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RESEARCH ARTICLE

SPECIES COMPOSITION OF WOODY PLANTS IN FOREST OF BLOCK NOWSHERA, DISTRICT RAJOURI (J & K), INDIA

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ABSTRACT

The present communication pertains to the species composition, regeneration status and distribution pattern of woody plants along an altitudinal gradient in the forest of Nowshera block, District Rajouri (J&K). The whole area is divided into two sites (S1&S2) based on altitudes (S1 from 500-750 and S2 from 750-1000m asl).The study was carried out in Northern and Southern aspects of both the sites. A total of 41 woody plants were reported from the study area, out of which 29 were trees and 12 were shrubs. A comparatively higher number of trees and shrubs were reported from Northern aspect of both the sites as compared to Southern aspect. *Pinus roxburghii* was dominant among tree species in both the sites and aspects having an IVI which ranges from 93.17to 248.57 and *Carissa spinarum* among shrubs having IVI ranges from 94.10 to 162.13. The data shows heavy deforestation and overgrazing.

INTRODUCTION

Vegetation is the outcome of the habitat, environmental conditions and existing biotic influences. Species composition, regeneration status and distribution pattern of plants vary along different environmental gradients. Presently it is the major topic of ecological investigation. The fundamental goal of ecological research is to understand the diversity of nature and it has been explained with reference to climate, biotic interaction and productivity etc. (Givnish 1999). Species composition of major forest of the Himalaya is described by (Rathan *et al*., 1982; Saxena & Singh 1982; Tewari & Singh 1981). They summarized the information on structure and functioning of Himalayan forest ecosystem. Himalayas embodies diverse and characteristic vegetation distributed over a wide range of topographic variations. The existence of different forest types is indicative of diversity. As plant community of a region is a function of time, however, altitude, slope, latitude, aspect, rainfall and humidity also plays an important role in the formation of community and their composition.

Study area

The present study was conducted in subtropical Chir Pine forest of block Nowshera District Rajouri (J&K) in the year 2009. The study area is located at an elevation ranges from 470 -1000m asl and lies between latitude of 32^0-57' to 33^0-17' N and longitude of 70^0-0' to 74^0-33' E. The block Nowshera lies in South-West of the district Rajouri and in Western circle of the Jammu division. It is bounded by block Rajouri in North, Kalakote and Sunderbani in East and Mirpur Pakistan in West and South. Most of the area is mountainous and rugged. Landscape consists of low lying undulating hills and valleys. Northward topography become very steep and high merging ultimately with Pir Panjal range near Ans River. Soil under forest is charcterised by sandstone, shale, clay and calcareous sandstone in lower siwalik and massive, soft, coarse, sandstone with sub ordinate clay in upper siwalik. The annual rainfall ranges from 920-960mm. The minimum and maximum temperature throughout the year ranges from 9^0C to 32^0C. Although some ethnobotanical studies in subtropical belt of the study area have been carried out by (Rashid *et al*., 2008), but no quantitative data on phytosociology of this block is available. The present study describes the species composition, regeneration status and distribution pattern of woody plant species in the study area.

Materials and Methods

The present study area is divided into two sites (S1 and S2) based on altitude (i.e., S1 from 500-750m asl and S2 from 750-1000m asl) and aspects (North and South). Phytosociological studies were conducted during 2009. The plants were indentified with the help of plant taxonomist and the published regional forest flora of Jammu and Kashmir (Sharma & Kachroo 1983; Swami & Gupta 1998). Tree layer was analysed by sampling of ten randomly placed quadrats of 10×10m size in each site and aspect, i.e., North & South aspects of each site. The size and number of samples was quantitatively analysed for abundance, density and frequency (Curtis & Mc Intosh 1950). Importance Value Index (IVI) for the tree layer was determined by sum of the relative

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frequency, relative density and relative dominance (Curtis, 1956). The Distribution pattern of different species was studied by using ratio of abundance to frequency (Whitford, 1949). Tree species were considered to be individuals >30cm cbh (circumference at breast height) and sapling 10-30cm cbh and seedling <10cm cbh (Saxena *et al*., 1984). The shrubs layer and seedling ware analyzed by sampling of quadrats of 5×5m and 1×1m randomly on each site. Thus relative value calculated and summed to get IVI. The abundance to frequency ratio was studied for eliciting their distribution patterns. This ratio indicates regular (<0.025), random (0.025-0.05) and contagious (>0.05) distribution of species (Curtis & Cottom 1956).

