Conservation prioritization of forest communities and habitats in the Manasbal Range of Sindh Forest Division of Jammu and Kashmir.

Abstract

Habitat degradation and over exploitation has caused the loss of biodiversity at a very faster rate, which has necessitated the conservation prioritization of communities, habitats and species, for conservation. The prioritization of communities and habitats through qualitative and quantitative assessment of vegetation is necessary for starting any conservation and management programme. During the course of study, Thirteen (13) forest communities and Thirteen (13) forest Habitats which were distributed between 1500-3000 m amsl were recorded. Overall, 46.15% communities were broad-leaved, 38.46% coniferous and 15.38% mixed. These communities and habitats have been evaluated for the species richness, native, endemic, economically important and threatened species. On the basis of these attributes these identified communities and habitats were prioritized. Among the recorded communities *Acer caesium- Pinus wallichiana* mixed, *Platanus orientalis* and *Aesculus indica – Juglans nigra* mixed showed highest Conservation Prioritization Index (CPI) and in case of habitats Marshy and Shady moist showed highest Conservation Prioritization Index (CPI) value. Monitoring of these prioritized communities and habitats on regular basis has been suggested. Besides, propagation and conservation of endemic, native, economically important and threatened species on a large scale and raising of their plantation in the Manasbal Range have been recommend.

Key words*: Diversity, community, habitat, conservation, prioritization*.

1.Introduction:

The most distinct characteristic feature of the Earth is the presence of life and most striking feature of life is diversity. Biological diversity, which is one of the major livelihood options, provides 13 types of ecosystem services (Costanza *et al.*, 1997; Singh, 2007). But because of habitat degradation and over exploitation, the biodiversity is diminishing at rapid rate (Samant *et al.*, 1998). At present, the speedy loss of species is estimated to be between 100 and 1000 times higher than expected natural extinction rate. Major threats to biodiversity and ecosystems are loss of habitat and fragmentation, over exploitation, pollution, invasion of alien species and global climate change (IUCN, 2003) and disruption of community structure (Novasek and Cleland, 2001). The International Union for Conservation of Nature and Natural Resources (IUCN) has estimated about 10% of the vascular plants of the world to be under threat (Nayar and Sastry, 1987-1990). The IUCN Red List of threatened species compiled by IUCN classifies species that have great probability of extinction in the future as Critically Endangered, Endangered, or Vulnerable. Degradation and fragmentation of 70% of the original habitats placed Himalaya in the list of Global Biodiversity Hotspots. The percentage of original habitats that remain unaffected in the Himalaya is 25% (Mittermeier *et al.*, 2004). The Convention on Biological Diversity Summit in June 1992 signalled global recognition of the alarming loss of biodiversity. The growing awareness of importance and high rates of loss make it imperative to firstly assess and conserve biodiversity at local, regional and global

levels. Since then, various studies have been carried out to explore and identify the threatened plants of the world (Singh, 2002).

India has 2.4 percent of global area and 8 percent of the world's total biological diversity, with around 47 000 species of plants and fungi and 89 000 animal species (Khoshoo 1995, 1996). Major part of the terrestrial biodiversity inhibits in forests, as many other terrestrial habitats have lost their natural status; so, conservation and protection of forests is synonymous with conservation and protection of biodiversity. India's national forest policy of 1988 rightly focused, inter alia on "conserving the natural heritage of the country by safe guarding the persisting natural forests with the large variety of flora and fauna, which represent the astonishing biodiversity and genetic resources of the country". The national environment policy of 2006 recognizes that "[forests] provide food, habitat, shelter for wildlife and the ecological conditions for preservation and natural evolution of genetic diversity of flora and fauna" and emphasizes that "forests of high local genetic diversity should be treated as things with Incomparable Value"; it also aims to "strengthen the protection and conservation of areas with a large number of endemic species and genetic resources ("biodiversity hot spots"), besides providing livelihoods alternatives and access to the resources to local communities who may be affected thereby" (Khoshoo, 1995, 1996). So, to achieve these goals the conservation of forest communities and habitats on priority basis is necessary. During this study the forest communities and habitats in the range were identifies for conservation.

2. Materials and methods:

Study area: Manasbal is located in Ganderbal district of U.T. of Jammu and Kashmir at 34°14'-34°15' North and 74°39'-74°41' East; 1583 meters above sea level. Manasbal is situated about 29 kilometres north of Srinagar, the summer capital of Jammu and Kashmir. According to Bagnoulus and Meher-Homji, (1959) the climate of Kashmir falls under Sub-Mediterranean type with four seasons based on mean temperature and precipitation. Manasbal range of Sindh Forest Division covers about 16700 ha of area, which include rugged terrain and uneven topography. Manasbal range of Sindh Forest Division has wide altitudinal range which varies from 1500-5000m above mean sea level.

