CHAPTER – II

GEO-ENVIRONMENTAL SETUP

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2.1 INTRODUCTION:

The present study of Radhanagri Wildlife Sanctuary has been done from the geographical point of view. The principle strategies are directed more towards understanding the bio-diversity and various effective geo – environmental factors in the area. Radhanagri Wildlife Sanctuary has diverse Flora and Fauna. Biodiversity is there in all forms that are at genetic level, species level and ecosystem level. The whole area falls under the Western Ghat, which is recognized as one of the "Hot Spots" of bio-diversity in India. The lush green forests of this area protect and feed the catchments of two major reservoirs namely "Rajarshi Shahu Sagar" of Kallamwadi and "Laxmi Sagar" with several minor tanks and water holes in Radhanagri Taluka. The rich bio-diversity of the sanctuary provides ample opportunity for research and education. The area of the sanctuary extends over 351.16 Sq. Km.

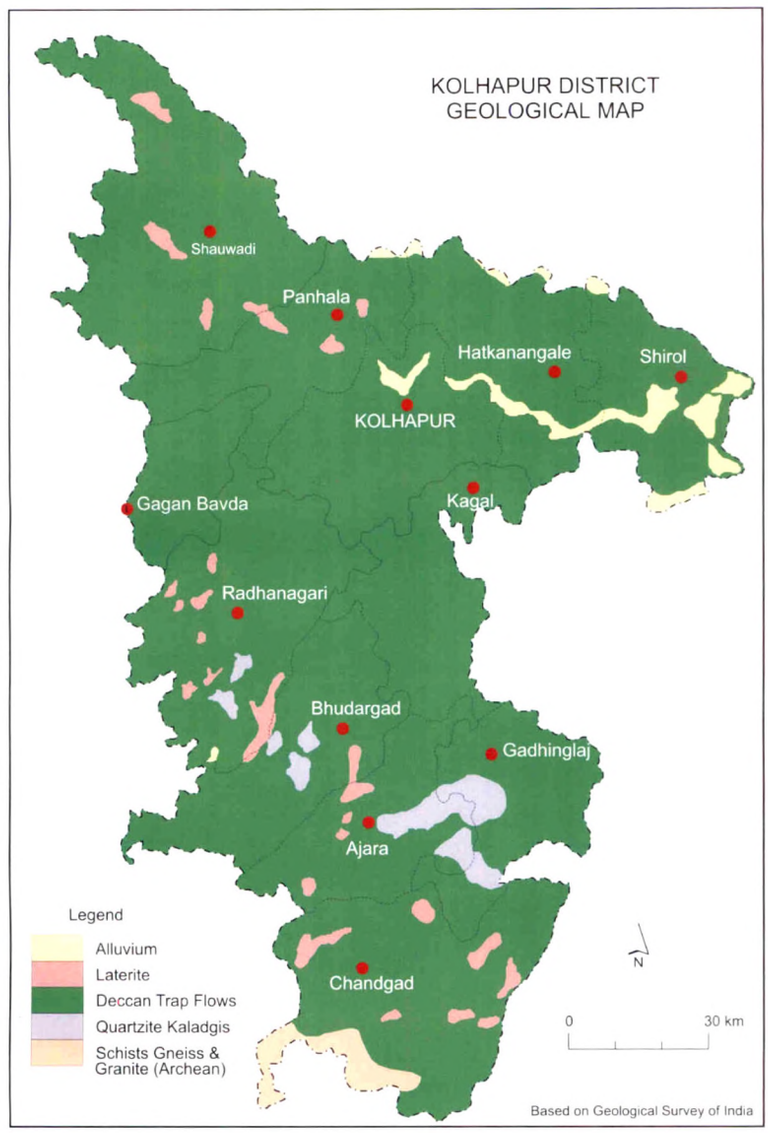
This area has got global and national significance. The Gaur (Bison) is the flagship species of this sanctuary along with the presence of Tiger, Panther, Sloth Bear, Giant Squirrel, Mouse Deer Barking Deer etc. Majority of the area is under thick forest. Grasslands are in small pockets, but they are very important for herbivores. The plant community in various habitats gives rise to plant diversity in the area. Most of the area is undulating and hilly which is the typical feature of Western Ghat.

The drainage pattern in this area is well developed. Dangs (Thick and dense forest patches) and Sadas (Open patches of Laterite Plateau) are the unique habitats in this sanctuary. The climate is moderate. The mean annual rainfall is about 2500 mm and maximum 5000 mm. The biological and ecological value of the area is of global significance and well recognized.

Radhanagri owing to the part of Kolhapur district while understanding the topography of the Radhanagri Wildlife Sanctuary one has to see the topography and other physiographical features of Kolhapur district which is the extreme Southern district of Maharashtra state, covering total area of about 7685 Sq. km. of Deccan Plateau lying along the east of Sahyadri, a part of Western Ghat. The Southern and Western part of district is hilly and remote accessibility. There are many forts important from the geographical, historical and botanical point of view that is namely Bhudargad, Gagangad, Panhala, Pargad, Rangana, Samangad and Vishalgad etc. The wind-gaps among the Sahyadri Mountain are called Ghat or passes which are having inevitable importance in accessibility and are abode and habitat of rich biodiversity. Amba, Anuskura, Bhui-bavada, Hanumanta, Karul, Fonda, Ramghat and Tillarighat are famous in this context.

