

Floristic Composition & Biological Spectrum of Darlaghat Wildlife Sanctuary, Solan, Himachal Pradesh, India

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Abstract: Floristic composition and biological spectrum of Darlaghat Wild Life Sanctuary (DWLS), located in district Solan of Himachal Pradesh, was studied from July, 2010 to July, 2012. Vast altitudinal variation (1075-2069 amsl) and jagged topography in this Protected Area (PA) has resulted in occurrence of much diverse climate, and this is well reflected in its floristic composition. A total 302 plant species belonging to 99 families were recorded from the study area. These include: 27% trees; 24% shrubs; 35% herbs; 5% climber; 5% fern; 2% grasses and 2% Sedges. Out of the total number of 302 species Dicots were the dominant group with 87%. The Monocots were 6% with 17 species. The pteridophytes were 5 % with 14 species and gymnosperms 2% with 6 species. Fabaceae with frequency percentage of 10% was the most dominant family. However, Asteraceae 9 % with second highest dominant family in the study area. Life form classes and percentage distribution was analysis showed that 302 species comprised of: - Phanerophytes: 47 %, Therophytes 36 %, Cryptophytes 9 %, Hemicryptophytes 5% and Chamaephytes 3%. It was found that Phenerophytes percentage was approximately the same as that of normal spectrum, but Chamaephytes, Cryptophytes and Hemicryptophytes were less then the normal spectrum. However, the therophytes showed variation from normal spectrum and were significantly higher than the normal spectrum. [Meenakshi Thakur, V. K. Santvan & Amrita Nigam. **Floristic Composition & Biological Spectrum of Darlaghat Wildlife Sanctuary, Solan, Himachal Pradesh, India.** *N Y Sci J* 2012;5(12):1-14]. (ISSN: 1554-0200). <http://www.sciencepub.net/newyork>. 1

Key words: Dharlaghat wild life sanctuary, Floristic composition, Biological spectrum.

Introduction

Floristic composition is an inventory of the plants of a definite and specified area. The inventory is authenticated by citations of herbarium specimens and of location or stations where each element is known to have occurred. It is customary to arrange the plants listed in a flora according to a recognized system of classification. Hence, floristic studies are taxonomic studies of a flora or of a major segment of a flora, of a given area. The Knowledge of vegetation and flora of any region is essential for the study of biodiversity and understanding the environment of that area.

Himalaya is a mega diversity region of world. It supports about 18,440 species of plants, of which 25.3% are endemic to Himalaya (Singh and Hajra, 1997, Samant *et al.*, 1998). Appearance and existence of any plant community is entirely a subject of its floristic composition and the life form spectrum of its individual components (Kranti, 2012). Whereas, life form spectrum is said to be excellent indicator of macro and microclimate (Shimwell, 1971). Life form is the sum total of adaptations of plant to climate (Humboldt, 1805). It is good indicator of climate and is assumed to have evolved in response to environmental conditions (Pandit and Puhurkar, 1998) However, biological spectrum is useful in

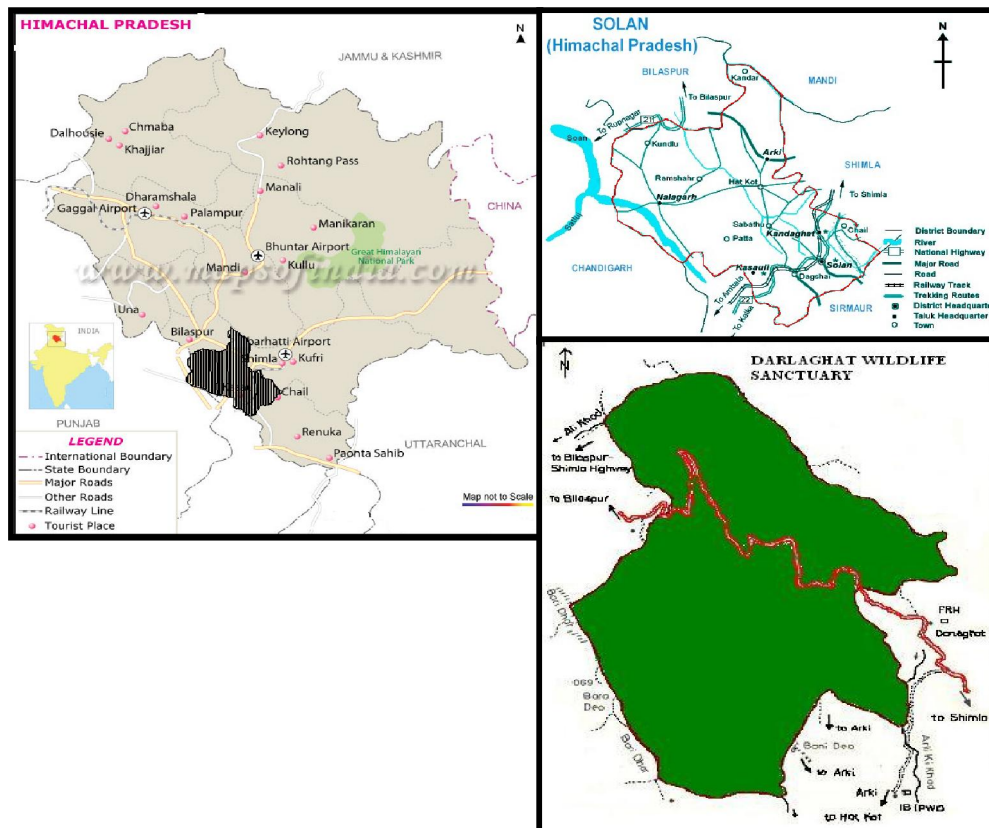
comparing geographically widely separated plant communities and is also regarded as good indicator of prevailing environment.

