CHAPTER 2.

STUDY AREA

Toranmal plateau is a quantum part of Satpura Mountain forming the cultural transition between Gujarat, Madhya Pradesh and Maharashtra with its high altitudinal (1155 AMSL) trijunctional location between the three states (Plate No. 1). It had remained as an isolated ecosystem for longtime. However, in recent days it is gaining considerable attention of Environmentalist, Naturalist, Geographers, Ecologists, Geomorphologists and of course Biologist. It lies in western Satpura Mountain which is a horst block between Narmada graban on north and Tapi in the south.

Toranmal Plateau is one of the important plateaus in mid Satpura in Northern Maharashtra. This plateau forms a table land and summit covering about 41 Sq.Km. area at 1155 meter altitude (AMSL). Because of its scenic beauty it has a long historical background. Formerly, it is believed to be capital of King Yuvanashav during Mahabharata period. The total plateau summit area covers 41 Sq.Km. and extend between 21^{o} 54´ North to 21^{o} 61´ latitude and 74^{o} 26´ to 74^{o} 34´ East longitude. This is one of the best hill stations and famous tourist resort in North Western Maharashtra, 55 Km. from Shahada Tahsil and 90 Km North of Nandurbar district (Plate No. 2).

The plateau with hill station known as Toranmal has a temple called the Torana Temple (as Goddess of tribals) and Toranmal village. The landscape has two lakes-the Yashwant Lake and the Lotus Lake, several streams of which two main streams are Sitakhai and Kalapani; Agricultural land and Forested tracts. After the formation of Maharashtra State the plateau was visited by then Chief Minister of Maharashtra State Mr. Yashwantrao Chavan. The Lake Yashwant was named in honour of the first visit of the chief minister in the year 1959. After his visit it was developed as hill station. Forest department Range head quarter of Toranmal is under Ranipur Forest Division- North Dhule with head quarters at Shahada, Forest Circle- Dhule. On the eastern bank of Yashwant Lake, the linear pattern settlement of tribal people along the road is the Toranmal village. Rest houses (MTDC) and tourist cottages (PWD and Forest department) are present on the north side of the Lake.

Physical Environment

Administratively it is a part of Dhadgaon Tahsil of Nandurbar District of Maharashtra. Geologically the area covers Deccan trap basalt rock formation and lies under monsoon semiarid deciduous forest cover. It is characterized with influence of temperature and rainfall which influence soil characteristics.

Landform

Toranmal plateau is confined by the escarpment from all sides that can be grouped as northern, southern, eastern and western escarpment, forming an inseparable land of the plateau. The waterfalls (*e.g.* Sitakhai and gorges Kalapani) are the associated landforms of the escarpments. They also create varieties of landforms like depressions, caves, outlier hills, *etc*.

Table: 2.1 Monthly Averages Temperature and Rain fall at Station-Dhadgaon (1975-2005)

Month	No. of Rainy Days	Mean Rainfall mm	Temperature ◦C		Mean Daily temp. ◦C (Average)
			Max. (Average)	Min. (Average)	
Jan	3	7	25.5	11.7	18.6
Feb	-	-	28	13.5	20.7
Mar	-	-	32.9	17.4	25.1
Apr	-	2	36.6	20.4	28.5
May	-	25	36.8	20.9	28.8
Jun	7	128	26.1	18.6	22.3
Jul	17	352	35.1	18.9	27.6
Aug	11	167	25.1	16.1	20.6
Sep	16	321	26.4	15.9	21.1
Oct	3	278	29.8	24.8	27.3
Nov	-	7	28.3	11.6	19.9
Dec	-	-	26.5	11.7	19.1
Annual	54	1287	29.7	16.8	23.2

Source: Stastical Department, Agricultural College, Dhule and Nandurbar district (Adayalkar, 2006).

Bio-climatic Conditions

The ecological profile of the Toranmal plateau hinges on the bio-climatic conditions of the region. As the climatic data of the region is not available, the climatic conditions are determined on the basis of temperature and rainfall data from the nearby stations like Dhadgaon, Shahada and Nandurbar. However, on the basis of adiabatic lapse rate (6.5^{o}C/1000m) data has been generated. Toranmal plateau does not experience frost or snow, but the temperature and rainfall constitute the principal component of its climate. Plateau area is covered by dry deciduous forest and the temperature is cool due to altitudinal effects.

