# CHAPTER I - INTRODUCTION

**Biodiversity** is the abbreviated word for **Biological Diversity.** Biodiversity is "the variability among living organisms from all sources including, *inter alia* (among other things), terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (United Nations 1992: Article 2). Diversity within species is Genetic Diversity, diversity between species is Species Diversity (also often referred to as Taxonomic or Organismal Diversity) and diversity at ecological or habitat level is Ecosystem Diversity (also known as Ecological Diversity).

## 1.1 Types of Biodiversity

Biodiversity is usually defined in terms of genes, species and ecosystem; corresponding to three fundamental and hierarchically related levels of biological organization. The same is documented as three kinds of biodiversity i.e., **genetic diversity, species** or **taxonomic diversity** and **ecosystem diversity** (Solbrig 1991, Groombridge 1992, Heywood 1994, Norse 1994). However, Harper and Hawksworth (1994) favour the terms referred as genetic, organismal and ecological diversity. In the context of conservation strategies, Soule (1991) distinguishes five divisions: genes; populations; species; assemblages (associations and communities) and whole systems at the landscape or ecosystem level. Another classification distinguishes three interdependent sets of attributes, compositional levels (the identity and variety of elements) structural levels (the physical organization or pattern of elements) and functional levels (ecological and evolutionary processes) (Noss 1990). Nevertheless, different types of diversity can be stated as follows:

### 1.1.1 Genetic diversity

Genetic diversity is clearly an important component of biodiversity (Gaston 1996, Mallet 1996): the 'fine scale' level of biodiversity is measured in the variety of expressed genes or characters among organisms (Williams *et al.* 1996). However, as a basic unit for measuring and assessing biodiversity it has previously been dismissed as too difficult and costly to use (Moritz 1994).

The conservation of genetic diversity can be considered a subset of the notion of conserving species diversity by conserving species across their range. This would alleviate apparent problems with fine taxonomic distinction (Mallet 1996), notwithstanding the clear need to incorporate studies of genetic variation in key species as part of overall strategies (Baur *et al.* 1996).

Genetic diversity refers to the variation of genes within species. This covers genetic variation between distinct populations of the same species. Genetic diversity can be measured using a variety of DNA-based and other techniques (WCMC 1992). New genetic variation is produced in populations of organisms that can reproduce sexually by recombination and in individuals by gene and chromosome mutations. The pool of genetic variation present in an interbreeding population is shaped by selection. Selection leads to certain genetic attributes being preferred and results in changes to the frequency of genes within this pool.

The large differences in the amount and distribution of genetic variation can be attributed in part to the enormous variety and complexity of habitats, and the different ways in which organisms obtain their living. This represents the heritable variation within and between populations of organisms. According to one estimate, there are 109 different genes distributed across the world's biota, though they do not all make an identical contribution to overall genetic diversity (WCMC 1992). In particular, those genes, which control fundamental biochemical processes, are strongly conserved across different species groups (or taxa) and generally show little variation. Other more specialized genes display a greater degree of variation. This pool of genetic variation presents an inter-breeding population that is acted upon by selection. A differential survival result in changes of the frequency of genes within this pool, and this is equivalent to population evolution. This signification of genetic variation thus is clear; it enables both natural evolutionary change and artificial selective breeding to occur. The present day classification Angiosperm Phylogeny Group III (APG III) is also based on molecular aspect particularly the matK gene; which is assisting in understanding the variation at subspecies and variety level.

**1.1.2 Species diversity**

In terms of readily measurable field entities and as units of evolution, species are the fundamental unit of organization in ecology. They are essential for the evaluation of ecological and evolutionary patterns and process as well as generally being considered the most appropriate units for the management and conservation of natural areas (Spellerberg 1996). Biodiversity is very commonly used as a synonym of species diversity. In particular the term is a substitute for the quantification of the species 'richness' (which is the number of species in a site or habitat). As such, species diversity refers to the variety of species. The aspects of species diversity can be measured in a number of ways. Most of these ways can be classified into three groups of measurement: species richness, species abundance and taxonomic or phylogenetic diversity (Magurran 1988). The measures of species richness count the number of species in a defined area, while species abundance measures the sample of the relative numbers among species. A typical sample may contain several very common species, a few less common species and numerous rare species. In effect, the measures of species diversity simplify information on species richness and relative abundance into a single index (Magurran 1988; Spellerberg 1992).

