CHAPTER III – METHODOLOGY

3.1 Floristic Diversity of Dangs

Floristics is the documentation of all plant species in a given geographic region (Simpson, 2009). Floristic studies are vital in the documentation of plant biodiversity. Assessment of floristic diversity provide basis for devising suitable strategies for conservation of the plant resources.

To collect the data for Floristic Diversity of Dangs district frequent visits were conducted from December, 2009 to August, 2013. The area was surveyed along different topographic gradient and climatic conditions in order to collect maximum plant species occurring in the district. Preliminary survey was undertaken throughout the district to identify the areas rich in diversity. These identified areas were paid more attention by conducting frequent field trips. The duration of each study tour ranged between 1-7 days. During monsoon regular field visits were made to collect the monsoon annuals as well as the effort was made to collect the plants in different seasons. The field data such as habit, habitat, flower colour and distribution was recorded.

Waghai, Saputara, Ahwa were the three major places visited frequently due to availability of transport. Other places of visits were Galkund, Mahal, Subir, Bhenskatri, Pimpri, Chinchli, Bhenskatri, Nishana, Lavchali, Bordahad etc. **(Plate 4)**

Specimens were collected in different seasons. Secateurs, blades, knives, and axe were used to cut the plants specimens. Pickaxe, spade, trowel, chisel and hammer and digger were used to dig plant parts. Scissors, long-handheld pruner, pruning saw were used to cut the plant part. String, webbing strap were used to secure bundle for transit. **Polythene bags** were used to collect plant materials. **Field portfolio** was used to immediate pressing of fresh plant materials. **Number tags** were used to tag unidentified specimens. **Plastic bottles** were used to collect seeds, fruits and fresh water plants. **Liquid fixative** or preservative were used to preserve plant specimens and plant parts. **Binocular** were used to observe trees, epiphytes and parasites.

All specimens were identified before being mounted because it is easier to place unmounted specimen under the microscope, to examine both sides and for the

removal of flowers or fruits for dissection. Collected plant specimens were dried using blotting papers, old newspapers and conventional cardboard plant press. Poisoning of dried specimens was done using Mercuric chloride (0.1%w/v) to protect specimen from insect attack. Dried plant specimens were mounted on herbarium sheets by strapping method using masking tape (Gummed linen tape). Only some of dried plant specimens were mounted using gum. Standard herbarium sheets of size 29 cm x 41.5 cm (11 ½ in. x 16 ½ in.) were used. (Bridson & Forman, 1992)

The collected specimens were identified by referring to various Floras, monographs and revisions. *Flora of The Bombay Presidency* (Cooke, 1903-1908) and *Flora of Gujarat State* (Shah, 1978) were mainly used to identify the plant materials. Identity of the specimens was established by referring to the herbarium material lodged in Herbarium of The Maharaja Sayajirao University of Baroda (BARO), Vadodara and BSI, Jodhpur. Voucher herbarium specimens prepared for all plants collected are deposited in the BARO herbarium, Vadodara.

A checklist of plants occurring in the district is prepared. The checklist is arranged according to plant families. All plant families are arranged according to Bentham and Hooker (1862-1883) with necessary alterations, based on split up of various families as proposed by Hutchinson (1926, 1934, 1956 & 1973), Brummit (1992) and Takhtajan (2009).

For each species, accepted botanical name followed by important synonyms is given. The nomenclature of plant has been adapted and updated applying ICBN (Greuter *et al.*, 2000) and referring to latest taxonomic literature. All botanical names are checked online for accepted names on International Plant Names Index (IPNI) (http://www.ipni.org), Tropicos (http://www.tropicos.org) and the plant list (http://www.theplantlist.org).

3.2 Vegetation of Dangs using Remote Sensing and GIS

Assessing and monitoring the state of the earth surface is a key requirement for global change research (Committee on Global Change Research, National Research Council, 1999; Jung *et al.* 2006; Lambin *et al.* 2001). Classifying and mapping vegetation is an important technical task for managing natural resources as vegetation provides a base for all living beings and plays an essential role in affecting global climate change, such as influencing terrestrial CO_2 (Xiao *et al.* 2004). Vegetation mapping also presents valuable information for understanding the natural

and man-made environments through quantifying vegetation cover from local to global scales at a given time point or over a continuous period. It is critical to obtain current states of vegetation cover in order to initiate vegetation protection and restoration programs (Egbert *et al.* 2002; He *et al.* 2005).

Traditional methods (e.g. field surveys, literature reviews, map interpretation and collateral and ancillary data analysis), however, are not effective to acquire vegetation covers because they are time consuming, date lagged and often too expensive. The technology of remote sensing offers a practical and economical means to study vegetation cover changes, especially over large areas (Langley *et al.* 2001; Nordberg and Evertson 2003). Because of the potential capacity for systematic observations at various scales, remote sensing technology extends possible data archives from present time to over several decades back. For this advantage, enormous efforts have been made by researchers and application specialists to delineate vegetation cover from local scale to global scale by applying remote sensing imagery.

