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Van Panchayats as an Effective Tool in Conserving Biodiversity at Local Level

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ABSTRACT

Forest vegetation of a community managed forest was studied along four aspects. Quercus leucotrichophora and Pinus roxburghii was the dominant species on each of the two aspects. Across the aspects the total tree density ranged between 193 *to* 324.3 *ind/ha, sapling density between* 119 *to* 258.6 *ind/ha and seedling density from* 249.98 *to* 845 *ind/ha. The shrub density varied from* 199.99 *to* 406.32 *ind/ha and herb density from* 9466.66 *to* 52483.33 *ind/ha. The total basal area varied from* 0.06 *to* 7.15 m^2*/ha at eastern and north facing aspect for Quercus leucotrichophora and Pinus roxburghii respectively showing that the forest is in young stage. Species diversity value for tree layer varied from* 0.21 *to* 1.23 *while concentration of dominance value ranged from* 0.56 *to* 0.94. *It was noticed that with an increase in species diversity concentration of dominance value decreases indicating inverse relationship between diversity and dominance.*

Keywords*: *Van Panchayat, Aspect, Diversity, Bhatkholi, Community Managed Forest

1. Introduction

The Central Himalaya, accounts for 8.68% of the total Indian Himalayan area (59436 km^2) and harbours rich biodiversity due to geographical and geological peculiarities subtending a wide range of vegetation types [1]. The Himalayan biodiversity is severely threatened by natural and anthropogenic means. The various disturbances present in the area are eroding this rich biological diversity day by day and have led to the expansion of xerophytic conditions [2]. The majority of the population in the region is agricultural and pastoral. Forests present around the agricultural fields are highly degraded due to continuous anthropogenic disturbances. Villagers frequently graze their cattle in the adjoining forest which influence the pressure beside this accidental fire also the main cause for degradations the forest. The exploitive management practices and the biotic stress exerted by hill population in relation to oak species have encouraged the pine in various ways [3]. Much of the area now occupied by pine was originally under the potential natural vegetation of oaks [4]. Conversion of oak forests to pine is still proceeding on larger scale this trend may lead to ultimate disappearance of the oak forest from the region. A reversal of this trend requires a through evaluation of current management practices including local people participation. The proportion of the old growth forests are being removed at a faster rate than young forests are being constituted, as a result the proportion of the middle aged forest is not stabilized, but is instead increasing [3]. In order to maintain such a structure of forests indefinitely, heavy subsidy in the form of cultural practices is required. Conservation of biological resources under community based conservation system is a key tool to lessen the depletion of biodiversity. Various programmmes have been implemented, for the conservation of biological resources in the Indian Himalaya under the protected area network.

The active participation and involvement of local people either at community or individual level is essential towards conservation of the forest and other natural resources. The Van Panchayats represent one of the largest and most diverse experiments in devolved common property management ever developed [5]. Most of the Van Panchayat in Uttarakhand were initiated after formation of Van Panchayat Act in 1931, on degraded sites under the control of the State Revenue Department. The Van Panchayats have been sustainably managing their forests for decades without any financial support. According to recent estimates, there are about 12,089 Van

Panchayats managing an area of 544965 hectares. The area under each Van Panchayat ranges from a fraction of a hectare up to over 2000 hectares [6]. The Community forests managed in accordance with Van Panchayat Act is a hybrid of state ownership and community responsibility. In contrast to civil forests, community forests are not open forests. Access and use of forests is guided by rules elaborately designed and implemented by the communities. A major objective of Van Panchayat is to rejuvenate and manage patches of civil soyam forests for local use; it also prevents neighbouring villages from intruding into this zone, once formally demarcated as a Van Panchayat forest.

In the present study we have tried to access the importance of management practices of the Van Panchayat on conserving and regenerating forest under their control.

