PART – 1

SUMMARY OF FACTS

CHAPTER – I

INTRODUCTION

1.1. - Madhav National Park is one of the oldest National Parks in Madhya Pradesh. The original Park was notified in 1956 as per the provision of the Madhya Bharat National Parks Act of 1955. This original area is finally settled as a National Park and has an area of 165.32 Sq.Km. **(Appendix – I).** Later in the year 1983, an additional area, the 'Extension area' was added to the park by notification under the provisions of the Wildlife (Protection) Act, 1972 **(Appendix - II).** The extension area was originally 181.278 Sq.Km. Subsequently, 20.6205 Sq.Kms falling within the submergence of the Manikheda Dam was excised out of the park. In lieu of this area, an area of 28.634 Sq.Km was added to the extension area **(Appendix – III).** Thus, the extension area at present is of 189.292 Sq.Kms. Determination of rights are in progress in the extension area. The extension area is located to the east of the original park and a four kms. long corridor of revenue land links the two. This corridor is also included in the notified area. Total notified area of the park is 375.233 sq.Kms. and the total net area for which Managemetn Plan is revised is 354.6115 Sq.Kms located between $77^0$38' to $77^0$56' longitude and $25^0$20' to $25^0$38' latitudes.

The original park area adjoins the town of Shivpuri and two National Highways viz. Agra – Mumbai (NH- 3) and Shivpuri - Jhansi (NH-25) pass through this area. The extension area is located to the east of the original park and to the north of the Shivpuri – Jhansi National Highway that forms the southern boundary of the Extension area for most part.

The park represents the Northern Tropical Dry Deciduous Mixed forest type as well as Dry Thorn Forests typical of North – Western Madhya Pradesh. The fauna is represented by the typical peninsular fauna which includes antelopes like Nilgai, Black buck, Chinkara and Chowsingha and deer including Chital, Sambar and Barking deer.

The other animals include the Tiger (rare), Leopard, Wolf, Jackal, Fox, Wild dog, Wild Pig, Ruddy Mongoose, Porcupine, Pangolin, Marsh crocodile, Indian Python etc.

The area was part of the Royal Shooting Preserve of the Maharajas of Gwalior who had their summer capital at Shivpuri. The Maharaja of Gwalior at the beginning of the 20th century, Madhav Rao Scindia was a great visionary who developed it as a rich wildlife area. In order to provide a permanent source of water supply, he built three dams across the river Manihar in the year 1918 to create a chain of three lakes viz. Jadhav sagar, Sakhya Sagar and Madhav Lake. The last two fall within the area of the National Park. These lakes not only add to the natural beauty of the area but also provide a permanent source of water to the wildlife and a fine wetland habitat to the aquatic fauna including thousands of migratory waterfowl.

The area whilst it was the Royal Shooting reserve was well protected and abounded with wild life and was famous for its Tigers. Things however changed with the dawn of Independence. As **E.P. Gee** wrote in *The Wild Life of India,* " the protection given to the park by the former Maharajas of Gwalior suddenly ceased, and excessive poaching took place. During this time most of the wild life, *Sambar, Nilgai* or *blue bull* (an Antelope), *Chital, Chinkara* and others were unfortunately killed off." In addition important migratory routes of animals were excised and put under cultivation and settlement. This has led to a drastic reduction in the wildlife over the years.

1.2 Unique Madhav National Park

Scene One

One afternoon in the last week of November, the sun seemed to eclipse behind the long wings of demoiselle and Eurasian cranes as they suddenly appeared in the sky from north-west direction. With distinct sounds as only cranes can make, they began to descend on the edges of beautiful Sakhya Sagar. There were hundreds of them.

Scene Two

In the month of May, the sun had just risen, was ascending slowly towards the George Castle situated on a hill-top overlooking the beautiful lakes. Abruptly attention was attracted by an alarming call of a sambar doe in the dense forest on right side. And

there it was. The magnificent leopard with its spotted golden coat was looking beautiful in early sun-rays.

These dreaded animals begin to look 'beautiful' to our eyes once the shock of recognition of a vicarious yet visceral sence of impending peril of their close proximity gradually recedes by field experience.

Madhav National Park, situated in Shivpuri district of north-west Madhya Pradesh, has so far been overshadowed by seemingly more important Kanha and Bandhavgarh and therefore, ignored if not neglected, by most naturalists. Conveniently situated at a distance of just five kilometres from the city, there is a good network of all-weather roads and fine accommodation in sailing club house near Sakhya Sagar inside the national park.

A typical example of dry deciduous mixed type forest, it was classified as 5B/C-2 by Champion & Seth. The forests of the park mainly consist of Kardhai, Khair, salai, dhaora, nirguri and siarkanta. The jamun and mahua are found along the nullahs.

With ideal habitat of undulating hills for nilgai and interspersed grassland for chital, the park provides shelter to a large number of sambar, Chinkara, chousingha and a few blackbuck. These herbivores provided food to carnivores like leopard, hyena, jackal and fox.

In this area hundreds of tigers used to roam once, and some of the largest tigers are claimed to have been hunted here. But no tiger has been seen for many years.

Large sounder of wild boars is generally seen near waterbodies. Common langur and mongoose are common while Indian pangolin is rarely seen mainly because it comes out of its burrow only after mid-night. The sloth bear is in the adjacent jungles.

The mugger is certain to be seen basking on some particular places near Sakhya Sagar. About 37 muggers are estimated in the lake. Besides Sakhya Sagar and Madhav Lake with their respective areas of 309.01 and 40 hectares, there are numerous gorges which contain water throughout the year in the park.

The two lakes which do not dry up even in severe drought conditions, attract thousands of migratory birds of 25 to 30 species every winter. Most of these migratory birds come from Central Asian countries. Migratory birds mostly come in the months of November and December and start their return journey in the month end of February. By the end of March, they leave this place for their original destination. The barheaded goose and greyleg goose come here regularly and their number of a few hundreds does not vary much from year to year. The arrival and group-size of demoiselle and Eurasian cranes is quite erratic. It depends on the availability of water in Gujarat and Rajasthan. In the winter of 1987-88 when these two states were affected by severe drought, up to 7000 demoiselle and 1000 Eurasian cranes were counted at Sakhya Sagar. Otherwise they have numbered a few hundreds for last years.

Other migratory birds include, ruddy shelduck, pintail, common teal, mallard, garganey, shoveller, common pochard, white stock etc. Flamingo pelican, white-necked stork, adjutant stork are local migratory while ibises, darter, cormorant, moorhen, pheasant-tailed jacana, painted stork and spoonbill build their nests in this park. A sudden decrease in the number of sarus has been noted. Once common, it is rarely seen now.

Including terrestrial and arboreal birds, a total of about 300 species has been recorded in the park.

1.3 Historical background of Madhav National Park discussed in the pages of books.

1. Gee, E.P.(1964): Wildlife of India. Collins. London.

"..... Not far from Shivpuri is a stone, recording the "record" tiger, shot by Lord Hardinge in 1916, measuring eleven feet six and a half inches. In 1924, slightly farther away, a tiger measuring eleven feet five and a half inches was shot by Lord Reading. I wonder ....."

".....There is a sort of viewing lodge at Shivpuri, where the Maharaja and his guests could sit under cover and watch a tiger at a kill. A 1000-candle power electric arc lamp was hung overhead, with special switch to regulate the light from five-candle power to full, so that photographs could be taken. After the tiger had made its

kill, the light was gradually increased from 5 to 1000 candle-power in a time of ten to fifteen minutes so that the tiger did not notice the oncoming "daylight" ....."

".....The gratifying thing that I heard from Vijay singh (then superintendent of Shivpuri N.P.) was that Marshal Tito (who as guest of Maharaja Scindia visited Shivpuri N.P.) declined the offer of shooting a tiger, but instead commendably took live films of it....."

2. Schaller, G.P.(1967): The Deer and the Tiger. Chicago University Press, Chicago.

".....Predator and pray species were very good in number in Shivpuri N.P.). Schaller found for his study Shivpuri National Park in Madhya Pradesh was a possible site....."

3. Singh, K. (1969): Hints on Tiger shooting. Jaico Books, Bombay.

Col. Kesri Singh was head of Game Department of Gwalior state. In this book he has given a number of incidents in which tigers were killed in broad daylight along road between Gwalior and Shivpuri, indicating that tigers were so numerous in the area.

CHAPTER - II

THE RESOURCES

2.1 Location

2.1.1 Physical:

The Park is a situated in the Central Highlands of India. It forms part of the Upper Vindhyan hills running east-west forming plateaus creased by small and big nullas. The slopes are generally gentle, rarely steep. Some big nullas are very deep in places forming deep gorges and associated waterfalls. The highest point in the National Park is near George Castle at 1597 feet (484 mts).

The National Park is located between $77^0$38' to $77^0$56' longitude and $25^0$20' to $25^0$38' latitudes.

2.1.2 Bio-geographic Location:

The park is part of the Indo-Malayan realm. As per the Bio-geographic classification of India (Rodgers and Pawar), the Park is located in Zone 4, the Semi-Arid zone. Within this zone the park falls within the Gujarat –Rajwara Province, 4 B.

2.1.3 Approach :

Shivpuri is the park headquarter and adjoins the Park itself. Shivpuri town lies in the Guna – Gwalior section of the rail network. Two National Highways viz. Agra – Mumbai (NH- 3) and Shivpuri - Jhansi (NH –25) pass through Shivpuri. The road distances from various cities are: Jhansi 98 kms, Gwalior115 kms, Delhi 428 kms, Mumbai 971 kms, Bhopal 320 kms, Indore 375 kms and Kanpur 375 kms. Gwalior is the nearest airport.

A map showing location and approach is attached **(Maps 1 & 2)**

2.2 Boundaries

2.2.1 External:

The entire original National Park area is duly notified and all rights have been extinguished. The area is demarcated on the ground with the help of dry rubble or masonry pillars, and cut and cleared demarcation lines of forest blocks. The extension area is demarcated by the perennial Sind river forming the eastern boundary while the northern boundary is formed by the Satanwada - Narwar road for most part. The new area added in lieu of the submergence zone to be created as a result of the Manikheda dam on the Sind extends north of the Satanwada – Narwar road up to the Amar nadi to the north which forms the northern boundary. The southern boundary of the extension area is represented for most part by the Shivpuri – Jhansi National Highway (NH – 25). The Barahi river forms the western boundary of the extension area comptt. no. N.119 and N. 109 of East range.

The boundaries of the corridor are unmarked on the ground. The rest of the area has boundary pillars.

2.2.2 Internal:

The old finally notified area of 165.32 Sq. Km has well defined internal boundaries. This area has 71 compartments numbered from 1 to 71. These compartments are part of Satanwada, Mamoni, Chironji and Lodhawali forest blocks. This old National Park area is divided into three parts by the two national highways. This physical division of the area has been a major factor in deciding the boundaries of the management units. The area between the National Highways was notified as the tourism zone while the other two parts were notified as the core zone. This old area was divided into two ranges, namely the North Range comprising compartments 1 to 36 and the South Range comprising compartments 36 to 71. Between 1987 and 1999 the tiger safari existed in compartment no. 51 and it was put in charge of a separate range officer. In the year 1982 an area of 18127.804 ha. was notified as National Park with a encroachment of 7.84 ha. in comptt. No. P.281. The encroachment case is still under trial of court. In this additional notified area, 2671.824 ha. is revenue land, in which 1897.94 ha. is private agricultural land of 15 villages and rest of 773.884 ha. is

Government land. The breakup of revenue land is given in **Appendix – III(A).** The extension area was with the Shivpuri territorial division until December 1995.

2863.40 ha. Reserve forest area was handed over to Madhav National Park from Shivpuri Territorial division in December, 2000 as per notification No./F/14-1-82-Ten-2 date 25.10.99 of M.P.Govt. (Forest Department).
This total extension area of 20991.204 ha. was constituted as two ranges namely East and Central range of Madhav National Park.

Now the present area of the park is as under :

1. Notification of area (in ha.)

Year	R.F.	P.F.	Revenue	Total
1956	16532.14	--	--	16532.14
1982	13033.98	2422.00	2671.824	18127.804
1999	2863.40	---	---	2863.40
Total	**32429.52**	**2422.00**	**2671.824**	**37523.344**

2. Deduction of submergence area (in ha.) from notified area in 1982
(By SDM Shivpuri letter no. Q/SDM/Reader/99/117/98-99/B-121 dated 18.3.99
Appendix- IV)

Year	R.F.	P.F.	Revenue	Total
1999	1208.18	196.87	657.00	2062.05
Total	**1208.18**	**196.87**	**657.00**	**2062.05**

The above forests area 1405.05 ha. was handed over to Shivpuri territorial Division on 25.12.02 vide Conservator Shivpuri letter no. 8232 dated 16.12.02.

Hence the present area (in ha.) is as under:

R.F.	P.F.	Revenue	Total
31221.34	2225.13	2014.824	35461.294

Thus the present distribution of internal management units are as follows :

S.No.	Range / Head quarter	No. of Sub-range	No. of Beat	No. of Comptt.	Total area	%
1.	South (Shivpuri)	3	11	36	7942.05	22.40
2.	North (Satanwara)	3	8	35	8590.09	24.22
3.	East (Surwaya)	3	11	33	8746.46	24.66
4.	Central (Satanwara)	3	11	35	10182.694	28.72
Total		**12**	**41**	**139**	**35461.294**	**100**

An information regarding land use of National Park by other departments is as under:

Area (in ha.)	Comptt. No.	User Dept.	Letter No.
6.268	54	MPTDC	No./14/34/80/2 dated 27.2.82
9.1	526	MPEB	No./8-161/91-FC(PT) dated 15.2.2000
0.23	N. 50	P.W.D. (NH)	No./8-B/077/2000/ FCW/ 1872 dated 12.9.2000
0.40	N. 31, N. 32 and N.35 along NH-3	Tele communication Dept.	No./8-B/081/2000/ FCW/2078 dated 6.10.2000
0.60	N. 31, N. 32 and N.35 along NH-3	Reliance Telecom Limited	No./6-1/97/FOR/Part-iv/2927 dated 10.9.01

2.3 Geo –Morphology

2.3.1 Terrain and drainage pattern:

The upper Vindhyan Hills run east to west forming a plateau creased by small and big nallas. The slopes are generally gentle, rarely steep. Some nallas are fairly big and deep at places forming gorges and water falls as in Tunda Bharka. At places in

such nalla beds, rocks show horizontal layering out of which water is seen trickling during the rainy season. The area of the park is mostly hilly with plateaus and nullas. The drainage pattern is towards north and northeast in the northern area of the park forming catchment of Amarnadi. In the central portion rivers and nullas flow east. On Manihar river dams are constructed forming Sakhya sagar and Madhav lakes. Bhurakho dam does not retain water. Other nullas flow into the Barhi river in the east. The nullas of the southern portion of the park flow east and southeast and join the tributaries of the Sind river. The park area forms catchment of the Sind river which flows along the eastern boundary of the park.

2.3.2 Geology:

The generalised geological succession in the area is as follows:-

Alluvium	-	Soil laterite
Deccan trap	-	Basalt lava flows
Intra trappeans	-	Lamta sedimentary beds
Vindhyas	-	Lime stone and sand stone
Archaeans	-	Bundelkhand granite

The eastern part of the area is occupied by sedimentary rocks of Vindhyan system, only upper Vindhyas are observed here. In general the upper Vindhyas are mostly sandstone, shale and limestones. The sandstone is quartzitic to semi-quartzitic. The rocks are sometimes flaky in nature.

In general, the formations are flat bedded or with gentle slope in the northerly direction.

Scarps, ripple marks, stratification are common features of these formations. Some important flag stone mines and quarries are the resultant features of the nature of the formation. Some such mines existed in the park area in the past.

2.3.3 Soils:

In Vindhyan hills, generally, the soil is shallow, sandy loam and well drained. Lateritic zone is covered by red soil with stony concretions. The texture is coarse as

most of the soils contain an appreciable proportion of incompletely weathered pebbles and boulders.

On the 'Pathars' or plateaus and steep slopes, the depth of soil is generally shallow, hardly exceeding 30 cms. At places the soil is absent and the underlying rock practically comes to the surface.

2.4 Climate

The climate of this district is characterised by a hot summer and general dryness except in the southwest monsoon season. The year may be divided into four seasons. The cold season – from December to February is followed by the hot season – from March to about the middle of June. The period from mid-June to about the end of September is the southwest monsoon season.

2.4.1 Rainfall:

The average annual rainfall in the district is 816.2 mm. The rainfall in the district decreases from the southeast towards the northwest in general. About 92 percent of the annual rainfall in the district is received in the monsoon months June to September, July being the rainiest month.

On an average there are 37 rainy days (i.e. days with rainfall of 2.5 mm. Or more) in a year in a district.

The heaviest rainfall in 24 hours recorded at any station in the district was 317.5 mm. at Shivpuri on 25th June 1933.

The Park and the Shivpuri district has suffered a draught in year 2003. Which was reported as a serious type draught when lake Sakhya Sagar and Madhav was almost completely dried.

2.4.2 Temperature:

A meteorological observatory at Shivpuri is functioning since 1960. Temperatures rise progressively from about the end of February. May is the hottest with the mean daily maximum temperature at about 40^{0}C and the mean daily minimum

at about 23^0 C. The intense heat in May and June with hot dust laden winds which blow on many days make the weather very uncomfortable. On individual days the maximum temperature may reach 46^0 C. Afternoon showers that occur on some days bring temporary relief. With the onset of the southwest monsoon from about the second week of June, the temperature drops appreciably. After the withdrawal of the monsoons by about the end of September there is a slight increase in the day temperature while the nights become progressively cooler. From November both day and night temperatures decrease rapidly. January is generally the coldest month with the mean daily maximum temperature at about 23^0C and the mean daily minimum at about 5^0C. In winter the district is affected by the cold waves caused by the western disturbances over North India and the minimum temperatures may go down to about 0^0C.

2.4.3 Humidity:

In the monsoon season the relative humidity is high, above 70%. In the post monsoon and winter seasons the humidity is usually between 50 to 65% while in the summer the daytime humidity is usually below 20%.

2.4.4 Cloudiness:

During the monsoons, the sky is generally overcast. During the rest of the year the skies are generally clear.

2.4.5 Winds:

Winds are generally light all year round. In the Monsoon and summer season they generally blow from the west or the southwest. In the post monsoon and winter seasons they generally blow from directions between southwest and northwest in the mornings and between northwest and northeast in the evenings.

2.4.6 Special Weather Phenomena:

During the monsoon season depressions originating in the Bay of Bengal sometimes bring widespread heavy rains and gusty winds. Thunderstorms generally occur during the period between April and September. Thunderstorms also occur in the

winter in association with the western disturbances. Fog and dust storms may occur occasionally in the cold and summer season respectively.

2.5 Water

The two lakes inside the old park area, Sind and Barahi rivers in the new extension area represent the major permanent sources of water in the area. In addition there are numerous springs and seepage which have water all year round. In the North and Central Ranges of the park, open pits of old mines retain water throughout the year. Desilting in Gatwaya & Moujpur ponds resulted in the perennial availabity of water.

2.5.1 Wetlands and Marshes:

The two lakes are the major wetlands situated in the park. The construction of the Manikheda dam will create another large wetland in the park. The village tank in Gatwaya village has the potential of being a fine wetland. The area of the Madhav lake is about 40 hectares and that of Sakhya Sagar is 309.01 hectares. The Manikheda dam will create a reservoir of over 3000 hectares in area. However the reservoir is likely to have steep sides and therefore not provide appropriate habitat to attract wetland birds. Water from the two lakes in the original area is released for meeting the drinking water needs of the Shivpuri town. Water for irrigation was also supplied from these lakes up to 1999. However a decision has now been taken not to provide irrigation water from these lakes. This would benefit the park. Sakhya sagar lake has rocky and mildly sloping treeless banks for most parts and it attracts thousands of migratory waterfowl during the winters. The lake was almost completely dried up due to draught in year 2003. A desilting operation was carried out by Irrigation department under the control of Collector, Shivpuri with permission of P.C.CF. (WL) M.P. Bhopal. The Madhav lake by contrast, has steep and densely wooded banks and consequently far less number of birds visit the lake. Both these reservoirs are rich in fish and Marsh crocodiles. Otters are seen occasionally.

A separate wet land project for Chandpatha (Sakhya Sagar) has been prepared and submitted to P.C.C.F. (WL) vide letter no. 468 dated 5.3.05 for Rs. 25.00 lakh. which was further revised and submitted vide letter no. Q.1 Dated 5.8.05 for **Rs. 112 lakh.**

2.5.2 Nature and distribution of sources of water:

Sakhya Sagar and Madhav Sagar lakes are the two large perennial water bodies situated in the central portion of the park close to the Shivpuri-Jhansi road.

In addition there are many big nullas like Tunda Bharka, Bhurakho and Amdar. These nalahs dry up during the summer but retain water pools at a few places throughout the summer. Similarly several springs like Jamunjhiri, Amjhiri, Sidhkho, Kaluakho provide water throughout the summer. In the extension area the Sindh and Barahi rivers are perennial. In addition there are several nullas and springs where water can be found all year round.

A major drawback about the distribution of water is that they are not uniformly distributed. Large portions of the North, Central and East ranges are deficient in water. A large portion of the South range too is deficient in water. In such circumstances concrete lined saucers provided with water by tankers during the summer season are the only way out. A few saucers have been constructed over the past few years. However most of these are in the South range. Many more saucers will have to be constructed all over the park in areas where the habitat is otherwise suitable for wildlife. Care has to be taken so that these new water holes do not become places of poaching. Creation of more stop dams and tanks will further augment the water regime in the area. The perennial / Seasanal water sources are listed as **appendix - V** and marked in **Map 3.**

2.6 Distribution of Salt licks

The park is deficient in salt licks and no natural saltlicks are known.Artificial saltlicks are provided at various places to overcome this drawback.

2.7 Flora

2.7.1 Distribution of plant communities:

The forests of the park fall within the category of Northern tropical dry deciduous mixed forests. According to the Champion and Seth system of classification, they are classified under the category 5B/C2. Important species in the park are Kardhai, Salai,

Dhaora and Khair. The understory comprises almost entirely of Ber, Makor and Karonda.

2.7.1.2 Kardhai forests:-

Forests with more than 50% Kardhai in the overwood are classified as Kardhai forests. Kardhai is found throughout the park in varying proportions. Pure Kardhai patches are found in Mamoni, Chironji and Satanwada blocks between elevations of 330mts.to 440 mts. It is also found in pure patches along nullas at low elevations.

2.7.1.3 Salai forests:-

Salai occurs in almost all the reserved forest blocks in the park.except Ludhauli. Salai is generally found to occur on the higher plateau and slopes on the warmer aspects and on hilltops. It occurs in soils with poor moisture conditions and hard shallow soils. Salai is generally found associated with Dhaora while its other associates are Jhingan, Tendu, Khair, Saja, etc.

2.7.1.4 Khair forests:-

Khair occupies the open areas along the foothills of the park. The crop is almost pure with open patches. The quality is generally poor. The main Khair areas are in compartment nos. N/52, N/70, N/43, N/42 and N/44. These area are sensitive to illegal tree felling. The main associates of Khair are Dhaora, Kardhai and Tendu.

2.7.1.5 Mixed forests:-

Mixed forests are limited in the original park area, but are widely distributed in the extension area. These forests occur on flat, relatively good well drained soils. The species composition includes Bahera, Chichwa, Kasai, Jamun, Mitragyna, Ficus, Safed Siris, Kusum etc.

2.7.1.6 Riparian forests:-

This type is not very common in the park and is found only along the banks of the perennial streams and in deep sheltered valleys. A prime example is in compartment no.N/51 below the shooting box. The main species are Arjun, Jamun, Kusum, mango etc. Other examples are along the Barahi nullah, the Jal mandir area and Amdar.

2.1.7.7 Grasslands, teak forests and aquatic vegetation:-

Pure grasslands are almost non existent. However, areas adjoining the Sakhya Sagar lake and near the various landings provide good grasslands. In addition there are good patches of grasslands in the North range and in the extension area. The deserted stone quarrying settlement of Larha and the villages of Ballarpur, Gatwaya, Lakhangawan, Arjungawan, Harnagar, Mamoni, Donger, Maujpur and Parasari can be developed as good grasslands after the relocation of the villages. Compartment no. N/41, N/43, N/44, N/46, N/51, N/52 and N/53 can be developed as grasslands as well.

Teak occurs in the park along the national Highway in a small patch in compartment no. N/32. It is however too small and was planted during the 1950's.

The only large water-bodies inside the park at present are Sakhya Sagar and Madhav lakes. The latter is quite small and does not support much aquatic vegetation. The receding waters of the Sakhya Sagar lake creates small swamps near the various boat landings. The area around Landing number 5, 8 and 9 are especially noted for their swampy constitution. *Ipomea* however is assuming weed proportions in some of these areas and some mechanical removals would be necessary. The *Ipome*a are good habitat for the Purple Moorhen and other birds. The *Ipomea* must be physically removed during the non-breeding season.

2.1.7.8 The forests being deciduous they shed their leaves during early summer and there is almost no shady tree to provide thermal cover to the animals. It is only in the mixed and riparian areas that some shade exists. The list of floral species found in the park is enclosed as **Appendix – VI.**

2.1.7.9 Endemic, rare and threatened species:-

There is no endemic fauna or flora in the park. Detailed studies need to be carried out in respect of fishes, insects etc.

Special features

There are many important places of scenic Geographical or wild life and public intrest.

1. Churanchhaj (North range)

2. Gadau Ghati (South range)
3. Georgeg at compartment No. 40 & 39 (South range)

2.8 Fauna

Chital or Spotted deer, Nilgai and Chinkara are the most common ungulates in the area. The areas around the two lakes is the main Chital bearing area of the park.. The eastern part of the original park is hilly with steep slopes and relatively dense forest cover this is the main Sambar area. Sambar are also found in the northern areas of the park associated with hilly and dense forests. Barking deer are rare. In the rest of the area Nilgai and Chinkara are common. Also seen are the Four-horned Antelope or the Chowsingha. Wild pig are seen in large sounders especially along the banks of the Sakhya Sagar lake.

The Leopard represents the top carnivore in the area although there are tigers visiting the area infrequently. Evidences of a tiger were found in the extension area in 1999 and there were several other unconfirmed sightings and other evidences of tigers over the past five years. A male tiger entered the Tiger safari in 1996 and was later shifted to the Van Vihar National Park, Bhopal.

Other carnivores include the Wild dog which are occasionally sighted Wolf, Jackal and the Hyena. The Jackal and Hyena are very common..

The two lakes have a good number of Marsh crocodile and they can often be seen basking in the sun during the winter.

The smaller fauna includes the Jungle cat, Palm Civet, Small Indian Civet, Otter, Fox, Porcupine, Monitor lizard, Blacknaped Hare etc.

Over 229 species of birds have been listed in the area. A large number of migratory birds visit the area during the winter. These include Demoiselle cranes, Spotbill Pelicans, Spoonbills, Shovellers, Natka, Barheaded Geese, Brahminy Duck, etc.

Cobra and Common Krait are the common poisonous snakes. The Indian Python is occasionally seen. Monitor lizards are frequently sighted.

The lakes are very rich in fish life and many species including Rohu, Katla, Narain etc. are found.

List of Scientific names, English names and Hindi names of fishes, reptiles, birds and animals are appended as **Appendix -VII**.

2.8.1 Endemism, Rare and Threatened Species:

Amongst the rare species of mammals, the following important ones are found in the Park:-

Wild dog

Otter

Marsh Crocodile and Indian Rock Python

are the threatened species of reptiles that are found in the Park.

2.9 Old mines:

Before being the part of National Park the old and extension area of National Park has been used for open cast mines activities. Several pits of mines can be seen in the region. Range wise detail of open cast mines are given below :

Range	No. of pits
North	217
Central	111
East	85

CHAPTER - III

3.1 Background information

3.1.1 Notification of the area, Settlement proceedings:

Preliminary notification of the National Park under the name of Shivpuri National Park with the description of boundaries was issued on 2nd february 1956 by the then Madhya Bharat National Park's Act. Collector Shivpuri enquired into the rights and claims put forward and after inquiry, the final notification was issued in september1958 by the government of Madhya Pradesh. The government through negotiation acquired the private property of the Maharaja of Gwalior situated within the park and the name of the park was changed to Madhav National Park after Sir Madhav Rao Scindia, the architect of this beautiful wildlife area. The original Park area is finally settled without any rights.