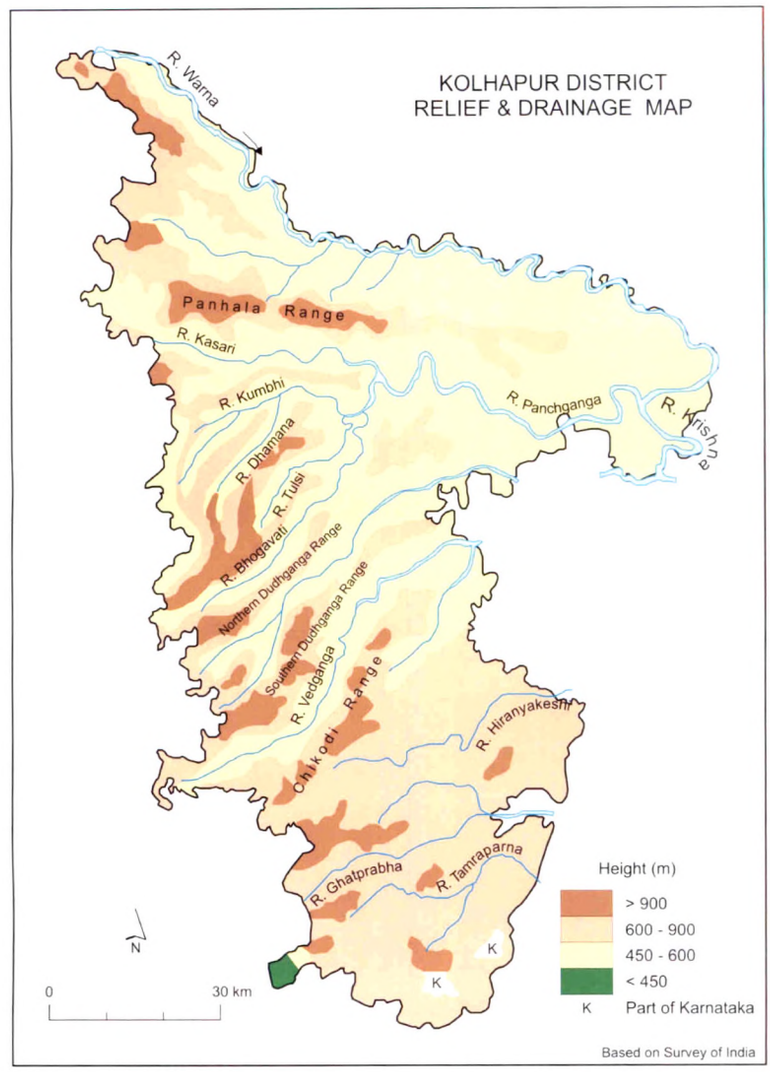
2.2 TOPOGRAPHY, GEOLOGY, DRAINAGE AND SOILS OF THE KOLHAPUR DISTRICT:

Kolhapur situated between 17^0 17' to 15^0 45' North Latitudes and 73^0 40' to 74^0 14' East Longitudes and cover total area of about 7685 Sq. km. The average height above sea level varies from 390 to 900mts. It has east-west stretch spread of the district which is



Map 2 : Geological Map of Kolhapur District

Map 3 : Physical Map of Kolhapur District



Map 4 : Relief and Drainage Map of Kolhapur District

about 75 km. and the north-south is about 102 km. The district is bounded by Sangali from east and north where as the Belgaum district from Karnataka State towards the east and south. From the west the boundary of district terminates with the escarpments of Sahyadri ranges of Sindhudurg and Ratnagiri district. Warana River make natural boundary of the district from the north side.

There are 12 tahsils with 1203 villages and 12 towns incorporating Kolhapur district. Tahsils includes Ajara, Bhudargad, Chandgad, Gadhinglaj, Gaganbavada, Hatkanangale, Kagal, Karveer, Panhala, Shahuwadi, Shirol and Radhanagari. According to the 2001 census, the total population of Kolhapur district is about 3515413.

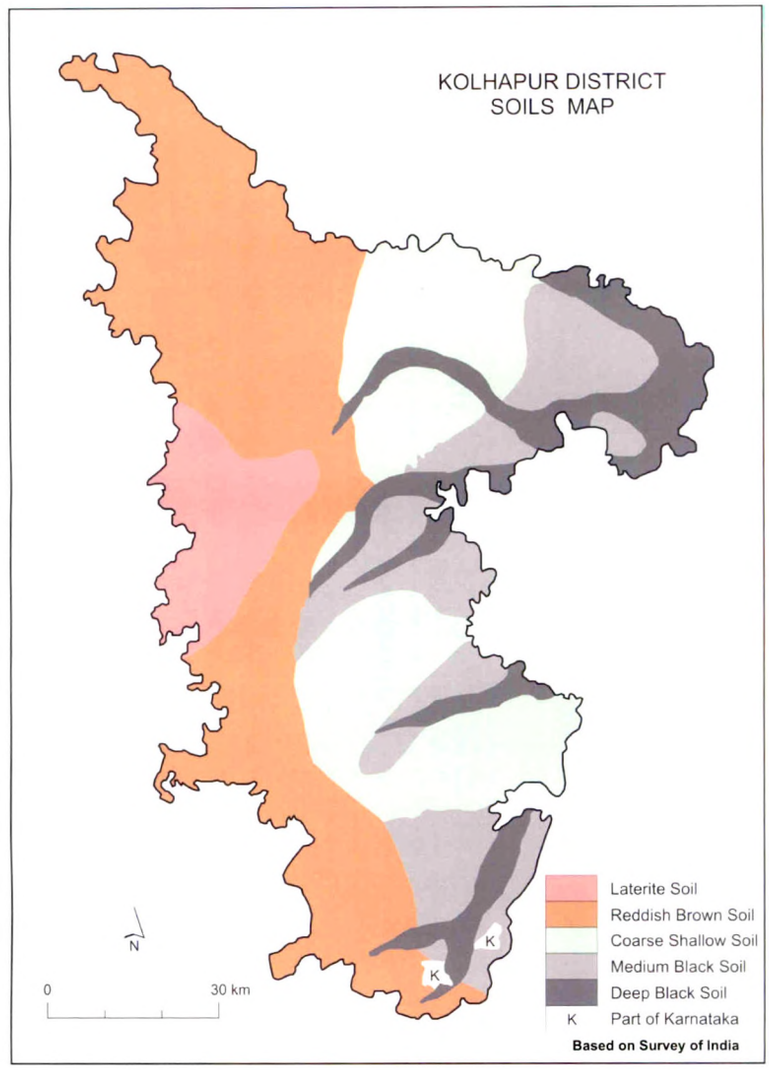
The physical setting of the Kolhapur district can be best appreciated in the background of its geology, relief and drainage. The details of the geology of the district are very important. In general major portion of the district occupied by the 'Deccan Trap' influences extremities the rock of the Dharwar and Lower kaladgi series which introduce a change in the topography. The district as the whole is a part of the deccan tableland with an average height of 1800 ft above sea level. The Sahyadrian scarp forming the most prominent feature along with western boundary form the gently uneven to towering crest of the Sahyadries. All the ranges of the Sahyadries have characteristic lava topography (Map: 2).

