

CHAPTER – V
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In the present dissertation all concerned objectives are well recognized. The main objective of the present study is to recognize biodiversity of the area by identifying and demarcating the flora and fauna with their environmental set-up including physiography, soil, drainage pattern, climate, diversified species of plants and animals and its management and planning related to protection and conservation. Keeping in broad view of the biodiversity of the Radhanagri Wildlife Sanctuary, the following conclusions have been made.

CONCLUSIONS:

1. Radhanagri Sanctuary is well known among the 35 Sanctuaries in Maharashtra situated in the ranges of Western Ghat which has global and national significance in respect of vulnerable and delicate ecology. Sanctuary has a slight dumbbell shape with 23 km east-west and 31 km of north-south stretch. There are two ranges namely Radhanagri (WL) and Dajipur (WL) covering 18336.41 hectare and 9898.29 hectare respectively. Altogether it covers 28234.70 hectare which is 351.16 Sq. km. According to the area occupied by the forest it is 23147.50 hectare by Reserve Forest (RF), 4728.59 hectare area by Protected Forest (PF), whereas 358.61 hectare area is occupied by Unclassed Forest (UF).
2. The Radhanagri Wildlife Sanctuary is in the Western Ghats of Sahyadri mountain ranges. Geomorphologically the whole area is a rugged territory. Eastern part of the sanctuary is less rugged,

however the area is undulating. The bare 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.

3. Topographically Radhanagri Wildlife Sanctuary has many peaks, some of from 2400 to 3200 ft high. 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 occupied 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 which has influence on the land use, flora and fauna in the region.
4. From the study of satellite image IRS-1B LZA-1 BAND 234, the drainage network of the area is quite interesting. 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 to words 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 and Kallammawadi 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.

5. Verifying the impact of water resources on flora and fauna the two major reservoirs with several minor and micro tanks and water holes have been cosider. These water bodies and their surrounding forests constitute prime habitat for the wildlife of this sanctuary. Water bodies scattered all over the sanctuary provide drinking water to wildlife. Bhogavati and Dudhganga rivers are the main sources of water. There is one percolation tank in the old Dajipur Sanctuary at 'Savarai Sada' which is effimeral besides; there are two Kolhapur Type bandharas in the old Bison Sanctuary, which provide water to wildlife throughout the year. In addition to this, there are some water holes on perennial nalas, which are maintaining by the forest staff. Wild animals frequently visit these water holes especially during the summer season. It is supposed that the wild animal can wonder the distance of 2.5 km to pecify the thirst. More than 80 percent water holes are in the circumfearance of this specification.
6. In case of plants it is obvious that at the places where water availability is more are having more growth of vegetation e.g. most of the vally floors are nothing but the water supplying channels of the rivers, and tributaries. These channels provide good and suitable habitat for the plant species. Dangs or dense forest patches are another such habitats where the growth of big trees, shrubs, climbers is flourished. The shrubs like Bhoma, Shendri, Jangli, Limbu, Pendri, Karvi are most common species. The places with less water availability particularly bare

rocky lands, plateau tops and some hill slopes are deprived of vigorous growth of vegetation, only some seasonal shrubs and herbs with good growth of grass and weeds are seen.

7. Growth of flora and habitat of fauna has also revealed the impact of physiography. Topographically the region has undulating surface. The plateau tops are with vigorous growth of grasses and stunted vegetation like *Jansenella griffithiana*, *Pogostemon deccanensis*, *smithia*, *Uricularia*, *Eriocaulon*, *Burmania colestis*, *Cyprus compressus* are common especially in rainy season. It really a spectacular experience to see the flowering of such plants in mid rainy season. By virtue of deposition of weathered soil on flank slopes of the hills and plateaus the vigorous growth of species like *Kalvan*, *Jambha*, *Shisvi* seen on the slopes. Plain areas and valley floor are shown good growth of all kinds of trees forming mix woods with *Jamun*, *Mango*, *Anjani*, *Hirda*, *Surangi* and *Par Jambul*. *Zulumb* is a common species of plants at altitude under 700 m above mean sea level. *Haldiya* and *Pandhara boke* are dominated over 700 mts.
8. 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 etc. 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 arrived. 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 form of 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. If we see the biodiversity gradient of the sanctuary, it is found that the core areas have more faunal habitat and it is less towards the flanks of the sanctuary.