RESULTS

A total of 41 woody plant species were reported from the study area of which 29 were trees and 12 were shrubs. Diversity and dominance of woody plant species in terms of IVI are given in Table-1, 2 & 3.

Table 1: Showing the diversity, regeneration status and distribution pattern of trees in Northern aspects of S1 & S2

Name of species	Northern aspect: Tree			Sapling			Seedling		
	Density Tree/ 100m^2	A/F Ratio	IVI Trees/ 100m^2	Density Tree/ 100m^2	A/F Ratio	IVI Trees/ 100m^2	Density Tree/ 100m^2	A/F Ratio	IVI Trees/ 100m^2
S 1									
Pinus roxburghii	3.9	0.048	93.17	0.6	0.150	35.09	0.4	0.045	23.6
Acacia modesta	1.4	0.156	27.64	0.9	0.056	67.91	0.5	0.056	27.3
Dalbergia sissoo	0.8	0.032	23.69	-	-	-	0.5	0.056	28
Mallotus philippensis	1	0.060	22.49	0.7	0.078	52.57	3.4	0.034	138
Olea cuspidata	0.7	0.044	15.87	0.6	0.067	44.85	-	-	-
Terminalia chebula	0.5	0.056	13.19	0.5	0.125	33.87	0.4	0.400	16.5
Toona ciliata	0.3	0.075	10.23	-	-	-	-	-	-
Zanthoxylum alatum	0.4	0.045	10.59	-	-	-	-	-	-
Grewia vestita	0.4	0.045	10.53	-	-	-	-	-	-
Acacia catechu	0.4	0.100	8.55	-	-	-	-	-	-
Ficus roxburghii	0.3	0.075	8.14	-	-	-	-	-	-
Euphorbia royleana	0.3	0.075	7.92	-	-	-	-	-	-
Syzygium cumini	0.2	1.529	6.82	-	-	-	-	-	-
Casearia tomentosa	0.2	1.346	6.64	-	-	-	-	-	-
Cassia fistula	0.2	0.200	5.26	-	-	-	-	-	-
Phyllanthus emblica	0.2	0.200	5.08	-	-	-	-	-	-
Ziziphus mauritiana	0.2	0.200	4.49	-	-	-	-	-	-
Rhus cotinus	0.2	0.250	4.78	0.3	0.750	23.76	1	0.034	20
Lannea coromandelica	0.1	0.100	3.65	-	-	-	-	-	-
Flacourtia ramontchi	0.1	0.100	3.18	0.1	0.100	10.4	-	-	-
Ficus carica	0.1	0.100	3.11	-	-	-	-	-	-
Pyrus pashia	0.1	0.100	3.17	0.2	0.050	20.8	1.1	0.068	47.3
Ficus palmata	0.1	0.100	2.37	0.1	0.100	10.75	-	-	-
S 2									
Pinus roxburghii	7.9	0.079	167.6	0.5	0.125	89.63	0.5	0.023	112
Mallotus philippensis	0.8	0.089	22.4	0.1	0.100	65.58	0.5	0.125	73.7
Phyllanthus emblica	0.6	0.025	20.96	0.2	0.200	32.02	0.2	0.050	30
Terminalia bellirica	0.6	0.100	17.93	0.3	0.075	36.75	-	-	-
Pyrus pashia	0.6	0.100	17.53	-	-	-	0.5	0.056	37.9
Pistacia integerrima	0.3	0.075	10.36	0.2	0.100	29.72	0.5	0.100	14.2
Syzygium cumini	0.3	0.075	10.44	-	-	-	-	-	-
Quercus leucotrichophora	0.3	0.075	10.05	0.4	0.100	46.8	-	-	-
Flacourtia ramontchi	0.3	0.300	7.27	-	-	-	-	-	-
Grawia vestita	0.2	0.200	5.71	-	-	-	0.3	0.300	32.5
Dalbergia sissoo	0.1	0.100	5.22	-	-	-	-	-	-
Zanthoxylum alatum	0.1	0.100	4.51	-	-	-	-	-	-

