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Original Research Paper

Ecological Analysis of Some Woody Species of Mine Affected Areas of North-West Himalayas

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ABSTRACT

The phytosociological analysis of woody species of the mine affected areas of north-western Himalayas at two sites, supporting three tree species, *Cedrus deodara*, *Pinus roxburghii* and *Quercus leucotrichophora,* indicated that the total basal cover varied from 925.03 to 4149.40 cm^2 per $100m^2$, and density from 0.5 to 1.8 trees per $100m^2$. The distribution pattern was random for most of the species.

INTRODUCTION

In Himalayan region, distinct vegetation communities exit in different altitudinal range (Saxena et al. 1978, Pandey & Singh 1991a & b, Saxena & Singh, 1981 &1982, Ralhan et al. 1982, Singhal et al. 1986, Singhal & Soni 1989). However, the quantitative information with regard to their proportion and particularly with changing land use pattern is not available. The present study is an endeavour in this direction and provides quantitative information with regard to vegetation in mine affected areas of north-western Himalayas.

MATERIALS AND METHOD

The study was carried out at two different sites.

Site-A: It lies in between longitude 77°30'to77°45'E and latitude 30°30' to 30°45'N at Sirmour district in Himachal Pradesh. The annual rainfall ranges from 1200-1800 mm, most of which is received during monsoon. May and June are the driest months with day temperature going above 40°C. The climate of the area varies from tropical to temperate.

Site-B: It is located between longitude 78°7.5' to 78°15'E and latitude 30°17.5' to 30°22'N in the district of Tehri Garhwal (Uttaranchal). Climatologically, the area lies in the sub-tropical zone having annual rainfall of 2200 mm. Mean summer temperature is 17.5°C, and mean winter temperature 0.9°C. The other details of the sites are given in Table 1.

Six study sites (three each in sites A and B) were selected. The phytosociological analysis was done on 10 running quadrats (10m × 10m) for all the 6 sites. Care was taken to sample the most representative area. Girth at breast height (GBH at 1.37m above ground level) for all the woody species with > 15cm GBH was measured in each quadrat and recorded individually per species.

Vegetation data were quantitatively analysed for frequency, density and abundance according to formulae given by Curtis & McIntosh (1950). The relative frequency, relative density and relative

abundance were determined following Phillips (1959). These three relative values were added to get importance value index (IVI). To get the distribution pattern of species, abundance to frequency ratio (A/F) of species were determined.

RESULTS AND DISCUSSION

The analytical characters of the species are presented in Table 2. A total of six sites described in the text are as *Cedrus deodara* forests (sites 1 & 2), *Pinus roxburghii* forests (sites 3 & 6) and *Quercus leucotrichophora* forests (sites 4 & 5).

***Cedrus deodara* forests (sites 1 & 2):** These forests were studied at two localities at site-A with same altitude of 2200 m above m.s.l. with different aspects (north and north-east). They were monospecific forests and showed absolute dominance in terms of TBC (total basal cover) and IVI. The TBC, MBC (mean basal cover) and IVI were 4149.30 and 3895.60 $cm^2/100m^2$; 2732.83 and 1385.13cm^2/tree and 300 respectively. The densities were 1.7 and 1.6 tree per $100m^2$ in the two sites.

***Quercus leucotrichophora* forests (sites 4 & 5):** These forests were studied at two localities at site-B with an altitude of 2000 and 2050m above m.s.l. and at north-east and south-east aspects. The main species was *Quercus leucotrichophora* and other species associated were *Rhododendron arboreum* and *Lyonia ovalifolia*. The TBC, MBC and IVI of *Quercus leucotrichophora* were 1925.03 $cm^2/100m^2$, 1280.31 cm^2/tree and 160.88 at site-4, whereas 2025.76 $cm^2/100m^2$, 1329.74 cm^2/tree and 153.67 at site-5 respectively. The densities were 1.20 and 0.90 tree per 100 m^2 in both the sites. The *Rhododendron arboreum* had 20.29 and 9135 $cm^2/100m^2$, 50.71 and 101.50 cm^2/tree and 75.21 and 146.33 MBC, TBC and IVI respectively. The densities were 0.40 and 0.90 tree per $100m^2$ respectively at the two sites. The MBC, TBC, IVI and density of *Lyonia ovalifolia* were 9.30 $cm^2/100m^2$, 31.00 cm^2/tree, 63.91 and 0.20 tree per $100m^2$ at site 4.

