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Phytosociological Analysis and Distribution Patterns of Tree Species: A case study from Govind Pashu Vihar, National Park, Uttarakhand

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ABSTRACT: Six forest stands located in and around Govind Pashu Vihar National park of Uttarakhand were studied for distribution pattern and species richness. Among tree species the total forest density ranges from 470 ind/ha- 600ind/ha. The maximum density were reported for *Pinus smithiana* (290ind/ha) while the least density for *Pinus wallichiana* (20ind/ha) while the total density of the saplings and seedlings ranged from 90-140 ind/ha and 50-510 ind/ha respectively. The distribution pattern of trees, indicated that most of the species were distributed randomly following regular distribution while few species were contagious distribution while in saplings contagious distribution were not found similarly in seedlings instead of contagious distribution, regular distribution were not present. [New York Science Journal. 2009;2(4):58-63]. (ISSN: 1554-0200).

Key words: Species richness, distribution pattern, study sites, vegetation, Garhwal Himalaya.

INTRODUCTION

The Himalayan mountain ranging from 27˚ 38' north latitude to 72˚ 98' east longitude embody a diverse and characteristics vegetation distributed over a wide range of topographical variation (Gupta, 1963). The Himalayan moist temperate forest extends from 1500-3000m asl in Western Himalaya is of the immense significance from the environmental conservation and sustainable development (Sharma and Baduni, 2000). The variable topography of the area supports luxuriant vegetation between 2200-2800m exhibit a dense canopy of Quercus species at moist situations (*Quercus floribunda*, *Quercus semicarpifolia*, *Quercus leucotrichophora*). Above 2800 m oak-conifer association occur where, *Quercus semicarpifolia*, *Abies pindrow*, *Piceae smithiana Pinus wallichiana*, *Taxus wallichiana* are in the dominant form (Bhandari, 1984).These forest have been under severe biotic pressure (Lopping, grazing and firewood collection) from human and livestock population which influence the rapid and frequent changes in land and resource use, reduction in species number, change in the climate pattern. These changes directly affect biodiversity (Heywood, 1995).

The present study provides a quantitative information and distribution pattern of recorded species of the study sites.

MATERIALS AND METHODS

The study area is located 30˚ 35' and 30˚ 18' north latitude and 77˚ 49' and 78˚ 37' east longitude in the temperate part of the western Himalaya in the altitudinal range of 1000-3200m, divisible in six different study sites. The climate of the lower part of study site have subtropical with more or less humid monsoon season from July to September at higher elevation it is cool even in June, winter is long with heavy snowfall from December to March. Soil mainly composed red loam and meadow type. Phytosociological analysis in the area was done by placing randomly 10, 100m^2 circular quadrats, the size and number of samples was determined following Saxena and Singh (1982). The vegetation data were calculated for density, frequency, abundance (Curtis and McIntosh, 1950). Importance value index for trees was determined as the sum of the relative density relative frequency, relative dominance (Curtis, 1959). Trees were consider to be individual >30cm cbh (Circumference at breast height), Sapling 10-30cm cbh and

seedling <10cm cbh (Saxena and Singh, 1984). Abundance to frequency ratio was done following Curtis and Cottam (1956) Distribution patterns were considered to be <0.025 regular distribution, 0.025-0.05 random distribution and >0.05 contagious distribution. Species richness was determined following Whittaker (1972) by tabulating the number of species in each site. Species diversity was computed by using Shannon-Wiener (1963).

Species	**I**			**II**			**III**		
	Density (Ind/ha)	**A/F**	**IVI**	**Density (Ind/ha)**	**A/F**	**IVI**	**Density (Ind/ha)**	**A/F**	**IVI**
Abies pindrow	180	0.018	114.24	180	0.022	85.76	-	-	-
Pinus wallichiana	90	0.036	126.53	120	0.048	58.64	60	0.006	35.87
Picea smihtiana	200	0.024	59.31	140	0.021	73.57	-	-	-
Cedrus deodara	-	-	-	70	0.043	39.88	-	-	-
Taxus wallichiana	-	-	-	90	3.6	42.15	-	-	-
Pinus roxburghii	-	-	-	-	-	-	170	0.047	90.64
Querques leucotrichophora	-	-	-	-	-	-	170	0.034	60.09
Querques floribunda	-	-	-	-	-	-	190	0.038	66.42
Rhododendron arboreum	-	-	-	-	-	-	80	0.05	29.99
Pyrus pashia	-	-	-	-	-	-	30	0.03	16.96
Total	**470**			**600**			**620**		

Table 1: Phytosociological attributes of Trees at different study sites

Abbreviations: ind/ha = individual per hectare, A/F= Abundance/ Frequency, TBA = Total Basal Area, IVI= Importance Value Index,

RESULTS

Phytosociological analysis of vegetation at different study sites are given in table1and 2. A total of 10 species of Trees and Seedlings, 9 Saplings species were recorded from the study sites. Among the Trees, the maximum density was that of *Piceae smithiana* (290ind/ha) at siteV and least density was that of *Pinus wallichiana* (20ind/ha) in site VI. Among trees *Piceae smithiana* was the dominant (IVI-147.2) in site V following *Piceae smithiana* (IVI=145.27) and *Pinus wallichiana* (IVI=126.53) of site VI and I respectively. While least dominant species was *Taxus wallichian*a (IVI=13.31) in site VI (Table 1 and 2). The distribution pattern of study site indicates that mostly species are in random distribution while some of them were distributed regularly very few of them distributed contagiously (Table 1 and2).