In India several workers have studied the biological spectrum of different regions (Meher Homji, 1964, 1981; Shina, 1990; Singh and Arora, 1994; Rana *et al.*, 2002; Jamir *et al.*, 2006; Patel *et al.*, 2010 and Pharswan *et al.*, 2010). In Himachal Pradesh, a few attempts have been made in this direction. Some of the notable contributions to study of life forms and biological spectrum are those of Kapoor and Singh (1990), Sharma and Singh (1990, 1995), Subramani *et al.* (2007), Attri *et al.* (2011) and Kranti *et al.* (2012).

The state of Himachal Pradesh ranks third among all the states in the country in terms of the percentage of total area of the state under Protected Area (PA). The thirty two Wild Life Sanctuaries and two National Parks of the state occupy 13.6% of the state's geographical area as compared to the national average of 4.7% (HPFD 2004b). While, two of the state's sanctuaries each cover an area of more than 1000 km², as many as sixteen out of the total thirty two sanctuaries are less than 75 km² in area. The Darlaghat Wild Life Sanctuary (DWLS) located in Solan district of Himachal Pradesh is one important protected area of the state. Adjacent to this Darlaghat

Wild Life Sanctuary a cement factory knows as Gujarat Ambuja Cement Limited has been established. The pollution emitting from the factory may be adversely affecting the flora of the wild life sanctuary. Therefore, the present study deals with

the floristic composition along with life forms of the Darlaghat Wildlife Sanctuary, This information can be of great value while preparing the management plan of DWLS.



MAP OF STUDY AREA

DESCRIPTION OF STUDY AREA

The present study on floristic composition and biological spectrum was undertaken in Darlaghat Wildlife Sanctuary (DWLS) located in Solan district of Himachal Pradesh. The Darlaghat wildlife sanctuary has an area of 628.40 hectare. It is situated between N 31°09' 12" 76°59' 30" E. The temperature ranges from 1° to 30° C with mean annual rain fall of 1040 cm. The altitude of the sanctuary varies from 1075 to 2069 masl. There are eight human settlement villages with a population of 1139 human beings. The wildlife sanctuary first time notified in 1962, and finally re-notified on 5 April 2002.

METHODOLOGY

The field survey was conducted in Darlaghat Wildlife Sanctuary from July 2010 to July 2012 in order to record the floristic composition and biological spectrum. Sanctuary area was divided into three altitudinal gradients i.e. hill top, mid hill and

hill base. The sampling was done at monthly interval following Misra (1968). Data on floristic composition, life forms (on the basis of nature of perennating buds of plant species) were recorded. All species were assigned to suitable life forms such as Phanerophytes (Ph), Therophytes (Th), Chamaephytes (Ch), Hemicryptophytes (Hg), Cryptophytes (Cr) and biological spectrum was prepared. This was compared with the Raunkiaer (1934) normal biological spectrum.

RESULTS AND DISCUSSION

A detail ecological reconnaissance of the area was undertaken to study the flora and to record the life forms. The complete list of the plant species encountered in the study area i.e. DWLS is given in Table-1. A total 302 plant species belonging to 99 families were recorded from the study area. These include: 27% (81 species) trees; 24% (73 species) shrubs; 35% (105 species) herbs; 5% (16 species) climber; 5% (15 species) fern; 2% (7

species) grasses and 2% (5 species) Sedges (Fig.1). Out of the total number of 302 species Dicots were the dominant group with 87% (265 species). The Monocots were 6% with 17 species. The monocots were represented by six families i.e. Liliaceae, Poaceae, Orchidaceae, Araceae, Amaryllidaceae and Dioscoreaceae. The pteridophytes were 5 % with 14 species and gymnosperms 2% with 6 species.(Fig.2) The percentage distribution of different families was: Fabaceae with frequency percentage of 10% ; Asteraceae 9 %, (16 species); laminaceae 7%, (13 species); Euphorbiaceae 5%; Solanaceae 4%; Rosaceae 7%; Poaceae 3%; Leguminoseceae 3.09%; Verbenaceae 3%; Moraceae 3%; Ranunculaceae 4%; Apocynaceae 3% and Amaranthaceae 2% (Fig.3). The floristic composition shows that the vegetation comprised mainly of shrubs and herbs. The presence of large number of shrubs and herbs may be due to climatic condition, poor soil and moisture availability.

