in both the cases. Tusks and arms were seized. In both cases poachers were from Kerala and were poaching with the help of local people. The poachers used the mussel loaded gun with the steel pellets and shot at the fore head of the Elephant. There was poaching of animals like sambar, spotted deer and other animals found rarely and stringent action has been initiated as per 1972 WP Act.

3.12.2 - Illegal Cutting of Trees:

There was rampant illegal cutting of valuable trees especially in Lakkavalli Wildlife Range and portion of Hebbe. The smugglers were entering the Sanctuary area through back water from N.R. pura and surroundings and also from Lakkavalli, Kundur, Baraganahalli and Guddadabeeranahalli villages. In the year 2002 one smuggler was shot dead in the encounter near Lakkavalli.

Now the smugglers have been controlled remarkably by establishing the anti poaching camps in the vulnerable areas by providing arms and ammunition and also the wireless network system. As the wireless net work system is working round the clock, good communication is established. Since the sanctuary boundary is consolidated by digging Elephant proof trench, the illegal entry of vehicles has been prevented. Action has been taken as per the Wildlife Protection Act 1972 against the offenders.

3.12.3 - Illegal Removal of NWP:

Before the process of rehabilitation there were 16 enclosure villages inside the sanctuary. During those days there were practices of removing NWP illegally. At present after the relocation of enclosure villagers the illegal removal of NWP is completely controlled. Establishment of anti poaching camps at vulnerable points is also helpful for controlling these activities.

3.12.4 - Encroachment and other illegal activities

After formation of Bhadra Wildlife Division in 1992, 70 encroachment cases were detected and out of which 49 encroachment cases, comprising 60.13 hectares of forest land were evicted. The action has been initiated for the eviction of remaining 21 cases comprising of 45.51 hectares of forest land.

3.12.5 - Domestic Livestock Grazing :

Grazing of domestic animals like buffalo and cattle is in practice by the villagers of fringe areas. Formerly the Genolis, a nomadic, used to camp in forest areas of the sanctuary. Since the declaration of the Sanctuary, this practice is discouraged and consolidation of boundaries by digging Elephant Proof Trench also affected the free movement of cattle to greater extent. Cases have been booked for illegal grazing. In eastern boundary near C.N. Kere village about 200 Ha. area is affected. The type of forest is mainly shrub to dry deciduous. Due to black cotton soil the eroding mounts of Elephant proof trench is noticed. This can be repaired by constructing retention walls. Repairs of Elephant Proof Trench in black cotton soil area can prevent the entry of domestic grazing animals. There is no incidence of cattle lifting reported inside the sanctuary. Poisoning of caracaus by villagers is also not noticed and reported.

3.12.6 - Wild Fires :

Bhadra Wildlife Sanctuary is very rich in Bamboo growth. The main species are Bambusa arundanesia, Dendro Calamus strictus. Bamboo growth is major in valleys and all along the streams and rivulets. Since 1998 Bamboo arundanesia (big bamboo) started flowering gregariously except in patches of

Tanigebyle and Lakkavalli. Then starts the dieing up off big bamboos. The dried big bamboos in the valleys resulted in forest fire. The failure of monsoon was very severe since 2002. Since October 2003 till March 2004 there has been no rain fall at all, which is an unusual situation. The weather has rendered the forest exceptionally dry and vulnerable to fire.

During March 2004, the fire menace occurred in the Sanctuary mainly in Muthodi area, parts of Tanigebylu, Lakkavalli and Hebbe Wildlife Ranges over an extent of 6490 ha. Though ground fire occurred in major part, dead and dried big bamboo burnt and triggered the crown fire due to flying of ashes from burning bamboo. In the 2004 monsoon the regeneration all over the burnt area has come up very nicely. The sample plots were drawn and the species like Bambusa arundanesia, Nandi, Beete, Mathi, Hunal, Neralu, Maru, Honne, Jagalakanti, Mavu etc., are found. The size of the sample plots were 10 x 10 mtrs.,

Removal of dead bamboo and other dead tress / flora.

The enormity of fire suggests that so long as such huge quantity of dead combustible material is available it is only a matter of time, that a fire would happen. Muthodi fires are unusual in intensity because of the quantity of the dead material existing. It may take several years for the bamboo to decay. The fallen dead hard wood like Teak, Beete etc., take decades to decay. The only way to ensure that the fire intensity is less is to remove the combustible material. As per Sec.29 of Wildlife Protection Act 1972 and as per the Hon'ble Supreme Court order, no material is supposed to be removed from the sanctuary area. But to protect the Sanctuary from fire, it is necessary to get permission from Hon'ble Supreme Court to extract the dead bamboo and the dead and fallen valuable timber material, so as to avoid intense fire in future. Perhaps an emergent application may be filed to the Hon'ble Supreme Court for permission to extract the bamboo and other valuable timber material.

Table 8: Year-wise break of area burnt in Sanctuary:

SL. No.	Year	Ha.,
1.	2000-2001	75.00

2.	2001-2002	1198.20
3.	2002-2003	-
4.	2003-2004	6561.00
5.	2004-2005	50.00

3.12.7 - Insect Attacks and Pathological Problems :

Insect attacks and pathological problems have been noticed in this division since early 2004. The Anogeissus Letifolia trees dried up considerably. This was followed by secondary attack by insects. The reason is not known (May be due to continuous drought during last 3 years).

3.12.8 - Wildlife Health :

In the year 1989 the render pest disease decimated the population of Indian guar considerably. Action has been initiated to stop the illegal grazing in the sanctuaries. The cattle population adjacent to the sanctuary has been vaccinated.

3.12.9 - Inter agency Programmes and Problems :

Inter agency programmes and problems were not found in this Division. Before taking up rehabilitation project the grazing problems was common. Presently they have been fully checked.

3.13 - Tourism :

Bhadra Wildlife Sanctuary is surrounded by picturesque hillocks like Bababudangiri Dathapeeta, Mullaiahnagiri (height 6317 mtr., MSL) Kallathgiri, Gangegiri, etc., Tourists have the opportunity to visit historical and pilgrimage centres like Sringeri (Sharadamba temple) Annapurneshwari temple in Hornadu, Khandya near Sangameshwarpete on the bank of Bhadra river, Kemmannugundi hill station etc.,

The jungle lodges and resorts have started to establish their resorts on the bank of Bhadra reservoir. Boating facilities may be provided to tourists in Bhadra Back waters which facilitate to watch the Wildlife which resembles Periyar of Thekadi in Kerala.

Table - 9 : The number of tourists who visited the Sanctuary during the last five years:

SL. No.	Year	Indian	Foreigners	Total
1.	2000-01	831	-	831
2.	2001-02	871	-	871
3.	2002-03	1817	14	1803
4.	2003-04	1548	24	1572
5.	2004-05	1308	8	1316

3.14 Research Monitoring & Training :

3.14.1 Research & Monitoring :

No research is conducted by the department but external agencies are conducting the research on different subject as mentioned;

1. Prof. M. Krishnappa & 3 others are conducting research on Bio-diversity on mosses in Bhadra Wildlife Sanctuary.

2. Dr. Y.L. Krishnamurthy and 4 others from Kuvempu University are carrying on research study on floral diversity of Bhadra Wildlife Sanctuary.

3. Dr. K. Ullas Karanth, Director of the Centre for Wildlife, Bangalore is working on a project on distribution and dynamics of Tiger and prey population in Karnataka.

3.14.2 Training :

There are two categories of training activities that can be recognized.

i) Job training like the Forest guards and Watchers have to be trained in controlling forest fires and they have to be taught the techniques for prescribed burning using of fire equipments etc.,

Legal aspects of law enforcements to field officers should be given periodically.

ii) ***Formal training*** :- The entire field staff can be trained in the training schools and they may be given additional fire arm training and maintenance of wireless equipments and its operation and material art training.

These kinds of trainings will improve the efficiency of field staff and they will become capable of handling the situations during smuggling, poaching and fire combating

3.15 - Wildlife Conservation Strategies and Their Evaluation:

The Sanctuary is surrounded by villages in eastern side and villagers of relocated area were involved in the hunting of small games. It is also noticed the labourers of estates used to hunt small games like Deer, hares etc., After the declaration of Wildlife Sanctuary, hunting has decreased considerably and action is taken as per Wildlife Protection Act 1972. Several country made muzzle load guns were seized and culprits were arrested and charge sheeted.

In the former days, the estate labourers from Kathle Khan used to cross the Bhadra river near Donegundi in Hebbe Wildlife Range an every Saturday to fetch ration from N.R. Pura. As a precautionary measure the movement of estate labourers through PA is banned.

A record has been maintained with photographs of the accused who were involved in such activities for future reference (Criminal diary). During regular patrolling, a track is maintained by regular enquiry by staff regarding the activities of such accused persons as a control measure. This activity has yielded a tremendous result. The western side of the Sanctuary is almost protected from direct entry of people from NR Pura Taluk as it is protected from main land by wide stretch of Bhadra back waters as a barrier. There are a number of fishermen camps on the other side of the back waters. Smugglers in guise of fishing used to enter the Sanctuary by using oracles. Action has been

taken to identify the fisherman by having contact with fisheries officials. In cases of involvement and abetment the licenses of such fishermen was asked to be cancelled to check such nefarious activities. A check list of such persons is maintained at Range level.

Since boats were provided for patrolling activities the illegal entry of smugglers and poachers is prevented from other side of the protected area. To improve the protection and the conservation works, it is required to enhance the budget for this purpose i.e., the new vehicles, sophisticated arms and ammunition, increasing of anti poaching camps, engaging of extra drivers for boats and vehicles. Tamed elephants can be used for the protection work i.e., to go deep into the forest for perambulation.

3.15-1 Administrative Set up :

The Sanctuary itself is a forest division created during 1992 headed by a Deputy Conservator of Forests, and his team of Officers. The division has 2 sub-divisions under the charge of two Assistant Conservators of Forests with headquarters at Chikmagalur and Lakkavalli and 4 forest Ranges, namely Muthodi, Hebbe, Lakkavalli and Thanigebyle. Ranges are further divided into sections and beats.

At present there are only 25 forest Guards working as against a sanctioned strength of 36. There is also acute shortage of departmental quarters to provide housing facilities to the existing staff.

Office of the Deputy Conservator of forests is housed in a departmental building. Many of the officers and other ministerial staff do not have departmental residential quarters and reside in rented accommodation. Adequate provision for transportation facilities to tourists, and communication facilities are yet to be realised.

Three watch towers had been constructed during the year 1995-96 and few more have to be constructed and the old ones have to be maintained.

Despite acute shortage of staff and infrastructural facilities, considerable work has been done in water shed management and habitat improvement. Great efforts have been put to maintain the road from Sukhalahatti to Muthodi by constructing 9 culverts and cause ways to this road, enabling the officers and staff to move within sanctuary from one range limit to other. Still 12 more culverts, cause ways need to be constructed to make this road pliable even during rainy season. Inspite of the shortage of the basic staff, the forests are greatly protected from fire damage, poaching, grazing and illegal felling. At present the Bhadra Wildlife Division is having perfect control over the entire sanctuary area.

The budgetary provision made available to this division is very meagre. The tourism sector needs to be developed by providing sufficient vehicles, transport facilities and Nature Camp facilities. Also the staffing should be adequate with office and residential accommodation.

The Project allowance given to the Project Staff at present is as below:-

Forest Watchers	Rs.,	350/-
Forest Guard	Rs.,	350/-
Forester	Rs.,	450/-
Range Officer	Rs.,	500/-
ACF	Rs.,	650/-
DCF	Rs.,	750/-

Range Forest officer has been provided with vehicles and other staff can also use them. Offices have been provided to RFO and checking barriers are erected for effective protection. There are ten watch towers and a checking gate in the Sanctuary i.e., at Honnahalla gate in Muthodi Wildlife Range.

3.16 Communication:

WIRELESS NETWORK:

The division has only 37 Walkie sets, 15 Static sets and 13 mobile sets for the protection of the sanctuary. It is proposed to provide a walkie to each

Forester, each checking gate, and each anti-poaching cum smuggling squad. The sanctuary should have at least a minimum of another 10 sets.

TELEPHONE:

The Deputy Conservator of Forests at Chikmagalur has been provided with Telephone connection to his office and residence. The facility should be provided to the Assistant Conservator of Forests and Range Forest Officers too.

LIST OF VEHICLES:

There are 13 vehicles in the Division,

Jeeps	7 Nos
Car	1 No.
Gypsy	1 No.
Mahindra Mini bus	1 No
DCM Toyota Van	1 No
Swaraj Mazda	1 No.
Tata 407 Mini lorry	1 No.

3.16-1 Summary of Threats to Wildlife :

The Wildlife of Bhadra Wildlife Sanctuary is subjected to poaching, smuggling, fire and viral diseases.

1. Smuggling of timber and fuelwood.
2. Cattle grazing
3. Poaching
4. Erosion
5. Destruction of habitat
6. Disease and pests
7. Agricultural land and coffee estates on the periphery of the Sanctuary.
8. Encroachment

9. Man-animal conflict
10. Possession of arms by the estate owners and agriculturists.
11. Drying up of streams and waterbeds in summer
12. Fire
13. Blockade and disturbance of corridors of elephants
14. Imminent flowering of bamboo
15. Cultivation within the Sanctuary by pattadars.
16. Rearing of cattle by pattadars.
17. Trespassing into the Sanctuary.

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CHAPTER – IV

THE PROTECTED AREA & THE INTERFACE LAND USE SITUATION

4.1 The existing situation in the Zone of influence

The extent of Bhadra Wildlife Division is 492.30 Sq.km., There are many villages on periphery of Muthodi Wildlife Range situated on the south eastern part and Hebbe Range falls in the south western part of Sanctuary.

The Muthodi Wildlfie Range is surrounded by villages like Melinahuluvathi, Balapura, Kaske, Karemane, Doddinakolaga, Karanji, Kolagame, Ukkada, Jagara, Kalenahalli, Balenahalli, Kelakunthi, Melukunthi, Siddarabana, Needugodu, Kelamallandur, Masgali, Galigudde, Siravase, Bogase etc.,

The Hebbe Range is surrounded by Khandya, Byramakki, Kadabylu, Bogase, Bidare, Ujini, Konkalamane, Saarya, Koskal, Bellangi etc., Three villages having 46 families from Bidare, Balegadde and Madhuguni are inside the sanctuary.

The Lakkavalli Range is surrounded by Singanamane, Tyvaragatta, Gonibeedu, Malligenahalli, Hunsekatte, Thammadihalli and Byrapura.

The Thanigebyle Range is surrounded by Nandibattalu, N.B. Colony, Hunsebailu, Saidukhan, Varthegundi, Jayapura, Kemmangundi, Machatavaru, Dopadakhan, Thanigebyle, Kallathipura, Virupakshakhan, Guddadabeeranahalli, Haruvanahalli, Gurupura, Bargenahalli, Thimmanabailu, and Roopline.