Survey, sampling, identification and data analysis:

Surveys were conducted at select sites along the Manasbal range in forest zone between 1500-3000m amsl. The identification of habitats was done on the basis of dominance of vegetation and physical characters. Attempts have been made to choose sites and habitats on each and every accessible aspect. At each site, a plot of 50 × 50 m was laid. Trees, were sampled by randomly placed 25, 10x10 m quadrats; shrubs by 25, 5 × 5 m quadrats; and herbs by 25, 1 × 1 m quadrats in each plot. For the collection of data from these quadrats standard ecological methods were followed (Curtis and Mc Intosh, 1950; Dhar *et al*., 1997; Greig-Smith, 1957; Misra, 1968; Mueller-Dombois and Ellenberge, 1974; Samant *et al*., 2002; Joshi and Samant, 2004). From each site, samples of each species were collected and identified with the help of floras (Aswal and Mehrotra, 1994; Chowdhery and Wadhwa, 1984; Dhaliwal and Sharma, 1999; Polunin and Stainton, 1984; Murti, 2001).

Identification of communities:

The forest communities were identified on the basis of IVI values of trees. The single tree species representing > 50% of the total IVI was designated as a single species dominated community, whereas two or more species contributing 50 or > 50% of the total IVI were named as a mixed community. Species richness was determined as the number of species.

Identification of habitats:

Sites having closed canopy with high per cent of humus and moisture were considered as moist habitats, whereas, low percent of the same as dry habitats. The site having >50% boulders of the ground cover were considered as bouldary habitat and the site facing high anthropogenic pressures were considered as degraded habitat (Samant *et al*., 2001).

Identification of native, endemic, economically important and threatened plants:

The species with its origin or first record from the Himalayan Region were considered as natives (Samant *et al*., 1998a; 2002). The species which are restricted to IHR have been considered as endemic, (Dhar and Samant, 1993; Samant and Dhar, 1997; Samant *et al*., 1996a; 1998a). The information on economically important species was generated through Participatory Rural Appraisal (PRA) (Samant *et* al., 2002; 2003) and the interviews of the knowledgeable persons and other villagers. The threatened species were identified based on, nativity and endemism of the species, population size, use pattern, habitat preference, extraction trend and distribution range. The conservation attributes used were divided into three grades/scores: highest (10 marks); followed by six marks and the lowest score of two marks. (Samant *et al*., 1996b; 1998b; 2002).

Prioritization of habitats and communities:

The prioritization of communities and habitats has been done using eight parameters like species richness, native, endemic, site representation, threatened plants, altitude, economically important, and habitats number following Joshi and Samant (2004); Pant and Samant (2007); Samant et al. (2002) (Table 1).

Table 1: Criteria's used for the prioritization of habitats and communities

Score	Richness	EIP (%)	Native (%)	Endemic (%)	Threatened (%)	SR	Altitude (m)	Habitats *
10	>50	>45	>45	>40	>40	1	<200	1
8	46-50	41-45	41-45	36-40	36-40	2	200-400	2
6	41-45	36-40	36-40	31-35	31-35	3	400-600	3
4	36-40	31-35	31-35	26-30	26-30	4	600-800	4
2	<36	<31	<31	<26	<26	>4	>800	>4

*Abbreviations: EIP = Economically Important Plants; SR = Site representation; and * = Criteria only applied for the communities*

Results

Community diversity, species composition.

Total of 27 sites were sampled and total of 13 tree communities were identified at Manasbal range (Table 2). The identified communities were broad leaved deciduous (i.e., *Aesculus indica - Juglans nigra, Platanus orientalis, Salix alba, Salix alba - Populus nigra, Robinia pseudoacacia, Robinia pseudoacacia - Prunus armeniaca*, Mixed community. Evergreen coniferous and deciduous broad leaved mixed (i.e., *Acer caesium-Pinus wallichiana* mixed), and coniferous evergreen (i.e., *Pinus wallichiana, Cedrus deodara, Pinus wallichiana - Cedrus deodara* mixed, *Picea smithiana, Picea smithiana - Abies pindrow*. *Pinus wallichiana* and *Cedrus deodara* communities showed wide altitudinal range of distribution.

