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Floristic Diversity Assessment of Major Forest Community of Col. Sher Jung National Park in Himachal Pradesh, India

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A B S T R A C T

The study was carried out at Col. Sher Jung National Park in Sirmour district of Himachal Pradesh, India, during the year 2018-19 with the aim to assess floristic composition, similarity index and dissimilarity index of major forest communities. Eight major forest communities were selected such as *Shorea robusta, Eucalyptus tereticornis, Syzygium cumini, Shorea robust + Terminalia tomentosa, Shorea robusta+ Eucalyptus tereticornis, Shorea robusta+ Syzygium cumini, Shorea robusta+ Diospyros melanoxylon* and Mixed forest. 90 plant species were recorded in these forests of which 6 were trees, 37 shrubs and 47 forbs. Mixed forest and *Shorea robusta+ Syzygium cumini,* are similar in shrub composition and have maximum similarity index. *Shorea robust + Terminalia tomentosa* and *Syzygium cumini* forest community has minimum similarity index. *Shorea robusta+ Diospyros melanoxylon* and *Shorea robusta + Terminalia tomentosa* forest has highest similarity in herbs. Whereas, *Syzygium cumini* and *Shorea robusta* forest community have lower similarity in herbaceous vegetation.

Introduction

Floristic studies have acquired increasing importance in recent years in response to the need of developing countries to assess their plant wealth. Biodiversity maintains balance for planetary and human survival (Virajman *et al.*, 2012). The service provided by biodiversity and ecosystem play a crucial role to sustain our livelihoods and protect our health (Sobuj and Rahman, 2011). Human disturbances through selective logging, wood

extraction, grazing, fire, and land clearing for permanent agriculture may influence many plant communities and their succession patterns. Long-term changes in patterns and processes in forest systems may lead to losses in their biological diversity and may render them more susceptible to invasion (Hobbs and Huenneke, 1992). Humans have extensively altered the global environment, changing global biogeochemical cycles, transforming land, and enhancing the mobility of biota. Many species have been eliminated from areas dominated by human influences (Chapin FS *et al.,* 2000). The study area although a reserved area is liable to different kind of biotic as well as abiotic interferences which include grazing, human encroachment and other anthropogenic pressures. It becomes very imperative to collect knowledge on the biodiversity and its distribution within the ecologically important and sensitive area for proper conservation and better management of the natural resources. Therefore the study was proposed to study floristic composition, similarity index and dissimilarity index of major forest communities of Col. Sher Jung National Park in Himachal Pradesh.

Materials and Methods

Study site

The present study was carried out in the Col. Sher Jung National Park (Fig:1) which encompasses an area of 27.88 sq. km in the Sirmour district of Himachal Pradesh. It is exactly located between latitudes 30^0 28'13''N to $30^0$23'31'' N and longitude $77^0$28'43''E to $77^0$27'40''E. It lies in Paonta valley of Himachal Pradesh which shares boundary with Kalesar National Park and Rajaji National Park.

National park shows a wide geoenvironmental variation. In location; annual minimum and maximum temperature ranges from 3^{o}C - 40^{o}C, mean annual rainfall about 1200 mm and relative humidity varies from 26 per cent in summer to 90 per cent during monsoon. Studied area is having an elevation range of 350amsl. to 700amsl. which is composed of unconsolidated siltstone, sandstone and conglomerate.

Sampling protocol

The study was carried out at Col. Sher Jung National Park in Sirmour district of Himachal Pradesh, India, during the year 2018-19. The major forest species that represent the Col. Sher Jung National Park are *Shorea robusta* (sal), *Eucalyptus tereticornis* (Eucalyptus) *Terminalia tomentosa* (sain) *Syzygium cumini (*Jamun) *and Diospyros melanoxylon* (tendu). The species occur either pure or mixed with other important or associated species.