Where, A/F ratio = Abundance Frequency ratio and IVI = Imporance Value Index

Trees and Sapling

In **S1,** Northern aspect of study area ranging from 500-750m asl represented a varied composition of *Pinus roxburghii, Dalbergia sissoo* and *Mallotus philippensis*. Density (individuals per 100m^2) of tree species ranged from 1.2-3.9 with *Pinus roxburghii* (3.9 individual /100^2) showing highest density while *Pyrus pashia*, *Ficus palmata* had lowest density (0.1individual/100^2). The Important Value Index (IVI) showed variation from 2.37 to 93.17 with *Pinus roxburghii* having highest value (93.17) while *Ficus palmata* had lowest value (2.37). Under sapling layer the *Acacia modesta* had maximum density of 0.9 ind/100m^2 and IVI 67.99 and minimum in *Flacourtia ramontchi* (0.1ind./100m^2& IVI 10.40). In southern aspect of S1, *Pinus roxburghii* was the dominant species having highest density (5 ind./100m^2 and IVI 151.18) followed by *Mallotus philippensis* (0.6ind. / 100m^2 and IVI 33.23), while lowest density was reported by *Ficus roxburghii* (0.2ind./100m^2 and IVI 7.99) In sapling layer *Pinus roxburghii* showed maximum density (3 ind./100m^2 and IVI 176.26) and lowest in *Ficus roxburghii* (0.1ind./100m^2 and IVI 14.21). In Northern aspect of S2, *Pinus roxburghii* exhibited highest density (7.9 ind./100m^2 and IVI 167.63), while lowest was reported in *Pistacia integerrima* (0.1ind./100m^2 and IVI 10.3).

Under sapling layer *Pinus roxburghii* had highest density 1.2 individual/100m^{2}and IVI 89.63 and minimum value was in *Pistacia integerrima* 0.2 indi./100m^2 and IVI 29.72 while in

Table 2: Shows the diversity, regeneration status and distribution pattern of Southern aspects of S1 & S2

Name of species	Southern aspect								
	Tree			Sapling			Seedling		
	Density Tree/ 100m^2	A/F Ratio	IVI Trees/ 100m^2	Density Tree/ 100m^2	A/F Ratio	IVI Trees/ 100m^2	Density Tree/ 100m^2	A/F Ratio	IVI Trees/ 100m^2
S 1									
Pinus roxburghii	5	0.107	151.7	3	0.185	176.3	0.9	0.036	112
Mallotus philippensis	0.6	0.024	33.23	0.7	0.078	55.48	1.1	0.030	136
Dalbergia sissoo	0.5	0.032	31.34	0.1	0.100	14.76	-	-	-
Toona ciliata	0.4	0.100	19.22	-	-	-	0.1	0.500	17.6
Olea cuspidata	0.3	0.750	15.17	-	-	-	-	-	-
Acacia modesta	0.2	0.300	10.22	-	-	-	-	-	-
Pyrus pashia	0.2	0.200	8.1	0.3	0.300	24.87	0.2	0.050	34.3
Grawia vestita	0.2	0.200	8.1	0.1	0.100	14.65	-	-	-
Ficus roxburghii	0.2	0.200	7.99	0.1	0.100	14.21	-	-	-
Morus alba	0.1	0.100	6.92	-	-	-	-	-	-
S 2									
Pinus roxburghii	6.5	0.065	248.6	2.6	0.040	223.1	1.2	0.034	124
Mallotus philippensis	0.7	0.028	52.37	0.4	0.044	48.74	1.2	0.048	120
Grewia vestita	-	-	-	0.4	0.400	28.17	0.3	0.300	30.5
Rhus cotinus	-	-	-	-	-	-	0.1	0.100	12.9
Terminalia chebula	-	-	-	-	-	-	0.1	0.100	13

