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Vegetation Structure and Diversity Analysis in the Manigam Block of Lidder Forest Division of Kashmir

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ABSTRACT

The study was conducted during April, 2022–August, 2024 at block Manigam of Lidder Forest Division, Anantnag district, Jammu & Kashmir, India to investigate the differences in plant and tree species diversity and community structure. Vegetation sampling was done by the quadrat method, and quadrates were laid down by systematic random sampling methods along the four vertical transects which were 100 m apart. In each transect, quadrates were laid down at definite intervals. The findings showed that a total of 29 plant species from 23 families were found at these four distinct elevations. Of the 29 plant species that were documented, 9 were shrubs from 7 families and 4 were trees, representing 3 families. There were 16 herbaceous species, belonging to 13 families. The main tree at all four elevations was *Pinus wallichiana*, which had IVI values of 155.4, 156.33, 158.42, and 182.61, respectively. At altitude 1, *Parrotia jacquemontiana* dominated the shrub population with an IVI score of 83.83. Rosa rubiginosa was prevalent at altitudes three and four, with IVI values of 64.98 and 67.26, respectively, whereas *Sambucus wightiana* was dominating at altitude two, with an IVI value of 56.56. Among herbs, *taraxacum officinale* with IVI value of 58.84 was dominant at altitude 1st. *Fragaria vesca* was dominant at altitude 2nd and 3rd with IVI values of 44.93 and 72.06, respectively. *Iris hookeriana* with IVI value of 112.69 was dominant at altitude 4th. Out of four altitudes, altitude 2nd reported the highest number of species followed by 1st, 3rd and 4th, respectively.

KEYWORDS: Phytosociology, IVI, dominant, family, batakote, lidder forest division

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1. INTRODUCTION

The degree of species diversity and interaction with other related living organisms in a given location are reflected in the variety of plants and trees found there. Increased species variety boosts the gene pool's amplitude and preserves the stability of the ecosystem. Any ecosystem's vegetation determines its structure. (Singh, 2019; Bhatti and Purohit, 2009). The key element in assessing a region's biodiversity status is assessing the species content of the area. Good biodiversity is always making the good environments which are helpful for people for many purposes. Biodiversity balance the food chain, food web, CO_2 sequestration, nutrient cycling and livelihood of human being (Jhariya and Raj, 2014). Under natural conditions, habitat factors (e.g., soil, climate, location) determine the growth and development of plants. These natural factors are superimposed on human activity, which is increasingly changing the plant cover (Konatowska and Rutkowski, 2019). Loss of biodiversity is a threat to the natural ecosystem in any particular area locally and leads to ecological imbalance as a whole globally (Krishnamurthy et al., 2010). So study of the plant biodiversity is an important parameter to understand and assess the population structure (Soni and Namdeo, 2022) Phytosociology is the study of the characterstics, classification, relationship and distribution of plant communities and it is useful to collect such as data to describe the population dynamics of each species studied and how they relate to the other species in the same community (Kiran, Giri, Bhupendra, 2019) Phytosociological studies are essential for protecting the natural plant communities and biodiversity as well as understanding the changes experienced in the past and continuing on in to the future. Phytosociology is the quantitative study of vegetation that allows us to assess a region's variety and community structure. "Braun-Blanquer approach" is a common name for it (Westhoff and Maarel, 1973). The analysis of landscape from the phytosociological point of view is a valuable tool for its comprehensive study, including its dynamism and heritage value. The common methodologies used in phytosociology are considered as an optimal choice in environmental management assessments of habitats, as has been recognized for decades (Lalanne et al., 2016). It is based on floristic inventories of homogeneous areas and the evaluation of the taxa present according to their abundance and dominance. This method has proven very useful in obtaining knowledge on vegetation and its dynamics over increasingly large territories (Rivas-Martínez, 2017). Despite the implicit subjectivity of such information, the enormous amount that has accumulated over the past century is currently viewed as an extraordinary database susceptible to statistical and multivariate analysis, using the inventory as a working unit. Researches have shown that these observations can be treated with a high degree of confidence (Cristea et al., 2015). The use of taxa and plant communities as indicators in land-use planning and their application in natural environment conservation policies is accepted in several countries, insofar as they are in themselves the object of such protection (Asensi et al., 2016) Some studies have applied the information contained in the study of vegetation (habitats) and their cartographic representation to territorial biological assessment criteria for natural areas (Bioret et al., 2011). Delineating and characterising vegetation types based on the full floristic composition is the main objective of this field of study, which focusses on plant communities, their composition, development, and the relationships between the species within them. The current study examined the species diversity and phytosociology of the Manigam block in the Lidder Forest Division of Kashmir. Understanding floristic vegetation features and estimating the species richness and diversity present in the studied region were the primary goals of the phytosociological investigation.