Based on species dominance, eight forest communities were selected i.e. *Shorea robusta* forest, *Eucalyptus tereticornis*, *Syzygium cumini* forest, *Shorea robusta*+ *Terminalia tomentosa* forest, *Shorea robusta*+ *Eucalyptus tereticornis, Shorea robusta*+ *Syzygium cumini* forest, *Shorea robusta*+ *Diospyros melanoxylon* and Mixed forest.

Community analysis was carried out during rainy season when majority of the plants were at the peak of their growth. In every forest community type, 3 quadrats of 31.62 m X 31.62 m (0.1 ha) size were randomly laid to study tree species. The tree species includes all the saplings, poles and trees present in the study area. The shrub and herbaceous species were studied by laying 3 quadrats randomly in each forest community type. In each quadrat, a sub-quadrat of 5m X 5m (25 sq m) size for shrubs and a sub-quadrat of 1m X 1m (1sq m) for herbaceous vegetation were selected. Indices of similarity and dissimilarity were calculated following (Mishra, 1989).

Results and Discussion

Floristic composition

Forest composition, community structure and diversity patterns are important ecological attribues correlated with prevailing environmental as well anthropogenic variables (Ahmad I *et al.*, 2010; Bisht AS and Bhat AB, 2011). The major forest communities that existed in the Col. Sher Jung National Park are *Shorea robusta, Eucalyptus tereticornis, Syzygium cumini, Shorea robust + Terminalia tomentosa, Shorea robusta+ Eucalyptus tereticornis, Shorea robusta+ Syzygium cumini, Shorea robusta+ Diospyros melanoxylon* and Mixed forest (Table 1 & 2).

Plant families representation in the flora revealed that in this region tree species are primarily from Dipterocarpaceae, Myrtaceae, Combretaceae, Ebenaceae, Euphorbiaceae, shrubs from Acanthaceae, Asparagaceae, Asteraceae, Apocynaceae, Euphorbiaceae, Fabaceae, Lamiaceae and *Rosaceae* and Solanaceae whereas, herbaceous flora belonged to Asparagaceae, Asteraceae, Fabaceae, Malvaceae and Phyllanthaceae. Similar dominance of the plant farmilies in forests of western Himalayan region has been reported earlier (Kala and Uniyal, 1999). The data pertaining to floristic composition of is given in Table 2. For different forests communities, *Shorea robusta, Shorea robust + Terminalia tomentosa* and Mixed forest community shows the maximum (35) herbaceous vegetation. Whereas, in other forests community, 18 to 33 only. It is in line of findings earlier in *Shorea robusta* forests of West Bengal, (Satya Prakash Singh Kushwaha and Subrata Nandy, 2012) and also in Eastern Himalaya *Shorea robusta* forests, respectively has been reported by Uma Shankar (2001).

Table.1 The major forest community in Col. Sher Jung National Park

Scientific name	Common name	Family
Shorea robusta	Sal	Dipterocarpaceae
Eucalyptus tereticornis	Eucalyptus	Myrtaceae
Syzygium cumini	Jamun	Myrtaceae
Terminalia tomentosa	Sain	Combretaceae
Diospyros melanoxylon	Tendu	Ebenaceae

Table.2 Floristic composition of major forest community type in Col. Sher Jung National Park

Sr. No	Scientific Name	Family
	Trees	
1	*Diospyros melanoxylon*	Ebenaceae
2	*Eucalyptus tereticornis*	Myrtaceae
3	*Mallotus philippinensis*	Euphorbiaceae
4	*Shorea robusta*	Dipterocarpaceae
5	*Syzyium cumini*	Myrtaceae
6	*Terminalia tomentosa*	Combretaceae