Where, A/F ratio = Abundance Frequency ratio and IVI = Imporance Value Index

Table 3: Showing diversity & distribution pattern of shrubs in Northern aspect &Southern aspects of S1 and S2

Name of species	Northen Aspect			Southern Aspect		
	Density Tree/100m^2	A/F Ratio	IVI Trees/100m^2	Density Tree/100m^2	A/F Ratio	IVI Trees/100m^2
S 1						
Carissa spinarum	10.5	0.105	94.1	7.7	0.077	162.1
Ipomoea carnea	2.9	0.323	80.73			
Justicia adhatoda	9.2	0.187	35.5	2.8	0.175	60.95
Dodonaea viscosa	2.4	0.150	26.84	1.7	0.068	45.87
Colebrookia oppositifolia	1	0.063	16.86	-	-	-
Rubus ellipticus	1.1	0.250	10.7	-	-	-
Acacia eburnea	0.5	0.125	9.26	-	-	-
Myrsine africana	0.4	0.100	7.5		-	-
Vitex negundo	1.5	0.167	7.5	-	-	-
Nerium indicum	0.7	0.700	6.94	0.2	0.700	14.79
Woodfordia fruticosa	0.3	0.300	4.77	-	-	-
Ziziphus mauritiana	-	-	-	0.5	0.125	16.28
S 2						
Woodfordia fruticosa	1	0.250	153.6	-	-	
Carissa spinarum	1	0.250	146.4	-	-	

