Chapter- 1
INTRODUCTION

Assessing the vegetation ecology is the study of its physical and biological processes, which control its distribution and dynamics. Variety of bioresources which are generated from biodiversity helps to sustain the livelihood of people. Study of regional plant biodiversity is an important aspect for exploring natural flora as a source for identifying gene bank in various plant groups (Sony and Modak, 2014). Plant diversity documentation requires surveying, sorting, cataloguing and quantifying (Heywood, 1995). It is very necessary to systematically study the native phytodiversity for better understanding and for promoting sustainable development. Enumeration of the plant diversity and its analysis is essential to develop strategies for its conservation. Study of forest composition, plant community structure and diversity patterns are some of the important ecological attributes, which are correlated with prevailing environmental as well as anthropogenic variables (Gairola et al., 2008). Plant community also plays a pivotal role in sustainable management by maintaining biodiversity and conserving the environment (Farooquee and Saxena, 1996). Floristic studies provide basic knowledge about the extent of plant diversity in the region. This important information serves as the foundation for many types of detailed studies using plants as the resource material. If plant diversity is not conserved, there are chances of losing several species, which may be of economic importance in many ways like, developing resistant varieties for insect pests, extracting lifesaving drugs now and times to come.

India has been identified as one of the top twelve mega bio-diversity countries in the world having 47,000 plant species, consisting of more than 15,000 species of flowering plants. Himalayas, are one of the largest and youngest mountain chains in the world and the Himalayan ranges are about 2500 km long, extending from 73º to 97º East longitude, and from 27º to 37º North latitude, and covering an area of approximately 236,000 sq km. Across the world, there are 34
hot-spots which has been identified on the basis of species endemism and degree of threat through habitat loss. Indian Himalayan Region (IHR) is one of the most important biodiversity hot-spot of the world. Indian Himalayan Region (IHR) extends from Jammu and Kashmir in north to Arunachal Pradesh in the east and supports representative, natural, unique and socio-economically important diversity (Rana and Samant, 2009). A total of 18,440 species of plants have been recorded from the region of which over 25.3% species are endemic (Singh and Hajra, 1996; Samant et al. 1998). The Himalayan temperate forests extend from 1500 m - 3000 m amsl in the western Himalayas is of immense significance from the environmental conservation and sustainable development viewpoint (Sharma and Badhuni, 2000). The protected areas (PAs) are very important that they contain a large amount of biodiversity within. A majority of these Protected Areas (PAs) are either unexplored or under-explored. Only a few efforts have been made to evaluate the status of biodiversity in PAs (Heywood et al., 2003). PAs are facing various natural and human generated pressures, which are causing a serious decline of flora and fauna. However, to avoid further losses it is essential to develop a suitable conservation strategy based on existing floristic composition, community structure and status of various threats in the PAs.

The Himalayan ecosystem is fragile and diverse. On account of it being in an evolving state, the ecosystem components in the Himalayan region exhibit great dynamism. It includes over 51 million people who practice hill agriculture and remains vulnerable. The Himalayan ecosystem is vital to the ecological security of the Indian landmass, through providing forest cover, conserving biodiversity, providing a rich base for high value agriculture, and spectacular landscapes for sustainable tourism. The Himalayan ecosystem is vulnerable and susceptible to the impacts and consequences of changes on account of natural causes, climate change resulting from anthropogenic emissions and developmental paradigms of the modern society. Many of the world’s crops originate in mountains, a crucial resource that should be conserved for sustaining modern agriculture. Natural wealth in the region, including geological assets, forms an important part of the Himalayan eco-system. All this has contributed to a whole range of diversity in indigenous human habitations, cultures and knowledge systems. The region is
largely inhabited by indigenous societies. Living in biodiversity rich areas of the country, the mountain people are dependent upon biodiversity for meeting with their livelihood needs. The region serves as a rich repository of plant and animal wealth in diverse ecological systems. These ecosystems reflect a mosaic of biotic communities at various spatial and organizational levels. Recognition of the Himalaya as one among 34 global biodiversity hotspots aptly reflects its' wide ranging ecological significance. The vulnerability of the biological and physical features of the Himalayan Ecosystem towards natural and human induced disturbances is well recognized.