Species diversity is also a conventionally accepted measure of diversity. There are effective ways to assess the composition of assemblages using species (or potentially surrogates of species) as units of distinction (e.g. Clarke 1993), and to consider the relative phylogenetic similarity between groups of interest, using species or higher taxonomic distinctions (Williams *et al.* 1996).

Measuring biodiversity using species diversity involves a complex combination of values such as species richness, species composition and taxonomic range (Gaston 1996; Williams *et al.* 1996). Species richness alone, as a measure of biodiversity, has been used in several experimental studies investigating the functional significance of biodiversity on 'ecosystem processes' (Naeem *et al.* 1994; Tilman *et al.* 1996). The approach has been criticized as being inappropriate (Wardle et al. 2000) because it does not account for differences between component species. Species richness alone is consequently a poor measure of diversity, although it must be recognized that biologists have historically assessed species diversity in more complex ways (Ghilarov 1996).

### 1.1.3 Habitat Diversity

Habitats can be defined as areas that provide the resource requirements for a discrete phase of a plant or animal's life (Southwood 1981). Implicit in most definitions of habitat is location in space - a 'place'. Andrewartha and Birch (1984) provide a broader context to potential influences on the survival and reproduction and hence distribution and abundance of organisms *via.* their theory of environment with direct (the Centrum) and indirect (the Web) influences on an organism. This is a concept that goes beyond a simple notion of 'habitat'. However in practice, their physical structure and their constituent vegetative species, especially with respect to dominant species within them often define habitats (Caley and Schluter 1997). Estimates of habitat diversity are often considered as a foundation of area-based management, although again it is often very difficult to assess habitats quantitatively.

It is often difficult to define boundaries for habitats and there are clear problems in defining when one habitat becomes another (Christensen *et al.* 1996). The classification of areas over coarse spatial scales using dominant vegetation can be very effective (e.g. Benson and Howell 1994), although the distinctions between habitats can often be blurred and more often than not are scaled over gradients (Budiansky 1995).

The key problem in evaluating and using habitats as measures of diversity lies in the complex and variable nature of habitats (Budiansky 1995). Despite the best efforts of numerous landscape ecologists (e.g. Christensen *et al.* 1996), the use of habitats as units for assessing biodiversity causes many of the same problems that some ecologists find with ecosystems.

**1.1.4 Ecosystem diversity**

Ecosystems are the largest units generally considered in biodiversity, comprising some amalgam of habitats, the species within them and importantly the processes occurring within and between the biotic and abiotic components (Wilcove and Blair 1995; Christensen *et al.* 1996; Noss 1996). Recently, it has been suggested that ecosystems form an appropriate unit for the management of large natural areas (Christensen *et al.* 1996; Noss 1996). However, the study of ecosystems and their use as management units has been thwarted by the looseness of definitions and the seeming inability to reach consensus on what they are in an operational sense, despite over 60 years of debate since Tansley first introduced the term (Tansley 1935). Tansley explicitly linked the term 'biome' with 'ecosystem', defining the former as comprising the complex of organisms and the latter the complex of organisms plus all inorganic factors. However, subsequent usage has obscured the meaning of the term, and has since been applied at broad and very fine scales. Additionally, the term "landscape" has become more frequently used in the past decade, but it too suffers from some definitional and usage problems.

Ecosystem diversity encompasses the broad differences between ecosystem types, and the diversity of habitats and ecological processes occurring within each ecosystem type. It is harder to define ecosystem diversity than species or genetic diversity because the 'boundaries' of communities (associations of species) and ecosystems are more fluid. Since the ecosystem concept is dynamic and thus variable, it can be applied at different scales, though for management purposes it is generally used to group broadly similar assemblages of communities, such as temperate rainforests or coral reefs. A key element in the consideration of ecosystems is that in the natural state, ecological processes such as energy flows and water cycles are conserved.

Ecosystem diversity is an essential element of total biodiversity and accordingly should be reflected in any biodiversity assessment. The quantitative assessment of diversity at the ecosystem, habitat or community levels remains problematic. While it is possible to define what is meant by genetic and species diversity, and to produce various measures thereof, there is no unique definition and classification of ecosystems at the global level, and it is thus difficult in practice to assess ecosystem diversity other than on a local or regional basis and that too only in terms of vegetation. Ecosystem further differs from genes and species in that they explicitly include abiotic components, being partly determined by soil parent material and climate.