An area from the average distance of 5 km. around the North & South range of the original park was declared as Buffer zone vide M.P. Government Forest Department letter No./F-14/46/77-10(3) dated 20 February, 1978. This includes 71 compartments and 72 villages of Tehsil Shivpuri and range Satanwara. & Shivpuri **Appendix -VIII.**

In the eighties the state government decided that the area of the Park should be expanded towards the east encompassing the wildlife area lying up to the Sind river. It was decided that a chunk of cultivation lying between the two forest areas would be acquired to form a corridor. A notification under section 35(1) of the Wildlife (Protection) Act 1972 was issued vide state government notification no. 14/1/28-10(2) dated 28.5.82. The process of determination of right and final notification by the Collector is underway. After the initial notification the area falling within the submergence of the Manikhera dam was excised out of the park vide SDM's order no. Q/SDM/Reader/99/117/98-99/B-121. The area excised out of the park is 20.6205 sq. Km. which includes 657 ha. area of 5 revenue village Saunsa, Binega, Kanthi, Bamnaua, Dador dehri (Dadoi). The resettlement process in above 5 villages has already been done by the Irrigation Department. In lieu of this area an additional area of 28.634sq. kms. was added to the extension area at its northern boundary. As a result the extension area had 15 villages within it. Out of which 5 villages coming under the

submergence of Madikheda Dam have been relocated outside the park by Irrigation Department. One village Ballarpur has been relocated outside the park by Forest Department. Now, the park has total nine villages within it.

The proposal for denotification of forest land for relocation of village Ballarpur has already been submitted to the Government of India by letter no./F-5/13/10-3/02 dated 25.7.02 by Government of M.P. Forest Department and the proposal for denotification of forest land for relocation of village Gatwaya has been submitted to P.C.C.F. (WL) M.P. Bhopal for sanction of Government of India vide letter no./2506 dated 6.9.04.

The valuation of compensation for 9 villages by the Collector, Shivpuri is as under:-

S.No.	Name of Village	Amount for compensation	Valuation year
1.	Arjungawan	8,53,91,504	2005-06
2.	Lakhangawan	3,52,09,171	2005-06
3.	Harnagar	4,49,39,915	2005-06
4.	Parasari	14,20,224	2005-06
5.	Mojpur	53,08,485	2005-06
6.	Mamoni	6,78,45,030	2005-06
7.	Larha	21,75,060	2005-06
8.	Donger	5,60,66,684	2005-06
Total		**29,83,56,073**	
9.	Gatwaya	1,60,34,363	2006-07
Grand Total		**31,43,90,437**	

3.2 Regional analysis

3.2.1 Socio-economic analysis:

The northern and southern boundaries of the original park area and the northern and eastern boundaries of the extension area have adjoining government forests. Shivpuri town which is also the district headquarter is situated right on the western boundary of the park. There are about a hundred and twenty two villages within a periphery of 5 kms. of the park. The main occupations of the residents of Shivpuri are

government service and business. The main occupations of the villagers are agriculture and as labours working in the stone quarries. Many of these villages are inhabited by gujars who own large number of cattle and as stall feeding is unknown, they intrude into the national park for grazing. The Saharia tribals, many of who sell fuel wood for their livelihood populate many villages. Protection of the Park from these severe biotic interferences is a challenge.

3.2.1.1 Existing land use:-

Agriculture and animal husbandry is the main land use in the area around the park.

3.2.2 Number of villages in the core and buffer area of the park:

At present 9 villages are within the core area of the park. Thease villages are situated in the additional area notified in 1982. With in a radius of 5 kilometers of the park boundary there are 122 villages. Within a radius of 10 kilometers, there are 250 villages. The villages are listed as **Appendix –IX** and **Appendix- X** respectively.

Of these villages, about 38 settlements are located right next to the park boundary, including the Shivpuri Town. These are very high impact villages. These villages bring out huge pressure on the Park in order to meet their demand of fodder, fuelwood and small timbers. These settlements located right on the boundary are:

1. Shivpuri (Town)
2. Madeva
3. Dawara
4. Barah
5. Karai
6. Jamunia
7. Amarkhoha
8. Chirota
9. Chitori
10. Mahendrapura
11. Satanwada

12. Binega
13. Chandanpura
14. Nohri Kalan
15. Kathmai
16. Bachora
17. Lakhangawan
18. Mamoni
19. Thakurpura
20. Mahuakheda
21. Har Nagar
22. Kota
23. Bhagora
24. Hatod
25. Neemdanda
26. Majhera
27. Barodi
28. Badagaon
29. Tilaghat
30. Ludhawali
31. Ghassari
32. Gangoli
33. Surwaya
34. Mahammadpur
35. Mitlauni
36. Piprai
37. Kharera
38. Dongar

3.2.3 Cattle population and grazing practices:

In the surrounding villages listed above the cattle population is more than the human population. The reason is that large number of gujars whose livelihood is based on animal husbandry only inhabits the neighbouring villages. There is no history of stall-feeding and so they depend on grazing only.

3.2.4 Fuel and minor Forest produce removals:

Fuelwood:

No regular felling are carried out in the park. Similarly there is total prohibition on removal of fuelwood. However some people comprising mainly women from Shivpuri town and nearby villages do sometimes enter the park to extract headloads of fuelwood. In the extreme northern and southern portions of the original area this problem is acute.

Tendupatta and other forest produce;

Tendupatta and other forest produce extraction is prohibited from within the National park area. However some illicit removals do take place.

3.3 Past history

3.3.1 History up to 1977:

The present national park area formed part of the royal hunting preserve of the maharaja of Gwalior. This hunting reserve was used exclusively by the royal family and their important guests. Sir Madhav Rao Scindia the maharaja was a great visionary. He constructed dams on the Manihar river creating the Sakhya sagar and Madhav lakes in 1918-1919. In addition he constructed the Sailing Club, numerous boat landings and Baradaris around the Sakhya sagar lake. Also constructed was many buildings like the Sultana hotel, Shooting boxes and above all fine network of well laid-out metalled roads. All these created scenic beauty and a complete infrastructure.

All round the lake and at suitable points the Maharaja constructed boat landing piers, picnic shelters, watch towers, hides etc. Maharaja also added in this area a remarkable and unique shooting box on the Chandpatha dam, for shooting wild life both with gun and camera. In order to protect the wild life from poaching all approaches to the park by road from the two National highways were stopped by erecting barriers and putting up locked gates at all strategic points. Since the forests of the park area were inside the royal Shikar reserve they were zealously protected and guarded. These forests thus enjoyed a measure of protection up to 1946 that has not

been matched since. As a result the area supported an impressive array of wildlife including tigers. Shivpuri eventually became famous for the large size of its tigers and two of the record tigers shot were "bagged" during viceregal shoots close to Shivpuri town. The stone commemorating the tiger shot by Lord Hardinge can in fact be seen 5 Kms out side the town on the national Highway to Gwalior.

Unfortunately after the merger of states following independence and till the formation of the National Park, the people residing in the area wrought havoc on it with vengeance and the area was subjected to heavy illicit felling, poaching and grazing. The central portion of the park (compartment No. N/31 to N/54) has since recouped somewhat due to protection given to it. The rest of the area still shows scars of those years. When the National Park was notified, the flat area to the east was left out of the park which was to prove disastrous for the wildlife. This area constituted the main forage and watering area during summer. Further, this was also the main corridor linking what is now the old park area to the forests to the east and the south.

Preliminary notification of the Madhav National Park with description of boundaries was issued in February 1956. In this notification the State Government notified its intention to form National Park under the national Park act 1955 and directed Collector Shivpuri to enquire into the rights and claims put forward by any one. After the inquiry by collector the final notification was issued in September 1958. There were many buildings inside the park which were private property of Maharaja of Gwalior. After protracted negotiation the Gwalior Rulers agreed to part with these buildings on the condition, that the park be named Madhav National Park. This was agreed to by the government and thus, fittingly perhaps, the park takes its name after Madhav Rao Scindia who with great foresight created this beautiful park.

3.3.2 Management Plans:

Initially the park was managed as a separate range in the Shivpuri territorial division. In 1977 a separate division was created and the Park put in charge of a Deputy Conservator of Forests, designated the Director. The first management scheme was outlined by Shri J.J. Dutta for the period 1977-78 to 1981-82. Then a plan was prepared by Shri S.K. Sharma for the period 1989 –90 to 1993 -94. The plan under review was prepared by Shri Subhranjan Sen for the period 2000 –01 to 2004-05.

Shri J.J. Dutta's plan made provisions for development of water sources, supplementary feeding, anti poaching measures, augmentation of visitor facilities, staff housing, office buildings, wireless network etc. Many of the objectives laid out were achieved . This was before the notification of the extension area and hence dealt with the original Park area only.

Shri S. K. Sharma's plan was also limited to the old park area. The 'central zone' between the two National highways was designated as the Tourism zone and the rest of the park was designated the core zone. The notified closed area was designated as the Buffer zone. Prescriptions were made for the augmentation of water sources, fencing of the central zone, establishment of the tiger safari, Park interpretation facilities etc.

Shri Subhranjan Sen's plan made provision for old park area as well as extension area.

Unfortunately not many of the prescriptions with regard to habitat improvement were implemented due to absence of budgetary support or other reasons.

3.3.3 Past usage of forests by local people:

The area constituting the park, have never been commercially exploited and received great protection up to 1946. After independence the pressure of population, both human and animal, the 'grow more food campaign' and the proximity of the park to the Shivpuri town all gave rise to political pressures. The main wrath therefore fell upon what was commonly believed to be the pleasure resorts of former rulers. In this first flush of enthusiasm after independence, permanent harm was done to the park by allotting land adjacent to park for cultivation and by permitting stone quarries inside the forest area surrounding the park. This area which is a flat valley with deep soil used to be the prime refuge of the wildlife during the hot dry summer and was also a corridor between the present old park and the Extension areas.

3.3.4 Past treatment of forests :

During the Ex-Gwalior State time, at least since 1939, these forests have never been put under any management plan for commercial exploitation but have been

reserved for nature and wild life conservation. The forests in the extension area had numerous stone quarries within them which was a great source of disturbance to the wildlife.

3.3.5 Past treatment of wild life :

(i) General :-

Shivpuri District has always been famous for the variety and abundance of 'game'. Due to royal patronage in the state time, the wildlife enjoyed a measure of protection it has never known since. Tiger and other animal were known to wander in great numbers in the area and often came as close as ½ Km from Shivpuri town . This was so because even forests now under the 'Chatri trust' were protected.. As in the rest of the country, the decimation of wild life accelerated in the post independence era. Common men who could not dare to go any where near the former shooting reserves now started indulging in poaching and tree felling as soon as the control of the state was lifted in these areas. The 'grow more food campaign' also had a disastrous effect on the area in that lot of area strategically important for wildlife was given over for cultivation thus causing not only shrinkage in wild life habitat but causing great restriction in their movements and escape and migration routes. Although wild life continued to enjoy statutory protection the actual control on the field has slackened - as compared to that before 1947. The increase in population, removal of fear that was associated with the violation of the royal shooting reserve both within the local population and the enforcement staff have all contributed. The wildlife, already faced with reduction in habitat, further suffered a severe set back due to fall in quality and carrying capacity of habitat when grazing within the National park increased due to the increase in domestic animal populations as well as the elimination of all grazing land outside the park. Further contracts for stone quarries were given in the immediate vicinity of the park and in the adjacent forest areas. The latter resulted in movements of heavy trucks and people in the forests causing disturbance. The blasting in quarries further disturbed the wild life.

3.4 Silvicultural systems and tending operations

At present no silvicultural systems and tending operations are conducted inside the Park area except measures aimed at increasing forage for the wildlife. This includes the growing of supplementary feeds, early burning and irrigation of grasslands..

3.4.1 Bamboo Working :

Natural Bamboo culms are very few and sparsh inside the park comptt. No. N/45, N/32, N/33, N/34, N/88, and N/97. Rest of the Park area has no bamboo stock..

3.5 Fire wood harvest and collection

No regular fellings are carried out in the Park. Similarly there is total prohibition on removal of fuel wood. But, dozens of people comprising mainly of women from Shivpuri town and nearby villages, enter the Park forests and extract fuel wood on head loads which is sold in Shivpuri fetching about Rs.25 to Rs.40 per head load. Fuel wood is being sold at about Rs.80 to 120 per quintal in the town.

Similarly some cyclists while passing along national highways extract fuel wood.. Some cyclists operate during the night and bring in fuel wood of large size. They fell and damage the trees.

In extreme northern and southern portions some cartmen of the nearby villages, especially around Amarkhoa sometime succeed in extracting fuelwood.

Villagers of Gatwaya collect firewood and other forest produce. Since identification of rights is in progress and as soon as the above mentioned village is rehabilitated out side the Park illegal collection of fire wood and other forest produce can be checked.

3.5.1 Non Wood Forest Produce (NWFP) :

Collection Non Wood Forest Produce in the park area is totally banned but some illegal collections do take place. The NWFP collected are Baheda, Aonla, achar, Jamun, Tendu, Ghont Fruits, Arjun, Rohini (bark), Asperagus spp. Apho (gudmar

leaves), Tendu Patta leaves, Safed musli, Kali musli, Honey, Mahua Flowers & Fruits, Gums of Khair, Dhaura, Palas, Salai, Chakoda Seeds, Chakoda leaves, Rohini Fruits, Ber, various grasses etc.

3.6. Insect Attacks and Pathological Problems

There is no history of insect attacks or of pathological infestations in the park.

3.7 Wildlife Health

As several thousand cattle graze within the National park. As the park itself is small with a high area to perimeter ratio and surrounded by settled tracts with a large number of cattle, it is no wonder that the threat of diseases spread by domestic animals especially cattle is ever present. There have been indications that diseases in ungulates contracted from cattle like Foot and mouth disease is prevalent. Attempts are being made to enforce the statuary provision of immunizing cattle in villages within and within a periphery of 5 Kms of the park. This is absolutely essential along the actual elimination of grazing for the health of the park. The cattle in the following areas must be vaccinated on a priority basis.

1.Shivpuri town 2. Madeva, 3. Dawara, 4. Vara, 5. Karai, 6. Jamunia, 7. Amarkhoha, 8. Chirota, 9. Chitori, 10. Mahendrapura, 11. Satanwada, 12.Binega, 13. Chandanpura, 14. Nohri Kalan, 15. Kathmai, 16. Bachora, 17. Lakhangawan, 18. Mamoni, 19. Thakurpura, 20. Mahuakheda, 21. Har Nagar, 22. Kota, 23. Bhagora, 24. Hatod, 25. Neemdanda, 26. Majhera, 27.Barodi, 28. Badagaon, 29. Tilaghat, 30. Ludhawali, 31. Ghassari, 32. Theh 33. Donger 34. Satanwada Khurd 35. Ganguli 36. Pripronia 37. Ganghrog 38. Karai 39. Surwaya 40. Gatwaya 41. Balarpur 42. Sonsa 43.Binega 44. Mitaloni 45. Mohamda pur 46. Nayagawan 47. BharaBawari 48. Khutla 49. Chanr 50 Sakalpur 51. Pipra 52. Khourea 53. Kankar 54. Banmor 55. Kari 56. Barah 57. Sujlapura.

The park area is actually deficient in saltlicks. Therefore artificial saltlicks must be provided near suitable water points as a supplement.

3.8 Cattle Population and Grazing Practices

In the surrounding villages listed above the cattle population is more than the human population. The reason is that large number of Gujars whose livelihood is based heavily on animal husbandry inhabits the neighboring villages. Stall-feeding is unknown or not practiced at all. When village pastures are used up, they enter the park.

Most of the cattle are unproductive. Whenever they are impounded by the park staff, few people come forward to pay the fine and get them released. In such a situation the Kanji house authorities auction them fetching prices as low as Rs.50/- to 100/- per head. Cattle found grazing in the park are taken to the cattle pound of the municipal and panchayat authorities or the departmental cattle pound. However the fact is that the cattle pounds are not effective deterrent in this situation.

Following is the details of impounded cattles :-

S.No.	Place	Year	Cow family	Buffalo family	Goat family	Total
1.	Shivpuri	2002-03	464	108	60	632
	Satanwara	2002-03	56	11	-	67
2.	Shivpuri	2003-04	408	314	17	739
	Satanwara	2003-04	184	207	67	458
3.	Shivpuri	2004-05	139	82	62	283
	Satanwara	2004-05	128	24	112	264
4.	Shivpuri	2005-06	139	19	-	158
	Satanwara	2005-06	57	54	-	111
5.	Shivpuri	2006-07	22	10	-	32
	Satanwara	2006-07	-	-	-	-

3.9 Tourism

Shivpuri is publicised as a tourist destination by the Madhya Pradesh Tourism Department. The principal attractions apart from the National Park are the magnificent Chattris and Bhadaiya Kund. The latter is in fact a forest pool with a small waterfall located just inside the park. A lot of visitors come to Shivpuri to visit the National Park. The Sakhya Sagar lake, George castle and the wildlife around the lake are prime

attractions. The Tiger safari was a major attraction. At one time the safari had fourteen tigers. In 1998 however, the safari was refused recognition by the Central Zoo Authority (CZA) and the tigers where sent to various zoos. The wire mesh enclosure has also been dismantled. A solitary tigress Shiwani has also been transfered to Van Vihar, Bhopal in March, 2007. At present there is no tiger in the dismantled safari of this park. The visitor figures for the last 15 years is attached.

The main tourist season is winter and the slackest is summer. As can be seen from the table, there has been a sharp decline in visitor arrivals from 1996 onwards. The increase in the park entry fee from rupees 1 to Rs. 10 from1997 (which resulted in a reduction in the number of visitors from Shivpuri town) and the closure of the Tiger safari are reasons attributed for the decline of tourists.

For the visitors to Shivpuri the accommodations available include park guest houses at Sailing club, the Circuit house, MP tourism hotel and a number of moderate hotels in the town which are less than 5 km. distance from the park. The MP tourism development corporation runs the luxurious Tourist Village hotel close to the Park gate. The provision for training to the staff and to the guides has been made to develop their knowledge regarding wild life environment, tourism so that they can interpretate the park and its activities. This human resource development is very necessary.

There are 2 Forest Ranger, 3 Dy. Ranger, 1 Forester and 43 Forest guard. Who are not trained in wild life management. They should be sent for 3 month wild life capsule course at WLI, Dehradun.

Table: 1

YEAR	NO. OF TOURISTS	
	INDIAN	FOREIGNERS
1992	33,741	119
1993	25,441	138
1994	26,846	234
1995	29,114	391
1996	34,530	170
1997	19,962	170

1998	17,324	200
1999	16,908	91
2000	11,364	90
2001	13,250	227
2002	14,792	213
2003	15,013	121
2004	14,514	115
2005	11,611	78
2006	12,490	145

The following are the current rate and fees charged from tourists :

P.C.C.F.(WL) M.P., Bhopal has revised the rate by letter no.178 Bhopal dated 4.8.06.

		Indian & Saarc	Other countries
1.	Park entry fee	Rs. 20/- per person	Rs. 200/- per person
2.	Entry fee for vehicle (petrol/Diesel only) Car, Jypsi, Jeep	Rs. 100/-	Rs. 100/-
3.	Mini bus fee	Rs. 150/-	Rs. 150/-
4.	Camera fee (Still), Mobile with camera	Free	Free
5.	Camera fee (video) V.H.S.	Rs. 200/- per round	Rs. 200/- per round
6.	Interpretation entry fee	Rs. 10/- (each) those who have not paid entry fee.	

The tourists are permitted to move in the tourism zone in vehicles on being accompanied by a park guide. Night excursions are not permitted. Tourists are also not permitted to walk on foot. Picnics are not permitted within the park. Heavy vehicles and diesel vehicles more than 5 years old are not allowed inside the park. Alternatively, Jypsies / Mini buses can be obtained and run by the department for the tourists. Playing of radio transistors, tape recorders or musical instruments inside the park is not permitted. Tourists are supposed to not take polythene carry bags in the park.

3.9.1 Nature Trail

To enrich the tourists and nature lovers with more information regarding forest and Environment and give wilder experience, nature trail has been created.

3.10 Arms registrations

As the provision of Wild Life Protection Act 1972 (As amended in 1991, 2002), district magistrate must get a no objection certificate from CWLW before issuing a fire arm license for the persons residing in the periphery of 10 km. from the National Park / Sanctuary. In accordance with above provision, park office is issing NOC'S. This office has no information as how many license have been issued by DM and how many procured by the applicants. This information is being collected by Director's office. In the Director's office, 713 fire arms are registered up to March 05.

CHAPTER - IV

STAFF, BASIC AMENITIES AND FINANCES

4.1.1. Staffing pattern, Mobile squad etc.

4.1.1.1 Administration:

The Director of the national park is of the rank of a Conservator of Forests. He is overall in charge of the park. He is assisted by an Assistant Director of the rank of an assistant conservator of forests.

Field organization:

The national park is divided into 4 ranges, sub ranges and beats. The villages of Ballarpur and Gatwaya as well as the corridor area have as yet not been given any compartment numbers. This has been proposed in this plan. The final compartment map is attached as **Map 5.** At present the corridor area is not assigned to any field staff. The new area added north of the Narwar – Satanwada roads has to be split into two beats for management. This has been sought to be done in this plan revision and three new beats have been created. The new beat map is appended as **Map 6.** The range map is also appended as **Map 7.** The total strength of the field staff is 77. In addition, there are 25 staff members in the office. The details of the posts and their pay Scales are given below:-

Table: 2 STAFF POSITION IN MADHAV NATIONAL PARK

POST	SANCTIONED STRENGTH	PRESENT STRENGTH	PAYSCALE
CF	1	1	16400-450-20000
ACF	1	1	10000 –325 - 15200
RANGE OFFICER	8	6	5500–175–9000/6500-200-10500
DEPUTY RANGE OFFICER	4	3	4500-125-7000

FORESTER/ GAME FORESTER	11	11	3500–80–4700–100–5200
FOREST GUARD	58	54	3050–75–3950-80-4590 3500-80-4700-100-5200
STENO TYPIST	1	1	4500 – 125 - 7000
ASST GR. I	1	1	5500 – 125 –7000
ACCOUNTANT	3	3	4000 – 100 – 6000
ASST GR. II	2	2	4000 – 100 – 6000
ASST GR. III	7	6	3050–75–3950-80-4590 3500-80-4700-100-5200
DRAFTSMAN	1	1	8000 –275 - 13500
DRIVER	3	3	3050–75–3950-80-4590
PEON /MALI /ODERLY/ WATCHMAN/	8	7	2550–55–2660–60–3200 2750-70-3800-75-4400
KHANSAMA	1	--	2550–55–2660–603200
CINEMA OPERATOR	0	1	4000-100-6000
ASSISTANT VETERINARY SURGEON	1	1	8000 –275 - 13500

4.1.1.2 Mobile squads:

At present there are 2 patrolling parties each consisting of field staff, Ex. Army personnel and casual laborers. One party patrols the park during the day and the other during the night. The mobile squads use the two Jeeps (Gypsies) available for patrolling. For patrolling the lake one motor boat and two paddal boats are available. These are very old and the conditions of boats are very poor. It is very dangerous to use them. They should be urgently replaced with new ones.

4.1.2. Staff housing:

Under Mr. J.J Dutta's Development plan a large number of staff and office buildings where constructed and a small colony was created. A list of buildings in the park is attached as **Appendix -XI**. A couple of additional staff quarters are however needed in the colony. At least three patrolling camps need to be constructed in the new extension area for effective patrolling.

4.2. Other assets

4.2.1. Rest houses:

There are 7 well furnised suites in National Park. 3 suits are AC. These suites are also available for tourist on payment. Renovation work has been done in the year 2006-07 from Vikas Nidhi fund. Regular maintenance will be required during the plan period. Proposal for left out upgradation work is being prepared.

Rates

S.No.	Suits Particulars	Govt. officer on Govt. duty	Govt. officer on private duty	For private tourists	For foreigner tourists
1.	Sailing club A.C. room (1&2)	40/- each	400/- each	1200/- each	1600/- each
2.	Ladies club (6&7)	30/- each	300/- each	900/- each	1200/- each
3.	Band stand (3,4,5)	20/- each	200/- each	600/- each	800/- each

Note : Each room service charges is Rs. 50/- per day.

4.2.2 Roads and Fire lines:

Roads:

The total length of roads exits in park is approx. 296 km. There is a well knit metalled road system in the central zone of the park and one metalled road exist in the north zone. The total length of such roads is 52.63 kms. The central zone roads keep the area open throughout the year for tourist traffic. In other part of the park fair weather cart roads exist there. These roads needs regular repair after rains. At some places cause way and small culverts can be constructed. In the extension area, the Narwar - Larha - Chapparghat road, Karai -Ballarpur road are the main roads. These roads are however unmetalled and a problem during the rains. A list of the roads is attached. The untarred metalled roads with weak culverts in the tourism zone are open to light vehicular traffic only. Heavy vehicles may cause damages to the culverts and the roads. Road map is attached as **Map 4** and a list of roads is attached as **Appendix -XII**.

Fire lines:

There are four regular firelines in the original park area And two firelines in the extension area. The central zone of the old park has a very good network of roads which serve the purpose of firelines. Similarly the park boundaries are also used as firelines. The fire lines are :-

S.No.	Location	Length
1.	North Range: Running east –west passing through compartment nos. N-11, N-12, N-13 and making the boundary of the Compartment nos. N-23 and N-22 and Then Passing through compartment N-24 and N-26.	**7.5 kms**
2.	South Range: Originates from the Jhansi road making the western boundary of the park bordering compartment no. N-55, makes the southern boundaryof compartment N-62 and runs towards north-east bifurcating compartment nos. N-69,N-61, N-70 and N-71.	**6.5 kms**
3.	South Range: Making the boundary between the Ludhavali and Chironji blocks.	**4.3 kms**
4.	South Range: Making the South-eastern boundary of the park.	**4.8 kms**
5.	East Range: From the RF – PF line in compartment N-118 to Ballarpur and then on to Benega and Sind River	**9.0 kms**
6.	East and Central Range: From National Highway 25 in compartment 89 and on to Ballarpur. Then on to Larha across the Barhi river and on to the	**27.0 kms**

Satanwada – Narwar road. Then along the western boundary of the compartments 529, 531, 534, 549 and 548 and on to Amar river.

59.1 km.

7. Outer boundaries of National Park will be used as fire line **213.0 km.**

South range	-	55.0 km.
North range	-	45.0 km.
East range	-	44.0 km.
Central range	-	69.0 km.
		213.0 km.

8. RF/PF boundary **29.0 km.**

Central range	- 11 km.
East range	- 18 km.
	- 29 km.

9. Village boundary (Gatwaya) East range **6.0 km.**

10. Both sides of roads. **296.0 km. road length**

11. Along the both sides of roads NH-3 & NH-25 fire protection works will be carried out.

12. During Ballarpur annual mela, it is necessary to clean some important footpaths and engage fire watchers in sufficient numbers.

13. In National Park area, specially in tourist zone where the protection is of high degree and the grasses grow in more height and at the same time number of herbivores are more, a special measure for fire protection should be taken by provision of special width along the roads and expenditure.

A map of the various fire lines in the park is attached. **(Map - 8)**

4.2.3 Check posts, Gates and Watchtowers:

4.2.3.1 Check Posts :-

The only operational check posts in the park are the gates of entry and exit from the park to control the entry and exit of tourists from the park. Three other check post are maintained by National Park as given below :

1-	Jhansi road check post	-	near gate no. 1 (South range)
2-	Chand check post	-	near village chand (Madhya range)
3-	Aravan check post	-	near village Aravan (Madhya range)

4.2.3.2 Gates

There is one gate on the Tunda Barka road in the Sorth range, two gates for entry into the South range and six gates for entry into the Central portion of South range. Of these only the mains gate and gate number three are open for tourists as entry and exit gates respectively. The other gates are used only by the staff and are kept under lock and key. In the extension area there are no gates. Gate no. 14 situated on the Agra-Bombay road (NH-3) in the North range is being developed and proposed for tourists entry and exit in this plan period.