The Dharwar Phyllites and Amphibolities outcropped with granite-gneiss are the oldest rocks noticed near Ajara in district. The lower Kaladgi series next in Chronological order rests over the Dharwars and the Granite-gneiss. Deccan trap formation overlies the Kaladgi bed and is spread over almost the entire district. A

large extensive lava beds have undergone large-scale erosion along the river valleys, exposing some where the underlying Kaladgi and Dharwar groups of rocks. The plateau tops are generally capped by laterite, ovr altitudes of 900 mts. to 1100 mts. (Map:3)

Kolhapur district has well-developed river valley and drainage pattern. There are five main tributaries of River Krishna, such as Dudhganga, Ghatprabha, Hiranyakeshi, Panchganga, Tamraparni and Warana. Warana has 80 km. length; Panchganga has 130 km. length with its tributaries Bhogawati, Tulasi, Dhamani, Kumbhi and Kasari. Doodhganga has two tributaries i.e. Vedganga and Hiranyakeshi has a 55 km. length , Vedganga has 75 km. length, Ghatprabha, Tamraparni, Shuk and Jamda are other important rivers in Kolhapur district. All major rivers originate from Sahyadri Ranges in the West and drain to eastward direction and flowing to the Bay of Bengal. (Map:4)

The Kolhapur district has mainly five types of soils (Map:5). Laterite soils occur mainly in the Western hilly region of heavy rainfall. The top of the hills and plateau are not covered by forest. The major soil types as below:



Map 5 : Soil Map of Kolhapur District

Table: 1

Soils of the Kolhapur District.

Types of soil	Percentage	Area
Laterite soil	10.62%	Radhanagari, Gaganbavada
Reddish brown soil	32.80%	Shahuwadi, Panhala, Radhanagari
Coarse shallow soil	25.60%	Hatkanagale, Panhala, Karveer, Bhudargad, Gadhinglaj, Radhanagari, Kagal, Chandgad
Black soil (Medium)	19.68%	Shirol, Kagal, Gadhinglaj, Chandgad.
Black soil (Deep)	11.30%	Hatkanagale, Kagal, Gadhinglaj

2.3 CLIMATE, RAINFALL AND TEMPERATURE OF THE DISTRICT :

The district has very salubrious tropical monsoon type of climate. This is pleasant and healthy. The western part of district always experiences cooler climate than eastern part of the district. Generally there are three seasons viz. summer (March to May), rainy (June to October) and winter (November to February). All these seasons are moderate.

The amount of rainfall received, decreases rapidly from west to east. The average annual rainfall is 1645 mm. within the district and varies from about 500 mm. in Shirol tahsil in east to 6000 mm. in Gaganbavada tahsil in west.

The district has a large range of temperature between winter and summer and between day and night. In summer, the temperature rises as high as 41.66^{0}C during the months of April

Table : 2

The Maximum / Minimum Temperature at Dudhaganganagar (^{o}C)

Sr. No.	Year	January		February		March		April		May		June		July		August		September		October		November		December	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	1991	31.00	21.00	32.00	23.50	34..50	25.50	35.50	27.00	35.00	27.00	33.00	26.00	27.00	24.50	26.00	22.00	32.00	25.50	32.00	24.00	32.00	21.50	31.50	19.00
2	1992	30.50	14.00	31.50	14.00	38.50	19.00	42.50	22.50	40.00	23.00	39.00	23.00	33.50	22.50	32.50	21.00	33.00	21.50	32.00	23.00	32.00	18.00	20.50	14.00
3	1993	30.50	12.50	33.00	14.10	36.50	17.50	40.00	23.50	40.00	23.00	38.00	36.50	30.50	20.00	29.00	19.50	29.00	21.00	30.00	21.00	30.50	20.50	27.00	16.00
4	1994	29.00	15.00	32.50	15.00	37.50	23.00	38.50	20.50	38.00	22.00	34.00	20.00	27.00	20.00	27.00	20.00	30.50	19.00	30.50	19.00	28.00	17.00	27.00	11.00
5	1995	28.50	14.00	33.00	16.00	27.00	19.50	39.00	24.50	38.00	22.00	39.00	22.50	32.00	21.50	31.50	22.50	30.00	20.00	30.00	20.00	28.00	17.00	27.50	15.00
6	1996	28.50	13.00	34.50	16.00	38.00	21.00	38.00	21.50	39.00	23.00	39.50	21.50	32.50	20.00	28.50	18.00	30.00	18.50	29.00	19.50	29.00	15.00	27.00	18.00
7	1997	29.50	13.00	31.00	13.50	37.00	19.50	38.00	21.00	39.50	21.50	35.00	21.50	29.00	27.50	25.00	19.00	30.00	20.00	33.00	19.00	29.00	20.00	27.50	17.50
8	1998	28.50	15.00	29.00	16.00	35.50	20.50	38.50	23.00	39.00	25.00	36.00	25.00	31.00	23.50	30.00	21.50	28.00	30.00	28.50	21.50	28.50	18.50	26.50	13.50
9	1999	27.00	13.50	31.50	17.00	36.00	20.00	37.00	22.00	36.50	23.00	30.00	22.00	30.50	20.50	27.50	21.00	28.50	20.00	29.00	31.00	29.00	17.00	27.00	15.00
10	2000	29.00	14.00	29.50	15.00	35.00	20.50	37.00	24.00	37.50	22.50	31.50	21.00	33.50	22.50	31.50	18.50	34.50	22.00	31.00	21.50	32.00	16.50	28.00	12.00