### 1.2 Diversity at different scales

Whittaker (1972) distinguished diversity at different scales.

**Inventory diversity** is the species diversity found within the unit.

1. Point diversity: The diversity of a single small or microhabitat sample within a community that is regarded as homogeneous.
2. Alpha (α) diversity: The diversity of a sample representing a single community.
3. Gamma (γ) diversity: The diversity of a landscape or a set of samples that includes more than one community.
4. Epsilon (ε) diversity: The diversity of a broader geographic area including different landscapes

**Differentiation diversity** is the way in which the species are grouped into subunits.

1. Beta (β) diversity: The difference in community composition between communities along an environmental gradient or among communities in a landscape.
2. Delta (δ) diversity: The difference in community composition between communities between geographic regions.

### 1.3 Megadiversity Countries

**Mittermeier** (1988) and **Mittermeier** and **Werner** (1990) had concluded that the tropical countries possess 70% of world's species diversity. They were the first to introduce the concept of "megadiversity countries". Subsequently, **McNeely** ***et al.*** (1990) used the species list from different countries and identified 12 megadiversity countries. Later, 17 megadiversity countries were recognised, which together cover one third of the global land surface, are estimated to support two thirds of the world's species-level biodiversity (Mittermeier *et al.* 1997).

**Biodiversity Hotpots**

Norman Myers (1988) first identified ten tropical forest "hotspots" characterized both by exceptional levels of plant endemism and by serious levels of habitat loss. To qualify as a hotspot, a region must meet two strict criteria: it must contain at least 1,500 species of vascular plants (> 0.5 percent of the world's total) as endemics, and it has to have lost at least 70 percent of its original habitat. In 1990 Myers added a further eight hotspots, including four Mediterranean-type ecosystems.

Conservation International (CI), a non-profit organization, adopted Myers' hotspots as its institutional blueprint in 1989, and in 1996, the organization made the decision to undertake a reassessment of the hotspots concept, including an examination of whether key areas had been overlooked. Three years later an extensive global review was undertaken, which introduced quantitative thresholds for the designation of biodiversity hotspots. In the 1999 analysis, published in the book *Hotspots: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions*, and a year later in the scientific journal *Nature* (Myers, *et al.* 2000), 25 biodiversity hotspots were identified. Collectively, these areas held as endemics no less than 44 percent of the world's plants and 35 percent of terrestrial vertebrates in an area that formerly covered only 11.8 percent of the planet's land surface. The habitat extent of this land area had been reduced by 87.8 percent of its original extent, such that this wealth of biodiversity was restricted to only 1.4 percent of Earth's land surface.

A second major reanalysis has been undertaken and published in the book *Hotspots Revisited* (2004). This updated analysis reveals the existence of 34 biodiversity hotspots, each holding at least 1,500 endemic plant species, and having lost at least 70 percent of its original habitat extent. Overall, the 34 hotspots once covered 15.7 percent of the Earth's land surface. In all, 86 percent of the hotspots' habitat has already been destroyed, such that the intact remnants of the hotspots now cover only 2.3 percent of the Earth's land surface.

**1.4 India**

India is the seventh largest country in the world and Asia's second largest nation with an area of 3,287,263 sq km. India is a tropical country with a geographical area of 2.4 % of the world has about 8 % of the world's total biodiversity. India's location is at a junction of three biogeographic realms namely Afro-tropical, Indo-Malayan and Paleo-arctic. India possesses a distinct identity, not only because of its geography, history and culture but also because of the great diversity of its natural ecosystems. The panorama of the Indian forest ranges from the evergreen tropical rainforest in the Andaman and Nicobar Islands, the Western Ghats, the North Eastern states, to the dry alpine scrub high in the Himalayas. The country has a semi-evergreen rain forest, a deciduous monsoon forest, a thorn forest and a subtropical pine forest in the lower montane zone and the temperate montane forests (Lal 1989). Champion (1936) developed one of the most important tropical forest classification. Later on Champion and Seth (1968) revised the forest types of India and divided them into six broad types ranging from tropical to alpine types which were further divided into 16 climatic forest types, 30 subgroups and 221 Minor Forest Types based on structure, physiognomy and floristic.