2. MATERIALS AND METHODS

The present study was carried out during April 2022–August, 2024 at four altitudes viz., A_1 (1700–2000), A_2 (2000–2300), A_3 (2300–2600) and A_4 (2600 and Above) of block Manigam of Lidder Forest Division, Anantnag district, Jammu & Kashmir, India. Vegetation sampling was done by the quadrat method, and quadrates were laid down by systematic random sampling methods along the four vertical transects which were 100 m apart. In each transect, quadrates were laid down at definite intervals. The trees were recorded from 30×30 m^2 quadrant samples across the selected sites. At every altitude each quadrate was divided into five quadrates of 30×30 m^2 for sampling of trees, 5×5 m^2 size, for sampling of shrubs and 1×1 m^2 for the herbs. The available plant specimens were mostly identified on the spot and the unidentified plants and trees were identified in department of Botany Kashmir university. The number of various tree and plant species found in each quadrant was counted. The vegetation was examined statistically for frequency, density, dominance, and the important value index of reported species.

2.1. Phyto-sociological analysis

Density is defined as the number of individuals of a species that occurs within a given sample unit or study area. It was recorded as:

$$\text{Density} = \frac{\text{Number of individuals of the species}}{\text{Total number of quadrats}}$$

2.2. Frequency

Frequency is defined as the number of times a plant species is present in a given number of sample units. It was calculated by the formula:

$$\text{Frequency}(\%) = \frac{\text{Number of quadrates in which the species occurred}}{\text{Total number of quadrats studied}} \times 100$$

2.3. Basal area

Basal area is the term used to describe the average amount of an area (usually an acre) occupied by tree stems. It is defined as the total cross sectional area of all stems in a stand measured at breast height, and expressed as per unit of land area (typically square feet per acre). It was calculated as:

Basal area=$\Pi D^2/4$

Where 'D' is the Diameter of tree at Breast Height.

2.4. Relative basal area, relative density, relative frequency and importance value index

These relative parameters were calculated from the per cent frequency, density and basal area according to procedure given by Phillips (1959).

$$\text{Relative basal area (RBA)} = \frac{\text{Total basal area of the species}}{\text{Total basal area of all the species}} \times 100$$

$$\text{Relative Density (RD)} = \frac{\text{Number of individuals of the species}}{\text{Total number of individuals of all the species}} \times 100$$

$$\text{Relative Frequency (RF)} = \frac{\text{Quadrates of occurrence of the species}}{\text{Total number quadrates of occurrence of all the species}} \times 100$$

2.5. Importance value index (IVI)

The IVI is an integrated measurement of the relative frequency, relative density and relative basal area which was calculated for trees, shrubs and herbs separately.

IVI=Relative basal area (RBA+Relative density (RD)+ Relative frequency (RF)

2.6. Vegetation Indices

2.6.1. Species richness

The species richness was calculated by using the method "Margalrf's index of richness" (Magurran, 1988).

Dmg=(S-1)/In N

Where,

S=Total number of species

N=Total number of individual

2.6.2. Shannon's index (H)

Shannon's index of diversity was calculated by using Margalef formula (Odum, 1971).

