Chapter I

INTRODUCTION

The forest cover of India as per the present assessment (FSI, 2000) is 63.73 million ha, consisting of 19.36 percent of the total geographic area. Out of this 37.74 million ha (11.48%) is dense forest, 25.50 (7.76%) open forest and 0.49 million ha (0.15%) constitutes mangroves. Forest areas in the vicinity of population centers/ village have been reported to be degrading very fast due to collection of fuel wood, cattle grazing and other types of exploitation. According to the registrar General of India, a provisional number of villages in the country having forest land in the immediate vicinity is estimated at about 1,70,000, with a total population of 147 million (FSI, 1999).

Mountain occupy about the fifth of the world land surface and provide the direct life support bases for about tenth of human kind. Approximately 5% of its area lies above its area 3000m and 2% above 4000m of total terrestrial land surface of the world discriminating all other attributes except altitude Ives et al. 1997. The mountain ecosystems provide many interacting components including flora, fauna, soil, air and water in its different phases and have therefore been utilized and modified for centuries. As a major ecosystem representing the complex and interrelated ecology of our planet, mountain environments are essential to the survival of the global ecosystem. Mountain and hillside areas hold a rich variety of ecological system. Because of their vertical dimension, mountain creates gradient of temperature, precipitation, and insulation. A given mountain slope may include several climatic system- such as tropical, sub-tropical, temperate and alpine each of which represents a large habitat diversity. Mountain ecosystems are, however rapidly changing. They are susceptible to accelerated soil erosion, landslides and rapid loss of habitat and genetic diversity. As a result, most global mountain areas are experiencing environmental degradation. Hence, the proper management of the mountain resources and socio-economic development of the people deserve immediate action.

The Himalayan Mountain (27° N latitude and 72° E longitude) are the greatest and youngest among the major mountain series of the world. Himalaya, also Himalaya (Sanskrit for “abode of snow”), mountain ecosystem in Asia, form a broad continuous area for nearly 2600km (1600m) along the northern fringes of the Indian subcontinent, from the bend of the Indus river in the northwest to the Brahmaputra river in the east. The Himalayan range, averaging 320 to 400 km (200 to 250 mi) in width, rises sharply
from the Gangetic plain. North of this mountain belt lies the Tibetan Plateau. The Himalayas from the earth’s highest mountain region and contains 9 of the 10 highest peaks in the worlds.

The middle (lesser) Himalayan range, which has a width of about 80-km (about 50m), borders the Great Himalayan range on the south. It consists principally of high ranges both within and outside the Great Himalayan range. This section comprises of mountain peaks ranging between 1200-3000m and valley between 400-1200 m above sea level. But with the pace of the rapid modernization and increasing anthropogenic pressure on vegetation in general and on forests in particular coupled with natural disasters, the Himalayan vegetation is rapidly deteriorating its richness as well as diversity. However, in recent past there has been a deep concern and realization for the conservation of the fragile Himalayan ecosystem.

Altitudinally defined climate and soil factors are deemed to be primary determinants of change in species composition and community structure in undisturbed mountains (Whittaker, 1975). Economic change and population increase is threatening the ecology of the Himalayas. In recent years the deforestation in the foothills and the middle Himalaya, and over grazing on the high pasture have led to soil erosion and other related problems. Deforestation is of particular concern in the western Himalaya, where increased demand for firewood, extensive tree trimming to feed livestock, and construction of roads in the border regions have increased the destruction rate of the forest and rate of land slides. Rapid population growth has accelerated pollution, and Himalayan streams that were once clear are now polluted with refuse and sewage. The cause and adverse consequence of these problems are well known and there is a fair to medium awareness at various levels within the concerned countries that some action needs to be taken to reverse the adverse cycle of the degeneration of the production base and devastation (FAO, 1982; WRI/WB/UNDP, 1985).