India is biologically rich as a result of its diverse physical features and climate, and the natural evolution of a variety of phytogeographic conditions. Several phytogeographers (Hooker 1904, Clarke 1898, Chatterjee, 1940, Puri, 1960, Rodgers and Panwar 1988) have variously divided the Indian region under several phytogeographical provinces based on the floristic composition, the naturalness of the flora and the local climate. Rodgers, Panwar and Mathur (2002) have taken account of all the previous classifications including that of Meher-Homji (1972) and have divided the country into 10 Biogeographical zones and 26 Biotic Provinces which are as follows:

| **Code** | **Biogeographical zones** | **Code** | **Biotic Provinces** |
|---|---|---|---|
| 1 | Trans – Himalaya | 1A | Ladakh Mtns. |
| | | 1B | Tibetean Plateau |
| 2 | Himalaya | 2A | North West Himalaya |
| | | 2B | West Himalaya |
| | | 2C | Central Himalaya |
| | | 2D | East Himalaya |
| 3 | Desert | 3A | Thar |
| | | 3B | Kutchchh |
| 4 | Semi-desert | 4A | Punjab Plains |

| Code | Biogeographical zones | Code | Biotic Provinces |
|---|---|---|---|
| | | 4B | Gujarat Rajputana |
| 5 | Western Ghats | 5A | Malabar Plains |
| | | 5B | Western Ghats Mtns. |
| 6 | Deccan Peninsula | 6A | Central Highlands |
| | | 6B | Chotta-Nagpur |
| | | 6C | Eastern Highlands |
| | | 6D | Central Plateau |
| | | 6E | Deccan South |
| 7 | Gangetic Plains | 7A | Upper Gangetic Plain |
| | | 7B | Lower Gangetic Plain |
| 8 | Coasts | 8A | West Coast |
| | | 8B | East Coast |
| 9 | North-East | 9A | Brahmaputra Valley |
| | | 9B | North-East Hills |
| 10 | Islands | 10A | Andamans |
| | | 10B | Nicobars |

India is one of the 17 megadiversity countries of the world. India shares 3 biodiversity hotspots; (i) Western Ghats and Sri Lanka, (ii) Himalayas and (iii) Indo-Burma.

**Western Ghats**

The Western Ghats or the Sahyadri is the majestic mountain range on the fringes of the west coast of India. It is one among the seven great mountain ranges in the country and is next only to the Himalayas. Its landscape is unique in terms of geology, biology and ecology. The mountain range extends over a distance of 1500- 1600 km from Tapti river in the north to Kanyakumari in the south with an average elevation of more than 600 m and traverses through Six States *viz*. Gujarat, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu.

Its geology and geomorphology coupled with high rainfall makes the Western Ghats as one of the most ecologically diversified landscapes. It is this ecological diversity of WG that supports: (i) a wide range of forest types ranging from tropical wet evergreen forests to grasslands, (ii) some 4000 species of flowering plants with high degree of endemism and (iii) rich fauna with endemism ranging from 11% to 78% among different groups. Consequently, Western Ghats constitutes not only one of the hotspots of biodiversity in the world, but also one among world's eight hottest hotspots.

Worldwide thousands of plant species are endangered and facing extinction with the current trend of their exploitation and destruction. In recent years, there is a growing awareness concerning the impact of temperature rise, industrialization, desertification and shift in the growing seasons of plants, loss of pollinators, seed dispersers and increasing frequency of intense weather events such as drought, storms and floods making several valuable plants extinct. According to the International Union of Conservation of Nature (IUCN), it is estimated that the current species extinction rate is between 1000 and 10,000 times higher than it would naturally be. It is acknowledged that the future survival of humanity depends on the conservation and protection of natural wealth, and destruction of a species or a genetic line symbolizes the loss of a unique resource.

Tropical forests show a high degree of species richness and endemism (Orians & Groom, 2005). Endemic taxa are restricted to specific areas such as oceanic islands, peninsular regions, mountain peaks and unique geographical areas. Globally 'botanically interesting' areas are rich in endemics, especially islands (Richardson, 1978). Regions with high concentration of endemic species are classified as 'Biodiversity Hotspots' by the Conservational International (Mittermeier *et al.*, 2004).

A thorough investigation of our flora has become an urgent necessity not only because of the economic and ecological importance of biodiversity but also of accelerated genetic erosion occurring as consequence of destruction of the forest and other habitat (Manilal, 1998).