These villagers are mainly cultivating paddy and are growing coffee. 10% of the people are big coffee estate holders and 25% of the people are middle class farmers and 10% of peoples are marginal farmers. Rest of the people are landless labourers. SC, ST and OBC community people also live here. Most of the SC's and ST's are landless and are working in the coffee estates and agricultural farmers. Besides this they are raring cattle, collecting the honey etc.,

To certain extent these people are depending on the forest for agricultural implements and fire wood. After the rehabilitation of the villagers, the pressure on the forest from inside the forest is completely stopped. These people celebrate local festivals like Deepawali, Shivarathri, Ganesha Chathurthi, Christmas, Moharam etc., During Dasara, the villagers go for hunting of small animals like rabbit, wild bores etc., Before declaration of Sanctuary, Madars were depending on the forest for bamboos to prepare the baskets. They used to collect the honey from the forest. During those days people were collecting the honey and minor forest produce like Seege, Nelli, Muruganahuli and some medicinal plants etc.,

Northern and North eastern boundary of the Sanctuary was bordering important villages like Lakkavalli, Kenchikoppa, Rangenahalli, Bavikere, Harvanahalli, Bargenahalli and Chennayanakere until recent years. The villagers used to venture into forest for their needs like timber and firewood and bamboo. Medars of Kukke camp in Lakkavalli sneak into protected area for bamboo to make baskets. Now their needs for bamboo are met by territorial range. In olden days there were a number of country brick kilns in the vicinity of these villages. After the consolidation of the boundary, illegal collection and transportation is stopped. The Aldara section of Lakkavalli Wildlife range is fragmented due to presence of Kundur M.F, Bhadra reservoir and its colonies. 230 acres of land in Singanamane M.F. is leased out to Kuvempu University in 1979 for a period of 20 years. The lease period is renewed every year at Rs. 50.00/acre. There is a small township in the vicinity of the University. University students are conducting research works on biodiversity of Bhadra Sanctuary and their awareness programmes are yielding fruits. Villagers of Shanthinagar, Tamadihalli, Gonibeedu were earlier depending on this part of sanctuary for firewood. But now they are depending on MPM plantations for their needs. The North West of sanctuary is bordered by Aldhara, Bairapura, Kanagalasara, Lingapura and Kakanahosudi. In the west, villages like Maridibba and backwaters of Bhadra reservoir is seen. A vast stretch of Bhadra back waters is separating the PA from villages of N.R. pura Taluk.

In these areas many camps of fishermen are operating seasonally. There are incidents of locals colluding with fishermen who are engaged in smuggling of valuable timber from PA. Two elephants were poached in 2004. Accused were from this part. In both the cases detailed enquiry revealed in arrest of accused and action was initiated. A crime record is maintained to check the incidents like poaching and smuggling in future.

Patrolling by boats yielded a good result in tracking the accused and protecting the Sanctuary from smuggling and poaching.

Northern and North-east boundary is bordered by Kundur MF which is under the jurisdiction of territorial Lakkavalli Range. 1/3 of the area is under illegal grant and encroachment. Remaining portion was consolidated by Wildlife Division by digging elephant proof trench. This area is also proned to firewood collection except in summer by locals. Even though jurisdictional powers are vested with Territorial Bhadravathi Division, this MF portion is being treated as buffer zone to the PA. This area can be added to PA to serve as buffer zone for future management purposes. A portion of this area is planned to be used by Jungle Lodges and Resorts and to explore this area for tourism activities. The unemployed youth, who were formerly engaged in illegal activities like smuggling, can be employed in tourism related activities to earn their livelihood. Cattle population in villages like Chennyanakere and Guddadabeeranahalli is exerting pressure on PA for grazing. In the past local nomads called “Gowlis” used to camp in this portion of PA with their cattle. Soon after the declaration of the sanctuary this practice was discouraged. Major portion of the Elephant proof trench is disturbed due to sinking of walls of trench. Elephant proof trench has to be consolidated by constructing retention walls to reduce animal man confrontation. The mounting pressure on PA can be reduced through Eco-development committees by proposing suitable measures. Action is in place for vaccinating the cattle of fringed villages to stop spreading of infectious diseases (data enclosed)

In the eastern portion near Tanigebyle, Bababudangiri SF is an added attraction to this Sanctuary. The area consists most undulating terrain with valleys and steep hillocks. The altitude varies from 65 mtrs. to 1875 mtrs.,

above MSL. The highest peak in the Sanctuary is the Kallathigiri peak with height of 1875 mtrs., Kemmangundi area is famous for haematite iron ore. This is being extracted since 1923 by VISL. The original area leased out was 738.55 Ha. which forms a portion of this SF. Subsequently in 1986 they restricted the operation area to 42.75 ha. which is just outside the PA in revenue area due to uneconomic reasons. In adherence to Hon'ble Supreme Court order and Environmental Protection Act, the mining activities were stopped. There is small township consisting of labour quarters and other establishment area and Raj Bhavan guest house run by Horticulture department. The increasing population is affecting the situation of PA. Horticulture department wants to expand its activities which should be curbed for the peaceful atmosphere of the sanctuary. Action has been taken to vacate the mining colony establishments Demolition of buildings and dismantling of mining equipments are in progress. As the area comes under Eco sensitive zone and worked areas are in split, reclamation is a big question.

In such areas slopes have to be formed and stablilisation works and planting with suitable species is to be carried out.

In Nandigave village of Lakkavalli Range an extent of 27.12 Ha., area is an enclosure. It is to be relocated. As there is no habitation, the area malki is to be evaluated and action may be taken to set right the issue.

Forests are known for their diversity. They constitute less than 10% earth's land surface but contain 90% of all plant and animal species. Millions of years of evolutionary pressures shaped these ecosystems into the most complex in the world. There is an intricate web of life, which is the essence of forests themselves. Very few habitations on earth contain such a profusion or weight of plant life per hectare. Hidden by the vegetation from all but a trained eye are a multitude of plants and animals, rare, strange and beautiful.

4.1.1 - Human scape :

The sanctuary houses nearly 46 families belonging to 3 settlements. 175 peoples and 710 cattle reside inside the sanctuary. The size of revenue enclosures vary from single household to a maximum of 22. Almost 90% of the houses are of Mangalore tiles. Thatched houses are hard to come by except

as cattle sheds. There are very few RCC buildings. 95% of the people are dependent on agriculture. The cultivated land per capita is an important index on the pressure of land. They also collect and sell a variety of forest products. In addition to these demands, people also encroached forestland mainly for cultivation purpose. Illegal felling of trees inside and outside the forests has come down drastically over the years and it has almost stopped.

4.1.2 - Community festivals :

Festivals observed in other parts of the state are also observed within the sanctuary also. Hunting on festive days was a tradition. At times the whole community was involved in it. Fortunately, it is now relegated to history. On the western slopes, paddy is harvested around Deepavali time and this is a time of great celebration. Whereas on the uplands, sowing is delayed and taken up in August. As a result the harvest is delayed until November. Deepavali, Shivarathri, Souramana Ugadi, Ramzan and Christmas are the important festivals widely celebrated.

4.1.3 - State of Economy :

Almost the entire population in and around Bhadra Wildlife Sanctuary is based on the farm sector. There are no established big, small or home industries. 80% of the population consists of small and marginal farmers. The population is also dependent on coffee plantations. The proportion of work force to the total population is as high as 65%. Seldom people have disposable surplus income. Every family has a first preference to grow food grains for home consumption. Quite a number of families have abandoned growing of food grains, as it is uneconomical but lease out the lands. However garden lands are looked after well irrespective of the returns. Economic slump laid off a large part of agriculture labour force and therefore some of the male members migrate to nearby towns for employment. But their number is small. The adverse effect of general economic situation is not harsh on the local people mainly because of stable monsoons and production of basic minimum food grains by each household. Traditional occupations such as carpentry, black smithy, fishing, weaving, handicrafts etc., are also very uncommon inside the Sanctuary area. The educated people prefer to do white or blue collared jobs

or petty business instead of agriculture. Leisure time is utilized for gathering non-forest products, pasturing cattle, etc. If the people are purged from using the forests directly or indirectly, living becomes difficult.

4.1.4 - Vocation:

The vocation of people living in and around the Sanctuary is agriculture, plantation, animal husbandry and forest based cottage industry like basket making and carpentry. Jobs are very few except in large coffee estates, local banks, hospitals, schools etc. In the coffee estates in addition to permanent labour, a lot of floating labour is utilised during the coffee picking season in December-January.

4.1.5 - Use of forest and Non-forest based resources:

Traditionally, local economy is dependant on Forest resources. Earlier, before the ban was brought on tree felling, the local economy was heavily dependant on the forest by Saw Mills, fuel and timber depots etc. But with the stoppage of felling poor families depend on sale of firewood illegally collected, for earning their livelihood. Likewise, with no grazing grounds for the villagers, the Sanctuary is depended upon during the crop season i.e., June to Dec. The villagers, are also dependant on the Sanctuary for their requirement of fuelwood, bamboo and small timber though illegally.

4.1.6 - Implications of the land use and resource dependence for the conservation of PA:

With the people living around the Sanctuary having low subsistence level of economy, they illegally fell trees, remove fuel- wood, bamboo and small timber, graze cattle inside the Sanctuary and attempt at encroachment within the Sanctuary. This exerts tremendous pressure.

Large quantity of small timber, bamboo and firewood is removed illegally both for their personal requirement as well as for sale. This has degraded the habitat. Illicit grazing also reduces palatable fodder for Wildlife in addition to spreading diseases. Graziers, burn the forest floor for obtaining fresh flush of grass and in the process extensive area is burnt degrading the habitat. Collection of NTFP like honey, seegakai etc illegally compete with Wildlife for food.

Man-animal conflict is thus increasing. Though, an Elephant proof trench has been dug all round the Sanctuary to keep the Wild animals from moving out of the Sanctuary and damaging crops, the trench is invariably filled up at various places especially near villages, to facilitate movement of cattle and villagers into the Sanctuary for illegal grazing and fuelwood collection etc. In turn, Wild animals also move out and damage fields and property.

4.1.7 - The zone of influence (ZI) :

Technically all settlements and non-forest lands are outside the sanctuary. People have been living in these enclosures and are drawing upon the forests for their daily needs. Therefore there is a zone of interference around each of these enclosures. The width of the zone depends on factors such as the population size, extent of cultivated land, cattle population, size of land holdings etc.

In addition, there are many villages and settlements in a radial distance of 5 kms. from the boundary of the Sanctuary. List of such villages and demographic details are presented in **ANNEXURE – VIII**. There is more pressure on the Sanctuary from outside because the number of people, cattle and cultivated land is many times more. They are also dependent on the Sanctuary resources, be it water, grass, climbers, reeds, fencing materials etc. Available forest cover within this zone is surrogate measure of the biotic pressure. Vegetation map furnished in Plate - 7 also indicates the status of this zone. Where ever the pressure is high and if cannot be satisfied locally, it tends to shift towards the Sanctuary. External pressure is very high on the southern, northwestern and northeastern sides of the Sanctuary.

Life style in Malnad region is such that people use firewood very liberally both for cooking and heating purposes. Fuelwood consumption is therefore quite high. As preparatory to the monsoon, every household collects four to five cart loads of dry firewood, either round or split and nearly utilizes the entire quantity by the end of monsoon. Just before the monsoon, every household member is engaged in gathering of firewood. If the same is not available sufficiently in and around home steads, they sneak into the nearby forest and carry head loads. Dry fuelwood is one of the biggest demands just before

monsoon. In any case, people from outside the sanctuary normally do not venture for more than 1 or 2 kms. into the sanctuary.

4.2 -THE DEVELOPMENT PROGRAMMES AND CONSERVATION ISSUES

Developmental programmes are taken up by the Forest Department as well as other Government Departments in the Zone of Influence and to a very small extent within the Sanctuary. None of the works taken up threaten the integrity of the PA or the eco development strategy.

The above programmes, are taken up by the Taluk Executive Officer annually, based on the budget available and the village requirements. As such, while preparing the micro- plan for the fringe villages under the eco-development project, it was decided, that the sanctioned proposals from the local panchayat officer would be obtained and then the micro plan drawn up so as to avoid duplication of development activities.

4.2.1 The interplay of market forces and their impact on the subsistence economy of the local people:

With publicity for luxury goods being made regularly through TV, Radio etc and with its wide spread distribution, markets for luxury goods have been created in these villages too. Forests being easy source of illicit money, market sources have thus increased pressure on thefts in forests. With Towns in the vicinity of the Sanctuary there is a lucrative market for fuel-wood and small timber and many poor families thrive on this illicit trade.

Moreover with good bamboo available in the Sanctuary and a high demand for bamboo products in and around the Sanctuary and towns, illicit removal of bamboo to meet this demand does take place, degrading the forest. Likewise with good demand for fruits and honey, illegal collection does take place on the periphery of the Sanctuary.

4.2.2 Summary of problems faced by people that affect the management of the PA and the Zone of Influence:

4.2.2.1 Problems faced by peripheral villagers:

i) Man-animal conflict and delay in payment of compensation.

ii) Annual maintenance of the trenches not undertaken.

iii) No grazing grounds.

iv) Lack of forestry employment.

v) Restrictions on collecting fuelwood, timber, & NTFP.

vi) Firewood depots to be opened to meet the demands of the villagers.

vii) Restrictions in movement and communication.

4.2.2.2. Problems faced by forest villagers:

i) Job opportunities in the forest reduced.

ii) Man-animal conflict.

iii) Restrictions on grazing, collecting bamboo, fulewood, small timber & N.T.F.P etc.

iv) Lack of educational and medical facilities.

v) Lack of communication, drinking water, proper housing etc.

vi) Some ready to be rehabilitated due to heavy crop depredation.

vii) Fuel depots to be opened to meet their requirements

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PART – II

PROPOSED MANAGEMENT

CHAPTER V

PLAN OBJECTIVES AND PROBLEMS

Bhadra Wildlife Sanctuary is very important Sanctuary both from point of unique location and biological diversity. Since the Rio conference the world is awakening to the simplex biodiversity of this planet and necessity to maintain it for human survival and well being. The following objectives are set for management of sanctuary.

5.1 - Conservation of flora and fauna and their habitat. The Bhadra Wildlife Sanctuary is rich in flora and fauna, the area is to be adequately protected and propagated. It is prime duty to protect sanctuary to the endemic flora and fauna.

5.2 - Habitat Management: Series of teak plantation were raised here. This resulted of forest degradation due to monoculture and due to introduction of total and fruit yielding species like :- Ficus, Syzigium species etc., There are about 134 teak and other species plantations. The teak plantations should be silviculturally thinned and gaps created. Water harvesting structures can be provided to increase the under ground water level by desilting of tanks, construction of check dams, gully plugs, formation of new water holes, providing salt licks etc., Uprooting of weeds like eupatorium and parthenium, deemgestion of bamboos and mulching can be taken up in future. Seeds of hameta grasses can be broadcasted after ploughing land wherever necessary.

5.3 - Area consolidation: It is very necessary to take up the resurveying work all along the coffee plantation area and to fix the cement structured cairns. Though the EPT has been already dug in almost all the areas, the remaining portions have to be taken up for EPT. Restoration of EPT work is also to be taken up without fail. The acquired lands after the shifting of the villages inside the Sanctuary with the adjacent revenue lands to an extent of 770 Ha., had been notified under section 18 of Wildlife Protection Act 1972 vide Government Order No. Ay®d.46.HyÂ¬.l®…²åãHŒ¬.2004 (1), vw¯ºN®: 28/02/2005 – Nµš®îµ £µ°q®ä, Ay®d.46.HyÂ¬.l®…²åãHŒ¬.2004

(2), vw¯ºN®: 28/02/2005 – Nµš®îµ £µ°q®ä, Ay®d.46.HyÂ¬.l®…²åãHŒ¬.2004 (3), vw¯ºN®: 28/02/2005 – Ÿy¯å £µ°q®ä, Ay®d.46.HyÂ¬.l®…²åãHŒ¬.2004 (4), vw¯ºN®: 28/02/2005 – Ÿy¯å £µ°q®ä, Ay®d.46.HyÂ¬.l®…²åãHŒ¬.2004 (5), vw¯ºN®: 28/02/2005 – Ÿy¯å £µ°q®ä, Ay®d.46.HyÂ¬.l®…²åãHŒ¬.2004 (6), vw¯ºN®: 28/02/2005 – œµ„µà £µ°q®ä .

