

Vegetation Analysis of Woody Species of Forests of Langate Forest Division in Kashmir, Jammu and Kashmir

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ABSTRACT

In the present study the community features of tree species in four different forest ranges of the Langate Forest Division in Kashmir Valley were assessed. A total of 19 tree species were recorded from all the selected sites during the study period. The total tree density varied between 3.33 to 4.20 trees 100m² and the total basal cover ranged between 5942.17 to 21997.09 cm² 100m². The distribution pattern was contagious for most of the species. The species diversity was greatest at Site II (Mawar range), followed by Site I (Rafiabad range). However, the value of concentration of dominance exhibited inverse relationship with the species diversity.

Key words: Community features, Langate Forest division, basal cover, dominance, species diversity, Kashmir valley.

INTRODUCTION

Knowledge on the composition of a community is a pre-requisite to the understanding of overall structure and functioning of an ecosystem. The composition, when evaluated in terms of species structure, also includes species diversity. While discussing the importance of species diversity, Odum (1963) stresses that the number of species reflects the adaptation potential of the community. The world vegetation cover under natural growth forests has been fast receding and a significant portion of this area is being converted to the man-made plantation forests, mainly timber trees to meet the growing need of the ever-increasing human population. The recurrent interventions into the forest communities for large-scale collection of fuel wood and minor forest products and the practices of grazing and trampling alter the habitats of many species. The impact of increasing human activities on the forest diversity influences the ecosystem functioning (Wilson, 1992), which has triggered interest in the studies related to the importance of diversity on ecosystems (Schulze and Mooney, 1993) and ecosystem services (Daily, 1997).

The vegetation of the study area (Langate Forest Division) is generally classified as Kashmir valley temperate forests, Kashmir valley sub-alpine forests and Kashmir valley alpine forests (Champion and Seth, 1968). The plant diversity of the Langate Forest Division has been studied by Khuroo *et al.* (2003), Lone and Pandit (2005, 2007) but extensive studies are still lacking both qualitatively and quantitatively. Therefore, the

present study was aimed to understand the structure, composition, pattern of distribution and diversity of woody species of the forests of the region.

STUDY AREA

The study area (Langate Forest Division) falls in the north-west part of the Kashmir valley (Fig. 1). The Division is situated between 34° 15' and 34° 45' N latitude and 73° 45' and 74° 35' E longitude with most of the area in district Kupwara and a small area in district Baramulla. The Division extends over an area of 36, 061 hectares and occupies north-eastern slopes of Kazinag and Shamsabari ranges. The drainage of most of the area is eastward with Pohru stream forming its eastern boundary.

The entire area of Langate Forest Division comprises of four territorial ranges- Rafiabab, Mawar, Rajwar and Magam. The Rafiabab range falls in tehsil Sopore of district Baramulla while as the remaining three ranges fall in tehsil Handwara of district Kupwara. The altitudinal gradient varies from 1,590 – 4,093m a.s.l. with Kazi-Nag Dhar forming its highest peak, while the principal forest extends up to 3,500m a.s.l. The climate of the area is, in general, conformity with the climate of the Kashmir Valley, being sub-Mediterranean type with marked seasonality having four distinct seasons. The selection of the study sites within each range was based on altitude, floristic composition, drainage pattern, accessibility, distance from nearest habitation and other characteristics. Four study sites I, II, III and IV were respectively selected in Rafiabab, Mawar, Rajwar and Magam ranges of the Forest Division.