Talking people-forest interaction in the present context, the former comprehensively depends on the latter for their subsistence. Cattle rearing, agriculture to fuel and timber requirements of the residents, particularly those living in upper reaches, is fulfilled by the forests growing in their vicinity. But due to substantial increase in human and bovine population coupled with decreasing forests in the recent past, the very existence of the rural folk is being threatened. Recent estimates have shown that in Garhwal Himalaya (Uttarakhand), dense and open forests constitute, respectively, 35.37 and 9.19% of the total geographical area (Anonymous, 2001). The available forest cover is not sufficient even to sustain to ecological balance besides the requirements of fuel, fodder and timber
etc. According to one estimate, the rate of firewood consumption for central Himalaya has been recorded in the tune of 1.40-1.49kg/capita/day (Bhatt et al. 1994). Similarly the green fodder requirement has been estimated to 10.34kg/capita/day, irrespective of livestock reared (Sachan, 2005). Thus, in addition to a low percentage of forest (39.7% vs. the prescribed 66.0% for the hills), the forest density is also in this part of country (33.0%), whereas, better soil and water conservation, the density of tree cover should not be reduced more than 50.0% (Anonymous, 1985).

Forest resources of the Himalaya are shrinking in size due to over exploitation and there is increased interest to protect, manage and make them more productive. This requires essentially the knowledge of their population status, production behavior and rate of utilization on unit area basis. Growing stock assessment is an important parameter required for sound forest management and planning. General information about the stock available per unit areas is the key information desired for forest inventories, where the empirical diameter distribution of sites is not measured.

Vegetation within the forest type is greatly affected by differences in the microclimate, aspect and altitude (Pandey et al. 1996). The selections pressure origination due to the difference in microclimate and inter specific composition, influence the regeneration of the different tree species and also open the door for the invasion and acclimatization of new species in the forest ecosystem. The interactive influence of the biotic and abiotic factor of the environment affects the survival and growth of seedling and sprouts (Sorenson and Forrel, 1979 and Muller-Dombios et al. 1980).

The most striking feature of the life is its diversity (Tilman, 2000). Biodiversity is essential for human survival and economic well being and for the ecosystem function and stability (Singh, 2002). Political and scientific concerns have been raised as we are experiencing an increase in species extinction rates caused by anthropogenic activities (Ehrlich and Wilson, 1991). Many kinds of environmental changes influence or determine processes that can both augment and erode diversity (Sheil, 1999). The unplanned and unscientific collection of various plants has led to loss in floral biodiversity.

The use of Non-Timber Produce is old as human existence. In sustenance and rural economics, the role and contribution of NTFPs are crucial because of their richness of biodiversity, as resource of food, fodder, fiber, fertilizers, herbal products, construction material, cosmetics and cultural products. They support village level craft activity. NTFPs provide raw materials to supports processing enterprises. They include
internationally traded commodities used in food products and beverages, confectionery, flavorings, perfumes, medicines, paints, polishes and more.

The recent rediscovery of remarkable plant properties have given a new life to the interdisciplinary science of ethnobotany, which deals with the direct relationship of plants with man. Ethnobotany should essentially not be synonymous to economic botany as the latter is concerned with the use of processed, improved or otherwise modified products and their commerce by man.

India’s climatic and topographical diversity is a boon to its wealth of medicinal plants. This medicinal plant wealth is a treasure of the *Materia medica* of medicine (Ayurveda, Siddha and Unani). Medicinal plants are not only an important source of traditional medicine but also from a number of drugs of modern system of medicine (Allopathy). In recent years, there has been a manifold expansion of indigenous drug industry in India and abroad. Consequently, the demand for raw material has increased enormously. Of the 20,000 and odd species of flowering plants reported to be growing in India, about 2,500 species have therapeutic value (Chopra *et al.*, 1956) and more than 500 are used in indigenous system of medicine (ISM). A large number of plants listed in pharmacopoeias are not being utilized by the drug industries in the traditional systems of medicine due to lack of data on their distribution, availability, correct identity, and standardization and quality control. About 90% of the raw material (crude drugs) is obtained from forests and the forest Department has classified only a few of them under minor forest products. All human are dependent on plant to meet various requirements for survival (Phillips and Meillur 1998). Globally, about 85% of the traditional medicines used for primary health care are derived from plants (Fransworth 1998). Human have developed knowledge of using available plants to treat a number of ailments

India has nearly a quarter of the world’s bovine population, the density working out to nearly 80 animals per 40 hectares of arable land, versus 40 in the USA., 25 in Egypt, 15 in the China and only 6 in Japan. Livestock or cattle constitute an important component of the village economy. In many parts of the country, the size of herds maintained is indicative of the social status of a person in the village. In addition, livestock provides milk, meat, bones etc., thus contributing significantly to the rural economy.