$H=-\sum (ni/N) \ln (ni/N)$

P*ln(p)

Where, ni=Importance value index of each species

N=Total importance value index

2.6.3. Simpson's index of dominance (D)

The formula used to determine Simpson"s index was

$D=\sum(pi)^2$

$pi=\frac{ni}{N}$

Where,

D=Simpson's index of dominance

Pi=The proportion of important value index of i^{th} species

ni=the important value index of the i^{th} species

N=the important value index of all the species

3. RESULTS AND DISCUSSION

3.1. Floristic composition

A total of 28 plant species belonging to 22 families were recorded from all four sites. Out of these, 4 species were trees, representing 3 families. Eight species were shrubs belonging to 6 families. The number of herbaceous species was sixteen representing 13 families (Table 1, 2 and 3). Among tree species, the dominant family was Pinaceae,

Table 1: Tree species identified in the study area

Name of the species	Family	Common name	Local name	A_1	A_2	A_3	A_4	Total
Aesculus indica	Sapindaceae	Horse chestnut	Han doon	+	+	-	-	2
Cedrus deodara	Pinaceae	Himalayan	Deodar	+	+	+	+	4
Juglans regia	Juglandaceae	Walnut	Doon	-	-	+	-	1
Pinus wallichiana	Pinaceae	Kail	Kayur	+	+	+	+	4
				3	3	3	2	11

Table 2: Shrub species identified in the study area

Name of the species	Family	Common name	Local name	A_1	A_2	A_3	A_4	Total
Berberis lyceum	Berberidaceae	Berberis	Kaw dach	-	+	+	+	3
Cotoneaster roseus	Rosaceae	Cotoneater	Luin	-	-	+	+	2
Hedera nepalensis	Araliaceae	Himalayan ivy	Agranth	+	-	-	-	1
Parrotia jacquemontiana	Hamamelidaceae	Parrotia	Poh	+	+	-	-	2
Rosa rubiginosa	Rosaceae	Sweet brier	Gulaab kuj	-	-	+	+	2
Rubus irritans	Rosaceae	Blackberry	Jhansh	-	+	+	+	3
Sambucus wightiana	Sambucaceae	Elder	Fhakee	+	+	-	-	2
Vibernum grandiflorum	Caprifoliaceae	Grand viburnum	Kul maach	+	+	+	+	4
				4	5	5	5	19

Table 3: Herb species identified in the study area

Name of the species	Family	Common name	Local name	A_1	A_2	A_3	A_4	Total
Artemisia absinthium	Asteraceae	Worm wood	Tethwen	+	+	-	-	2
Bromus inermis	Poaceae	Arctic brome	Vishki gaas	+	+	+	+	4
Cannabis sativa	Cannabaceae	Hemp	bhang	+	+	+	-	3
Capsella bursa pastoris	Brassicaceae	Shepherd's purse	Kral mound	+	+	+	+	4
Cynodon dactylon	Poaceae	Couch grass	Dramun	+	+	+	+	4
Dactylis glomerate	Poaceae	Orchard grass		+	+	+	+	4
Fragaraia vesca	Rosaceae	Himalayan strawberry	Ringrech	-	+	+	-	2
Iris hookeriana	Iridaceae	Hooker's iris	Krishm	-	-	+	+	2
Matricaria chamomilla	Caryophyllaceae	May scented weed	Fackh gaas	+	+	-	-	2
Plantago major	Plantaginaceae	common plantain	Boud gull	+	+	-	-	2
Podophyllum hexandrum	Berberidaceae	Himalayan may apple	Wan wagun	-	+	+	+	3
Taraxacum officinale	Asteraceae	Common dandlion	Hand	+	+	+	+	4
Trifolium pretense	Fabaceae	Red clover	Batakh leunt	+	+	-	-	2
Urtica dioica	Urticaceae	Stinging nettle	Soi	+	+	-	-	2
Valeriana hardwickii	Valerianaceae	Indian valerian	Mushkbala	+	+	-	-	2
Verbascum Thapsus	Scrophulariaceae	Great mullein		-	+	+	-	2
				12	15	10	7	44

representing two species and among shrubs Rosaceae was dominant family representing three species. Among herbs, Poaceae was dominant family representing three species and Asteraceae, was represented by two species.