Where, A/F ratio = Abundance Frequency ratio and IVI = Imporance Value Index

Fig.1 (a) Northern aspect

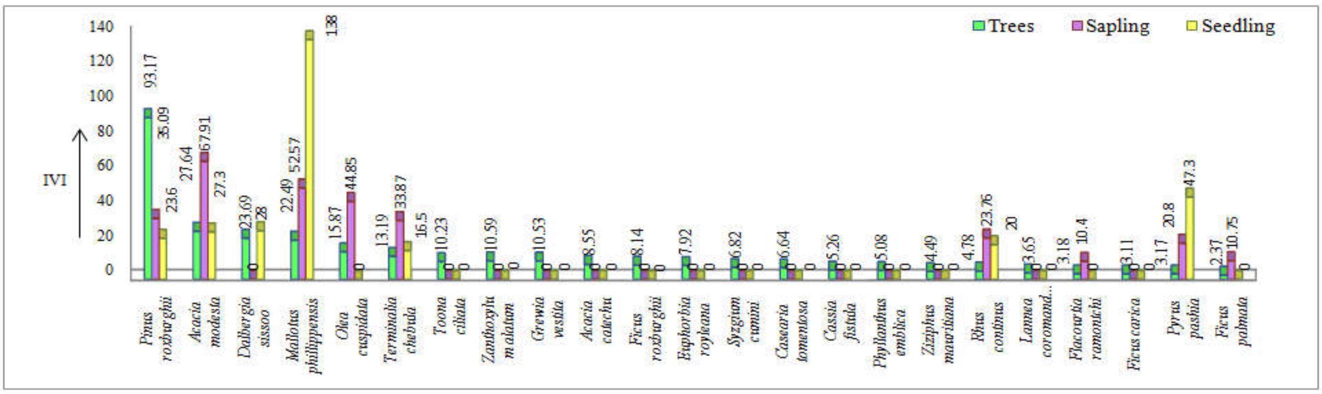

Fig.1 (b) Southern aspect

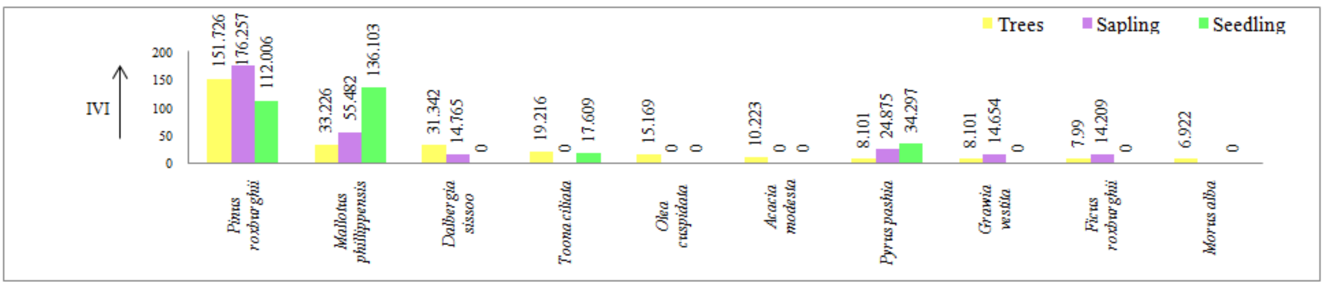

Fig.1 (a & b): Representing the diversity & regeneration status in terms of IVI of Northern and Southern aspects of S1

Southern aspect, *Pinus roxburghii* again showed its dominance by showing highest density 6.5 indi. /100m^2 and IVI 248.57 while *Mallotus philippensis* was the second species found in Southern aspect having density 0.7indi./100m^2 and IVI 52.37. While in sapling layer *Pinus roxburghii* had maximum density 2.6ind./100m^2 and IVI 223.09.

Seedlings

In SI highest density of seedling 3.4indi./100m^2 was shown by *Mallotus philippensis* and lowest by *Rhus cotinus* (0.3indi./100m^2)in Northern aspect. While in Southern aspect *Pinus roxburghii* had highest density (0.9indi./100m^2) and lowest by *Toona ciliata* (0.1 indi./100m^2). In S2 highest density was shown by *Pinus roxburghii* (2.6indi./100m^2) and lowest by *Grewia vestita* (0.4indi./100m^2) in Northern aspect. While in Southern aspect highest density was in *Pinus roxburghii* (1.2indi./100m^2) and lowest by *Terminalia chebula* (0.1indi. /100m^2).

Shrubs

In S1 density ranged from 0.3-9.2 indi. /100m^2 and IVI 4.77 to 94.10 in Northern aspect among these *Carissa spinarum* was the dominant species having highest density (10.5 indi./100m^2 and IVI 94.10), while lowest value represented by *Ziziphus* and *Woodfordia*, while in Southern aspect *Carissa spinarum* again showed the dominance having highest density (7.7indi./100m^2 and IVI 162.13). In site II shrubs found only in Northern aspect i.e., *Carissa* and *Woodfordia* while in Southern aspect no shrubs were found (shown in Table 3.).

DISCUSSION

The vegetation of Nowshera block was very diverse and similar to other Indian Himalayan forests. The geographical location, climate and topography of the block have contributed to its characteristic vegetation and flora. In S1 more diversity of woody plants was reported in Northern aspect as compared to Southern aspect. In trees, *Pinus roxburghii* was the dominant species in all the aspects and in S1 it showed more diversity in Southern aspect as compared to Northern aspect than Southern aspects. Besides these plants some other plants in foot hills make the broad leaf forest, i.e., *Mallotus philippensis*, *Olea cuspidata*, *Grewia vestita, Zanthoxylum alatum, Ziziphus mauritiana* (Osmaston, 1926), *Dalbergia sissoo* etc.(Shown in Table1,2 & Fig.1,2 (a&b), While in S2 more diversity of woody plants was reported in Northern aspect as compared to Southern aspect. *Pinus roxburghii* showed its dominance in both the aspects but it had more density in Southern aspect as compared to Northern aspect. Besides *Pinus roxburghii*, *Mallotus philippensis* was co-dominant Species in both the aspects of S2 (fig.2.a & b).