4.2.3.3 Watch towers

There are six watch towers in the park. These towers are situated in the central zone and other areas of the park. These towers are the Bhura Kho tower in compt. no. N-37, Ladies' club or golf tower in compt. no. N-50, East of George castle in compt. no. N-48, Bhura kho Jal mandir in Comptt. no. N.31, Near Tunda Bharkha in compt. no. N-14, and near Aravan in compt. no. 534. These towers can be used for wildlife watching as well as fire watch towers. Visibility from the Ladies' club or golf tower is the most extensive and areas beyond the Sakhya Sagar lake, and far south of the Jhansi road can be seen. Some more watch towers in the park are needed.

4.2.4 Transport and vehicles :

At present the following vehicles are available in the park:

i . Petrol Jeep (Gypsy)	3 For officers and patrolling
ii. Bolero Jeep (Diesel)	1 For officers and patrolling
iii. Tractor with two tankers	1 For miscellaneous uses
iv. Paddle boats	2 For patrolling
v. Motor boat	1 For patrolling

The old vehicles with the park including two jeeps, motorcycles a trekker and mini bus used for tourist excursions have been written off as they were bought before 1987.

The park therefore faces an acute paucity of vehicles. Presently, Jypsies available with the park are very old. Also, there is no jeep for resque squad /immunization programme in the park. All 3 Jypsies are to be replaced. 2 Bolero campor/ Mahindra utility are urgently needed for regular patrolling. 1 separate Jeep is needed for immunization programme / Resque squad. Similarly 1 Tractor with trolly and tankers is required for water supply during summer season and misc. purpose. A tourist vehicle (Mini bus) is also necessary in the park for tourist excursion. Further as two national highways pass through the park, highway patrolling is unavoidable. Diesel jeeps would be economical. All boats are very old and in depleted condition. They are to be replaced with new ones very soon.

4.2.5 Communications – Telephones – Wireless etc.

4.2.5.1 Telephones:

There are 5 telephones in the park, in the Director's office, in the Director's residence, in the residence of the assistant director, South range office and in the sailing Club. The telephone system is adequate.

4.2.5.2 Wireless:

At present 6 base stations at Shivpuri, Sailing club, Satanwada, Surwaya, Amarkhoa and Aravan have been established. This is inadequate and four more stations are required at Larha, Ballarpur, Karai and Mitlauni. In addition the 4 vehicles have wireless sets mounted on them. There are 44 hand held sets distributed among the officers and staff of the park. The number of hand held sets too is inadequate and at least 20 more sets will be required in view of the sensitiveness of the area.

4.3 Budgetary provisions

Budgetary provisions for the park during the last five financial years is given overleaf: -

YEAR	NON PLAN		PLAN		Conservator Shivpuri		CENTRAL ASSISTANCE		12th finance commission	
	Allotment (Rs.)	Expenditure (Rs.)	Allotment (Rs.)	Expenditure (Rs.)	Allotment (Rs.)	Expenditure (Rs.)	Allotment (Rs.)	Expenditure (Rs.)	Allotment (Rs.)	Expenditure (Rs.)
2002-2003	1,33,20,000	1,07,94,197	8,00,000	7,85,065	6,75,000	5,10,108	45,71,000	43,55,634	---	---
2003-2004	1,28,93,954	1,36,36,389	17,90,000	17,01,206	20,00,000	1,34,294	51,08,600	32,72,101	---	---
2004-2005	1,30,92,000	1,47,93,642	29,64,000	29,43,499	10,70,000	10,68,627	42,56,400	18,40,498	---	---
2005-2006	1,37,31,000	1,46,16,694	8,45,000	8,45,376	--	--	63,29,213	43,77,614	40,00,000	33,35,457
2006-2007	1,39,17,500	1,44,01,705	7,00,000	7,00,000	--	--	85,30,000	83,44,646	46,65,000	46,64,113

Table - 4 Detailed Non Plan Budget allotment and Expenditure

2002 - 2003 to 2006-2007

YEAR	NON PLAN		
	Budget Head	**Allotment**	**Expenditure**
2002-2003	10-2406 Non plan. Establishment, wages, office expences and others Road &Bridges repairs Building maintenance 02 wages 03 others	1,36,95,000	1,09,64,844
2003-2004	10-2406 Non plan. Establishment, wages, office expences and others Road &Bridges repairs Building maintenance Development of tiger reserves, National Park & Sanctuaries	1,28,93,954	1,36,36,389
2004-2005	10-2406 10-2406 Non plan. Establishment, wages, office expences and others Road &Bridges repairs 6218 Building maintenance.	1,30,92,000	1,47,93,642
2005-2006	10-2406 Non Plan	1,37,31,000	1,46,16,694
2006-2007	10-2406 Non Plan 10-2216 Non Plan 10-3054 Non Plan	1,39,17,500	1,44,01,705

As can be seen, the allotments for the various activities, especially habitat improvement works, upgradation of roads and buildings etc. are inadequate and an increase in allotments is urgently required.

CHAPTER -V

THE PROTECTED AREA AND THE INTERFACE LANDUSE SITUATION

5.1 The zone of Influence and the existing situation therein:

The old park has a notified closed area around it. A notification under the provisions of the Wildlife (Protection) Act was issued vide notification no.F-14/46/77-10(3) dated 20 – 02 - 1978 . This comprises 72 revenue village around the original park area. This along with a belt of 5 km width around the rest of the area may be defined as the zone of Influence around the park. This area is about 1,00,000 hectares. This area has at least 122 villages. The map of the area is attached as **Map 9.**

The park as mentioned earlier has 10 enclaved villages of which 2 are inhabited and the notified corridor area has another 5 villages. Thus, there are 15 villages inside the notified area of the Park. 1 village Ballarpur has been relocated outside the Park. The relocation process for other villages is in progress. In addition there are over 122 villages within a radius of 5 Kms. from the park boundary. All these villages influence the park habitat and the wildlife in various ways.

Most of the villages are involved either in agriculture related activities, cattle rearing or work as labourers in the various stone quarries. Characteristically, the villagers have a large number of cattle. The cattle population actually exceeds the human population in many of these villages. Stall-feeding is virtually non-existent. A large number of the cattle graze in the park, especially in the area north of the NH 3, the new extension area and the area south of NH25. The central area between the two national highways is relatively free of grazing mainly due to active patrolling of the area. Here too attempts to take in cattle to graze are made. Elimination of the grazing pressure from the park for the recovery of the park habitat is essential.

Many of these villages also try to extract firewood from these forests. This problem is especially acute in the extreme north and south of the original area. The removals are in the form of headloads. However extraction by bicycle and bullock cart

loads are also known. This is especially so as in many of the areas the National Park area is the only bit of forest for miles around.

Sahariya tribals populate many of the villages in the zone of influence. These tribals mainly earn their livelihood by working as labourers in the stone quarries or as other forms of labour. The other large group are the gujars who are herdsmen involved in animal husbandry and agriculture. In some villages Sikhs from the Punjab form a substantial population. They are mainly farmers, practicing intensive agriculture.

Many of the villagers try and collect non-timber forest produce from these forests. The main products collected are Mahua, amla, other medicinal plants and roots /tubers, Gums etc. Most of these collections are seasonal. In addition to the loss caused due to the removal of forest products, the method of extraction also causes damage. For example, the collection of mahua flowers often involves the burning of the forest floor immediately below the trees to facilitate the collection of the white mahua calyx. This more often than not results in forest fires. Similarly, collection of certain medicinal plants often involve lopping.

5.2 Implications of the existing land use and resource dependency for conservation of the Park:

The Madhav National Park is a small park even by Indian standards. Therefore the illicit removal of forest products, grazing, fires etc. exerts a great negative influence on the park poses a grave threat to the ecological health of the park especially as the park is located in the semi – arid zone. Certain biotic influences in fact threaten the very survival of the park as a productive and balanced natural ecosystem.

5.3 Park management practices and their implications for the people:

The very fact that forest produce removals are forbidden in a National Park imposes a severe restriction on the villagers within and in the immediate vicinity of the park. This is especially so because in many areas there are no forests in the zone of influence except within the National park.

CHAPTER - VI

BIODIVERSITY IN MADHAV NATIONAL PARK

6.1 Population dynamics and profile change in larger mammals in Madhav National Park.

Upto the end of the seventh decade of the century, this national park (earlier known as Shivpuri N.P) was regarded as one of the finest places to see the wildlife. Gee (1964) has written how Marsal Tito of Yugoslavia visited this park, and refusing the offer to shoot wild tigers, photographed them instead. Schaller (1967) found that it was the second best place to study predator prey relationship. first being Kanha where he made his study. Naik (1978-82) was in charge of the national park and maintained detailed dairies which contain his meticulously noted observations. His notes provide glimpses of wildlife, now lost. After this period, wild animals began to disappear due to cutting of forests; poaching, expansion of Shivpuri town, encroachment on the fringes of the national park, increasing number of vehicles plying on the two national highway running through it, and above all the biotic pressure of 122 surrounding villages in the form of fire wood collection and cattle grazing.

Recently, under the new management plan, efforts have been made to restore the wildlife of the park by erecting chain link fencing and stone walls around the park and along the national highway to check poaching and cattle grazing. After a decade of decline, the number of wild animals have begun to increase during last three years. The observations on the population change during last 25 years were made to compare the past and present status of larger mammals in order to chalk out a more effective, management policy for the national park.

To study the mammals, the most popular method of "natural history observation" used by Schaller (1967) and Johnsingh (1983) was followed, The herbivores were divided into adult male, adult female, sub-adult and juvenile. The population data were mostly collected by direct observation but in case of nilgai and chinkara the indirect evidences in the form of confirmed defection were used. Data

published on the mammals of other national parks were studied for comparing the present status of mammals in Madhav National Park.

Naik (1978-82) noted that the sighting of 700 to 800 Chitals (*Axis axis*) in a single herd was not uncommon. Today, the total number of chital in the park is 1805. This is indicative of the improving conditions of the forest. Schaller (1967) found 60 chitals per sq mile (2.56 sq km) in Kanha. It was 5-6 animals per sq km in chital populated areas of Madhav N.P.. The population of chital is on the rise for last four years.

Vijay Singh (as quoted by Schaller (1967) . once counted 18 Sambar (*Cervus unicolor*) in a herd in National Park. The group size of samber is 4 to 5 animals according to Jerdon (1874) and Prater (1939); 3 to 4 according to Pocock (1939) ; 10 to 50 according to Forsyth (1889) and Fletcher (1911) . Brander (1923) never saw more than 8 hinds together, and the largest herd observed by Shockley (1928) consider of 2 stags and 8 hinds. In the study area, the sambar was found to live in dense forest on the slopes of the hills in the central and northen zone. The largest herd seen during present study consisted of 4 animals. In June 1991, the population of sambar in Madhav N.P. was estimated to be 60 at the maximum, since, then the number of sighting of sambar has incresed and the data collected in 1993 suggest that their population was around 130. In the latest census (2003) their number is 378.

Data on the past status of nilgai (*Boselaphus tragocamelus*) and chinkara (*Gazella gazella*) are not available. Preferred habitat of nilgai is undulating hills while the chinkara lives in forest and on scrubland, but they have one common habit of collective defection. The place where this is found is considered their meeting place and their sighting on such places is most probable. Nilgai were found in all regions of the park while the chinkara was sighted in central and southern parts only.

Schaller (1967) found that the population of nilgai in Madhav N.P. out of 276 *nilgai*, 62 were bulls,139 cows and 75 calves. This comes to a composition of 45 bulls and 54 claves per 100 cows. According to Prakash (1964),the herd size of nilgai varied from 5 to 9 animals. Prater (1948) stated that they were found in groups of 2 to 20. The population of nilgai seems to be stable over the last four years.

Chinkara was sighted only rarely in Madhav N.P., and therefore their population could not be estimated. On the basis of 9 to 16 sightings per years for last 10 years, their average groups size in the park was found to be 2 animals per herds. More than 3 chinkara were never sighted together. This may be compared with the average herd size of 3 animals noted by Prater (1948), 11.8 found in Jodhpur region by Sharma (1977) and 1.9 in Kalbagh (Pakistan) recorded by Schaller (1976). The rare sighting of chinkara in this national park can be compared with 345 chinkaras noted by Bedi (1977) and up to 100 seen in a single herd in park on 19/9/78 by Naik (1978-82).

Blackbuck (*Antilope cervicapra*) was common in Madhav N.P. in the mid-70's but in 1981, only 26 of them were counted. The population declined rapidly and only 5in 1982 and 4 in 1983 were seen. None of them was sighted in 1984 when two blackbucks were reintroduced but both of them died in next two years. Since then no blackbuck has been seen.

Chausingha (*Tretracerus quadricornis*) was sighted single only on three occasions.

Wild boar (*Sus scrofa*) is common animal generally seen in the central zone of the park. The animals seen in a sounder numbered from 7 to 20, but the large sounder comprising upto 70 animals has been found during the stud, no specific information is available about its past status in the area but their population seems to be stable over the last 10 years. Smaller sounders comprising of 4 to 8 animals are also sometime noted in the north zone. The density of wild boar in the central zone is 6.5 to 7.67 animals per sq km while in north zone, it was 0.65 to 1.18. Overall density in Madhav N.P. comes to 2.26 to 2.62 animals per sq km.

Langurs (*Presbytis entellus*) in the central zone of the park were studied more than 15 years ago by Kankane (1982). He found their 14 groups with an average group size of 21.2 animals. But only 8 groups in 1993 with an average groups size of 26.75 animals were recorded. The group size in Madhav N.P. was found to be higher than 18-25 noted by Jay (1965) and Prater (1948) in north india. The decline in the number of groups and higher concentration of animals per groups shows that some suitable habitats in the park have disappeared and therefore, the langurs are forced to live in larger at a few suitable places.

Many instances have been cited by Singh (1965) which prove that the tiger (*Panthera tigris*) shooting on roads day light was common upto the sixth decade of this century. Well known wildlife researchers used to visit this place to see the tigers, Gee (1964) regarded it one of the best places to observe tigers and Schaller (1967) visited this place before going to Kanha for this study. During the last three decades, the forests of the area have been so adversaly affected by the biotic pressure that the wild tiger has not been seen for long time. Sometime, the reports of a wild tiger having been seen or heard come to notice but they could not be confirmed except twice when pug marks were seen in Satanbara and south zone regions.

Leopard (*Panthera pardus*) with the ability to adapt to the changing condition is least affected by the changing habitat. They are not uncommon in Madhav N.P. They are generally seen in late evening and early morning and sometime during daytime basking after heavy rains. Two leopards were sighted in September 1991 and one of them was killed in a truck accident on N.H.No.25 on 30/9/91. Earlier two leopardesses with three cubs each were sighted near the old tiger safari in the central zone and the dam wall of Sakhya Sagar. The number of wild leopards is estimated to be 13.

Wild dog (*Cuon alpinus*) was never common in the region. One peck of 19 wild dogs was sighted in 1989, and in another sighting, 14 of them were counted in 1991.

Madhav N.P. is one of the most prospective place where the rapid recovery of wildlife can be expected. Two perennial water bodies situated in the park make it one of few places where in summer in the semi- arid zone. In summer, when grasslands wither and the land becomes fallow, the management provides grasses to build herbivores at selected sites. If the plan to build water saucers, provide salt licks, build the chain fencing, stone walls to check poaching and cattle grazing are fully implemented, the trend of increasing population will continue and the national park can achieve the status of its past glory.

6.2 Census

The census figure 2005 done in January, 2006 is still not available in this office because the data is being processed and finilized by WII, Dehradun. Census figures of

last 4 years from 2001 to 2004 of important carnivores and herbivores of Madhav National Park are given bellow :

Census Result

Øekad	iztkfr	o"kZ 2001	o"kZ 2002	o"kZ 2003	o"kZ 2004	o"kZ 2005
1	'ksj	1 lQkjh esa	1 lQkjh esa	1 lQkjh esa	1 lQkjh esa	Hkkjrh; oU; tho laLFkku nsgjknwu ds }kjk fu/kkZfjr izi=kksa esa x.kuk fnukad 16-1-06 ls 21-1-06 rd fd;k tkdj {ks=k lapkyd] dkUgk jk-m-e.Myk dks Hksth xbZ gSA
2	rsanqvk	13 ,oa 3 lQkjh esa	13 ,oa 2 lQkjh esa	13	11	
3	phry	1987-2091	1451	1805	3160	
4	lkaHkj	635-668	371	378	492	
5	HksM+dh	---	178	166	240	
6	fpadkjk	1787-1882	1511	1627	1974	
7	uhyxk;	3172-3379	1954	2010	2445	
8	taxyh lqvj	---	1210	1406	2409	
9	yaxwj	VF	3309	2862	4006	
10	canj	---	---	696	830	
11	d`".ke`x	---	---	22	32	
12	eos'kh	3636-3827	1384	266	294	
13	fl;kj	---	F	102	170	
14	ydM+c??kk	---	R	R	63	
15	isaxksfy;u	---	---	---	01	
16	[kjxks'k	---	VF	231	436	
17	lksudqRrk	---	R	R	11	
18	eksj	---	VF	246	387	
19	HksfM+;k	---	R	R	34	
20	ykseM+h	---	O	O	27	
21	Hkkyw	R	R	24	36	
22	taxyh fcYyh	---	O	O	20	
23	lsgh	---	---	VF	13	
24	usoyk	---	---	VF	---	
25	dcjfoTtw	---	---	VF	05	
26	exj	---	---	---	37	
27	pkSflaxk	198-209	---	---	---	

VF- Very Frequent, F- Frequent, R- Rare, O- Occasional

Analysis of census figures of different species shows good sign. Important herbivores like Cheetal, Sambhar, Chinkara, Bhedki, Nilgai, etc. are showing increase in their numbers. This is the result of intensive protection and habitat development measures. In the years 2002, 2003, 2004 Chowsingha population is nil. This is not true, as there may be some kind of fault in recognising and counting them. At present, be can see numbers of Chowsingha in Majhera circle of South range and also in other areas of Madhav National Park.

Similarly, important carnivores like Wild dog, Wolf, Jackal and Hyena have shown sharp increase in their numbers. But, the number of top carnivore in the area Leopard is almost stagnant. The number of Marsh Crocodiles is also showing significant increase. The other smaller fauna Jungle Cat, Civet, Otter, etc. are in increasing order.

Census figure shows top carnivore Tiger absent in the Park. Severe biotic interference, absence of corridor and lack of connectivity from other adjoining forest areas, fragmented condition due to highways are reasons of Tiger not seen in this Park.

The analysis of census figures shows positive trend except for Tiger. By further interventions, like protection measures, habitat improvement works, reduction in biotic interference, corridor area villages relocation, etc. can bring Tiger inside the Park. If these interventions area applied with all seriousness, someday Tiger may show its presence in the area of Madhav National Park.

6.3 Some behavioral observation on nilgai (Boselaphus Tragocamelus) in Madhav National Park.

Nilgai *(Boselaphus tragocamelus)* is the larges of four antelope species found in india. Other are Chinkara *(Gazella gazella)*, Blackbuck *(Antilope cervicapra)* and Four-horned Antilope *(Tetracerus quadricornis).* At most of the place nilgai enjoys complate immunity as the people consider it a cousine of cow which is religiously sacred. Despite this fact, the population of this animal deteriorating is decreasing considerably due to the habitats.

Nilgai avoid dense forest cover. Their usual haunts are hills sparsely dotted with trees or level or undulating plains covered with grass and patches of scrub (Prater 1980). Preference for this habits is indicative by the fact that nilgai is more numerous in Madhav National Park. Sporadic incidences of crop damage by nilgai have come to notice. During present study most of the sightings were recorded on hill tops and slopes followed by plains. This can be compared with a study in western Rajasthan where Rana (1910) found maximum number in crop fields.

6.3.1 Size weight and health.

Sale at al(1988) carefully selected 14 full grown nilgai for immobilization and traslocation. Mean measurements of 9 immobilized bulls are body length with tail 248.6 cm; tail 51.6 cm; shoulder height173.8 cm; chest girth 157 cm; horn size 20.4 cm while those of 5 cows are body length with tail-47.8 cm; shoulder height - 11.6 cm; chest girth 126 cm. Earlier measurement of specimens from Madhya Pradesh as noted by Brander (1923) and Schaller (1967) are more or less same.

In Madhav National Park the nilgai were found to be healthier and more stout than those found in Gujrat and Rajasthan, specially in Sariska National Park where Rodgars (1986) recorded a large number of nilgai being infected by ear-sore, and where adult female nilgai visible ribs and pelvic girdles. Ranjitsingh (1987) noticed unusual coloration in nilgai in the same national park.

6.3.2 Herdsize and breeding

Herdsize of nilgai is usually 4 to 10. sometime as many as 20 or more according to Prater (1980). Schaller (1967) saw 50 nilgai forming a loose herd. During the present study herd size was 4 to 23 in non-breeding herds while the breeding herds consisted of 1 bull, 6 to 8 cows and 2 juveniles. Seven cows and 6 yearlings were sighted in a non-male herd. old bulls usually isolated themselves from other members. Five such bulls of darkest colour were seen living peacefully in a territory of about 2.5 sq km in Madhav National Park.

No specific breeding season was noted anywhere, and juvenlies were seen throughout the year.

6.3.3 Food and daily movements

Food of a free ranging tame nilgai as recorded by Sanksr and Vijayan (1992) included 13 trees, 5 creepers, 16 herbs and 9 grasses. During the persent study no sample of food item of this animals was collected but a few of them were identified on the spot. *Zizyphus jujuba* and *Z. nummularia* were two of the main food plant species. Nilgai was also found to feed on sprouting leaves of *Acacia nilotica*. These leaves

contain Acacia pods and the mongoose comes to feed them in the pellets of nilgai as reportes by Sharma (1988).

Dring the study on large mammals of Madhav National Park, daily movements of nilgai were recorded. The animals is common in the central part of the park, it is occasionally seen in southern range and a heap of collective defecation indicates its presence in north range as well.

The collective defecation was noted at three places in the central part. all on the table -land on top of the hills. The animals usually feed till about 9 am. with the sun rising high, they gradually move from peripheral area of lakes to the hilly region. Female and sub-adults continue to feed for some more time after adults males settle to rest in the shade. This may be because the dark coat of full grown male absorbs more heat and consequently need early shade.

In summer additional food is provided by the park management to nilgai alone with other herbivores. In June 2003 & 2004, nilgai already assembled at a place where such food was to be provided. Here, the otherwise aggressive nilgai behaved like a domesticated animal.

Information on distribution, habitat preference. food habits, herdsize and its formation in breeding and non-breeding seasons, and morphological features of nilgai is available. But there is almost no information on selection of cows by bull in breeding season, the mate-choice and actual mating sequence and parental care in nilgai. These aspects should be the focal points for further research.

6.4 Ecological adaptation of chital *(Axis axis)* and samber (Cervus unicolor) in Madhav National Park.

Chital (*Axis axis*) and samber (*Cervus unicolor)* are widely distributed deer species in india. With the eastern distribution range lyin in Assam along Bhutan border and western range extending upto Gir forest in Gujarat, the chital is found along the foothills of the Himalayas in the north and in Kerala in the south (Prater 1948, Gee 1964, Sankhala 1964). It prefers moist deciduous and dry deciduous forests, and has occupied the evergreen and thorn forest only peripherally (Schaller 1967). Sambar is

also found throughout the peninsular india and upto the Himalayas n the north. But there is a marked difference in the preferred habtal of sambar from that of the chital. Sambar lives in the thorn forest of Gujarat and Rajasthan, in the dry and moist deciduous forest in peninsular India and in the pine and oak forest of Himalayas (Jerdon 1874, Baldin 1877, Lydekkar 1898). It is a typical forest deer which likes hilly tracts where there are extensive belts of tall grasses (Krishnan 1972).

Almost identical range of distribution has made if possible for both the species to live in different habitats in the same forest. Both are herbivores, and growth of antlers, their hardening before rut and shedding after the breeding season take place in both the species. Similarly their fawns require tender leaves in the beginning and increasing quantity of vegetation as they grow. Despite their similar requirements, the breeding seasons of chital and sambar are different. This aspect of their lives was studied on the basis of their ecological adaptation.

The forest of the area are northern mixed dry deciduous type and mainly consist of *Anogeissus pendula, A. latifolia, Bosewellia serrata, Acacia catechu, Vitex nigunda* and *Argemone mexicana*.

Chital, sambar, nilgai, chinkara, chausinga, langur and wild boar are main harbivorous mammals of the national park.

The data on the population, density, herd size, composition, movement, food and breeding were collected. Their ecological adaptability was studied.

6.4.1 Ecological adaptability of Chital

Fletcher (1911) found that the chital rut from October to April on south India, Braner (1923) and Prater(1948) stated that rutting takes palce in summer in Madhya Pradesh. The breeding and birth of fawns depends on the food availability. In tropics and equatorial regions where the seasons vary so little that young may be born at any time of the year and have an almost equal chance of survival (Sadleir 1969). But the food availability in Madhav National Park has seasonality and the breeding activities take place in fixed optimal seasons.

In this National Park the main breeding period of chital is form March to June. At this time the stage sported dry and full grown antlers. Adults (sporting antlers of 75 cm length) fought with one another and the winner selected does for courting. The defeated males chose from remaining females. Males ascertained the receptibility of the females by licking and sniffing the valva. The peak mating seasons in chital was in the months of April and May.

Gestation period of chital is stated to be 6 months according to Hodgson (1847), Prater (1934) and Shull (1962); about 7 months by Asdell (1946); 8 months by Sclater (1863) and Stebbing (1911), and 6 to 8 months according to Sharatchandra and Gadgil (1975). Considering the gestation period of about 8 months the fawns conceived in April-May are born in December-January.

The breeding is related to the growth of antlers. They are shed in July-August and again begin to grow in October. For rapid growth of the antlers good quality of food in sufficient quantity is required. It has also been suggested that with the growth of antlers an enormous amount of energy is spent which must be supplied by extra food (Hawkins 1986). Their growth coincides with the calcium content of vegetation help the stage grow their antlers the same is supposed to be used by the females for the development of ovaries. A continued supply of tender grass also enchances the development of embryo conceived earlier (Johnsingh 1983).

In the beginning the antlers are covered in velvet which is a thick covering on the antlers and contains blood vessels. Therefore, in order to protect them from any damages, chital has to avoid thick forests; this they did easily as the grasses were plentiful in open areas and they did not need to go inside the thick forests till antlers dried up. Chital were seen removing the dried velvets by rubbing them on the trees in February and March.

Chital fawns nibble grass when they are a week old and begin eating it in quantity by 5 weeks (Graf and Nichilas 1966). The chital fawns born in December-January in Madhav National Park had tender grasses in the beginning and as the dry season stated at the end of March,fawns are old enough to eat a variety of vegetations.

6.4.2 Ecological adaptability of Sambar

Available literature suggests that breeding in sambar take splace from October to December in peninsular India. Blanford (1888-91), Lydekkar (1898), Forsyth (1889), Russel (1990), Comber (1904), Stockley (1928), Prater (1934), and Schaller (1967) limited it to November- December. In Madhav National Park the breding season was found to be the same. Sambar does with fawns of 5-6 months old were sighted. The gestation period in sambar is about 8 months (Sclater 1863; Fin 1929; Asdell1946). This indicates that majority of fawns were born in July-August. In beginning samber fawns also had good quality grasses in sufficient quantity. When they become 3 to 4 months old in March and April, the grassland withered and land became fallow. The ability of sambar to consume a variety of food, specially as a browser helped in this condition.

In Madhav National Park, sambar preferred thick forests of the slopes of the hill. But during the period when its antlers are in velvet it had to avoid them. Like chital it was easy for sambar to avoid thick forests as the vegetation in and after monsoon was available in open places.