3.2. Site/altitude wise distribution of flora

3.2.1. Altitude 1(1700–2000)

A total of 20 plant species belonging to 15 families were recorded at altitude 1. Out of these 3 species were trees, representing 2 families, 5 were shrubs representing 5 families.The number of herbaceous species was 12 under 9 families. Among trees, *Pinus wallichiana* was dominant with IVI values of 155.4, followed by *Cedrus deodara* (108). The maximum value for frequency (80.1%) was recorded for *Pinus walliachiana* followed by *Cedrus deodara* (78.9). Maximum value for density (310.6), and basal area (88.1) were also recorded for *Pinus wallichiana* followed by *Cedrus deodara* (260.9 and 38.2), respectively. The phytosociological data related to shrubs is also depicted in (Table 4). Out of twelve herbaceous species, *Taraxacum officinale* with IVI value of (58.84) and density (5.74) frequency (67.1) and basal area (1.98) was dominant species followed by *Trifolium pretense* (56.61). The lowest value of density (4.01), frequency (54.2) and basal area (0.87) was recorded for *Cannabis sativa* (Table 4).

The different diversity indices recorded for the trees, shrubs and herbs layer were Shannon diversity, Simpson index and species richness indicated in (Table 8).

Table 4: Phytosociological data of tree, shrubs and herb species at altitude 1(1700–2000)

		A_1 (1700–2000)						
		Av. D	Av. F	Av. Ba	RD	RF	RBA	Total
Trees species	*Aesculus indica*	85.68	46.8	1.007	13.038	22.743	0.791	36.572
	Cedrus deodara	260.89	78.88	38.18	39.698	38.332	30	108.03
	Pinus wallichiana	310.61	80.1	88.08	47.264	38.925	69.21	155.4
	Total	657.18	205.8	127.3	100	100	100	300
Shrubs species	*Dioscorea deltoidea*	0.59	63.66	1.43	17.251	19.457	16.69	53.394
	Hedera nepalensis	0.52	35.33	1.31	15.205	10.798	15.29	41.289
	Parrotia jacquemontiana	0.81	84.56	2.94	23.684	25.844	34.31	83.834
	Sambucus wightiana	0.71	61.21	2.21	20.76	18.708	25.79	65.256
	Vibernum grandiflorum	0.79	82.43	0.68	23.099	25.193	7.935	56.227
	Total	3.42	327.2	8.57	100	100	100	300
Herb species	*Artemisia absinthium*	4.56	56.71	1.43	15.4	14.832	15.82	46.051
	Bromus inermis	4.11	52.34	1.31	13.88	13.689	14.49	42.061
	Cannabis sativa	4.01	54.21	0.87	13.543	14.178	9.624	37.345
	Capsella bursa pastoris	4.11	61.21	1.11	13.88	16.009	12.28	42.168
	Cynodon dactylon	4.78	62.12	1.56	16.143	16.247	17.26	49.647
	Dactylis glomerate	4.32	60.12	1.2	14.59	15.724	13.27	43.588
	Matricaria chamomilla	4.53	67.12	1.43	15.299	17.555	15.82	48.672
	Plantago major	4.11	62.13	1.01	13.88	16.25	11.17	41.303
	Taraxacum officinale	5.74	67.11	1.98	19.385	17.552	21.9	58.84
	Trifolium pretense	5.85	71.11	1.65	19.757	18.598	18.25	56.607
	Urtica dioica	4.82	58.17	1.54	16.278	15.214	17.04	48.527
	Valeriana hardwickii	4.56	56.71	1.43	15.4	14.832	15.82	46.051
	Total	29.61	382.4	9.04	100	100	100	300

3.2.2. Altitude 2(2000–2300)

A total of 24 plant species belonging to 19 families were recorded at altitude 2nd. Out of these 3 species were trees, representing 2 families, 6 were shrubs representing 5 families. The number of herbaceous species was 15 under 13 families. Among trees, *Pinus wallichiana* with IVI values of (156.33), density (308.8), frequency (79.9) and basal area (86.02) was dominant. The minimum values for IVI (34.24) density (81.23), frequency (41.22) and basal area (1.06) was recorded for *Aesculus indica* (Table 5). Phytosociological data related to shrubs and herbs is also depicted in (Table 5).

The different diversity indices recorded for the trees, shrubs and herbs layer were Shannon diversity, Simpson index and species richness were as 0.96, 0.42 and 0.83 for trees, 1.78, 0.17 and 1.64 for shrubs and 3.56, 0.17 and 3.70 for herbs respectively. (Table 8).