Table: 2.2 Average Climatic Conditions at Nandurbar Station During 2005 to 2010 (District Headquarter of Toranmal)

Month		Mean daily Temp°C		Range °C	Relative Humidity		Rainfall mm	Average Rainy Days	Rainfall Intensity mm/rainy Day	Windity Km/Hrs.
		Max.	Min		8.30 am	5:30 pm				
Summer	March	37.5	22	15.5	48	21	1.5	0.2	7.5	6.8
	April	40.4	25.5	14.9	47	19	1.3	0.2	6.5	8.6
	May	40.7	25.8	14.9	62	25	6.6	0.4	16.5	12.5
	Mean	39.5	24.43	15.1	52.3	21.6	3.1	1.04	10.16	9.3
Monsoon	June	36.6	25	11.6	74	48	117.3	5.9	19.88	13.8
	July	30.7	23.2	7.5	87	77	205.5	14.9	13.79	11.3
	Aug.	29.7	20.7	9.0	90	80	126.5	11	11.5	10.1
	Mean	32.3	22.96	9.36	83.6	68.33	149.76	10.6	15.05	11.73
Post – Monsoon	Sept.	31	20.5	10.5	85	74	117.3	6.8	17.25	9.1
	Oct.	34.4	29.4	5.0	62	44	36.8	1.9	19.36	5.2
	Nov.	32.9	16.1	16.8	46	36	17.5	0.9	19.4	5.1
	Mean	32.76	22	10.76	64.3	51.3	57.1	3.2	18.67	6.4
Winter	Dec.	31.4	16.3	15.1	47	35	4.1	0.3	13.6	5
	Jan	30.3	16.2	14.1	54	33	7.4	0.4	18.5	5.5
	Feb.	33.5	18.1	15.4	42	24	1.3	0.2	6.0	6.0
	Mean	31.73	16.88	14.66	47.66	30.66	4.26	0.3	12.7	5.5

Source: Stastical Department, Agricultural College, Dhule and Nandurbar district (Adayalkar, 2006).

Besides, the strong and steady breeze across the Lake adds the chilled pleasantness. During mid summer, the mean maximum temperature hardly reaches upto 25 °C. Nevertheless, the mercury occasionally touches 35 °C in the afternoons in the months of April and May. However, soon after the climate turns into a pleasant afternoon or evening. Generally, from the end of the February temperature starts increasing steadily and stabilizes by the end of May or the first week of June. The mean daily range of temperature is high in this period. This is a period of hot and dry winds and intense heat. In the wet season the rainfall is torrential and some time it falls in the form of heavy down pour as to make visibility very poor. Annual rainfall exceeds above 1696.2 mm which again reduces the summer hotness. It is evident that the Toranmal plateau is never too hot and it is pleasantly comfortable all throughout the year. The overall climate of Toranmal plateau merits it as an important hill station of Maharashtra. Record of rainfall for Nandurbar station is availed in gazetteer (The mean annual rainfall was 937 mm from 1975 to 2005 Table: 2.1). As Toranmal is located in Dhadgaon Tahsil about 27 Km aerial distance away from Dhadgaon Taluka head quarters, it is assumed to have similar climatic conditions. Meteorological data from Dhadgaon is utilized to analyse the weather conditions of Toranmal. The thirty years data of Dhadgaon shows mean average rainfall of 1287 mm and daily mean temperature fluctuations between 16.8 to 29.7 °C.

Land Use

The land use is the function of the slope relief, soil, water, natural vegetation and cultural aspects. As per the land use classification of Gupta *et al*., (1998) at Toranmal area has presence of Agriculture land, Forests, Streams and Gorges, areas not available for land use like rocks and slopes, and also tribal settlements. However, the agricultural land is considerably less in this area, which also includes illegal encroachments of Forest land. The cultural waste land on Toranmal plateau is very negligible due to sparseness of settlement and the region not developed for human settlement. However, there lies a great threat to the ecology of the area.

Soil

The terrain of the Toranmal plateau is made up of Deccan trap basalt rock. The comparatively higher rainfall due to altitudinal influence leads to intensive chemical weathering. The inherent soil properties have been derived from the influence of these factors. Six textural types of soil are evident at Toranmal Area (Suryawanshi, 2008). Three main texural types of the soils found on plateau top are sand loam, clay loam and silt clay loam. The soil of the plateau is less alkaline. These authors state that the soil at Toranmal is immature and neutral to soil reactions, total soluble salts are poor due to heavy leaching and deficient in essential nutrients hence unfavorable for agriculture. This region experiences intense torrential monsoonal rainfalls that wear and tear the soil particles. However, the few patches of forest cover diminishes the force of raindrop impaction, bushes and grasses check the pluvial action and the roots of the trees and grasses bind the soil particles to prevent the soil erosion.

Forest

The major area of Toranmal plateau is forest area which comes under dry deciduous type. In past the forest was comparatively dense and flourished in two storeys (Dashpute, 1983). However, present field observations show that the area is affected by deforestation activities. Higher rainfall and altitudinal influence on temperature preserves moisture for forest growth. The major forest species are teak, bamboo and dwarf spike trees along with grasses, with distribution of plant species following altitudinal influences. The teak and bamboo are found on the slopes and lower valley bottoms of Toranmal plateau, whereas few tall trees and dwarf trees with spikes and grasses are found over the plateau summit. The forest of Toranmal area is tropical dry deciduous with *Tectona grandis* (Teak) as major tree species. The other trees generally observed are *Anogeissus latifolia, Acacia ferroginea, Boswellia serrata, Madhuca longifolia, Terminalia crenulata, etc*. The flora of Toranmal area was surveyed from time to time during the study and is given in Annexure I.