Source : Management Plan, Radhanagari Wildlife Sanctuary - Plan period 2001 - 2002

Table : 3
Rainfall at DUDHAGANGANAGAR (R.W.S.) mm

Sr. No.	Year	Jan	Feb	Mar	April	May	Jun	July	Aug	Sept	Octo	Nov	Dec	Total
1	1998	0.00	0.00	0.00	0.00	40.00	1434.60	2018.60	1819.20	734.40	450.00	54.40	0.00	6551.20
2	1999	0.00	0.00	0.00	0.00	211.40	1791.40	2880.00	847.60	386.20	335.40	19.00	0.00	6471.00
3	2000	0.00	0.00	40.00	0.00	330.00	820.00	2010.00	1701.00	320.00	40.00	30.00	0.00	5291.00
4	2001	0.00	0.00	18.00	10.20	29.40	1003.00	1816.80	1416.00	31.80	64.60	57.60	0.00	4447.40
5	2002	0.00	0.00	0.00	12.20	6.80	522.40	1356.40	480.40	120.20	336.00	0.00	0.00	2834.40
6	2003	0.00	0.00	0.00	0.00	113.20	718.20	1131.20	594.00	205.00	237.40	34.80	0.00	3033.80
7	2004	0.00	0.00	0.00	60.80	20.40	1503.80	2449.00	1421.00	1072.00	343.00	15.60	0.00	6885.60
8	2005	0.00	0.00	0.00	0.00	0.00	874.00	1869.00	1617.00	647.00	68.00	0.00	0.00	5075.00
9	2006	0.00	0.00	6.00	0.00	163.00	641.00	2273.00	1971.00	135.00	66.00	78.00	0.00	5333.00
10	2007	0.00	0.00	0.00	4.00	9.00	1064.00	1434.00	1620.00	454.00	24.00	25.00	0.00	4634.00

Source : Radhanagari Tahsil & Kolhapur Wildlife Division.

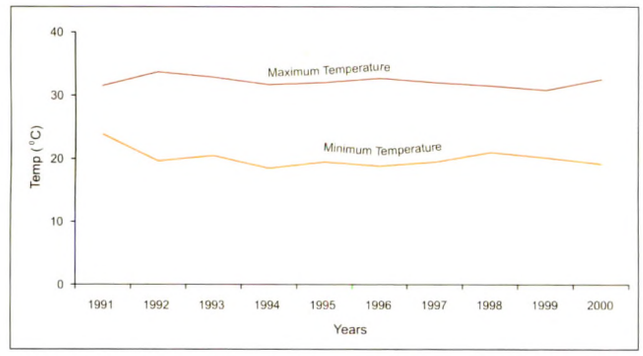
and May and its goes down as low as 14.44^{0}C during the months of December and January. In the district, there are March, April and May the hottest months and December, January and February are the coldest months in the year.

2.4 GEOLOGY, DRAINAGE AND SOILS OF THE RADHANAGRI WILDLIFE SANCTUARY :

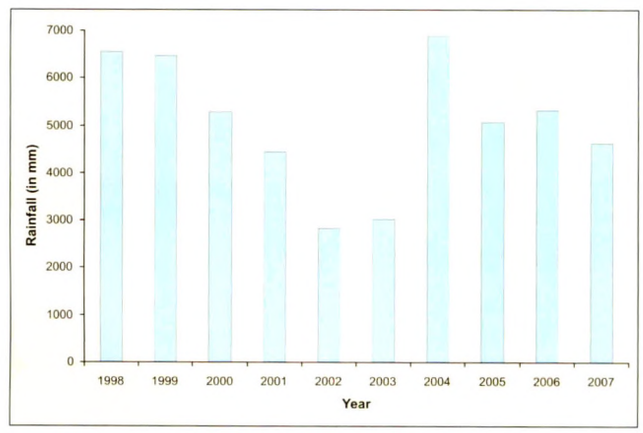
The Radhanagri Wildlife Sanctuary is in the Western Ghats of Sahyadri mountain ranges. The whole area is a rugged territory. Eastern part of the sanctuary is less rugged, but the area is undulating. The open plateau tops are the main feature in this area. The main geological formation of the area is the Deccan trap. The rock mainly consists of basalt, which was formed due to volcanic activity. Bauxite is the main mineral ore found in the areas like Padli, Savardhan, Ramanawadi, Patpanhala, Dublewadi, Savarde plateau.

Radhanagri area shows the largest bauxite deposits seen over about 4 to 8 Km patch north of Radhanagri on Kolhapur – Phonda Ghat road and are accessible by footpath from Radhanagri dam site. The massive Bauxite varying in thickness from 2 – 5 meters. It is estimated that about 10, 80,000 tons of Bauxite may be available in this area. (Govt. Rpt.)

A proper survey has been done of this area, approximately 85 lack tones of Bauxite might be found but this area has been declared 'Bison protection forest area' by the Government of Maharashtra (Gazetteer 1990). However, Bauxite mining is being conducted at Durgmanwad town which is on the verge of North-East boundary of Sanctuary which caused major disturbance to

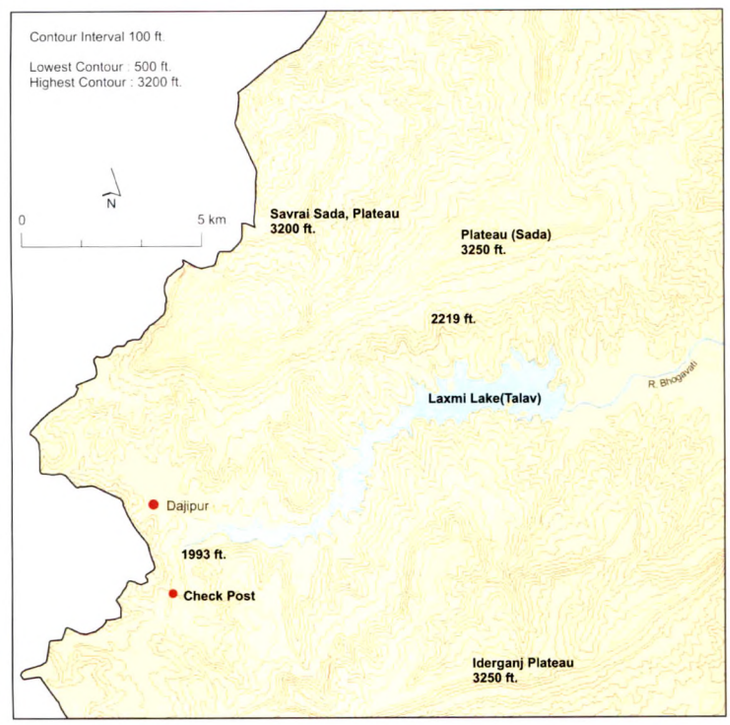


Graph 1: Maximum and Minimum Temperature at Dudhganganagar (RWS)