6.4.3 Adaptability of chital and Sambar with each other

Sambar is definitely more nocturnal than chital. The different times of their most of the activities helps avoid their competition for space. Sambar's prefered habitat is thick forests in Madhav National Park while chital lives in open grasslands. The requirement of good quality food is sufficient quantity for the development of antlers, ovaries or the embryos in sambar is from March to August, in chital it is from August to December. In this way both the herbivores have different ecological needs while living in the same area. Without competing with each other and avoiding over explotation of available natural resources of Madhav National Park by adapting to different seasons, they survive together.

6.5 Four-horned antelope (*Tetracerus quadricornis*) in Madhav National Park

Four-horned antelopes have been recorded in Madhav National Park. General description of the Four-horned Antelope *(Tetracerus quadricornis)* is given by

Prater (1980). Brewick (1974) studied its herdsize, composition , reproduction and habits and food preferences.

Rice (1991) listed 24 sites with presence of four-horned Antelope in undivided Madhya Pradesh. Madhav National Park is one of them.

To update the status of the Four- horned Antelope in Madhya Pradesh, the sites mentioned by Rice (1991) the following additional sites in Madhya Pradesh should be added to his list.

	Site	Source
1.	Madhav National Park	Recorded Observation
2.	Ghatigaon Sanctuary	Recorded Observation (1989-1993)
3.	Sanjay National Park	Forest Department (General Census -1993)
4.	Bandhavgarh National Park	Forest Department (General Census -1993)

6.6 Chinkara *(Gagella gazella)* in Madhav National Park.

Chinkara (*Gagella gazella*) is one of the four antelope species found in india Other are nilgai *(Bosclephus tragocamelus)*. Blackbuck *(Antilope cervicapra)* and four-horned antilope *(Tetracerus quadricornis)* Chinkara is not endangered species, and is frequently sighted throughout, its range of distribution. Despite this fact not many serious studies has been conducted on this animal. This ungulate has been casually referred in some multi species researchers. These includes the works of Brander (1923) Strockley (1936), Gee (1964) Krishnan (1972). Prater (1980) and sexena et al (1994). Some specific information on chinkara provided by schaller (1976) Prakash (1977) and Rahmani (1988).

Observation on chinkara were made during visits to National Park. Whenever they were sighted anywhere, their number, herd-size male female ratio habitat and general behavior were recorded.

Beside direct sighting, indirect evidences in the form of heaps of collective defecation and remains of dead Chinkara were also relied on. Observations were made through 7X50 binoculars. Pertinent information from available literature was culled and cited.

6.6.1 Distribution and habitat

Chinkara is found in the plains and low hills of north western and central india extending through the open lands of the Deccan to a little south of Krishna river (Prater 1980). Outside India, it lives in Pakistan, Afghanistan, Iran, the whole of the middle east and in certain North African countries like Morocco, Algeria and Tunisia. In Africa it is called the Mountain Gazella and in Arabia *Idmi* (Rahmani, 1988). In Madhya Pradesh, it is found in most of protected areas.

According to Prater (1980), Wastelands broken up by nallahs and ravines, scattered bushand thin jungle are the usual haunts of chinkara, They live in the desert Zone and ascend levels of about 1200 meters. But during the study, it was noted to be thriving in dry deciduous mixed type forests of Madhav N.P.. Three pairs, two singletons and a groups of four chinkaras were seen in dry yellow grasses amidst *Acacia* jungle on the sloppy terrain in Madhav N.P. within 24 hours in the first weeks of april 1997. Earlier, maximum 3 individuals in a herd were recorded.

6.6.2 Food and daily movement

The grass, various leaves, crops and fruits such as pumpkins and melons constitute the diet of chinkara. In Rajasthan, It is able to digest the poisonous leaves of *Calotropis gigantea* and *C.procera*, fresh juice from which is said to be capable of killing a large dog within 15 minutes (Rahmani,1988). in Madhya Pradesh, it was noted to browse on *Zizypus* and *Capparis* species and nibble at tender grasses near water. In Karera Sanctuary, it is known to raid crops with blackbuck at night.

This ungulate can go without water for long periods and do without it completely in desert country is no water. Almost all the protected areas in Madhya Pradesh have their water resources, and chinkara is actually seen drinking water at

midday. The animal is definitely more active in the morning and evening, but their sighting during hot hours of days is not rare.

Chinkara lies up in grass or under the bush but the places where it deposits its feaces were always found to be open stony area, fire line and muram roads.

6.6.3 Breeding and population dynamics

Very little research has been done on population dynamics and breeding of chinkara. April and October are two birth peaks. During the study newly born fawns were sighted in October-November. With a gestation period of 51/2 months, it is estimated that the mating takes place in April-May, although it is rare to come across actual mating phase.

It was mostly slighted in pairs or as singletons and in groups of three-a fawn with parents. Wherever a larger herd was seen, it was found later that two or more herds had mixed together.

Saxena et al (1994), on the basis of data collected upto 1993, had suggested that the population of samber was on the rise while chinkara was rarely sighted in Madhav N.P. In 1997, larger population of chinkara was noticed here but the sambar was not seen in the central zone of the national park. An inference may be made that sambar's suitable habitat of thick forest is giving way to the chinkara's prefered habitat of thin forest.

6.7 Reptiles of Madhav National Park

No specific efforts has been made to study the reptiles of Madhav National Park. Whenever sighted, they were noted down. In the National Parks the reptiles or any other wildlife cannot be collected. Therefore, they could not be preserved. They were identified with the help of local experts and later checked with the help of books, on reptiles.

6.7.1 Crocodiles

Mugger or Marsh Crocodile-*Crocodylus palustris*.

They are sighted in Sakhya Sagar which was built in 1918 and an unspecified number of mugger was released into this lake. On 10.1.88, eight muggers were seen basking at different places within two hours. On 15.6.91 a nest containing 31 eggs was found. Some eggs had already been eaten by crows. This nest was unusual because of its location. It was in a hole which was dug for tree plantation. This may be due to the fact that other areas in the periphery of Sakhya Sagar remain disturbed because of the fish poaching in the night. Out of 31 eggs, 15 successfully hatched and hatchlings were released into Sakhya Sagar.

6.7.2 Turtles

Flap Shell Turtle- *Lissemys punctata*.

Only one specimen was seen on 21.10.90, about 300 m. away from Sakhya Sagar on a *kuchcha* road in the national park. There had been heavy rains in previous four days. It could not be ascertained whether the turtle was washed away in the rains or it was making an overland journey.

6.7.3 Lizards

1. Northern House Gecko- *Hemidactylus flaviviridis.* .

Seen only in the occupied and deserted buildings inside the national park.

2. Common Garden Lizard- *Calotes versicolor*.

Common in lower branches of trees in mixed forest between Sakhya Sagar and Madhav Lake. This area is wet throughout the year because of the leakage, and sometime deliberately making water flow from Sakhya Sagar to Madhav Lake. This portion of forest gives an impression of wet green forest rather than dry deciduous one.

3. Common Skink- *Mabuya carinata*.

4. Snake skink- *Riopa punctata*.

Only four sightings were recorded, all of which were after rains near rock crevices along roads inside the park.

5. Common Indian Monitor- *Varanus bengalensis*.

Commonly seen in the rocks where there was loamy soil around. It may be mentioned here that from the Shivpuri district towards Morena district along Chambal river, its density increases. Along Chambal river where the soil is loamy and sandy loam and termite mounds are numerous they are very common. Some of them are even found crushed on the highway. Local 'Nad' tribe kills them for various uses.

6.7.4 Snakes

1. Python- *Python molurus*.

Not common. After rainy season when the grasses are upto four feet high they were seen on the road in the night. In daytime their drag marks were seen on sandy road. It seems that they prefer to go on road in place of wading through the high and dense grass to move from place to place.

2. Dhaman - *Ptyas mucosus*.
3. Common Kukri Snake- *Oligodon arnensis*.
4. Checkered Keelback - *Xenochrophis piscator*.
5. Schneider's Smooth Water Snake- *Enhydris enhydris*.

This snake is frequently seen near the Sailing Boat Club Building which overlooks Sakhya Sagar. Once this " slender" snake was seen moving on the narrow wall of the building at about 14 hours.

6. Common Indian Krait- *Bungarus caeruleus*.
7. Indian Cobra- *Naja naja*.

Only two sighting in the wet sandy area in the periphery of Sakhya Sagar.

8. Russel's Viper- *Vipera russelli*.

6.8 Observation on the status of mugger *(Crocodylus palustris)* of Madhav National Park

Madhav National Park was the hunting reserve of the erstwhile Maharaja of Gwalior. The Maharaja constructed dams across river Manihar in 1918 and as a result there is now a chain of three lakes; Jadav Sagar, Sakhya Sagar and Madhav Lake. The last two measuring 300 and 49 hactares respectively are situated in the central zone of the present national park. Both the water bodies are perennial and the water from Sakhya Sagar is released into Madhav Lake to provide water to Shivpuri town throughout the year. Sakhya Sagar has rocky, muddy and slopey banks with good marshes at different points while the Madhav Lake has steep, rocky banks surrounded by tree groves.

No specific attempts were made to study the muggers. Whenever sighted their number, location and activities were noted. The following observations are collected from the field diaries and official records.

6.8.1 Population

In 1918, an unspecified number of muggers were released into Sakhya Sagar (Saxena 1991). In January 1988, eight muggers basking at different places on the bank of Sakhya Sagar were sighted within two hours. their present estimated population is 35 in Sakhya Sagar and 3 in Madhav Lake.

6.8.2 Breeding

The constant population over the years suggests that the mugger breeds successfully in this national park. Successful hatching has been observed once and broken eggs found were on the banks on two occasions.

In June 1991, and unusual nesting site was located. The mugger had laid eggs in one of the pits dug for road- side tree plantation. The reason for selection this site can be attributed to the disturbance caused by illegal fishing on other peripheral areas of Sakhya Sagar at night. All the 15 hatchlings of this clutch were released into the reservoir on 5.7.91.

Broken mugger eggs were found on the south western bank of Sakhya Sagar in April 1994. On the same day, one mugger was seen stranded in a tunnel which carries water from Sakhya Sagar to Madhav Lake. The mugger was stranded between the closed tunnel beneath the dam wall and the chain fending along the dam wall. The chain fencing is that of the old tiger safari which was built in 1989. Finding no other place, the mugger had laid her eggs in open where there was little soil to cover them. Subsequently all the eggs were destroyed or eaten by the crows.

6.8.3 Movement

The water tunnel leading from Sakhya Sagar to Madhav Lake is open at few places, and it passes through the old tiger safari area. The muggers were found to use this tunnel to move from one waterbody to another. This phenomenon was evident from their sightings in intermittent pools made by the spilled water from the open places of the tunnel. Till 1993 to dam wall was the western fence of the old tiger safari and the movement of mugger was not affected. Later a chain fencing was also erected along the dam wall, which permitted only water and not the mugger. Now the mugger of Sakhya Sagar cannot go to Madhav Lake and vice versa.

6.8.4 Conservation

There are two major problems in the conservation of mugger in Madhav National Park. First is the increasing illegal fishing activities which coincides with the breeding season of mugger. Control on illegal fishing can lead to successful breeding and better eggs survival. Consequently the number of mugger can be expected to increase.

The second problem is water pollution. The nullah carrying all waste of Shivpuri town drains into Sakhya Sagar, leading to slow eutrophication. Although stop dams are there, they are not so effective in preventing the waste materials from entering the water of Sakhya Sagar.

If these problems are properly addressed, the national park can become a major place to study the muggers.

6.9 Unusual nesting site of Mugger *(Crocodylus palustris)* in Madhav National Park

Sakhya Sagar Lake is situated in the central zone of Madhav National Park. From the main gate of the central zone, a road runs on the elevated land along the southern bank of Sakhya Sagar, for about 200 m up to the Sailing Club House inside the national park.

In January and February 1991, many holes were dug for tree plantation along this road. The diameter and the depth of each hole were 60 cm. On 15 June 1991, the forest staff saw a crow feeding on some eggs on the road. On investigation, 31 eggs of the mugger *Crocodylus palustris* were found in one hole which was dug for plantation. Broken pieces of a few eggs were scattered nearby and the hole was partially covered by soil. This hole was situated at a distance of 15 m and at an elevation of 4 m from the waters of Sakhya Sagar. Earlier an adult mugger had been seen on the road many times. This was an unusual nesting site not only because of egg laying in a hole meant for tree plantation but also because of the high level of disturbance, with a large number of vehicles and men moving along the road from dawn to dusk.

Seven hatchlings came out of the eggs on 17 June 1991 and they were released into Sakhya Sagar on 24 June 1991, Eight more eggs hatched on 29 June and hatchlings were released on 5 July. On hatchling among those released was found on the bank on 13 July 1991. It was again released onto the water on the same day.

This is also the first time that successful breeding of mugger has been recorded in Madhav National Park.

6.10 Interaction between Mugger (*Crocodylus palustris*) and Wild Boar (*Sus scrofa*)

Mugger (*Crocodylus palustris*) in one of 15 reptiles recorded so far in Madhav National Park. Present note describes the interaction between mugger and wild boars (*Sus scrofa*) who forage in the bed-reeds of Sakhya Sagar Lake which is situated in the central part of the national park.

Around Sakhya Sagar to conduct midwinter waterfowl census. On the point known as Landing Station No.7 on an elevated narrow land strip jutting into the lake. This place has muddy marshy shoreline. It was spotted that Two muggers, one was basking and the other was lying submerged near the bank. There was a sounder of wild boars in the bed-reeds behind these reptiles.

The muggers and the wild boars were showing neutral interaction- neither of them evincing any interest in the other's activities. Soon the mugger which was so far lying submerged tried to come on the bank, and finding the spot too steep climb, swam a few metres and began to emerge on the edge of the water. Wild boars who were digging and foraging peacefully became alert. Some of them ran into the thicket of vegetation. All of them maintained a safe distance.

Three boars - two full grown adult and one young- became inquisitive and moved towards the emerging mugger which was a large one, and seeing its face, both the adult boars scampered away. The young continued to stand at a distance of about 20 metres from the mugger. It put one leg forward and postured threateningly towards the mugger. The mugger had now emerged more than half its body. The young boar grunted four times and ran away.

6.11 Butterflies of Madhav National Park

Fourteen butterfly species have been sighted in Madhav National Park. No specific efforts has been made to record the butterflies in the National Park but whenever sighted, they have been noted down and identified on the spot or later on the basis of photographs taken. They are identified following the photographs and

descriptions provided by Wynther-Blyth (1957) and Gay *et al.,* (1992). Scientific names as given by Gay et al., (1992) are used. Common English names for the following species are same as used by Varshney (1983) and Gay *et al.,* (1992). except for *Danaus genutia* for which former used the name common Tiger while the latter named it Striped Tiger.

1.	Papilio demoleus	Lime Butterfly
2.	*Papilio polytes*	Common Mormon
3.	*Cepora nerissa*	Common Gull
4.	*Ixias marianne*	White Orange Tip
5.	*Ixias pyrene*	Yellow Orange Tip
6.	*Parenonia veleria*	Common Wanderer
7.	*Eurema hecabe*	Common Grass Yellow
8.	*Euchrysops cnejus*	Gram Blue
9.	*Danaus chrysippus*	Plain Tiger
10.	*Danaus genutia*	Striped Tiger
11.	*Tirumala limniace*	Blue Tiger
12.	*Junonia orithya*	Blue Pansy
13.	*Acraea terpsicore*	Tawny Coster
14.	*Udaspes folus*	Grass Demon

6.12 Snails of Madhav National Park

Snails form the largest group among molluscs and vary widely in structure and habits. They are mainly categorised as lung breathing land snails, freshwater snails and sea snails. A faunal study of snails was conducted during 1994 on the banks of Sakhya Sagar which is situated in the central zone of Park. The shoreline of the Lake is mostly muddy marshy gradually slopping down to shallow and then deep water. The Submerged vegetation includes *Hydrilla verticillata, Vallisneria spiralis, Chara* sp. and *Potamogeton* sp. Floating vegetation is dominated by *Nymphaea nuchalis* sp. and emergent vegetation by *Scirpus, Typha* and *Phragmites.*

The snails recorded are as follows.

1. *Indoplanosbis exustus* (Deshhyes 1834)
2. *Lymnaea acuminata* (Lamark 1822)
3. *L. luteola* (Lamark 1822)
4. *Gyraulus convexinsculus* (Hutton 1849)
5. *Bellamya bengalensis* (Lamark 1822)
6. *Shaira tuberculata crebra* (Lee 1850)
7. *Passeysia fevidens viridula* (Benson 1862)
8. *Lamellidens jenkinsianus* (Benson 1862)
9. *Corbicula peninsularis* (Prashad 1928)

6.13 Amphibian fauna of Madhav National Park

Mr. P.K. Chandra, officer-in-charge Amphibia Section, Zoological Survey of India (ZSI) Kolkata, identified 10 amphibia specimens available in the park during his faunistic survey on Amphibia in August 2003.

6.13.1 List of Amphibian specimens in Madhav National Park

Class : Amphibia
Order : Anura
Family : Bufonidae
Genus : *Bufo Laurenti*

1. *Bufo stomaticus* Lutken (Marbled Toad)
2. *Bufo melanostictus* schneider (Common Indian Toad)

Family : Microhylidae
Genus : *Microhyla* Tschudi

3. *Microhyla ornala* (Dumeril & Bibron) (Ornala Microhylid)

Genus : *Kaloula* Gray

4. *Kaloula pulchra* Gray (Painted frog)

Family : Ranidae
Genus : *Rana* Linnaeus

5. *Rana cyanophlyctis* Schneider (Skipping Frog)
6. *Rana tigerina* Daudiu (Indian Bull Frog)
7. *Rana crassa* Jerdon (Jerdon's Bull Frog)

8. *Rana keralenis* Dubois (Gunther's Warty Frog)

9. *Rana limnocharis* Boie (Cricket Frog)

Genus : *Tomopterna* Dumeril & Bibron

10. *Tomopterna breviceps* (Schneider) (Burrowing Frog)

6.14 The Cranes of Madhav National Park

India can boast of having 6 out of 15 species of crane found in the world. They are Sarus (*Grus antigone*), Blacknecked (*G. nigricollis*), Common or Eurasian (*G. grus*), Hooded (*G. monacha*), Siberian (*G. leucogeranus*), And Demoiselle Crane (*Anthropoides virgo*).

In Madhya Pradesh, the Sarus, Common & Demoiselle have been regularly reported from Chambal sanctuary (district Morena), Karera Sanctuary and Madhav National Park (both in district Shivpuri) . The Cranes have been seen in Dhar district also. The Present status of cranes in other parts of Madhya Pradesh remains obscure.

The largest congregation of these three not-yet-endangered species of crane in Madhya pradesh has been reported from Mahav National Park where they can be seen in large number in winter.

6.14.1 Lakes

Two lakes, namely sakhya sagar and Madhav Lake, are situated in the south-central part of the unextended Madhav National park, the area being 3 sq. kms. and 0.49 sq. kms. respectively. The water level of the lakes during rains rises by 8 feet.

The one-fourth of the boundary of Sakhya Sagar is concrete wall while the rest is natural boundary with muddy, marshy area gradually sloping down to shallow and then deep water. Cranes are found in the latter area. They are also seen at Madhav Lake.

6.14.2 The Cranes

Demoiselle and Eurasian Cranes arrive in Madhav National park in winter while the Sarus breeds here.

Table shows the year- wise census of cranes of the park. The census has been done in winters. In case of the year when major variation was found in the number of cranes counted by different persons, the maximum number has been taken for comparison.

Data for the years before 1983-84, are not available.

Sarus should also be counted during the breeding period. Their numbers shown in Table-1 have been taken from winter census only.

Table

The Census of Cranes in Madhav National park

Year	Demoiselle	Eurasian	Sarus
1983-84	600	125	21
1984-85	650	80	13
1985-86	400	50	17
1986-87	557	100	50
1987-88	7000	1000	50

Up to the winters of 1986-87, Only a few hundred Demoiselle and Eurasian Cranes arrived annually in Madhav National park. But in the winters of 1987-88, upto 7000 Demoiselle and 1000 Eurasian Cranes were counted. Even if a big error margin is left, it is certain that these cranes came in far greater number than previous years.

Their sudden increase appears due to scarcity of rains in adjoining status of Gujarat and Rajasthan in 1986 and 1987, and an early drying of the lakes in the north. Severe winter in the north in 1986-87 and 1987-88 might be a second cause. The winter of 1987-88 may be called "the winter of great variation".

The Sarus breeds in Madhav National park. Four juveniles with their parents were seen in January 1988. Here they build their nest in muddy and slightly grassy area near the shallow water of the lake. Cattle grazing is a major problem as they

come to this shallow area to drink water, thus disturb the cranes and destroy their breeding ground.

A large concentration of the Demoiselle Cranes was found near Kota (Rajasthan), and the Sarus has also colonised here. As the straight distance between Madhav National park and Kota is about 200 kms. there is scope to compare the number of cranes that arrive every year at both places to find out if any relationship exists between them. If it does, whether it is proportionate or inverse. This may be with the cranes of Karera Sanctuary also. From many places in the India the cranes are reported to cause a lot of destruction to crops, and hence the farmers are annoyed. These is no such problem with the cranes of Madhav National park because during their stay the cranes seem to remain within the park .If they cause any damage to the crops of surrounding villages, it should be negligible as no complaint has been filed so far.

It is necessary to know the present status of cranes in central and eastern Madhya Pradesh to ascertain whether all Demoiselle and Eurasian Cranes that arrive in Madhav National Park remain there or some of them further migrate towards other parts of the state.

6.15 Indian Pangolin (*Manis crassicaudata* Gray)

In Madhav National Park, at about 2 O'Clock on the night of 5/6 October 1984, observers heard a 'hiss' from inside a room which had been since long locked up and had an uncemented floor.

On opening the door, it was seen a long burrow in a corner and an Indian Pangolin (*Manis crassicaudata* Gray) standing nearby. Obviously, it had arrived by burrowing from outside into the house. As the compound fence of the house is not less than 12 feet away from the spot, it should have made a long burrow.

The Indian Pangolin is occasionally seen in the Madhav National Park. However, it is the first time that is came into a house! The Pangolin was greenish-brown in colour. It was captured and later released safely at suitable site.

6.16 Wild Cattle of Madhav National Park

Recorded observations in 1988 indicate that two herds of cattle were permanently living in the north range, and their behaviour towards humans was strangely aggressive.

In 1989, two herds comprising of 37 and 42 animals respectively, further description of census party was like this, "We were travelling in a jeep. Suddenly a few of them came out of the dense forests and tried to ram the jeep. As soon as the driver switched off the engine, they stopped and slowly moved away. On 5 December 1990, these cattle disappeared after seeing us from a distance of about 200 metres. But on 12 Jan. 1991, they tried to rush us as they abruptly came in front of us while we were on foot. This behaviour proved that they were now fully wild in nature. They could be further distinguished from the village cattle that come to some parts of the park for grazing by the facts that (a) they were always in the same herds b) no village cattle came to this area because of the fear of these wild cattle and (c) they did not have traditional leashes around their necks".

They further recorded, "On 25 June 1991, during the annual census of wild animals, we saw the same herds but they were accompanied by 4 and 6 calves respectively which showed that they had not lost their reproduction capacity as was claimed by some. In the subsequent three days it was observed that at night they came upto the periphery of adjoining agriculture farms but did not enter the villages, and before sunrise, they went back into the deep forests for the day".

PART – II

PROPOSED MANAGEMENT

CHAPTER - VII

7.1 Wild life management :-

For the stability of the ecological system, biodiversity conservation is a must. Food chain is an unique means of ecological balance amongst the various wild life species at various levels. Even a little imbalance in this may prove to be disastrous not only for the wild life but also for the human being. Therefore, wild life conservation and its management is of paramount importance.

7.2 Possible reasons of the decrease of number of wild life:-

1. Diversion of forest land into agricultural land adversely affected the natural habitat of various wild life species.
2. Easy accessibility of hunters due to construction of motarable roads.
3. Decrease in the number of field staff and lack of logistics resulted adversely in effectively curbing the wild life offences.
4. Heavy biotic pressure due to grazing leading to destruction of wild life habitat and therefore less food availability to herbivores. At times, cattle are carrier of contagious diseses for wild life.
5. Periodic fire incidence also destroy the habitat to great extent.

7.3 GOI has prepared after long deliberation and discussion a draft of national wild life action plan. Some of the salient points of this action plan are as under:-

1. Identification & establishment of PAs.
2. Management & rehabilitation of PAs with the active participation of local people, addressing their local needs.

3. Creating such conditions in the PAs as to maintain the genetic continuity of the flora & fauna.
4. Conservation of threatened and near extinct species.
5. Emphasis to be laid on the captive breeding of the threatened species.
6. Extension of wild life education with a view to creating awareness amongst the people.
7. Increasing the emphasis on research & monitoring to develop better under standing and data base regarding wild life habitat and their nature.
8. seeking the help and co-operation of NGOs in wild life conservation.

7.4 Objectives of wild life management :-

1. The prime objective of wild life management is the conservation of wild life and removal of all the adverse factors, hampering their proper growth with a view to increase their habitat & ensure adequate availability of food, water & shelter. Since the quality and quantity of wild life species are on the decrease therefore, all possible measures, scientific & legal should be fully applied. CWLW has prescribed a daily diary for the game guards which they fill in during their field visits everyday. This information can provide a valuable wealth of data base regarding the life cycle pattern of the wild life, their habit and nature, their preybase information, their gestation period etc. on the basis of these data, their profile study can be made and it will provide valuable information for their proper management decisions.

PLAN OBJECTIVES AND PROBLEMS

7.5 Objectives of management :-

This management plan will be operational for 10 years (2007-08 to 2016-17) with a provision of midterm review after 5 years.

1. To preserve for all times this area of biological and historical importance and scenic beauty as a national heritage for the benefit, education and enjoyment of the people.

2. To take all necessary measures that will increase the number and variety of wildlife in the area.

3. To maintain and strengthen protection measures against poaching and elements of habitat destruction like forest produce collection, fires, illicit felling, grazing, cattle diseases etc.

4. To take measures to improve the habitat of the park by augmenting the food and water availability.

5. To judiciously develop tourist facilities in a regulated and controlled manner so as to provide the visitors with a true wilderness experience without inconveniencing the wildlife.

6. To reduce the dependence of the surrounding populace on the resources of the park by providing appropriate eco-development inputs and in to involve them in strengthen conservation.

7. To relocate the existing 9 villages with the concurrence of the villagers and to develop the vacated areas for wildlife.

8. To take appropriate measures to facilitate works of action plan for re-introduction of tigers in Madhav National Park.

9. To promote eco-tourism, have to develop places of tourist attractions and plan activities for eco-tourism.

10. To promote research and development activities in order to facilitate scientific wildlife management in the area.

11. To set in place and maintain appropriate interpretation and conservation education facilities so as to educate the public, especially the local population about the importance of conservation in general and Madhav National Park in particular.

7.6 Problems in achieving the objectives :-

The various problems that stand in the way of achieving the above objectives are: -

A. Habitat destruction:

The destruction of the habitat of the park and within its ecological boundaries is the main problem to be overcome in order to achieve the objectives set out in the preceding section. Habitat destruction and degradation has been responsible for the rapid decline in the number of herbivores and carnivores over the last fifty years. The rapid erosion of the habitat just outside the original park area especially to the east was responsible for this in a large measure. Within the present park area the main factors contributing to the degradation of the habitat are :-

Grazing :-

Grazing by cattle from the villages enclaved and outside the National park is one of the chief agents of habitat destruction. Over 30,000 heads of cattle graze within the limits of the park. Most of these cattle come from villages inside the park and villages situated right on the boundary of the park. Other areas with heavy grazing pressure include parts of the North range and the extreme southern portion of the Majhera circle. The central portion between the two national highways is relatively free although regular intensive patrolling is necessary to keep the cattle out. Cattle from Shivpuri city, Kota, Thakurpura, Bardhkhedi, Karondi, Lakhangawan, etc. come in the central portion. There are also more than 300 feral cattle permanently residing in the central portion. The masonry wall and the dry stone rubble wall are already broken and missing at several places and they afford easy access in to the park. Regular intensive patrolling to prevent entry of cattle and to drive out the cattle that enter seems to be the only way out. In the extension area most of the cattle grazing are from the villages Gatwaya and others. Relocation of these villages should be carried out on a priority basis.