## 1.5 Gujarat

Gujarat state is a well-marked geographic assemblage, limited by effective barriers like the sea in west and southwest, the lofty Aravallis in northwest, Thar Desert in north, Vindhyas and Satpura range in west, and high hills of Western Ghats in south. Of the 10 biogeograhic zones of India (Rodgers, Panwar and Mathur, 2002), Gujarat is further sub divided into four zones- Zone 3, 4, 5 and 8. The provinces of these zones in Gujarat are province 3A-Kutchchh, 4B-Gujarat-Rajputana, 5A-Malabar plains, 5B-Western Ghat Mountains and 8A-West coast. Gujarat has a territory of 196,024 sq km, and is endowed with a great diversity of natural ecosystems ranging from desert, semi-arid, mangroves, coral reef-rich coast and forest with dry deciduous, moist deciduous and evergreen trees.

### Type of Forests in Gujarat:

Gujarat has 4 major forest types which are classified in to 4 subgroups according to revised forest types of India (Champion and Seth, 1968) which are as follows:

- Sub-group 3-B -**South Indian moist deciduous forests**: Dangs, Valsad and Surat.

- Sub- group 4-B-**Swamp forests or tidal forests**: Kachchh, Jamnagar, Bhavnagar, Bharuch and Surat.
- Sub-group 5-A-**Southern Tropical dry deciduous forests**; Dangs, Gir-Girnar, Sabarkantha and Panchmahals.
- Sub-group 6-B **Northern tropical thorn forests**: Saurashtra, Kachchh and North Gujarat, Little Rann of Kutch (LRK) and Great Rann of Kachchh (GRK) and Banni.

## 1.6 Study Area - Dangs district

### 1.6.1 Geographical Position

Dangs (The Dangs) district is situated in the south-eastern part of Gujarat State of India between the parallels of 20°33’40” N and 21°5’10” N latitudes and 73°27’58” E and 73°56’36” E longitudes, encompassing geographical area of 1,764 sq. km. Dangs district is bordering with Dhule and Nashik districts of Maharashtra in the east and south respectively and Tapi and Navsari districts of Gujarat in the north and west respectively **(Plate 1)**. Dang is also part of Western Ghats.

### 1.6.2 Topography

The hilly terrain is the chief natural feature of the district. The Sahyadri Hills occupy the whole of the Dangs district. Barring a few high hills in the east and south, most of the area is made up of a series of flat-topped low hills. The elevation of these hills varies from 105 m in the west to 1,317 m above mean sea level (amsl) on the eastern border. However, most of the area lies between 300 m and 700 m amsl.

### 1.6.3 Geology

Dangs is covered by Deccan Lava flows as horizontally bedded sheets. Hence flat topped hills are common in the area which is characteristic of the Trappean country. At places, the trap contains iron and traces of feldspar and hornblende, producing the red, sharp gravel covering many hillsides (Khanchandani 1970). The soil in the valleys is mostly black cotton soils composed mainly of clay mineral. The texture is clay loam and the soil is fertile. It contains high amounts of alumina, lime and magnesia, with a variable amount of low nitrogen and phosphorus. On the slopes of the hill is red soil, which is light and porous and contains no soluble salt (Patel, 1971). The agricultural soils are mildly acidic to neutral with the pH value ranging from 6.7 to 7 and moderately rich in organic Carbon.

### 1.6.4 Drainage

Total 46 wetlands were mapped including 22 small wetlands with 4368 ha area in Dangs district where major wetland category is River/ Streams (National wetland Atlas-Gujarat, 2011). A detail of area estimates of wetlands in the district is shown in table 1.1. **(Plate 3)**

**Table 1.1 Area estimates of wetlands in Dangs district** (Area in ha.).

| **Sr. No.** | **Wetcode** | **Wetland category** | **Number of Wetlands** | **Total Wetland Area** | **% of wetland area** | **Open Waters** | |
|---|---|---|---|---|---|---|---|
| | | | | | | **Post monsoon area** | **Pre monsoon area** |
| | **1100** | **Inland Wetlands - Natural** | | | | | |
| 1 | 1106 | River/Streams | 16 | 4305 | 98.56 | 675 | 966 |
| | **1200** | **Inland Wetlands – Man-made** | | | | | |
| 2 | 1201 | Reservoir/ Barrages | 5 | 28 | 0.64 | 29 | 24 |
| 3 | 1202 | Tank/Ponds | 3 | 13 | 0.30 | 13 | 13 |
| | | Sub-Total | 24 | 4346 | 99.50 | 717 | 1005 |
| | | Wetlands | 22 | 22 | 1.50 | - | - |
| | | Total | 46 | 4368 | 100.00 | 717 | 1005 |