Trees and shrubs have long been considered as important source of nutrition for grazing animals, especially in those areas with a pronounced dry season. Often called browse or top-feed, they are an effective insurance against seasonal feed storages, supplementing the quantity and quality of pasture compounds (Lefory *et al.*, 1992).
Fodder tree are less affected by seasonal dry conditions because of their more extensive root system and longer life-spans (Abel et al., 1997).

Bamboos are tall, perennial, arborescent grasses, belonging to sub family bambusideae of family Poaceae. Almost all the 75 genera and 1,250 species of bamboo are woody and fast growing (Soderstron and Ellis, 1988). Bamboos are one of the most important renewable natural resources, which have capacity to produce the maximum biomass per unit area and time compared to other forest plants. Bamboo plays an important role in daily life of rural communities in numerous ways- in house construction, agricultural tools, by providing food materials and weaponry etc. besides being a convenient source of cellulose for paper manufacture and rayon, it supports a number of traditional cottages of industries such as baskets making, furniture, handicrafts etc. Bamboos are also known as ‘the poor man’s timber’ ‘friend of the peoples’ ‘green gold’ and ‘the cradle to coffin timber’.

Garhwal Himalaya exhibits submontane to alpine climate with distinct physiography, altitude, and aspect that harbours a variety of forest types. Owing to the varied topography and altitudes, diverse forest and alpine pasture communities may occur within a distance of 300-500 km (Singh, 1992). The disturbance of different forest types is primarily governed by the altitude and secondarily by the factor such as geology, soil, orientation of the valley and other biotic and abiotic stresses (Champion and Seth, 1968). Forest, account for 45% of the total geographical area of the Garhwal Himalaya (Anonymous, 1993). A wide variety of forest types are found in this region of Uttarakhand hills. The vegetation is dominated by Sal (Shorea robusta), Chir pine (Pinus roxburghii) and oak (Quercus leucotrichophora) in altitudinal gradient. Some of main species found in the region are Cedrus deodara, Abies pindrow, Albizia spp, Rhododendron arboreum, Lyonia ovalifolia, Myrica esculenta and Prunus cerasoides.

Alpine belt (occurring between 3000-5000 m elevations) cover less than 5% of the central Himalaya and is considered to be one of the most species rich areas of the central Himalaya Mani(978). They generally have a mosaic of communities varying in proportion of grasses, sedges and forbs (Saxena and Singh1980; Rikhari et al. 1992) and also exhibit growth from related synchrony with respect to the growth cycle (Negi et al. 1992).

The available literature in the lesser Himalaya indicates that studies have been carried out on the inventory, rarity and utilization pattern of the plant resources. But, still there is a large gap in the knowledge of the different aspects such as nutrient status, niche relation and diversity pattern and many other functional aspects. Any terrestrial
ecosystems can be managed approximately when it contains database on all the basic aspects that reflects structural and functional features. Therefore, keeping this view in mind the present study on forest type between 1500 and 3500m has been undertaken study to plant diversity variation in relation to disturbance, aspect and position on the slope (concave, convex and uniform slopes) and aspect. Traditional knowledge of various plants, their parts use and traditional conservation has been followed and documented. Folk taxonomical knowledge has been gathered. The present study has been undertaken with the following objectives so as to provide conservation and management strategies for moist temperate forest of Garhwal Himalaya.

1. To analyses the pattern of plant species diversity in the moist temperate forest of Garhwal Himalaya in relation to -
   a) Aspect.
   b) Altitude and
   c) Position on slope
2. To identify the major traditionally used plants through community participation and documenting their local uses and identifying the characters (folk taxonomy).
3. To asses the erosion of knowledge in plant identification and uses between younger generation and older generation.
4. To develop site-specific biodiversity database.