9. Genetic diversity defines the difference in a species in its genetic formation. In this area of Radhanagri Wildlife Sanctuary, many plants are declared as genetically endangered. A famous NGO ATREE (Ashoka Trust Research in Ecology and Ecology and Environment) from Bangalore is intensively engaged in reproduction of a *Hubbardia heptaneuron* an extinct grass by genetic variables and from the view of a reproductive Biology. Prof. Yadav S. R. dept. of Botany, Shivaji University, Kolhapur is engaged with in situ and ex-situ conservation of such plants species. As far is concern with wild animals not yet genetically extinct but the Tigers are endangered.
10. Different types (species) of plants and animals occur in region incorporate species diversity. In the Radhanagri Wildlife Sanctuary some areas are richer in plant species than others. Popularly they are called as Dangs, meaning thick forest. These are also categorized as Hot spots of diversity. Wagache Pani, Patacha Dang, Laxmi Talav, Kokan Darshan point, Zanzuche Pani, Shivagad etc. At present conservation scientist and many

scholars have identified and categorized about 15000 species of flowering plants. Many new species are being identified specially in the flowering plants and insects. It is worthy to note that a extinct grass *Hubbardia heptaneuron* and *Ceropegia fantastica* are being reproduced through the conventional methods and biotechnological tools (Tissue Culture) by Prof. Yadav S. R. and his enthusiastic team from Dept. of Botany, Shivaji University, Kolhapur. Faunal species are incorporating 47 species of mammals, 59 species of reptiles, 20 species of amphibians, 264 species of avifauna with 66 species of butterflies. Gaur or bison is major animal found in this area whereas panther or leopard, sloth bear, Indian pangolin, mouse deer, jungle cat are endangered animal species.

11. The fore going study of the Radhanagri Wildlife Sanctuary has unfold the some problems some are acute and will take some time to mend and some problems can be eradicated by little efforts. The problems like encroachment, Karvi plethora, soil degradation, wild life health, man wildlife conflict, undisciplined tourism are acute. While the problem of poaching, habitat loss, illegal cutting of trees, domestic livestock grazing, wild fires etc. can be reduced by strict vigilance and disciplined management.
12. Radhanagri Wildlife Sanctuary itself is amalgamation of many diverse ecosystems. By the landscape it comes into forest grassland and mountain ecosystem where as by aquatic ecosystem it incorporates rivers, lakes and ponds ecosystems. There are reserve forest known as Dangs enriching many plant and animal species. Sadas occupied by grassland with variety of grasses. Mountain tops and flank with variety of plants and

animals habitat. e.g. Shivgad, Zanzuche Pani, Savarai Sada, Hadakyeche Sari, Kokan Darshan Kada, Plateau of Shelap etc. Aquatic ecosystem like rivers, lakes and ponds are contributing into the bounty of nature in Radhanagri Wildlife Sanctuary. River ecosystem like Bhogavati and Doodhganga are major rivers who shaping the landforms in the area with several tributaries and nalas. Many water tanks are forming individual pond ecosystem providing habitat for many distinguished plants and animals. However, Shahusagar and Laxmi Lake are major lakes ecosystem which help to symbiosis of varieties of plants and animals.

13. When we see the value of biodiversity forests are storehouses of valuable diversified ecosystems, which are vital at the local, regional and global levels. The production of Oxygen, depletion of Carbon dioxide, balancing the water cycle, protection of soil are some vital services conducted by the forest and jungles. It is therefore clear that biological diversity is essential for present ecological processes. There are many such values of biodiversity of Radhanagri Wildlife Sanctuary. At the instance consumptive use value by providing forest dwellers all their daily needs such as food, fodder, building material, medicines and variety of other product, making available some species of trees and fruits consumed by Bison or Gaur, Sambar, Barking Deer, Giant Squirrel, Mouse Deer and other herbivores. Productive use value such as production of marketable goods e.g. timber, high value fruits, leaves, medicinal plants like *Acacia concinna*, *Abutilon indicum*, *Asparagus racemosus*, *Var. javanica*, *Biophytum sensitivum*, *Bombyx micranthus*, *Cassia fistula*, *Dillenia indica*, *Embllica officinalis*, *Jasminum*