3.2.3. Altitude 3(2300–2600)

A total of 18 plant species belonging to 13 families were recorded at altitude 3rd. Out of these 3 species were trees, representing 2 families, 5 were shrubs representing 3 families. The number of herbaceous species was 10 under 8 families. Among trees, *Pinus wallichiana* was dominant with maximum values for IVI, density, frequency and basal area followd by *Cedrus deodara* (Table 6) Among shrubs, *Rosa rubiginosa* was dominant with IVI value of 64.98 followed by *Berberis lyceum* (61.82). The maximum value for density and frequency was recorded for *Cotoneaster roseus* with vales as 0.81 and 73 , respectively followed by *Vibernum grandiflorum* and *Rubus irritans*. The lowest values for density and frequency was recorded for *Berberis lyceum* viz., 0.69, 68.1 and 1.72, respectively (Table 6). The data related to herbs is depicted in Table 6.

The different diversity indices recorded for the trees, shrubs and herbs layer were Shannon diversity, Simpson index and species richness were as 0.98, 0.41 and 0.83 for trees, 1.61, 0.20 and 1.31 for shrubs and 2.45, 0.64 and 1.59 for herbs, respectively (Table 8).

Table 5: Phytosociological data of tree species at altitude 2(2000–2300)

		A_2 (2000–2300)						
		Av. D	Av. F	Av. Ba	RD	RF	RBA	IVI
Trees species	*Aesculus indica*	81.23	41.22	1.065	12.458	20.9451	0.847	34.2494
	Cedrus deodara	262	75.68	38.723	40.186	38.4553	30.78	109.42
	Pinus wallichiana	308.8	79.9	86.024	47.356	40.5996	68.38	156.331
	Total	652	196.8	125.812	100	100	100	300
Shrubs species	*Berberis lyceum*	0.69	66.12	1.73	16.547	17.2696	19.95	53.7702
	Dioscorea deltoidea	0.61	55.21	0.79	14.628	14.42	9.112	38.1602
	Parrotia jacquemontiana	0.62	56.22	1.72	14.868	14.6838	19.84	49.3905
	Rubus irritans	0.72	69	1.24	17.266	18.0218	14.3	49.5902
	Sambucus wightiana	0.73	62.12	1.98	17.506	16.2248	22.84	56.5682
	Vibernum grandiflorum	0.8	74.2	1.21	19.185	19.3799	13.96	52.5208
	Total	4.17	382.9	8.67	100	100	100	300
Herb species	*Artemisia absinthium*	4.27	64.82	1.25	10.646	11.8149	10.41	32.8686
	Bromus inermis	4.11	46.26	1.11	10.247	8.43191	9.242	27.921
	Cannabis sativa	3.99	58.22	1.31	9.9476	10.6119	10.91	31.4671
	Capsella bursa pastoris	3.47	39.87	0.89	8.6512	7.26719	7.41	23.3289
	Cynodon dactylon	4.11	52.34	1.31	10.247	9.54013	10.91	30.6945
	Dactylis glomerate	4.56	56.71	1.43	11.369	10.3367	11.91	33.6121
	Fragaraia vesca	6.23	84.11	1.69	15.532	15.3309	14.07	44.9348
	Matricaria chamomilla	4.28	57.42	1.32	10.671	10.4661	10.99	32.1276
	Plantago major	3.53	50.11	1.05	8.8008	9.13366	8.743	26.6772
	Podophyllum hexandrum	4.56	56.71	1.43	11.369	10.3367	11.91	33.6121
	Taraxacum officinale	4.6	66.25	1.12	11.468	12.0755	9.326	32.8696
	Trifolium pretense	4.79	64.99	1.51	11.942	11.8459	12.57	36.3609
	Urtica dioica	4.56	56.71	1.43	11.369	10.3367	11.91	33.6121
	Valeriana hardwickii	4.27	64.82	1.25	10.646	11.8149	10.41	32.8686
	Verbascum thapsus	3.29	47.51	1.21	8.2024	8.65975	10.07	26.9371
	Total	40.11	548.6	12.01	100	100	100	300

3.2.4. Altitude 4(2600 and above)

A total of 14 plant species belonging to 9 families were recorded at altitude 4th. Out of these 2 species were trees, representing 1 families, 5 were shrubs representing 3 families.The number of herbaceous species was 7 under 5 families. Among trees, *Pinus wallichiana* was dominant with maximum values for IVI (182.61), density (298.10), frequency (84.28) and basal area (73.43) followed by *Cedrus deodara*. The phytosociological data related to shrubs and herbs is also depicted in (Table 7).