Further these lands have to be notified as **"Sanctuary"** as per section 26 of Wildlife Protection Act 1972. Due to the rehabilitation total area acquired is 760 acres. Besides this, the adjacent revenue status government land is also to be added to section 18 notification.

The areas coming in and around the Sanctuary will be consituted into conservation reserve and community reserve as per provisions of the Wildlife Protection Act 1972.

5.4 - Promotion of Eco-tourism: Eco-tourism is necessary to maintain and develop to extent considered for recreation, education and to provide wilderness, experience to genuine enthusiasts. Hence it is necessary to provide and form the trekking paths in particular places in all the 4 ranges of the Bhadra Wildlife Division. Watch towers are also needed to have bird view of the Sanctuary. The infrastructure has to be developed in existing nature camps and a new nature camps are to be developed at Tegurgudda forest area on Bhadra River Bank. The tents can aslo be erected. The boating can be developed in back waters of Hebbe and Lakkavalli Ranges. The medicinal plant plots can be developed for the study purpose of the tourists. The heritage temples such as Markandeya, Bhavanishankari, Panchalingeshwara are situated within Sanctuary and can be visited by the tourists with assistance of the guides. There is a natural heritage giant teak tree in Muthodi Wildlife Range. This is one of the attractive place for tourists. Besides this, the Kemmangundi and

Bababudangiri the hill stations are located within the Sanctuary. The Hebbe Falls is also very attractive spot for the Eco-tourists.

5.5 - Eco-Development: The Bhadra Wildlife Sanctuary is surrounded by many villages in fringes or borders of the Sanctuary. Most of the people are socio-economically backward. Hence it is very necessary to create the awarness among them to serve and protect the forest. Employment generation for the most needy section of society, particularly women, scheduled castes / scheduled tribes and landless labourers inhabiting forest land and adjoining areas is required. It is necessary to encourage the Stree Shakthi groups to start self employment like poultry, piggery, bee culture, pisciculture, tailoring and cottage industries like manufacturing of pickles, papard etc.,

Vaccination to cattle is also very essential to avoid the foot and mouth disease. LPG connections should be provided to poor people, thereby reducing the pressure on forests for fuel. Raising the plantation on the farm lands by planting the species of fodder and food, small timber, fulfills the need and reduces the pressure in the forests. Water harvesting structures can be taken up in the village limits close to lands. Providing the solar fence reduces the man-animal conflict. Entry point programmes can be taken up, which would inspire to co-operate towards the fire protection and conservation of the forests.

Grazing can be controlled by stall feeding in villages and by engaging of fire watchers and anti-poaching watchers from fringe villages.

5.2 PROBLEMS IN ACHIEVING OBJECTIVES

5.2.1 Problems related to protection:

a. ***Illegal removal of firewood and small timber:*** A large number of peripheral villages, especially falling in Tarikere taluk, are very dependant on the Sanctuary for their requirements of fuelwood, bamboo and small timber.

b*. *Grazing: The peripheral villages have nearly 39316 heads of cattle, and in the absence of grazing land in the villages, drive their cattle into the Sanctuary. They not only compete with Wild animals for fodder, but are also carriers of various diseases.

c. Forest fire: With habitation found within and on the periphery of the Sanctuary, incidence of fire is very common.

d. Hunting and poaching: With the Sanctuary surrounded by villages and coffee estates there have been attempts of poaching.

5.2.2 Problems related to habitat management:

a. Past forestry practices: Large tract of monoculture of teak, eucalyptus & miscellaneous sps, (27.45 sq. km) have been raised which has changed the natural habitat.

b. Invasion of weeds: Lantana, Eupatorium, Parthenium have invaded the Sanctuary and retards fresh regeneration and also growth of fodder for Wild animals.

c. Drying up of water holes: Observed in the drier parts of the Sanctuary in Lakkavalli Range

e. Corridors not maintained: Corridors, for movement of Wild animals from Sanctuary to other areas, are blocked by trenches, coffee estates or private solar fencing.

5.2.3 Other related problems:

a. Man animal conflict: Man animal conflict are mainly due to crop depradation by Wild animals and tiger and panther predation on livestock. Deaths due to elephants are also reported.

b. Epidemics and diseases: In the past there have been reports of rinderpest, foot and mouth having spread from domestic cattle to Wild animals.

c. Inadequate staff: Nearly 17% of the posts sanctioned are vacant and needs filling up. In addition, the staff need to be updated in modern PA management techniques.

d. Lack of facilities for staff:

- Shortage of staff quarters.
- Shortage of schooling facilities.
- Lack of medical facilities.
- Lack of wireless, arms and ammunition.
- No sufficient incentives

e. Lack of research, monitoring and interpretation: Research is very limited and facilities wanting. No interpretation centre exists.

f. Tourism and Facilities: Though very rich in Wildlife, has very limited facilities to promote tourism. Rest houses and vehicles for tourists is wanting.

g. Inadequate PA - People interaction: There is a very little or no interaction. This requires to be improved.

h. Inadequate inter departmental co-ordination: Inter departmental coordination is very necessary for protection of Wildlife and its habitat. This interaction needs improvement.

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CHAPTER – VI

THE STRATEGIES

6.1 – General :

Through a series of measures, most of the objectives set out for the first phase of the previous plan are achieved. Bhadra Wildlife Sanctuary is now totally free from timber extraction operations. Protection level is enhanced. Hunting pressure on the mega fauna has come down drastically. The forests have been regenerating very satisfactorily. Faunal density is also growing appreciably. Constitution of the Sanctuary and the restrictions thereon are also adequately publicized. The Sanctuary is now at a crucial stage of take off. For achieving the plan objectives, the following strategies are necessary :

a) Provide for an efficient administration and effective protection,

b) Reverse the habitat fragmentation and consolidation thereof,

c) Zonation of the Sanctuary and zone wise prescriptions

d) Tourism, and,

e) Mitigate the external pressure.

6.3 – ZONATION:

Taking the above vegetation pattern into consideration, the Sanctuary is proposed to be zoned. A Zone is an area of specific management category distinguishable on account of its objectives. The number and kind of zones required depends on objectives and how different the objectives are with respect to each other, so as to necessitate separation of strategies by areas. Zones, cannot be planned in isolation, but must relate realistically to the surrounding areas of other zones and where relevant, to areas outside the PA.

6.3.1 - The Core or Wilderness Zone:

The ‘Core Zone’ as a management entity was for the first time introduced for the management of Wildlife in India in the year 1973 under 'Project Tiger'. In fact, the term used was ‘Sanctum Sanctorum’ which changed to ‘Core’ with

usage. Such areas, require to serve as centres of ecological reference and ecological processes so as to maintain atleast a good percentage of the key habitats, elements of conservation importance such as species, communities and populations under reduced threats.

Main objective of constituting this Zone is to preserve it in as near natural as possible condition by providing all protection. Protection, shall be against all forms of biotic interference and only scientific studies permitted.

6.3.2 - **Restoration Zone:**

The Restoration Zone, would include, the area on the fringe of the Sanctuary which have been degraded over the years due to heavy biotic pressures and to mitigate further degradation. These, are mostly found in the Lakkavalli Range. These areas, now require to be rigidly protected against all forms of biotic interference and restocked with indigenous species as early as possible to improve the habitat and to build up resources. In addition, soil conservation planning, management of water shed and a special planting effort are required to be undertaken.

6.3.3 - **Tourism Zone:**

At present three areas at Muthodi, Lakkavalli & Hebbe have been earmarked for Wildlife viewing and tourism. Activities like viewline clearance, saltlicks, erection of watch towers, creation of water holes and maintenance of roads will have to be done.

6.3.4 - **Habitat Management Zone:**

This Zone includes all the plantations raised in the Sanctuary, areas with thick lantana growth, as well as, the areas which are not included in any of the other zones.

6.3.5 - Buffer Zone:

India has pioneered the concept of core-buffer zonation within the Wildlife Protected areas. Briefly, the concept stems from the fact that the interface

(edge) between any two competing land use systems is going to be one of tension. People are attracted into the PA for wood and fodder. Wild animals are attracted into the agricultural fields by nutritious crops. Past policies have been one of enforcement, barriers, armed patrols etc. If the interface is seen as a zone of sharing resources, then this interface absorbs people dependency pressure and does not seek to repel it. This is the socio economic role of a buffer zone (Saharia 1984).

A second role, is that of a dispersal area; where the buffer which still has some natural cover, absorbs dispersing animals and probably maintains viable populations of species more robust to disturbance. Buffer zones, act as corridors, linking two separate zones.

To start with, buffer zone should be large enough to be functional, absorb boundary pressure and thus protect the other zones. Buffer zone management depends on:

i) acceptance by the people, which in itself will follow their involvement in management and their appreciation of resouces value.

ii) active development of accessible alternatives

This zone will include areas outside the boundary of the Sanctuary. It includes the RF's and SF's and the villages and hamlets upto a radius of 3-5 km from the Sanctuary boundary where the eco-development project is in progress. The buffer zone management would reflect shared land use. Such integration in Wildlife and forestry would add corridors (through Reserve Forests) between PA's (Sawarkar and Panwar). This again requires intrasectoral integration and enabling the PA plans to recommend improvements in surrounding areas that would enhance biological diversity and ecological conditions in buffer and fringe zones on one hand while meeting biomass needs on the other.

6.4 - ZONE PLANS

6.4.1 - Zone Plan for Core or Wilderness Zone:

6.4.1.1 - ***General Constitution:***

This includes areas with least disturbance and with minimum management intervention and includes areas having good contiguous forest cover representing moist deciduous forests with least fragmentation. The Core Zone, would now be 329.22 Sq. Kms.

6.4.1.2 - ***Objectives of Management:***

This Zone, is constituted with the main objective of preserving the area in as natural a state as possible by providing it all protection from various biotic factors. Natural course of ecological succession is to be promoted.

6.4.1.3 - Activities permitted in this Zone:

1. The forests in the core area, would be preserved as a gene pool to serve as a centre for ecological reference.

2. Limited scientific studies would be permitted.

3. Strict protection against biotic factors like fire, grazing is to be provided.

4. Development activities for Wild animals is to be permitted, like maintenance of waterholes, salt licks, habitat management of older monoculture plantations etc.

5. Except staff and researchers, no movement within the Core is to be permitted.

6.4.2 - **Zone Plan for Restoration Zone:**

6.4.2.1 - ***General Constitution:***

This includes areas along the periphery of the Sanctuary, which have been subjected to heavy biotic pressure from grazing, removal of firewood, bamboo, small timber and non timber forest produce resulting in removal of understory cover as well as tree growth. The areas included in this zone are degraded forests.

6.4.2.2 - Objectives of Management:

This Zone, is constituted with the purpose of rigidly protecting the area from further biotic interference, mitigate further degradation, restocking the area, soil conservation planning & management of water sources to bring it back to its original habitat.

The restored zone, can be allotted to any other zone after achieving the restoration objectives.

6.4.2.3 -Activities to be allowed in this Zone:

1. Rigid protection against grazing, fire and poaching, illicit collection of small timber, firewood, bamboo and NTFP.

2. Rigid protection of the area and habitat improvement by tending the existing stock and supplementing it by planting indigenous species.

3. Planting of grasses, bamboo, fruit species and other fodder species useful for Wild animals and simultaneously raising adequate nurseries.

4. Closing the area being regenerated from any external interference for a period of three years by solar fencing.

5. Carry out simultaneously, ecodevelopment in the villages adjoining these areas so that pressure is completely reduced/eliminated.

6. Soil conservation planning & management of water resources on watershed basis in the drier sections of the zone to improve the growing stock.

6.4.3 - Zone Plan for Tourism Zone:

This zone will be in three units, two of which are at present being used as the Tourism Zones at Muthodi, Lakkavalli and Hebbe and would now include the area around Kemmangundi to be developed in due course as the fourth area.

6.4.4 - Zone Plan for Habitat Management Zone:

6.4.4.1- General Constitution:

This Zone would include all the plantations raised in the Sanctuary, area with thick lantana and eupatorium growth, and areas not included in any of the other Zones namely Core, tourism and restoration Zones. The area represented by this zone is 91.28 sq km.

6.4.4.2 - Objectives of management:

As mentioned earlier, nearly 27.45 Sq. Kms., of monoculture plantations of eucalyptus, teak and miscellaneous sps have been raised in the Sanctuary. Eucalyptus being an exotic, it has no place in a Protected Area. In addition, eupatorium, lantana and parthenium have invaded the Sanctuary in a very big way. These require to be eradicated or controlled. Teak plantations would also have to be silviculturally thinned and clearfelled in stages and attempts made to facilitate forest regeneration and re-establishment of old growth forest through a process of natural succession.

6.4.4.3 - Activities to be allowed in this Zone:

1. Rigid protection against grazing, fire, illicit removals and poaching.
2. Habitat management in the form of thinning, removal of eucalyptus, weed eradication, limited felling of older teak plantations.
3. Carry on Ecodevelopment activities in the peripheral villages.
4. Restocking the area by tending and planting.
5. Wild animals requirements of water, fodder, etc to be supplemented.

6.4.5 - Zone Plan for Buffer Zone:

6.4.5.1-General Constitution:

All R.F's, S.F's and villages falling within a radius of 3 to 5 sq km, included in the Eco-development project, are brought under the Buffer Zone. The villages and hamlets included are as shown in Annexure IX which are brought under the eco-development project.

6.4.5.2 Objectives of Management:

1. Provides extension buffering for Wildlife and social buffering for people.
2. To meet the area required for domestic livestock grazing.
3. To meet the demand of fuelwood, small-timber & NTFP.
4. To provide employment to the villagers who depend on forestry activities for their livelihood.

6.4.5.3 Activities to be allowed in this Zone:

1. Rotational grazing.
2. Raising of fast growing species to meet the requirements of the villagers through Joint Forest Management (JFM) till the eco-development project is self sustaining.
3. Rigid fire protection measures.
4. Regulated collection of NTFP through Societies.

6.5 - **THEME PLAN**

The following strategies are proposed for meeting the objectives of management.

6.5.1 - **Habitat Improvement:**

Habitat improvement will be based on the following considerations:

1. Protecting the area against biotic degradation.
2. Improving the habitat for Wild animals.
3. Conserving, protecting & increasing the biodiversity.
4. Taking up an afforestation programme in the restoration Zone and gaps by introducing indigenous species, fruit trees and fodder sps.

The following works are thus proposed:

6.5.1.1- Management of Monoculture Plantations:

Of the 27.45 Sq. Kms. of plantations raised in the Sanctuary, 20.71 sq km is of teak, 0.86 Sq. Kms. of eucalyptus, 1.65 Sq. Kms. of Silver Oak, 4.20 sq km of mixed species and 2.10 Ha., of coffee plantation.