The floristic studies were decided based on the earlier studies and identifying highly dense regions using Remote Sensing Data. Various field studies were made to check the ground truth. The details of the methodology that was adapted is as follows:

3.2.1 Satellite Data Products

IRS P6 LISS III data was used to map the vegetation. IRS P6 LISS III provide data in 4 spectral bands; green, red, Near Infra Red (NIR) and Short wave Infra Red (SWIR), with 23.5 m spatial resolution and 24 day repeat cycle. The spatial resolution is suitable for 1:50,000 scale mapping. The descriptions of the scenes used for the study are provided (Table 3.1). Two date data, one acquired during May/April and another during October were used to capture the pre-monsoon and post-monsoon vegetation variability of the land respectively **(Plate 5, 6)**

Table 3.1 Description of Satellite scenes used in the study.

Sr. No.	Satellite	Sensor	Path-Row	Date of Acquisition	
				Date 1	Date 2
1	IRS P6	LISS III	94 -57	Oct 24, 2006	May 9, 2006

2	IRS P6	LISS III	94 -58	Oct 24, 2006	May 9, 2006
3	IRS P6	LISS III	95 -58	Oct 10, 2005	Apr 20, 2006

Ancillary Data

The following ancillary data were used directly or indirectly for the study.

i. Survey of India topo-sheets on 1:250,000 and 1:50,000 scales.

ii. Forest type maps of India (Champian and Seth, 1968)

iii. Biogeographical map (Rodgers and Panwar, 1988)

3.2.2 Digital Classification of Satellite Data

Pre-processing

The raw digital data was enhanced using contrast stretching based techniques to facilitate better discrimination during ground data collection or locating sample points. Plate 5 and Plate 6 shows the overview of the part of Dangs district as seen in the LISS III FCC of post- monsoon and pre-monsoon data respectively.

Reconnaissance Survey

In order to convert raw satellite data into meaningful information the reconnaissance survey was undertaken for getting better acquaintance with the general nature of vegetation of the area. Major vegetation types and few prime localities of characteristic types were noted during reconnaissance survey. The variations and tonal patterns were also observed on existing images /maps. Traversing along major drainage, roads, paths etc. for ground truthing, existing literature survey, and interaction with forest officials were also made during field survey. Stratified random sample technique is used by which the floristic area is first divided into homogenous vegetation group based on type or density (Forest cover / type classification) using satellite data and then samples are distributed to each vegetation group proportionately based on their aerial extent.

3.2.3 Vegetational characterization using Satellite Data

Satellite data in digital form were used for analysis to characterize the vegetation using interactive digital analysis procedures. The preparation of vegetation map assumes a critical step in the biodiversity characterization procedure. All these

scenes were geometrically corrected with reference to Survey of India 1: 250,000 scaled topo-sheets. The different scenes were classified using Maximum likelihood algorithm. The Vegetation classification was performed as per the scheme mentioned earlier. After completing the classification, misclassified areas were checked and reclassified considering small Area of Interest (AOI) or through Interactive Editing for improved accuracy. Finally all classified scenes were mosaicked and the edges were smoothened. Digitally classified vegetation/cover map was made **(Plate-7)**.

3.3 Provisioning Services of Ecosystem

Ecosystem is "a dynamic complex of plant, animal and micro-organism communities and their nonliving environment interacting as a functional unit" (United Nations 1992: Article 2). Ecosystems vary enormously in size; a temporary pond in a tree hollow and an ocean basin can both be ecosystems. Humans are an integral part of ecosystems. Benefits people obtain from ecosystems are called as **Ecosystem services**. The Millennium Ecosystem Assessment (2005) divided ecosystem services into four categories: **(i)** ***provisioning services*** are the supply of goods of direct benefit to people, and often with a clear monetary value, such as timber from forests, medicinal plants, and fish from the oceans, rivers and lakes; **(ii)** ***regulating services*** are the range of functions carried out by ecosystems which are often of great value but generally not given a monetary value in conventional markets. They include regulation of climate through the storing of carbon and control of local rainfall, the removal of pollutants by filtering the air and water, and protection from disasters such as landslides and coastal storms; **(iii)** ***cultural services*** are not providing direct material benefits, but contributing to wider needs and desires of society, and therefore to people's willingness to pay for conservation. They include the spiritual value attached to particular ecosystems such as sacred groves, and the aesthetic beauty of landscapes or coastal formations that attract tourists; **(iv)** ***supporting services*** are not of direct benefit to people but essential to the functioning of ecosystems and therefore indirectly responsible for all other services. Examples are the formation of soils and the processes of plant growth.

Biodiversity is not regarded as an ecosystem service itself, but rather as a pre-requisite underpinning each of them. Biodiversity and ecosystems are closely related concepts.

To collect the data for Provisioning services of Ecosystem of Dangs district, interviews of local people were conducted. A questionnaire was used to conduct an interview. Name of informer and locality also recorded.