Chapter 1.

General Introduction
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1.1. Background

According to the United Nations Global Environmental Facility (UNGEF) Biodiversity is the “heart of sustainable agricultural systems”. It is the “life insurance of life itself” (Mc Neil & Shei, 2002). The Biodiversity is a new International buzzword and received popularity during the National Forum on Biodiversity held at Washington D.C., w.e.f., September 21-24, 1986, under the auspices of the National Academy of Science, Smithsonian Institute, the word spread like fire throughout the world. In the Rio Environmental Summit in 1992, biodiversity dominated the central issues of scientific and political concern worldwide (Wilson, 1997). Biodiversity contributes directly and indirectly to many constituents of human well-being, including security, basic material for a good life, health, good social relations, and freedom of choice and action (MA-Millennium Assessment, 2005). Man has been utilising biodiversity elements since time of his emergence on this planet. Humanity derives all of its food, many of its medicines, domestic needs and industrial products from the wild and domesticated form of biodiversity. The traditional life of society is based on a subtle and silent relationship with nature. These traditions and relationships now form the core of interdisciplinary science known as ‘Ethnobotany’ (Singh, 2007).

India is one of the world’s top 12 mega diversity countries (Anonymous, 2010) with 10 biogeographic regions (Rodgers & Panwar, 1990). In addition to this it has over 40 sites which are known for their high endemism and genetic diversity (Nayar, 1980). The Indian subcontinent is known for its rich biological diversity and support two-mega hot spots i.e., Western Ghats and Eastern Himalaya. The climatic and altitudinal variations, coupled with varied ecological habitats of the country, have contributed to the development of immensely rich vegetation with a unique diversity. The India composes 2.4 % of world’s geographical land area and contains 8% of the total number of species (Khoshoo, 1996). The flora comprises of 46,620 species of plants, of which about 17,000 species are flowering plants, 2,500 algae, 1,600 lichens, 2,3,00 fungi, 2,584 bryophytes, 1,022 pteridophytes and 64 gymnosperm (Kulkarni et al., 2002). The great British Botanist Sir J.D. Hooker (1906) said about the Indian Flora that ‘the flora is more varied than of any other Country of equal area in the hemisphere if not in the globe”. In India, the Himalayan landscape covers 18% of the total geographical area of the country stretching between geographical limits of 26°20’ and 35°40’ N latitudes and 74°50’ and 95°40’ E longitudes and accounts for 50% of the forest cover (Singh & Hajra, 1996). The Himalaya is the largest and youngest mountain chain in the world and covers close to 16.2 % of India’s total geographical area.

The Indian Himalayan Region (IHR) forms the major part of Himalaya. The Indian Himalayan
Region (IHR) stretching from Jammu & Kashmir in Northwest to Arunachal Pradesh in East between latitudes 27°-38°N and longitudes 72°-89° E, spreads over in a huge crescent of 2500 km area of 236,000 km² (Valdiya, 1980). It is known for its representative, natural, unique and socio-economically important biodiversity. The IHR harbours 18,440 species of the plants (Singh & Hajra, 1996). The rich plant diversity of the region is used for the various purposes such as medicinal, wild edible, fuel, fodder, religious, timber, making agricultural implements, etc. by the inhabitants. The floral wealth of this region comprises of 1,748 medicinal plants (Samant et al., 1998a), 675 wild edibles (Samant & Dhar, 1997), 155 plants of sacred plants (Samant & Pant, 2003), 118 essential oil yielding medicinal plants (Samant & Palni, 2003, and 279 fodder plants (Samant, 1998) have been recorded from the IHR. In addition to this, fauna of the IHR is constituted by barking deer, goral, black bear, kalij pheasant in the foot hills; serow, musk deer, koklas, monal and tragopan pheasants in temperate areas; Himalayan tahr, ibex, snow leopard and brown bear in sub-alpine and alpine zones.

The IHR is also rich in cultural diversity. The prominent cultural groups of the IHR are Gaddis, Gujjars, (Trans, North West Himalaya), Bhotia, Raji, Boxa and Tharu (West Himalaya), Bhutia, Lepcha (Central Himalaya) and, Chakma and Naga (East Himalaya) (Samant & Dhar, 1997). They are largely dependent on the biodiversity elements for their sustenance. Due to over exploitation and habitat degradation the population of many species have been decreased to a great extent and 142 species have been recorded in the Red Data Book of Indian plants (Nayar & Sastri, 1987, 1988, 1990) and about 120 species of medicinal plants have been assessed for various threat categories of the IUCN (Ved et al., 2003, 2005).