IHR is important for its high forest cover. More than 41.5% of its geographical area is under forests representing one-third of the total forest cover in India and nearly half (47%) of the “very good” forest cover category of the country. These forests generate a plethora of goods and services. However, a complex interplay of climatic and geological processes, destructive patterns of resource use and economic marginalization have led to the situation of heavy resource degradation and associated environmental consequences on the highly diverse and fragile Himalayan eco-system.

Phytodiversity in species diversity along environmental gradient is a major topic of ecological investigation and has been explained by reference to climate, productivity, biotic interaction, habitat heterogeneity and history (Givnish, 1999; Willig et al., 2003; Gonzalez-Espinosa et al., 2004). The forest herbs, which play important role for rural communities for example, the livestock totally dependent on them for fodder and as traditional medicines, have been hardly studied from diversity standpoint (Singh and Singh, 1987). The realisation of the economic potential of the biodiversity and the necessity for its preservation for the future welfare of mankind has suddenly boosted the stock of the subject of Taxonomy (Manilal, 1997). Taxonomy is defined as the study of the laws and principles underlying a system of classification (Candolle, 1813). Taxonomy is classified as a sub-division of Systematics. Simpson defined systematics as “the scientific study of the kinds and diversity of organisms and of any and all relationships among them”(Simpson, 1961). Systematics is also concerned with the development of
methods including numerical methods, for various aspects of phylogenetic inference and biological nomenclature/classification (Candolle, 1813). The importance of classification to biology and society results from both the process and the product of classification (Stuessy, 1994). Classification consists of two associated activities, namely, identification and nomenclature. It involves referring an individual specimen to a previously classified and named group (Jardine, 1969). The naming of groups of organisms and the rules governing the application of these names is called nomenclature (Stuessy, 1989). Swingle made a distinction between systematics and taxonomy with the latter regarded as dealing with phylogenetic classification, and the former being broader to include taxonomy and nomenclature (Swingle, 1946). Crowson concludes that “the words classification, systematics, and taxonomy are now commonly treated as synonyms, an example of the confusion and the carelessness in the use of words which is prevalent in so much modern writing” (Crowson, 1970). Plant taxonomy applies a number of subjects tool to diversify into various domains of research like Cytotaxonomy, Chemotaxonomy, Molecular Taxonomy, Numerical Taxonomy, Taxonometrics, etc.

Taxonomy plays the role of “data processing system for biology” (Heywood, 1973). Taxonomy allows construction of framework with the millions of pieces of data collected by the taxonomists from the natural world to arrange the total available biological information, the data about life. Systematics also helps to understand the process of evolution, which is information used by other areas of biology. Systematics studies also help reveal patterns of evolution or phylogenetic relationships, which stimulate ideas on the origin of life, the development of ecological zones through geological time scale. Ecology, Phyto-geography, Palaeobotany, etc., are virtually dependent on the data generated in systematic studies (Das et al., 2010). Very few works has been done to systematically explore the flora of reserve forests in Himachal Pradesh. Intensive floras of smaller areas are much useful and necessarily required for better understanding and compilation of natural floras. Plants growing together have natural relationship among themselves and with the surrounding environment.
This interaction among different plants and between plants and their environment results in the outcome of different vegetation types in different areas.

The quantitative study of vegetation called “Phytosociology” has the principal aim to describe the vegetation, explain or predict its pattern and classify it in a meaningful way. It can also be described as science dealing with the plant communities, their composition and development as well as the relationships between species within them. Species diversity determines the distribution of individuals among the species in a particular habitat. The aim of phytosociology is to achieve a coefficient empirical model of vegetation using plant taxa combination that characterizes vegetation units. Phytosociology is useful to describe the population dynamics of each plant species occurring in a particular community as well as to understand how they relate to the other species of the same community. As Himalayas are the having a unique geographical features so the phytosociological characters differ among aspect and positions, even in the same vegetation types. The quantitative relationship between rare and profusely growing species is an important structural property of a plant community.

