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Analysis of Anthropogenic Pressure on Forests of Kumaun Region

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Abstract – The current examination manages structure, variety and recovery of Sal (Shorea robusta Gaertn.) backwoods in Kumaun locale of Central Himalaya. Two timberland types were explored for example Sal prevailing backwoods and Sal teak (Tectona grandis Linn.) blended woods in Kumaun Himalaya. Tree, sapling and seedling thickness was 650-911, 36-1303 and 400-6656 ind.ha-1, individually. Sal demonstrated opposite J-molded bend speaking to great recovery and T. grandis demonstrated opposite chime molded demonstrating reasonable recovery in network the board framework while Sal indicated helpless recovery in the public authority the executive's backwoods. Sal indicaed similarly great recovery in Sal blended in network oversaw woodland while helpless recovery in Sal prevailing government the executive's framework. Over misuse of Sal species for essential requirements of individuals therefore give the negative effect on recovery of timberland. Accordingly it is proposed that in blended timberlands in with higher number of species diminishes the tension on individual species as brought by neighborhood individuals so that woodland ought to be overseen and preserved reasonably.

Key Words: Shorea Robusta; Tectona Grandis; Density; Species Diversity; Regeneration; Van Panchayat.

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INTRODUCATION

The Himalayan backwoods vegetation goes from tropical dry deciduous woodland in the lower regions to snowcapped glade above tree line (Singh and Singh, 1992). Organization of the backwoods is different and fluctuates all around in view of shifting geography, for example, fields, lower regions and upper mountains (Singh, 2006). Monetarily and ecologically, the normal assets are the principle hotspot for individuals in this locale (Ram et al., 2004). Moreover, ecological issues are especially recognizable in this locale as a type of corruption and consumption of the woods assets (Sati, 2005). Backwoods are predominantly overwhelmed by chir-pine and oak species. Exceptionally assorted compositional example of backwoods normal for focal Himalaya, has been investigated by Singh and Singh (1987). Other than the biological system works the dispersion and event of species had been influenced by human intercessions (Singh and Singh, 1987). Among human impact, business misuse, rural prerequisites, woodland fire, and touching weight are the significant wellsprings of aggravation (Singh and Singh, 1992). Vegetation assumes a significant job in soil arrangement (Chapman and Reiss, 1992). Plant tissues (from over-the-ground litter and subterranean root garbage) are the fundamental wellspring of soil natural issue, which impacts physiochemical qualities of soil (Johnston, 1986) coming about contrasts in plant network structure and creation (Ruess and Innis, 1977). Prior examinations in the Kumaun district has been investigated on different perspectives that is, about the backwoods vegetation by following (Singh and Singh, 1987; Dhar et al., 1997), altitudinal variety (Saxena et al., 1985; Adhikari et al., 1995; Kharkwal et al., 2005), phytosociology (Ralhan et al., 1982, Saxena and Singh, 1982) and populace structure (Saxena et al., 1984; Singh et al., 1987). The primary goal of this paper is to portray underlying ascribes of the tree, bush and spice species in various timberland destinations.

Woodlands of Himalaya assume critical part for maintainable advancement of the locale as they give lumber and tar to enterprises as well as satisfies the fundamental requirements of townspeople, for example, fuel, little lumber, grain, and other minor items living close by zones. Woods region and timberland cover represented around 65 and 46 percent in the Uttarakhand. In Kumaun locale, woods cover is 40.3 percent of the state's woodland cover. The most extreme backwoods are being overseen by foresters while a little zone (20%) is under the administration control of town local area normally known as Van Panchayat woods. The reliance of slope individuals for their fundamental requirements lies just in local area oversaw (Van Panchayat) woods in light of exacting principles actualized by the public authority timberland office. Thusly in local area oversaw woodlands the asset extraction pressure are developing consistently, therefore affecting the presence of such backwoods as the timberland destinations contain extremely modest number of

usable plant species. In our examination locales, Sal is one of the prevailing backwoods networks in Shiwalik of Kumaun area in Uttarakhand.

This locale is likewise generally populated and having distinctive advancement exercises hence the backwoods in the zone are experiencing human and creature's pressing factor. Since most recent fifty years, such developing anthropogenic tension on backwoods and extension of foundation has prompted over abuse of widely varied vegetation. Preservation of organic assets under local area based protection framework is a vital device to reduce the consumption of biodiversity. In numerous piece of Central Himalayan area and somewhere else because of deforestation and backwoods corruption demonstrated that the variety, species sythesis and recovery of timberland tree species are being changed thus impacting the profitability and supportability of the woods environments.