The different diversity indices such as Shannon diversity, Simpson index and species richness were as 0.67, 0.52 and 0.42 for trees, 1.61, 0.20 and 1.31 for shrubs and 2.45, 0.32 and 1.59 for herbs, respectively (Table 8).

3.3. Diversity indices

In the present study, Shannon diversity index (H') for tree species was recorded as highest in altitude 3rd (0.98) whereas lowest value (0.67) was recorded in altitude 4th. For shrubs, highest Shannon diversity index (H') was found (1.78) for altitude 2nd. For the herb layer highest value of the Shannon diversity Index was observed for 2nd altitude (3.56) whereas the lowest was observed for 4th altitude (2.45). The diversity index (H') for different forests has been reported to be between 0.83 to 4.1 (Singh, 1984, Visalakshi 1995). Variation in density and basal area of different forest stands may be attributed to altitudinal variation, species composition, age structure, successional stage of the forest, and degree of disturbance (Swamy, 2000). The highest value of Simpson's index for trees 0.52 was recorded for altitude

Table 6: Phytosociological data of tree species at altitude 3(2300–2600)

		A_3 (2300–2600)						
		Av. D	Av. F	Av. Ba	RD	RF	RBA	IVI
Trees species	*Cedrus deodara*	259.6	61.12	36.2	39.512	31.12	30.072	100.71
	Juglans regia	94.56	49.88	1.29	14.394	25.4	1.0728	40.868
	Pinus wallichiana	302.8	85.37	82.8	46.094	43.47	68.855	158.42
	Total	656.9	196.4	120	100	100	100	300
Shrubs species	*Berberis lyceum*	0.69	68.13	1.72	18.1579	19.3	24.363	61.824
	Cotoneaster roseus	0.8	73	0.91	21.0526	20.68	12.89	54.625
	Rosa rubiginosa	0.75	71.23	1.77	19.7368	20.18	25.071	64.989
	Rubus irritans	0.78	69.32	1.32	20.5263	19.64	18.697	58.863
	Vibernum grandiflorum	0.78	71.27	1.34	20.5263	20.19	18.98	59.699
	Total	3.8	353	7.06	100	100	100	300
Herb species	*Bromus inermis*	3.29	47.51	1.21	14.8131	14.87	18.195	47.878
	Cannabis sativa	2.89	48.79	1.11	13.0122	15.27	16.692	44.974
	Capsella bursa pastoris	3.11	29.89	0.15	14.0027	9.355	2.2556	25.613
	Cynodon dactylon	3.53	50.11	1.05	15.8937	15.68	15.789	47.367
	Dactylis glomerate	4.11	54.39	1.31	18.5052	17.02	19.699	55.227
	Fragaraia vesca	5.64	75.12	1.54	25.394	23.51	23.158	72.063
	Iris hookeriana	4.79	64.99	1.51	21.5669	20.34	22.707	64.614
	Podophyllum hexandrum	4.27	64.82	1.25	19.2256	20.29	18.797	58.31
	Taraxacum officinale	4.27	64.82	1.25	19.2256	20.29	18.797	58.31
	Verbascum Thapsus	3.24	49.76	1.1	14.588	15.57	16.541	46.703
	Total	22.21	319.5	6.65	100	100	100	300