Sr. No	Scientific Name	Family
	Shrubs	
1	*Adhatoda vasica*	Acanthaceae
2	*Ardisia solanacea*	Primulaceae
3	*Agave cantula*	Asparagaceae
4	*Asparagus adsecndes*	Asparagaceae
5	*Baliospermum montanum*	Euphorbiaceae
6	*Barleria strigosa*	Acanthaceae
7	*Boehmeria frutescens*	Urticaceae
8	*Calamus tenius*	Arecaceae
9	*Calotropis procera*	Apocynaceae
10	*Cassia occidentalis*	Fabaceae
11	*Carissa opaca*	Apocynaceae
12	*Callicarpa macrophylla*	Lamiaceae
13	*Clerodendrum viscosum*	Lamiaceae
14	*Coffea benghalensis*	Rubiaceae
15	*Colebrookia oppostifolia*	Lamiaceae
16	*Dendrolobium triangulare*	Fabaceae
17	*Desmodium gangeticum*	Fabaceae
18	*Desmodium pulchellum*	Fabaceae
19	*Eupatorium adenophorum*	Asteraceae
20	*Flemingia bracteata*	Fabaceae
21	*Flemingia chappar*	Fabaceae
22	*Holarrhena antidysentrica*	Apocynaceae
23	*Indigofera gerardiana*	Fabaceae
24	*Ipomea atropurpurea*	Convolvulaceae
25	*Ipomea carnea*	Convolvulaceae
26	*Lantana Camara*	Verbenaceae
27	*Murraya koenigii*	Rutaceae
28	*Phlogacanthus thyrsiflorus*	Acanthaceae
29	*Randia uliginosa*	Rubiaceae
30	*Rubus ellipticus*	Rosaceae
31	*Solanum hispidum*	Solanaceae
32	*Solanum torvum*	Solanaceae
33	*Toddalia asiatica*	Rutaceae
34	*Urena labata*	Malvaceae
35	*Vitex negundo*	Lamiaceae
36	*Woodfordia floribunda*	Lythraceae
37	*Xanthium strumarium*	Asteraceae

Sr. No	Scientific Name	Family
	Herbs/Grasses/Climbers	
1	*Achyranthes aspera*	Amaranthaceae
2	*Acrocephalus Capitatus*	Lamiaceae
3	*Alternanthera sessilis*	Amaranthaceae
4	*Asparagus racemosus wild*	Asparagaceae
5	*Ageratum conyzoides*	Asteraceae
6	*Bidnes biternata*	Asteraceae
7	*Borreria articularis*	Rubiaceae
8	*Commelina benghalensis*	Commelinaceae
9	*Cynaglossum lanceolatum*	Boraginaceae
10	*Corchorus aestuans*	Malvaceae
11	*Desmodium heterocarpan*	Fabaceae
12	*Desmodium triliflorum*	Fabaceae
13	*Emilia sanchifolia*	Asteraceae
14	*Euphorbia hirta*	Euphorbiaceae
15	*Malvastrum coromandelianum*	Malvaceae
16	*Mazus ragosus*	Mazaceae
17	*Mimosa pudica*	Fabaceae
18	*Nepeta hindostana*	Lamiaceae
19	*Oxalis corniculata*	Oxalidaceae
20	*Peperomia pellucid*	Piperaceae
21	*Phyllantus virgatus*	Phyllanthaceae
22	*Phyllanthus urinaria*	Phyllanthaceae
23	*Portulaca pilosa*	Portulacaceae
24	*Sida cordata*	Malvaceae
25	*Sida cordifolia*	Malvaceae
26	*Sida rhomboidea*	Malvaceae
27	*Spilanthes Paniculata*	Asteraceae
28	*Syndrella vialis*	Asteraceae
29	*Tridax procumbens*	Asteraceae
30	*Triumfetta rhomboidea*	Malvaceae
31	*Vernonia cinerea*	Asteraceae
32	*Xanthium indicum*	Asteraceae
33	*Cynodon dactylon*	Poaceae
34	*Cyprus kyllingia*	Cyperaceae
35	*Digitaria cilaris*	Poaceae
36	*Ergrostis minor*	Poaceae
37	*Eulaliopsis binata*	Poaceae
38	*Oplismenus composites*	Poaceae
39	*Paspalidium flavidum*	Poaceae
40	*Saccharum spontaneum*	Poaceae
41	*Cyperus distans*	Cyperaceae