The deforestation and over abuse exercises in backwoods gathered in the lower belt as well as extended in the upper piece of Himalayan woods overwhelmed with wide leaved and conifer timberland species. Populace design of tree species in a timberland passes on its recovery conduct, which is portrayed by the presence of adequate populace of seedlings, saplings and youthful trees for effective recovery.

MATERIAL AND METHODS

The examination locales are situated between 29°21' - 29°24' N scope and 79°25' - 79°29' E longitude in Nainital catchments in Kumaun area of focal Himalaya. A few subtleties of the examination destinations' qualities are given in Table 1. The atmosphere is rainstorm type, which happens from mid-June to mid-September. The normal measure of yearly precipitation is 2488mm/yr. The year is distinguishable into three seasons, blustery (midJune to mid-September), winter (October to April) and summer.

The present study has been carried out in Kotabagh Block forest of Nainital District in central Himalaya region of Uttarakhand, India. At the study site, two forest types i.e. Sal dominant and Sal mixed teak forest (Table 1).

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Table 1. General characteristics of the study sites.

Site	Elevation (m)	Forest type	Aspect	Dominant tree species
S1	1580 - 1700	Chir-pine	E, SW	*P. roxburghii*
S2	1700 - 1800	Chir-pine	NE	*P. roxburghii*
S3	1800 - 1950	Banj-oak	E, W	*Q. leucotrichophora*
S4	2000 - 2300	Tilonj-oak	E, SW	*Q. floribunda*
S5	2300 - 2600	Kharsu-oak	NE, NW	*Q. semecarpifolia*

E, east; SW, southwest; NE, northeast; W, west; SW, southwest; NW, northwest.

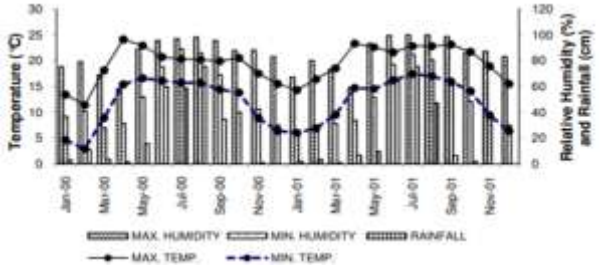

Figure 1. Ombrothermic graph for the study region (Source: State Observatory, Manora Peak, Nainital).

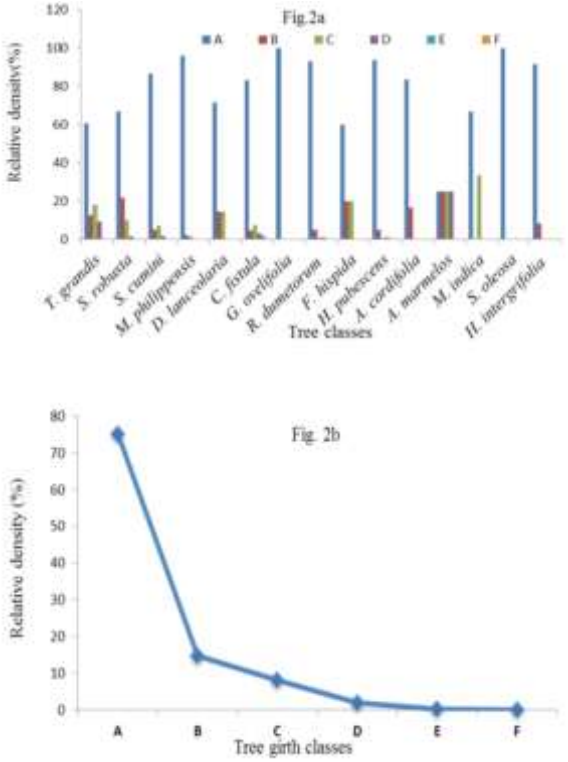

Fig. 2: Population structure fig.2a and regeneration of tree species fig.2b in community managed forest. Different size tree girth classes i.e. A= seedling 0-10.0cm, B= sapling 10.1-30.0cm, C=30.1- 60.0cm, D=60.1-90.0cm, E= 90.1-120.0cm and F=120.1cm<