Graph 2: Rainfall at Dudhganganagar from 1998 to 2007

Contour Map of Dajipur Range (RWS)



Map 6 : Contour Map of Dajipur Range of RWS

district wildlife habitat in the area. Soil is formed from parent rock Deccan trap and is of lateritic type. The soils of grayish green loam and murum are found on gentler slopes in this area.

2.5 CLIMATE, PHYSIOGRAPHY AND DRAINAGE OF THE RADHANAGRI WILDLIFE SANCTUARY:

The climate is moderate with three seasons broadly divided into wet, cold and hot. Summer extends from February to May. The rainy season from June to September and winter season from October to January. During summers mean temperature ranges from 30^0C to 35^0C, maximum being 41^0C. The minimum temperature during winter is 9^0C to 16^0C. The mean annual rainfall is about 2500 mm and maximum being 5000 mm. There are storms during rainy season, during monsoon season and some times in winter season. Western part of the sanctuary gets covered with thick fog. (Table: 2 , 3)

Topographically the region has large diversified surface. The most of the area of this sanctuary is an undulating surface which is the typical feature of the Western Ghats. The plateau tops are flat and are with sparse vegetation particularly devoide of trees. The plateau region is mostly covered with the grasses and this area acts as a shelter place for wild animals during monsoon seasons to avoid disturbances from the leeches and mosquitoes. Due the undulating physiography, the drainage pattern in this area is well defined dendretic type. The area is the catchments area of the Bhogavati and Dudhganga major rivers with many nalas and streams which act as the feeder channels to the main rivers. (Map:6)

Radhanagri Wildlife Sanctuary has many peaks, some hills height from 2400 ft. to 3200 ft. Savarai hill (3200 ft.) is the highest point in this area. If one can see the area as its altitude and percentage of occupied area the inferences come forward as 44% of the area is occupy by the hills which are having 2000 to 2500 ft altitude. The 40% of an area is occupied by the hills of 2500 to 2800 ft height, whereas the hills of 2800 to above 3000 ft occupy 16% of an area. Radhanagri Wildlife Sanctuary have 25 peaks such as Nanacha Dung, Ugavaidevi hill, Patpanhala, Kegadicha Sada are the important hills. The rocky trap provides many interesting features of valley, hills, gorges etc. which has influence on the land use and Flora and Fauna in the region. (Map:7)

The drainage network of the area quite interesting because it is seen that the drainage network is structurally and litho logically controlled. Over all the fine network of dendretic type of drainage network has been seen, how ever at the north side of the area the radial pattern of drainage network primarily draining towords the south has particularly been seen. This is the highest point at 3232 feet. The majority of the tributaries are draining in to the back water of the Radhanagri dam which is constructed on Bhogavati River. The fluvial erosion is meajor geographical process which is shaping the area. The deep gorges, valleys, trenches are seen in the area. (Map: 8)

2.6 FLORAL AND FAUNAL RESOURCES:

The geographical area of the sanctuary is classified in reserved forest, protected forests, unclassed forests, and other government lands, gairan and mulkipad area. The total area of the sanctuary is 351.16 Sq. Km. In view of forestry there are 2 ranges

(area under 250 Sq.Km.), 6 rounds (area under 30-40 Sq.Km), 17 beats (area under 10 Sq.Km.), 46 compartments (basic management unit) and 33 villages in the sanctuary (Map:9). The area falls under the western region. The plateau tops in this region are lateritic in origin, small grasses and stunted vegetation of Syzygium and Mimolon are common on such plateaus. While slopes of these plateaus have got very good vegetation. The main species found are Jamun, Mango, Anjani, Hirda, Surangi and Par Jambul, Ain, Kinjal, Bibla, Nana, Behada, Umbar, Assana Kumaba, Kumkum etc. Zulumb is common species in sanctuary. The shrubs like Bhoma, Shendri, Jangli, Limbu, Pendri, and Karvi are the common species in sanctuary. Under different plan schemes various plantation activities had been carried out in the sanctuary area. The purpose of which is different as per the objects of the scheme.

Radhanagari Wildlife Sanctuary is home of variety of wild animals. Out of the 47 species of mammals recorded in this area, 7 species of mammals are of endangered status, namely Tiger, Leopard, Sloth Bear, Bison, Mouse Deer and Pangolin. There are as many as 264 species of avifauna recorded in the sanctuary. There are 59 species of reptiles, two of which are of endangered status namely Indian Python and Indian Monitor Lizard. There are 66 species of Butterflies recorded from the protected area.

