

## Phytosociological analysis in brown oak dominated forest of Garhwal Himalaya, India

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**ABSTRACT:** The present study was carried out in eight forest sites dominated by *Quercus semecarpifolia* (brown oak) to assess variations in floral biodiversity and community with changes in microclimatic conditions between 2500-3500 m elevation in Chopta (Garhwal). Anthropogenic disturbances are changing the species richness and diversity, which influence the soil and environmental conditions. Thus, the conservation and management of these forests will be important for the sustainability of human and land in the region. A total of 14 species of trees, 8 species of shrubs and 20 species of herbs & grasses were encountered across the study area. [New York Science Journal. 2009; 2(4): 1-4]. (ISSN: 1554-0200).

**Key words:** Tree species, study sites, Garhwal Himalaya

### INTRODUCTION

India is among the important mega-biodiversity centers of the world, with a lot of contribution from the Himalayan ecosystem. Biodiversity is used variously for fodder, fuel wood, timber, and leaf litter for manuring crop fields, construction, industrial raw material and several non-timber forest produce. Biodiversity is the totality of genes, species, and ecosystem in a region. Vegetation in a mountain area is affected by several factors of which altitude, aspect, slope, soil, canopy cover and microclimate are predominant as they modify regimes of moisture and exposure to sun. Forest diversity is the main source of livelihood of the people living in Uttarakhand, Central Himalaya. Species composition of major forest types of central Himalaya have been described by Ralhan et al (1982), Saxena and Singh (1984), Singh and Singh (1987), Singh and Singh (1992) have summarized the information on the structure and function of the Himalayan forest ecosystem. The present study was conducted in eight forest sites of *Quercus semecarpifolia* (brown oak) located between 2500-3500m elevations in Chopta forest of Garhwal to assess the phytosociological analysis of the vegetation. The impact of local people on vegetation, variation in floral biodiversity and community with changes in microclimatic conditions, and regeneration status were recorded during 2006.

### MATERIALS AND METHODS

Chopta forest is located at 79°-79°30'E longitude and 30°30'-30°42'N latitude between 1500-4000m elevation in the Garhwal Himalaya. Altitudinally Chopta is located in temperate zone. For the detailed study of plant biodiversity and other vegetational parameters, the area was divided into eight forest sites. All the sites were located within the elevation range 2500-3500m.

The Chopta is characterized by its typical climate from temperate to alpine. About 60% of the area falls under alpine zone, which remains under snow during winter months. Broadly, three seasons can be recognized for the Chopta area, viz. summer (April-June), rainy (July-September) and winter (October-March). Winter experiences serve cold the main precipitations are received in the form of snow. Maximum snow depth occurs in the sub-alpine and alpine areas during February-March. With the rise the temperature in the month of April snow start melting in the lower altitudes by April it remains in scattered isolated patches below 2800m especially in shady localities. Snow melts only in April-May in the alpine zone. The main annual rainfall of the Central Himalaya is 2000mm (Singh and Singh, 1992). Rains are mostly confined to rainy season and heavy down pours in rainy season causes landslides and soil erosion.

A total of 15 (10mX10m) quadrats for trees, saplings and seedlings, 40 (2mX2m) for shrubs, and 40 (50X50cm) for herbs in each site were placed randomly and studied. Regeneration in the forests was sampled at four levels namely mature tree, sapling and seedling. Mature tree comprised of plants with >31.5 cm (gbh) over the bark at breast height (1.37m), sapling included all individuals >10.5 cm and <31.5cm gbh and seedling class composed individuals of <10.5cm gbh (Chaturvedi, et al 2005). The vegetational data was calculated for density (Curtis and McIntosh, 1950), and species richness was determined following Whittaker (1972) by tabulating the number of species in each site.

## RESULTS

Quantitative analysis of trees, saplings, seedlings, shrubs and herbs at different study sites are given in Table 1-3. A total of 14 species of trees, 8 species of shrubs and 20 species of herbs & grasses were recorded from the study area. Except three sites (site 4<sup>th</sup>, 5<sup>th</sup> and 8<sup>th</sup>) broadly have similar major tree species. *Quercus semecarpifolia* and/or *Rhododendron arboreum* are the major tree species in all the eight sites. Only five sites are well canopied having 50-58% canopy cover.

*Tree layer:* Among the different sites, the maximum total tree density 2488 ind ha<sup>-1</sup> recorded in the site 4<sup>th</sup>. However the minimum total tree density 323 ind ha<sup>-1</sup> was recorded at site 3<sup>rd</sup> (Table 1).