Fire :-

The park lies in the semi – arid zone and is hence extremely dry and fire prone. The park as a result has high incidences of fires breaking out in the fire season mainly due to deliberate acts of vandalism. The fires are generally started by graziers, collectors of forest produce, fishermen, visitors to the numerous places of worship etc. As the forest is almost completely deciduous, the leaf litter, grass, fallen trees and small bushes often get burned down completely leading to a shortage of forage and shelter. There are numerous ground dwelling birds in the area and the effects on them may be catastrophic. The fallen leaves of the kardhai *(Anogeissus pendula)* which constitutes an important food source for the deer, especially sambar during the dry season gets burnt.

Removal of forest produce:-

Illicit felling

Like grazing & fire, other menace to the park is the illicit felling of trees. This should be firmly checked by day-night patrolling, regular beat inspection and prosecution by court of law as under WLA 1972 (Amendent 2002), destruction of wild life habitat has been made non-bailable and imprisonment for 3 to 7 years many be possible. Ruthless curbing the menace of illicit felling can only help the enrichment of wild life habitat. Illicit felling which often reported, however, is of nistar type, mainly for fuelwood purposes by dwellers of nearby villages. Eco-development committees should also be activated and their help is also solicited to effectively protecting the habitat.

The removal of forest produce from the park contributes to the habitat degradation of the park. The removal of firewood, grass and other non-timber forest produce, which is carried out illegally, affects the habitat both by the physical removal as well as because of the method of removal which is often destructive. The removal of firewood often involves the lopping or cutting down of trees. The collection of Mahua and honey often leads to forest fires. The collection of several plants of medicinal value involves the lopping of trees or their uprooting. The park does not have the problem of illicit timber theft as the only timber species of value, teak is extremely restricted in distribution. Khair wood is sometimes stolen for the kattha industry.

B. Scarcity Of Water

The park lies in the semi – arid zone and is hence extremely dry. The rainfall is only about 800mm. The forests start to dry up in December and by March the water is restricted to a few pools and springs apart from the two lakes and the perennial Sindh river. The distribution of this water is also highly skewed with large parts of the North range, Central range and East range areas are without water sources. A few saucers and stop dams have been created but even these are too few and mostly in the central zone between the two National Highways. Many of the water sources require yearly maintenance, which has been irregular of late due to paucity of funds and other reasons.

Important Nallas, Tanks & spring where wild life enjoys water throughout the year are Sakhya Sagar, Madhav lake, Khori, Jal mandir, Mahuakheda ardan dam, Kalua kho, Aamdar in South range, Shiv kho, Matawari, Churanchhaj, Tunda Bharkha, Safeda khadan, Bansraiya, Jhirna, Jogia nala in North range, Mojpur talab, Matkuli khadan and many other khadans, Barahi nadi, Parasari springs, Gatwaya talab, Sindh river in East range & Berkudi khadan, Berkudi nala jhiriya, Berkudi spring, Chandmari Barrack jhiria, Belwali jhiria, Parasari mandir jhiria, Barahi nadi, Jhirna, Raipur talab, Amar nadi, Larha spring, Ballarpur talab and Ballarpur spring in Madhya range.

Some other water sources dries up from December to March are Chhamchhoniya, Umarjhala, Okhri jhirna, Lohra khar nala in South range, Kerrawali raiya, Nou kho and some old mines in North range, Ballarpur tank (South), Gatwaya spring, Gatwaya nala, Gatwaya Serana tank, Matkuli nala in East range.

Water supply in park

Water availability is less in the park area. Water deficient areas have been identified and special measures needs to be initiated to provide sufficient water supply in these areas. Due to change in climate and decrease rainfall as well as lowering down the water table. Many springs and Nallas dried up in December to June. So to provide water within 5 km. area there should be at least one perennial water source should be provided to wild life. A provision is made in the plan.

C. Emigration of animals

During the establishment of the park, the flat valley areas to the east, which constituted an important habitat for the animals, was left out. As a result of this discrepancy between the legal and ecological boundaries of the park, many animals, especially herbivores migrate out of the park in to this area as it has perennial water sources . This area is also intensely cultivated and this constitutes another attraction to the herbivores. Instances of animals being poached in this area have been recorded.

D. Poaching

The park is an extremely sensitive to poaching. The shape of the original park area, the easy access on account of two National Highways passing through it, the proximity to the district town of Shivpuri are all contributory factors. The areas especially prone are the Chandmari and gate no.11 areas of the south range, Patpara area of the North range, the Patkhera area and along the Sindh river in the extension area. The methods employed are varied and include shooting with guns, trapping with nets, use of live electric wires and the use of village dogs. The last two are especially employed by the villagers of Kota, Hatod etc located in the east south of the notified corridor.

E. Fishing

Fishing is prevalent in the Sakhya Sagar lake and the main culprits are the fishermen of Shivpuri and Kota village. Regular patrolling of the reservoir to confiscate the nets and the apprehending of the culprits are carried out and these will have to be continued. **Year wise cases of fishing are given below :**

Year	No. of cases	Trial in court	Accused persons
2002-03	**59**	**04**	**11**
2003-04	**61**	**15**	**32**
2004-05	**36**	**08**	**12**
2005-06	**28**	**10**	**12**
2006-07	**15**	**06**	**08**

F. Stray Dogs

As the several villages and Shivpuri town exists at the boundary of park. Stray dogs are nuisance to herbivore. This problem should be tackled with the help district administration, municipality and arms.

G. Resettlement and Land acquisition

The original park area is a finally notified park and has no rights or villages within it. However the extension area has several rights within it. Village Ballarpur has already been relocated near village Boorhi barod in comptt. no. P.306 of Shivpuri range in the year 2000. Gatwaya village will have to be relocated outside the park at a place of the villager's choice. A relocation plan of village Gatwaya has been submitted. The villagers identified forest land near Village Jagti in Shivpuri range and other near village Chandawani of Karera range. Land acquisition and payment of compensation in rest of the 8 villages are to be done. The corridor area connecting old park and extention area has 5 villages namely Mamoni, Arjungawan, Lakhangawan, Harnagar & Donger within it. The acquisition of land especially in the corridor area would involve a great deal of money and negotiation with the land owners. This would undoubtedly be a challenge that must be taken up and accomplished. Other 3 villages to be compensated for their land and properties are Parasari, Mojpur & Larha. Thus, relocation and acquisition of land work is to be completed in 9 villages. At today's prices the money required for land acquisition would be to the tune of rupees 31,43,90,437/- for 9 villages. Other 5 villages coming under submergence Madikheda dam reservoir have been relocated outside the Park by Irrigation Department.

Right settlement

Collector, Shivpuri has initiated the steps to settle the right and finally notify the area added to the park as extension area.

Relocation plan

Relocation of Ballarpur village has been completed and resettlement for New Ballarpur village is being done. Relocation plan for Gatwaya village has been

submitted to the Govt. Other 8 villages are not to be relocated from the park as there are no inhabitant. Only compensation for the private land & properties as assessed by the Collector, Shivpuri has to be disbursed among the owners. Collector, Shivpuri has completed the work in this regard.

I. Other sources of disturbance

In addition to the above the following sources of disturbances poses varying degrees of threat to the Madhav National Park.

i. Highways:

Two National Highways cut across the National Park. NH -3 and NH – 25. Of the two the NH –25 has the potential to cause more disturbance to the wildlife as it cuts through the riparian zone along the Madhav lake. Plans are already afoot to divert this highway around the periphery of the National Park. Speed breakers exist in some portion of this road more speed breakers at regular intervals need to be constructed and maintained. The NH-25 (Shivpuri-Jhansi road) has been diverted around the periphery of the National Park. This highway is being upgraded into a 4-lane express highway (NH-76). Under passes have been proposed for safe movement of wild animals in the areas where forest cover exists on both sides of the highway.

ii.Temples:

There are about thirteen small and large temples located within the national park. Some of these are attended by one or more priests while others are visited by local villagers only during festivals. These temples often cause a great deal of disturbance by the use of loud speakers, are brightly lit up at night, collection of fuelwood, camping of pilgrims and are a serious fire hazard. Strict control needs to be exercised so that new temples do not come up and the disturbance caused is minimised.

iii. Dhabas:

Several dhabas are present along the two national highways just outside the national park area. Their legal status needs to be ascertained and if possible, they must be closed down as they are centers of consumption of the illegal fuelwood removals and also provide a good hideout and are a consumer for the poacher’s wares.

iv. Sewage:

Shivpuri's drainage system is planned in such a way that most of the sewage from the town flows in to the Jadhav Sagar tank which acts as a settling tank and the decant then overflows through a series of weirs into the Sakhya Sagar lake. However, over the years the Jadhav Sagar has silted up and no longer functions as a sedimentation tank. This results in a large amount of sewage entering the Sakhya Sagar lake. This is especially a problem in the dry season when the water becomes heavily polluted. This could have an effect on the wildlife as this one of the main sources of water during the summer season.

Encroachment

National park is practically free from the encroachment. Area transferred from Shivpuri division in year 1995, called the extension area of the park, have the old cases of encroachment. List of encroachment is given in **Appendix -XIII.**

Attack of insects, caterpillar and fungus and loss to the flora

Teak defoliator and speletenizer insects attack the teak trees in the park area. However, its attack is not found to be serious. Fungus attack is also nominal in the park.

CHAPTER -VIII

THE STRATEGIES

8.1 Broad strategy for management

To meet the objectives of management the following broad strategy is proposed:-

1. To maintain the entire area of the park as core zone. It will consist of the old park area and the extension area added afterwards. There will be complete protection to the wildlife and habitat in the core zone.

2. To maintain the central area of the old National Park between the two National Highways, specifically the area around the Sakhya Sagar lake as the **tourism cum recreation area.** To provide for appropriate visitor and interpretive facilities in the tourism area.

3. To relocate the villages inside the Park and acquire the rights within the notified core zone so that the entire area can be managed without any encumbrances for wildlife.

4. To delimit an **"Eco-development zone"** around 5 km. periphery of the Park so that Eco-development inputs can be incorporated regularly.

5. To improve the habitat and water regimes of the Park by appropriate habitat improvement and water regime improvement measures.

6. To ensure proper patrolling and effective anti-poaching measures in order to safeguard the wildlife in the area.

7. To safeguard the boundaries of the Park by suitable measures including rubble stone masonry, chain-link fencing, pucca boundary wall, etc.

Separate prescriptions are prescribed for each zone in detail in the subsequent chapters.

8.2 Zonation Plan

For the purpose of management, the entire Park area is to be divided in to the following zones:

1. **Core Zone**
   - **(i) Tourism area**
   - **(ii) Restoration area**
2. **Eco- development Zone**

Map -10 showing the aforesaid zonation is attached. The area statement of zonation is given below :-

TABLE1

S.no	Zone	Area Included	Area in Hectares
1	Core Zone	The entire area of the National Park.	35461.294
(i)	Tourism area	Compartment nos. N/41, N/45 to N/49 and N/51 to N/54	1763.32
(ii)	Restoration area	The entire area of core zone minus tourism area.	33697.974
2	Eco-development zone	The notified closed area and a belt of 5 kms around the boundary of the extension area added afterwards in the year 1982 and 1999.	1,00,000 (approx)

8.3 Zone plans

8.3.1 The core zone :

The core zone will constitute all the notified area of the National Park presently available for wildlife management. Tourist traffic will be allowed in areas prescribed for tourism purposes only. The main thrust of activities would include:-

i. Complete protection of the area from encroachment, grazing, fires, removal of forest produce, poaching and all activities detrimental to wildlife.

ii. Habitat improvement works, especially augmentation of water sources available to wildlife during the summer.

iii. Fire protection measures including the maintenance of established firelines and the creation of new ones if required.

iv. Regular intensive patrolling in the area and the area immediately adjacent to the park as a anti poaching and security measure.

8.3.1.1 The Tourism and recreation area:

This area has a good road network and plenty of attractions for tourists. Efforts in this area shall be to promote regulated tourism and to improve the infrastructure and other services in order to provide the visitor a good wilderness experience. New potential tourism areas will be developed and opend for tourists with the permission of CWLW. The tourism area plan is detailed in Chapter - IX.

8.3.1.2 The Restoration area :

The entire area other than tourism area is to be managed as the restoration area. Here the thrust of the management inputs will be to restore the habitat in this area as the area has been subjected to heavy grazing, mining and other severe biotic interference. The various management inputs to be incorporated will include:

i. Proper demarcation of the boundaries on the ground
ii. Acquisition of all land and rights within the notified area
iii. Fencing off of the corridor area in order to establish the link between the extension area and the old National Park
iv. Relocation of the villages of Ballarpur and Gatwaya
v. Removal of grazing pressure from the area
vi. Reclamation of old stone quarries for use as waterholes
vii. Habitat improvement works, especially around Larha, Parasari, Ballarpur and Gatwaya
viii. Construction of patrolling camps, wireless stations, roads, firelines and water holes

All of these will involve a great deal of expenditure and time. However most of these activities will be necessary if the area is to be developed to its potential as a wildlife area.

8.3.2 Eco-Development Or Buffer Zone:

As per notification of GOMP F-14/46/77-10 (3) dated 20 Feb 1978, a buffer zone has been notified **(Appendix -VIII)** which include 71 comptt. and 72 villages. This buffer zone surrounds 4 km. to 8 km. (Average 6 km.) area around South and North ranges of finally notified park area of 1958. This buffer zone comes fully under Shivpuri Tahsil and 5 open cast mines has been proposed by Shivpuri Division namely (1) Sujiapura (2) Majhera (3) Barodi (4) Karai ahamadpur kalapani (5) Mudkheda lamba kho.

It is proposed that no deforestation and mining activities detrimental to wild life should be resorted to in the buffer zone for the proper management of Madhav National Park.

Proposal for 5 km. wide zone out side the new extension area added to the old area to notify as buffer zone is to be made. Efforts in this zone will be concentrated at measures to reduce the dependence of the villagers on the resources within the National Park, especially with regard to grazing, firewood, and other non-timber forest produce. The number of villages in this zone is over 120. The basic thrust of the eco development activities is detailed in Chapter X.

8.4 Theme plans

A. Management of water

The park lies in the semi- arid zone. The limiting factor in such areas is usually the availability of water in the dry season. The Park has two large man made reservoirs in the main national park area – the Sakhya Sagar and the Madhav Sagar both of which are in the tourism area. Since the reservoirs supply Shivpuri town's drinking water, the water level during the dry season often recedes to just the center of the reservoir. The MDL (Minimum Drawl Level) of Sakhya Sagar is proposed at 338.78 meter. Therefore the distance water from the waters edge is quite considerable at most points along the reservoir bank. These acts as a sort of deterrent to most herbivore species from accessing the water because of the vast open stretch that they have to cover. They therefore are forced to go to the water once darkness falls. However heat stress on these animals is maximum during the afternoon hours, which is when they need water the most to cool themselves. It is therefore important that alternate water arrangements be made for the ungulates within the forest area itself. Provisioning of water may be done shallow draft or concrete lined saucers along the roads, but they should not positioned to close to each other.

In the northern area there are a few perennial springs which support dense riparian vegetation and these are vital for the wildlife of the area. Apart from these, there is little water elsewhere on the northern plateau.

In general, all efforts should be made to improve the water regime of the national park. Simple techniques of soil and water conservation can be used, such as digging contour trenches, constructing dry rubble check dams, finance with black cotton soil puddling along with the construction of concrete lined saucers at suitable places.

The central area of the part between the two national highways has about five perennial springs and about eight concrete lined saucers. Most of these saucers are however located along the George castle – Mohun chowraha road. At least ten more sources are needed in this area as it is the main wildlife zone. Many of the perennial water sources silt up and become unavailable to the animals. They therefore must me

maintained every year by cleaning the accumulated sand and other debris. Vital water sources of this type includes Jamunjhiri (N/38), Kalua Kho(N/39),Cham chonia (N/71) Amdar (N/71) Sidhbaba (N/45). There are about three springs above the Bhura Kho tower, which feeds the Bhura Kho stream. These too must be cleaned every year and adequate anti poaching measures put in place.

Small check dams can be built in the streams flowing between compartment nos. N/61&N/62 and compartment 59.

The area of the park north of NH 3 is acutely deficient in water. The only perennial sources are the Tunda Barka nala and the Patpara nala. At least twelve concrete lined saucers are proposed to be set up in this area to supplement the water supply. These will be located compartments-

The southern portion of the park to the south of national highway is an area extremely deficient water the only perennial sources of water here are Chamchonia, and Aamdar nalas located near the Eastern boundary. The stop dams built in the area have silted up or have broken down. Urgent repairs are essential in the Chamchonia stop dam. At present there is only one concrete saucer in the area. At least twelve saucers are proposed in this area.

The village hand pumps and the tube well in the temple can also be used to supplement the water in neighborhood. Similarly, once relocated, the village tank of Gatwaya can form the main source of water for the area. The village tank in the deserted village of Parasari can be used immediately to irrigate the grass meadow there and as a source of water. In the central range, the Barahi nadi is a permanent source of water. The rest of the range is highly deficient in water. Two artificial water sources near Chappar Ghat have been created in1999. Maintenance of these water sources is necessary. Certain abandoned mines store water well into the summer season. These mines are in compartment numbers 94&95, 125, 77, 75&76, 75&74. These are however not usually available to the wildlife as they have almost vertical side walls. These can used as water sources after the slopes are made accessible by breaking down the vertical slopes and getting a gently inclined access to the water. There are number of pits of abandoned open cast mines in different ranges which can be used as water

holes after proper development as per their condition to restore them as water source. List of these pits are given in **Appendix -XIV.**

Suitable points in some streams like the Gatwaya nala in Compartment 75&76 and in 88&89, the Larha nala in 99&100, the Parasari nala in compartment no. 116, 115, 114, 113, 108, 104, 111, 103 and between 113&114, and the nulla near Sausa in compartment 80&91, and 92&93are suitable for the construction of wire mesh-loose boulder check dams with black cotton soil puddling.

The other perennial water source in the extension area is the Sind river which forms the Eastern boundary of the park. The Proposed Manikheda dam will be built on this river just outside the park.

B. Habitat improvement

Keeping in view the status of stock in the park area, habitat should be improved for the overall betterment of flora and fauna of the park. All weeds which spoil the good meadows and grasslands, must be eradicated before their seeds ripen up. This should be repeated at least for continuous three years to clear off the area from the menace of weeds.

In order to restock the blank areas, site specific seeds of suitable species should be sown, especially fruit bearing species like Mahua, Tendu, Neem, Achar, etc.

Soil & water conservation measures should be adopted on the refractory, eroded and fragile areas of the park. Soil conservation is most important in the park area, as soil depth is quite less. Soil binder grass species should be planted along the loose soil in order to check the further soil erosion and checking soil loss by run off due to rains & floodings. For this, suitable specific soil conservation techniques should be used like contour bunding, continuous contour, staggered contour, etc.

Apart from eliminating the sources of habitat degradation - mainly from grazing, fire and removal of forest produce, the wildlife habitat needs to be actively managed order to provide conditions for the increase in wildlife. A major part of habitat improvement will impose the increased availability of water during the summer months as detailed the preceding section. Apart from that, it shall involve:-

i. Grasslands management
ii Supplementary feeds
iii Weed eradication
iv Provision of salt licks

i. Grassland Management:

The National park lacks the presence of good grasslands. Many areas are flat and open but support extremely dry grasslands mainly populated by bhurbhuri and other unpalatable grasses. The central portion around the Sakhya Sagar lake however has some patches of good grasslands. These can be further developed by harrowing and watering. Most of these grasslands was earlier cordoned off for the Tiger safari. The Tiger safari has now been dismantled and the wire mesh fencing removed. Attention now must be concentrated in this area in compartment numbers 41, 43, 44, 50, 51, 52 and 54 for developing grasslands. This area is almost flat and being close to the lake, portions of it can be irrigated. Further, the garden in front of the Sailing club can be transformed in to a good grassland for the Chital herds around by dismantling the wire mesh fence and using the tube well already present to irrigate the area. Most of the north range not suitable for developing grasslands. However some areas close to the Bhura Kho tower in compartment number 34 and 35 are ideal for developing grasslands. In the rest of the north range strict protection measures especially to the riparian areas are necessary.

In the East and Central range, the old village sites of Parasari (N/112), Maujpur(N/86), Larha (N/96), Ballarpur (N/127) etc. have excellent prospects of turning into fine grasslands. Similarly, the corridor area after acquisition should be managed as a grasslands and in all probability will make the finest grasslands in the park. In addition, patches of grasslands can be developed in compartment numbers N/54, N/34 of South range and N/85, N/97, N/ 101, N/102, N/111, N/113, N/115 and N/117 of other ranges.

ii Supplementary feeds

For-years now supplementary feeds in form of *'Barseem'* -is given to the herbivores during the summer in the central tourism area of the park which is the main chital area. This commences in the middle of March and is continued till May and June. The Baeseem is grown in a 2 hectare plot along the Madhav channel. This is essential as during this period the forage available to the herbivores, mainly spotted deer or Chital is limited. It is proposed to continue this practice till the natural forage availability is deemed to be sufficient. It is envisaged that the efforts to increase the palatable grass cover as detailed in the preceding section will eventually make supplementary feeds redundant. As of now it will be necessary to continue the system of supplementary feeds for the present.

iii Salt licks

As mentioned in section-the park area lacks natural salt licks. To overcome this artificial salt licks are provided and the system must be continued.

iv Removal of weeds

The weeds present in the national park include mainly *Lantana, Cassia tora* and *Ipomea. Lantana* is restricted in distribution and its presence in fact may be beneficial to the wildlife in certain areas as it provides the much-needed thermal cover. As such no management action is proposed for removal of *Lantana.*. *Cassia tora* is widespread, especially in the extension area and the area south of national highway number 25 as these areas are subjected to heavy grazing. In areas otherwise suitable for grasslands, mechanical removal of *Cassia tora* After the first few rains will be essential. It is expected that the elimination of grazing pressure will eventually lead to a decline in the *Cassia tora* infestation. Ipomea is prevalent in certain portions of the-lake, especially in the main feeder stream and along landing numbers 5 to 9. These areas are however useful for many water birds such as Purple Moorhen. Certain portions of the *Ipomea,* especially in the feeder stream and near landing numbers five to eight must be physically removed during the non-breeding season of the water birds.

v Fire management

Fire as mentioned in-is one of the main agents of habitat degradation in the park. Strict control has to be exercised before and during the fire season to eliminate the ill effects of yearly fires. As the fire season in the park starts right from December, the early seburn must be completed every year by 31st December. This will not only ensure that fires can be contained but also be beneficial for wildlife as during December-January the area experiences heavy dew during the night which would promote the growth of grass on the burns. Further, there are usually winter rains during this period, which would stimulate grass growth on the burns making forage available for the herbivores.

While no new fire lines are being proposed, it is essential that the existing fire lines are regularly maintained by an yearly cycle of cutting and burning. Further, both sides of the roads, especially in the central zone between the two highways need to have strips of 3 m. each on either side brunt to function as an effective fire break. Similarly protection measures are essential in the old safari area in compartment number N/51, the riperian areas and the areas to be managed as grasslands. In the dry season, Sambar especially depend upon the dry fallen leaves of Anogeissus pendula. Therefore special efforts are needed to prevent fires in the Sambar areas especially around George Castle and Bhura Kho tower. The RF – PF line parallel to the southern boundary of the extension area should also be maintained as a fireline.

During the fire season at least 40-50 five watchers need to be employed to keep vigil and fight any fire outbreaks. At least one vehicle needs to be kept available for fighting fire outbreaks. During the fire season, a 24 hour vigil has to be maintained from vantage points such as George Castle, Sailing club, Bhura Kho tower, Park office building etc. Special fire watchers and staff have to be deployed during the annual Ballarpur fair which takes place right in the middle of the fire season, in April. People have been known to deliberately set fire to the forest during the fair due to blind faith.

Fire protection

Annual incidence of fire is the enemy number one for the park. All the efforts to protect the parks is infructuous unless a sound fire control scheme is prepared and implemented.

Maintenance of fire line

Fire lines of the park should be cleared before 15th February every year.

Type of fire lines	**width of line**
Outer boundary of forest block	12 M
Inner boundary of forest block	6 M
PWD roads & other roads	6 M
Forest road & boundary lines	6 M
Plantation area	12 M
Old fire lines	30 M

Unified fire control management includes extention education, intensive patrolling, use of wireless for gathering quick information, fast fire extinguishing operation and close watch on the fire sensitive areas from watch tower and fire watchers. Remote sensing technique should also in applied to detect the fire incidence. Visitors sometime create havoc by carelessly throwing the lit cigarette.

In National Park area, fire incidence is of special nature. It requires more efforts to mop up the fire by personally attending each trees and shrubs. Wild life should also be fully protected by the fire as they are very sensitive to heat and smoke. A special rescue team with field staff and a veterinary doctor should also be pressed into service to protect the flora & fauna.

C. Infrastructure Development

Roads

There are about 296 km. roads in the park area. Its list is given in **Appendix-XIV** General conditions of the roads are poor. For the regular patrolling and protection of the park, the proper up-keep and regular maintenance of these roads is a must. Special budget provision should be made under this head.

Width of the forest road.

Forest Road (Muram)	9-11 feet
Forest Road (Gravel)	12-16 feet

The original park area, especially the central zone between the two national highways has a very dense network of metal roads. The roads in this area was until 1998 maintained by a PWD gang and the budget for these was borne by the PWD. After 1998 the PWD has stopped the budget and therefore the roads are being maintained by the normal departmental budget which over the years has been inadequate. This is especially so because the roads in Madhav National Park are open to regular traffic throughout the year. Yearly maintenance of these roads especially in the tourism area is essential. Spreading of Morum every year is essential on the metal roads. The total road length in the park is about 296 kms of which about 52 kms are metalled.

The rest of the area especially the new extension area is however deficient in roads. The roads here are unmetalled. New roads have to be constructed in this area for proper patrolling and for movement of tourists vehicles. These proposed new and to be upgraded roads are given below:-

1.	Jhansi road - Barahi Nadi (along the submergence area) - Larha to Satanwara - Narwar road. (New)	48 km.
2.	Parasari to Dadoi (New)	5 km.
3.	Karai to Ballarpur (Upgrade)	9 km.
4.	Bharkuli to Gatwaya (Upgrad)	5 km.
5.	Surwaya to Ballarpur (Upgrad)	9 km.
6.	Chand to Raipur (Upgrad)	8 km.
7.	Surwaya to Hatod (Upgrad)	11 km.
8.	From inspection road to Jhirna Kho (New)	2 km.
9.	Thakur baba to Chhamchhonia (Upgrad)	3 km.
	Total -	100 km.

These new roads will facilitate patrolling of the area by vehicle, movement of tourists vehicles and also function as firelines.

Boundaries

As mentioned in section 2.2.1., most of the boundary is already marked by masonry boundary pillars. 992 pillars exist. However the corridor area do not have boundary pillars and new pillars have to be constructed over here. Total length of the boundary of the park is 213 km.

Range wise length of boundary (Artificial & natural) and pillars in the park are given below :-

S.No.	Range	Range wise Length of boundary (in km.)			No. of pillars
		Artificial	Natural	Total	
1.	South	55	-	55	204
2.	North	45	-	45	210
3.	East	25	19	44	275
4.	Madhya	24	45	69	303
Total		**149**	**64**	**213**	**992**

Demarcation lines & Boundary pillars and its maintenance :-

In a national park, proper maintenance of its demarcation lines and boundary pillers is most important. During cover mapping it has been observed that general conditions of boundary pillers has been found to be poor. 5 year demarcation plan has been prepared and given in **Appendix -XV.** Boundary pillers should be inspected every year by the range officer incharge of the range. Though most of the pillers are made permanent however, specific efforts should be made to maintain it in future also.