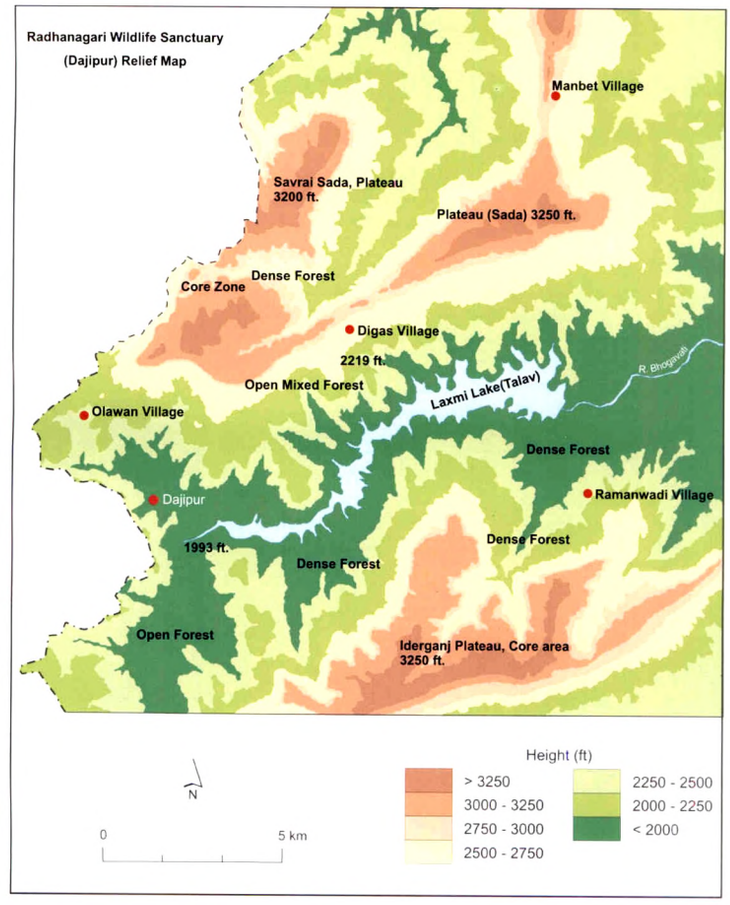
Amphibians are generally found in rainy season in most of the area and some times in decaying ground vegetation in the forest. All together 20 species from 2 orders, 5 families and 10 genera are listed in the sanctuary.

Animal in the present context refers to the faunal life of the protected area. Sanctuary has diverse wildlife, though no scientific wild life survey of this region has been made so far, the records are prepared from the study of pugmarks, droppings and actual sighting by the field staff and reports from local people. There is no uniform method for population estimation of different species. Considering the hilly terrain, scattered water holes, biotic interference on the periphery, it is not possible to follow a particular technique to estimate the number of wild animals within the sanctuary. Hence the pugmark technique as well as water hole counting methods is followed simultaneously for the Tiger and Panther. The population estimation of other wild animals such as Bison, Sambar, Barking Deer, Wild Boar, Mouse Deer, Sloth Bear is done by using the water hole counting method and 20% block counting method in the month of May every year since 1994.

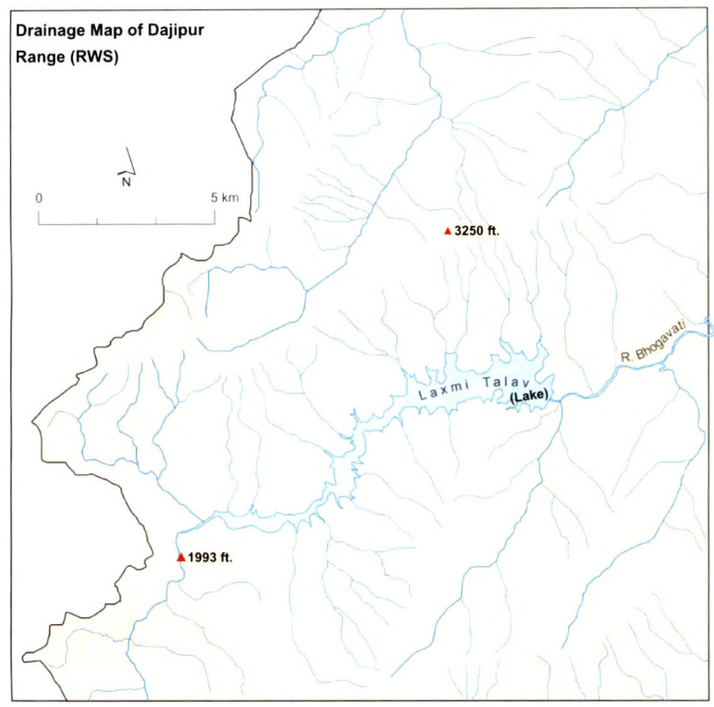
2.7 IMPACT OF WATER RESOURCES ON FLORA AND FAUNA:

There are numerous streams perennial and seasonal, scattered all over the area. Two dams have been constructed on the rivers Bhogavati and Dudhganga. The catchment of these two reservoirs is included within the sanctuary. These two reservoirs and their surrounding forests constitute prime habitat for the wildlife of this sanctuary.

Water is the most important component of a habitat. In addition, water bodies themselves act as a habitat for several species of animals. Water bodies scattered all over the sanctuary, which provides drinking water to wildlife. Two rivers namely Bhogavati and Dudhganga are the main sources of water (Map:12).



Map 7 : Relief Map of Dajipur Range of RWS



Map 8 : Drainage Map of Dajipur Range of RWS

There is one percolation tank in the old Dajipur Sanctuary at 'Savarai Sada' which is seasonal. In addition, there are two Kolhapur type bandharas in the old Bison Sanctuary, which provides water to wildlife throughout the year. In addition to this, there are some water holes on perennial nalas, which are maintaining every year. Wild animals frequently visit these water holes during pinch period.

As per the manual of wildlife management technique, an animal can under normal circumstance walkup to an average distance of 2.5 Km. to quench its thirst. Therefore there should be a minimum of one water hole within a radius of 2.5 Km. as per the criteria 80% of this protected area is effectively covered with water. So the water sources to the wildlife are sufficient. But in the effectively covered area also some new water holes are required for easy accessibility.