The Himanchal Pradesh (30° 22’ 40” to 30° 12’ 40” N latitude and 75° 47’ 55” to79° 04’ 20” E Longitude) is the part of Western Himalayas. It covers 55,673 km² area (Appr.350-6975m) and supports diverse habitats, species, populations, communities and ecosystems. Like other provinces of the IHR, the state is also known for rich biodiversity. The vegetation mainly comprises of tropical, sub-tropical, temperate, sub-alpine and alpine types. The population of state is 60,77,248 million; majority lives in the villages and belongs to diverse culture and communities. The Gaddis, Kinnera, Koli, Gujjars, Lahulas, Sanglas and Ghirth tribes live in the state. Over 3,500 species of plants including non-vascular plants are known from the State have been estimated (Chowdhery & Wadhwa, 1984; Aswal & Mehrotra, 1994). The rich biodiversity is used by the rural communities for various purposes such as food/edible, medicine, fodder, fuel, making agricultural tools, religious and various other purposes for a long time. With the increasing demand of local inhabitants for their livelihood the plant biodiversity is facing tremendous pressure. The tropical, sub-tropical and temperate zones of the State are densely populated and the inhabitants are largely dependent on forest resources to meet out their daily needs. The human relationships with bioresources keep evolving and changing. Exploitation or protection of bioresources, which is usually also selective, influences the distribution, abundance and consequently availability, which in turn compels modification or substitution in man – plant or man – animal relationship. These relationships cover a
very wide canvas, from wild foods, medicines, fibers, fodders, dyes, body ornamentation, etc. With the increasing human population, the demand of agriculture land, and income generating resources is also increasing. The multifold demand of the forest resources has increased the pressure on the useful plant resources. Due to habitat degradation and over exploitation most of the ecologically and economically important species of the State are at the risk of extinction. 68 medicinal plants in the State have been assessed for the threat categories of the International Union for Conservation of Nature and Natural Resources (IUCN). Of these, 12 species are Critically Endangered (CR), 21 Endangered (EN), 27 Vulnerable (VU), 2 Near Threatened (NT) and 3 Least Concern (LC) (Ved et al., 2003). The reckless felling of trees for timber and fuel, and unmanaged lopping of the fodder species has increased the rate of habitat degradation. Many shade loving species have been disappeared from these degraded forests and hardy and spiny species with low value for the mankind are establishing rapidly (Dhar et al., 1997, and Samant et al., 2000, 2006). Such unmanaged activities are changing the whole forest ecosystems gradually (Singh & Singh, 1992). Such trends of biodiversity necessitate initiating studies on assessment and monitoring of biodiversity in Himachal Pradesh.

1.2. Review of literature

The Himalaya has been always attraction of several plant taxonomists, naturalists, ethnobotanists and ecologists from all over the globe on account of its uniqueness in terms of habitats (landscape elements), species, population, communities and ecosystems. A review of existing literature on floristic inventory and resource utilization pattern, nativity, endemism, threat categorization and prioritization of species for conservation has been done and summarized below:

1.2.1. Floristic Surveys

1978, 1979 & 1982; Kihara, 1955, Press et al., 2000; etc. and in Bhutan Grierson & Long, 1983, 1984, 1987 & 1991; etc. were the major contributors on flora. Polunin & Stainton (1984; 1987) gave the floristic account of the whole Himalayan region and Naithani (1990) the species of flowering plants not included in the Hooker’s Flora of British India (1872-1897). Focused studies on the flora of Sacred Shrines have not been carried out so far in the IHR except Kapur & Sarin (1990) who investigated the flora of Vaishnavi Devi Sacred Shrine in Jammu and Kashmir. Similar studies at watershed level are also required across the IHR.