Table 2: Prioritization of forest communities for conservation using different parameters

in Manasbal range:

Community type	Habitats	SR	Altitude (m)	SPR	Native	Endemic	EIP	Threatened species	CPI
Acer caesium-Pinus wallichiana	1	1	2800-3100	15	7	1	12	3	**38**
Platanus orientalis	1	1	1700-2000	11	1	0	4	2	**38**
Aesculus indica-Juglans nigra	1	1	2300-2600	12	1	0	4	2	**38**
Salix alba-Populus nigra	1	1	2100-2600	11	2	1	8	2	**36**
Salix alba	1	1	1800-2200	7	1	0	3	1	**36**
Picea smithiana - Abies pindrow	1	1	2600-3200	12	7	0	7	4	**36**
Picea smithiana	1	1	2700-3200	12	5	0	6	4	**36**
Robinia pseudoacacia-Prunus armeniaca	1	1	1700-2400	14	1	0	7	0	**34**
Pinus wallichiana-Cedrus deodara	2	2	2000-2400	16	3	0	5	0	**34**
Robinia pseudoacacia	2	2	1800-2100	19	2	0	5	1	**34**
Mixed Community	3	4	1500-2400	60	9	2	26	9	**26**
Cedrus deodara	2	4	1800-2700	42	9	0	19	6	**26**
Pinus wallichiana	4	7	1800-3200	54	17	2	25	7	**22**

Abbreviations: SR = Site Representation; EIP = Economically Important Plants; SPR = Species Richness; and CPI = Conservation Priority Index.

Table 3: Some important native, endemic, economically important and threatened species of the main prioritized communities

Prioritized	Native	Endemic	Economically	Threatened

communities			important plants	
Acer caesium-Pinus wallichiana	*Pinus wallichianum, Acer caesium, Parrotiopsis jacquemontiana, Indigofera heterantha, Rosa webbiana, Aconitum heterophyllum, Rheum emodi*	*Ulmus villosa*	*Pinus wallichianum, Acer caesium, Indigofera heterantha, Parrotiopsis jacquemontiana, Rosa webbiana, Bergenia ciliate, Rheum emodi, Aconitum heterophyllum*	*Aconitum heterophyllum, Rheum emodi, Acer caesium*
Platanus orientalis	*Convovulus arvensis*		*Platanus orientalis, Populus alba, Polygonum portulaca, Prunella vulgaris*	*Platanus orientalis, Populus alba*
Aesculus indica-Juglans nigra	*Tulipa stellata*		*Juglans nigra, Aesculus indica, Salix caprea, Sonchus oleracus*	*Aesculus indica, Juglans nigra*
Salix alba-Populus nigra	*Ulmus villosa, Adiantum venustum*	*Ulmus villosa*	*Salix alba, Populus nigra, Ulmus villosa, Berberis lycium, Adiantum venustum, Taraxicum officinale*	*Ulmus villosa, Adiantum venustum*
Picea smithiana-Abies pindrow	*Picea smithiana, Abies pindrow, Taxus contorta, Adiantum venustum, Rheum emodi*		*Picea smithiana, Abies pindrow, Taxus contorta, Adiantum venustum, Rheum emodi*	*Taxus contorta, Abies pindrow, Adiantum venustum, Rheum emodi*
Salix alba community	*Berberis aristata*		*Salix alba, Berberis aristata, Rosa foetida*	*Berberis aristata*
Picea smithiana	*Picea smithiana, Acer caesium, Podophyllum hexandrum, Geranium wallichianum*		*Picea smithiana, Acer caesium, Geranium wallichianum, Podophyllum hexandrum, Saussurea costus*	*Saussurea costus, Podophyllum hexandrum, Acer caesium, Geranium wallichianum*
Robinia pseudoacacia-Prunus armeniaca	*Tulipa stellata*		*Prunus armeniaca, Robinia pseudoacacia, Rubus ulmifloius, Berberis lyceum, Rosa foetida, Centurea iberica,*	
Cedrus deodara-Pinus wallichiana	*Cedrus deodara, Pinus wallichiana, Parrotiopsis jacquemontiana*		*Cedrus deodara, Pinus wallichiana, Parrotiopsis jacquemontiana, Berberis lyceum,*	