2. Materials and Method

The present study has been carried out in the Van Panchayat forest of Bhatkhoi situated between 29°32.98'-29°34.32' N latitudes and 79°41.44'-79°43.2' E longitude of Lamgara Developmental Block of Almora District (Uttarakhand), where villagers put efforts to conserve the surrounding forest (approximately 10.12 ha). The basic climate pattern is governed by the monsoon rhythm. The annual rainfall varied from 832.0 mm to 921.9 mm, mean maximum temperature from 16.7℃ to 32.6℃ and the mean minimum temperature from 5.8℃ to 19.5℃ [7]. Rock types mainly comprises of schist, micaceous quartizimeta morphism, plutonic bodies of granodiorites and granites [8]. The vegetation type mainly comprises Himalayan moist temperate oak forest, subtropical pine forest. The dominated tree species of the Van Panchayat are *Quercus leucotrichophora*, *Pinus roxburghii*, *Rhododendron arboreum*, and *Myrica esculenta*. Information regarding the vegetation was collected through questionnaires which will be distributed to the villagers of the Van Panchayats. The house holds were selected randomly on the basis of number of family members and categorized in to small (< 4), medium (5-9) and larger (> 10). Estimations also made by actual observations of the number of head loads removed daily, actual number of days in a year in which collection is done, number of hours and the frequency of collection by each family. Four aspects south west, east, north west, and north were identified with in each aspect trees were analysed by placing randomly 10,100 m^2 circular quadrats, the size and number of samples was determined following [9]. Sapling, seedling and shrub were studied in 10, 5 × 5 m^2 quardrats placed randomly. The vegetational data were calculated for density, frequency, abundance [10]. Importance value index for trees was determined as the sum of the relative density relative frequency, relative dominance [11]. Individuals of the tree species were divided in to three classes, Trees were consider to be individual > 30 cm cbh (Circumference at breast height), Sapling 10-30 cm cbh and seedling < 10 cm cbh [3]. Species richness was determined following [12]. Species diversity was computed by using Shannon-Wiener's Index [13] and Concentration of dominance (CD) was calculated following [14].

3. Results

3.1. Tree Layer

The total tree density ranged between 193 to 324.3 ind/ha and total basal area ranged between 5.26 and 9.41 m^2/ha among all the aspects (**Table 1**). The highest tree density was that of *Pinus roxburghii* (275 ind/ha) at north facing aspect, where the lowest tree density was that of *Rhododendron arboreum* and *Quercus leucotrichophora* (6.6 ind/ha each) at north west and eastern aspect respectively. The *Pinus roxburghii* was the most dominant species in term of the total basal area and IVI (7.15 m^2/ha and 287.97%) at north and eastern aspect respectively. Species diversity value for trees varied from 0.21 to 1.23 at east and north west facing aspect where as the concentration of dominance value ranged from 0.56 to 0.94 on north west and eastern aspect.

3.2. Sapling Layer

The total sapling density ranges from 119 to 258.6 (ind/ha) at eastern and north west aspect. Across all the aspect the total sapling density of individual species ranged from 6.6 ind/ha to 173 ind/ha each at north west aspect for *Pinus roxburghii* and *Quercus leucotrichophora*. The most dominant species was *Pinus roxburghii* (IVI = 228.71%) at eastern aspect, however the total basal area was highest for the same species (0.49 m^2/ha) at northern aspect (**Table 2**). Species diversity value for sapling layer varied from 0.75 to 1.32 which was highest on north west aspect and lowest on east where as the concentration of dominance value ranged from 0.45 to 0.66 at south west and eastern aspect (**Table 3**).

3.3. Seedling Layer

The total seedling density varied from 249.98 to 845 ind/ha at north and north west aspect respectively. The seedling density was highest for *Quercus leucotrichophora* at the north west aspect (626 ind/ha) and lowest on north facing aspect for *Quercus leucotrichophora* (16.66 ind/ha). Species diversity value for seedling layer varied from 1.06 to 1.64 on south west and north facing aspect respectively while the concentration of dominance value ranged from 0.09 to 0.58 on north and north west aspect respectively (**Table 3**).

Table 1. Vegetational parameters for tree and sapling layers.

Aspect	Species	Tree			Sapling		
		Density (ind/ha)	TBA (m^2/ha)	IVI (%)	Density (ind/ha)	TBA (m^2/ha)	IVI (%)
South West	*Quercus leucotrichophora*	153	4.13	219.84	86	0.34	160.32
	Pinus roxburghii	20	0.32	35.17	60	0.28	116.63
	Myrica esculenta	20	0.84	45	13	0.03	23.04
	Total	**193**	**5.29**	**300**	**159**	**0.658**	**299.99**
North West	*Quercus leucotrichophora*	173	4.33	182.59	173	0.6	192.16
	Rhododendron arboreum	6.6	0.86	21.08	53	0.18	42.63
	Pinus roxburghii	26	0.41	38.89	6.6	0.02	53.07
	Myrica esculenta	33	1.09	57.44	26	0.18	12.13
	Total	**238.6**	**6.69**	**300.00**	**258.6**	**0.98**	**299.99**
East	*Quercus leucotrichophora*	6.6	0.061	12.04	26	0.11	71.28
	Pinus roxburghii	200	5.2	287.97	93	0.34	228.71
	Total	**206.6**	**5.26**	**300**	**119**	**0.45**	**299.99**
North	*Quercus leucotrichophora*	8.3	0.15	11.31	40	0.1	68.52
	Rhododendron arboreum	16	0.74	27.1	-	-	-
	Pinus roxburghii	275	7.15	225.05	93	0.49	192.74
	Myrica esculenta	25	1.37	36.53	13	0.03	38.73
	Total	**324.3**	**9.41**	**300**	**146**	**0.62**	**299.99**