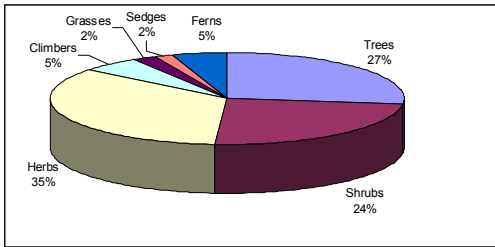


Fig 1. Pie diagram showing percentage contribution of various plant habits in DWLS

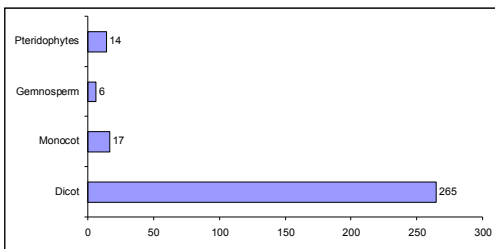


Fig:2. Distribution of different groups according to taxonomic categories

The various species present throughout the year were also analyzed for different life form classes and percentage distribution was computed. The analysis showed that 302 species comprised of: - Phanerophytes: 47 % (142 spp.); Therophytes 36 % (108 spp.); Cryptophytes, 9 % (27 spp); Hemicryptophytes, 5% (16 spp.) and Chamaephytes, 3% (9 spp) (Fig.4).

When the present spectrum is compared with normal spectrum of Raunkiaer (1934) it was found that Phenerophytes percentage was

approximately the same as that of normal spectrum, but Chamaephytes, Cryptophytes and Hemicryptophytes were less than the normal spectrum. However, the therophytes showed variation from normal spectrum and were significantly higher than the normal spectrum. (Table.2 Fig .4) Raunkiaer (1934) reported phanerophytes 46% as the most dominating life form globally as has been found in the present study. The dominance of therophytes 36% indicated that the investigated area was under heavy biotic pressure due to various anthropogenic activities as has been reported by Barbero *et al.* (1990) also. Higher percentage of therophytes can also be attributed to dry condition in the area (Arsi, 2003). The lesser number of cryptophytes may be due to the fact that the area is not subjected to severe climatic conditions as reported for alpine regions by Santvan and Agarwal (1993) and Rawat and Pangety (1985). In the present study chamaephytes were reported less than the normal spectrum, because higher percentage of chamaephytes is an adaptation to colder and higher altitude conditions (Braun-Blanquet, 1938).

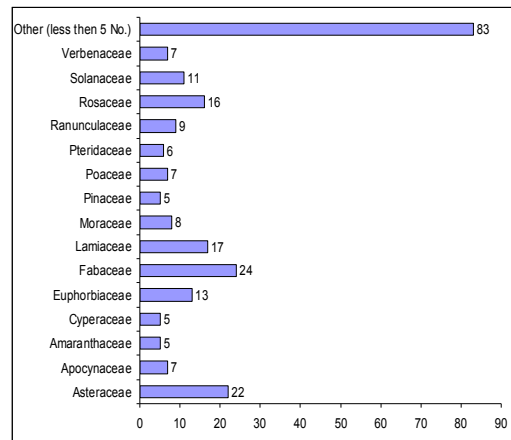


Fig 3. Graph showing families' wise distribution of flora

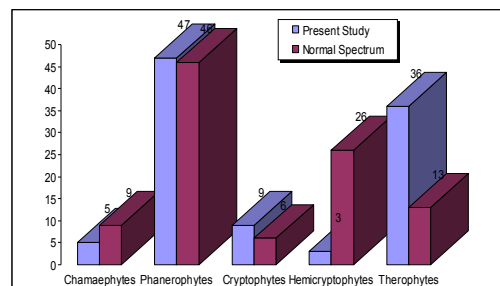


Fig 4. Biological spectrum of life-forms of present study and its comparison with the Raunkiaer's normal biological spectrum representing world flora

Table:2. Comparison of Biological spectrum of Present site with other area of Northwest Himalaya

Place	Author(s)	No. of Species	Ph.	Th.	Cr.	He	Ch	Association
%								
Normal Spectrum	Raunkiaer (1934)	400	46	9	26	6	13	Ph-Hg
Shimla	Kapoor (1987)	28	---	14.3	17.9	10.7	57.1	Th
Northwest Himalayas	Santvan & Agrawal (1993)	79	--	29	29.48	32.05	11.53	Ch-Hg
Alsindi (Mandi)	Attri et al (2010)	76	53	-	29	-	18	Ph-Hg
Renuka WLS	Subramani et al(2007)	395	48.56	31.24	2.10	5.51	7.61	Ph-Th
Bandli WLS	Kranti Thakur et al(2012)	144	42.36	2.08	18.75	3.47	33.3	Ph-Th
Present work		302	47	36	9	3	5	Ph-Th