			Indigofera heterantha	
Robinia pseudoacacia community	*Berberis aristata, Rosa webbiana*		*Robinia pseudoacacia, Berberis aristata, Rosa webbiana, Rosa foetida, Viola odorata*	*Berberis aristata*
Mixed community	*Cedrus deodara, Rosa webbiana, Indigofera heterantha, Lavatera cashmeriana,*	*Lavatera cashmeriana, Ulmus villosa*	*Cedrus deodara, Ulmus villosa, Cupressus torulosa, Prunus armeniaca, Populus nigra, Celtis australis, Nelumbo nucifera, Lavatera cashmeriana*	*Ulmus wallichiana, Lavatera cashmeriana, Nelumbo nucifera, Trapa natans, Ficus carica, Celtis australis, Juglans nigra, Platanus orientalis, Ailanthus altissima*
Cedrus deodara	*Cedrus deodara, Prunus tomentosa, Pinus wallichiana, Parrotiopsis jacquemontiana, Rheum emodi, Bergenia ciliata*		*Cedrus deodara, Pinus wallichiana, Ailanthus altissima, Prunus tomentosa, Parrotiopsis jacquemontiana, Rheum emodi, Bergenia ciliata*	*Ailanthus altissima, Prunus tomentosa, Juglans nigra, Populus alba, Artemisia absinthium, Rheum emodi*
Pinus wallichiana	*Pinus wallichiana, Indigofera heterantha, Berberis aristata, Cotoneaster microphyllus, Ziziphus jujuba var spinose, Parrotiopsis jacquemontiana, Podophyllum hexandrum, Lavatera cashmeriana, Podophyllum hexandrum, Rheum emodi*	*Ziziphus jujuba var spinose, Lavatera cashmeriana*	*Pinus wallichiana, Morus alba, Ailanthus altissima, Morus alba, Berberis aristata, Ziziphus jujuba var spinose, Prunus tomentosa, Prunus cornuta, Prunella vulgaris, Podophyllum hexandrum*	*Lavatera cashmeriana, Podophyllum hexandrum, Ailanthus altissima, Prunus tomentosa, Berberis aristata, Catalpa bignonioides*

Habitat diversity:

Thirteen forest habitats (13) Marshy, Shady moist, near road, Grassland, Water courses, Near-settlements, Riverine, Forest, Camping sites, Shrubberies Dry, Degraded and Rocky habitats were identified (Table 2). Among which forest, degraded and rocky habitats

showed wide range of distribution. The site representation varied from (1-8), Species richness ranged from 11-71, natives 1-17, endemics 0-3, economical important species 3-33, and threatened species 1-33. Amongst the habitats, maximum species richness (71), native (17), endemic (2), economically important (33), threatened (13) species were recorded in the forest habitat, followed by rocky, species richness (31), native (11), endemic (1), economically important (16), threatened (5); shrubberies habitat, species richness (34), native (8), endemic (1), economical important (14), threatened (5);shady moist, species richness (25), native (3), endemic (1), economical important (11), and threatened (3) species were recorded. The remaining habitats showed relatively less number of species (Table 4). Some notable native, endemic, economically important and threatened species of the prioritized habitats have been presented in Table 4.

Table 4: Prioritization of habitats for conservation in Manasbal range of Sindh Forest Division

Habitat type	SR	Altitude (m)	Species Richness	Native	Endemic	EIP	Threatened species	CPI
Marshy	1	1500-1700	23	1	0	10	2	**30**
Shady moist	1	1800-2000	25	3	1	11	3	**30**
Near road	1	1600-1900	16	2	1	8	3	**28**
Grassland	1	2700-3000	12	5	0	6	4	**28**
Water course	1	1700-2000	11	0	0	4	2	**28**
Near settlements	2	1800-2100	17	5	0	9	1	**26**
Riverine	2	2300-2600	22	3	1	12	3	**26**
Forest	8	2100-2900	71	17	2	33	13	**24**
Near camping sites	2	2000-2500	20	5	0	8	1	**24**
Shrubberies	2	1800-2300	34	8	1	14	4	**24**
Dry	1	2100-3000	11	2	0	3	1	**22**
Degraded	2	1700-3000	22	4	0	8	1	**20**
Rocky	3	1900-3100	31	11	1	16	5	**18**

Abbreviations: SR = Site representation; EIP = Economically Important Plants; CPI = Conservation Priority Index.

Species richness:

The richness of species in the identified communities for trees ranged from 1-14, shrubs 1-10, herbs 4-34. The richness of trees was highest in mixed community (i.e. 14), followed by *Pinus wallichiana* community (8), *Cedrus deodara* (7). The richness of shrubs was highest in *Pinus wallichiana* (10) followed by *Cedrus deodara* (7), and richness of herbs was again highest in mixed community (34), followed by *Pinus wallichiana* (32) and *Cedrus deodara* (28) communities.

Native, endemic, economically important and threatened species:

The native species ranged from 1-17, endemic species 0-2, economically important species 3-26 and threatened species 0-9 within the communities. Maximum species were recorded in mixed community 60 (native 9; endemic 2; economically important 26, threatened 9), followed by *Pinus wallichiana* 54 (native 17; endemic 2; economically important 25, threatened 7), *Cedrus deodara* 42 (native 9; endemic 0; economically important 19, threatened 6), *Robinia pseudoacacia* 19 (native 2; endemic 0; economically important 5, threatened 1). The remaining communities showed comparatively lesser species (Table 2).