42	*Cyperus rotundus*	Cyperaceae
43	*Cryptolepis buchananii*	Ascepiadaceae
44	*Milletia auriculata*	Fabaceae
45	*Pueraria tuberose*	Fabaceae
46	*Adiatum venustum*	Pteridaceae
47	*Chelilanthes farinose*	Pteridaceae

Table.3 Shrubs species under different forest community in Col. Sher Jung National Park (H.P)

Sr. No.	Shrub	Sal	Eucalyptus	Jamun	Sal + Sain	Sal+ Eucalyptus	Sal + Jamun	Sal + Tendu	Mixed Forest
1	*Adhatoda vasica*	+	-	-	+	+	+	+	+
2	*Ardisia solanacea*	+	-	+	+	-	+	+	+
3	*Agave cantala*	-	+	+	-	+	+	+	+
4	*Asparagus adsecndes*	+	-	+	-	-	+	+	+
5	*Baliospermum montanum*	+	-	-	+	-	-	-	+
6	*Barleria strigosa*	-	-	-	+	-	-	-	-
7	*Boehmeria frutescens*	-	-	-	+	-	+	-	+
8	*Calamus tenius*	-	+	+	-	+	-	+	+
9	*Calotropis procera*	-	+	+	-	+	-	-	-
10	*Cassia occidentalis*	-	-	-	+	-	-	-	+
11	*Carissa opaca*	+	+	+	-	-	+	-	+
12	*Callicarpa macrophylla*	-	-	+	-	-	-	+	-
13	*Clerodendrum viscosum*	+	-	-	-	+	-	-	-
14	*Coffea benghalensis*	-	-	-	-	-	+	+	+
15	*Colebrookea oppostifolia*	-	-	-	-	-	-	+	-
16	*Dendrolobium triangulare*	-	-	+	-	-	+	-	-
17	*Desmodium gangeticum*	-	-	+	-	-	-	-	-
18	*Desmodium pulchellum*	-	-	+	-	-	+	-	-
19	*Eupatorium adenophorum*	+	-	-	-	-	-	+	+
20	*Flemingia bracteata*	-	-	-	-	+	-	-	-
21	*Flemingia chappar*	-	+	+	-	-	+	-	-
22	*Holarrhena antidysenterica*	+	-	-	+	-	-	+	+
23	*Indigofera gerardiana*	-	+	+	+	-	-	+	-
24	*Ipomea atropurpurea*	-	-	-	-	-	-	+	+
25	*Ipomea carnea*	-	-	-	+	-	+	-	+
26	*Lantana Camara*	+	+	-	+	+	-	-	-
27	*Murraya koenigii*	+	+	+	+	+	+	+	+
28	*Phlogacanthus thyrsiflorus*	+	-	-	-	-	-	+	-
29	*Randia uliginosa*	-	-	-	+	-	-	-	-
30	*Rubus ellipticus*	+	+	-	-	+	-	-	+
31	*Solanum hispidum*	+	-	-	-	+	+	-	+
32	*Solanum torvum*	+	+	-	+	+	+	+	+
33	*Toddalia asiatica*	-	-	+	-	-	-	-	-
34	*Urena lobata*	+	-	-	+	-	-	+	-
35	*Vitex negundo*	-	-	+	-	-	-	+	-
36	*Woodfordia floribunda*	-	-	-	+	-	-	+	-
37	*Xanthium strumarium*	-	-	-	+	-	-	+	-
	Total	**15**	**10**	**15**	**16**	**11**	**14**	**18**	**18**

Table.4 Herbaceous vegetation under major forest community types in Col. Sher Jung National Park