The regeneration status of trees in both the sites (S1&S2) was studied by using following guidelines (Ajay Koul, 2008). Good regeneration; if Seedling>Sapling>Adults; Fair

Fig.2 (a) Northern aspect

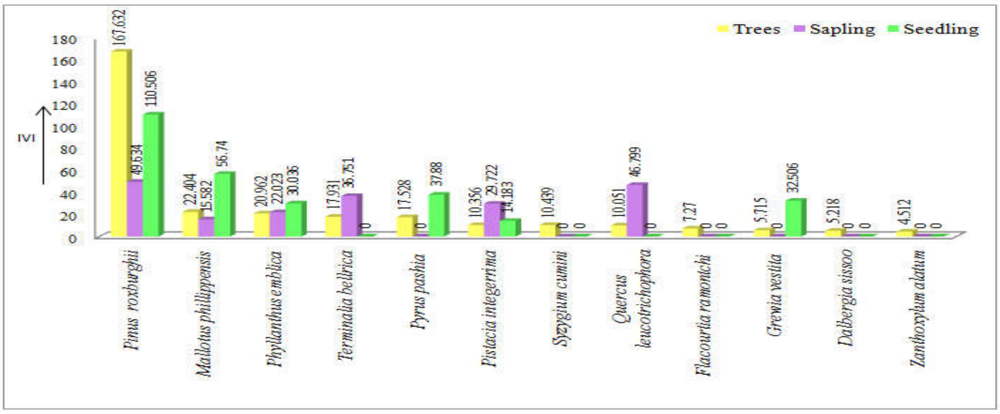

Fig.2 (b) Southern aspect

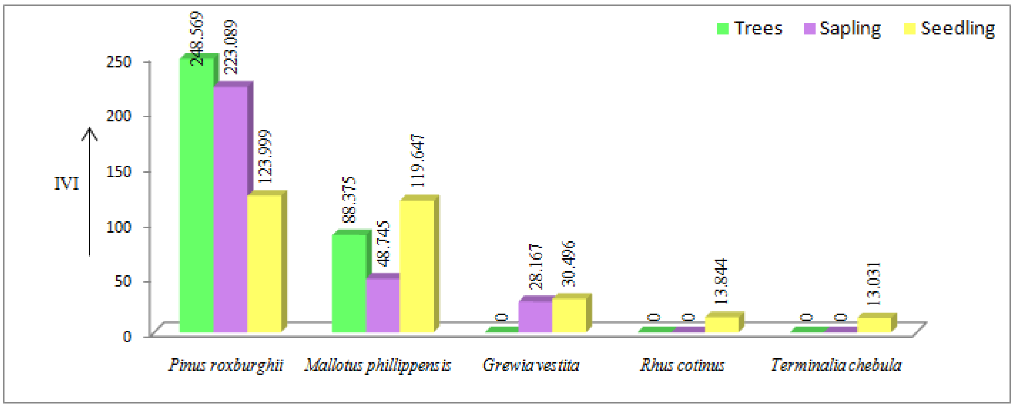

Fig.2 (a& b): Showing the diversity and regeneration status in terms of IVI of Northern and Southern aspects of S2

regeneration, if Seedling > or ≤ Sapling ≤ Adults; poor regeneration only by Sapling stage but no Seedling. If species is present in adult stage it is considered as no regeneration. In S1 of study area *Mallotus philippensis* had good regeneration in both the aspects and *Acacia modesta* showed fair regeneration in Northen aspect while *Pinus roxburghii* exhibited poor regeneration in Northern aspect as compared to Southern aspect. Some species of S1 had poor regeneration while other showed no re generation (Table:1,2 & Fig.1a&b.). In S2 *Pinus roxburtghii* had fair regeneration in both the aspects and *Mallotus philippensis* showed good regeneration in both the aspects. The plants like *Grewia, Terminalia* and *Rhus* showed new regeneration (only Seedling and Sapling

in both the sites and aspects. (Table1,2&3.). The occurrence of contagious distribution in natural vegetation was also reported by various workers from the different areas of the World (Kreshaw, 1975; Odum, 1971, Greig smith, 1957).

Conclusion

Hence, we may conclude that the study area needs a complete protection from biotic interferences, deforestation, grazing and human activities so that the natural vegetation can occur again. The Forest Department should take active action against the local inhabitants which are involved in cutting of forest for earning their livelihood.

Fig.3 (a).S1.