auriculatum, *Jatropha curcas*, *Mangifera indica*, *Sesamum orientale*, *Tamarindus indica* are the common. It is worthy to note that there are various economically important plants which may categorized as cereal crops, pulses, fruits vegetables, leaf vegetables, root and tuber vegetables, fruits, etc. are uncommon agricultural value. Besides these social value, ethical and moral value, asthetic value and option value which describe possiblities of future uses of natural resources.

14. The Radhanagri Wildlife Sanctuary though under control of mighty forest department, it is not free from the acute problems such as encroachment, poaching, habitat loss, illegal cutting of trees, domestic livestock grazing, wildfires, unwanted growth of grassland, wildlife health, man/wildlife conflict, undisceplined tourism etc.
15. Biodiversity can be conserved by In-situ and Ex-situ methods. In-situ conservation species are conserved at their own natural habitat. However, there are situations in which some species are about to extinct. In such cases, unless we don't try to conserved and reproduce. Such species in laboratory i.e. outside its natural habitat in scientifically controlled environments. e.g. Botanical garden, Zoological parks etc where an attempt is made to multiple reproduction of species. Offcourse the method is expensive, sometime in Western countries such rare species of plants and animals are preserving by their germplasm in gene banks.
16. When we see the existing status of the flora According to the Champion and Seth's classification the major three types of forests are seen over this area such as Southern Tropical Semi Evergreen and West Coast Semi Evergreen Forest which occurs

in and around the places like Manbet, Walwan, Hasne, Nidankhan, Sawarde, Dublewadi with the main species like Jamun, Mango, Anjani, Hirda, Surangi and Par Jambul. The shrubs like Bhoma, Shendri, Jangli Limbu, Pendri, Karvi. Southern Tropical moist mixed deciduous forest this occurs mainly at places like Taliye, Borbet, Shelep, Fejivade, Farale and Wakibelt. The species like Ain, Kinjal, Hirda, Bibla, Nana, Behada. The species like Jamun, Mango, Umbar, Assana, Kumaba, Kumkum etc. also found to a lesser extent. The underwood consists of Lantana, Rametha, Karvand, Murud Sheng, Wavding, Chikni etc. West Coast Tropical evergreen forest where Zulumb is a common species. Species like Kali, Shisvi, Kalvan, Jambha and Holigama Grahmil are common.

17. The sanctuary is home of variety of wild animals. Out of the 47 species of mammals recorded in this area, 7 species of mammals are endangered status, namely Tiger, Leopard, Sloth bear, Gaur, Mouse deer and Pangolin. There are as many as 264 species of avifauna recorded in the sanctuary. There are 59 species of reptiles, 2 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 seasons in most of the area and some times in decaying ground vegetation in the forest. All together 20 species from second orders, 5 families and 10 genera are listed in the sanctuary.

18. Bison is the flagship species of this sanctuary however many distinguished wild animals are found in this area. Tigers and panthers are seldom sighted in the area but gaur, sambar, wild

boar, barking deer, mouse deer, are found through out the sanctuary in varying numbers. Sloth bear found in Geazekada, Nidan khan, Kaladang, Waghache pani of the dense forest and undulating surface where the caves and den are found. Barking deer take refuge in the hilly and woody area where its fodder will easily available with assured shelter. On the rocky hillsides mouse deers are located where growth of grass is very vigorous. Giant squirrel has been sighted at Patyach dang, Kala dang and Surangee area. Radhanagri Wildlife Sanctuary also harbors some endangered fauna species such as Indian Pangolin, small Indian Civet, Jungle Cat, Wild Dogs etc. these wild animals are very rarely sighted in this area.

RECOMENDATIONS:

While keeping in the view for the appropriate protection and conservation of the biodiversity of the Radhanagri Wildlife Sanctuary and for the minimal degradation of the elements of biodiversity the following recommendations are made.