Table: 1. List of plant species, life forms, habit and taxonomic distribution encountered in Darlaghat Wildlife Sanctuary, Solan, Himachal Pradesh

S. No.	Plant Name	Habit	Life form	Taxonomic Form
Acanthaceae				
1.	Dicliptera bupleuroides	Herb	Th	D
2.	Strobilanthes delhousteanus	Herb	Th	D
3.	Aechmanthera gossypina	Shrub	Th	D
4.	Justicia adhatoda	Shrub	Ph	D
Agavaceae				
5.	Agave american	Herb	Cr	D
Amaranthaceae				
6.	Achyranthes aspera	Herb	Th	D
7.	Achyranthes bidenta	Herb	Th	D
8.	Amaranthus caudatus	Herb	Th	D
9.	Amaranthus cruentus	Herb	Th	D
10.	Ammaranthas paniculatus	Herb	Th	D
Anacardiaceae				
11.	Mangifera indica Linn.	Tree	Ph	D
12.	Pistacia integrimma (Stewart) Recht.	Tree	Ph	D
13.	Cotinus cogniya	Shrub	Ph	D
Apiaceae				
14.	Heracleum candicans	Herb	Th	D

Apocynaceae				
15.	<i>Vinca major</i>	Herb	Th	D
16.	<i>Cryptolepis buchananii</i>	Climber	Ph	D
17.	<i>Ichnocarpus fragrans</i> Wall.	Climber	Ph	D
18.	<i>Carissa carandas</i>	Shrub	Ph	D
19.	<i>Carissa opaca</i>	Shrub	Ph	D
20.	<i>Holarrhen antidysenterica</i> Wall.	Shrub	Ph	D
21.	<i>Nerium indicum</i>	Shrub	Ph	D
Araceae				
22.	<i>Alocasia indica</i>	Herb	Th	D
23.	<i>Ariseama propinquum</i>	Herb	Cr	D
24.	<i>Scindapsus officinalis</i> (Roxb.)Schott.	Herb	Ph	D
25.	<i>Scindapsus officinalis</i> (Roxb.)Schott.	Climber	Ph	D
Areaceae				
26.	<i>Phoenix sylvestris</i> Roxb.	Tree	Ph	M
Asclepiadaceae				
27.	<i>Hemidesmus indicus</i> (L.) R. Br.	Herb	Th	D
28.	<i>Calotropis procera</i>	Shrub	Ch	D
29.	<i>Calotropis gigantia</i>	Shrub	Ch	D
Asparagaceae				
30.	<i>Asparagus racemosus</i>	Herb	Th	D
31.	<i>Asparagus adscendens</i>	Shrub	Ph	D
Asphodelaceae				
32.	<i>Aloe vera</i>	Herb	Cr	D
Aspleniaceae				
33.	<i>Asplenium trichomanes</i>	Fern	Cr	P
34.	<i>Asplenium pulchera</i>	Fern	Cr	P
Asteraceae				
35.	<i>Ageratum corysoides</i> L.	Herb	Th	D
36.	<i>Anacyclus pyrethrum</i> DC.	Herb	Th	D
37.	<i>Anaphalis contorta</i>	Herb	Th	D
38.	<i>Artemisia roxburghiana</i>	Herb	Ch	D
39.	<i>Biden tripartita</i>	Herb	Th	D
40.	<i>Bidens pilosa</i>	Herb	Th	D
41.	<i>Blumea wightiana</i> DC.	Herb	Th	D
42.	<i>Cirsium wallichii</i>	Herb	Th	D
43.	<i>Cirsium verutum</i> (D.Don)	Herb	Th	D
44.	<i>Launaea procumbens</i>	Herb	Th	D
45.	<i>Eclipta alba</i> (L.) Hassk.	Herb	Th	D
46.	<i>Erigeron multicaulis</i>	Herb	Th	D
47.	<i>Gerbera gossypina</i>	Herb	Th	D
48.	<i>Sonchus arvensis</i>	Herb	Th	D
49.	<i>Tagetes minuta</i>	Herb	Th	D
50.	<i>Taraxacum officinale</i>	Herb	Th	D