The climatic changes have great influence on the flora. Majority of herbaceous elements sprout out on the onset of monsoon and complete the life cycle by the end of November.

The species which withstand cold weather survive longer. The highest plant species were observed during October and lowest during the hot season, especially in April and May. After the first showers in June some genotypes belonging to the families like Liliaceae and Araceae make their first appearance. Then there is a sudden rise in the number of herbaceous species such as *Alysicarpus hamosus, Biophytum sensitivum, Cassia purmila, Vernonia cineria, etc*. by the beginning of July. Some short lived monocotyledons and ephimera dicotyledons disapper by the end of September. In October when the monsoon ends, numbers of species attain the highest peak. A large number of herbs, some shrubs, twiners and climbers are common in occurrence. Some species occur in dense stands *e.g. Cassia tora, I. cordifolia, etc*. while forest undergrowth is determind by *Cassia pumila, Zornia gibbosa, Justica, etc*. From early December, the water content of the soil starts decreasing and concomitantly there is a gradual fall in the number of plant species especially from March to May when the humidity is low. The rate of evaporation and transpiration is higher on account of hot sun and gusty winds. This condition is not suitable for the herbaceous flora. Most of the forest trees such as *Madhuca longifolia, Butea monosperma, Acacia spp., Terminalis spp. etc*. and lianas, bloom in summer.

Study Sites

Main habitats used in the present study are Yashwant Lake, Lotus Lake, Sitakhai Stream, Kalapani area and Khadki area (details given in chapters).

Yaswant Lake : Many small residual hills are observed on Toranmal plateau with local relief of about 30 to 40 meters and surrounded by the plateau from all sides. Yashwant lake is located on the northwest side of the plateau with 2.75 Km. perimeter, with 39 hectars of spread area and average depth of 10 meters. It was constructed during British period by damming a deep gorge. A gravel embankment of 400 m is present on its north side which arrests the main flow. Its littoral zone is covered with various macrophytes and the Lake on the west and northwest is surrounded by forested land. The main drainage inflow of water enters the Lake from southern bank and minor drainages from Northwest. The outflow of the Lake is located on north east boundary. It runs downward upto Sitakhai fall arrested in between as small reservoir (Lotus Lake).

Lotus Lake: Lotus Lake is a shallow perennial water body, located at 21^{o} 53′ 20′′ N latitude, 24^{o} 28′ 01′′ E longitude and 900 mAMSL with 1.17 Km perimeter. It spreads in 3.5 hectare. Its North-South linear length is 154 m while East-West is 419 m. It receives water through streams from higher altitudes of Toranmal Plateau. It has a gravel embankment on North side which arrests the main flow of the streams. Water of the Lotus Lake is utilized by the local people for domestic purpose like washing, bathing and also to some extent for agriculture. It is covered with Lotus flowers hence centre of attraction at Toranmal tourist station.

Hydrological changes are noted as the season changes (discussed in next chapter). The inflow drainage in monsoon carry silt which is deposited on Western bank of the lake due to this the bank has become shallow and muddy. The soil deposits increase the fertility of this area that supports large number of macrophytes. Lake is also having rocky and sandy shores where very few macrophytes are able to grow. Northern bank has littoral vegetation consists of small to medium size trees, herbaceous and seasonally inundated or floating vegetation.

Kalapani Area : It is located at 21˚51’ 03” N and 74˚ 28’ 06” E and 822 AmsL. This area is located south and 10 km before Toranmal. The high magnitude waterfall is observed in the lower part of the escarpment *i.e*. Kalapani Waterfall (25 m.). the upper part of the escarpment is multifaceted and clearty shows seven steps. This escarpment is locally known as ‘Satpairy Ghat’. This is the most active land sliding zone of the Toranmal Plateau. It is forested area with tall trees. Natural vegetation was forest type with *Tectona grandis* (Teak), as a dominant tree species. Among the tall trees gaps (open) are present at few places where shrubs and herbs grow. Cattle grazing pressure was also observed in this area. The wild weeds includes *Achyranthes aspera, Cassia tora, Vernonia cinerea, Tridax procumbens* and *Andropogon spp.*

Khadki area : It is located at 21˚ 51’ 56” N and 74˚ 27’ 07” E and at 1003 mAMSL, extreme northwest of Toranmal plateau. It is plain area with degraded forest. Very few tall trees such as *Phyllanthus emblica, Terminalia arjuna, T. bellirica, Butea monosperma, Acacia chundra etc*., many herbs, shrubs and grasses are present here which start drying from postmonsoon. Cattle grazing was frequently recorded in this area.

According to Suryawanshi (2008) the soil at khadki is dry silt clay and loam type with pH (7.5) and exchangeable Ca 68.4 %.