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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 robusta + 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.

Keywords
Floristic composition, Similarity index, Dissimilarity index, National Park

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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 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\(^\circ\)C - 40\(^\circ\)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 attributes 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 robusta + 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, Asteraeaceae, Apocynaceae, Euphorbiaceae, Fabaceae, Lamiaceae and Rosaceae and Solanaceae whereas, herbaceous flora belonged to Asparagaceae, Asteraceae, Fabaceae, Malvaceae and Phyllanthaceae. Similar dominance of the plant families 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 robusta + 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      | Syzygium cumini           | Myrtaceae            |
| 6      | Terminalia tomentosa      | Combretaceae         |
| Sr. No | Scientific Name       | Family        |
|--------|-----------------------|---------------|
| 1      | Adhatoda vasica       | Acanthaceae   |
| 2      | Ardisia solanacea     | Primulaceae   |
| 3      | Agave cantula         | Asparagaceae  |
| 4      | Asparagus adscendes   | Asparagaceae  |
| 5      | Baliospernum 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 oppositifolia | 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 torun         | 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            |
|-------|-------------------------|-------------------|
| 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     | Borroria articularis    | Rubiaceae         |
| 8     | Commelina benghalensis  | Commelinaceae     |
| 9     | Cynaglossum lanceolatum | Boraginaceae      |
| 10    | Corchorus aesteans      | 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 ciliaris      | Poaceae           |
| 36    | Ergrostis minor         | Poaceae           |
| 37    | Eulaliopsis binata      | Poaceae           |
| 38    | Opismenus composites    | Poaceae           |
| 39    | Paspalidium flavidum    | Poaceae           |
| 40    | Saccharum spontaneum    | Poaceae           |
| 41    | Cyperus distans         | Cyperaceae        |
| 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 adscendes         | +   | -          | +     | -         | -                | +         | +         | +            |
| 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 oppositifolia   | -   | -          | -     | -         | -                | +         | +         | -            |
| 16     | Dendrolobium triangulare    | -   | -          | +     | -         | -                | +         | -         | -            |
| 17     | Desmodium gangeticum       | -   | +          | -     | -         | -                | -         | -         | -            |
| 18     | Desmodium pulchellam        | -   | -          | +     | -         | +                | -         | -         | -            |
| 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         | -   | -          | +     | -         | -                | +         | -         | -            |

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

| 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 | Ja Mun | Sal+ Sain | Sal+ Eucalyptus | Sal+ Jamun | Sal+ Tend u | Mixed Forest |
|---------|------------------------|---------------|--------|----------|----------------|------------|------------|-------------|
| 1       | Achyranthas aspera     | +             | +      | +        | +              | +          | +          | +           |
| 2       | Acrocephalus Capitatus | +             | -      | -        | +              | -          | +          | +           |
| 3       | Alternanthera sessilis | +             | +      | +        | +              | +          | +          | +           |
| 4       | Asparagus racemosus wild | -       | -      | +        | -              | -          | +          | -           |
| 5       | Ageratum conyzoides    | +             | +      | -        | +              | -          | +          | +           |
| 6       | Bidens bidentata       | -             | -      | +        | +              | -          | +          | +           |
| 7       | Borriera articularis   | +             | +      | +        | +              | +          | +          | +           |
| 8       | Commelina benghalensis | -             | -      | -        | -              | +          | +          | +           |
| 9       | Cynoglossum lanceolatum | -         | -      | -        | -              | -          | -          | +           |
| 10      | Corchorus aethus       | +             | +      | -        | +              | +          | +          | -           |
| 11      | Desmodium heterocarpum| +             | +      | +        | +              | +          | +          | +           |
| 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 pellucidaa   | +             | -      | -        | +              | -          | +          | +           |
| 21      | Phyllanthus virgatus   | +             | +      | -        | +              | -          | +          | +           |
| 22      | Phyllanthus urinaria   | -             | +      | -        | +              | -          | -          | -           |
| 23      | Portulaca pilosa       | -             | -      | +        | -              | -          | -          | -           |
| 24      | Sida cordata           | +             | +      | -        | +              | -          | -          | +           |
| 25      | Sida cordifolia        | +             | -      | +        | -              | -          | -          | -           |
| 26      | Sida rhomboidea        | +             | +      | -        | +              | +          | +          | +           |
| 27      | Spilanthes Paniculata  | -             | +      | -        | +              | -          | -          | -           |
| 28      | Syndrela vialis        | +             | +      | +        | +              | +          | +          | +           |
| 29      | Tridax procumbens      | +             | +      | -        | +              | -          | +          | +           |
| 30      | Triumfetta rhomboidea  | +             | -      | +        | -              | +          | +          | +           |
| 31      | Vernonia cinerea       | +             | +      | +        | +              | +          | +          | +           |
| 32      | Xanthium indicum       | -             | -      | +        | -              | -          | -          | -           |
| 33      | Cynodorus daeiton      | +             | +      | +        | +              | +          | +          | +           |
| 34      | Cypres kyllingia       | +             | +      | +        | +              | +          | +          | +           |
| 35      | Digitaria ciliaris     | +             | -      | +        | -              | -          | +          | +           |
| 36      | Eragrostis minor       | +             | +      | -        | +              | -          | +          | +           |
| 37      | Eulaliopsis binata     | +             | -      | -        | -              | -          | -          | -           |
| 38      | Opismenus composites   | +             | +      | -        | -              | +          | +          | +           |
| 39      | Paspalium flavidum     | -             | -      | +        | -              | +          | -          | -           |
| 40      | Saccharum spontaneum   | -             | +      | -        | -              | +          | +          | +           |
| 41      | Cyperus distans        | +             | +      | -        | +              | -          | -          | -           |
| 42      | Cyperus rotundus       | +             | -      | +        | -              | +          | +          | +           |
| 43      | Cryptolepis buchananii | +             | -      | +        | -              | +          | +          | +           |
| 44      | Millettia auriculata   | +             | -      | -        | -              | +          | +          | +           |
| 45      | Paederia tuberosa      | +             | -      | -        | -              | -          | -          | -           |
| 46      | Adiantum 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       | Index of similarity & dissimilarity of shrubs in different forest community type | Eucalyptus | Jamun | Sal + Sain | Sal + Eucalyptus | Sal + Jamun | Sal + Tendu | Mixed |
|---------|----------------------------------------------------------------------------------|------------|-------|------------|-----------------|-------------|-------------|-------|
| Sal     | -                                  | 0.23       | 0.51  | 0.53       | 0.48            | 0.43        | 0.66        |
| Eucalyptus | 0.76                                | -          | 0.81  | -          | 0.29            | 0.4         | 0.47        | 0.41  |
| 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       | Index of similarity & dissimilarity of shrubs in different forest community type | 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        | -     |

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**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 robusta* + *Terminalia tomentosa* forest community (16), *Shorea robusta* 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 robusta*, *Shorea robusta*+ *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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