51.	<i>Vicoa indica</i>	Herb	Th	D
52.	<i>Zinnia spp.</i>	Herb	Th	D
53.	<i>Artemisia capillaris</i>	Shrub	Th	D
54.	<i>Inula cappa</i>	Shrub	Th	D
55.	<i>Parthenium hysterophorus</i>	Shrub	Th	D
56.	<i>Xanthium indicum</i>	Shrub	Ph	D
Bambusaceae				
57.	<i>Arundinaria falcata</i> Nees.	Tree	Ph	D
58.	<i>Bombusa arundinacea</i>			D
59.	<i>Dendrocalamus hamiltonii</i> Nees & Arn. ex Munro	Tree	Ph	D
Begoniaceae				
60.	<i>Begonia amoena</i> Wall.	Herb	Th	D
Berberidaceae				
61.	<i>Berberis aristata</i>	Shrub	Ph	D
62.	<i>Berberis lycium</i> Royle	Shrub	Ph	D
Bignoniaceae				
63.	<i>Oroxylum indicum</i>	Tree	Ph	D
64.	<i>Oroxylum indicum</i>	Tree	Ph	D
Bombaceae				
65.	<i>Bombax ceiba</i> Linn.	Tree	Ph	D
Cactaceae				
66.	<i>Opuntia chlorotica</i>	Herb	Cr	D
67.	<i>Opuntia dillenii</i>	Herb	Cr	D
Caesalpinaceae				
68.	<i>Berberis vahlii</i>	Climber	Ph	D
69.	<i>Cassia fistula</i> L.	Tree	Ph	D
70.	<i>Cassia tora</i> L.	Herb	Th	D
71.	<i>Cassia occidentalis</i> L.	Shrub	Th	D
72.	<i>Cassia mimosoides</i>	Shrub	Th	D
Cannabaceae				
73.	<i>Cannabis sativa</i> L.	Herb	Th	D
Caryophyllaceae				
74.	<i>Vaccaria pyramidata</i>	Herb	Th	D
Celastraceae				
75.	<i>Celastrus paniculata</i> Willd.	Climber	Ph	D
Chenopodiaceae				
76.	<i>Chenopodium album</i> L.	Herb	Th	D
Clusiaceae				
77.	<i>Hypericum oblongifolium</i> Chosiy.	Shrub	Ph	D
78.	<i>Hypericum perforatum</i>	Shrub	Ph	D
Combretaceae				
79.	<i>Terminalia alata</i> (Heyneex Roth).	Tree	Ph	D
80.	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Tree	Ph	D
81.	<i>Terminalia tomentosa</i> (DC) Wt. & Arn.	Tree	Ph	D
82.	<i>Terminalia chebula</i> Retz.	Tree	Ph	D
Convolvulaceae				

83.	<i>Ipomea headeraca</i>	Shrub	Th	D
84.	<i>Ipomoea purpurea</i> Roth.	Shrub	Th	D
Cordiaceae				
85.	<i>Ehretia acuminata</i> R. Br.	Tree	Ph	D
86.	<i>Ehretia laevis</i> Roxb.	Tree	Ph	D
Cressulaceae				
87.	<i>Bryophyllum pinnatum</i> (Lam.) Oken.	Herb	Cr	D
Cupressaceae				
88.	<i>Cupressus torulose</i>	Tree	Ph	G
Cuscutaceae				
89.	<i>Cuscuta reflexa</i> Roxb.	Climber	Ph	D
Cyperaceae				
90.	<i>Cyperus rotundus</i>	Sedge	He	M
91.	<i>Cyperus seariosus</i> R.Br.	Sedge	He	M
92.	<i>Fimbristylis dephylla</i>	Sedge	He	M
93.	<i>Fimbristylis dichotoma</i>	Sedge	He	M
94.	<i>Juncus</i> Spp.	Sedge	He	M
Dioscoreaceae				
95.	<i>Dioscorea bulbifera</i>	Climber	Ph	M
96.	<i>Dioscorea deltoidea</i>	Climber	Ph	M
97.	<i>Dioscorea sativa</i>	Climber	Ph	M
98.	<i>Dioscorea sativa</i>	Shrub	Ph	M
Dipsacaceae				
99.	<i>Dipsacus inermis</i>	Herb	Ph	D
Dipterocarpaceae				
100.	<i>Shorea robusta</i> Gaertn. F.	Tree	Ph	D
Dryopteridaceae				
101.	<i>Diplazium esculentum</i> Sw.	Fern	Cr	P
102.	<i>Diplazium maximum</i>	Fern	Cr	P
103.	<i>Dryopteris</i> spp.	Fern	Cr	P
Elaeagnaceae				
104.	<i>Elaeagnus umbellate</i> Thumb.	Shrub	Ph	D
Equisetaceae				
105.	<i>Equisetum</i> Spp.	Fern	Cr	P
Ericaceae				
106.	<i>Rhododendron arboretum</i> Sn.	Tree	Ph	D
107.	<i>Rhododendron campanulatum</i> D.Don	Tree	Ph	D
Euphorbiaceae				
108.	<i>Emblica officinalis</i> Gaertn.	Tree	Ph	D
109.	<i>Glochidion velutinum</i> Wight	Tree	Ph	D
110.	<i>Mallotus phillipensis</i> Muett.	Tree	Ph	D
111.	<i>Sapium insigne</i> (Royle) Benth.	Tree	Ph	D
112.	<i>Euphorbia geniculata</i>	Herb	Th	D
113.	<i>Euphorbia hirta</i>	Herb	Th	D
114.	<i>Euphorbia pilosa</i>	Herb	Th	D