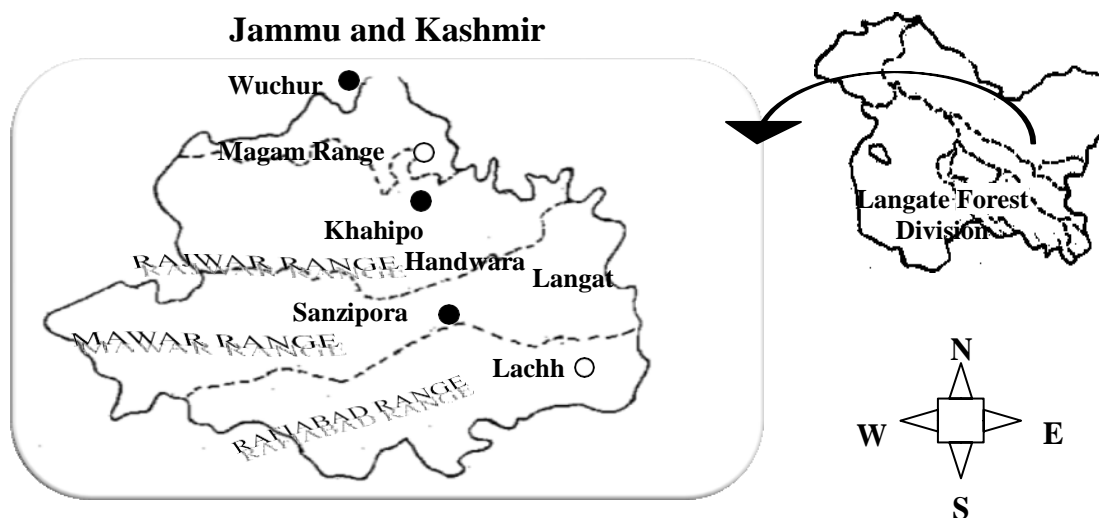


Fig. 1. Map showing location of study sites.

MATERIAL AND METHODS

The phytosociological studies of woody species were conducted by laying quadrats randomly at and around the study sites, almost covering the whole study area. Forty quadrats of varied sizes (10mx10m) were laid for different vegetation types. The size and the number of the quadrats were determined respectively by species area curve (Misra, 1968) and runnings mean method (Kershaw, 1973). The vegetational data was quantitatively analyzed for density, frequency and abundance according to Curtis and McIntosh (1950). The relative values of density, frequency and dominance were summed up to get Importance Value Index (IVI) of individual species in order to express the dominance and ecological success of the species. The ratio of abundance to frequency (A/F ratio) was used to interpret the distribution pattern of the species (Whitford, 1949; Curtis and Cottam, 1956). The basal cover was calculated following Ralhan *et al.*, (1991) and species diversity following Shannon-Weiner (1963). Index of Dominance (C) was calculated according to Simpson (1949) and species richness was determined by using Menhinick Index (Menhinick, 1964). The species evenness or the equitability component (E) was determined after Pielou (1975) while as the index of similarity (S) to compare the forest of two stands was calculated following Sorenson (1948).

RESULTS AND DISCUSSION

There was a marked variation in the phytosociological features of woody species at different sites in the Langate Forest Division. A total of 19 species of trees were recorded from all the selected sites during the entire study period, but with significant spatial variations. Sites II and III recorded 15 species each while as 13 species each were registered from sites I and IV. Except at Site I where *Pinus wallichiana* recorded highest frequency, *Cedrus deodara* was the most frequent species at other three sites (Table 1). The most dominant species at site I in terms of cover was *Abies pindrow* (7589.88cm² 100m⁻²), followed by *Cedrus deodara* (5051.72 cm² 100m⁻²), *Pinus wallichiana* (4279.69 cm² 100m⁻²) and *Piceae smithiana* (3023.00 cm² 100m⁻²) in a decreasing order while as the maximum value for Importance Value Index (IVI) was recorded for *Pinus wallichiana* (79.30) and a minimum of (3.12) for *Ailanthus altissima*. Except *Pinus wallichiana*, which depicted A/F ratio of 0.05 and thus showed slightly random distribution, all the other species showed contagious distribution.