4th, whereas the lowest 0.41 was observed for 1st and 3rd altitudes. Simpson's value for shrubs was found highest (0.21) for 1st altitude. Simpson's index observed for the herb layer was highest 0.64 in altitude 3rd. Simpson's index values by various authors have been reported in the range from 0.03 to 0.92 (Deb and Kushwahaand, 2011). The values for species richness among trees was recorded same 0.83 altitudes 1st, 2nd and 3rd . Among shrubs, highest value 1.64 was recorded for altitude 2nd and for herbs highest being 3.70 was recorded in altitude 2nd and lowest 1.59 in altitude 4th. The studies on Phytosociological studies in Himalayan forests have been reported by several authors (Sharma et al., 2014; Siddiqui et al., 2013). (Mugloo, 2021) also reported the same density range for trees on his study on Floristic Diversity along Altitudinal Gradient in Shopian Forest Range of J&K, India. The density values of shrubs were within the same range value as reported by (Verma, 2016) on his study on Status of plant diversity along an altitudinal gradient in district Chamba, Himachal Pradesh. Herb density decreased as the increase in altitude and the results are in conformity with Bharali (2011) who reported decrease in herb density at higher altitudes. Decrease in diversity and species richness at high elevation strata could be due to ecophysiological constraints such as reduced growing season and low temperature (Korner, 1998). The altitude, environmental factors, habitat and soil characteristics may be the main factors which eventually lead to the variations in species diversity and density in the three sites.

Table 7: Phytosociological data of tree species at altitude 4(2600 and above)

		A_4 (2600 and above)						
		Av. D	Av. F	Av. Ba	RD	RF	RBA	IVI
Trees species	*Cedrus deodara*	257.9	58.97	31.232	46.384	41.166	29.84	117.39
	Pinus wallichiana	298.1	84.28	73.427	53.616	58.834	70.16	182.61
	Total	556	143.3	104.66	100	100	100	300

Table 7: Continue...

		A_4 (2600 and above)						
		Av. D	Av. F	Av. Ba	RD	RF	RBA	IVI
Shrubs species	*Berberis lyceum*	0.61	58.21	1.38	17.681	18.312	23.27	59.265
	Cotoneaster roseus	0.72	69.01	0.89	20.87	21.709	15.01	57.587
	Rosa rubiginosa	0.69	68.78	1.52	20	21.637	25.63	67.269
	Rubus irritans	0.72	56.91	1.17	20.87	17.903	19.73	58.503
	Vibernum grandiflorum	0.71	64.97	0.97	20.58	20.439	16.36	57.376
	Total	3.45	317.9	5.93	100	100	100	300
Herb species	*Bromus inermis*	3.24	49.76	1.1	26.711	29.352	36.18	92.247
	Capsella bursa pastoris	2.32	29.23	0.14	19.126	17.242	4.605	40.973
	Cynodon dactylon	3.47	39.87	0.89	28.607	23.518	29.28	81.401
	Dactylis glomerate	4.01	54.21	1.2	33.059	31.977	39.47	104.51
	Iris hookeriana	4.11	61.11	1.3	33.883	36.047	42.76	112.69
	Podophyllum hexandrum	4.01	54.21	0.87	33.059	31.977	28.62	93.654
	Taraxacum officinale	4.01	54.21	0.87	33.059	31.977	28.62	93.654
	Total	12.13	169.5	3.04	100	100	100	300

Table 8: Different diversity parameters across the studied area at Manigam block of lidder forest division

	Shannon's index (H)				Simpson's index of dominance (D)				Species richness			
	A_1	A_2	A_3	A_4	A_1	A_2	A_3	A_4	A_1	A_2	A_3	A_4
Trees	0.97	0.96	0.98	0.67	0.41	0.42	0.41	0.52	0.83	0.83	0.83	0.42
Shrubs	1.58	1.78	1.61	1.61	0.21	0.17	0.20	0.20	1.31	1.64	1.31	1.31
Herbs	3.46	3.56	2.99	2.45	0.30	0.17	0.32	0.64	2.91	3.70	2.38	1.59

4. CONCLUSION

29 species across four elevations, with *Pinus wallichiana* dominated at all heights. The Shannon diversity index (H') ranged from 0.67 to 0.98, indicating moderate to high diversity. Species with low density values required special attention for conservation. Using density, frequency, dominance, and distribution as indicators of environmental degradation, helped us to identify threats to forest ecosystems and guide conservation efforts effectively

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