115.	<i>Euphorbia thymifolia</i>	Herb	Th	D
116.	<i>Euphorbia royleana</i>	Shrub	Ph	D
117.	<i>Euphorbia pulcherrima</i>	Shrub	Ph	D
118.	<i>Jatropha curcas</i>	Shrub	Ph	D
119.	<i>Phyllanthus emblica</i> L.		Ph	D
120.	<i>Ricinus communis</i> L.	Shrub	Ph	D
Fabaceae				
121.	<i>Acacia catechu</i> Willd.	Tree	Ph	D
122.	<i>Acacia nelotica</i> (L) Willd. ex Delile.	Tree	Ph	D
123.	<i>Albizia julibrissin</i> Durazz.	Tree	Ph	D
124.	<i>Albizia lebbeck</i> Benth.	Tree	Ph	D
125.	<i>Albizia stipulata</i> (DC.)Boiv.	Tree	Ph	D
126.	<i>Bauhinia purpurea</i> Linn.	Tree	Ph	D
127.	<i>Bauhinia variegata</i> Linn.	Tree	Ph	D
128.	<i>Butea monosperma</i> Kuntze	Tree	Ph	D
129.	<i>Dalbergia sissoo</i> Roxb.	Tree	Ph	D
130.	<i>Erythrina suberosa</i> Roxb.	Tree	Ph	D
131.	<i>Robinia pseudoacacia</i> Linn.	Tree	Ph	D
132.	<i>Abrus precatorius</i> Linn.	Herb	Ph	D
133.	<i>Clitorea ternatea</i> L.	Herb	Th	D
134.	<i>Crotalaria albida</i> Heyne.	Herb	Th	D
135.	<i>Lotus corniculatus</i>	Herb	Th	D
136.	<i>Milletia auriculata</i> Baker ex. Brandis	Herb	Ph	D
137.	<i>Pueraria tuberosa</i> DC		Cr	D
138.	<i>Tecoma stans</i> (L) H.B.S.K.	Herb	Ph	D
139.	<i>Trifolium repens</i> L.	Herb	Th	D
140.	<i>Vicia setiva</i> L.	Herb	Th	D
141.	<i>Desmodium gangeticum</i>	Shrub	Th	D
142.	<i>Hedysarum campylocarpon</i>		Th	D
143.	<i>Vicia angustifolia</i>	Climber	Ph	D
144.	<i>Fagus grandiflora</i> Ehrh.	Tree	Ph	D
Fagaceae				
145.	<i>Quercus leucotrichophora</i> A. Camus	Tree	Ph	D
146.	<i>Quercus semecarpifolia</i> Sm.	Tree	Ph	D
Flacourtiaceae				
147.	<i>Flacourtia indica</i> (Burm.f) Merr.	Tree	Ph	D
Fumariaceae				
148.	<i>Fumaria indica</i>	Herb	He	D
Geraniaceae				
149.	<i>Geranium walliichiaum</i>	Herb	Ch	D
Hippocastanaceae				
150.	<i>Aesculus indica</i> Colebr.	Tree	Ph	D
Juglandaceae				
151.	<i>Juglans regia</i> Linn.	Tree	Ph	D
Lamiaceae				
152.	<i>Mentha piperita</i>	Herb	Th	D
153.	<i>Roylea elegans</i> Wall.	Shrub	Th	D

154.	Salvia moorcroftina Wall.	Shrub	Th	D
155.	Ajuga Bracteosa Wall.ex Benth.	Herb	He	D
156.	Leucas lanata	Herb	Th	D
157.	Mentha longifolia	Herb	Th	D
158.	Micromeria Biflora (Buch-ham exD.Don) Benth	Herb	Th	D
159.	Nepeta erecta	Herb	Th	D
160.	Ocimum Canum Sims	Herb	Th	D
161.	Ocimum sanctum Linn.	Herb	Th	D
162.	Orignum vulgare Linn.	Herb	Ch	D
163.	Thymus linearis	Herb	Th	D
164.	Colebrookia oppositifolia	Shrub	Ph	D
165.	Meriandra stobilifera	Shrub	Ph	D
166.	Rabdosia rugosa	Shrub	Th	D
167.	Salvia coccinea	Shrub	Th	D
168.	Plectranthus stachyi	Shrub	Ph	D
Lauraceae				
169.	Litsea monopetala Roxb.	Tree	Ph	D
170.	Machilus odoratissima (Wall. ex Nees)	Tree	Ph	D
Leguminosae				
171.	Indigofera pulchella Roxb.	Shrub	Ph	D
172.	Lathyrus aphaca L.	Shrub	Th	D
173.	Lespedeza spp.	Shrub	Th	D
Lythraceae				
174.	Woodfordia fruticosa	Shrub	Ph	D
175.	Impatiens balsamina Linn.	Shrub	Th	D
Malvaceae				
176.	Sida cordifolia L.	Herb	Th	D
177.	Hibiscus cancellatus Roxb.	Shrub	Cr	D
Marsileaceae				
178.	Marselia Spp.	Fern	Cr	P
Meliaceae				
179.	Cedrella toona Roxb. ex Rottl.	Tree	Ph	D
180.	Melia azedarach Linn.	Tree	Ph	D
181.	Toona ciliata M.Roem	Tree	Ph	D
Menispermaceae				
182.	Cissampelos pareira var.hirsuta	Herb	Ph	D
183.	Stephania glabra(Roxb.) Miers.	Herb	Cr	D
184.	Tinospora cordifolia (Willd.)	Climber	Ph	D
185.	Cocculus laurifolium DC.	Shrub	Ph	D
Moraceae				
186.	Ficus auriculata	Tree	Ph	D
187.	Ficus Benghalensis L.	Tree	Ph	D
188.	Ficus palmata	Tree	Ph	D
189.	Ficus racemosa L.	Tree	Ph	D
190.	Ficus religiosa L.	Tree	Ph	D
191.	Morus alba Linn.	Tree	Ph	D
192.	Morus nigra Linn.	Tree	Ph	D