Table 1. Community features of trees at Site I of Langate Forest Division

S. No	Name of the species	Frequency (%)	Density 100m ²	Abundance 100m ²	A/F Ratio	TBC cm ² 100m ²	IVI
1	<i>Abies pindrow</i>	20.00	0.68	3.38	0.17	7589.88	63.60
2	<i>Cedrus deodara</i>	35.00	0.85	2.42	0.07	5051.72	65.55
3	<i>Pinus wallichiana</i>	50.00	1.18	2.35	0.05	4279.67	79.30
4	<i>Picea smithiana</i>	7.50	0.22	3.00	0.40	3023.00	23.94
5	<i>Betula utilis</i>	5.00	0.20	4.00	0.80	203.06	8.98
6	<i>Robinia pseudoacacia</i>	7.50	0.13	1.66	0.22	297.56	9.03
7	<i>Acer caesium</i>	5.00	0.08	1.50	0.30	340.75	6.45
8	<i>Aesculus indica</i>	7.50	0.13	1.66	0.22	189.31	8.54
9	<i>Ailanthus altissima</i>	2.50	0.05	2.00	0.80	81.33	3.12
10	<i>Fraxinus excelsior</i>	5.00	0.05	1.00	0.20	173.73	5.06
11	<i>Juglans regia</i>	5.00	0.05	1.00	0.20	404.73	6.11
12	<i>Populus ciliata</i>	5.00	0.13	2.50	0.50	143.17	6.82
13	<i>Salix alba</i>	10.00	0.25	2.50	0.25	219.18	13.33

Table 2. Community features of trees at Site II of Langate Forest Division

S.No	Name of the species	Frequency (%)	Density 100m ⁻²	Abundance 100m ⁻²	A/F Ratio	TBC cm ² 100m ⁻²	IVI
1	<i>Abies pindrow</i>	27.50	0.65	2.36	0.09	5162.72	68.97
2	<i>Cedrus deodara</i>	65.00	1.25	1.92	0.03	6016.23	112.61
3	<i>Pinus wallichiana</i>	42.50	0.95	2.22	0.05	1218.56	58.52
4	<i>Picea smithiana</i>	7.50	0.13	1.66	0.22	937.11	14.13
5	<i>Betula utilis</i>	2.50	0.10	4.00	1.60	73.29	4.64
6	<i>Robinia pseudoacacia</i>	2.50	0.10	4.00	1.60	101.53	4.83

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7	<i>Acer caesium</i>	2.50	0.05	2.00	0.80	85.92	3.37
8	<i>Aesculus indica</i>	2.50	0.08	3.00	1.20	94.68	4.11
9	<i>Ailanthus altissima</i>	2.50	0.03	1.00	0.40	46.55	2.42
10	<i>Celtis australis</i>	5.00	0.05	1.00	0.20	78.81	4.75
11	<i>Juglans regia</i>	5.00	0.08	1.50	0.30	176.47	6.10
12	<i>Populus ciliata</i>	2.50	0.05	2.00	0.80	45.52	3.09
13	<i>Salix alba</i>	2.50	0.08	3.00	1.20	51.57	3.81
14	<i>Taxus wallichiana</i>	2.50	0.05	2.00	0.80	151.22	3.82
15	<i>Ulmus wallichiana</i>	2.50	0.05	2.00	0.80	268.84	4.63

Table 3. Community features of trees at Site III of Langate Forest Division

S. No	Name of the species	Frequency (%)	Density 100m ⁻²	Abundance 100m ⁻²	A/F Ratio	TBCcm ² 100m ⁻²	TVI
1	<i>Abies pindrow</i>	22.50	0.45	2.00	0.09	1489.45	49.40
2	<i>Cedrus deodara</i>	55.00	1.05	1.90	0.03	2766.17	106.58
3	<i>Pinus wallichiana</i>	45.00	1.10	2.44	0.05	1690.30	86.15
4	<i>Robinia pseudoacacia</i>	2.50	0.08	3.00	1.20	43.10	4.45
5	<i>Cupressus sp.</i>	2.50	0.03	1.00	0.40	17.56	2.58
6	<i>Morus alba</i>	2.50	0.05	2.00	0.80	42.17	3.69
7	<i>Acer caesium</i>	2.50	0.08	3.00	1.20	76.14	4.93
8	<i>Aesculus indica</i>	5.00	0.05	1.00	0.20	32.19	5.13
9	<i>Ailanthus altissima</i>	2.50	0.05	2.00	0.80	33.64	3.56
10	<i>Celtis australis</i>	2.50	0.03	1.00	0.40	23.62	2.67
11	<i>Juglans regia</i>	2.50	0.03	1.00	0.40	64.41	3.26
12	<i>Populus ciliata</i>	2.50	0.13	5.00	2.00	96.46	6.72
13	<i>Salix alba</i>	5.00	0.15	3.00	0.60	107.65	9.24
14	<i>Platanus orientalis</i>	2.50	0.05	2.00	0.80	309.55	7.56
15	<i>Ulmus wallichiana</i>	2.50	0.03	1.00	0.40	106.11	3.86