Sr. No.	Herbs/ Grasses/Climbers	Sal	Eucalyptus	Jamun	Sal+ Sain	Sal+ Eucalyptus	Sal+ Jamun	Sal+ Tendu	Mixed Forest
1	*Achyranthes aspera*	+	+	+	+	+	+	+	+
2	*Acrocephalus Capitatus*	+	-	-	+	-	-	+	+
3	*Alternanthera sessilis*	+	+	+	+	+	+	+	+
4	*Asparagus racemosus wild*	-	-	+	-	-	+	-	-
5	*Ageratum conyzoides*	+	+	-	+	+	-	+	+
6	*Bidens biternata*	-	-	+	+	-	+	+	+
7	*Borreria articularis*	+	+	+	+	+	+	+	+
8	*Commelina benghalensis*	-	-	-	+	-	-	+	+
9	*Cynoglossum lanceolatum*	-	-	-	-	-	-	-	+
10	*Corchorus aestuans*	+	+	-	+	+	+	+	-
11	*Desmodium heterocarpon*	+	+	+	+	+	+	+	+
12	*Desmodium triflorum*	+	-	-	+	+	+	+	+
13	*Emilia sonchifolia*	+	-	-	+	+	+	+	+
14	*Euphorbia hirta*	-	-	+	-	-	+	-	-
15	*Malvastrum coromandelianum*	+	+	-	-	+	-	+	-
16	*Mazus rugosus*	-	-	-	+	-	-	-	+
17	*Mimosa pudica*	+	+	-	-	+	+	+	+
18	*Nepeta hindostana*	-	-	-	+	-	-	+	+
19	*Oxalis corniculata*	+	-	-	-	-	+	+	+
20	*Peperomia pellucidaaa*	+	-	-	+	-	-	+	+
21	*Phyllanthus virgatus*	+	+	-	+	+	-	+	+
22	*Phyllanthus urinaria*	-	+	+	-	+	+	-	-
23	*Portulaca pilosa*	-	-	+	-	-	-	-	-
24	*Sida cordata*	+	-	-	+	+	-	-	+
25	*Sida cordifolia*	+	-	+	+	-	-	-	-
26	*Sida rhomboidea*	+	+	-	+	+	+	+	+
27	*Spilanthes Paniculata*	-	-	+	-	-	+	-	-
28	*Syndrella vialis*	+	+	+	+	+	+	+	+
29	*Tridax procumbens*	+	+	-	+	+	-	+	+
30	*Triumfetta rhomboidea*	+	-	+	+	-	+	+	+
31	*Vernonia cinerea*	+	+	+	+	+	+	+	+
32	*Xanthium indicum*	-	-	+	-	-	-	-	-
33	*Cynodon dactylon*	+	+	+	+	+	+	+	+
34	*Cyprus kyllingia*	+	+	+	+	+	+	+	+
35	*Digitaria ciliaris*	+	-	-	+	-	-	+	+
36	*Eragrostis minor*	+	-	+	+	-	+	-	+
37	*Eulaliopsis binata*	+	-	-	-	-	-	-	-
38	*Oplismenus composites*	+	+	-	+	-	-	+	+
39	*Paspalidium flavidum*	-	-	+	-	-	+	-	-
40	*Saccharum spontaneum*	-	-	+	-	-	-	-	-
41	*Cyperus distans*	+	+	-	+	+	-	-	+
42	*Cyperus rotundus*	+	-	+	-	-	+	+	+
43	*Cryptolepis buchananii*	+	-	-	+	-	-	+	+
44	*Millettia auriculata*	+	-	-	-	-	-	+	+
45	*Pueraria tuberose*	+	-	-	-	-	-	-	-
46	*Adiatum venustum*	+	-	+	+	-	+	+	+
47	*Cheilanthes farinose*	+	-	-	+	-	-	+	+
	Total	**35**	**18**	**22**	**35**	**21**	**25**	**33**	**35**