***Pinus roxburghii* forests (sites 3 & 6):** The pure patches of monospecific forest of *Pinus roxburghii* were situated at an altitude of 1750 m at site-3 (Site-A) and 1900 m at site-6 (Site-B) and north-east and south-east aspects. These forests exhibited an absolute dominance in terms of TBC and IVI. However, MBC was 1075.00 cm^2/tree (site-3) and 280.31 cm^2/tree (site-6), whereas the density was 1.1 tree per $100m^2$ in the two sites respectively.

Several workers (Dabel & Day 1977, Killingbeck & Wali 1978, Saxena & Singh 1982) have reported the values of TBC and density varying from 1561 to 5930 $cm^2/100m^2$ and from 3.5 to 20.8 tree/$100m^2$ respectively for temperate forests. Ralhan et al. (1982) reported the value of TBC and density varying between 2686 and 6045 $cm^2/100m^2$, and 3.89 and 16.33 tree/$100m^2$ for temperate forests of Kumaon Himalayas. Singhal et al. (1986) also reported that the value of TBC and density varied between 1455 and 5672 $cm^2/100m^2$, and 0.7 and 3.7 tree/$100m^2$ for temperate forests of Chakarata Himalayas. The values of TBC and density in the present study are more or less within the reported range.

Distribution Patterns: According to Kershaw (1973) the most likely situation, which produces regular distribution, is one where there is high density of individuals within a uniform area. However, the analysis of distribution pattern of various species indicates that in these stands the tree species are distributed randomly, as also reported by Saxena & Singh (1982) the general preponderance of random distribution for forest communities of Kumaon Himalayas (U.P.), and by Singhal et al. (1986) for the temperate forests of Chakarata Himalayas (U.P.).

Table 1: General description of sites.

Name of species	Location	Pre-dominant		Altitude(m)	Slope		Soil depth	Aspect	Predominant lithology
		Upper storey	Under wood		Shape	Degree (%)			
Site-A, Paonta									
Cedrus deodara	Banol	C. deodara	*C. deodara*	2250	Convex	45	V. deep	North	Limestone
C.deodara	Baldwa	*C. deodara*	*C. deodara*	2200	Convex	45	Deep	North-East	Limestone
Pinus roxburghii	Shilla	*P. roxburghii*	*P.roxburghii*	1750	Convex	35	Deep	North-East	Limestone
Site-B, Chipaldi									
Quercus leucotrichophora	Dhaulagiri	*Q. leucotrich-ophora*	*R. arboreum* *Lyonia ovalifolia*	2000	Convex	35	Deep	North-East	Slate
Quercus leucotrichophora	Dandagaon	*Q. leucotrich-ophora*	*R. arboreum*	2050	Convex	30	Deep	South-East	Phyllite
Pinus roxburghii	Stengal	*P. roxburghii*	*P. roxburghii*	1900	Convex	25	Shallow	South-East	Granite & Schist

Table 2: Quantitative characters of tree species.

Site no.	Name of species	Frequency (%)	Density tree (tree/100m^2)	Abundance	A/F ratio	Mean Basal Cover (cm^2/tree^1)	Total Basal Cover (cm^2/100m^2)	Relative Frequency	Relative Density	Relative Dominance	IVI
Site-A, Paonta											
1	*C. deodara*	100	1.8	1.7	0.017	2732.83	4149.30	100	100	100	300
2	*C. deodara*	100	1.5	1.6	0.016	1385.13	3895.60	100	100	100	300
3	*P. roxburghii*	100	1.1	1.1	0.010	1075.00	1103.20	100	100	100	300
Site-B, Chipaldi											
4	*Q. leucotrichophora*	90	1.2	1.3	0.01	1280.31	1925.03	60.00	66.67	34.21	160.88
	R. arboreum	40	0.4	1.0	0.03	20.29	50.71	26.67	22.22	22.26	75.21
	L. ovalifolia	20	0.2	1.5	0.08	9.30	31.00	13.37	22.22	22.39	63.91
5	*Q. leucotrichophora*	90	0.9	1.5	0.02	1329.74	2025.76	60.00	50.00	43.67	153.67
	R. arboreum	60	0.9	1.29	0.02	91.35	101.50	40.00	50.00	56.33	146.33
6	*P. roxburghii*	100	0.5	1.1	0.010	280.31	925.03	100	100	100	300

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