(May to mid-June). Spring and harvest time are the change zones. Snowfall is continuous throughout the cold weather months (December - February). The mean month to month most extreme temperature went from 13.0 to 23.7°C. The mean month to month least temperature changed somewhere in the range of 4.9 and 16.6°C (June). The low temperature esteems happened in February and high in July (Figure 1). Soil dampness (0 - 30 cm) fluctuated from 42 to 57% in the stormy season. Soil pH was in the scope of 5 to 6 showing the acidic idea of the dirt. Level of sand, residue and mud fluctuated from 50 to 65%, 17 to 30% and 11 to 28%, individually. Natural issue and water

holding limit went from 3 to 5% and 55 to 80%, individually. The stones of Nainital have a place with Krol arrangement. The pyretic, carbonaceous rocks uncovered in banj-oak woodland have a place with the Infra Krol Member. The limestone rocks of tilonj-oak timberland are as disconnected gigantic squares and kharsu-oak woodland has a meager layer of limestone followed by a solitary shale or record arrangement with interbedded obligations of sand-stones and limestone with dolomite or siliceous in nature (Valdia, 1983). Phytosociological investigation of tree and bush species in each testing site was done arbitrarily by utilizing 15 10 × 10 and 5 × 5 m 2 quadrats, separately. The size of the quadrats was controlled by the running mean technique (Kershaw, 1973). Species region bend was created for spice species (Kharkwal, 2002) and it was inspected arbitrarily by utilizing 15 1 × 1 m 2 quadrats in each woods site. Vegetational information were examined following Curtis (1959) and A/F proportion by Whitford (1949) for the appropriation design. As per Curtis and Cottam (1956), the proportion of wealth to recurrence underneath 0.025 shows standard dissemination, somewhere in the range of 0.025 and 0.050 ndicates arbitrary conveyance and when surpasses 0.05, demonstrates infectious appropriation.

RESULTS AND DISCUSSION

Tables 2a and b shows factual investigation between various boundaries. Critical connection ($P < 0.05$) found between soil dampness versus thickness (Tree, bush and spice). Also, there is huge connection ($P < 0.05$) between soil carbon versus tree and spice thickness (Td and Sd), and soil natural issue versus spice thickness (Hd). Spice thickness demonstrated a positive connection to tree thickness ($P < 0.01$) while it indicated a negative connection among tree and bush thickness ($P < 0.01$). Hussain et al. (2008) and Sharma et al. (2009) discovered comparable connection among vegetational and soil boundaries. Recurrence is a proportion of the consistency of the conveyance of an animal categories; in this manner a low recurrence demonstrates that an animal categories is either unpredictably circulated or uncommon in a specific stand or woods. Recurrence appropriations of plant thickness, cover, biomass per unit territory, and tallness, as measures for communicating natural wealth and organic predominance of vegetation, have been utilized to portray species organization and spatial examples of vegetation in

Table 2a. Statistical analysis of soil and vegetational parameters one-way ANOVA.

Summary statistics				
Dataset	N	Mean	SD	SE
Data1_C	27	0.20444	0.0471	0.00906
Data1_clay	27	17.80741	4.802	0.92414
Data1_Hd	27	21.11556	10.58095	2.03631
Data1_Moisture	27	43.31111	10.16057	1.9554
Data1_Organicmatter	27	5.18148	0.61459	0.11828
Data1_Sand	27	57.20741	4.5969	0.88467
Data1_Sd	27	2.42963	2.02139	0.38902
Data1_Silt	27	24.47037	3.77948	0.72736
Data1_Td	27	6.97037	1.90401	0.36643

Table 2b. ANOVA.

ANOVA					
		Sum of mean			
Source	DF	Squares	Square	F Value	P Value
Model	8	82176.8884	10272.1110	328.11254	0
Error	234	7325.76087	31.3066704		

Invalid Hypothesis: The methods for all chose datasets are equivalent. Elective Hypothesis: The methods for at least one chose datasets are unique. At the 0.05 level, the populace implies are fundamentally unique.

Distinctive plant networks (Chen et al., 2008). In the current investigation, the predominant tree, bush and spice species base on recurrence (%) in various examining destinations are portrayed in Table 3. From this table it is clear that *Pinus roxburghii* was the predominant tree species followed by *Myrica esculenta* at S1 (east and southwest) site. At S2 (Southwest) site, *P. roxburghii* was the prevailing tree species followed by *Rhododendron arboreum. Quercus leucotrichophora* was the prevailing tree species at S3 (east and west) site followed by *Fraxinus micrantha, M. esculata and Cornus oblonga, Biota orientalis,* separately. S4 (East and Southwest) site was overwhelmed by *Quercus floribunda* followed by *Q. leucotrichophora* and *Quercus semecarpifolia* was the predominant tree species at S5 (Northeast and Northwest) site (Table 3). Essentially, *Eupatorium adenophorum* and *Cassia laevigata* were the prevailing bush species at S1 (East and Southwest) site. S2 (Southwest) and S3 (East and West) destinations were overwhelmed by *Boenninghausenia albiflora* and *Daphne cannabina*. *B. albiflora* and *Randia tetrasperma* were prevailing bush species at S4 (East and Southwest) site though S5 (upper east and northwest) site was overwhelmed by *Colquehonia coccinea* and *D. cannabina*, individually (Table 3).