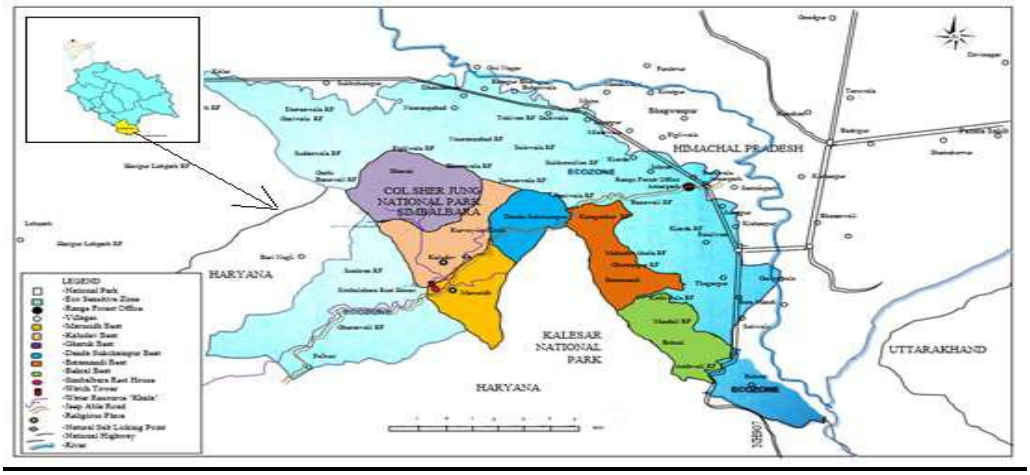
Table.5 Index of Similarity and Dissimilarity of Shrubs in Different Forest Communities

S / D	Index of similarity & dissimilarity of shrubs in different forest community type							
	Sal	**Eucalyptus**	**Jamun**	**Sal + Sain**	**Sal + Eucalyptus**	**Sal + Jamun**	**Sal + Tendu**	**Mixed**
Sal	-	0.24	0.26	0.51	0.53	0.48	0.48	0.66
Eucalyptus	0.76	-	0.48	0.23	0.57	0.41	0.35	0.42
Jamun	0.74	0.52	-	0.19	0.3	0.55	0.48	0.36
Sal + Sain	0.49	0.77	0.81	-	0.29	0.4	0.47	0.41
Sal + Eucalyptus	0.47	0.43	0.7	0.71	-	0.4	0.34	0.48
Sal + Jamun	0.52	0.59	0.45	0.6	0.6	-	0.37	0.68
Sal + Tendu	0.52	0.65	0.52	0.53	0.66	0.63	-	0.55
Mixed	0.34	0.58	0.64	0.59	0.52	0.32	0.45	-

Table.6 Index of Similarity and Dissimilarity of Herbs in Different Forest Communities

S / D	Index of similarity & dissimilarity of shrubs in different forest community type							
	Sal	**Eucalyptus**	**Jamun**	**Sal + Sain**	**Sal + Eucalyptus**	**Sal + Jamun**	**Sal + Tendu**	**Mixed**
Sal	-	0.71	0.45	0.88	0.71	0.63	0.88	0.82
Eucalyptus	0.29	-	0.5	0.6	0.92	0.6	0.62	0.56
Jamun	0.55	0.5	-	0.49	0.46	0.8	0.5	0.49
Sal + Sain	0.12	0.4	0.51	-	0.64	0.66	0.95	0.94
Sal + Eucalyptus	0.29	0.08	0.54	0.36	-	0.65	0.66	0.64
Sal + Jamun	0.37	0.4	0.2	0.34	0.35	-	0.68	0.63
Sal + Tendu	0.12	0.38	0.5	0.05	0.34	0.32	-	0.88
Mixed	0.18	0.44	0.51	0.06	0.36	0.37	0.12	-

Fig.1 Detail map of Col. Sher Jung National Park, Simbalbara, Sirmour, H.P., India (Inset: Location map of Sirmour in H.P.)



Similarity and dissimilarity index

The shrubs that existed under major forest communities are given in Table 3. Maximum shrubs were recorded in *Shorea robusta+ Diospyros melanoxylon* and Mixed forest community (18) followed by *Shorea robust + Terminalia tomentosa* forest community (16), *Shorea robust* and *Syzygium cumini* forest community (15), *Shorea robusta+ Syzygium cumini* forest community (14), *Shorea robusta+ Eucalyptus tereticornis* (11), *Eucalyptus tereticornis* community (10) in descending order.