3.4. Shrub Layer

The shrub density is highest for *Pyracantha crenulata* (366.66 ind/ha) at north west aspect while lowest 6.66 ind/ha each for *Urtica dioica*, *Carex nubigena* and *Berberis asiatica* at south west, north west and east facing aspect respectively (**Table 2**). The Species diversity value was highest on north west facing aspect (0.63) and lowest on north west aspect (0.21), however the concentration of dominance value varied from 0.79 to 0.93 on north and east aspect respectively.

3.5. Herb Layer

The total herb density varied from 7866.66 to 52,483.33 ind/ha at east and northern aspect respectively. Among all the aspect *Apluda mutica* was the most abundant herb present on all the four aspect having highest density value 11333.34 ind/ha on north west aspect. The least density were shown by *Ocimum americanum* (66.67 ind/ha) on the north west aspect. The Species diversity value was highest on south west (2.01) and lowest on north west aspect (0.84), however the concentration of dominance value ranged from 0.39 to 0.69 on south west and north west aspect respectively (**Table 3**).

3.6. Regeneration

The population structure of some dominant species is given in **Figure 1**. The seedlings and saplings of *Quercus leucotrichophora* were present on all the aspect. On eastern aspect number of *Quercus leucotrichophora* seedlings was higher where as saplings was higher on northern aspect. Trees of *Quercus leucotrichophora* were present in the younger girth classes (30-60 cm) indicating good regeneration status of this species while *Pinus roxburghii* saplings and seedlings were higher at south western aspect, similarly the majority of trees of this species was that of younger and in the girth class of 30-60 cm (**Figure 1(c)**). Conversion of seedlings to saplings and saplings to trees of *Quercus leucotrichophora* was satisfactory indicating well regeneration pattern and effective forest management.

4. Discussion

The value of total tree density (193 to 324.3 ind/ha) reported in the present study falls within the range values reported earlier by [6,15,16] for different central Hima-

Table 2. Density (ind/ha) for seedling, shrub and herb layers.

Species	Aspect			
Seedling	South West	North West	East	North
Quercus leucotrichophora	266	626	173	16.66
Rhododendron arboreum	-	20	-	33.33
Myrica esculenta	73	173	53	133.33
Pinus roxburghii	26	26	26	66.66
Total	**365**	**845**	**252**	**249.98**
Shrub				
Prinsepia utilis	13.33	-	-	-
Pyracantha crenulata	240	366.66	193.33	325
Urtica dioica	6.66	-	-	-
Berberis asiatica	-	20	6.66	33.33
Rubus ellipticus	-	-	-	8.33
Carex nubigena	-	6.66	-	-
Pyrus pashia	-	13	-	-
Total	**259.99**	**406.32**	**199.99**	**366.66**
Herb				
Apluda mutica	11200	11333.34	6933.34	6266.67
Galium aparine	800	-	-	266.68
Themeda anathera	2100	-	133.34	-
Rosea brocera	1000	-	-	-
Setaria homonyma	2200	-	-	-
Hypericum elodeoides	250	-	-	-
Anaphalis contorta	600	-	-	266.67
Desmodium podocarpum	800	200	666.67	533.34
Anaphalis busua	-	-	-	2266.68
Oplismenus compositus	-	2066.67	133.34	-
Micromeria biflora	-	133.34	-	-
Ocimum americanum	-	66.67	-	266.67
Carex nubigena	-	-	-	400
Total	**18,950**	**13,800**	**7,866.66**	**52,483.33**

layan oak and pine forest (280-1680 ind/ha). The saplings and seedling density of *Quercus leucotrichophora* were higher on north western aspect where as eastern aspect shows least density. The lower density on eastern was due to encroachment of fuelwood, fodder and animal grazing by villagers. Conversion of seedlings to saplings and saplings to trees of *Quercus leucotrichophora* was satisfactory indicating well regeneration pattern and effective forest management.