The predominant spice species at S1 (east and southwest) site was *Ageratum haoustonianum*. S2 (Southwest) site was overwhelmed by *Neanotis calycina. Pilea umbrosa* and *Care cruciata* were predominant spice species at S3 (East and West) site. At S4 (East and Southwest) site, the prevailing spice species were *Thalictrum foliolosum* and *Pilea scripta* in any case; *Sanicula elata* and *Plectranthus striatus* were the predominant spice species at S5 (Northwest and Northeast) site (Table 3). The thickness and wealth recurrence proportion of tree, bush and spice species are portrayed in Figure 2. The complete thickness of tree, bush and spice species in various testing site went from 10 to 28.6 people (indv/100 m 2), 1.8 to 21.7 indv/25 m 2 and 28.1 to 103.7 indv/m 2 , individually. Tree thickness was most extreme at S3 (east) site and least at S5 (Northeast) site. Bush thickness was greatest at S5 (Northeast) site and least at S2 (Northeast) site though, spice thickness was most extreme at S2 (Northeast) site and least at S5 (upper east) site. The examination results got by Chen et al. (2008) shows that the thickness of any species in a given stand or

woods type relies generally on ecological conditions and the region covered by every individual stem. The complete bounty recurrence (AF) proportion of tree, bush and spice species in various testing locales went from 0.23 to 1.25, 0.25 to 1.79 and 3.4 to 27.3, individually. The proportion of tree species was most extreme at S1 (Southwest) site and least at S2 (Northeast) site. In the event of bush species the proportion was greatest at S5 (Northeast) site and least at S2 (Northeast) site

Table 3. Dominant and Co-Dominant Species in Different Forest Sites

Site	Tree species	Frequency (%)
S1_E	*Pinus roxburghii, Myrica esculenta*	100, 30
S1_SW	*P. roxburghii, M. esculenta*	100, 30
S2_NE	*P. roxburghii, Rhododendron arboreum*	100, 30
S3_E	*Quercus leucotrichophora, Fraxinus micrantha, M. esculenta*	100, 20, 20
S3_W	*Q. leucotrichophora, Cornus oblonga, Biota orientalis*	100, 20, 20
S4_E	*Quercus floribunda, Q. leucotrichophora, R. arboreum*	100, 50, 20
S4_SW	*Q. floribunda,Q. leucotrichophora*	100, 60
S5_NE	*Quercus semecarpifolia, Cedrus deodara, Cupressus torulosa*	100, 50, 40
S5_NW	*Q. semecarpifolia, Q. floribunda, Acer oblongum*	100, 50, 40
	Shrub species	
S1_E	*Eupatorium adenophorum Berberis asiatica, Pyracanthus crenulata*	50, 40, 30
S1_SW	*Cassia laevigata, Rubus ellipticus*	60, 50
S2_NE	*Boerninghausenia albiflora, Cotoneaster microphylla*	40, 30
S3_E	*Daphne cannabina, Hypericum cernuum, Indigofera heterantha*	50, 40, 20
S3_W	*D. cannabina, Berberis asiatica*	40, 30
S4_E	*B. albiflora, D. cannabina*	60, 50
S4_SW	*Randia tetrasperma, Celtis tetrasperma, I. heterantha*	60, 40, 30
S5_NE	*Colquehonia coccinea, Sarcococa hookeriana, I. heterantha*	70, 60, 50
S5_NW	*D. cannbina, Viburnum cotinifolium*	70, 50
	Herb species	
S1_E	*Ageratum haustonianum, Stachys sericea, Micromeria biflora*	86.7, 60, 40
S1_SW	*A. haustonianum, Bidens biternata, Urena Lobata*	100, 60, 30
S2_NE	*Neanotis calycina, Carex rubigena, Setaria glauca*	100, 53.3, 33.3
S3_E	*Pilea umbrosa, Oxalis corniculata, Achyranthes bidentata*	86.6, 53.3, 43.3
S3_W	*Carex cruciata, Erigeron karvinskianus, P. umbrosa*	60, 53.3, 40
S4_E	*Thalictrum foliolosum, Ainsleae aptera, Leucas lanata*	86.7, 53.3, 40
S4_SW	*Pilea scripta, Setaria homonyma, Justicia simplex*	100, 86.7, 73.3
S5_NE	*Plectranthus strictus, Sanicula elata, Syriotis rufinervis*	100, 86.7, 66.7
S5_NW	*S. elata, S. rufinervis, Erigeron karvinskianus*	86.7, 66.7, 46.7