For the Conservation and Protection of the Flora:

1. Conservation of the plant species should be practiced by in-situ and ex-situ conservation process. For the monitoring and more scientific survey of the all elements of biodiversity the help of non governmental organizationa, Private Institutions, and Universities should undertake.
2. Hill slope protection programme should be implemented by aforresting, plantation of some plants.
3. Ban on extraction of ground water, restriction on digging new wells, only bonafide farmers are permitted to use of chemical fertilizers and chemical pest controllers or pesticides.

4. Each and every employee should be instructed to keep records of Sighting of any wild animal, condition of the roads, any damage to the plants, trees, flowering stages of the plants, fruits, water level in the anicuts and water holes, grass growth, status of any unexpected event etc. by which there will be updated check list of flora and fauna.

For the Conservation and Protection of the Fauna:

1. For the fear free migration and sojourn of the wild animal there should be free continuous corridors within the forests of Chandgad, Kallamawadi, Inderganj, Radhanagri, Dajipur, and Gagangad to the Chandoli sanctuary.
2. Breeding programme of the bison, sambar, deer etc. should be taken by the forest department. Habitat development programme should implement more intensively.
3. The number of watch tower should increased. Presently there are only two watch towers, one is at Waghache pani and second is at Sawarsisada (laterite plateau). More over scaffoldings (Machan) should be knoughted on the high grown trees to watch the wildanimals. In this regard shelap, inderganj plateau, samberkond, umbrachepani are the ideal location where hideout of the wild animals occure.
4. There should be more leagal restrictions on the lisened fir arms holders. Every bullet has to be accounted for and every shot must be reported and justified in grate detail in writing. Resently the population of tigers and leopards is estimated by the pug mark estimation method which has some flaws and errors. The direct close monitoring system should apply.

5. The methods of population estimation of the wild animals should modify, more scientific and correct method should adopted.
6. The tranquilising gun with sufficient doping cartridges should be provided to the wild life management staff. This can be utilized in case of man animal conflict.
7. It is supposed that the wild animal can wander the distance of 2.5 km to pecify the thirst. The distance between the most of the water holes is more than that this specification. Therefore it is required to create more water holes in the circumfearance of 2.5 km of location of each habitat.

For the Management and Planning:

1. The Radhanagri Wildlife Sanctuary should be declared as ecosensitive zone by the central government. The Protected, reserve and transition zone open for the visitars and villagers only after issuing entry pass or entry ticket.
2. Traffic through this ecosensitive zone should be controlled and toll against the dameging ecosystem by air and noise polution. The highway should be trancefereed to the forest department (Image: 2). There should be restriction or seeking prior permission for any addition, alteration, repairs, renivation, demolition or any structural change in dwellings in villages which will desturb the sensitive zone.
3. Monitoring and patrolling squad should update with good version of all terrain vehicles, wireless sets, powerfull binaculors, torches and fire arms.
4. The proposed budget of management for the next two year is about 232.81 lakhs only, which is very less. Therefore provision for the budget for the proposed management and planning should increase sufficently so the need can be met properly.

5. Maintenance and protection of the forest boundry is challenging task infront of forest employees it therefore should mainten very strictly and keep under continuous vigil.
6. At present there are three entry points where check post are present. To controll the whole area it required more such check points because many time local villagers, stray persons, agrssive tourists, smuglars, and other trace passers who have ill objective are get entry in to the sanctuary and cause some problem to the biodiversity. In this regard Shelap, Radhanagri, Digas, Rajapur and other places should consider.

For the Development of Ecotourism:

1. Waterfalls, pools, anicuts, springs, gorges, groves, cave, ridges should declare as a natural heritage to abate their importance.
2. No plastic in the area, no person shall use plastic bags, pet bottles, tetra packs, or any artificial packging if found, should be fined heavily.
3. There should be staff recruitment which can be utilised for the proposed management of tourism and research monitoring.
4. Employment outsourcing particularly for vehicles hire, tourist occomodation, lunch houses, guides, photographers etc. should made availabe to minimise the pressure on core staff of the forest.
5. Revenue can be generated by production and marketing of the medicinal plants ,ecotourism, providing services like guide, vehicles, tourism packges, trekking trails, photographers, launch ferry, some water games, selling artifacts etc.