Table 4. Community features of trees at Site IV of Langate Forest Division

S.No	Name of the species	Frequency (%)	Density 100m ⁻²	Abundance 100m ⁻²	A/F Ratio	TBC cm ² 100m ⁻²	IVI
1	<i>Abies pindrow</i>	7.50	0.25	3.33	0.44	756.11	24.64
2	<i>Cedrus deodara</i>	65.00	1.75	2.69	0.04	3675.54	153.42
3	<i>Pinus wallichiana</i>	45.00	1.00	2.22	0.05	1088.68	75.71
4	<i>Robinia pseudoacacia</i>	5.00	0.13	2.50	0.50	65.20	7.85
5	<i>Aesculus indica</i>	2.50	0.05	2.00	0.80	30.10	3.52
6	<i>Ailanthus altissima</i>	5.00	0.05	1.00	0.20	37.80	5.26
7	<i>Acer caesium</i>	2.50	0.03	1.00	0.40	22.87	2.69
8	<i>Celtis australis</i>	2.50	0.03	1.00	0.40	14.19	2.54
9	<i>Morus alba</i>	5.00	0.08	1.50	0.30	30.48	5.96
10	<i>Juglans regia</i>	2.50	0.03	1.00	0.40	46.24	3.08
11	<i>Populus ciliata</i>	5.00	0.05	1.00	0.20	37.41	5.25
12	<i>Ulmus wallichiana</i>	2.50	0.03	1.00	0.40	88.72	3.80
13	<i>Salix alba</i>	5.00	0.75	1.50	0.30	48.83	6.16

Except *Cedrus deodara* and *Pinus wallichiana*, which depicted slightly random distribution, all the other species at site II showed contagious distribution as revealed by their A/F ratios. The highest basal cover of trees at the site was recorded for *Cedrus deodara* (6016.23 cm² 100m⁻²) against the lowest of 45.52 cm² 100m⁻² for *Populus ciliate* (Table 2). Trees like *Abies pindrow* (5162.72 cm² 100m⁻²) and *Pinus wallichiana* (1218.56 cm² 100m⁻²) occupied the intermediate position between the two extremes. The highest overall IVI for the site was, however, reported for *Cedrus deodara* (112.61), followed by *Abies pindrow* (68.97) and *Pinus wallichiana* (58.52).

Cedrus deodara dominated site III in terms of frequency (65.00), total basal cover (2766.17 cm² 100⁻²) and overall IVI (106.58). The other noteworthy species at this site in terms of overall IVI were *Pinus wallichiana* (86.15) and *Abies pindrow* (49.40). All the other 12 species depicted insignificant IVI values of less than 10.00. The distinctive feature of the site III was the slightly random distribution of *Cedrus deodara* and *Pinus wallichiana* and the highly contagious distribution of all other species (Table 3).

Cedrus deodara, *Pinus wallichiana* and *Abies pindrow* contributed almost 85% to the overall Importance Value Index at site IV (Table 4). All other species except *Abies pindrow* revealed insignificant values for overall IVI. The maximum total basal cover for the site was reported for *Cedrus deodara* (3675.54 cm² 100m⁻²) against the minimum for *Celtis australis* (14.19 cm² 100m⁻²). The species like *Cedrus deodara* and

Pinus wallichiana showed random distributional pattern against the contagious pattern of *Abies pindrow* and *Piceae smithiana*.

The diversity indices for tree vegetation revealed marked spatial variations (Fig. 2). The index of dominance values ranged from 0.180 (Site I) to 0.267 (Site IV) while as species richness varied between 1.03 (Site I) and 1.30 (Site III). The species were more evenly distributed at site I with an index value of 0.502 as against the least even distribution at site III (0.44). The diversity index species varied from 1.638 (Site IV) to 1.898 (Site II). The maximum similarity was observed between Site III and Site IV registering index value of 92.85 % and the minimum between Site I and Site III (71.42 %).