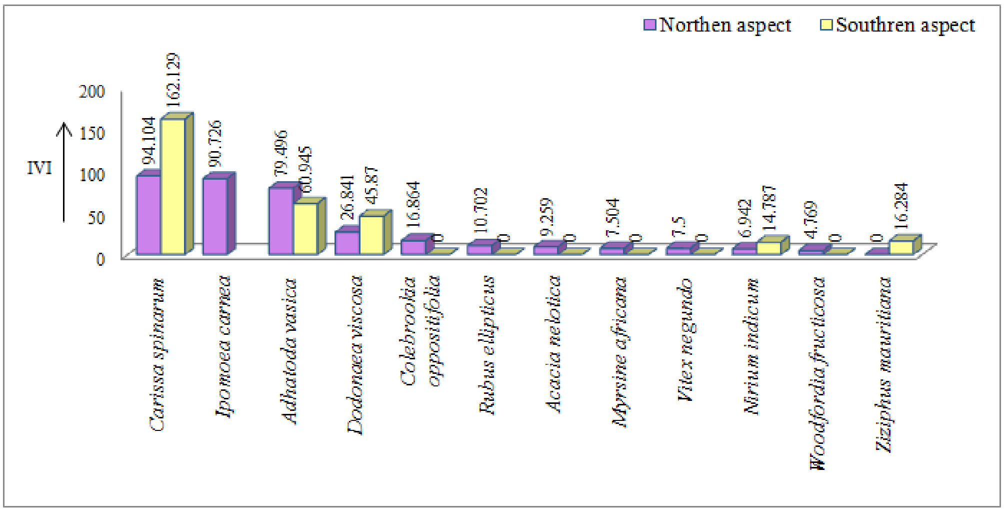

Fig.3(b).S2.

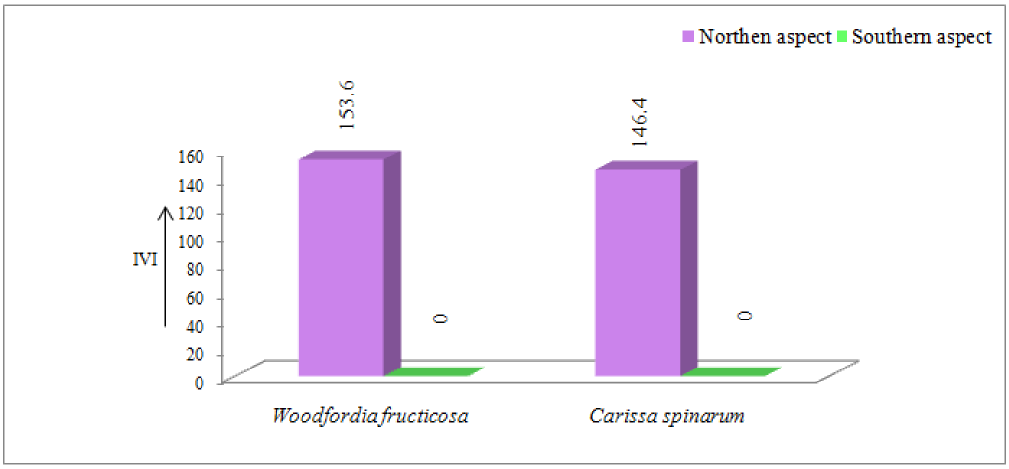

Fig.3(a) & (b): Showing the diversity of shrubs in terms of IVI in Northern and Southern aspects of S1 &S2.

were reported from the study area and no adult plant was found)(Table 1,2& Fig.2 a&b). In both the sites (S1 &S2), shrubs had more diversity in Northern aspect as compared to Southern aspect. In S2 the shrubs were reported only in Northern aspect and no shrubs were present in Southern aspect this may be due to the allelopathic effect and anthropological disturbance in southern aspect. (Table 3 & Fig.3 a&b). In Study area most of the trees species exhibited contagious distribution. But species like *Dalbergia sissoo and Mallotus philippensis* showed random and regular distribution in both the sites (S1 &S2). The Shrubs showed contagious distribution

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