Amongst the communities, threatened species ranged from 0-9 (Table 2). It was highest in mixed community (Endangered 1; Vulnerable 5; Near Threatened 3), followed by *Pinus wallichiana* (Endangered 2; Vulnerable 2; Near Threatened 3), *Cedrus deodara* (Vulnerable 2; Near Threatened 4), *Picea smithiana - Abies pindrow* (Critically Endangered 1; Near Threatened 3), *Picea smithiana* (Critically Endangered 1; Endangered 2; Near Threatened 1) and *Acer caesium-Pinus wallichiana* (Critically Endangered 1; Endangered 1; Vulnerable1; Near Threatened 1) communities. The remaining communities showed comparatively less number for threatened species. The notable native, endemic, economically important and threatened species of the prioritized communities have been presented in Table 3.

Prioritization of habitats and forest communities:

Among the communities, *Acer caesium-Pinus wallichiana*, *Platanus orientalis*, *Aesculus indica-Juglans nigra* showed highest i.e., (38) Conservation Priority Index (CPI), followed by *Salix alba - Populus nigra*, *Salix alba* and *Picea smithiana-Abies pindrow*, *Picea smithiana* (36 each) and *Robinia pseudoacacia - Prunus armeniaca, Pinus wallichiana-Cedrus deodara* and *Robinia pseudoacacia* communities (34, each). *Cedrus deodara*, Mixed Forest community (26 each). However, lowest CPI (22 each) was recorded for *Pinus wallichiana* community.

Amongst habitats, the Marshy and Shady moist habitats showed highest (i.e.30) Conservation Priority Index (CPI), followed by Near road, Grassland and Water course (CPI: 28) habitats, followed by Near settlements and Riverine (CPI:26) habitats, followed by Forest, Near camping sites and Shrubberies (CPI:24) habitats and Dry, Degraded habitats (CPI;22,20) respectively. The Rocky habitat showed minimum CPI 18 (Table 4).

Table 5: Some important native, endemic, economically important and threatened species of the main prioritized habitats

Prioritized habitats	Native	Endemic	Economically important plants	Threatened
Marshy	*Mentha arvensis*		*Nelumbo nucifera, Trapa natans, Salix alba, Populus deltoids, Rubus ulmifloius, Taraxicum officinale, Centurea iberica, Mentha arvensis*	*Nelumbo nucifera, Trapa natans*

Shady moist	*Cedrus deodara, Salvia moorcroftiana*	*Lavatera cashmeriana*	*Cedrus deodara, Populus nigra, Populus alba, Celtis australis, Salix alba, Berberis lyceum, Juglans nigra, Viola odorata*	*Juglans nigra, Populus alba, Celtis australis*
Near road	*Lavatera cashmeriana, Rosa webbiana*	*Lavatera cashmeriana*	*Platanus orientalis, Lavatera cashmeriana, Robinia pseudoacacia, Ailanthus altissima, Cupressus torulosa, Prunus armeniaca, Viola odorata*	*Ailanthus altissima, Platanus orientalis, Lavatera cashmeriana*
Grassland	*Picea smithiana, Acer caesium, Parrotiopsis jacquemontiana, Podophyllum hexandrum, Geranium wallichianum*		*Picea smithiana, Acer caesium, Parrotiopsis jacquemontiana, Saussurea costus, Podophyllum hexandrum, Geranium wallichianum*	*Acer caesium, Saussurea costus, Podophyllum hexandrum, Geranium wallichianum*
Water course	*Convovulus arvensis*		*Platanus orientalis, Populus alba, Polygonum portulaca, Prunella vulgaris*	*Platanus orientalis, Populus alba*
Near settlements	*Cedrus deodara, Pinus wallichiana, Berberis aristata, Parrotiopsis jacquemontiana, Indigofera heterantha*		*Cedrus deodara, Pinus wallichiana, Salix alba, Berberis aristata, Parrotiopsis jacquemontiana*	*Berberis aristata*
Riverine	*Ulmus villosa, Adiantum venustum*	*Ulmus villosa*	*Ulmus villosa, Juglans nigra, Aesculus indica, Salix caprea, Populus nigra, Berberis lycium , Taraxicum officinale, Sonchus oleraceus,*	*Ulmus villosa, Aesculus indica, Juglans nigra*