Table 2: Phytosociological attributes of Saplings at different study sites

Species	I		II		III		IV		V		VI	
	Density (ind/ha)	A/F	Density (ind/ha)	A/F	Density (ind/ha)	A/F	Density (ind/ha)	A/F	Density (ind/ha)	A/F	Density (ind/ha)	A/F
Abies pindrow	30	0.075	-	-	-	-	-	-	70	0.028	50	0.055
Pinus wallichiana	-	-	30	0.033	-	-	-	-	-	-	-	-
Piceae smithiana	60	0.066	60	0.037	-	-	-	-	50	0.055	110	0.044
Cedrus deodara	-	-	20	0.05	-	-	-	-	-	-	-	-
Taxus wallichiana	-	-	10	0.1	-	-	-	-	40	0.1	70	0.077
Pinus roxburghii	-	-	-	-	-	-	210	0.025	-	-	-	-
Ouerques leucotrichophora	-	-	-	-	80	0.05	120	0.033	-	-	-	-
Ouerques Floribunda	-	-	-	-	50	0.031	-	-	-	-	-	-
Rhododendron. arboreum	-	-	-	-	40	0.1	80	0.05	-	-	-	-

Table 3: Phytosociological attributes of seedlings at different study sites

Species	IV			V			VI		
	Density (Ind/ha)	A/F	IVI	Density (Ind/ha)	A/F	IVI	Density (Ind/ha)	A/F	IVI
Abies pindrow	-			150	0.030	71.3	100	0.027	63.55
Pinus wallichiana	170	0.02	98.42	-	-	-	20	0.05	77.87
Rhododendron arboreum	50	0.055	21.4	-	-	-	-	-	-
Cedrus deodara	-	-	-	70	0.028	34.33	-	-	-
Taxus wallichiana	-	-	-	80	0.032	47.13	150	0.023	13.31
Pinus roxburghii	150	0.018	91.13	-	-	-	-	-	-
Querques leucotrichophora	210	0.002	89.03	-	-	-	-	-	-
Piceae smithiana	-	-	-	290	0.029	147.2	240	0.029	145.27
Total	**580**			**590**			**510**		

Species	I		II		III		IV		V		VI	
	Density (ind/ha)	A/F	Density (ind/ha)	A/F	Density (ind/ha)	A/F	Density (ind/ha)	A/F	Density (ind/ha)	A/F	Density (ind/ha)	A/F
Abies pindrow	90	0.036	-	-					90	0.056	200	0.08
Pinus wallichiana	210	0.233	-	-	40	0.1	60	0.066	-	-	-	-
Piceae smithiana	170	0.068	-	-	-	-	-	-	-	-	180	0.072
Cedrus deodara	-	-	-	-	-	-	-	-	50	0.055	-	-
Taxus wallichiana	-	-	-	-			-	-	-	-	130	0.052
Pinus roxburghii	-	-	-	-	140	0.056	150	0.093	-	-	-	-
Ouerques leucotrichophora	-	-	-	-	80	0.032	120	0.033	-	-	-	-
Ouerques Floribunda	-	-	-	-	50	0.056	-	-	-	-	-	-
Rhododendron. Arboretum	-	-	-	-	-	-	140	0.155	-	-	-	-
Pyrus pashia	-	-	-	-	110	0.044	-	-	-	-	-	-

Table 4: Species diversity of different study sites.

Sites	Parameters	Trees	Saplings	Seedlings
I	SR*	3	2	3
	SD**	1.51	0.92	1.52
II	SR	5	4	0
	SD	2.24	1.73	0
III	SR	5	3	5
	SD	2.14	1.52	2.13
IV	SR	4	3	4
	SD	1.9	1.47	1.93
V	SR	4	3	2
	SD	1.77	1.54	0.94
VI	SR	4	3	3
	SD	1.66	1.5	0.91

*SR = Species Richness for Trees (per 100 m2), Saplings And Seedling (per 25m2).
**SD= Species Diversity (density based).

DISCUSSION

The total tree density value ranged from 140-750 trees/ha in Pindari catchments forest (Pangtey et.al., 1989), 820 trees/ha in natural forest of Gangotri, (Dhaulakhandi et.al. 2008). The total tree density value of the present study sites ranged from 470-590 ind/ha, these values were within the range values reported earlier by Pangtey et.al. (1989), Dhaulakhandi et.al. (2008). According to Saxena and Singh (1982) total tree density for temperate forests of Kumaun Himalaya ranged from 420-1640 trees/ha. Saxena and Singh, (1982), but these values for temperate forests of Garhwal Himalaya ranged from 652-1028 trees/ha (Kumar et.al. 2001). The total saplings density ranges from 90-410 ind/ha while seedlings density varied from 50-510 ind/ha. The distribution pattern of tree, sapling and seedling layers indicated that most of species are distributed randomly, while some species of trees and saplings were in regular distribution however in tree layer very few of them were in contagious distribution while contagious distribution is absent in saplings instead of this regular distribution were absent in saplings . These values were similar as earlier reported by Dhaulakhandi et.al. (2008). Odum (1971), emphasized that contagious distribution pattern is the commonest pattern in nature. Kumar and Bhatt (2006), also reported the contagious distribution pattern in forests of Garhwal Himalaya. Species diversity of the present study site ranged from 1.9-2.24 which is more or less similar to the value calculated by Braun (1950) in certain temperate forest and similar to the value calculated by Singh and Singh (1987) (1.19-2.15) in chir pine mixed forest of central Himalaya. Conversion of forest land to agricultural land, lopping for fuelwood, deforestation for household purposes have severly threatened the plant biodiversity. The conferous dominant forest have high economic value but due to close proximity to human interference these forest suffer various level of disturbances which would be the causitive factor regarding loss of plant biodiversity.

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