193.	Morus serrata Roxb.	Tree	Ph	D
Moringaceae				
194.	Moringa oleifera Lam.	Shrub	Ph	D
Myricaceae				
195.	Myrica esculenta	Tree	Ph	D
Myrtaceae				
196.	Eugenia jambolana Lam.	Tree	Ph	D
197.	Eucalyptus umbellata (Gaertn.)Domin.	Tree	Ph	D
Nephrolepidaceae				
198.	Nephrolepis spp.	Fern	Cr	P
Nyctaginaceae				
199.	Mirabilis jalapa L.	Shrub	Ph	D
Oleaceae				
200.	Nyctanthes arbortristis	Shrub	Ch	D
201.	Olea ferruginea	Tree	Ph	D
Onagraceae				
202.	Epilobium himalayense	Herb	Th	D
Oxalidaceae				
203.	Oxalis corniculata L.	Herb	Cr	D
204.	Oxalis dehradunensis	Herb	Cr	D
Papaveraceae				
205.	Papaver rhoeas	Herb	Th	D
206.	Argemone mexicana L.	Herb	Th	D
Martynaceae				
207.	Martynia annua	Shrub	Ph	D
Pedaliaceae				
208.	Sesamum orientale	Herb	Th	D
Pinaceae				
209.	Abies pindrow Royle ex D. Don	Tree	Ph	G
210.	Cedrus deodara (Roxb.) Louden	Tree	Ph	G
211.	Picea smithiana Boiss.	Tree	Ph	G
212.	Pinus roxburghii Sarg.	Tree	Ph	G
213.	Pinus wallichiana A. B. Jackson	Tree	Ph	G
Plantaginaceae				
214.	Plantago major	Herb	Th	D
Plumbaginaceae				
215.	Plumbago zeylanica	Herb	Th	D
Poaceae				
216.	Andropogon contortus	Grass	He	M
217.	Apluda mutica	Grass	He	M
218.	Cymbopogon jwarancusa	Grass	He	M
219.	Cymbopogon martini Wats.	Grass	He	M
220.	Cynodon dactylon(L)Pers.	Grass	He	M
221.	Pespalum spp.	Grass	He	M
222.	Saccharum spontaneum	Grass	He	M
Polygonaceae				

223.	<i>Fagopyrum esculentum</i>	Herb	Th	D
224.	<i>Rumex hastatus</i>	Shrub	Th	D
Primulaceae				
225.	<i>Androsace rotundifolia</i> Hardw.	Herb	Th	D
Proteaceae				
226.	<i>Grevillea robusta</i>	Tree	Ph	D
Pteridaceae				
227.	<i>Adiantum venustum</i>	Fern	Cr	P
228.	<i>Lpteris cretica</i>	Fern	Cr	P
229.	<i>Onychium contiquum</i>	Fern	Cr	P
230.	<i>Pteris cretica</i>	Fern	Cr	P
231.	<i>Pteris vitae</i>	Fern	Cr	P
Punicaceae				
232.	<i>Punica granatum</i>	Tree	Ph	D
Ranunculaceae				
233.	<i>Aconitum chasmanthus</i>	Herb	Th	D
234.	<i>Anemone vitifolia</i>	Herb	Th	D
235.	<i>Anemone tetrasepala</i>	Herb	Th	D
236.	<i>Delphinium denudatum</i> Wall	Herb	Th	D
237.	<i>Ranunculus laetus</i>	Herb	Th	D
238.	<i>Ranunculus muricatus</i>	Herb	Th	D
239.	<i>Clematis buchnaniana</i>	Climber	Ph	D
240.	<i>Clematis moactara</i>	Climber	Ph	D
241.	<i>Thalictrum foliolosum</i>	Shrub	Ch	D
Rhamnaceae				
242.	<i>Zizyphus jujuba</i> Mill.	Tree	Ph	D
243.	<i>Heolinus lanceolatus</i> Brandis	Herb	Th	D
244.	<i>Helinus lanceolatus</i> Brandis	Shrub	Ph	D
Rosaceae				
245.	<i>Cydonia oblonga</i>	Tree	Ph	D
246.	<i>Prunus armeniaca</i> L.	Tree	Ph	D
247.	<i>Prunus cerasoides</i> D. Don	Tree	Ph	D
248.	<i>Prunus persica</i>	Tree	Ph	D
249.	<i>Pyrus pashia</i> Ham.	Tree	Ph	D
250.	<i>Fragaria indica</i>	Herb	He	D
251.	<i>Prinsepia utilis</i>	Shrub	Ph	D
252.	<i>Rosa cathayensis</i> L.H. Bailey	Shrub	Th	D
253.	<i>Rosa macrophylla</i>	Shrub	Th	D
254.	<i>Rosa moschata</i> Herm.	Shrub	Th	D
255.	<i>Rubus ellipticus</i> Sm.	Shrub	Ph	D
256.	<i>Rubus Paniculatus</i> Sm.	Shrub	Ph	D
Rubiaceae				
257.	<i>Rubia cordifolia</i>	Climber	Ph	D
258.	<i>Leptodermis lanceolata</i>	Shrub	Th	D
259.	<i>Randia tetrasperma</i>	Shrub	Th	D