It is interesting that the previous research on chirpine indicates that pine is good reproducer not only in its own forest but also in other forest [9] and the replacement of

Table 3. Species diversity (SD), species richness (SR) and concentration of dominance (CD) along different aspects.

Aspect	Parameter	Vegetation layer				
		Tree	Sapling	Seedling	Shrub	Herb
South West	SD	0.94	1.31	1.06	0.47	2.01
	CD	0.65	0.45	0.57	0.85	0.39
	SR	3	3	3	3	9
North West	SD	1.23	1.32	1.17	0.63	0.84
	CD	0.56	0.51	0.58	0.87	0.69
	SR	4	4	4	4	5
East	SD	0.21	0.75	1.19	0.21	1.21
	CD	0.94	0.66	0.53	0.93	0.57
	SR	2	2	3	2	4
North	SD	0.84	1.24	1.64	0.59	1.74
	CD	0.72	0.49	0.09	0.79	0.43
	SR	4	3	4	3	7

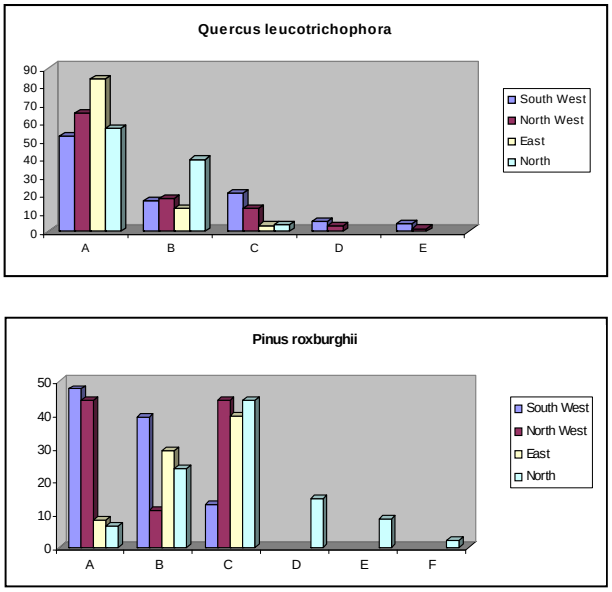

Figure 1. Population structures of two dominant species at different aspects; the relative density is on y-axis and the girth classes on x-axis; A = Seedlings, B = Saplings, Trees-C = 30-60 cm, D = 61-90 cm, E = 91-120 cm.

the oak forest by pine has become a common and ever-increasing phenomenon [3], however from this study it is clear that if the forests are management properly the banj-oak will not disappear in near future. The total basal area of the present study for tree layer varied from 5.26 and 9.41 m^2/ha. This pattern of total basal area was similar to the pattern reported earlier by [9,17,18], (35.02 to 83.77 m^2/ha) for different oak forests of Kumaun Himalaya. The lower total basal area of the present study shows that the forest is in young stage. The Species diversity of tree layer of the present study varied from 0.21 to 1.23 while concentration of dominance value ranged from 0.56 to 0.94. These values are generally comparable with the values reported earlier by different workers for temperate forests [16,19,20]. Tree species richness were higher in north and north west aspect where as seedling species richness were higher north west and north facing aspect respectively. Where as the herb richness were higher on south west. It is a well known fact that the altitude and aspect represents a complex gradient along which many environmental variables change concomitantly. The ecosystem functions, distribution and occurrence of species had been affected by human interventions [2]. Among human influence, commercial exploitation, agricultural requirements, forest fire, and grazing pressure are the important source of disturbance [21]. However if the forest are managed properly with the involvement of the local community condition of their forest has been improved and the forests are free from heavy anthropogenic disturbances which also helpful for mitigating climate change and carbon trading.

Once the people start realizing that the carbon of their forests is saleable they will be motivated to conserve them. Thus, management of natural resources by the community becomes more evident keeping in minds its utility value and benefits to the communities. Forests of Uttarakhand are huge natural resource that could be tapped to eradicate rural poverty. It could be managed in a way to contribute more significantly towards rural livelihoods than at present. It is not possible to conserve these forests for long without participation of the community this would enable them to save the carbon sinks of Uttarakhand.

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