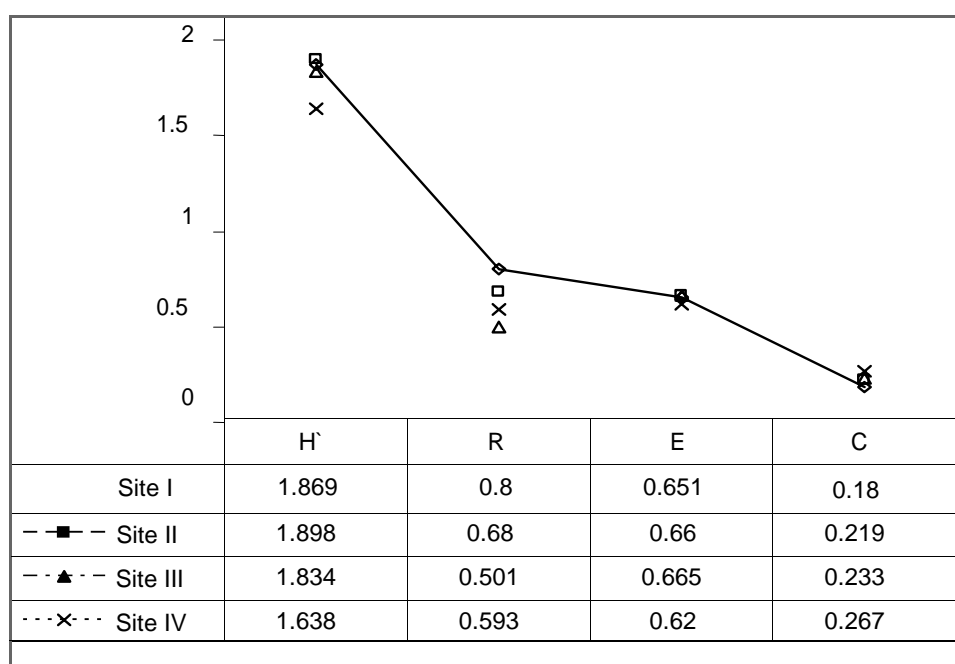


Fig.2. Spatial variations in diversity, richness, evenness and dominance indices of trees in Langate Forest Division

In general, the Langate Forest Division is dominated by three coniferous species viz., *Cedrus deodara*, *Pinus wallichiana* and *Abies pindrow*, which together contribute about 80% of the overall Importance Value Index of the tree community. Despite the lesser number of species of conifers, they comprised the dominant component of the forest vegetation extending throughout its length and breadth. The broad-leaved species are restricted in distribution and generally lie along the gorges and moist depressions. The density of the forest stands varied from 3.33 to 4.20 trees 100m⁻². The higher values for density were recorded at site IV and the

lower values at site III. The total basal cover (TBC) of trees ranged from 17.19 to 7589.88 cm² 100m⁻². The higher values for TBC were found at site I and the lower values at site IV. Generally, the higher values for TBC were recorded for coniferous species and the lower values for broad-leaved species at all the sites. The values of TBC at different forest sites in the present study were recorded to be more than the values reported for other Himalayan forests while as the density values in the present study were lower than those of the tropical and temperate forests (Saxena, 1979; Ralhan *et al.*, 1982; Saxena and Singh, 1982; Singhal *et al.*, 1986; Negi and Nautiyal, 2005). The tree layers, in general, were more or less similar among different sites as revealed by community coefficient values.

In the present study, the species diversity ranged from 1.63 to 1.89. Low species diversity for trees may be due to low species richness as the forests are dominated by coniferous species especially *Cedrus deodara*, *Pinus wallichiana* and *Abies pindrow* associated with few broad-leaved species scattered unevenly within the forests. These values are comparable with the values generally reported for temperate forests (Monk, 1967; Singh and Singh, 1987). The diversity of the tree stratum tended to level off after reaching maximum value of 13 to 15 species. In a deciduous forest community, Monk (1967) observed that diversity tended to reach a maximum level after a community is composed of 12-15 species. The lower diversity and consequently greater concentration of dominance in temperate vegetation could be due to lower rate of evolution and diversification of communities (Fischer, 1960; Simpson, 1964) and severity in the environment (Connel and Orias, 1964).

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