			Adiantum venustum, Centurea iberica	
Forest	*Cedrus deodara, Pinus wallichiana, Prunus tomentosa, Picea smithiana, Abies pindrow, Taxus contorta, Indigofera heterantha, Berberis aristata, Podophyllum hexandrum, Bergenia ciliata Rheum emodi*	*Lavatera cashmeriana, Ziziphus jujuba var spinose*	*Juglans nigra, Prunus tomentosa, Picea smithiana, Abies pindrow, Taxus contorta, Cedrus deodara, Pinus wallichiana, Ailanthus altissima, Populus alba, Lavatera cashmeriana, Catalpa bignonioides, Rheum emodi, Bergenia ciliata*	*Taxus contorta, Aesculus indica, Ailanthus altissima, Populus alba, Catalpa bignonioides, Prunus tomentosa, Abies pindrow, Lavatera cashmeriana, Podophyllum hexandrum, Rheum emodi, Adiantum venustum, Artemisia absinthium, Berberis aristata*
Near camping sites	*Cedrus deodara, Pinus wallichiana, Berberis aristata, Indigofera heterantha*		*Cedrus deodara, Pinus wallichiana, Berberis aristata, Indigofera heterantha, Parrotiopsis jacquemontiana, Rubus niveus, Bergenia ciliata, Prunella vulgaris*	*Berberis aristata*
Shrubberies	*Pinus wallichiana, Prunus tomentosa, Cedrus deodara, Parrotiopsis jacquemontiana, Berberis aristata, Indigofera heterantha, Ziziphus jujuba var spinose, Salvia moorcroftiana*	*Ziziphus jujuba var spinose*	*Pinus wallichiana, Cedrus deodara, Prunus persica, Cytisus scoparius, Parrotiopsis jacquemontiana, Berberis aristata, Indigofera heterantha, Ziziphus jujuba var spinose*	*Prunus tomentosa, Ziziphus jujuba var spinose, Ficus carica*
Dry	*Cedrus deodara, Parrotiopsis jacquemontiana*		*Cedrus deodara, Parrotiopsis jacquemontiana,*	*Artemisia absinthium*

			Artemisia absinthium	
Degraded	*Berberis aristata, Rosa webbiana, Salvia moorcroftiana, Tulipa stellata*		*Robinia pseudoacacia, Berberis aristata, Rosa webbiana, Rosa foetida, Salvia moorcroftiana*	
Rocky	*Pinus wallichiana, Acer caesium, Rosa webbiana, Cotoneaster microphyllus, Ziziphus jujuba var spinose, Indigofera heterantha, Bergenia ciliata, Rheum emodi*	*Ziziphus jujuba var spinose*	*Pinus wallichiana, Acer caesium, Robinia pseudoacacia, Rosa webbiana, Cotoneaster microphyllus, Ziziphus jujuba var spinose, Rosa foetida, Bergenia ciliata*	*Acer caesium, Ziziphus jujuba var spinose, Berberis aristata, Aconitum heterophyllum, Rheum emodi*

3.Discussion:

Conservation prioritization of the communities, habitats, and species is essential for the management planning of the biodiversity in protected and unprotected areas (Joshi and Samant, 2004). Therefore, attempt has been made to prioritize the communities and habitats of the Manasbal range of Sindh forest division. The habitat denotes the natural environment that surround a species, or species population, or community (Clements and Shelford, 1939). Today, over exploitation and habitat destruction are the major factors in which cause a species population to decrease, eventually leading to its being endangered, or even to its extinction. The identified forest communities were thirteen (13) including six (6) broad leaved forest communities, five (5) conifers forest communities and two (2) mixed forest communities. Coniferous communities were found to have a wide range of altitudinal distribution, followed by mixed forest communities, while as, broad leaved forest communities were found in few patches and had a narrow range of distribution.

Similarly 13 habitats were also identified including forests, shady moist, marshy, rocky, near road, near settlements, water course, grassland, dry, degraded, near camping sites, shrubberies and riverine from the range. forest habitat dominated the most of the area followed by rocky habitat. Prioritization and conservation of communities and habitats supporting high species diversity, native, endemic, economically important and threatened species is important and threatened species would help to some extent for the conservation of biodiversity. Amongst the communities, Mixed community, *Pinus wallichiana*, *Cedrus deodara*, *Picea smithiana*, *Robinia pseudoacacia* and *Pinus wallichiana* - *Cedrus deodara* mixed and showed high species richness, native, endemic, near-endemic, economically important and threatened species. Among habitats Forest, Rocky, Shrubberies and Shady moist showed high species richness, native, endemic, near-endemic, economically important and threatened species. In Manasbal range, like any other parts of Indian Himalayan Region the percentage of native and endemic species increased with the altitude and species richness decreased. In the IHR, most