(i) As far as the **'Eucalyptus plantations'** are concerned, it being an exotic, it requires to be removed completely.

- To start with, on a trial basis 1-2 ha of the oldest plantation, should be clear felled, as a 'Sample Plot' to facilitate natural regeneration.
- If this is found successful, then the plantations could gradually be felled over the years, to facilitate natural regeneration and wherever necessary supplemented by artificial regeneration.
- However, as there is very heavy damage by Wild animals and weeds invade the area opened up, a **cautious approach** is necessary.
- By clear felling the plantations in stages, the understorey should be permitted to grow.
- This should be supplemented by planting indigenous species along with fruit trees, bamboo and other fodder species.
- As there are 85.90 Ha., of Eucalyptus plantations spread over four ranges, annually 10 ha could be clear felled agewise (selecting the oldest first), solar fenced and planted up simultaneously with tall plants.
- The Eucalyptus, felled could then be used to run fuel-wood depots at subsidised rates in the villages on the periphery of the Sanctuary and Eucalyptus poles supplied for construction of houses etc, so as to wean away the pressure on the Sanctuary. The villagers, also feel that this would help meet their requirements of fuel-wood and house construction material, till the Agro-forestry programme initiated bear results.

- Section 35(6) of the Wildlife Protection Act, also provides for exploiting the habitat provided the State Government is satisfied that such exploitation is necessary for the improvement and better management of wildlife therein.

- In the absence of plantation journals and in view that **'teak thinning operations'** have been carried out in the past, only plantations, raised after 1960, are proposed to be tackled. **To start with, it would be worthwhile and useful to identify all the plantations in the Sanctuary from Working Plan maps, affixing small metal plates of dimension 30 cm x 10 cm, giving details of the year of plantation and hectarage.** The total plantations of teak raised after 1960 is as follows:

Table 10: Teak plantations raised after 1960.

SL. No.	Range	Acreage (In Ha.,)	Remarks
1.	Muthodi Wildlife Range	1201.33	
2.	Hebbe Wildlife Range	1260.00	
3.	Lakkavalli Wildlife Range	350.00	
4.	Thanigebyle Wildlife Range	323.42	
	Total:	**3134.75**	

- A total of 3134.75 acres are identified as available.

- Sample plots of 1-2 hect in each range should be laid out at random, the teak enumerated and silvicultural thinning carried out in keeping with the prescriptions of the earlier Working Plans, the Yield and Stand Tables.

- The area, should be rigidly fire protected and solar fenced.

- The undergrowth at the time of thinning and periodically later would have to be recorded, studied to ascertain whether thinning would improve the availability of fodder for Wild animals or otherwise.

- Artificial regeneration with indigenous sps, fruit sps and fodder sps be undertaken to supplement the natural regeneration.

- Based on these results and if successful, the thinning schedule should be fixed, taking up approximately 100 ha in each Range annually, starting with the oldest plantations so as to cover all the teak plantation's, to be thinned during the Plan period.

- Care should be taken during the felling not to disturb the area very much. The felled material (by chain saws), should be brought out of the area on to the roadside using elephants and then transported by departmental lorries. The operation should be continuous and fast so that disturbance is reduced as far as possible.

- It is also observed, that many of the younger teak plantations have been heavily damaged by elephants and the teak poles stripped of their bark. In such areas, further thinning would not be necessary, except for salvaging the felled and damaged poles.

(iii) Regarding the **'older teak plantations'** raised prior to 1960 following would be the package of practices to be followed:

Table 11: Teak plantations raised prior 1960.

SL. No.	Range	Acreage (In Acres)	Remarks
1.	Muthodi Wildlife Range	997.43	
2.	Hebbe Wildlife Range	521.00	
3.	Lakkavalli Wildlife Range	462.50	
4.	Thanigebyle Wildlife Range	-	
	Total:	**1980.93**	

- Sample plots of 1-2 ha in the oldest plantation in each Range be laid at random.

- The undergrowth (biodiversity values) in these plantations is recorded.

- The teak marked and felled preferably before the rains. Felling and conversion to be carried out by power saws, timber dragged to road side by elephants and transported by lorries with minimum delay to avoid disturbance.

- The area solar fenced.

- The area, be planted with tall indigenous species, fruit trees, bamboo and grasses during the rains.

- The area, be rigidly protected from fire, weeded, cleaned and beating up of casualties followed over a period of 3 years.

- The seedlings planted be manured, soil mulched etc.

- All the growth in the area be monitored for a period of 3 years, through a series of regenerative surveys.

- **Based on the results analysed and if satisfactory,** annually 50 ha could be selected in each Range, starting with the oldest plantation and attempts be made for recovery of the original habitat through secondary succession. However, if biotic pressures are severe and are not conducive to the above proposal, the plantations should be retained as they are.

6.5.1.2 - Plantations in the Restoration Zone:

The above area fall along the fringe of the PA, and have been degraded due to various but heavy biotic factors, as there are many villages adjoining the Sanctuary. With Ecodevelopment activities taken up in the fringe villages, it is hoped, that pressure on these areas would reduce and stop over the years.

In this Zone to start with

- Sample Plots' should be laid and planting taken up in 1-2 ha in each Range and the results watched and monitored for three years.

- The solar fencing on the periphery of the Sanctuary could be extended to cover this area.

- If there is heavy damage to the plantation by wild animals, then nurturing the coppice growth only, should be attempted along with rigid protection of the area from any biotic interference.

Nurturing of the Zone is proposed based on the results of the Sample Plot. For this,

- Each Range will select an area of 25 ha annually, starting from within the Sanctuary and going towards the periphery in due course.

- All important indigenous species will be retained (mostly copice growth), weeds cut back and burnt during March-April.

- Nursery, for raising tall indigenous species, fruit sps and fodder, should be raised a year in advance.

- Bamboo should be raised through seeds, node cuttings or rhizomes be collected from the wild. Tall saplings should be prefered.

- After solar fencing the area with 5 strands of wire, the fruit and fodder species should be planted at 4mx4m with bamboo in quin-cunx. In between, grasses could either be sown or planted.

- These plantations should be maintained for a period of 3 years by weeding, cleaning, beating up casualties etc.

- Necessary mulching and manuring of individual plants should be undertaken in the first two years.

- The area should be rigidly fire protected.

Attempts have been made in the past towards underplanting, but have not been successful. This could be, because the efforts have not been continuous area not protected or due to severe damage by the Ungulates. Hence a pragmatic approach would be necessary.

6.5.1.3 - Improving lantana infested areas:

Lantana has invaded certain portions of the Sanctuary. The question of removal of lantana and artificially regenerating the area is disputable. In areas, where bamboo had flowered in the past like in Bandipur, it is noticed that bamboo is slowly overtopping and suppressing the lantana.

Some feel that lantana is browsed by gaur, sambar and chital, probably when other better fodder is not available, and are against its removal. This is noticeable mainly along the fringe of the view lines and animal tracks. Attempts, have also been made in the past in uprooting lantana, burning and planting up the area, but there have been no concerted efforts, as success is deceptive or not noticeable. Moreover both lantana and eupatorium suppress all fodder growth.

6.5.1.4 - Parasites

The common parasite on many tree species is Loranthus longiflorus. It is commonly found on teak and phylanthus. The infection results in mutilation and death of branches on tops and finally death of trees in case of heavy infection as seen in phylanthus.

Sanitation cutting affected branches, 0.3 m below the point of infection, particularly when trees are leafless, keeps the parasite under control.

6.5.1.5 - ***Maintenance of water-holes:***

There are 72 water-holes scattered all over the Sanctuary. The numbers are adequate, but majority of them, get silted up and water is not available during the summer, especially in the drier parts of the Sanctuary. In these areas, due to the long dry season it is necessary to desilt the tanks to restore the catchment capability in a phased manner from time to time, before the monsoon sets in. This, would also provide labours. A gradual approach/slope should be given so that the wild animals can access the water easily. The silt dug up, should be dumped on the side of the bund, to increase the water holding capacity & not on the opposite side, as it would then be

washed back into the waterhole during the rains, negating the purpose of desilting.

All the drains, on either side of the forest roads, should lead into the water holes and act as feeder drains. Where-ever necessary, additional feeder drains should be dug to augment the water supply.

It would also be necessary, to get the water in the peripheral water-holes, examined against water borne diseases which spread from domestic cattle and appropriate action taken. Application of lime and bleaching powder after desilting, should also help.

The following criteria has been adopted for identifying suitable sites for the construction of check dams.

- Narrow valleys with close centres, so that evaporation loses are minimum.
- Waterholes as far as possible, away from the border of the Sanctuary.
- Away from the existing waterholes.
- Valleys with gentle slope along the bed.
- Mainly 2nd or 3rd order streams with sufficient catchment.
- Less submergence of forest.
- Not to cut across more than one drainage at a time, however certain check dams are suggested at the junction of two streams.
- Catchment with less erosion potential.

6.5.1.6 - Maintenance of salt licks:

Salt licks, have been concentrated in the tourism Zone. They, not only attract Wild animals, but also serve to replenish the salt contents in the body of the animal. Natural salt licks are also found in the Sanctuary but are rare. It is necessary, to have many more salt licks scattered in different parts of the Sanctuary and common or block salt spread atleast twice a year in the other zones and thrice a year in the tourism Zone.

6.5.1.7 - Corridors and Linkages:

A corridor, tenuous as it is, is vital in ensuring gene flow. It needs to be maintained, to avert threats to population viability. It is also necessary for free movement of Wild animals lest they get fragmented.

6.5.1.9- Soil and Moisture Conservation:

Not much work has been carried out towards this end. The aim should be to retain all the rain falling in the Sanctuary within it so that the sub-soil moisture and vegetation improves and there is better fodder for Wild animals. Towards this end, the drier parts of the Sanctuary would have to be taken as a whole. All rivulets in the area would have to be tackled systematically by constructing inverted bunds, gully plugging and check dams with stones and mud, and planting up with agave for consolidation. This work should be taken up before the monsoons so that planting can be done during the rains. **Watershed units, would have to be identified and tackled individually for conservation of soil & moisture and in turn improving vegetation as well as recovery of riparian vegetation. This in addition to providing work for landless labour in the fringe villages.**

6.5.1.10 - Removal of drift timber from the streams/rivers:

It is observed that drift and fallen wood at times block the normal course of streams/rivers resulting in change in water course and damage to the banks, bridges etc. **As such, all drift timber should be removed after the rains with the help of elephants for free flow of water. The removed drift & fallen wood should be left to decay within the Sanctuary.**

6.5.1.11- Maintenance of Hadlus or Swamps:

These should be preserved and maintained as they are an edaphic climax. Due to succession some tree species are found encroaching the grasslands, particularly after a series of years with deficit rainfall. **These should be removed and the succession halted or by burning the hadlus to suppress woody growth to maintain the grassy vegetation.**

The hadlu habitat holds the key to maintenance of high ungulate densities (particularly of Chital, gaur, and elephant) in Muthodi and other similar ecosystems. These moist grass savannahs appear to be maintained naturally in years of normal rainfall, but after a series of years with a deficit rainfall, they appear to be invaded by native woody plants and other weeds. If there is a series of dry years, this could lead to a problem which may need to be addressed by artificial clearing & burning of the hadlus to suppress woody plants and to maintain the normal grassy vegetation.

The Wildlife Institute, Dehra-dun have suggested monitoring the hadlus for encroachment of woody regeneration along the margins. They feel this is happening and needs to be validated. Currently a biological investigation of such habitats is on in the Parambikulam Wildlife Sanctuary in Kerala. It is suggested that linkages may be established and investigation on similar lines carried out.

6.5.1.12 - Removal of dead and fallen trees:

The removal of dead and fallen trees in the Sanctuary has been debated over the years. The dead wood was essential in providing biomass, in replenishing the top soil, which forms a vital part of the life cycle and it would be unwise to disturb this cycle. With rigid fire protection, the dead and fallen trees, do not constitute a fire hazard. In addition these dead trees, are home to a variety of hole nesting birds, reptiles, amphibians and smaller animals.

The forests have been heavily logged under a prescription for removal of dead and fallen trees. All such forestry operations have considerably degraded the old growth forest structure, eliminated very large old trees and lianas, and caused major gaps in which invasive exotics are thriving. The old growth community in this forest includes many birds, civet, flying squirrel and an undocumented number of reptiles, amphibians and invertebrates. Several of these are key dispersers of seeds and pollen and regulators of insect pests. Old growth forest structure and integral ecological communities. All wood removal, including dead and fallen trees should be permanently stopped.

6.5.2 - Strategies to overcome Protection Problems:

6.5.2.1- Control of Poaching and Illicit Felling:

These strategies, are for the Sanctuary as a whole. To control poaching of Wild animals and illicit felling of trees the following strategies are proposed:-

6.5.2.1.1 - Effective ant poaching effort:

For this, the basic requirement is sanctioned staff to be in position. With nearly 17% of the posts vacant, it would be very difficult to organise an effective mechanism to control poaching. The Sanctuary already has a mechanism, which needs to be supplemented with man and equipment to make it effective and fool proof.

Extensive patrolling on foot, on elephant back and by vehicles is one of the duties of paramount importance. The staff should follow up and analyse each case of poaching or illegal felling towards its logical end. Though cases like elephant poaching are reported and handed over to the local police, their priorities being different, they do not find time to follow up such cases. Hence, the Assistant Conservator of Forests and the Range Forest Officer concerned should be personally held responsible in following up such cases within a time schedule prosecuting those apprehended and finalising the cases. They should be permitted to move into the neighbouring States, in the course of their investigation. This is all the more necessary, as till date, there have been prosecution of offenders in any poaching case in the State.

Permanent anti poaching camps are now being built as earlier the camps, were located on tree tops or in thatched huts which were easily burnt or damaged by the poachers or smugglers when the staff were away on patrol. With permanent camps having been built at strategic locations, duly connected by wireless round the clock vigil can be maintained.

Table 12: Permanent Anti-poaching Camps

SL. No.	Range	Anti-poaching Camp	
		Existing	Additional required
1.	Muthodi Range	5 Nos.	4 Nos.
2.	Hebbe Range	6 Nos.	2 Nos.
3.	Lakkavalli Range	9 Nos.	4 Nos.
4.	Thangiebyle Range	6 Nos.	2 Nos.

The forests, of Lakkavalli range are very susceptible and vulnerable to poaching & smuggling, as it is bound on one side by the river Bhadra & Lakkavalli village border on the other side. As the river level rises, it become's very easy for smugglers to float timber and bamboo across to N.R.Pura and the villages adjoining Lakkavalli. As such, it is necessary to have a number of antipoaching / antismuggling camps along the river, assisted by patrolling by boats.

The motor boats, should be equipped with powerful engines and search lights for patrolling at night. The staff in the motor boat should be armed with wireless equipment.

All the above camps, should be provided with

- A static wireless set and the staff equipped with walkie talkies and guns.
- Should be energised with solar lighting and provision for recharging the wireless equipment.
- Should have a borewell and solar fencing around the camp for security.
- The staff, manning these stations should be on a rotation basis, as in the police department, with special allowance and food items provided free of cost.
- At present, watchers on daily wages man these camps. It is necessary to have permanent forest guards, for this purpose, so as to fix responsibility on them.