Herbaceous vegetation that existed in eight major forest communities of Col. Sher Jung National Park is given in Table 4. Maximum herbaceous vegetation was recorded in *Shorea robust, Shorea robust + Terminalia tomentosa,* and Mixed forest community (35) followed by *Shorea robusta+ Diospyros melanoxylon* forest community (33), *Shorea robusta+ Syzygium cumini* forest community (25), *Syzygium cumini* forest community (22), *Shorea robusta+ Eucalyptus tereticornis* forest community (21) and *Eucalyptus tereticornis* community type (18) in descending order. Different forests had varied herbaceous composition but still some species were common to them like, *Achyranthes aspera, Alternanthera sessilis, Ageratum conyzoides, Borreria articularis and Desmodium heterocarpon.* The presence of any species in any area is determined by the prevailing environmental conditions and its tolerance and adaptation (Bhandari BS *et al.*, 1999).

The value of similarity index (Table 5) for shrubs (0.68) was observed maximum between Mixed forest and *Shorea robusta+ Syzygium cumini* forest and minimum (0.19) in *Shorea robusta + Terminalia tomentosa* and *Syzygium cumini* forest community.

While in case of herbs, maximum similarity (0.95) in *Shorea robusta+ Diospyros melanoxylon* forest and *Shorea robusta + Terminalia tomentosa* forest and minimum (0.45) between *Syzygium cumini* forest and *Shorea robusta* forest (Table 6). This similarity between different forest community types may be due to same altitudinal zone and similar type of habitat conditions. Less difference in the value of similarity index indicated that growth forms in the stands responded in a similar fashion (Adhikari BS *et al.,* 1991). Whereas, minimum similarity observed between different sites may be due to different climatic conditions and different type of habitat (Itow S and Nakanishi K, 1980) reported that large area contained more varied habitat types then smaller ones, and each of the habitat type supports a specific set of its own, which is more or less different from that of other habitat types. (Suyal S *et al.,* 2010) opined that close proximity results in high similarity index of vegetation. The same could be related to the grouping of forests based on similarity index in the present study.

In conclusion, there were 6 species of tree, 37 species of shrub and 47 species of herb belonging to 42 families in the Col. Sher Jung National Park. Mixed forest community is denser as compared to *Syzygium cumini, Shorea robusta+ Syzygium cumini, Shorea robusta+ Diospyros melanoxylon, Shorea robusta + Terminalia tomentosa, Shorea robusta+ Eucalyptus tereticornis, Shorea robusta and Eucalyptus tereticornis* community in descending order. Shrub density is higher in *Shorea robusta* forest community as compared to *Shorea robusta + Terminalia tomentosa, Shorea robusta+ Diospyros melanoxylon, Shorea robusta+ Syzygium cumini, Mixed, Syzygium cumini, Shorea robusta+ Eucalyptus tereticornis* and *Eucalyptus tereticornis* forest community in descending order. Herb density is higher in

Shorea robusta+ Diospyros melanoxylon forest community compared to *Shorea robusta + Terminalia tomentosa, Shorea robusta, Mixed, Shorea robusta+ Syzygium cumini, Syzygium cumini, Shorea robusta+ Eucalyptus tereticornis and Eucalyptus tereticornis* forest community. Mixed forest and *Shorea robusta+ Syzygium cumini* forest community have maximum shrub similarity index. *Syzygium cumini* forest and *Shorea robusta* forest community has minimum similarity index. *Shorea robusta+ Diospyros melanoxylon* forest and *Shorea robusta + Terminalia tomentosa* forest has highest similarity in herbs. Whereas, *Syzygium cumini* forest and *Shorea robusta* forest community have lower similarity in herbaceous vegetation.

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