of the studies related to prioritization of species for conservation have been carried out using qualitative attributes/observations, only. Assessment of status of the species for prioritization using qualitative as well as quantitative attributes has been suggested by few workers (Joshi and Samant, 2004; Samant *et al.*, 1996; 1998; 2001). Further, assessment status and values of the communities for conservation is urgently required. In the present study, amongst forest communities identified, *Acer caesium - Pinus wallichiana*, *Platanus orientalis* and *Aesculus indica - Juglans nigra* mixed, *Salix alba - Populus nigra* mixed, *Salix alba*, *Picea smithiana - Abies pindrow* mixed and *Picea smithiana* respectively showed the high CPI, hence are prioritized for conservation (Table 2). Among habitats, Marshy (30), Shady moist (30) respectively, showed high CPI and are prioritized for conservation (Table 4). Amongst the habitats, shady moist forest, bouldary, dry forest, alpine moist slope and rocky habitats showed high CPI values and indicated the urgent need for conservation planning. Adequate management planning of these habitats would help in maintaining their conservation and socioeconomic values. These communities and habitats, requires regular monitoring, so that proper management of these communities and habitats could be done in time. Some of the communities, such as *Pinus wallichiana*, *Cedrus deodara*, Mixed community and *Robinia pseudoacacia* showed wide range of distribution (Table 2).

4. Conclusion:

Due to adverse climatic conditions prevailing in the area the recorded species richness under forest communities and habitats was relatively less as compared to other areas. The communities and habitats with wide range of distribution represented high species richness, high number of native, endemic, economically important and threatened species. *Acer caesium-Pinus wallichiana*, *Platanus orientalis* and *Aesculus indica - Juglans regia* communities showed highest CPI value 38**,** these communities had the most priority for conservation. *Pinus wallichiana* community was the dominant among all communities representing 7 sites and 4 habitats. In case of habitats Marshy and Shady moist habitats showed highest CPI value 30**,** as these represented only 1 site and had narrow altitudinal range. The conservation of broad-leaved communities is important for improving soil fertility status and to maintain the ecosystem conducive for regeneration establishment. The communities located near habitations showed high anthropogenic pressure than that of distant communities. The protective measures of key stone species against adverse climate should be encouraged for conservation. In a nutshell, it is suggested that proper strategy and policy dealing with conservation management for prioritized communities and habitats should be formulated so that effective management of forests could be achieved in posterity.

5. REFERENCES:

Anitha, K., Joseph, S., John, C. R., Ramasamy, E. V. and Prasad, S. N. (2010). Tree species diversity and community composition in a human-dominated tropical forest of Western Ghats biodiversity hotspot, India. Ecol.Complex. 7: 217-224.

Anonymous, (2007). Biodiversity hot spots. http://www.biodiversityhotspots.org/xp/hotspots/himalaya/pages/default.apx.

Aswal, B. S., and Mehrotra, B. N. (1994). Handbook of Flora of Lahaul-Spiti (A cold desert in

north west Himalaya). Bishen Singh Mahendra Pal Singh.

Chowdhery, H. J. and Wadhwa, B. M. (1984). Handbook of Flora of Himachal Pradesh, Botanical Survey of India, Calcutta, India pp. 1-3.

Clements, F. E. and Shelford, V. E. 1939. Bio-ecology. John Wiley and Sons, Inc., New York.

Coetzee, J., Bredenkamp, P. G. J. and Reopen, N. V. (1995). Phytosociology of the grassland of the Ba and 1B land types in the Pretoria - Heidelberg area. S. Afr. J. Bot. 61(3): 123-133.

Costanza, R., D'Arge, R., De-Grott, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., Ruskin, R. G., Sutton, P. and Belt, M. V. D. 1997. The value of the world's ecosystem services and natural capital. Nat.387: 253-260.

Curtis, J. T. (1959). The Vegetation of Wisconsin, An Ordination of Plant Communities. Wisconsin Press, Madison, Wisconsin.

Curtis, J. T. and Mclntosh, R. P. (1950). The interrelations of certain analytic and synthetic phytosociological characters. Ecol. 31: 434-455.

Deshmukh, P. and Jain, S. (2016). Assessment of floristic diversity in Miyar Valley of Lahaul and Spiti district, Himachal Pradesh, India. JGR. 2: 90-95.

Devi, T. (2013). Assessment and conservation prioritization of floristic diversity for the socio-economic development of Rissa Khad Watershed in Central Himachal Pradesh, North Western Himalaya. G. B. Pant Institute of Himalayan Environment and Development, Himachal Unit, Mohal-Kullu-175126 Himachal Pradesh, India And Department Of Botany, D.S.B. Campus, Kumaun University, Nainital-263001, Uttarakhand, India pp. 12-13.

Dhaliwal, D. S. and Sharma, M. (1999). Handbook of Flora of Kullu District (Himachal Pradesh). Bishen Singh Mahendra Pal Singh, Dehra Dun, India.

Dhar, U. (1997). Handbook of Himalayan Biodiversity-Action Plan, Gyanodaya Prakashan, Nainital.