- The staff at these camps, should also be assigned perambulation duties during the day. Two members of the staff could stay back at the camp, while the others perambulate the forest as fixed by the Range Forest Officer, returning to the camp at night. By this, effective watch on any illegal movement within the Sanctuary could be detected.

6.5.2.1.2 - Providing Adequate Staff; special allowance and life insurance:

Though the requirement of staff is dealt in a separate Chapter, it is very necessary to see that all posts are duly filled up and as far as possible, young staff who have an aptitude for wildlife conservation and management be selected. **As the staff, are required to live in the interior in hostile conditions, "Special Allowance" should be sanctioned as well as 'Insuring the Life' of the staff at Govt. cost. In addition, incentives and rewards should be given, commensurate with cases detected etc.**

6.5.2.1.3 - Strengthening Communication System and creation of a strike force:

The Sanctuary has a good network of roads, but they have to be metalled. In addition, an EPT has been dug around a major portion of the Sanctuary. It is necessary for a road to run all along the periphery for perambulation, with culverts constructed where-ever necessary and duly maintained throughout the year. In some parts of the Sanctuary, this road needs to be extended for continuity and easy patrolling. Majority of the roads are used as firelines also. In areas with black cotton soil, the roads require to metalled and maintained to make patrolling effective.

At present, all staff-DCF, ACF's and RFO's have car and jeeps, which are used for patrolling and other official works. These vehicles are required to be replaced once in every five years, as, running on rough roads would reduce the longevity and efficiency of the vehicle. For exclusive patrolling purposes and to act as a **'Strike Force',** 2 vans under the control of the ACF Lakkavalli and ACF Chikmagalur, would be necessary and helpful with each Patrolling Van comprising of 1 Forester, 2 Forest guards and 2 Watchers. The van should be equipped with a wireless set and the staff armed & provided with Walkie

talkies. These mobile units can be rushed to assist the Range staff as and when required and also used during the fire season.

6.5.2.1.4 - Strengthening Wireless Network:

The Sanctuary, has already a network of wireless equipment. The network, would be most effective when all the staff, vehicles, various Sanctuary offices and antipoaching camps can be contacted at very short notice. For this, all the staff upto the level of F.G., should be equipped with a walkie talkie, the vehicles with mobile sets and all the antipoaching camps and offices with static sets. An extra battery with charger should be provided to each walkie talkie set, so that when one battery is being charged the other can be used. In addition, the division office should maintain six additional sets, so that they can replace the ones which come up for repairs from time to time.

Repairs to wireless sets are delayed, as one agency is fixed at the State level at Bangalore. It would be more appropriate if agencies are fixed locally or at the district level, so that repairs can be carried out faster whereby the wireless network can be more effective.

Table 13: The Wireless sets available in each Range and the additional set required.

SL. No.	Range	Static sets		Mobile sets		Walkie Talkie	
		Available	Reqd	Available	Reqd	Available	Reqd
1.	Division office	1 No.	-	2 Nos.	-	1 No.	1 No.
2.	Chikmagalur Sub-division	-	-	1 No.	-	1 No.	-
3.	Muthodi Range	7 Nos.	5 Nos.	1 No.	1 No.	4 Nos.	10 Nos.
4.	Hebbe Range	5 Nos.	5 Nos.	1 No.	1 No.	5 Nos.	10 Nos.
5.	Lakkavalli Range	7 Nos.	5 Nos.	6 Nos.	1 No.	21 Nos.	5 Nos.
6.	Thanigebyle Range	3 Nos.	3 Nos.	1 Nos.	1 No.	12 Nos.	5 Nos.

Additional to this, 12 Nos. of Mobile Telephone sets of BSNL Company should be provided for effective communication.

6.5.2.1.5 - Fire Arms and Ammunition:

Though the staff protect an invaluable resource of flora and fauna, very meagre supply of arms, some of which are outdated have been supplied to the staff. Except for building some confidence among the staff, these arms and ammunition-DBBL guns are obsolete and no challenge to the sophisticated arms the poachers are equipped with these days. Hence it is time that the forest staff are trained in the use of sophisticated arms and supplies undertaken. The DCF, ACF and RFO's should be equipped with pistols or revolvers. They should be trained at the nearest police firing range in the use and maintenance of the rifles/guns and should produce it before the RFO every month when they go to receive their salary for necessary check on maintenance etc.

Table 14: No. of guns available with the staff and that required.

SL. No.	Range	Guns available and that required by the staff					
		Pistols		DBBL		0.315 Refiles	
		Supplied	Reqd	Supplied	Reqd	Supplied	Reqd
1.	Chikmagalur Sub-division	-	2 Nos.	-	-	1 No.	-
2.	Lakkavalli Sub-division	1 No.	-	-	-	-	-
3.	Muthodi Range	-	-	4 Nos.	2 Nos.	1 No.	-
4.	Hebbe Range	-	-	5 Nos.	-	1 No.	-
5.	Lakkavalli Range	-	-	6 Nos.	-	1 No.	-
6.	Thanigebyle Range	-	-	7 Nos.	-	1 No.	-

Discussions with the staffs indicated, that they would prefer DBBL guns as the staff were untrained in the use of arms and hence less harmful as the cartridges contained only pellets. Moreover as they received 'no immunity' under the Arms Act, less powerful arms and

ammunition was being preferred. This attitude, would counter all protective measures proposed. Hence it is very necessary, that the forest staff who protect such a rich wealth at the risk of their lives are provided:

i) **Immunity in using arms while performing their duties**

ii) **More sophisticated arms, other than DBBL, for protecting life and Government property.**

6.5.2.1.6- Secret Fund and Intelligence Network:

Though a Secret Fund exists in the department its utility is very minimal. It would be very necessary to place sufficient secret funds at the disposal of the Deputy Conservator of Forest - Chikmagalur, for collecting intelligence and paying of rewards. **As in the Police Department, informers should be identified, and rewards paid to them and those detecting the offence, based on Government Orders from time to time.**

6.5.2.1.7 - Publicity and Public Relation to create awareness:

This is very much lacking as the department has been working in isolation. As on today, a brochure & a write up on the Sanctuary has been brought out for tourists. Publicity material should be prepared and updated from time to time, both in English and Kannada and distributed freely among the tourists, school children and the surrounding villages to create an awareness on conservation of wildlife. An appropriate Interpretation Centre is very much wanted in the Sanctuary, as by sending all the tourists who visit the Sanctuary, through the Interpretation Centre, it would educate them on the values of the Sanctuary and improve the cause of wildlife conservation.

Publicity, could also be carried out through TV, Radio, Newspapers etc. Periodically taking the local journalists around the Sanctuary and keeping them informed about the activities & developments in the Sanctauary, would encourage transparency and provide all the publicity required.

The Eco-development project would be carrying out due publicity in the peripheral villages during their mass contact operations and through EDC's which would take care of publicity in these villages. **"A Publicity and Liaison Officer should be appointed on a regular basis.**

6.5.3- Fire Control:

As in all other sanctuaries fire in the Sanctuary is man made, deliberately or otherwise. Fire predates man, by million of years, and is one of the most widespread and fundamental of habitat factors. Fire, affects physical vegetation and animal components of the eco-system and different people may view these effects in very different ways. While there is a considerable amount of personal discussion on fire as a habitat control factor, very little quantitative study has been documented.

Man sets fire to the forest for various reasons:

- to encourage new flush of grass for grazing cattle.
- encroachment or extending the present cultivation.
- burning the forest floor for collection of minor forest produce.
- burning the forest by those having grudge against the department or for non employment
- poachers or smugglers to divert attention.
- burning around habitation as protection against wild animals.
- inadvertently by smokers, tourists, pilgrims.

Wildlife should have an open mind about fire, and examine its effect on the wildlife values, before reaching immediate conclusions. With the number of people using the forest environment increasing dramatically over the last few decades, the frequency of fire has also increased and become an annual occurrence today. A carefully worked out system of fire lines and patrols should effectively prevent fires.

The range of potential effects of burning (modified from Rodgers (1979) and Orington (1984) are as follows:

Soils, Soil Development and Nutrient Circulation:

- increase in soil erosion with reduction of vegetation cover.
- removing, or changing rates of soil organic matter formation and accumulation.

- affecting amounts and availability of minerals.
- affecting numbers and rates of activity of soil organisms.
- reduction in overall level and rate of nutrient circulation.

Water and Water Circulation:

- changed rates of evaporation and transpiration.
- changed rates of precipitation, interception and through fall.
- changed rates of permeability, surface and sub surface flow.
- changed rates of sediment and water discharge.
- changed stream and river structure.

Vegetation and Plant Species:

(a) Long term

- curtailment of natural succession and regression.
- a mosaic of successional stages reflecting burning frequency.

(b) Short term

- affecting plant biomass, structure and shape
- affecting plant phenology
- affecting forage nutrient level and availability.

Animal species:

- altering pattern of resource availability- cover, food, water.
- altering pattern of distribution.
- possibility of mortality.

6.5.3.1- Fire Suppression: Principles

Whatever the approach to fire suppression (Sawarkar 1986), the managements inputs involved are:

i) Prevention of fire, or preventing spread of fire in the event of an out break.

ii) Fire detection.

iii) Fire fighting.

6.5.3.2 - Management Actions:

6.5.3.2.1 - Setting up a basic Meteriological station:

Rainfall distribution, temperature, humidity and seasonal average wind speeds are of management importance. For fire tracing, it would require low temperature, high humidity and low wind speed to be effective. **As such each range should set up a basic "Digital Electronic Weather Station" which lets you monitor all the above information. The climatological data would be useful in initiating fire tracing and subsequently fire control.**

6.5.3.2.2 - Prevention of fire:

Early burning, was first experimented in different Reserve Forests, in fire prone areas of hardwoods to prevent uncontrolled fires in summer. The practice did not meet with success, due to problems in maintaining schedule for burning and required logistics.

However, since the Sanctuary has already a net work of principle firelines along with subsidiary lines extending over 1380 km, it is very necessary that the firelines are cut starting from December and the cut material and leaves stacked in the middle of the line to dry.

Table 15: Details of Firelines in each Range

SL. No.	Range	Length of Firelines (Km)
1.	Muthodi WL Range	325.00 Kms.,
2.	Hebbe WL Range	325.00 Kms.,
3.	Lakkavalli WL Range	430.00 Kms.,
4.	Thanigebyle WL Range	300.00 Kms.,

The first burning should be completed by February end, with burning taken up during the early morning hours or in the evenings when there is low temperature, high relative humidity and least amount of breeze. While burning, care should be taken to see that the fire watchers are posted on either side of the fire line so as to prevent any fire from moving into the forest inadvertently. In deciduous forests especially with teak, where there is continuous leaf fall, the lines would again have to be swept of all the leaves, stacked in the middle and burnt between April 15th and April 30th with due care.

Simultaneously, during this season, it would be worthwhile in educating the villagers on the periphery and within the forest on care to be taken to keep fire under control. **Pamphlets and catchy publicity boards, explaining the ill effects of fire should be circulated and put up.**

Fire fighting schedule:

Dec 15th to Jan 15th	-	Cutting of Firelines
Jan 16th to Feb 15th	-	Cut material to be stacked in the middle of the firelines to dry
Feb 16th to Feb end	-	1st Burning
March 15th to April 15th	-	Resweeping of the lines, leaves & unburnt material & stacked in the middle of fireline
April 15th to April 30th	-	Second burning

During the fire season, these towers are to be manned from 6am to 6pm, with a forest guard or watcher who knows the area well, stationed on top of the tower with a walkie talkie. On seeing any smoke or fire, duly locating the area, compartment etc he should flash a message to the local RFO who in turn should alert his or the neighbouring Range staff. The Range staff with the help of fire watchers, should be rushed to the scene of the fire to bring it under control. During this period, it is necessary that the RFO has an additional vehicle exclusively to reach his staff to control fire. The Range Forest Officers, should be permitted to hire vehicles if necessary.

It should be made mandatory for the RFO to report every case of firebreak to the DCF; so that a record can be kept of the number of

instances of such firebreaks, causes, the area effected and action taken. This would also help, to negate the criticism the forest staff is subjected to during this season.

It would be useful to map the location of fire outbreaks over a period of time, so as to prioritise areas more prone to fire & thus requiring special attention.

6.5.3.2.4 - Fire fighting:

At present, the fire fighting in the Sanctuary has to rely on labour force and villagers from adjoining villages who are trained over the years in conventional fire fighting operations. The general requirements are:

(i) sufficient man power and

(ii) fast transport to reach the site of occurrence.

The fire fighting operation would depend upon the terrain, direction and speed of wind, details of which would be available once the Digital Electronic Meteorological station is set up. Immediate action would be to beat out the fire, which at times may be difficult when fire passes through thick undergrowth of grass, lantana or eupatorium. In such cases, counter firing from lower levels in case of hill slopes, or wind aided, towards the fire in flatter country is possible. Already burnt fire lines, if conveniently available, serve as a good base for counter firing. For this purpose the following are required:

i) sufficient number of axes, helemts, fire rakes, spades / shovels, bill hooks and jerry cans of water for the staff.

ii) men experienced in fire fighting be selected.

iii) men with an idea of the topography of the forest, fire lines etc to develop strategies for fire fighting.

iv) Water tanker in each range to augment the water requireemnts of the fire fighting staff.

v) A first aid kit to accompany each team.

Due to the difficult terrain, use of fire fighting equipment like fire fighting engines, extinguishers, back pack pumps, are not recommended, as they prove

futile in local forest conditions due to the difficult terrain. Hence the age old practice of beating out the fire would have to be followed with appropriate transport and communication facilities.

The eco-development project in progress in the surrounding villages, it would be necessary to appoint atleast one fire watcher from each village, so as to bring in an involvement of protection of the Sanctuary, and villagers.

And finally, adequate and timely funding is necessary for preventing, detecting and fighting the fires.

6.5.4 - Control of illegal removal of timber, fuelwood and NWFP:

With a large human population outside the Sanctuary, completely dependent for their requirements of firewood, bamboo & small timber on the Sanctuary vast areas especially in the range of Lakkavalli have been degraded over the years. Alertness of the staff have been instrumental in controlling the illegal removals to a great extent.

6.5.4.1- Strategies to reduce illicit fellings:

- Formation of EDC's within and outside the Sanctuary and providing the villagers alternatives, to wean them away from being dependant on the sanctuary.
- Promoting awareness through nature education and publicity.
- Strict vigilance and patrolling.
- Frequent raids in villages habituated to illegal fellings.
- Develop a proper system of intelligence and payment of incentives and awards for detection.
- Setting up a series of antipoaching and antismuggling camps at strategic locations.
- Promoting the concept of JFM in villages adjoining reserve forest outside the Sanctuary.

6.5.4.5 - Reduce man-animal conflict:

This is an acute problem with coffee estates and agricultural fields surrounding the Sanctuary and fragmentation of habitat. Depradation, is mainly by wild elephants, gaur, deer and wild boar. Cattle kills, by tigers/panther are also reported.