Rutaceae				
260.	<i>Zanthoxylum armatum</i> DC	Tree	Ph	D
261.	<i>Murraya koenigii</i>	Shrub	Ph	D
Salicaceae				
262.	<i>Populus ciliata</i> Wall. Ex Royle	Tree	Ph	D
263.	<i>Populus nigra</i> Linn.	Tree	Ph	D
264.	<i>Salix karelinii</i> Turcz.	Tree	Ph	D
265.	<i>Salix tetrasperma</i> Roxb.	Tree	Ph	D
Sapindaceae				
266.	<i>Dodonaea viscosa</i>	Shrub	Ph	D
Scrophulariaceae				
267.	<i>Verbascum thapsus</i>	Herb	Th	D
268.	<i>Veronica persica</i>	Herb	Th	D
Selaginellaceae				
269.	<i>Selaginella</i> Spp.	Fern	Cr	D
Sinopteridaceae				
270.	<i>Cheilanthes dalhousie</i>	Fern	Cr	P
Smilacaceae				
271.	<i>Smilax aspera</i>	Climber	Ph	D
Solanaceae				
272.	<i>Datura suaveolens</i>	Herb	Th	D
273.	<i>Datura stramonium</i>	Herb	Th	D
274.	<i>Meriandra physalodes</i> (L) Gaert.	Herb	Th	D
275.	<i>Physalis minima</i> Linn.	Herb	Th	D
276.	<i>Solanum nigrum</i>	Herb	Th	D
277.	<i>Solanum pseudo-capsicum</i>	Herb	Ph	D
278.	<i>Solanum surattense</i>	Shrub	Th	D
279.	<i>Solanum xanthocarpum</i>	Shrub	Th	D
280.	<i>Solanum anguivi</i>	Shrub	Th	D
281.	<i>Nicotiana tobacum</i> Linn.	Herb	Th	D
Sterculiaceae				
282.	<i>Helicteres isora</i>	Herb	Ph	D
Thymelaeaceae				
283.	<i>Daphne cannabina</i> Wall.	Shrub	Th	D
Tiliaceae				
284.	<i>Grewia oppositifolia</i>	Tree	Ph	D
285.	<i>Grewia optiva</i>	Tree	Ph	D
Tropaeolaceae				
286.	<i>Tropaeolum majus</i>	Herb	Th	D
Ulmaceae				
287.	<i>Celtis australis</i> Linn.	Tree	Ph	D
288.	<i>Ulmus racemosa</i> D. Thomas	Tree	Ph	D
Urticaceae				
289.	<i>Boehmeria rugulosa</i>	Herb	Th	D
290.	<i>Girardinia diversifolia</i>	Herb	Th	D
291.	<i>Debregeasia hypoleuca</i>	Shrub	Ph	D

292.	Urtica dioica L.	Shrub	Th	D
Valerianaceae				
293.	Nardostachys grandiflora	Herb	Ch	D
Verbenaceae				
294.	Tectona grandis Linn.(f.)	Tree	Ph	D
295.	Lippia nodiflora Mich.	Herb	Th	D
296.	Callicarpa macrophylla	Shrub	Th	D
297.	Caryopteris wallichiana	Shrub	Ch	D
298.	Lantana camera Var. aculeate mold.	Shrub	Ph	D
299.	Premna lantifolia Roxb.	Shrub	Ph	D
300.	Vitex negundo	Shrub	Ph	D
Violaceae				
301.	Viola pilosa	Herb	He	D
Zingiberaceae				
302.	Hedychium spicatum	Herb	Cr	D

*Ph-Phanerophytes, Th-Therophytes, Ch-Chamaephytes, Hg-Hemicryptophytes, Cr-Cryptophytes, D-Dicots, M,- Monocots

Hence the life form association in the present study is Ph-Th as compared to Ph-Hg of Raunkiaer (1934). Thus the present study clearly shows that the area is under biotic stress and conservation strategies be developed accordingly.

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