**Rivers**

There are four main rivers Gira, Purna, Khapri and Ambika in the area that emerge in the hills of the Western Ghats and flow towards the west. All four are perennial rivers. The Gira and Khapri are major tributaries of Purna and Ambika respectively. All the rivers originate from the north-eastern side of the Dangs and flow towards the south-western part. The drainage of the rivers mostly follows the south western direction.

### 1.6.5 General Climate

The climate of the Dangs shows three seasons- summer, monsoon and winter. **Summer season** includes the months from March to May. Temperature increases steadily with its maximum temperature in the month of April. The southern part remains pleasant with compared to the eastern part of the district, which is too hot and temperature rises up to 37°C. **Monsoon season** starts on the onset of the south-west monsoon which arrives in June and lasts till October. Sometime rainfall also occurs in November. Humidity during this season is highest of all the seasons. **Winter season** includes the months of November to February. During this season temperature is at its minimum. Humidity decreases in this period to the minimum, heavy fogs gather soon after sunset and towards the morning.

### 1.6.6 Climatic variables

**Precipitation / Rainfall**

Major precipitation is in form of rainfall, besides occasional occurrence of dew and fog. The south east monsoon commences towards the mid of June and burst until the end of September. The district receives average rainfall of 2000 mm and has 80-100 rainy days. All the annual rainfall occurs between June to October. The west receives more rains than the east.

**Table 1.2** Data on rainfall and Temperature for the period of 10 years from 2003-2012 (Data was procured from Indian Metrological Department).

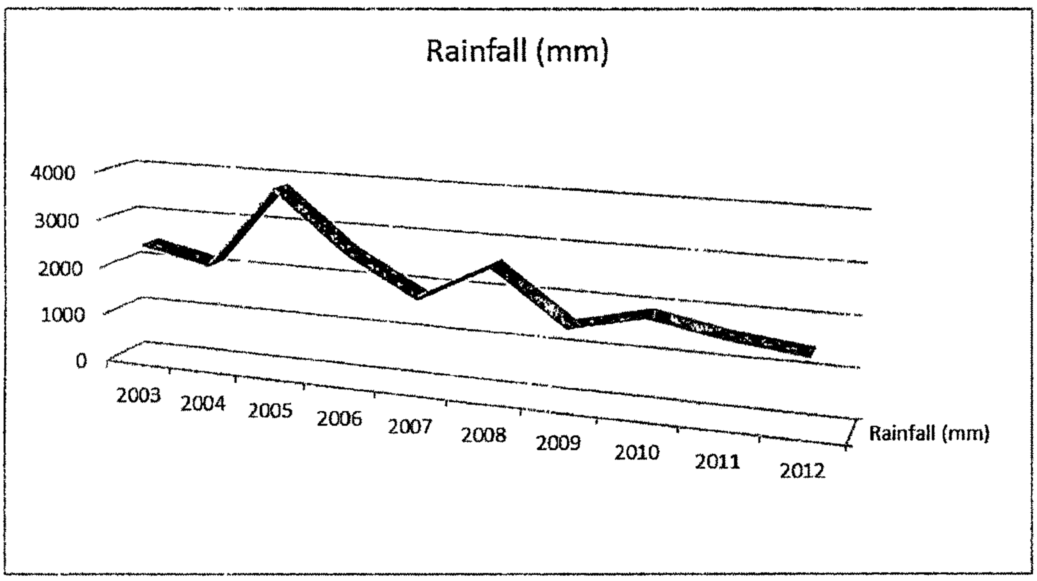


**Chart 1.1** Rainfall data of Last 10 years

**Temperature**

April and May are the hottest month when the mean daily maximum temperature soars up to 38.6°C; while December and January are the coldest months in the district. Minimum temperatures are usually well above freezing at 13.7°C (based on 2003-2012 data).