To reduce the conflict the following are proposed:

i) Maintenance of the EPT annually by both the department and various EDC's.

ii) **Putting up quality solar fencing at vulnerable locations and monitoring its effect everyday. Solar fenced gates to be erected wherever roads break up the EPT or using the dead and fallen teak poles in the Sanctuary, a cattle trap like construction be made, so as to maintain continuity of the effect of an EPT.**

iii) Improving water and fodder requirement within the Sanctuary.

iv) Cropping pattern along the periphery to be changed so that they do not attract wild animals.

v) Timely payment of compensation.

vi) Appropriate propaganda and publicity on the above.

vii) Speedy payment of compensation for crop damage, death, injury etc.

viii) All powers for payment of compensation be decentralised and the Deputy Conservator of Forest be empowered for making all the payments.

ix) Capturing and domesticating elephants that are orphaned or problem animals.

x) Appropriate and timely allocation of funds be made for speedy payment of compensation.

R. Sukumar (1989) indicates that wildlife populations that come into severe conflict with human interests may have to be directly managed to keep their levels below tolerable limits. This will involve removal of problem animals from the population. A proper understanding of the demography of the species is important if one is to ensure that a viable population is maintained. One

example of how elephant populations can be managed to minimize conflict and yet maintain their viability can be outlined from a synthesis of social organisation, demography and population genetics of the species. It is clear that the adult male elephants are inherently more predisposed to raiding crops as a consequence of social organisation.

The removal of an adult male elephant from the population would have a far greater effect in reducing crop damage (by a factor of 20 in economic terms) and saving human lives than the removal of an elephant from a family herd. Demographic processes have also shown that the loss of certain proportion of males is not likely to affect the intrinsic rate of growth of the population. The removal of females from the population would certainly reduce its growth rate. Hence, the selective culling for domestication of male elephants identified as inveterate crop raiders or rogues would be the best form of population management.

6.5.5 - Immunisation & reduction of cattle around the Sanctuary:

As mentioned earlier, there had been an outbreak of Rinderpest in the year 1989, literally wiping out the gaur population. Since then the forest department with the help of the local veterinarians have been carrying out an immunisation operation in the villages surrounding the Sanctuary, as generally the domestic stock are the carriers. This was limited to the finances and man power available.

Now, under the project, immunisation of village cattle has been taken on a priority and in a big way. To start with, pamphlets are distributed in the villages selected for immunising of cattle, where the dates on which the veterinary staff would be visiting a particular village is indicated. In the village the cattle are immunised against, Foot and Mouth, Rinderpest, Black Quarter (BQ) and Haemorrhagic septiscemia (HS). **There should be a veterinarian exclusively for the Sanctuary, taking the magnitude of the work into consideration and immunisation of cattle carried out annually and regularly.**

Artificial insemination: the number of cattle in the villages around the Sanctuary require to be reduced, as with very little or no grazing grounds, they are dependant on the forest for fodder. Artificial insemination to

improve the cattle stock & disposal of unwanted cattle should be taken up under the eco- development project to reduce grazing pressures on the Sanctuary. Stall feeding should be encouraged.

6.5.6 - Annual Census:

The census carried out during 1993-94 and 1997-98, is incomplete and do not provide a correct picture of the fauna of the Sanctuary. **As such, an annual census in future would be more appropriate.**

Understanding animal abundance, distribution, and movement pattern is a very important aspect of wildlife management. Measuring abundance of animal populations essentially means census. Some census methods may require complex statistical treatment of the data which perhaps deters managers from trying to improve their knowledge of census techniques. Yet, the simple techniques, will also yield useful results if undertaken with a clear understanding of assumptions and limitations. After all, the census is required to provide an understanding of the area, its animals and its ecology so as to evaluate management actions.

Census objectives:

1. To determine, whether a population of a species is increasing stable or decreasing, i.e. the trend.
2. To compare densities of wildlife in an area before and after management intervention, like burning, tending etc.
3. To compare densities in areas of high and low water abundance, different areas like core, tourism, restoration, plantations etc to know the pattern of distribution.
4. Relationship between prey and predator populations.

CHAPTER - VII

ECO-TOURISM

7.1 – Introduction :

It is recognized that unless people from different walks of life see and experience for themselves the serenity and beauty of the natural environment, the sheer richness, complexity and delicate balance that exists within the biological world and the grand nature of many rare and endangered species such as Tiger, Elephant, King cobra, wonderful orchids, etc., they are unlikely to appreciate the true value of biodiversity conservation and in turn the required public support may be found wanting. In every visitor to Sanctuary lie a potential friend, supporter and crusader for future conservation and propagator of good work done by the Karnataka Forest Department.

7.2 – Eco-tourism :

Our philosophy :

- Submit to Nature
- Be ecologically sensitive
- Bring people closer to Nature
- Create ambassadors of Conservation
- Support Local Communities
- Support Forest Department, Karnataka.

Eco-tourism is unique in several ways in Bhadra Wildlife Sanctuary. There are many attractive landscapes, replete with thick glades of forests, clear and silent streams and religious places. The picture perfect landscapes and their wilderness attract a lot of visitors mainly as wildlife viewers and trekkers. The tourist spots are dispersed and therefore there is no pressure on the forests. Eco-tourism is markedly different from other kinds of tourism and requires a sensitive and cautious approach including meticulous planning. So lot of planning is necessary to enhance the physical carrying capacity and also ensure that visitors experience the wilderness.

7.3 – OBJECTIVES:

i) To strengthen the cause of conservation in general and of the management of the PA in particular, through conservation oriented tourism.

ii) To provide wilderness experience to visitors.

iii) Enable the visitor to view a cross - section of PA values.

iv) To provide economic benefits to the local communities.

v) It should be fully compatible with other objectives of the PA.

vi) Manage tourism primarily for awareness generation about bio-diversity and only secondarily for economic returns.

7.4 - PROBLEMS:

i) Category of tourists are many and aspirations vary widely.

ii) Within a given time, tourists expect to see a range of Wildlife.

iii) Some tourists wish seclusion and privacy to visit sites normally not open to all tourists.

iv) Private agencies may dislike regulated tourism and wish for more freedom.

v) Inadequate infrastructure like accommodation, well maintained roads, vehicles restrict tourism.

vi) Inadequate interpretive media like interpretation centre, publicity material, guides etc.

vii) Many departments involved with varying priorities.

7.5 – THE STRATEGIES:

1. ZONATION:

For effective management, the Sanctuary has been classified into three zones namely Core, Buffer and Tourist Zone. The tourist zone is part of the Buffer Zone. Areas adjacent to coffee estates and private lands and those surrounded by the village limits are included in the Buffer Zone. The inner most areas which harbor the richest and the most diverse flora and fauna and are fully undisturbed constitute the core zone.

7.3.1 - TOURIST ZONE :

Muthodi Block:

The tourist zone is part of buffer zone and includes the area on to the right of Somavahini from Nature Camp upto Kesave and then along the main game road upto Nagarabhave Road Cross and along Hulikere Road, Nature Camp Road and Sigekhan Guest House Road.

i) P.W.D. Road from Nature Camp to Jagara **(4 Kms.)**

ii) Main game Road from PWD Road to Kesave passes through 1972 Teak Plantation, Tadabehalla, Doddahadlu **(9.5 Kms.)**

iii) Nature Camp Road-starts from interpretation hall and Joins PWD Road near 1972 Teak Plantation. **(3.5 Kms.)**

iv) Old Muthodi, N.R.Pura Road-from Muthodi village to Kesave **(8.0 Kms.)**

v) Link Road connecting main game Road and Old N.R.Pura Road.

a)	Coupe Road	-	4.0 Kms.
b)	Chandranahadlu Road	-	2.0 Kms.
c)	Honnemarada Road	-	0.5 Kms
d)	Jagara Joint Road	-	1.5 Kms

vi) Hulikere Road – Taking deviation from main game Road and passing by the side of Hulikere Tank and Hulikere Machan and joins the main game Road near Doddahadlu Karl Tank. (**3.5 Kms**.)

LAKKAVALLI BLOCK:

1) Sukhalahatti Road (**12.0 Kms**.)
from Kundur Maingate to Sukhalahatti Guest House.

2) Mavinahalla Road from Sukhalahatti Road to back water Of Bhadra River. (**1.5 Kms**.)

3) Katimaradahalla Road connecting Sukhalahatti Road and Deviation Road (**3.0 Kms**.)

4) Deviation Road from Katimarada (**4.0 Kms**.)

5) Channaiahnakere Road (**2.0 Kms**.)

7.3.2 - BUFFER ZONE:

Muthodi: The Beat areas of Honnalla, Muthodi, Jagara, Kolagave, 23rd Mile Stone and part of Kesave will form the buffer zone.

Hebbe: The Gangegiri, Vaddihatti, Madla and Madhuguni S.F. will form into the buffer zone.

Lakkavalli: The Beat areas of Sannakanive, Kumtimatti, Kumtimatti beat areas of Lakkavalli S.F. Aldhara, Kakanahosodi, Thammadihalli, Singanamane S.F. areas form into buffer zone.

Thanigebyle : Part of Guddadabeeranahalli, Channaiahnakere and Kadurayanamatti beat areas of Lakkavalli S.F. will form into the buffer zone**.**

7.3.3 - CORE ZONE:

The rest of the areas other than the areas included in the buffer and tourist zones of the sanctuary will form the core zone.

The Zones have been indicated in the Map at **– PLATE 5**

Locally well-known hill peaks such as Gangegiri, Kagemanegiri and Bababudangiri have been traditional trekking destinations and can be permitted to be visited under the supervision of departmental staff or a qualified and recognized guide. These peaks and the trekking paths connecting them have not been formally recognized as a tourism zones because of the narrow stretch of visitor use but are permitted for tourist use.

7.4 – Tourist facilities :

The existing Muthodi nature camp needs to be improved by providing a dormitory, tented accommodations, dining block, interpretation facilities and a good library. Each center should be equipped with accommodation for about 30 people, a kitchen and dining hall, an interpretation center, facilities for water recreation, etc. Signages and literature are very poor and they have to be improved substantially.

Another nature camp needs to be established at Tadasa near the anti-poaching camp. On the periphery a nature camp can also be established at Khandya.

7.5.2.6 - Management of Viewlines:

These lines, are required only in the tourism zone to facilitate viewing of wild animals as they turn out to be ideal foraging grounds. The width should be restricted to a maximum of 30m and cleared of weed and tall grass thrice a year. In many places, it is observed that parthenium, solanum and calotropis have invaded the view lines. **In such cases, it is better that the weeds are uprooted during the rains, before flowering sets in and if possible burnt so that the seeds do not disperse and the spread is halted. The total area under viewline should not exceed 5% of the total.**

7.5.2.7 - Watchtowers:

A few watchtowers 10 overlooking the water holes have been erected for tourists to view wild animals. But it is only those privileged, who get an opportunity to spend time on the tower. Most tourists are only taken around the tourism zone in the government vehicles and do not get a chance to spend some time on the tower. Viewing wild animals from the tower is a different experience, as it requires patience and is rewarded with good sighting of both bird and animal life.

7.5.2.8 - **Elephant riding:**

It would be more appropriate, if the elephants are used for longer rides and to view Wild animals, which would add to the thrill. With lumbering having been stopped, the department elephants are at times used for patrolling, but in general they are kept idling. Atleast, by using them for riding, they could earn their maintenance cost. This should be encouraged. Government has fixed the hire charges for elephants and it would definitely be an added attraction.

7.5.4 - Development of Interpretation Media:

Education and Interpretation of Sanctuary resource is part of the overall tourism management effort with an emphasis on increasing public support. Interpretation according to Freeman Tilden is 'An educational activity which aims to reveal meaning and relationships through the use of original objects, by first hand experience, and by illustrative media, rather than simply to communicate factual information. It informs the tourists about:

i) the most significant features which need to be protected (animal sps, habitat, historic sites).
   - why they need protection.
   - management problems.
   - research.

ii) provides orientation.

iii) creates concern for endangered species and ecosystem.

iv) satisfies peoples curiosity.

v) publicises the available activities and attractions.

vi) warns and guides.

vii) builds up public support for conservation.

7.5.6 - Nature Camps:

Nature camps, provide outdoor recreation and conservation education for urban and local school children. They, offer a unique opportunity to instill love and concern for nature at a young and impressionable age.

Nature camps, are a cost effective method for reaching the young. Compared to the interpretation centre where tourists view exhibits, participants in a nature camp become actively involved and receive personal attention by trained staff. Nature camps, should only be established in locations where movement on foot can be permitted.

Nature camps, also offer an ideal opportunity for Non Government Organisations and PA staff to work together. The Sanctuary authorities, could supply the infrastructure and logistic support, while the NGO's could organise visits, transport and teaching staff.

7.5.6.1 Objectives:

i) Introduce basic ecological principles in ways which are conducive to learning by personal experience.

ii) Motivate participants, to gather information on aspects of the biotic and abiotic environment and their conservation.

iii) Encourage participants, to analyse and discuss conservation issues in a constructive and problem solving manner.

iv) Foster admiration and respect for the complexities of relationships between species and within natural communities.

v) Dispel unfounded fear of wild animals and help participants feel comfortable in the wilderness.

7.5.6.2. Activities:

A camp is successful, if it is fun for the participants and the objectives are partially met. Choosing activities which allow a maximum of personnal involvement is the key to success.

The programme could be planned in three stages:

i) Discovery phase:

Check list/treasure hunt, collect items, display and discuss.

Blind walk - walk blind folded along a rope, explore surrounding through sense of touch, smell.

Bird watching - record of species identified, describe characteristics.

Trail walking - boating.

Waterhole/machan watch

Orienteering - finding way with compass and map. Evening camp fire, interactive meet, lectures, quiz, etc.

ii) Directed investigation phase:

Collect rocks, discarded antlers, dung pellets.

Systematic observation of animal behaviour.

Guided tours on selected topics.

Identification / plaster casting of pug marks.

Plant species identification.

iii) Small project phase:

Competition, exhibition of collected items, posters, pledges, recommendations, discussions, tree planting.

7.5.8- Mobile Interpretation Centre:

An exhibition on wheels is required to be built up which can go to the fringe villages during market days, festivals etc. and to schools around the Sanctuary. It should have provision for proper interpretation within, like exhibits of the common flora and fauna, their role in nature, management issues like fire, poaching and smuggling, how to control them and the role of the villagers etc in assisting the department. Films could also be projected highlighting the above.

7.4.1 – Game paths :

Game paths will be open to tourists as per their requirements. The target groups are students, youth and teachers. Private vehicles may be franchised to take tourists on these routes on fixed charges. A trained guide/departmental staff should accompany such hired vehicles.

7.4.2 – Trekking paths :

There is also a need for developing certain hiking paths from the fringe to the nearest hill peak or to a specific landscape element.

Table - 16 : List of trekking paths proposed for development :

1	**Muthodi Wildlife Range**	
	From Nature camp to Jagara Road	3.00 Kms.
	From Nature camp to Seegekhan	4.00 Kms.
	From Nature camp to Kagemanegiri to Kesave	14.00 Kms.
	From Karanji – Nagarabhavi – Kesave	14.00 Kms.
2	**Hebbe Wildlife Range**	
	From Hebbe Bhavanishakar temple to Somavahini	6.00 Kms.
	From Khodi Heggar to Gangegiri hills	15.00 Kms.
	From Siragola to Gangegiri hills	12.00 Kms.
3	**Lakkavalli Wildlife Range**	
	From Near Bhadra Dam Sri. Ranganathaswamy Temple to Kundur Machan	3.00 Kms.
	From Near Bhadra Dam Sri. Ranganathaswamy Temple to Sukalhatti IB	7.50 Kms.
4	**Thanigebyle Wildlife Range**	
	From Kemmangundi to Hebbe Falls	4.00 Kms.
	Kemmangundi to Bababudangiri	8.00 Kms.