1.2.2. Nativity and Endemism

At the global level, study on nativity of the species was started by Anonymous (1883-1970). In general, attempts have been made to study the nativity (Gentry, 1986; Chauhan & Parmal, 1994; Samant et al., 1998a&b, 2000a, 2001a&b, 2002a, 2005, 2006, 2007a,b,c&d; Samant & Dhar, 1997; Samant, 1998, 1999, 2002; Gopalan & Henry 2000; Samant & Palni, 2000; Arya, 2002; Joshi, 2002; Samant & Pant 2003, 2006; Joshi & Samant, 2004; Samant & Joshi, 2004; Pant, 2005; Bari, 2006; Gupta, 2006; Pandey, 2006; Semwal et al.,2007; Lal, 2007; Rana, 2007; Singh, 2007; Sharma, 2008; Anonymous, 2011; etc.) and endemism (Troll, 1967; Muesel & Schubert, 1971; Favarger, 1972; Rao, 1972; Mani, 1978; Nayar, 1980, 1996; Dhar & Kachroo, 1983; Kruckerberg & Rabinowitz, 1985; Takhtajan, 1986; Gentry, 1986; Arora, 1987; Vir Jee et al., 1989a&b; Major, 1990; Dhar & Samant, 1993; Matthews et al., 1993; Dhar et al., 1996, 1998; Samant et al., 1996a,b; Kerr, 1997; Gopalan & Henry, 2000; Dhar, 2002; Vetaas & Grytnes, 2002; Werff & Consiglio, 2004; Bari, 2006; Gupta, 2006; Pandey, 2006; Lal, 2007; Rana, 2007; Singh, 2007; Sharma, 2008; Pandit et al., 2007; Sajem et al., 2008; Zhang et al., 2009; etc.) of the species at regional, national and international levels. However, a very few studies regarding nativity and endemism are available in the IHR (Dhar, 2002; Dhar & Samant, 1993; Dhar et al. 1996; Samant et al., 1996a; Samant et al., 1998 a&b, 2000a, 2001a&b; Joshi et al., 1999, 2001a; Samant, 1999; Sundriyal & Sundriyal, 2001; Behera et al., 2002; Samant & Joshi, 2005; Lal, 2007; Rana, 2007; Singh, 2007; Sharma, 2008; Sakshi, 2009; Pant & Samant, 2008; Rana & Samant, 2009; Singh et al., 2009; Mahar et al., 2009; Sharma & Mishra, 2009; Tewari et al., 2010 etc.).

The above studies clearly show that studies on the nativity and endemism of the floristic diversity at watershed level across the IHR in general and Himachal Pradesh in particular are not available.

1.2.3. Ethnobotany and Resource Utilization Pattern

At regional, national and international levels, a large number of studies have been carried out on ethnobotany and/ or resource utilization pattern (Collett, 1921; Cameron, 1917;
In Himachal Pradesh also, studies are available on ethnobotany and resource utilization pattern (Shabnum, 1964; Gupta, 1964,1971; Uniyal & Chauhan, 1971; Uniyal et al., 1973; Sharma, 1976; Srivastava et al., 1981,1987; Srivastava & Gupta, 1982; Aswal & Mehrotra, 1987; Jain, 1991; Chauhan, 1988, 1989, 1996 & 1999; Singh, 1993; Gaur & Singh, 1993; Singh, 1996; Singh et al., 1994; Rawat et al., 1995, 1999, 2009; Samant & Dhar, 1997; Shah, 1997; Samant et al., 1998a, 2006b, 2012; Joshi, 2002; Pant, 2005; Lal, 2007; Rana, 2007; Singh, 2007; Sharma, 2008; Sakshi, 2009, Sharma & Mishra, 2009; Singh et al., 2009; Rana & Samant, 2011b; Rana et al., 2012; etc.). Species wise extraction trends of the fuel and fodder species have been investigated by a few workers (Samant et al., 2000b, 2006b, 2012; Joshi, 2002; Pant, 2005; Lal, 2007; Rana, 2007; Singh, 2007; Sharma, 2008; Sakshi, 2009, Sharma & Mishra, 2009; Singh et al., 2009; Rana & Samant, 2011b; Rana et al., 2012; etc.)
The above studies clearly show that studies on ethnobotany and utilization pattern of floristic diversity at watershed level across the IHR in general and Himachal Pradesh in particular are not available.

1.2.4. Threat categorization of floristic diversity

Identification of rarity of the species using various criteria such as distribution range, habitat specificity, and population size at global level has been carried out by some workers (Ayensu, 1981; Rabinowitz, 1981; Belousoff & DeMissiva, 1981; Myers, 1988, 1990; Heywood & Iriondo, 2003; Thuiller et al., 2005 and Liu et al., 2007; Rai & Lalramnghinglova, 2011.). A Red Data Book on threatened plants has been published by IUCN to update the information on the threatened biological resources (IUCN, 2003). In India, efforts have been made to generate and document the information on threatened plants by Jain & Sastry (1980, 1984). Botanical Survey of India has published Red Data Book of Indian Plants based on the available information at regional, state and national levels (Nayar & Sastry, 1987, 1988, 1990). A new basis for categories given by Mace & Lande (1991); Mace & Stuart (1994) was used to prepare IUCN 1996 Red List of Threatened Trees (Oldfield et al., 1998).