2.8 IMPACT OF PHYSIOGRAPHY ON FLORA AND FAUNA:

Topographically the region has large diversified surface.(Image:8) The plateau tops in this region are lateritic in origin, small grasses and stunted vegetation of Syzygium and Mimoxylon is common on such plateaus while slopes of these plateaus have got very good vegetation. The flat land vegetation is densely in the sanctuary. Zulumb is a common species of plants at altitude under 700 m above mean sea level; Haldia and Pandhara boka are dominated

The sanctuary has forest types i.e. Southern tropical semi evergreen and sub type West Coast semi evergreen forest, Southern tropical moist mixed deciduous forest, West Coast tropical

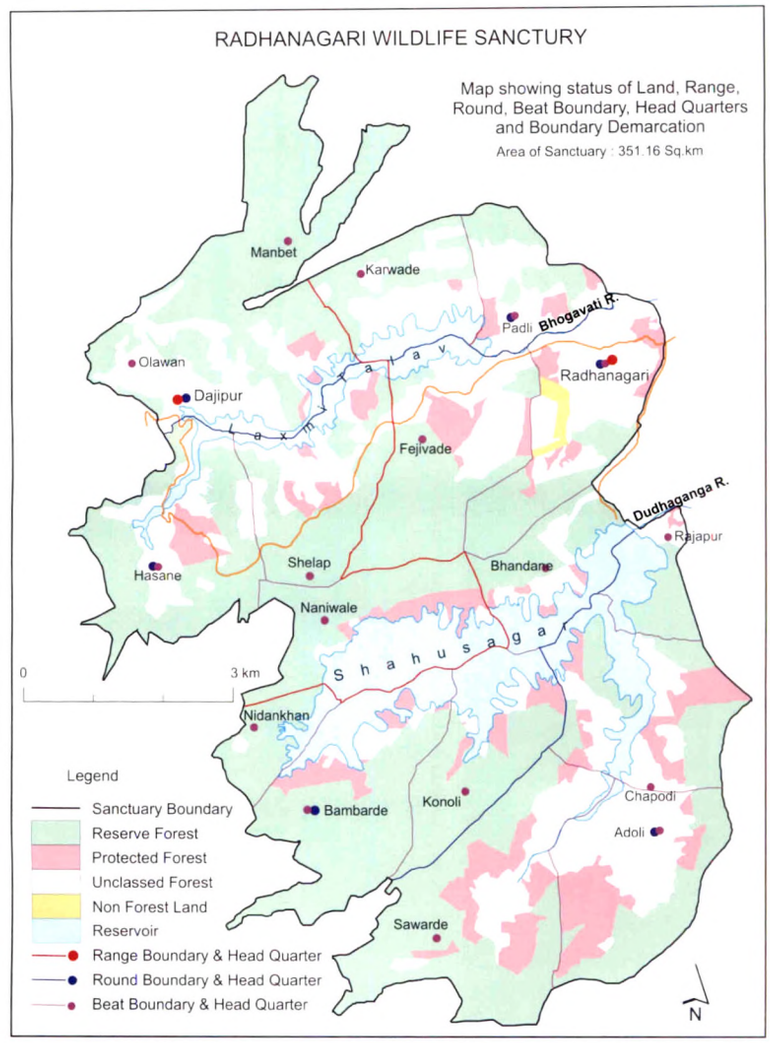
evergreen forest which are belong to the major groups of tropical forests.

Manbet, Walwan, Hasne, Nidankhan, Savarde, Dublewadi area are under the Southern tropical semi evergreen forest. The main species over 700 m mean sea level, species lilke kalvan, jambha, shisvi are common in the sloppy area. Jamun, Mango, Anjani, Hirda, Surangi and Par Jambul are found at plain area. The shrubs like Bhoma, Shendri, Jangli, Limbu, Pendri, Karvi etc. are seen in some mixwoods.

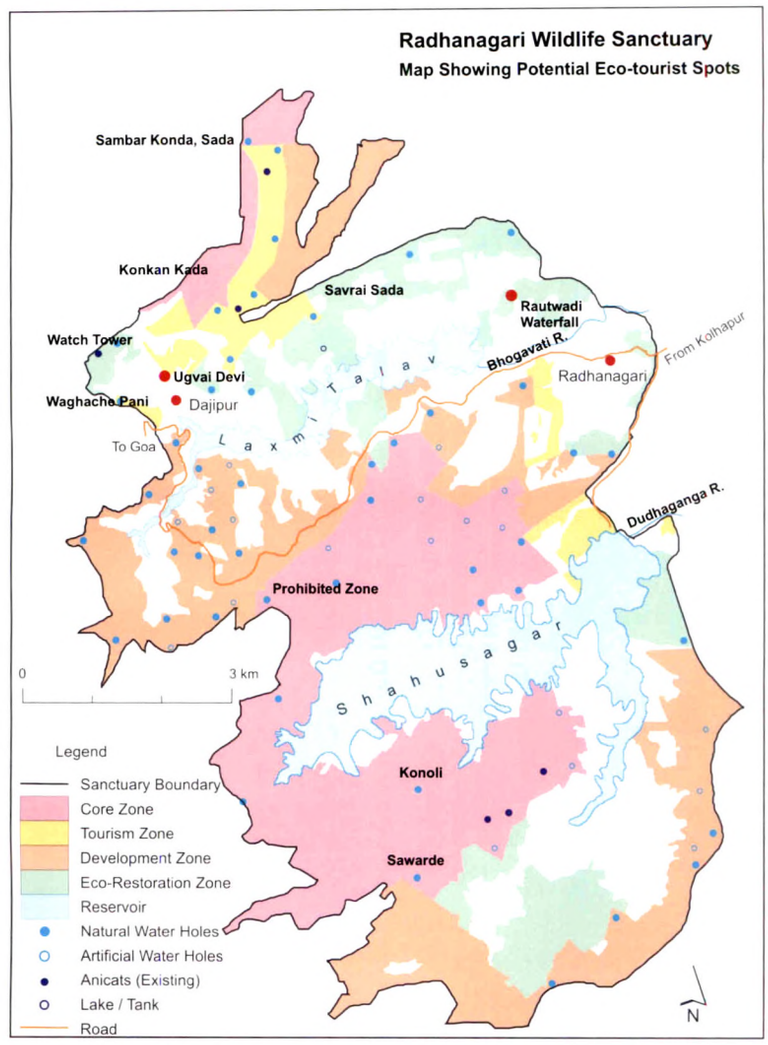
Southern tropical moist mixed deciduous forest occurs mainly at place like Taliye, Borbet, Shelap, Fejivade, Farale and Waki belt. The top canopy contains Ain, Kinjal, Hirda, Bibla, Nana, and Behada. The species like Jamun, Mango, Umbar, Assana, Kumaba, Kumkum etc. also found sparely. The under wood consist of Lantane, Rametha, Karavand, Murud, Sheng, Wavding, Chikni etc. plant species.