These hiking paths should be well laid out, provided with good signages and manned by trained local youth who will also act as guides. Separate skill development training should be held for the local youth for this purpose. Further considering the requirements of various trekking groups, routes may be chalked out in future.

7.4.3 – Do's & Don'ts :

In the wildlife sanctuary:

Please **DO NOT**

- littler
- tease animals
- talk loudly/ make noise
- smoke
- get off the vehicle unless asked
- wear strong perfumes
- pick up anything from the forest floor as souvenir
- touch insects/ bird nests
- wear bright coloured clothes
- play music - as a rule music is not allowed in any of our resorts
- go swimming as it is prohibited and risky
- disturb the tranquility of the place - others have come to enjoy the peace
- feed the monkeys or other animals in the camp
- tip individually - there is a common tip box
- Avoid using pollutants, such as detergent, in streams or springs.

In the Camp/ Lodge:

Please **DO**

- wear forest friendly colours
- take photographs/ video of your trip
- listen to the sounds of nature
- observe and obey safety rules during coracle/ boat rides, rafting etc.
- Sanctuary vehicles only in designated areas
- be punctual for all activities

- Do take away all non-degradable litter-empty bottles, tins, polythene bags etc. And throw them in municipal dustbins only, so that they can be disposed off properly.

7.5 – Eco-tourism guidelines :

Trekking Programmes in Sanctuaries: Description, Rules, Regulations, General Guidelines, etc.

Trekking is a recreational, educational and conservation-oriented outdoor activity consisting of walking along designated marked trails. The rich bio-diversity of various classes of flora and fauna of Karnataka forests could be seen and experienced during this activity. Trekking may be a day-trip, or involve night halts at designated camping sites.

Trekking trails are being established in the Sanctuary (NP) and Sanctuaries (WLS) of Karnataka. These trails are the footpaths and patrolling tracks used by the Sanctuary personnel, and approved in the Management Plan. These facilities are expected to offer exciting experiences for nature enthusiasts.

7.5.1 - Trekking guidelines/ instructions:

- The maximum number of trekkers allowed per route at a time is 6 to 10. Further, the officer in charge shall regulate the overall number of trekkers in the Sanctuary at any given time to within 20 to 50, depending on the eco-sensitivity, expanse of the NP/WLS, and the number of trekking routes available.

- Trekking groups should be accompanied by an approved Guide provided by the Forest Department. Guide service is compulsory. The Guides are local tribals, well-versed with the terrain and physically fit. The Guide's task is to provide navigation and general support, and not explaining about the flora, fauna and other things. However, he may impart such knowledge to the extent he is capable of. Instructions of the guide are required to be followed during trekking.

- Apart from the guide service, services of **Group Leader**-cum-Naturalist are also available. This service is optional, but the guide has to be there. Naturalists are persons who are knowledgeable about the flora and fauna and are capable of educating trekkers scientifically so as to enhance their experience, understanding and interest in the various aspects of NP/WLS. Naturalists are accredited by the Chief Wildlife Warden on due scrutiny of their knowledge and caliber. They carry an accreditation card. The list of such Naturalists is available on this website. Further, M/s Jungle Lodges & Resorts, the Department's sister Company, also maintain on their roll a cadre of accredited Group Leaders-cum-Naturalists. Trekkers may avail their services also.

- The Group Leader-cum-Naturalist plays a wider role. He may take the full responsibility of reservation, explaining to trekkers on various requirements before commencement of the programme and arrange to provide the facilities during the trek and other extra facilities by mutual consultation. For example, the Group Leader may arrange for water supply at a particular camp site. He may provide igloo tents or porter service or a cook. For these services, the Group Leader may propose a budget which includes the Forest Department tariffs and charges for other offerings, plus his own service charges. The Forest Department would not like to interfere with the fee structure offered by the Group Leader. It is open to the trekkers to receive competing offers from other Group Leaders. The instructions of the Group Leader are required to be implicitly obeyed. Failure to do so will constitute an offence. Apart from Group Leader, the trekker is required to obey the directions of all Sanctuary personnel as well.

- It is preferable that the members of a trekking group be of the same level of physical fitness. If someone falls behind due to lack of physical fitness, etc, it is the responsibility of the entire group to ensure that the person is somehow brought to the camp.

- The trekking group should plan in advance and work out the pace of the trek from point to point. This will enable reaching the destination well before dark, as trekking is not allowed after sunset.

- It is expected that the trekkers behave properly, show respect and cooperate with each other. The Group Leader / Guide may penalize or expel any misbehaving participant, or even terminate the whole programme at any stage, depending on the gravity of the incident. No compensation is payable to trekkers on such events.

- It is made clear that there is no vehicle facility to pick up the participants, should they decide to terminate their programme mid-way. There is no place for vehicles in trekking programme. Trekking options should be availed keeping this factor in mind.

- If a trekker is lost, he should stay at the same spot and keep blowing the whistle at regular interval. A search party will be organized to find him. Whistle is heard far in the forest and he will be located. He should never react in panic.

- Children below 15 years are not allowed in the programme. Nor are pets allowed.

- Walk strictly along demarcated route, illustrated in the map. Stations are marked at every 0.5 km in the form of cairns (a pyramidal formation of stones). Move on till destination is reached. Wherever branching routes are seen, look out for the signs or directions at the point and proceed on the correct path.

- Never throw en-route or at camp anything you have brought. Follow the Leave No Trace' principle. Collect all waste in the garbage bag and

bring it back. If you find any left behind by others, be good enough to collect that too.

- Using matchbox or smoking during trekking is prohibited. It may cause forest fire.

- Do not collect any souvenirs such as plants or animal parts from the forest.

- Remember, the trekking activity is a form of wilderness education and conservation. So help the Forest officials in putting out fire. Also report it to the nearest official.

- Assist, if called upon by the forest officials, in nabbing poachers, smugglers, etc. Also report any such activity immediately. Inform about grazing of cattle also.

- Report sighting of any injured wildlife to the authorities.

7.5.2 - Dress code for trekking

- Cotton shirts of dull colour like forest-green or mud-brown.
- Comfortable cotton trousers /pants /salwar khameez of earthy colour.
- Dhoti, Saree, etc, not allowed.
- Trekking shoes of good quality.
- Hat / cap to ward off sunlight. Sweaters in winter. Wind cheater / rain coat during rains.

7.5.3 - Items to be carried by trekker

Trekking requires a set of basic items. Some essential and optional items are given below:

Haversack

- Trek route-map

- Water bottles with 2 to 3 liters drinking water / day.
- Garbage bags for taking back all wastes generated
- Thin towel and inner wear
- Toiletries soap, toothpaste/ brush, shaving kit, comb, toilet paper, etc.
- Medicines (as needed)
- Torch & candle. Not match or lighter
- Binoculars & camera
- Whistle
- Easy-to-cook / ready-to-eat food items like '2-minute noodle', 'Knorr soup', 'MTR ready mix', etc and glucose packet
- Utensils, plates, etc, for the group (enquire for availability at camp-site)
- Scribbling pad and pen
- Sleeping bag/ blanket & Sleeping mat (6' x 2')
- Mosquito repellent
- Tobacco, salt, etc, to ward off leeches, which could be expected in evergreen forests during monsoon; not in dry forest.

7.5.4 - Items to be carried by Group Leader / Guide

- First aid kit
- Nails and jute yarn to make stretcher
- Book on identification of fauna & flora
- A medium size knife in sheath & a Swiss Army knife
- Alum (200 gm) for clarifying turbid water

- Kerosene (200 ml) for lighting fire
- Match, lighter & candle
- Tweezers for pulling out thorns
- Can opener
- An extra pair of shoes
- Maps, brochure, GPS & compass

7.5.5 - Good trekking practices

- The trekking group should move together in a single-line formation, with no one going too far ahead or behind.
- Be independent. Carry one's own pack. Pack not to exceed 15 kg.
- Littering, shouting, spitting, singing or using transistors and music systems during the trek are prohibited.
- Carrying or consuming narcotic drugs is a serious offence.

7.5.6 - Camping guidelines

- Night halting arrangements are available in the Anti-poaching Camps (APC) or some of the Rest Houses in the jungle. These are simple and basic facilities. Do not expect any luxury.
- Water is a critical item. Its availability differs from camp to camp, and should not be taken for granted. Trekkers either have to depend on the water they bring themselves, or make arrangement with the Group Leader for additional requirement at the camp for cooking, bathing, etc.
- APCs may keep stock of some basic items like aluminium cooking utensils, rustic cots made of bamboo, firewood, and may be a few other things. Enquire about these in advance.

- Trekkers have to prepare their own food at the camp and also lunch en-route. Learn to make fire and cook food at the camp. Assistance of the Guide may be solicited to make things easy.

- Consumption of alcohol is not allowed.

- Nature's call: A crowbar will be available to make cat-holes required to attend to Nature's call. One or two Cat-holes (8 inch diameter, 2 feet deep pits) are required to be dug near the camps for each group. After using it, throw in the toilet paper if any, cover the cat-hole by pushing in some soil into the pit. Attending it elsewhere is prohibited.

- A couple of hurricane lamps may be available at APC to use at night, but take care to hit the bed early, so you can wake up early for the morning trek.
- The trekkers should not venture beyond the APC boundaries after dark. Campfire is permissible only inside the camp boundary, that too, if approved by the Group Leader or the Guide.
- Once the team reaches the exit point, the trekking programme is deemed to be over. Beyond this point it is the trekkers' responsibility to proceed further. Try to gather information before-hand as regards further transportation facilities, etc, from exit point to home.
- All necessary precautions will be taken to ensure safety during trekking programme. But as the activity is carried out in a wilderness area, there is always some risk, and the Forest Department will not be liable for any injury or loss of life.
- The Forest Department wishes all the trekkers an enjoyable experience.

- Activities permitted are trekking, bird watching, photography, swimming in the notified places, and wildlife viewing without disturbing them.

- Group activities should be encouraged.

- Guides should be selected, trained and made available to the visitors on payment.
- The tourists should be given a thorough briefing of dos and don'ts and necessary guidelines should be included in the guidebook.

The forests of Bhadra Wildlife Sanctuary has moderate visibility of wildlife due to the thick undergrowth and low carrying capacity of large animals. Wildlife cannot be sighted easily from vehicles. So visitors should be taken on foot to observe and study the rich biodiversity of smaller organisms and enjoy the beauty of natural landscapes and wilderness. Bhadra Wildlife sanctuary has been famous for animals and landscape. The visitors come to enjoy the walk on the difficult terrain of the steep hill slopes, to view the animal and enjoy the landscape. Arrangement shall be made to issue tickets at the nature camps and a few important visitors' spots. Reservation of accommodation should be computerized at the divisional office. E-mail access should be created for the visitors. A website should also be launched and managed. Free film shows and slide shows should be arranged to the visitors at the interpretation center. Special camps on trekking, bird watching, botanical visits, etc., may be arranged seasonally.

7.5.7 – Monitoring eco-tourism :

Impact of the tourism should be monitored closely by observing the sighting chances of wild animals, visible impacts of litter, wear out of the trekking paths, degradation of the vegetation, frequent encounter of each other by tourists etc., to determine the carrying capacity and accordingly the tourist number should be controlled.

A feedback should be obtained from every visitor and follow-up action should be taken consistent with the management objectives.

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CHAPTER - VIII

ECO-DEVELOPMENT

8.1 - General :

There cannot be any development and protection of the sanctuary without the active cooperation and support of the local population. Many people do not have basic facilities like safe potable water, health services, education, electricity, etc. There are 46 families within and many more families reside on the periphery. As most of theses villagers are agrarians the dependence on forests is multifold. They depend on the forests for their daily need of fuel, small timber, fodder and green manure.

26 Nos. of villages and 3914 population of friniges villages and 102 Nos. of villages and 3916 population falling within a radius of 10 Kms.,

The goal of eco-development would be, to conserve bio- diversity by implementing the eco-development strategies. The activities are:

i) involving the villagers living in and around the PA, in management and protection of the area.

ii) identifying alternatives to the bio-mass resources use presently being obtained from the PA and weaning them away from further pressures on the habitat.

Eco-development has been defined as:

i. “Site specific package of measures for development through peoples participation, with the objective of promoting sustainable use of land and other resources, as well as on farm and off farm income generating activities which are not detrimental to PA values” (Panwar 1992).

ii. “Limited rural development designed with the participation of local people for the purpose of reconciling genuine human needs with the specific aim of PA management” (Rodgers 1992)

iii. “Strategy for protecting ecologically valuable areas (PAs) from unsustainable or otherwise unacceptable pressures resulting from the needs and activities of the people living in and around such areas” (IIPA, 1994).

iv. “To Improve productivity of lands and resource that are ecologically sustainable among rural communities in that they are not dependent on declining levels of natural resources.”

v. “To achieve PA conservation by promoting socio-economic development and providing local people with alternative income sources which do not threaten to deplete the plants and animals within the PA” (Brandon and Wells, 1992)

vi. I would define it, “as a process of weaning away the villagers/tribals living in and around the Sanctuary, from the traditional dependency on forest by providing them alternate sources of energy and income, improving their economic status and in turn involving them in protecting the biodiversity”.

8.2 - **OBJECTIVES**

i) To involve the fringe villagers, in and around the Sanctuary in PA planning, protection and conservation by educating them on the values of the Sanctuary.

ii) Developing, site specific eco-development micro-plans, with the participation of the villagers.

iii) Develop alternate sources of bio-mass and income to divert pressure from the Protected Area, while strengthening the economic condition of the villagers.

iv) Reduce man-animal conflict by involving the villagers in maintenance of the E.P.T., solar fencing, so that the Wild animals do not stray out, thus improving the Sanctuary - villager relationship.

v) Wean villagers away from the traditional dependance on forests by providing alternate sources of livelihood and training.

vi) To build up awareness among the villagers towards conservation, by appropriate education programmes.

8.3 - SPECIFIC ISSUES

i) Traditionally the villagers, especially in Tarikere taluk, surrounding the Sanctuary have been dependant on the Sanctuary for labour, fuel-wood, bamboo and small timber.

ii) With no grazing grounds in the villages, they are dependant on the Sanctuary to graze their animals as well as collect fodder. To enhance grass the forests are also set on fire.

iii) Relationship between Sanctuary staff and villagers are not very cordial and now requires to be built up.

iv) Man - animal conflict is severe and payment of compensation is very much delayed.

v) Taking up other income generating activity by the landless like poultry, piggery, diary, tailoring, vermiculture, manufacturing agricultural implements etc.

vi) Providing work for the landless by taking up gully plugging, digging EPT, desilting tanks and opening new tanks.

vii) Taking up artificial insemination, to improve the cattle stock, stall feeding and reduce the unwanted cattle.

viii) Interact with other developmental departments so that the villages could improve with the combined effort.

ix) Involvement of NGO’s for better relationship between the department - NGO - and the villagers.

x) Awareness generation through education and publicity.