In the IHR, attempts have been made to identify threatened plants using various attributes (Hajra, 1983a, 1983b; Jain & Rao, 1983; Gaur & Semwal, 1983; Goel & Bhattacharya, 1983; Hajra, 1983a&amp;b; Pangtey & Samant, 1988; Samant & Pangtey, 1993; Samant, 1994, 1999; Samant et al., 1993, 1996a, 1998 a&amp;b, 2001a&amp;b, 2002a, 2007a&amp;b; Rawal & Dhar, 1997; Rikhari et al., 1998; Kala, 2000; Rai et al., 2000; Badola & Pal, 2003; Samant & Pal, 2003; Semwal et al., 2007; Sajem et al., 2008; Pant & Pant, 2011; etc). One hundred twenty one (121) species of vascular plants have been recorded in the Red Data Book of Indian Plants from the IHR (Nayar & Sastry, 1987, 1988, 1990). Of these, 17 species are medicinal plants (Samant et al., 1998a). One hundred twenty (120) medicinal plants of the IHR have been also categorized as Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern, Data Deficient, etc. using new criteria of International Union for Conservation of Nature and Natural Resources (IUCN) criteria (Ved et al., 2003, 2005).

In Himachal Pradesh, a very few attempts have been made on the threatened species ((HPSEB). 1998; Ved et al., 2003; Innocent et al., 2004; Badola & Pal, 2003; Bari, 2006; Gupta, 2006; Samant et al., 2007a&amp;b; Lal, 2007; Rana, 2007; Singh, 2007; Sharma, 2008; Bali, 2009; Sakshi, 2009; Singh et al., 2009; Rana & Samant 2010; Samant et al., 2010; etc.).

The above studies clearly show that studies on threat categorization of the floristic diversity at watershed level across the IHR in general and Himachal Pradesh in particular are not available.
1.2.5. Conservation Prioritization

International Union for Conservation of Nature (IUCN) listed the species in Red list for their conservation in 1963. After this, significant studies have been carried out on species prioritization (Hawkes, 1988; McNeely et al., 1990; Master, 1991; Daniels et al., 1991; Anonymous, 1992; Heywood & Watson, 1995; Badoni, 1995; Anonymous, 1997; Heywood & Iriondo, 2003; IUCN, 2003; ENVIS, 2010; Singh & Srivastava, 2010; Côté, 2011, etc.) and ecosystem and eco-region prioritization (Myers, 1988, 1990; Blab et al., 1995; Myers et al., 2000; Marguely et al., 1994; Marguely & Pressey, 2000; Mittermeier et al., 2004; Rodriguez et al., 2007; Kontula & Raunio, 2009; Bragazza, 2009, etc.).

In the IHR, a very few studies are available on the prioritization of the species (Dhar & Samant, 1993; Saberwal, 1996; Johnsingh et al., 1998; Dhar et al., 1996, 1998, 2000; Singh, 2002; Mathur et al., 2000, 2004; Samant et al., 2002a, 2003, 2005; 2007a,b,c&d, 2011, 2012; Satyal et al., 2002; Heywood & Iriondo 2003; Ved and Kinjal 2003a, 2003a; Ved et al., 2003&2005; Samant & Pal, 2003; Pandey, 2006; Bari, 2006; Gupta, 2006; Singh, 2007; Bali, 2009, Singh et al., 2010; Pant & Pant, 2011;); and species and communities (Samant et al., 2002a; Joshi, 2002; Arya, 2002; Joshi & Samant, 2004; Pant, 2005; Pant & Samant, 2007); and habitats, species and communities (Lal, 2007; Rana, 2007; Singh, 2007; Sharma, 2008; Sakshi, 2009; Rana & Samant, 2009, 2010; etc.).

The above studies clearly show that studies on conservation prioritization of the floristic diversity at watershed level across the IHR in general and Himachal Pradesh in particular are not available.

1.3. Objectives

- To assess the floristic diversity of Rissa Khad Watershed
- To analyze the floristic diversity for nativity and endemism
- To assess the dependence of inhabitants on floristic diversity
- To assess floristic diversity for threat categories
- To prioritize floristic diversity for conservation and socioeconomic development of the watershed