In the West Coast tropical evergreen forest, the common species like Zulumb in canopy at altitude under 700 mts. above MSL. Haldiya and Pandhara boke are dominated over 700 mts. MSL. Species like Kali, Shisvi, Kalvan, Jambha and Holigarna grahmil are common.

Majority of area is under thick forests locally known as Dangs. Grassland is in small patches but they are very important for herbivores. There is evergreen vegetation along the locations of perennial water sources. The plant communities in various habitats give rise to plant diversity in the area. The rich flora and fauna of the habitats need to be studied. Under different plantation schemes,



Map 9 : Forest Boundries of RWS (Map Based on CFW Kop.)



Map 10 : Potential Eco-tourist Spots of RWS (Map Based on CFW Kop.)

plantation activities is being carried out in the some pocket of sanctuary area.

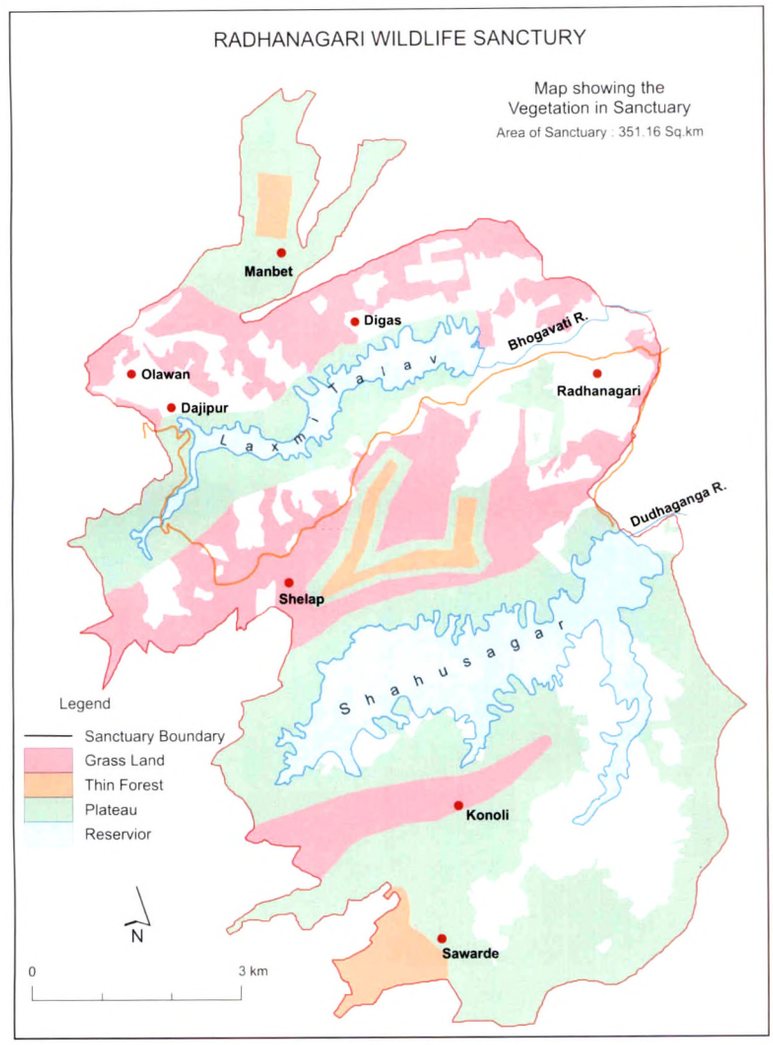
Western Ghat is identifying as one of the 18 global bio-diversity 'Hot Spots' in India. (Brij Gobal - 1997). By virtue of located in Western Ghats, Radhanagri Wildlife Sanctuary has diverse flora and fauna. The Bison is the flagship species of this sanctuary along with the presence of Tiger, Panther, Sloth Bear, Giant Squirrel, Mouse Deer, and Barking Deer.

Radhanagri Wildlife Sanctuary is home of variety of wild animals. Out of the 47 species of mammals 7 species are recorded in endangered status namely Tiger, Leopard, Sloth Bear, Bison, Mouse Deer, Indian Pangolin and Giant Squirrel. There are as many as 264 species of avifauna recorded in the sanctuary. More over there are 59 species of reptiles, two of which are of endangered status namely Indian Python and Indian Monstor Lizard. There are 66 species of Butterflies recorded from the protected area. Amphibians are generally found in rainy season in most of the area and some times in decaying ground vegetation in the forest.

According to the wildlife survey of this region the records of animals are prepared from the study of pugmarks, actual occurrence seen by the field staff or visitors, some time water hole counting methods are used to collect the population data of animals and some time from the dropping of animals.

Based on the data of population estimation and observation by the fieldwork, the pattern of distribution of various major animals in the protected area is prevailed. Panther are found through out the protected area; Tiger is found in Geezekada,

Nanivale, Surangee and Waghche Pani, Shelapche Pathar, Bamaber area only. Bison, Sambar, Barking eDeer, Wildboar, Mouse Deer are found through out the protected area in varying degrees. Sloth Bear is found in Geezekada, Nidankhan, Kaladang, Waghbamabar area of rocky broken country where they can get shelter in the caves and dens. Bison and Sambar are essentially animals of hilly area. Barking Deer prefers hilly and wooded country where dens undergrowth is available. Mouse Deer prefers grass covered rocky hill site. Giant Squirrel is found in Surangee area, Patacha dang and Kala dang.



Map 11 : Vegetation in RWS (Map Based on CFW Kop.)

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