8.4. VILLAGE LEVEL SITE SPECIFIC STRATEGIES

i. **Formation of Eco-development Committee (EDC's):** All the families in the village, are enrolled as members of the Eco Development Committee by paying a fee of Re. 1/- and they in turn form an Eco-development Committee (EDC) in terms of the Government order No. FEE 8:FDWL 97dt 14.3.1998. Local villagers would provide a minimum of 25% of the total investment costs, for all regular village eco- development investments, in cash, kind or labour. Government has also constituted Committee's at various levels for proper implementation of the Project namely:-

1. Committee at Government level
2. Coordination Committee at District level &
3. Sanctuary level Committee.

vi. **Socio-Economic Survey:** The following procedure is adapted for socio-economic survey of the villages by visiting each family and the following data collected:-

- Demographic data
- Livestock
- Literacy status
- Sources of fuel collection
- Grazing pattern
- Cropping pattern
- Irrigation facility

vi. Participatory Rural Appraisal Exercise (PRA): The PRA exercise, is conducted after the exposure visit. Villagers share their experience of the exposure visit with others during PRA exercise. The NGO's carry out the PRA exercise in the respective villages allocated to them.

8.5 – PREPARATION OF MICRO-PLANS

After, the preliminary interaction with the villagers, exposure visits, formation of EDC's etc, a micro-plan is prepared in consultation with the villagers listing out the priority requirements of the village.

Following issues are considered:-

1. Drawing of village map
2. Identification of community activities
3. Wild animal damage
4. Measures to reduce pressure on forest
5. Identification of income generation activities.
6. Modalities for collection of 25% contribution.
7. Other activities.
8. Implementation strategy
9. Conflict resolution.
10. Feasibility of Eco-development activities chosen
11. Mutual obligations.

8.6 - ACTIVITIES

8.6.1 - Supply of Energy saving devices:

To reduce the dependency on firewood, the following fuel saving devices are provided.

- Gobar gas
- Astra ole
- L.P. gas
- Pressure Cooker.

8.6.2 - Implementation of Agro-Forestry Models:

This is an important land based activity suggested by the farmers to attain self sustainability and generate income in course of time. Agro forestry includes planting of 40 fruit plants of guava, sapota, mango, lemon or tamarind and 400 fuel and fodder species in each plot.

8.6.3 - **Creation of Farm ponds:**

To help harvesting all the rain water received, farm ponds were excavated. This was identified as a very important activity and included in the micro-plan. Along with the EDC members and Sanctuary authorities, the locations are identified.

8.6.4 - Vermiculture Entrepreneurship training:

Vermiculture entrepreneurship, is identified as one of the income generation activities, for the landless families.

8.6.6 - Linkages with other Agencies:

Rural Development and Self Employment Training Institutes provides training to youths in tailoring, agriculture, motor-rewinding, electrical home appliance repairs etc.

8.6.8 - Kuroiler Poultry Birds:

This is another activity proposed for the landless. Kuroiler Chicken is a hardy strain, genetically engineered to combine flavour and plumage of the native chicken. It provides the advantage of very low investment for a bird having high resistance to diseases and requiring minimal management effort with no special feed or supplements. The bird is capable of attaining 1 kg weight in 7 weeks. Many villagers have come forward to adopt this activity.

It is these people within and around the sanctuary who either put fire or help in extinguishing the fire. The nearest and maximum encountered government machinery is a forest official.

In order to mitigate the pressure on forests directly and to take the people along the following socio eco developmental works are proposed.

- Distribution of smokeless chullahs, which reduce the consumption of firewood by almost 60%.
- One time subsidy in the form of LPG stove
- Construction of gobar gas plants
- Training camps on vermiculture, mushroom cultivation, sericulture as appropriate.
- Training in bee keeping and distribution of beehive boxes. Distribution of grafts of fruit trees to aid and enhance their earning.
- Nature camp for the local population for exposure about forests and Bhadra Wildlife sanctuary.
- Encouragement to go for better breeds and stall-feeding.
- Medical facilities in the form of artificial insemination and vaccination to the cattle.

8.11. MONITORING AND EVALUATION

One of the several reasons for rural development programmes not having succeeded, is almost total lack of monitoring and evaluation of programmes. The monitoring and evaluation, will not serve its purpose, unless each activity and programme is backed by implementation mechanism till such time as the villagers are ready to take over the maintenance and continuity of the programme, on the basis of faith, conviction, acquisition of skills and the spirit of cooperation.

In all the EDC's formed care should be taken to see that all resolutions, minutes, registers, accounts are recorded and maintained, updated and audited from time to time which would definitely lead to its success. It is necessary, that officers involved in this programmes, should be continued in their present posts, for a minimum of three years, so that there is continuity of coordination and success.

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CHAPTER IX

RESEARCH, MONITORING AND TRAINING:

There is no separate research section in the wildlife wing. Academic and research institutions conduct most of the research work with their own funding. Usually the research work is isolated and unconcerned with the management issues of the PA. Findings of the research work are not made available. Considering the high bio-diversity and a conglomeration of agencies working on different subjects, there is a need to monitor research work very closely at the PA level itself. Every research agency must sign a Memorandum of Understanding (MOU) with the Deputy Conservator of Forests and should take specific permission every time to visit the PA. A summary of work done on each visit shall be presented to him during the next visit and a final copy of the research findings along with raw data should be deposited with him. There are large number of areas to be researched by the social scientists, ecologists and field biologists. From the management perspective, a detailed inventory of the floral and faunal species is urgently required. For an exhaustive and scientific survey, a set of permanent monitoring plots have to be laid out covering different altitudes, terrains, forest types etc

Research should be taken in these plots on a long-term basis and the results should be documented plot wise. The executive staff are not conversant with research aspects.

10.1.1 - Objectives:

i) To reduce progressively, the extent and degree of uncertainty on which management decisions and strategies are based.

ii) Develop the consultative process and mechanism to ensure that research, addresses information needs that are critical to this project and to the long term management of the PA.

iii) Develop, research interest and expertise in local institutions around the PA so that information needs of the PA are met locally.

iv) Ensure that PA supports and attracts sustained research that would meet their information needs from time to time.

10.1.2 - **Research Facilities:**

The Sanctuary has no basic facilities for research. To start with, a field laboratory or research station with a Researcher would be very essential. The laboratory should be equipped with basic equipment like computers, refrigerator, microscopes, oven, weighing machine, veterinary instruments etc. A vehicle, would have to be kept at the researchers control, as he would have to coordinate all the research and their findings. Additional field stations should also be set up based on the requirements of research.

Some of the topics for research as follows :

a) Grass land and Fire ecology especially with the invasion of ferns
b) Fire fighting techniques and management
c) Effect on repeated fires on wildlife
d) Biology of flagship species
e) Population dynamics of different species
f) Sound zonation of Sanctuary
g) Habitat management in all zones
h) Prey-predator relationship in different zones
i) Role of weeds in the regeneration of fodder species in different zones
j) Identification of fragile ecosystem and habitats
k) Survey of endangered species and conservation methods
l) Check listing of floral diversity – Macro/Micro etc.,
m) Check listing of faunal diversity – Macro/Micro etc.,
n) Status and distribution of birds
o) Social and economic aspects of the communities living inside and on periphery the sanctuary

p) Impact of biotic pressure on the sanctuary
q) Effects of grazing by domestic cattles in the fringe areas
r) Study on communicable diseases
s) Man – Animal conflicts
t) Hydrology and water regime of the sanctuary
u) Migration and seasonal patterns of larger mammals
v) Feeding behaviour of Ungulates, Carnivores etc.,
w) Determination of the carrying capacity of sanctuary

Regular surveillance should be kept on communicable diseases within the sanctuary and a record of their occurrence should be maintained. They are generally confined to pockets and need immediate attention.

10.1.4 - Monitoring:

Monitoring through a consistent set of measures would periodically do the following:

a. Provide an integrated view of the present status of bio- diversity in the PA.

b. Provide a view of socio-economic conditions and interactions between PA's and people inside and around the PA that are relevant to the project.

c. Evaluate whether the project activities have had the desired effect.

d. Identify inadequacy, ineffectiveness which cause non- compliance with expected values.

It is not necessary that all monitoring and research is to be carried out by the researchers. Monitoring can also be done by the field staff on a day to day basis of:

i) Tiger movement by tracing pug marks, droppings, camera trap.

ii) Wildlife health and diseases by the departmental veterinarian.

iii) Tracking of elephant herds and recording herd size, sex ratio, health, movement pattern, feeding habits, etc.

iv) Impact of tourism.

v) Feeding behaviour of ungulates.

vi) Migration pattern of animals.

vii) Changes in vegetation to be monitored as per ecologists advice.

viii) Thinning, clearfelling, under planting in cleared lantana area etc.

ix) Interaction between PA & people inside & outside

x) Whether project activities have had the desired effect.

10.1.5 - Training:

Generally, all the staff posted in the Sanctuary, that is, forest guard upwards wouldhave undergone professional training in forestry before joining the department. But as Wildlife management has over the years encompassed many disciplines like ecology, tourism, public relations, Wildlife management, land use planning etc it is very necessary to carry out refresher courses for all the staff at various level and bring them abreast of the current day requirements. In addition, the curriculum in all the forestry training Institutes in the State should also be modified so that the above subjects are included in the training.

10.1.5.2. Study tours:

In addition, it would be worth while if officials visit different PA's within and outside the State to learn how other PA's are managed.

10.1.5.3. Department of Tourism courses:

The Department of Tourism and other Agencies run courses for tourist guides which could be attended by the staff earmarked as forest guides so that they develop sufficient skills to address and communicate with tourists. **Preference should be given to tribal youths of the locality.**

10.1.5.4. Training programmes of Wildlife Institute - Dehradun:

Wildlife Institute of India runs many refresher courses and workshops in different PA's all over the Country. This should be taken advantage of and officers from the PA's sent regularly to attend these courses. Following are some of the courses conducted by the Wildlife Institute of India.

10.1.5.5. Strenthening **Prosecution capabilities of the staff:**

Several of our offence cases, fail in courts due to improper recording, inadequate processing and wrong interpretation of legal provisions. Prosecution capabilities of the staff would therefore be required to be strengthened. A few sample cases of both success and failure could be selected by the officers of the Forest Department and with the assistance of a Legal Adviser, discussed with other lower staff periodically, and a set of guidelines prepared as to how a case is to be dealt with, for assisting the field staff. A weeks training at ATI, Mysore by legal experts would be an advantage.

10.1.5.6. Wildlife evidences, collection of biological material & their interpretation:

Wildlife management, often employs interpretation of field evidences to enhance biological knowledge which in turn is used in supporting management skills. The experienced senior staff, have a key role in ensuring development of skills among the junior staff such as recognising Wildlife evidences, their documentation, interpretation, collection of evidences etc. By continuous practice such skills can be elevated to a fine art.

Training field staff to develop capabilities for identifying tracks and signs, sex and age of animals, identification of birds is to be considered.

CHAPTER – X

ORGANISATION AND ADMINISTRATION

10.1 - Organisation of forest area :

Each of the state forests, which forms a part of the sanctuary varies in size. The State Forests have not been organized into blocks and compartments on the ground. Earlier working plans, no doubt provided for blocks and compartments but only on the map with an intention to provide for fellings etc. With the change in the concept of management for these forests, it is felt necessary to reorganize the compartments in a manner consistent with the present administrative structure and working pattern. Maps showing the new arrangement have to be provided up to the beat level. A miniature map of the area organisation is provided at **Plate – 2**. Demarcation of compartment boundary and beat boundary has to be marked on the ground as per map after finalization.

10.2 - Administration :

The Deputy Conservator of Forests, Bhadra Wildlife Division with headquarters at Chikmagalur, administers the Sanctuary. This Division was brought into being in G.O.No.AHFF.83.FNG-92, dated: 08-05-1992. There are four ranges located at Muthodi, Hebbe, Lakkavalli and Thanigebyle. There are two sub-divisions – one at Chikmagalur and one at Lakkavalli. All these offices are newly created. The executive staff was drawn from the respective territorial divisions, which contributed the area to the Sanctuary. Sections and beats were since reorganized and as of today the Sanctuary is divided into 17 sections and 39 beats. In addition to this 2 sections and 10 more beats have been proposed. A flow chart of the administration set up for the Bhadra Wildlife sanctuary is furnished at the **Plate - 3.**

10.3 - Infrastructure :

All the officers are provided with office and residential accommodation. Every officer is provided with a jeep. Majority of the subordinates are also

provided official accommodation. In view of the reorganization and posting of more number of staff, some more quarters are required. Anti-poaching camps are usually run in temporary/semi-permanent sheds. All the patrolling tracks have been provided with entry barricades. No patrolling track is allowed to be kept in open condition. So far three wildlife watchtowers were erected – one at Doddahadalu, Chandranahadlu and one at Hulikere Road. The infrastructure facilities created so far are furnished at **ANNEXURE – X.** Infrastructure required in the next 10 years is furnished hereunder:-

Table – 17 : List of required quarters :

Sl. No.	Name of the Range	Required quarters	Place
1.	Division Head quarters	Superintendent-1No FDA – 3 Nos. SDA – 1 No. Typist – 1 No. Driver – 1 No.	Chikmagalur Chikmagalur Chikmagalur Chikmagalur Chikmagalur
1.	Muthodi	Forester Forest Guard	Karanji Huluvathi/ Konkalumane Karanji Huluvathi Konkalumane
2.	Hebbe	Forester Forest Guard	Khodi Konkalumane Khodi Konkalumane
3.	Lakkavalli	Forester	Lakkavalli
4.	Thanigebyle	Forester Forest Guard	Kemmangundi Kemmangundi

10.4 - Wireless network and telephones :

The sanctuary is provided with a good wireless network. There are four static wireless sets at the range head quarters and eight mobile sets in the vehicles. All the officers, foresters and forest guards are provided with walkie-talkies.

The Divisional Office and Hebbe Range Forest Office are connected by telephones.

10.5 - Forest protection camps (FPCs) :

26 FPCs have been working as temporary establishments at different locations inside the sanctuary. Local youth are employed in these camps. But working of these camps is not yet systematized. They are used as support structures to make up the staff shortages.

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CHAPTER XI

THE BUDGET

Development of the Sanctuary received an impetus after it was declared as Project Tiger Area. It is anticipated that adequate budgetary resources will be made available under the five year plan schemes in addition to the normal state and central budget resources. The proposed budget from 2005 to 2015 is furnished in **ANNEXURE – XIII (a) and ANNEXURE – XIII (b)**

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CHAPTER - XII

THE SCHEDULE OF OPERATION AND GENERAL REGULATIONS

12.1 – Schedule:

The revenue and expenditure of the Bhadra Wildlife Division in the last 5 years is furnished at **ANNEXURE – XI.** It is not possible to segregate the expenditure incurred exclusively on the Sanctuary. The expenditure is mainly on habitat improvement, infrastructure development and fire protection. Revenue in the early years was largely from the sale of timber, poles, etc. Now income is mainly from the entry fees, fines and forfeitures. The schedule of operations for the next 10 years is provided in the **ANNEXURE – XIII (a) and ANNEXURE – XIII (b).** More emphasis will be provided to protection, habitat improvement, eco-development and eco-tourism and research.

12.2 – Record of deviations and implemented targets:

All the record of deviations are recorded in the control forms obtained from the “Manual for Planning Wildlife Management in Protected areas and Managed Forests” by Sri. Vishwas B. Swarkar. The control forms are provided in the **ANNEXURE – XII**

Range Registers and maintenance of compartment histories will be kept in each range and consolidated at the Division level.

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