Fencing

In order to prevent cattle from getting into the park, rubble dry stone walls or cattle proof walls and in certain areas masonry walls have been constructed. However most of this is ineffective as they are broken down at many places allowing free access for the cattle. Even when these walls exist, they are far too low to prevent the migration of deer outside the park boundaries. As mentioned in -one of the major

problems in the park is the migration of wildlife outside the park where poaching incidences are common. This is especially so along the Eastern boundary of the central zone which borders the former grasslands of Kota, Hatod and Mamoni. A possible solution to this will be to fence off the area with wire mesh fencing so that wildlife can be prevented from entering crop fields. This will necessitate the creation of additional water sources and foraging areas within the park area before fencing is undertaken. This will also prevent entry of cattle into the park. The vital corridor area once acquired will have to be fenced off in a similar fashion. The area between the national highway and the park boundary in the northern range, which is a revenue area just outside the Park, can also be similarly fenced off after it is put under the control of the park by the district authorities. This area is flat and has the potential of forming fine grasslands. This will also help in reducing the incidences of road kills prevalent along this road.

Year wise fencing completed in National Park is given below :

S.No.	Year	Length	Location
1	2002-2003	7.5 km.	Madhav lake to Mahuakheda (South range.)
2	2003-2004	3.08 km.	Mahuakheda to A.B. road (South & North range)
3	2004-2005	7.88 km.	Mahuakheda to A.B. road (North range) continue
4	2005-2006	6.00 km.	Kathmai and Bardhkhedi beat (South & North range)
5	2006-2007	3.7 km.	Along A.B. road (North range)

A detailed plan of chain link fencing / CPW is proposed as under:

S.No.	Year	Length	Location
1	2007-2008	7.5 km.	From compt. No. 65, 66, 67,68,71,59,58 (South range)
2	2008-2009	7.5 km.	From compt. No. 58,50 = 2.5 km. & A.B. road to North boundary of corridor along compt. No. 129,130,131
3	2009-2010	7.5 km.	Along the boundary of compt. No. 131,132 i.e. Southern boundary of corridor (Madhya Range)
4	2010-2011	7.5 km.	Along the boundary of compt. No. 2,4,8,9,29,30 (North range) & compt. No. 527, 531, 534 (Madhya range)
5	2011-2012	7.5 km.	Along compt. No. 106,100,105 (Madhya Range)
6	2012-2013	7.5 km.	along the boundary of compt. No. 105 & 98 (Madhya range) up to Satanwara - Narwar road 1.5 km. & Barahi

S.No.	Year	Length	Location
			nadi to Sindh river along compt. No. 119, 120 (East range) 6.0
7	2013-2014	7.5 km.	Along the southern boundary of the East Range compt. No. 120,121,122
8	2014-2015	7.5 km.	Along the boundary of compt. No. 122,126,89,74,123,73
9	2015-2016	7.5 km.	Along the boundary of compt. No. 19,21,22,26,27 (North range) & compt. No. 538, 549 (Madhya range)
10	2016-2017	7.5 km.	Along the boundary of compt. No. 10,11,13,17,18 (North range) & compt. No. 547,548 (Madhya range)

Equipments

At present the various important field and office equipment such as Binoculars, Cameras, Wireless sets, etc. available in the park are listed in Appendix 11. Among the equipment urgently required are wireless sets (at least 6 Base stations and 20 hand held sets), a GPS receiver for mapping, and 10 binoculars. Computer too are urgently required. Two night vision powerful Binoculars are also required for night patrolling.

Vehicles

As detailed in section 4.2.4., the park is deficient in vehicles for patrolling and for use of tourists. A tourist vehicle (mini truck/bus) and a tractor with trolley are urgently required. All 3 Jypsies presently available in the Park are to be replaced with new vehicles. 2 Bolero camphor/ Mahindra Utility vehicles are required for Day & Night patrolling. In addition 1 Motor boat & 2 Paddle boats are required for river / lake patrolling. 1 vehicle is needed for resque squad / conducting immunization programme.

Patrolling Camps

The deserted villages of Larha and Parasari do not have any buildings that can be used for Patrolling staff.. A third patrolling camp will be required at Chad village to control the new area north of the Satanwada – Narwar road. Thus, a total of three new Patrolling camps are required.

Watch towers

New watch towers in comptt. no. N.13 North range, comptt, no. N.25 and junction of comptt. no. N. 101, N.102, N.105, Central range, comptt. no. N.56 South range and N. 126 East range are proposed.

Electricity

Buildings, patrolling camps, watch towers, Entry gates do not have electricity facility. Due to inaccessibility of these areas, solar lighting system is the only solution. Provision is being made to install solar light system on these buildings to provide electricity facility to the staff posted here.

Buildings

General condition of the parks buildings is unsatisfactory. Most of the buildings require immediate repairs and maintenance. Some new buildings should be constructed for the staff. List of the buildings is given in **Appendix - XI.**

Office building

Director's office building needs extension as the National Park office has been upgraded to C.F. level. Hence following is the proposal :

C.F. & Director's Office room	-	01
Store/ Record room	-	02
Range Office, East range	-	01

Staff Quarters

New accommodation will be necessary in the Khirni naka colony and at other places. These will be used to house field staff as well as clerical staff who can then be picked up quickly at one place in situations of emergency. A director's residence building is also required as it is presently housed in a PWD quarter. Total requirement as given below :

C.F. & Director's Residence	-	01
Veterinary Doctor's Residence	-	01

Forest Ranger quarter	-	02
Forester quarter	-	04
Forest guard quarter	-	06
Staff quarter	-	08

Staff

Presently the staff is not sufficient as the National Park has many villages at the boundary so the biotic pressure is more to maintain the park and protect the wild life to meet the developmental activities and to support the tourism which is a growing at fast pace . Following additional staff is required.

1.	ACF	- 01	- For 2-2 ranges each.
2.	Forest Rangers	- 03	- 01 Management plan implementation 01 Eco-development 01 Protection
3.	Dy. Ranger/Forester	- 06	01 Dy. Ranger & 01 Forester for Director's flying squad 04 Dy. Ranger or Forester for four ranges
4.	Forest guards	- 20	04 for Director's flying squad. 16 for four ranges.

Flying squad

Though a flying squad is working in the park, but it suffers from shortage of staff. So to upgrade the flying squad as per increasing biotic pressure and to control fishing and poaching as well as theft of NTFP a following provision is proposed. This flying squad will be directly under the supervision and control of Director, Madhav National Park. There will be 01 Forest Ranger, 02 Dy. Ranger / Forester, 04 Forest guards (Ladies/Gents), 06 retired Army personnel with sufficient labour and 2 vehicles. The squad will be divided in two parts. One party will be engaged in day patrolling and other in night patrolling in the Park area.

Grazing control

National park is situated very near to the Shivpuri city and nearby villages have high number of dry as well as milch animals, therefore, most perceptible threat to the

national park is over grazing and trampling of seedlings. First and foremost, total control on illegal grazing is a must in order to protect the park. All the boundaries must be fully protected by the chain-link fencing, as stone wall has been found to be inadequate to check the intrusion of cattle in the park area as it is very easy to break the wall. All efforts to enrich the park by way of planting & seedling will be meaning less unless illegal grazing is ruthlessly curbed. Regeneration is also adversely affected leading to poor stocking in the park area more so when the climatic & edaphic conditions are also a limiting factors for the park.

Important Development plan

To develop the park as an important one in North-West region, some ambitious plans have been submitted.

1. Tourism plan
2. Development plan (Five year Action plan)
3. Management plan for Introduction of Tiger In Madhav National Park.
4. Wet land Development project of Chandpatha (Sakhya Sagar).

Tourism department has allotted Rs. 8.84 lakh for Bhadaiya kund development and Rs. 1.74 lakh for Bhura kho tourist spots. Work has been completed.

Transfer of forest land

GOI has totally banned the transfer of forest land for the non-forestry use under the provision of Forest Conservation Act, 1980. Being a national park, it attracts the provision of FCA as well as wild life (Protection) Act, 1972 as amended from time to time.

CHAPTER – IX

ECO-TOURISM

Tourism, Interpretation and Conservation education

The Madhav National Park is in many ways ideally situated for the promotion of conservation education and tourism. It is close to the district headquarter of Shivpuri and relatively easy to approach. The infrastructure in terms of accommodation, roads etc. are well established. However due to the inherent problems in the park including the low density of wildlife, tourism and conservation education has not achieved its potential here. One of the principal objectives of this plan shall be to develop this park as a true recreational and educational area.

9.1 Objectives

The objectives of managing tourism shall be:-

1. To promote regulated tourism in the tourism area prescribed- subject to the overall maintenance of the area as a good wild life habitat.
2. Introduce the visitor to the importance of national Parks in general and Madhav National Park in particular and win over the cause of conservation.
3. To introduce the visitor to the rich historical, cultural and natural history of national park.
4. To afford the visitor a truly educating and entertaining wilderness experience in the national park.
5. To propagate conservation education among the public visiting the national park, the citizens of Shivpuri and the local population around, especially the villagers in the area of influence and to elicit their support and cooperation for conserving national park.

9.2 Problems

The various problems that exists and are envisaged in the tourism area can be summarized as follows:-

1. Littering, noise etc.

Littering is one of the major problems in the park. This is especially so because of the widespread use of plastics and Polythene packaging materials. Most of the visitors to the park are ignorant of the harmful effects of plastics and it poses problem for the wildlife. Similarly noise pollution is another problem faced by the park management. This is usually in the form of blowing vehicular horns and playing of radios and transistors by the visitors.

2. Unregulated tourism:-

The tourism area as it existed (the entire central area between the National Highways) was a fairly large one and the area has a very dense network of roads. It is sometimes difficult to control the route taken by the tourist vehicles. This is especially so as there are only three trained guides in the park. During the peak tourist season these three guides and the staff at the sailing club are not enough to accompany every vehicle.

3. Disturbance to wildlife:-

Sometimes visitors disturb the wildlife especially birds and ungulates by shouting or throwing stones at them. Rarely, visitors try and feed the animals or try and follow them with their vehicles.

4. Defacing and vandalism:-

The Madhav national park has a number of historical buildings. Many of these are located in the tourism area. In addition there is at least one site with ancient rock painting in Churanchajj. Sometimes visitors have been found to have defaced walls of the buildings as well as the paintings.

9.3 The strategies

The strategy for the management of the tourism area shall involve achieving the following objectives:-

1. To inform and educate the visitor before he enters the park by setting a good park interpretation center.

2. Prevent littering by putting in place the system of making visitors use waste disposal bags for putting litter while within the park. At some places waste disposal bins are to be kept.

3. Establishing out road signs and growth logs to keep the tourist rages on the roads designated for tourist traffic. This will involve the erection of road blockades/ barriers at the entry points of the debarred roads.

4. Improving the visitor signs in the tourism area to highlight the various points of historical, ecological and other interests.

5. Increase the number of guides by training achieved for other locals. Making guides compulsory will help prevent disturbance to wildlife, littering, defacing etc.

6. Improve the visitor experience and learning inside the park by installing appropriate interpretive signs in places of geomorphologic, vegetation and historical interests along the tourist route including the sailing club, Sakhya Sagar dam, shooting box, George Castle.

7. Create more take-home souvenirs and brochures on various subjects related to the park in particular and wildlife conservation in general.

8. Create awareness on water conservation and pollution control measures, because there are two big water bodies named Sakhya Sagar and Madhav lake are inside the tourism area.

9. Create awareness among the visitors on safety measures to be taken while watching wild animals, crocodiles etc.

9.4 Identification of the area

The tourism area shall include the area immediately around the Sakhya Sagar lake, George castle, the Sailing club and the Golf tower. The area is marked in **Map-11**.

The area shall comprise of compartment numbers N/41, N/45, N/46, N/47, N/48, N/49, N/51, N/52 and N/54. The total tourism area is 1454.31 hectares. The area up to Bhura Kho tower, namely compartments N/31, N/32, N/33, N/34, N/35, N/36, N/37 N/38, N/42, N/43, N/44 is also be opened for tourist traffic if the park management so decide. At present tourists inter in the park from gate no. 1 and exit from gate no. 3. On Agra-Bombay highway (NH-3), presently there is no entry point. To attract tourists and promote eco-tourism, there should be a entry point at this main highway. On this road, gate no. 14 is to be opened for tourists and some potential wildlife areas around it to be added. In this area Bhura kho jal mandir and Bhura kho tower and dam will be special attractions for tourists. Other tourists attractions are Madikheda dam and reservoir, area along Sindh river, Tunda Barkha and Churanchhaj will be developed and opened for eco-tourism in a phased manner.

There is a great potential for tourism as there are so many important old buildings and Eye-catching spots in the park. Some of the important buildings & spots are given below:

1- Sailing club
2- Sakhya sagar
3- Bhadai kund
4- Golf Tower
5- Ghari ghar
6- Ladies Club
7- Baradari
8- Chandpatha dam
9- Shooting box
10- Madhav lake
11- George castle
12- Landings No. 1 to 10
13- Baradari (Dancing flor)
14- Bhura kho tower and dam
15- Bhura kho Jal mandir
16- Tunda Barkha
17- Churanchhaj
18- Madikheda dam and reservoir
19- Crocodile safari in Sakhya Sagar lake

20- Migratory birds during winter season in Sakhya Sagar lake

21- Boating in Sakhya Sagar lake

22- Chaparghat section of Central range

9.5 Infrastructure

9.5.1 Roads:

The tourism area has a good network of WBM roads. Yearly maintenance is required on these roads. Yearly maintenance would normally involve the spreading of morum on these metal roads. Some new roads are to be created and some roads are to be upgraded for protection and tourism purpose.

9.5.2 Accomandation:

There are 3 grand rest houses namely Sailing Club, Ladies Club and Band Stand exits inside the Park. 3 eco-lodges have been created for the tourists. These rest houses should be properly maintained so that tourist should not have any inconvenience in staying there.

9.5.3 Food :

Tourist visiting the Park and staying in the rest houses shoud get snacks, drinking water and food at reasonable rate. For this there shoud be a well eqipped canteen at Sailing Club.

9.5.4 Transport and guides:

At present there are only 3 trained guides operating in the National Park. Some more local peoples should be trained and deployed as guides in the Park. Some tourists demand transport vehicles for round in the Park. Atleast 1 Jypsy should be kept for eco-tourism purpose. On payment, this can be used by tourists.

9.5.5 Training :

The staff handling the eco-tourism should be properly trained and should have updated knowledge of the Park. The personnel attending the rest houses, main gate,

interpretation centre, canteen should be properly trained to deal with the tourits efficiently. These people should be courteous, properly dressed and with sufficient information.

9.5.6 Buildings for interpretation:

The Sailing club, the George castle and the new park interpretation building can be developed as a rich interpretation centres. However interpretive materials need to be installed within them. The Sailing club as a visitor activity area, especially for children can be developed as a awareness centre. The historic George castle must be converted into a museum showcasing the rich history of the park. The new interpretation building constructed in the year 2000 have appropriate interpretive materials installed by C.E.E. Ahmedabad in the year June, 2002 for educating and informing the visitor on what do expect in the park, the importance of protected areas in general and the Madhav National park in particular. The interpretation center also has a lecture hall where wildlife films can be screened at fixed intervals. Appropriate timing can be between 11 AM and 3 PM when the park remains closed. The tin roofed glass house near the sailing club can be used as a daytime canteen for the visitors.

9.5.7 Interpretive signs and literature:

Old signs made of rocks are placed around the important tourism places. These old signs are elegantly and aesthetically done in the abundantly available local sandstone. More signs are essential in the tourism area. Especially essential are signs that can be used by the tourist's as road guides, to explain and inform them about the history of various structures and monuments such as the sailing club, Sakhya Sagar dam, Ladies' Club, Band Stand, Golf Tower, Shooting Box, Baradaries, Boat Landings, George Castle etc. It is desirable that the road signs are done like the old signs, in the local sandstone. This would be expensive but appropriate. Signages on migratory birds, rules and regulations, water conservation, pollution control measures etc. are also to be displayed at vantage positions.

Informative boards displaying the common animals, birds and trees of the national park can also be displayed. As the CEE is eminently qualified for establishing an interpretation program, alternative funding must be obtained to develop the

interpretation center at George castle and install more informative material at Interpretation centres.

9.5.8 Brochures, Posters etc.:

At present the only brochure available in the park is one that deals with the park in general. This brochure is available in both Hindi and English. Apart from this the only printed matter available are some posters. There is therefore a great need for other printed materials such as brochures on the birds and mammals found in the national park. Other informative materials like Caps, T-Shirts, Key rings, Badges etc. are to be made available to tourists for creating awareness for conservation of protected area in general and Madhav National Park in particular.

Tourist spots of the Park

There are a number of beautiful grand sites of historic and archival significance in the Park area. A list of tourist spots of the Park is given in **Appendix -XVI.**

9.6 Eco-tourism : Policy & Guidelines

9.6.1 Preamble:

Eco-tourism is emerging as an important component of the Indian tourist industry. The significant growth in nature tourism and the numerous tourist operators bear adequate testimony to this. Though the term " eco-tourism" is popular, it is rather loosely used by many. Hence, it is imperative to distinguish this from the general mass tourism. Eco-tourism has been considered here as a sustainable, equitable, community based endeavour for improving the living standards of indigenous host communities. Apart from these stake holders, there is also a dire need to forge partnership with the existing tourism industry of the state.

9.6.2 Eco-tourism defined:

Eco-tourism is "sustainable, nature tourism" involving the indigenous stake holders, while forging partnership with the existing tourism industry. The Word

Tourism Organization (WTO) difines eco-tourism as "tourism that involves travelling to relatively undisturbed natural areas with the specified object of studying, admiring and enjoying the scenery and its wild plants and animals, as well as any existing cultural aspects (both of the past or the present) found in these areas". Eco-tourism or nature tourism is distinguished from resort tourism or mass tourism by requiring lesser infrastructure development and a lower impact on the environment.

The key elements of eco-tourism are:

1) Existence of National Park / Sanctuary / natural environment as a prime, star attraction.
2) Should be ecologically, socially, culturally and economically sustainable.
3) Should have participation of the local stake-holders (host community).
4) should be a low profile venture.
5) Should be capable of dove-tailing in the existing tourism of the State.

Synonyms of Eco-tourism:

- Environmentally friendly tourism
- Nature tourism
- Green tourism
- Sclentific tourism
- Cottage tourism
- Wildlife tourism
- Wilderness tourism
- Safari tourism
- Designer tourism
- Hard tourism
- Risk tourism
- Adventure tourism

9.6.3 Policy and Planning:

The National Eco-tourism Policy & Guidelines (1998), after considering the National Policy on Tourism, has identified the following cardinal principles for the development of Eco-tourism :

1. It should involve the local community and lead to the overall economic development of the area
2. It should identify the likely conflicts between resource use for tourism and the livelihood of local inhabitants and attempt to minimize such conflicts
3. The type and scale of tourism development should be compatible with the environment and socio-cultural characteristics of the local community and
4. It should be planned as a part of the overall area development strategy, guided by an integrated land-use plan while avoiding inter-seetoral conflicts and ensuring sectoral integration, associated with commensurate expansion of public services

9.6.4 Operational Guidelines:

9.6.4.1 For the management:

The following operational guidelines are indicated :

- The planning should be flexible, site-specific & participatory and should form part of larger eco-development / eco-regional plan for the area, within the normative standards of a Landscape Code
- Assessment of existing infrastructure, surface transportation, air service, road, electricity, water supply, law and order situation
- The eco-tourism package should invariably include :
    - Simple, adequate boarding & lodging facilities, in tune with the environment & the general setting of the landscape
    - Road network within the identified tourism zone
    - Self - guided Nature trails
    - Transportation options
    - Interpretive Centres
    - Way-side exhibits
    - Signages
    - Observation towers
    - Public conveniences
    - Garbage disposal facility
    - Living quarters for staff / personnel

- Structures with an exotic look causing visual pollution and non-compatible and unaesthetic architecture should be avoided
- Site-specific micro-planning for community based eco-tourism should be resorted to
- Environmental, physical & social carrying capacities to limit the various developmental activities in the fringe area to be identified for eco-tourism
- Devise mechanism to ensure continuous monitoring of adverse effects of tourism for quick redressal
- Recognize eco-tourism operators, provide incentives to deserving cases and award quality labels
- Provide visitor information & interpretation services (bilingual) covering:
    - "Do s" and "Don'ts"
    - What to see ?
    - Where to see ?
- Periodic training programmes on eco-tourism should be conducted for tourism administration, planners, operators and general public
- Ensuring training programme to the host community in:
    1. Lodge ownership / management
    2. Basic education & awareness
    3. Health and sanitation
    4. Skill development for preparation of local suovenirs as appropriate
    5. Codes of conduct
    6. Forest and wildlife conservation
    7. Litter control
    8. Forging partnerships with tourists & tourism industry
    9. Environmental management

9.6.4.2 For The Visitors:

- Abiding by the code of conduct, "Do s" & "Don'ts"
- Helping conservation, apart from protecting any site natural of cultural, which may be adversely affected by tourism

- Avoiding wastage of resources
- Avoiding littering & carrying back all non-degradable litter
- Leaving the camp sites clean before departing
- Avoiding removal of plants, seeds, drift-wood from the site
- Respecting local culture / customs
- Respecting holy places
- Strictly adhering to the safety precautions

9.6.4.3 For Host community:

- Respect the value of environment, cultural heritage
- Avoid overusing the area
- Co-operate with the authorities in ensuring healthy eco-tourism
- Realize & react to the threat of Investors who see opportunities & exploit the locals
- Be friendly with the visitors as effective "nature guides" & "conservationists"

9.6.5 Development of PA-level Participatory Eco-tourism & Visitor Strategy

9.6.5.1 Action points for planning:

- To develop an overall eco-tourism strategy which shall incorporate:
  - Local participation
  - Sound environmental design
  - Visitor management
  - Conservation education
  - Training
  - Financial sustainability
  - Monitoring & evaluation
- To assess:
  - The existing tourism situation & potential
  - The desirable tourism situation & identify steps to attain the same

- To prepare a Participatory Community Based Eco-tourism strategy for the project area, involving the stakeholders through meetings & workshops
- The Eco-tourism strategy should also address the following :
    - Potential PA attributes vis-a-vis eco-tourism
    - Identification of sites
    - Development of monitoring mechanisms for ecological impact of eco-tourism
    - Visitor information & levels
    - Identify marketing opportunities

9.6.6 Community based Eco-tourism: Possible Inputs

9.6.6.1 Opportunities For indigenous host communities:

- Creation & management of low cost accommodation for tourists
- Providing guide service to visitors for jungle excursions
- Providing sale outlets for local herbal medicine
- Management of eco-tourism inputs like:
    - Cafeteria
    - Pony ride
    - Souvenir making & sale
    - Organizing folk dance
    - Picnic spots
    - Elephant rides
    - Nature trail
    - Cycle trail
    - Organizing visit to a typical host community village & exposure to country culture
    - Organizing bird club (restricted)

Attractions For visitors:

- Eco centres
- Nature trail

- Interpretation inputs:
    - Orientation centre
    - Visitor centre
    - Museum
    - Amphitheater
    - Road-side exhibits
    - Signages
    - Road-side Markers
    - Literature
    - Light & sound display
    - Vehicular excursions
    - Picnic spots
    - Elephant rides
    - Pony rides
    - Village visit
    - Ethnic / folk dance
    - Bird club
    - Souvenir shops
    - Cycle trail

9.6.7 Environmental requirement for eco-tourism

1. The carrying capacity (site-specific) of each eco-tourism site should be assessed at the following three levels :
    - Physical carrying capacity
    - Real carrying capacity
    - Effective / permissible carrying capacity
2. The landuse in the notified area should be environmentally compatible, without causing any adverse impact. Activities like mining, quarrying, industries with the likely discharge of environmental pollutants should be prohibited in such areas.
3. Structures with exotic look causing visual pollution should be avoided. Temporary housing structures merging with the surrounding with sloping roof using local material and design should be encouraged.

4. The planning, architectural design and construction of tourist facilities should use eco-friendly techniques like : solar energy, recycling of garbage, harvesting of rain water, natural cross ventilation instead of AC, self sufficiency in food thorough kitchen garden and farming with controlled sewage disposal.

5. The development should be sensitive to the conservation of fauna and flora, the corridor value of the area, apart from respecting the religious and historic sites in the area.

9.6.8 Estimation of carrying capacity

MADHAV NATIONAL PARK

(a) Visitation Data

(Average of last 5 years)

Visitors (Indian)	:	13166.00
Visitors (Foreign)	:	113.40
Total	**:**	**13279.60**

Number of tourist vehicles per day (average) = 6

(b) Carrying Capacity Computation

i. Physical Carrying Capacity (PCC)

PCC = A x v/a x Rf

- √ Only vehicular movements permitted on forest roads, hence road length is more relevant than area
- √ "Standing area" is not relevant, but closeness between vehicles is important
- √ There is a required distance of at least 500m. (½ km.) between 2 vehicles to avoid dust (2 vehicles / km.)
- √ At least 3 km. hours are needed for a single visit
- √ The PA is open to tourists for 12 months in a year and 9 hours per day
- √ Linear road length (for tourists) = 53 km.

$$\text{Rotation Factor (Rf)} = \frac{9 \text{ hours}}{3 \text{ hours}} = 3$$

PCC = 53 km. x 2 vehicles / km. x 3
= 318 visits / day

ii. Real Carrying Capacity (RCC)

Road Erosion

Total Road Length = 53 km. (Mt.)

Medium erosion risk = 5 km. (weightage factor = 2)

High erosion risk = 10 km. (weightage factor = 3)

$M_1 = 5 \times 2 + 10 \times 3 = 10 + 30 = 40$ km.

$$Cf_e = \frac{40}{56} \times 100 = 71.4 \text{ or } 71\ \%$$

Disturbance of Wildlife

$$\text{Sambhar (1 month)} = Cfw_1 = \frac{1}{12} \times 100 = 8.3\%$$

$$\text{Sambhar (2 months)} = Cfw_1 = \frac{2}{12} \times 100 = 16.6\%$$

$$\text{Panther (2 months)} = Cfw_1 = \frac{2}{12} \times 100 = 16.6\%$$

Overall corrective factor for disturbance of wildlife in Madhav National Park =

$Cfw = Cf_1 + Cf_2 + Cf_3 = 8.3 + 16.6 + 16.6 = 41.5$ or 42%

Temporary closing of sites

$$Cft = \frac{\text{2 limiting weeks / year}}{\text{36 weeks / year}} \times 100 = 5.5\%$$

$$RCC = PCC \times \frac{100 - Cf_e}{100} \times \frac{100 - Cf_w}{100} \times \frac{100 - Cf_t}{100}$$

$$318 \times \frac{100 - 71}{100} \times \frac{100 - 42}{100} \times \frac{100 - 5.5}{100}$$

318 (0.29 x 0.58 x 0.95)

50.8 or 51 visits / day

iii. Effective Permissible Carrying Capacity

(MC = Managerial Capacity = 40%)

EPCC = RCC x MC

51 x 0.40 = 20.4 or 20 vehicles / day

CHAPTER - X

ECO-DEVELOPMENT

10.1 The Eco-development Zone

The present park area is virtually an island in a sea of cultivated and heavily populated habitation. At present, there are 09 villages within the extension area of the park and about 122 villages within a periphery of five kilometers. In addition to the human population, these villages typically have large number of cattle, a large number of which graze within the national park. This along with the dependence of the people on various forest resources creates a potential source of conflict between the Park and the villagers. Because all kinds of extraction of forest produce and grazing is prohibited within the Park, there is a feeling of deprivation among these villagers, which is not desirable for the future well being of the park. It is therefore necessary to assuage these feelings and provide compensation and alternative source of fuelwood, fodder, small timber, etc. to these villagers so that they do not look upon various measures of conservation in a negative light.

A major area of management inputs will be the ecodevelopment activities in the Eco development zone. As specified earlier, the zone shall comprise the notified closed area around the original park and a belt of 5 kms around rest of the area. There are about 122 villages in this area. Emphasis should however be placed in the villages immediately outside the park boundaries, which have a significant effect on the park ecosystem.