Dhar, U., Rawal, R. S. and Samant, S. S. (1997). Structural diversity and representativeness of forest vegetation in a protected area of Kumaun Himalaya, India: implications for conservation. Biodivers. Conserv. 6: 1045-1062.

Greig-Smith, P. (1957). Quantitative Plant Ecology. Academic Press, New York.

IUCN, (2003). IUCN red list of threatened species. Switzerland, Cambridge, UK: IUCN, Glands.

Joshi, H. C., and Samant, S. S. (2004). Assessment of forest vegetation and conservation priorities of communities in part of Nanda Devi Biosphere Reserve, West Himalaya. Part I. Int. J. Sustain. Dev. 11(3):326-336.

Khoshoo, T. N. (1995). Census of India's biodiversity: Tasks ahead. Curr. Sci. 69(1): 14-17.

Khoshoo, T. N. (1996). Biodiversity in the developing countries. In: Biodiversity, science, and

development: Toward a new partnership (Eds. Castri, F. and Younès, T.). CAB International IUBS, University Press, Cambridge, England. pp. 304-311.

Misra, R. (1968). Ecology workbook (Vol. 244). Oxford and IBH Publishing Company.

Mittermeier, R. A., Gil, P. L., Hoffman, M., Pilgrim, J., Brooks, T., Mittermeier, C. G., Lamoreux, J. and Fonseca, G. A. B. D. 2004. Hotspots revisited: Earth's biologically richest and most endangered terrestrial eco regions. Washington: Conservation International, Washington pp. 11-19.

Mueller-Dombois, D. (1974). Aims and methods of vegetation ecology. John Willey and Sons, New York.

Murti, S.K. (2001). Flora of cold deserts of western Himalaya. Vol. I. Botanical survey of India, Calcutta, India.

Nayar, M. P. and Sastry, A. R. K.C. (1987). Red data book of Indian plants, Vols. I-III. Calcutta: Botanical Survey of India.

Novacek, M. J. and Cleland, E. E. (2001). The current biodiversity extinction event: scenarios for mitigation and recovery. Proc Natl Acad Sci. 98(10): 5466-5470.

Polunin, O., and Stainton, A. (1984). Flowers of the Himalaya -Oxford University Press, Oxford, New Dehli, India,79.

Samant, S. P. S. (2007). Assessment of plant diversity and prioritization of communities for conservation in Mornaula Reserve Forest. Appl. Ecol. Environ. Res. 5(2): 123-138.

Samant, S. S. (1996). Conservation of rare endangered plants: The context of Nanda Devi Biosphere Reserve. Conservation and management of biological resources in Himalaya.

Samant, S. S. (1998). Diversity, distribution and conservation of fodder resource of West Himalaya, India. In: Proceedings of the Third Temperate Pasture and Fodder Network (TAPAFON) (Eds. B. Misri), Pokhra, Nepal, 9-13 March, 1998, sponsored by F.A.O. Rome. pp. 109-128.

Samant, S. S. and Pal, M. (2003). Diversity and conservation status 9 of medicinal plants in Uttaranchal State. Indian Forester.129(9): 1090-1108.

Samant, S. S., and Dhar, U. (1997). Diversity, endemism and economic potential of wild edible plants of Indian Himalaya. Int. J. Sustain. Dev. World Ecol. 4(3), 179-191.

Samant, S. S., and Joshi, H. C. (2003). Floristic diversity, community patterns and changes of vegetation in Nanda Devi National Park. Biodiversity Monitoring Expedition. Uttaranchal Forest Department. pp. 39-44.

Samant, S. S., Dhar, U. and Palni, L. M. S. (1998). Medicinal plants of Indian Himalaya: Diversity distribution potential values. Nainital: Gyanodaya Prakashan, Nainital, India.

Samant, S. S., Dhar, U. and Rawal, R. S. 1998. Biodiversity status of a protected area of west Himalaya. I-Askot Wildlife Sanctuary. Int. J. Sustain. Dev. World Ecol.5: 194-203.

Samant, S. S., Joshi, H. C., Arya, S. C., and Pant, S. (2002). Studies on the structure, composition and changes of the vegetation in Nanda Devi Biosphere Reserve of West Himalaya. Biosphere Reserves in India and their Management (eds. JK Sharma, PS Easa, C. Mohanan, N. Sasidharan and RK Rai). Ministry of Environment and Forests, New Delhi and Kerala Forest Research Institute, Peechi, Kerala, 133-139.

Singh, A. (2007). Assessment of plant diversity and conservation status of forest vegetation in a cold desert biosphere reserve of the Western Himalaya, Kumaun University, Nainital pp. 12-15.

Singh, J. S. (2002). The biodiversity crisis: a multifaceted reviesw. Curr. Sci. 638-647.