Based on physiographic climate and cultural features, out of 20 agro-climatic regions in the country, Himachal comes under arid ecosystem, representing the cold arid zone of western Himalayas. Protected areas especially in Himalayan region are immense source of plant genetic resources (PGR). Plant genetic resources is that part of biodiversity, which encompasses cultivated varieties (in use), newly developed varieties, farmers varieties (land races), wild and weedy species, near relatives of cultivated varieties and special stocks including elite and current breeder’s lines used in agriculture, medicine, and agro-pharmaceutical industries, where great breakthroughs have been made for the benefit of mankind (Mooney, 1997; Evenson et al., 1998). PGR include all species, which contribute to peoples’ livelihoods by providing food, medicine, shelter, fiber, and energy. These are either cultivated by man or they are found in natural habitats as wild plants or relatives of crops. Plant Genetic Resources (PGR) constitutes an important sector of biodiversity that is crucial in attempts to feed and sustain the steadily increasing global population (Arunachalam, 1999). It
has also been established that the development and sustainability of agriculture are strongly dependent on the access to plant genetic resources for food and agriculture, and as a result, the urgency to address the issues surrounding access to genetic resources has increased in the last few years. Plant genetic resources are a reservoir of genetic adaptability, which acts as a buffer against harmful environmental changes and economic challenges (Hammer et al. 1999). If not well managed, these plant genetic resources will be vulnerable to genetic erosion. The erosion of these resources results in a severe threat to the world’s long-term food security (Hammer et al., 1999). To ensure genetic resources are continually available for sustainable food security, the need for maintaining genetic diversity in agricultural systems is widely accepted.

Ethnobotany is a science of relationship between the indigenous people and their plant surroundings (De, 1968); it includes a study of the plants used by the local peoples for their day to day uses like food, medicine and clothing etc. (Jain, 1968). Aumeeruddy (2003) has given the modern concept of Ethnobotanty, he described Ethnobotany as a science which studies the relationship between given society and environment and particular, the plant world. So we can say that Ethnobotany is a multi-disciplinary science of Botany, Ecology and Anthropology. India has age-old traditions of natural conservation and the same is reflected not only in its old literature and ethics, but also in the constitution, policies legislation and organizations. There are about 2500 plant species in India which are known for ethnobotanical importance (Jain, 1991). There are 1748 medicinal plants (Samant et al., 1998), 675 wild edible (Samant and Dhar, 1997), 279 fodder plants (Samant, 1998), 118 essential oil yielding (Samant and Palni, 2000) and 155 sacred plants (Samant and Pant, 2003) reported from Indian Himalayan Region (IHR) which are of ethnobotanical importance. Himachal is bestowed with a rich flora, the diversity of which is spread over its Shivalik belt, temperate forests, deep ravines, open grassy slopes and alpine pastures. Out of the 47,000 plant species found in the country as many as 3245 species (7.32%) are available in the state of Himachal Pradesh (Verma, 2000).
The State of Himachal Pradesh (geographical area 55,673 km²) comprises the part of Trans and northwest Himalaya that supports a unique biodiversity. Chail wildlife sanctuary has established in 1999 in Solan district of Himachal Pradesh. It covers an area of 10854.30 ha (108.54 sq km). Recently, the state forest department of Himachal Pradesh redefined the boundary of the sanctuary and area has been reduced to 16.30 sq km. Study area has been divided into various eco sensitive zones by the Ministry of Environment, Forest and Climate Change (Figure 1).

Being a famous tourist destination and a densely inhabited area, Chail sanctuary is facing various pressures which may cause swear threat to this biodiversity rich site. Site is facing various pressures due to livestock farming and ranching (includes forest grazing) - small-holder grazing, ranching or farming; logging & wood harvesting - unintentional effects: subsistence/small scale; mining and quarrying; ire & fire suppression; commercial and industrial development and residential and commercial development.

Keeping these factors in view, it has becomes very imperative to collect knowledge on the biodiversity and its distribution within the ecologically important and sensitive area for proper conservation and better management of the natural resources. The present work, “Study on Dynamics of Plant Bioresources in Chail Wildlife Sanctuary of Himachal Pradesh” was carried out to achieve the following objectives:

- To systematically explore the floral diversity of the study area.
- To conduct phytosociological studies in different altitudinal zones of the study area.
- To understand the dynamics of plant genetic resources.
- To collect and collate ethno-botanical and traditional knowledge.
Figure 1: Eco-sensitive Zones in Chail Wildlife Sanctuary