10.2 Eco-development plan

There are 29 EDC (Eco development committees) around the park. A spot evaluation reveals that most of the EDCs are inactive and their role in the protection of the Park is negligible. However, efforts have been regularly made to organize regular monthly meetings and their views are evaluated for the management of the Park. Microplans for most of the EDCs have been prepared and eco-development activities should be based on these plans. Plans should lay emphasis mainly on employment generation, social forestry and agro forestry with a view to reduce

dependence on people on fuelwood, fodder and small timbers. Basic infrastructure like roads, water supply (Hand pump, tube well) cottage industries should be incorporated in the eco development plan with a prime motive to reduce the biotic pressure on the park and winning the goodwill of villagers residing around 5 km. area of the park. An amount of Rs. 255.00 lakh will be required during the 10 years of management plan. Details are given in **Appendix - XVII.**

10.3 The Strategy

The ultimate objective of the project shall be to elicit the active support and participation of the peripheral villagers in conservation and to make them realise the many, mostly intangible benefits they derive from being so close to the park. The project's immediate objective shall be to reduce the dependence of the people on the resources within the park and to increase the goodwill towards it by improving their living standards and thereby also reduce the pressures on the park. 12 villages were covered under the eco-development component of the Madhya Pradesh Forestry project. In some villages this has led to a perceptible change in the attitude of the villagers and the park has benefited in terms of reduced biotic pressure. These villages already have approved microplans. Future activities will be implemented as per provisions of the individual microplans. Many more villages are eager to form eco-development committees and suitable villages must be taken up and ecodevelopment activities taken up as per the microplans. However, the various components of the eco-development plan will be as follows:

10.3.1 Promotion of Activities Related to Agriculture:

10.3.1.1 Promotion of irrigation facilities

In order to improve agriculture in the identified villages, facilities for irrigation namely bore wells, irrigation tanks, and pump sets will be provided to the villagers. Part of the amount will be a grant while the rest will be in the form of a loan to be returned. The returned amount will be circulated within the village as a revolving fund to be managed by the villagers.

10.3.1.2. Utilization of Biomass for Production of Farmyard Manure

Since time immemorial land has being brought under cultivation after clearance of forest to cater the food need of growing population. Land becomes deficient in various elements, due to excessive and continuous exploitation. Extensive and irregular use of chemical fertilizers without using the farmyard manure, has a adverse effect on physio-chemical and biological properties of soil. Organic matter content in the soil is also depleted day by day due to one or other reasons. The use of organic matter also improves the buffer behavior and water holding capacity of soil. Organic matter has tremendous quality of binding the soil particles, which reduces the soil deterioration due to erosion.

Apart from wood as fuel, the farmers are using cow dung as fuel. Very little quantity of dung is available for making compost. The quantity of compost prepared by traditional method is insufficient to improve the physio-chemical and biological properties of soil. In traditional method farmer gets very little quantity of farmyard manure once in a year.

Nadep is a method by which farmer many get many more time F.Y.M. with same quantity of dung. Hence it is proposed to promote this method. In this method farm refuse, weeds and dung from farm animals may be used for recycling and preparation of compost. Little quantity of cow dung is required as a starter and catalytic agent. Total cost of each Nadep unit would be Rs.1600.

Justification

- Soils of the area are poor in organic matter content.
- Traditional Method of making compost can not cater the need of required F.Y.M.
- Recycling of farm refuses weeds and wastes from farm animal would increase the soil fertility of the zone.
- This will be the cheapest source of essential Plant nutrients.

- In proposed method of composting farmer will get compost at least twice a year.

- Farmer can prepare compost in abundant quantity as more as he wants.

10.3.2 Integrated pest Management:

So as to protect the local traditional crops from insect pests and to avoid use of chemicals and pesticides integrated pest management practice like use of pheromones, use of neem oil etc. is being proposed to be used in crops in the area on an experimental basis..

10.3.3 Agricultural Extension & Training:

Two days training camps of 50 cultivators each and a total number of 30 such camps will help the cultivators to learn low input technology, seed treatment, pest and disease control etc. to improve their crop production.

10.3.4 Pasture Development:

Propagation of suitable pasture grasses in Govt. or village land will also help in solving the fodder problem and maintain live stock in good health and productive condition. Pasture development will be carried out in the villages where suitable land is available.

Cultivation of grass like *Styto hamata, Sirrado*, Din Dayal may be proposed.

10.3.5 Promotion of Non-Conventional Energy Sources:

To protect the forests, non-conventional resources of energy have become the necessity of time.

(1)- Biogas / Gober gas plants : Installation of bio-gas plant can serve as a tool to meet out the fuel need of the people. It is healthy and cheap source of energy without any adverse effect of human health and biosphere. The slurry, which produced as byproduct of the plant, is rich in plant nutrient. It can be used as supplement of the fertilizer, helpful in increasing the production and productivity of the soil.

Generally 2 and 3 cubic meter plant size is suitable for a small farming family, even then the number of animals, their age, method of grazing and quantity of available dung influence the plant size. Twenty-five kg. cow dung per days is enough for 1 cubic meter bio-gas plant. 2 cubic meter plants are proposed for the area.

Selection of Model

In recent, different models of bio-gas plant are in practice, like KVIC, Janta and Dinbandhu. Among all, Dinbandhu, model is most suitable for this locality. A simple Raj Mistri can construct the plant. It is very simple and easy to use. Keeping in low cost in view the Dinbandhu model of biogas plant is to be advised for the area.

(II) L.P.G. connection - To reduce pressure on forests of Park for fuelwood, distribution of L.P.G. connections on 50% subsidy basis to the villagers shall be taken up on large scale. This will reduce the dependance for fuelwood on forests. This is a eco-friendly measure.

(III) Smokeless Chulhas - All the poor house holds shall be provided smokeless Chulhas. This will enhance fuel efficiency and reduce quantity of fuelwood presently used for cooking purpose.

10.3.6 Cattle and Poultry Management:

In order to improve the quality of the cattle population and their yield veterinary services is proposed to be strengthened. These would include mass castration of local scrub bulls, introduction of better local breeds, immunisation from diseases and extention works including training of village youths as 'Gosewaks' for providing basic veterinary services to the villages. These activities will be concentrated in villages located within or in close proximity to the forest areas.

10.3.7 Genetical Improvements in Live Stock:

To improve the present status of indigenous cattle and poultry in the villages around the Madhav National Park and in order to eliminate non - descript male cattle population and check the inbreeding and inbreeding hazards, it is proposed to induct

better germplasm of high producer (milk) and draught dual purpose with consultation with the local veterinary department.

The success of above essentially depends on the mass castration programme of scrub bulls

10.3.8 Animal Health Care and Immunization:

To take care of the health of live stock and poultry population of subjected village, one camp in each village per year shall be organised. The expenditure of one camp including cost of medicines and other managerial activities will be Rs. **7,500/-** (Unit cost).

To maintain the general condition of the health of animals and to increase the resistance power against the contagious diseases, vaccination programme is of utmost importance.

This will include immunization of live stock against the following contagious diseases which results death of wild ungulates.

(a) Foot and mouth disease
(b) Haemorrhagic septecemia
(c) Black quarter disease.

Improvement of Poultry

In the villages of biosphere area the poultry keeping is being done since ages in backyard form with the "desi birds".

Without developing any resistance against the dreadfull viral, bacterial and parasitic infestation (ecto and endo parasites) heavy mortality and production lossses of native germplasm occur which breaks the chain of income and nutritional loss occurs.

By way of immunization programme and control of Ecto and Endo parasitic infestation, we can produce immunity and improve production (Egg and Meat). Thus securing the native germ plasm.

10.3.9 Improvement of health, medicine and family planning:

In order to promote the general health of the villagers, especially women and children, a regular health monitoring plan will be implemented. Among the activities to be taken up shall be a regular schedule of health camps, a mobile health service, training of village level health workers, promotion of family planning activities, and a comprehensive immunization program along with an intensive education program about proper sanitary practices. Also included will be appropriate nutrition supplements for children and expectant mothers.

In some villages, household toilets shall be constructed on subsidised rates. These villages are situated right on the boundary of the Park and villagers do not have household toilets. They come within the Park boundary for desiccation. Similarly, some works to improve sanitation are also required. Villages internal roads are to be made pucca with proper drainage system facility. This will improve the health and hygiene condition in the village.

10.3.10 Drinking water:

Most of the villages are facing drinking water problem. Hand pumps, wells and bore wells are the main source of drinking water in the villages for human as well as cattle population. But, these are not in sufficient numbers to cater to the needs of villagers. Hence, to deal with drinking water problem tube wells with tanks, wells and hand pumps are to be established on priority basis.

10.3.11 Income generating activities:

In order to improve the economic condition of the villagers, identified individuals will be imparted training in order to adopt a profitable means of livelihood. Among the alternative employment activities to be explored will be carpet weaving, making of other handicrafts, tailoring, etc.

10.3.12 Education:

The project also envisages the promotion of conservation education through the agency of visits to the park and other protected areas, using folk theatre and puppet shows, film shows, and other interpretive materials.

CHAPTER- XI
RE-INTRODUCTION OF TIGERS

1. Introduction

The National Park is part of the landscape where tigers were the dominant species not very long ago. Its neigbouring districts of Sheopur and Ashok Nagar still support small tiger populations. Some of the largest tigers in the world have been shot around Shivpuri and Gwalior. The national park is situated in the middle of the landscape that connects Panna and Ranthambhore Tiger reserves, both situated in the dry tropics. The park has a long history of conservation and protection and it should be easy to secure a sufficiently large habitat to start a nascent population of tigers. The park has beautiful water bodies and extensive forest cover, the prime requirement for tigers. The prey base, though, is rather low, but this can be supplemented by translocation.

2. Recomendation of the high level committee

To fulfill the above objective the Government of Madhya Pradesh constituted a High Level Committee by Order No. F-91/28/2005/1/4 dated 22 Nov. 2005 (Annexure I) to examine the proposal for the re-introduction of Tiger in Madhav National Park, Shivpuri. According to the Terms of Reference set out in the above-mentioned Order, the Committee was given the following specific tasks:-

a) To examine the project proposal prepared by the Director, Madhav National Park, Shivpuri, for re-introduction of tiger and suggest modifications/ amendments or to recommend further studies that might be necessary.

b) To comment whether re-introduction of tiger is possible in Madhav National Park.

c) If the reintroduction of tiger is found possible, to suggest the protocol and a time frame for the operation and also to recommend the financial requirement for accomplishing the task and the sources from where financial support may be mustered.

The Committee suggested to provide the rationale for tiger re-introduction in Madhav National Park, including the necessity to revive the highly fragmented and threatened tiger habitats in northwest India. A multi-pronged strategy was also suggested to restore and revive the park with the aim of making it a suitable tiger habitat, having linkages with other tiger bearing areas like the Kuno Sanctuary in MP and Ranthambhore Tiger Reserve in Rajasthan. The proposal should be in conformity with the IUCN/SSC **Guidelines for Re-introduction** and included the broad cost estimates along with some innovative suggestions for funding the proposed initiative.

The Committee has taken into consideration the fact that the northwest range of tiger distribution in the country is marked by dominant dry deciduous forest and scrub-savannah type of vegetation. Such habitats have much greater potential for forage productivity suitable for the browsing ungulate prey of the tiger and the more open canopy structure therein is also a helpful factor. If the biotic pressures on such habitats are reduced sufficiently, specially by helping the local communities with viable livelihood options and the pasturelands are restored by meaningful interventions, including suitable animal husbandry inputs, the currently undermined carrying capacity of these habitats can be substantially improved both for the wildlife, including the tiger, as well as the local people and their livestock.

The Committee has suggested the following essential requirements have to be met for ensuring the success of the proposed initiative :-

1. A project of such a dimension and conservation significance requires total commitment and support from the highest level in the State Government. It is also necessary that the proposal receives approval of the State Cabinet.
2. As the programme involves re-introduction of an endangered species included in Schedule I of the Wild Life (Protection) Act, approval of the Central Government and the full involvement of the newly constituted National Tiger Authority will have to be ensured. Besides, timely financial assistance for village relocation, payment of compensation for acquisition of rights/ property and eco-development activities from the Central Government (Ministry of Environment & Forests) will be critical for the success of the programme. Further, the support of the Central Government

will also be necessary for other matters, such as engaging national and foreign institutions and experts during implementation.

3. The proposed closure of the central portion of the national park will surely cause public resentment and outcry, especially on the part of the local people who are presently dependent illegitimately on the resources of the park. This situation will have to be tackled with firmness and utmost tact.
4. The State Government must ensure posting of selected and dedicated staff for the implementation of the proposed programme and spare them from the vagaries of transfers and undue interference.
5. Ad hoc or piecemeal efforts will not work and it is crucial that detailed planning is done and a detailed project implementation plan with time-bound targets must be in place before starting execution on the ground.
6. For ensuring proper coordination guidance and monitoring, a steering committee at the state level and another at the district level should be constituted. The mechanism for regular and proper monitoring must also be setup.
7. The State Government must ensure that no development activity that may compromise the ecological integrity of the national park or pose a threat to the flora and fauna therein is allowed within or in the immediate vicinity of the national park.

The committee has also taken note of the problems associated with the two national highways passing through the national park. It is the considered view of the Committee that just as the Gwalior-Indore railway line was aligned with due care to avoid the national park area and, following the same criterion, now the NH-25 (to be upgraded as a 4-lane expressway) is being diverted away from the park. It is very necessary that the other existing highway. i.e. NH-3, that traverses through some parts of the national park, should also be diverted in such a way that the new alignment does not pass through any portion of the national park. The increasing valume of fast moving traffic on this highway, which will surely rise further in the near future, makes the suggested diversion even more essential. Besides, the Committee emphasises that until this is achieved, up-gradation of any public road passing through any portion of the national park should not be permitted.

The Committee wishes to reiterate, with all emphasis, that the above-mentioned stipulations have to be viewed as a single package, which has to be adopted in all seriousness, if the proposed plan of tiger re-introduction in Madhav national Park is to succeed in any measure. It is also necessary to emphasise that any casual approach or half-hearted implementation will not work and must not be attempted. The Committee is also of the considered view that the proposed plan provides a very good opportunity to mobilise and harness the much needed public support for the national park, specially from the people of Shivpuri town and the nearby villages, and all efforts must be made to achieve this purpose in the larger interest.

3. Strategy for Re-introduction of Tigers in Madhav National Park

On the basis of the recommendations of the high level committee, the broad contours of the strategy for re-introduction of tigers in Madhav National Park are as follows:

(i) Start with a small tiger population, consisting of a sub-adult male and one or two sub-adult females all at a stage where they can breed in an year or two. These may be elected from from different areas of a single park or from different parks. Preference shall be given to the stock from a dry deciduous region, similar to the re-introduction site. The sub-adult male can be older say 2.5-4 years as against the female 2-3 years. These are to be kept in an absolutely secure (fenced) but near-natural conditions, under proper scientific supervision, in the central part of the old park, between the two highways. The area of the proposed site is approximately 45 km^2. The central part the park has been selected on the basis of its compactness, infrastructure availability, prey base, water availability, convenient access, and its suitability for developing tourism, and above all, because it is the only part that links the older park with the extension area through the proposed corridor.

(ii) Simultaneously, prepare the extension area for receiving the progeny of the founder tiger population, along with an equitable and people-friendly rehabilitation programme for villages, situated in the corridor and the main extension area.

(iii) Undertake an ecodevelopment programme, with the help of district administration, in the surrounding villages, to win their support for conservation by mitigating their difficulties regarding pastures, fuel wood, employment and

by providing health facilities for women and educational programmes for children. The local people must see the arrival of the tiger as an advantage rather than a new threat.

(iv) The project is proposed to be financed as far as possible, fully or partly, though Public-Private Partnership (PPP). While the resources for ecodevelopment will mainly be generated through convergence of ongoing rural development schemes of the state, resources for village relocation shall be accessed from the Government of India. Resources for tiger re-introduction, preparation of site, and attendant scientific management, are proposed to be generated by sponsorships from business houses, conservation NGOs and other donors, both in India and abroad, as well as by exploring the possibilities of offering exclusive filming, documentation and tourism rights in exchange for investments and appropriate profit sharing. These agreements shall be negotiated on a competitive basis, as far as possible. A flexible and adaptive approach to fund raising is emphasized.

4. Action Plan

The tiger re-introduction process in Madhav National Park will broadly involve the following steps:

(i) Fencing

The central part of the old park, lying between the two highways shall be secured by erecting a 3-m tall fence. The fencing can either be a chain-link fencing, a masonry wall with/without a barbed wire top, or a combination of the two, depending upon site variability. The main fence will be supported by a 2-3 string power fence on the inner side to discourage the animals from coming close to the fence. A fair weather road (just a path) shall also be prepared along the inside of the fence to facilitate maintenance and inspections. In fact, a fence already exists along nearly 30 km out of the total perimeter of 36 km. It will be adopted for the purposes of the project, after necessary strengthening and repairs. Special designs will be required for the points where the natural drainages cross the fence.

(ii) Habitat Development

Habitat inside the proposed site is good with adequate fodder and water supply. As a result of the proposed fencing, there will be further recovery of the vegetation, as all illegal livestock grazing shall be eliminated. However, areas with any deficiency, especially regarding water availability shall be identified and treated, as required. Removal of unpalatable weeds, such as Parthenium, Eupatorium, Cassia *tora* and Lantana will also be undertaken on a site-specific basis.

(iii) Building up Prey Populations

Chital, sambar, nilgai and wild pig are the major prey species in the area. Presently, their combined population, numbering nearly 1400 in all, may not be adequate to sustain the introduced tigers. No real growth of these populations has been observed in the recent past despite the absence of tigers. Apart from natural predation and some poaching, these populations are under severe pressure from pariah dogs from the town of Shivpuri and adjoining villages. With the erection of the fence, poaching and the menace of dogs shall be eliminated to a substantial extent, and the prey populations are likely to grow faster. However, prey supplementation by translocation from other parks will be considered after detailed assessment of prey availability and requirement. Tentatively, translocation of 500 chital/ sambar/ nilgai may be required to stock the area adequately.

(iv) Construction of Boma (Temporary Holding Area)

A small enclosure, called Boma in South Africa, shall be erected to house the tigers on arrival, for observation and acclimitisation on arrival. The Boma will cover an area of nearly 100m by 100m and shall have the same fence as in the larger area. Hopefully, from some contact with the power fence, the animals will learn that they must not go near the fence. If any health treatment is required, the same may also be provided, before release. The stay in the Boma will of short duration only.

(v) Development of Infrastructure

On site housing facilities for the scientific team and their assistants shall be required. A small field lab for storing biological samples that may be collected from time to time shall also be required. Efforts shall be made to use existing buildings for this purpose as far possible. These facilities shall be development along with the erection of the fence.

(vi) Selection and Translocation of Tigers

This starting stock can best consist of a sub-adult male and one or two sub-adult females all at a stage where they can breed in an year or two, to be selected from different areas of a single park or from different parks. Preference shall be given to the stock from a dry deciduous region, similar to the re-introduction site. The sub-adult male can be a older say 2.5-4 years as against the female 2-3 years. Because the selected animals have been brought up in wild environment and on wild prey under training and care of their respective mothers, they would not need fostering by humans, provided food in the form of natural prey (with only minimal facilitation in the initial few days) is available. They would have their own urge to come together and breed once they young female comes in estrous. Once they show signs of having settled, another similar male or a couple can be brought from another park after 4-5 years. Once additional habitats, along with the corridor are ready, as a result of village relocation and ecodevelopment, and show signs of revival of habitat and natural prey buildup; some of the animals can be selectively taken and released in other revived areas of the Madhav National Park.

(vii) Monitoring

The health, behaviour, movements, interaction with other species, both prey and co-predators shall be continuously monitored thorough a team of wildlife biologists, who will be part of the team to be constituted for project implementation. The Wildlife Institute of India and some other national institutions involved in wildlife research, shall be approached to become partners in the project to provide scientific inputs both for planning and implementation of the tiger introduction, as well as for monitoring the

establishment of the introduced animals. Latest telemetry techniques and equipment shall be used for monitoring.

(viii) Rehabilitation of Villages from the Extension Area

Additional habitat for the establishment of a self sustaining population will be available in the proposed extension area of the park. The tigers and the prey can spread to the extension area only if the villages, first from the corridor, and then from main block are relocated expeditiously. The District Magistrate/ Collector of Shivpuri has already completed the assessment process and the relocation process can begin as soon as funds and land are made available. The process will be expedited in order to keep pace with the progress of tiger establishment in the old park.

(ix) Eco-development

Eco-development inputs in the bordering villages will go on concurrently with the other operations. A committee at the district level of at the level of Commissioner shall be constituted to direct rural development resources into the target villages on a preferential basis. Emphasis shall be made on giving people alternatives for their dependency on the park, especially related to livestock, grazing and fuel wood needs. A conscious effort to link the arrival of the tiger with the welfare of the local people, by providing health and educational benefit through this project shall also be pursued. The project would provide support for preparation of village micro-plans.

(x) Tourism and Filming

Development of ecotourism focusing on introduced tigers, taking benefit of the scenic beauty and the heritage buildings available in the park shall be a major activity focus of the project. The entire re-introduction and establishment process shall be filmed. Excusive rights for preparing documentaries on the re-introduction process are proposed to be marketed, on a competitive basis, if possible, before the initiation of the project. Possibilities for marketing tie-ups for tourism with reputed tour operators shall be explored. Efforts shall be made to generate maximum funds through these activities to finance the project to the extent possible.

(xi) Consultancy Support

An innovative venture of this nature, which may pave the way for future conservation initiatives in the country must be planned and executed with utmost care and efficiency. There should be absolutely minimal chance of a failure. India has no experience of successful re-introduction and re-establishment of major wildlife species, except in the case of rhino and gharial. Without the support of experienced professionals, who have executed similar jobs successfully, the chances of something going wrong at some stage will always be there. A large body of experience in capture, translocation of carnivores and herbivores is available in other parts of the world particularly Africa. This experience may be extremely useful in ensuring a success of this project. Technical support from experienced professionals shall be made available throughout the period of the project. The planning and implementation of this project would provide valuable opportunities to wildlife scientists and protected area managers to practice adaptive management.

5. Project Duration

The project is proposed to be implemented over 10 years, in two phases. Phase I will consist of the establishment of the founder population, along with ecodevelopment and rehabilitation of villages in the extension area and the corridor. Phase II will consist of the establishment of the tiger population in the extension area through a guided migration or translocation, after the villages have been relocated. Ecodevelopment, awareness raising, tourism, filmmaking and other ancillary activities shall continue in both the phases. The two phases shall merge into each other seamlessly. A detailed time schedule shall be prepared by the implementing team after all the clearances are available.

6. Cost Estimates

The estimate of costs is as follows:

I	Tiger Re-introduction Operations	: Rs. 1143 Lakh or US $ ca. 2.48 million
II	Ecodevelopment Operations	: Rs. 640 Lakh or US $ ca. 1.39 million
III	Village Relocation	: Rs. 3500 Lakh or US $ ca. 7.60 million
	Total :	**Rs. 5,283 lakh** **or Rs. 52.83 Crore or** **US $ ca. 11.48 million**

These are very broad, indicative estimates, mainly to understand the scale of operations, Actual estimates, based on detailed planning may be significantly different from these estimates.

These estimates are only for the first phase of project. Estimates for the second phase will be worked out at the appropriate time based on experience and progress of work in the first phase.

CHAPTER - XII

WILD LIFE HEALTH MANAGEMENT

Madhav National Park have a great biodiversity in abundance. Park has fair population of carnivores and herbivores. Beside this Park have about 122 villages in its 5 km. periphery of the boundary, in which there are about 60,000 livestock population interface with wild animals.

So management of health of these wild animals and livestock is an important activity of the Park. For ideal veterinary care following proposals given below :

12.1 Objective

1. To maintain healthy population of wild animals in the Park.
2. To reduce non-productive livestock population in the surrounding villages.
3. To prevent the possibilities of transmission of diseases from domestic to wild animals and vice-versa.
4. To provide required veterinary care to injured, orphan and rescued wild animals.
5. To research on wild life health related topics.

12.2 Problems

1. Adequate infrastructure is not available for health management activities.
2. No technical supportive staff is available.

12.3 Proposals

1. Well trained adequate staff should be provided in the well equipped veterinary unit of the park. The staff setup is given below:

S.no.	Name of proposed post	No.
1.	Forest veterinary officer	01
2.	Forest veterinary field assistant	04
3.	Forest veterinary lab technician	02
4.	Clerk	01
5.	Peon	01
6.	Safaiwala	01

2. Establishment of separate well equipped and adequate building at proper place. Required building must have these structures given below:

S.no.	Name of proposed building	Cost in lakhs
1.	Office of Forest veterinary Officer and its staff .	10
2.	Laboratory	25
3.	Operation theater cum treatment room.	15
4.	Post-mortem and incinator room.	15
5.	Store	5

3. There should be provision for separate mobile veterinary care vehicle is required.
4. Vaccination of the domestic animals of 5 km. surrounding villages for FMD, H.S. & B.Q. every year.
5. Treatment camps should be organized in EDCs of the park every year.
6. Projects should be made for reducing non-productive cattle population and traning program organized to the villagers for livestock rearing.
7. Monitoring of the wild as well as domestic animals should be done by collecting different samples and analysis in laboratory.

12.4 Information of routine veterinary health working :

12.4.1 Veterinary care of wild animals and surrounding village's livestock

As the cattle grazing is very common in the MNP and wild animals are liable to attack by different diseases such as Foot and Mouth, Anthrax, H.S., B.Q. etc. that transmitted through cattle, so veterinary care of livestock is one of the most important duties of the park authorities. Veterinary unit should be engaged for care of livestock on fringe villages by means of immunization and treatment camps.

12.4.2 Monitoring

Monitoring of health of wild animals and domestic animals for the following parameters are important for the evaluation of health and detection of diseases.

For the maintenance of health of wild animals inside the park, it is essential to monitor and survey the parasitic and infectious diseases, periodically. On

the basis of information available by these reports park managers can adopt or can take necessary actions to prevent the disease outbreaks.

Following parameters are important for the detection of diseases in the wild ungulates of Madhav national Park.

Methods of monitoring of health

A. General examination
   a. Physical examination
   b. Clinical observation

B. Laboratory test
   c. Faecal examination
   d. Hematological examination
   e. Serological examination

C. Study of kill
   f. Detailed post-mortem examination
   b. Collection of material for laboratory examination

A. General Examination of animal includes:

a. Physical examination: Body Condition Evaluation

This is the first step of the clinical examination. The inspection of the animal should be undertaken in unhurried fashion and should involve as little as possible disturbance to the animal. Body condition may be normal, emaciated or cachetic.

Body part	Point = 0	Point = 1	Point = 2
Skin coat	Smooth with luster	Dull without or with little luster	Rough, thick with folds, no luster
Flank	Depression is barely visible, outline is indistinct	Slightly concave and outline visible	Depression concave and tucked in
Ribs	Thoracic surface is smooth, ribs not visible	Ribs are visible but all can not be counted	Ribs clearly visible within costal depression
Pelvic girdle	Bony projections of pelvic girdle are barely	Slightly visible	Clearly visible

	visible		
vertebral column	Laterally it is smooth without any break, lumber processes visible	Lateral processes of the lumber are visible	Lateral processes prominent
Lumber shelf	No depression in shelf, areas almost round from behind	Slight depression on either side	Depression deep and concave

Interpretation

0-4 - Good

5-7 - Fair

8-10 - Poor

b. **Clinical observation**

i) Mastication and Salivation

Observer should carefully examine these, whether this function is slow or less.

ii) Change in Behaviour

Observer should look for changes in behaviour, like whether the animal is excited or dull. By understanding these behavioural changes one can suspect parasitic gastroenteritis, etc. The animal may show difficulty in mastication and excessive salivation in Rinderpest, FMD, Actinosis, etc.

iii) Gait

Gait means how an animal walks. While walking an animal may show some abnormalities. The observer should examine the movements of an animal. If the animal is lambing then the observer should record the affected leg and type of lameness. He should also examine the joints particularly in case of young animals. Lameness may be observed in FMD, Rickets and joint ill.

c. **Dehydration**

There are two main cause of dehydration:

i) **Lack of water intake -** This is usually due to water deprivation of possibly a lack of thirst that occurs in conditions such as Toxaemia or any physical problem like in Pharyngeal paralysis, Oesophageal obstruction.

ii) **Excessive loss of body fluid in diarrhea -** Bacterial, viral and parasitic diseases.