However, the ratio for herb species was maximum at S3 (East) and minimum at S4 (Southwest) sites (Figure 2). Present study indicates that the tree, shrub and herb species are contagiously distributed in all forest sites. Similar findings has been reported by Greig-Smith (1957), Odum (1971), Kershaw (1973), Verma et al. (1999), Kumar

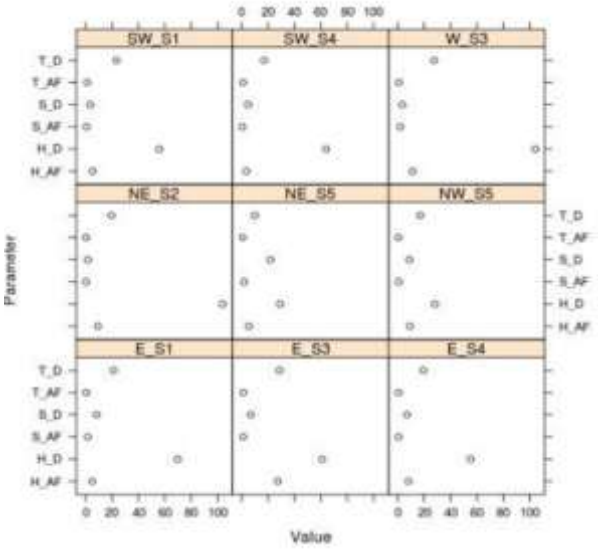

Figure 2. Distribution pattern in different forest sites (T, tree; S, shrub; H, herb; D, density; AF, abundance-frequency ratio).

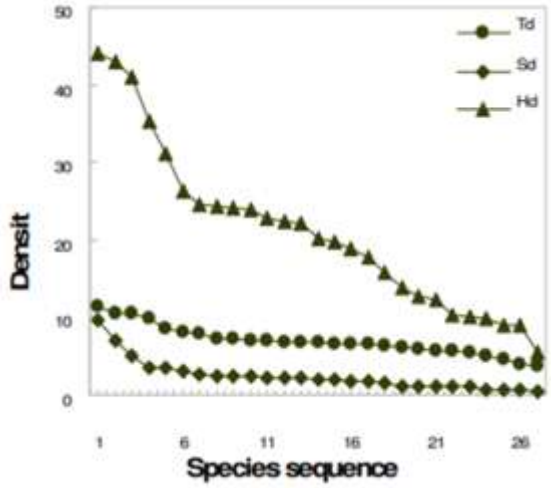

Figure 3. Dominance-diversity curve for different plant species (Td, tree density; Sd, shrub density, Hd, herb density).

et. al. (2004) and Chen et al. (2008). Strength variety bends plotted among thickness and species grouping of tree, bush and spice species demonstrates a connection between various animal types indicating significance esteem. The bend demonstrated comparative steepness in bush and tree species with the steepest slant for spice species (Figure 3). In the event of spice species, there was a sharp drop in thickness, even on a log-scale, from the first-to the six-sequenced species, while in others, the diminishing in thickness as an element of grouping was gentler among the exceptionally sequenced species. The log ordinary arrangement as a rule of tree and bushes is demonstrative of the exceptionally blended nature of vegetation (Whittaker, 1975; Saxena and Singh, 1982; Rawal, 1991). The mathematical structure is regularly appeared by vascular plants having lower thickness (Whittaker, 1975). Magurran and Henderson (2003)

expressed that bountiful species are log regularly appropriated while incidental species happen rarely which are commonly low in plenitude and furthermore follow log arrangement dispersion

CONCLUSION

In the Himalayan area, woodland tree species arrangement and structure shift from lower to higher heights because of fluctuating soil and climatic conditions. Aside from these, the administration and usufructs extraction techniques utilized by foresters and town network individuals. In this investigation, the species variety and recovery consequences of government oversaw woods were not discovered acceptable contrasted with network the executive's timberlands due to huge zone of woodlands just as higher thickness of tree species.

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