**Relative Humidity**

Relative humidity is normally highest during rainy season (July –August), often recorded near to saturation point (92-97%) in thickly forested zones especially in Saputara, it gradually decreases till December. The drier part of the year is the period from January to April, when relative humidity is about 30%.

**1.6.7 Wind speed**

The first half of the monsoon start with high velocity winds of southwest direction. Some rainfall also starts from northwest direction. These winds blow from June to September with an average speed of 10 km/hr. Winter have usually northeast winds.

**1.6.8 Forest types and Forest cover**

According to Champion and Seths (1968) revised classification of forest types (1968), the forests of the Dangs belong to the subgroup; **South Indian Moist Deciduous forests.** Within this type they are classified a **'moist teak forests'**. Based on the holistic classification of vegetation followed by Puri *et al.* (1983) these forests are classified as deciduous teak forest types intermediate between dry and moist categories. They are named as the *Tectona-Terminalia* series which is also encountered in the Valsad district of Gujarat, Nasik and Thane districts of Maharashtra and in Nagar Haveli. Teak is the most dominant species and its occurrence is almost universal throughout the area. The composition of tree growth varies slightly according to the edaphic and biotic factors but by and large it is the same throughout the area (Worah 1991). According to Gadgil and Meher- Homji (1986) it is vital that the vegetation of this region should be preserved and not 'sacrificed on the altar of teak plantations'. In view of these facts the conservation importance of these forests cannot be overemphasised.

Dangs district has forest cover of 77.64% of its geographical area and has 209 sq. km. of very dense forest, 745 sq. km. of moderate dense forest, 414 sq. km. of open forest and 3 sq. km. of scrub forest (FSI, 2013).

**1.6.8 Demography**

The district comprises of 311 villages, 70 Panchayats and one taluka. The total population is 226,769 as per provisional figures of Census 2011 compared to 186,792 in 2001, an increase of 21.44% compared to figures of the 2001 Census. The Dangs district population constitutes 0.38% of Gujarat's population. It is totally a Scheduled Tribe [ST] area; about 94% population in the district are Scheduled Tribe. The sex ratio of girls per 1000 boys was recorded as 1007 i.e. an increase of 20 points from the 2001 Census which puts it at 987.

Bhil, Konkana (Kunvi), Varli, Kotwalia, Kathodi and Gamit being the major tribal groups. The Bhils have historically been residing in the Dangs whereas the other tribes came to the Dangs in search of a livelihood. The Konkanas have migrated to this area from a coastal region in the south-west, the Konkan. The name, *Konkanas* and their dialect (Marathi dialect with certain North Konkani elements) derive from their place of origin. According to an oral tradition the community migrated north because of the terrible Durgadev famine of 1396-1408. The Varlis have also migrated to south Gujarat from the Konkan area but in a later phase due to the pressure of the British. The Varlis speak their own dialect, which is a mixture of Khandeshi, Bhili and Marathi.

Tribals in Dangs are acquainted with various languages however they speak Dangi, the local dialect. The different dialects spoken by tribals are considered unscheduled languages. Dangi is a mix of Gujarati, Marathi, Konkani and Hindi languages. There are two reasons for the large Marathi influence. Firstly the region borders Maharashtra so there is much contact with Marathi speaking people and secondly the area was under Maharashtra jurisdiction before the formation of the separate state of Gujarat. During these times the education was also in Marathi. Not only the language but also the culture and for example the dressing pattern has Marathi influences. Given the fact that the Dangis are getting more formal education in Gujarati, the tribal languages and dialects are facing the threat of extinction. The loss of language is affecting tribal culture, especially their folklore.

**1.7 Selection of site**

Based on review of literature the numbers of plants sited from the region are in ranges of 878 species (Surynarayana 1968, Shah 1978). However, looking into Western Ghats wherein the species range from 1000-1500. The number of species reported from Dangs is low in number. Being the tip of Western Ghats and the number of species reported till date is matter of curiosity to know whether the plant diversity of the region is the same or has changed in last 3 decades.

Hence the present work was undertaken to bring out a comprehensive account on Floristic diversity of Dangs district.

### 1.8 Objectives

1. To study the **Floristic Diversity of Dangs**
2. To study the **Vegetation of Dangs using Remote Sensing and GIS**
3. To study the **Provisioning Services** of Ecosystem
4. To study the **Threats to the Biodiversity**