2. Laboratory test

a. Faecal Examination

This includes gross examination and microscopic examination. Faecal samples should be collected from the grasslands, which are common for both wild ungulates and domestic animals. Fresh faecal samples should be collected in the morning hours, preferably between 8 to 9 am. Sample should be collected in clean glass vials containing sufficient quantity of 10% formalin.

Microscopic Examination

II. **Direct smear method -** The direct smear can be made by using either tape water or physiological saline. The saline is good for trophozoids, will remain intact and motile. This is a rapid and an easy method but eggs and occysts are not concentrated. Place a drop of the diluting fluid on a glass slide and thoroughly mix a bit of faeces with it, cover it with cover slip and examine under microscope.

III. **Sedimentation -** Most operculated trematode eggs and a few nematode eggs are difficult or impossible to recover by flotation and sedimentation technique. Mix one gram of faeces with 40 ml of saline in a beaker, making certain that the faeces are thoroughly dissociated to make the eggs separate. Centrifuge the sample containing eggs at a moderate rate 2 to 3 thousand RPM for 5 minutes. Discard the supernatant and collect a small quantity of sediment with the help of a pipette, put a drop on a clean slide. Cover it with cover slip and examine under microscope.

IV. **Floatation method -** Take one to two gram of faecal sample with sufficient saline in a beaker to make a fluid mixture. The faeces must be dissociated from the eggs and occysts. Filter the mixture through muslin cloth and discard the debris. Transfer the fluid in centrifuge tubes and centrifuge for 5 minutes at 1000 RPM. Discard the supernatant and add Zinc Sulphate solution or saturated salt solution and mix thoroughly. Centrifuge again for same time at same speed. Using the wire loop,

remove fluid from the top of the centrifuging tubes, place it on a clean glass slide, cover it with cover slip and examine under microscope.

b. Haematological Examination

Blood examination is a good tool for the evaluation of animal health. It provides the information regarding functional state of the different systems and organs of the body.

The blood should be collected after immobilization of the wild animal, from the jugular vein in a dry, sterilized and chemically cleaned glass containers (vials). About 5 ml of blood is required for haematological examinations. The blood should be mixed with 1-2 mg of anticoagulant (EDTA) per ml of blood. Vigorous shaking should be avoided as it results in haemolysis. It is desirable to start the examination within an hour of the collection, but if it is delayed, the sample should be stored in a refrigerator for 4 degree centigrade for 24 hours.

For routine haematological study following parameters are taken into consideration.

1. Total Erythrocyte count (TEC)
2. Haemoglobin estimation.
3. Packed cell volume (PCV)
4. Total leucocyte count (TLC)
5. Differential Leucocyte count (DLC)
6. Total plasma protein
7. Reticulocyte count
8. Fibrinogen indices
9. Erythrocyte indices
10. Erythrocyte sedimentation rate
11. Icterus indes (II)
12. Erythrocyte morphology

Collection of Serum

The blood should be collected in a sterilized, dry and chemically cleaned glass container. Blood should be allowed to clot for 1 hour at 37^0C. At this stage the clot should be freed from the walls of the container by using sterile defibrinating stick and the blood is left at 4^0C. for overnight. Serum with minimum RBC_S can be withdrawn

by pipette to centrifuge tubes. The serum is spun at 1500 RPM for 20 minutes to remove red cells. Preservatives can be added at this stage. Serum sample should not be pooled and store separately.

Storage of serum:

Serum may be stored in sterilized, dry and chemically cleaned screw-capped glass vials or small universal-capped tubes. An airtight seal is essential for all containers. Rubber-capped vials should not be used. Containers should be labeled properly with sample number and date of collection. The serum may be stored in liquid nitrogen containers of deep freezer.

Preservatives:

Thiomersal (Merthiolate) 1:10,000 or Sodium acid 0.1% (weight/volume) are good for long term of storage of sera.

Serological examinations can be conducted by

1. Precipitation Test
2. Complement fixation test
3. Enzyme linked immuno-sorbant-assay (ELISA)

These tests require sophisticated instruments, hence can be done only in well-established laboratories. Therefore, serum samples should be send to Indian Veterinary Research Institute, Izzatnagar or nearby Veterinary colleges of Indian Wildlife Health Co-operative centers for central region located at Jabalpur.

12.5 Brief information of some important diseases of wild animals.

1. Foot and mouth disease (FMD).

Foot and mouth disease is an acute febrile highly contagious disease of cloven footed animals. Disease is caused by Picorna virus. Morbidity is 100% but mortality is less. Clinical signs of this disease are high temperature, apathy to food, vesicles on oral muscosa, inter digital space and udder. There is no specific treatment of the disease provide symptomatic treatment to the animals. Immunization is the way of control the disease in the affected area.

2. Canine distemper (CD).

Canine distemper is an acute highly infectious disease of carnivore animals caused by Paramyxo group of virus. Disease is characterized by diphasic fever, ocular and nasal discharge, bronchopneumonia, vomition, haemorrhagic enteritis and some time skin of foot pad and nose may become hard due to hyperkeratitis. There is no specific treatment but provide supportive treatment according to symptoms. Use vaccine to control the disease.

3. Rabies

This is an acute zoonotic infection in man and other warm blooded animals. The disease is caused by lyssa virus and characterized by sign of abnormal behaviour, nervous disturbances, impairment of consciousness, ascending paralysis and death. The disease is propagated by bite from animal to animals and animals to man. Anti-rabies vaccine should be used as a preventive measures.

4. Feline pan leukopaenia (FPL)

This is highly contagious disease of cats. The disease caused by DNA virus and characterized by fever, anorexia, depression, vomition, diarrhoea, marked leukopaenia and high fatality rate. There is no specific treatment. A course of broad spectrum antibiotics may be of value in combating secondary bacterial infection. For preventive measures vaccination should be done as a routine protocol.

5. Anthrax

It is an acute widespread infectious disease of animals which is zoonotic in nature. The disease is caused by bacteria known as *Bacillus anthracis*. Transmission of the disease is by spores. High rise of temperature, refused to eat, bloat, muscular tremor, dyspnoea, oozing of blood from natural orifice & death are some main features of the disease.

6. Haemorrhagic septicaemia (HS)

This is an acute safety septicaemic disease of most of the herbivores animals. It is caused by Pasteurella multocida bacteria. The disease is characterized high rise of temperature, depression, pneumonia, pleuritis, pericarditis and arthritis. In treatment sulpha drugs are very effective to cure the animals. For control various type of vaccine are available in the market.

7. Tuberculosis (TB)

It is a chronic, insidious, contagious and zoonotic disease of man and animals caused by Mycobacterium bacteria. The main symptoms are lose of body weight, respiratory problems like dyspnoea, increase rate of respiration, persistent and painful dry hacking cough. Iso-nicotinic acid have been used as chemotherapeutic agent for encouraging results.

8. Black quarter (BQ)

This is an acute infectious disease caused by *Clostridium chauvoei* bacteria. Clinical sign of the disease are development of focal gangrenous and emphysematous myositis gives rise to crepitation and sero-haemorrhagic swelling in the heavy muscles like gluteal muscles. The disease produces severe toxaemia with a very rapid course and high mortality. Satisfactory response has been reported from the use of penicillin, aureomycin and oxytetracycline. Vaccination is the way of control the disease.

9. Trypanosomiasis (Tryps)

It is an infectious protozoan disease which is caused by *Trypanosoma evansi*. High rise of temperature, anaemia, wasting and cutaneous eruptions. Effective drug for curative purpose is quinapyramine.

12.6 Detailed Postmortem examination

12.6.1 Precautions before postmortem

The following points have to be borne in mind before one proceeds with the examination of the carcass:

1. If the animal is suspected to have died of poaching and poisoning, the case should be handled by the forest department. Any case of poisoning must be subjected to legal investigations.
2. Protective clothing is always advisable when zoonotic disease are suspected. While rubber gloves are essential, over-alls and gum-boots are desirable.
3. Check nostrils, mouth, anus and genital orifices of the carcass for evidence of blood stained discharge which are signs of anthrax. But distinguish the blood discharge of anthrax from injuries caused by scavenging birds which often

prefer these areas. Discharged blood due to anthrax is tarry red in colour and does not coagulate (clot) upon exposure to air. It can be seen in most natural orifices but there can also be exceptions. Evidence of skin damage and clotted blood sticking around the soft body parts indicate external injuries caused by scavenging birds.

Do not open the carcass if anthrax is suspected. If such carcasses are opened. anthrax organisms *(Bacillus anthracis)* may sporulate and the spores survive in the soil for several years. These spores can cause anthrax when it come in contact with other susceptible animals. Anthrax is a zoonotic disease, but not as dangerous as rabies. Make several blood smears from superficial veins blood smears revealing bipolar organisms will only 'suggest' anthrax because several organisms resemble anthrax bacilli when see under a microscope. It is therefore essential to collect a swab of blood and transport under refrigeration to the laboratory for isolating the bacteria by culturing.

4. From the human hazard point of view, rabies is an important zoonotic disease. It is imperative that all disease investigators should be immunized against rabies. A rabies suspected carcass can however, be examined safely even by a non-vaccinated person if handled with proper care. One should wear gloves and take sufficient care not to get injured while opening the cranium or beheading in case of doubt. one can always undergo a post-exposure treatment.
5. Take a colour photograph of the animal before PM include also the surroundings of the animal in the frame. If you consider that some of the externally visible abnormalities are of significant importance (eg. blood discharge, gun-shot wound, prolapse of internal organs, foot and mouth lesions, loss of hair, ear sore, fracture, bite mark etc.), take a close-up picture of them. But often the problems are internal.
6. As far as possible a rough estimate has to be made of how long the animal has been dead. This can be assessed by looking for the following **PM changes**.

(i) Rigor mortis (RM) - While the presence of RM would suggest a recent death, absence would mean that either RM has not set in or it has disappeared. This rule is generally applicable during summer. In winter, RM takes a longer time to disappear.

(ii) Autolysis - When RM is absent, the age of the carcass can be assessed once it is opened. Muscles show autolysis in advanced cases and are often watery and soft.

(iii) Heart blood - Presence of unclotted blood in the heart is an indication of recent death.

12.6.2 External examination of the carcass

1. Look for bite marks of carnivores. If present, do not conclude that kills need not be autopsied. Bite marks and feeding sings by carnivores can follow subsequently to a natural death. Moreover, week and sick animals are more likely to be predated on the healthy and strong animals. A fresh kill is a valuable source for parasitological and pathological investigation.
2. Look for external injuries, like evidence of fight among conspecifics (antler/horn punctures), gun shot wounds and rashes.
3. Palpate the limbs, flex and extend them for evidence of fracture.
4. If muzzle, eye-balls and other soft body parts are damaged by scavengers, make note of it.
5. Look for ectoparasites on the skin surface. Examine all body surfaces, particularly neck, groin, pinnae, brisket, and hoof-clefts/inter digital space. As some species of ectoparasites leave the dead host as the carcass cools down, efforts should be taken to collect all ectoparasites immediately after death. This becomes immaterial, however, in the case of a chemically immobilized animal where body temperature is maintained. Lice and fleas can be dislodged from hairy parts using a comb. All ectoparasitological findings should be recorded in a format.
6. Examine the body surface for rashes and extensive areas of rough and hard skin. These may be scabies or mange caused by mites in the skin. Though these mites can be seen only microscopical examination, their presence can easily be established by the lesions they cause. These can be any where, but examine particularly around mouth, lips, nostrils, flanks, neck and hind quarters. Also look for skin warbles which are caused by infestation by warble fly *(Hypoderma spp)* larvae.

7. In mammals, examine mammary glands for evidence of lactation. This can be done by squeezing the teats of the mammary gland. If lactation is evident, milk should be collected for bacteriological examination. Milk is a diagnostic material in mastitis (inflammation of mammary gland) and many infectious

diseases affecting reproductive system (Brucellosis, Vibriosis ect.). Make a slide smear of milk for demonstrating acid-fast organisms and collect about 5 ml of milk aseptically for microbial culturing.

12.6.3 Internal examination

Make sure that you have all the basic equipments, specimen containers and preservatives. Protected areas should keep a stock of these items of equipment and be prepared before calling a veterinarian. The preservative one most often has is formalin which is good enough for tissue specimens for histopathological examination and preservation of parasites. But remember that only very few diseases (eg. paratuberculosis, canine distemper, tuberculosis) can be confirmed by histopathological examination. Other diseases can be confirmed only by isolating and identifying the causative organisms from the affected organs.

(A) RUMINANTS

1. To avoid the interference of rumen during dissection, make the carcass lie on its left side.
2. Lift right fore and hind limbs and disarticulate them at shoulder and groin respectively. (Remove the udder in the case of females).
3. Make a midline incision on the skin from pubis to throat, dissect and fold the skin sideways on either side.
4. Abdomen is now opened without severing internal organs, particularly rumen.
5. Extend the abdominal incision further towards the sternum and from there change the direction of incision downwards all along last rib or between the last two ribs till you reach the back bone. This is done on either side.
6. Sever the diaphragm from all its peripheral attachments.
7. Make a downward incision, starting from the neck-base, all the first rib till you reach the back bone.
8. Saw through the articulation between ribs and vertebrae on either side and open the rib cage.

(B) EQUINES

1. Equines have very large colon and caecum, positioned on the right side of the abdomen. To avoid their hindrance while dissection, position the carcass on the right side.
2. The left fore and hind legs are disarticulated by cutting through the shoulder and groin respectively.
3. Incise the skin from the anus to chin and reflect it on either side of the body.
4. Open the abdomen by an incision from pubis to sternum, without disturbing the internal organs.
5. From now on, follow the same procedure for opening the thorasic cavity. The other method is to saw or axe through the sternal and vertebral ends of ribs and thus split open the thorax.

(C) CARNIVORES AND SWINES

1. Carnivores and pigs do not have large stomach or intestines. Hence place them on their back.
2. Disarticulate all the limbs by cutting through the shoulder and groin.
3. Make an incision beginning from the pubis to chin, first on the skin, then muscles.
4. To open the thorax, disarticulate the ribs from the sternum and simultaneously lift and reflect the sternum. If necessary the ribs can be reflected back.

(D) SMALL CARNIVORES,BIRDS,TURTLES AND LIZARDS

Since these animals are usually small and easy to carry, the whole animal can be preserved and transported to the nearest veterinary laboratory. Double pack the whole carcass in clean plastic bags, keep it in a thermocole container with ice packs on all sides in case of epidemics. increase the number of carcasses for examination when it becomes imperative to perform a postmortern on some individuals particularly large birds(bustards, vultures, pelicans cranes etc) the followings procedures can be adopted.

1. Make the birds lie on its dorsal side. The birds can also be fixed wooden boards by nailing on the wings and legs.
2. Feathers are moistened using a disinfectant solution.

3. Make a midline incision on the skin and peel its skin backwards .
4. Cut through the breast muscles, to expose the breast plate(sternum)
5. Remove sternum by cutting through the ribs
6. Now oesophagus, heart, liver and gizzard are visible for examination. Dissect out any abnormal organ.

12.6.4 Examination for abnormalities

Once you open the carcass and expose the cavities and internal organs, discard the gloves, knife and all other equipment which may have been used till then. Remember that you are now proceeding to collect specimens for laboratory diagnosis which to be carried out under strict aseptic precautions. Record all observations immediately after completion of every body system in the PM records sheet and never rely on your memory. Examine digestive system in the end to prevent spillage of gut contents on other organs . Give a detailed description of every part examined. if no abnormalities were detected in an organ (Say liver), mention NAD (=No Abnormalities Detected) and if you did not examine any organ/part (often the heads), mention NE (=Not Examined). A separate format can be used recording endoparasitological findings. Keep a copy of both these formats ready before proceeding with the PM.

A. BODY CAVITIES AND SUB-CUTANEOUS TISSUE

Pathological	Parasitological
Examine sub-cutaneous (s/c) area for bruises & haemorrhages. Burns in the subcutis could be due to lightning strike . Examine cavities of thorax & abdomen for abnormal amount of fluid. Note down its quantity . colour and Consistency. if necessary . collect some fluids in a plain vacutainer tube or test tube.	Look for nematodes & fly larvae on s/c surface. Cysts are found in body cavities of ruminants, usually located close to the internal organs of thoracic, abdominal & peritoneal cavities. Also look for nematodes in body cavities.

B. SPLEEN AND LYMPH NODES

Pathologically, spleen and lymph nodes are important organs. Examine for abnormal enlargement. Where there is infection, these organs get enlarged and there may be even abscesses. In such cases, collect a portion of spleen (or the whole lymph node) in a sterile container. Take multiple samples and preserve in 10% formalin (for histopathology), in 50% buffered glycerine (For virology) and a few parts under refrigerations/freezing (for microbilogy). Borax is an alternative for refrigeration. Smears made from cut surface of these organs will be useful in diagnosing diseases like Theileriasis (a haemoprotozoan disease).

C. RESPIRATORY SYSTEM

Pathological	**Parasitological**
Look for tumours and tumour-like eruptions in the nasal passage. Open trachea and bronchioles, look for presence of mucous & blood. Examine lung, note for colour and consistency. Look for nodules which may be due to tuberculosis or cysts. If present, note down the proportion of lung affected. Lung is an important organ of abnormality for many diseases.	Nasal and tracheal passages may harbour nematodes. Occlusion of respiratory passages by heavy lungworm infection is a possibility. When cut pieces of lung are left in a basin of water for 15 minutes, the worms will sink to the bottom. Lung is also an important organ to look for cysts. One should be able to differentiate cysts form tuberculous nodules. While TB nodules area extensive and small, cysts are soft, larger and contain larvae.

D. LIVER AND GALL BLADDER

Pathological	**Parasitological**
Examine liver for colour, consistency and abscesses. Slice the liver at a number of places to detect any hidden abnormalities (haemorrhage, pus). Also look for tuberculous nodules.	Look for cysts on the liver and in the liver while slicing through. Open the gall bladder and bile duct for liver flukes. Some times nematodes and tiny adult tapeworms can be found.

E. HEART AND BLOOD VESSELS

Pathological	Parasitological
Note the amount, colour and consistency of pericardial fluid. Peel off the epicardium, examine heart surface for pale areas, blood tint, cysts and necrosis. Expose heart chambers and note down the nature of blood (clotted or partially clotted or unclotted). Heart blood is an important diagnostic material. Collect whole blood in case of suspected poisoning and for microbial isolation. Partially collected blood is good for serum separation.	Look for cysts in heart muscles of ungulates and heart worms in heart cavities of carnivores. Look for nodules or ulcers in all large blood vessels (LBV) close to heart. Filarid worms can be seen embedded in LBV close to heart. Blood flukes may be present inside blood vessels. For blood protozoans, which can not be seen with naked eye, blood smears have to be made.

F. DIGESTIVE SYSTEM

Examination of the alimentary is an important part of PM examination as it includes many organs. beginning from oesophagus to rectum. besides invariably most carcasses have a helminth parasites in stomach and intestines. While their presence undoubtedly suggest an infection. it does not necessarily mean that the animal is diseased. As for as possible, organs of the digestive system should be examined last to avoid spillage of gastro-intestinal (GI) contents. For easy and systematic examination of GI tract. tia a knot at either end of the tract (one on the proximal end of oesophagus and the other at the distal end of rectum). The GI tract can now be examined separately either by removing wholly or (preferably) in parts by tying more knots (between stomach and duodenum, and at ileo-caecal junction in order to separate large and small intestines).

Pathological	Parasitological
Oesophagus: Open the passage and look for occlusions by foreign bodies, ingesta and tumours. Examine the inner wall for abnormalities.	The inner wall of the oesophagus may have nematodes which are usually embedded, sometimes in a nodule.

Stomach: In the case of ruminants, note the colour, consistency and amount of rumen contents. If necessary, collect some. Examine reticulum for foreign bodies. Abomasum in ruminants and stomach of non-ruminants are important sites of stomach for inflammation, haemorrhagic spots & other abnormalities. If required, preserve cut pieces of stomach in different preservatives.	In ruminants, look for rumen flukes attached to the inner wall of rumen. Flukes may also be present in abomasum and intestine. Stomach of non-ruminants and carnivores (and abomasum of ruminants) may have a variety of nematodes. Make not of their approximate numbers and collect a few for species indentification.
Small intestines: Empty the contents of duodenum & ileum separately into clean containers. Cut open the passage throughout the tract and examine the inner wall for haemorrhagic streaks, spots and other lesions.	Examine the intestinal contents and the inner wall for endoparasites. Note their abundance, and collect few specimens. Collect 5 gm of the contents in 10% formalin and 5 gm in 2.5% potassium dichromate.
Large intestines: Empty the contents of caecum, colon and rectum into different containers. Examine both contents and inner wall of these parts for abnormalities.	Large intestines may harbour nodular worms, whip worm, hook worm and sometimes flukes (in ruminants). Preserve faeces for ova and oocyst examination as described for intestinal contents.

G. UROGENITAL SYSTEM

Pathological	**Parasitological**
Kidneys: Examine by stripping off its capsule. Note its consistency (soft / firm / pulpy). Look for abnormalities like haemorrhagic spots and abscesses on the surface. If you notice any abnormality, collect & preserve in different preservatives.	Cut through the kidneys and look for cysts and kidney worms.

Urinary Bladder: Examine whether it is full or empty. Collect urine samples (i) in case of suspected poisoning, (ii) death due to capture myopathy and (iii) for demonstrating eggs of kidney worms. Add no preservatives. A urine smear can be made for demonstrating the presence of microscopic organisms. Open bladder and look for lesions. Preserve selected parts of bladder in 10% formalin if necessary.

Genital organs: In case of females, examine the uterus for pregnancy. If not, open the tract for scars of previous implantation. In case of abortion, collect uterine fluid and endometrial

tissues, including cotyledons and caruncles, for microbiological examination. Examine ovaries for cysts. Similarly, examine male reproductive organs also.

H. HEAD, BRAIN AND NASAL CAVITY

This part is sometimes left without detailed examination. If rabies is suspected, however, send the whole head packed in ice to the laboratory. If the head is too big, open the cranium and send the brain under refrigeration. If the diagnostic laboratory is very far, divide the brain into two equal halves along the midline. Preserve one half in 10% formalin and the other half in 50% buffered glycerine. While the former can be used for histopathological diagnosis, the later can be used for diagnosing rabies by Fluorescent Antibody Test (FAT) or by mouse inoculation. If gross pathological lesions are found in the brain, one half (in 50% buffered glycerine) can be sent for diagnosing rabies and the other half can be subjected to further investigation.

Pathological	**Parasitological**
Examine brain for abscesses and haemorrhages. Disarticulated the lower jaw and examine for tooth wear. Examine gums, tongue and buccal mucosa for ulcer.	Expose the nasal passage and look for bot fly larvae. Examine eyes for eye-worms. Cut through tongue for cysts. If necessary, brain can also be examined for nematodes & cysts.

I. MUSCULATURE

Pathological	Parasitological
Shoulder or thigh muscles have to be examined in case of black-quarter (BQ) disease. Samples are essential for bacteriological examination if BQ is suspected. Necrosis of skeletal muscles is a PM finding in capture myopathy (a non- infectious disease associated with capture of wildlife).	Musculature is an important part to look for cysts. Cut through muscles, particularly muscles of jaw, loin, shoulder and thigh of ruminants and swine for cysts. If cysts are present, make note of the location (muscle name) & indicate the number of cysts found. Besides cysts, muscles may also have tiny nematodes.

12.7 Collection and preservation of specimens

It is not always possible to make even a provisional diagnosis based on post-mortem findings alone. No disease investigation is complete unless it is confirmed by laboratory findings. Though it is preferable to submit the whole carcass to the pathologist in the laboratory, it is often not possible to do so in the case of large mammals. The investigator should have an idea about collection and preservation of laboratory materials. The ability of the pathologist at the laboratory to correctly diagnose the disease depends on what materials were collected, and how they were collected and preserved. This of course includes appropriate packing and despatch of the material. It is essential to remember the following points :

1. Specimens should be collected from a fresh carcass as far as possible. As decomposition sets in quickly, (this is variable according to season) efforts should be made to collect specimens once the carcass is located.
2. As a general rule, specimens should be collected in clean and dry containers. They should have been sterilized when specimens are to be collected for microbiological diagnosis. There are different types of specimen containers available for collecting various diagnostic materials.
3. Materials for microbiological examination should be collected with strict aseptic precautions. They must be subjected to refrigeration/freezing immediately after removal from the carcass. This can be achieved either by

carrying a ready-made assemblage of cooling agents inside a thermocole box or the specimens can be temporarily collected in a sterile container and kept inside a thermos-flask before it is kept in the thermocole box with cooling agents. For details on the method of packing such specimens with cooling agents.

4. Selection of materials for laboratory diagnosis depends on the disease suspected.
5. The investigator should collect and submit as many specimens as possible, duplicating each specimen. In different preservatives for different diagnostic tests (histopathological, microbiological and toxicological). In the field one may have only formalin and a few containers. Preserving parts of all major organs (heart, liver, lung, kidney, spleen, stomach, intestines, bladder, muscles etc.) in 10% formalin is of considerable value in diagnosing diseases like tuberculosis, johne's disease, canine distemper, capture myopathy etc.
6. As a general rule, specimens should reach the laboratory as early as possible. However, certain materials can be with held for a few days, some for months or even years while others require an immediate despatch to the laboratory. This will depend on the type of material and the preservation method used.
7. All collected specimens should have a label. If specimens containers are small, they should be marked with a code number and the details can be mentioned in the laboratory specimen form.

Proforma for body condition evaluation of wild animal

Protected area ---------- Species ----------

Date	Locality/ / Beat	Age	sex	Score for different body parts									PCI	Remark
				1	2	3	4	5	6	7	8	9		

1. Flank area
2. Ribs
3. Pelvic girdle
4. Vertebral column
5. Temporal depression
6. Tail contour
7. Lumber shelf

Signature.....

Investigator.....

List of diseases of wild animals

1- Bacterial diseases

Tuberculosis

Paratuberculosis

Nocardiosis

Anthrax

Pasteurellosis

Clostridial infections

Strangles

Streptococcosis

Staphylococcosis

Salmonellosis

E.coli infections

Shigellosis

Aeromonas infections

Pseudomoniasis

Leptospirosis

Plague

Corynebacterial infections

Mycoplasmonsis

2- Rickettsial diseases

Anaplasmosis

Coxiellosis

Ehrlichiosis

3- Mycotic diseases

Mycoses

Aflatoxicosis

4- Viral diseases

Rabies

Foot and mouth disease

Rinderpest

Infectious feline enteritis

Infectious peritonitis

Infectious hepatitis

Canine distemper

African horse sickness

Kyasanur forest disease

Pox

Feline pan leukopaenia

5- Protozoan diseases

Babesiosis

Theileriosis

Trypanosomosis

Plasmodiusis

Toxoplasmosis

Sarcocystosis

Coccidiosis

Entamoebosis

Blantidiosis

6- Helminthic diseases

Trematodosis

Fasciolosis and fasciolopsis

Paramphistomosis

Schistosomosis

Echinostomosis

Paragonimosis

Cestodosis

Taeniosis

Anoplocephalosis

Dipylidiosis

Spirometrosis

Monieziosis

Echinococcosis

Stilesiosis

Diphyllobothriosis

Nematodosis

Oxyuriosis and enterobiosis

Ascarididosis

Capillariosis

Rictularid infection

Protostrongylidosis and ollulanosis

Strongyloidosis

Trichuriosis

Trichinellosis

Oesophagostomosis

Stephanuriosis

Ancylostomatidosis

Spiruroid

Filariosis