*Sapling layer:* The total sapling density was recorded between 6-645 ind ha<sup>-1</sup> at different sites. The *Quercus semecarpifolia* was found in sapling stages at only four sites except site 1<sup>st</sup>, 2<sup>nd</sup>, 5<sup>th</sup>, and 8<sup>th</sup> and its density ranged from 6-133 ind ha<sup>-1</sup> (Table 1).

*Seedling layer:* The seedling density of *Quercus semecarpifolia* was recorded to maximum 692 ind ha<sup>-1</sup> at site 7<sup>th</sup> and minimum (6 ind ha<sup>-1</sup>) at site 2<sup>nd</sup> and site 8<sup>th</sup> respectively. Among the species maximum seedling density was recorded 692 ind ha<sup>-1</sup> for site 7<sup>th</sup> and the minimum density also recorded 32 ind ha<sup>-1</sup> at site 2<sup>nd</sup> (Table 1).

*Shrub layer:* The shrub density was recorded maximum 29675 ind ha<sup>-1</sup> at site 1<sup>st</sup> and minimum 425 ind ha<sup>-1</sup> at site 5<sup>th</sup> (Table 2).

*Green layer:* The herbaceous (ground vegetation) density was recorded to be maximum 526000 ind ha<sup>-1</sup> at site 6<sup>th</sup> and minimum density was 425 ind ha<sup>-1</sup> at site 5<sup>th</sup>.

*Distribution pattern:* There was no regular distribution pattern of the different strata observed in the study area as maximum species (88.01%) displayed their random distribution pattern at different sites and 11.98% species displayed contagious distribution pattern at different site of the study area (Kumar, 2008).

**Table 1:** Density (ind ha<sup>-1</sup>) for trees, saplings and seedlings

Site	Species	Trees	Saplings	Seedlings
1	<i>Quercus semecarpifolia</i>	193	-	210
	<i>Rhododendron arboreum</i>	213	53	-
	<i>Abies pindrow</i>	106	-	-
	<i>Taxus baccata</i>	20	-	26
	<i>Ilex dipyrena</i>	40	-	-
	<i>Acer sp</i>	6	-	-
			<b>578</b>	<b>53</b>
2	<i>Quercus semecarpifolia</i>	372	-	6
	<i>Rhododendron arboreum</i>	80	-	13
	<i>Ilex dipyrena</i>	33	-	13
	<i>Acer sp</i>	13	-	-
	<i>Abies pindrow</i>	13	-	-
	<i>Taxus baccata</i>	6	-	-
			<b>517</b>	<b>0</b>
3	<i>Quercus semecarpifolia</i>	153	6	53
	<i>Abies pindrow</i>	25	-	-
	<i>Ilex dipyrena</i>	40	-	-
	<i>Rhododendron arboreum</i>	53	-	60
	<i>Lyonia ovalifolia</i>	6	-	26
	<i>Machilus gamblei</i>	33	-	-
	<i>Quercus floribunda</i>	13	-	-
		<b>323</b>	<b>6</b>	<b>139</b>
4	<i>Quercus semecarpifolia</i>	546	6	-
	<i>Rhododendron arboreum</i>	390	20	-
	<i>Acer sp</i>	220	20	-
	<i>Aesculus indica</i>	666	-	-
	<i>Taxus baccata</i>	666	-	-

		<b>2488</b>	<b>46</b>	<b>0</b>
5	<i>Quercus semecarpifolia</i>	293	-	73
	<i>Rhododendron arboreum</i>	380	73	16
	<i>Abies pindrow</i>	13	-	-
	<i>Taxus baccata</i>	13	6	6
	<i>Acer sp</i>	13	-	-
		<b>712</b>	<b>79</b>	<b>95</b>
6	<i>Quercus semecarpifolia</i>	220	10	40
	<i>Rhododendron arboreum</i>	120	40	40
	<i>Acer sp</i>	113	40	-
	<i>Taxus baccata</i>	26	-	6
	<i>Sourbus cuspdata</i>	6	-	-
	<i>Syzygium cumini</i>	13	-	-
	<i>Abies pindrow</i>	13	-	-
		<b>511</b>	<b>90</b>	<b>86</b>
7	<i>Quercus semecarpifolia</i>	293	133	406
	<i>Rhododendron arboreum</i>	220	46	-
	<i>Rhododendron anthopogon</i>	160	426	286
	<i>Taxus baccata</i>	80	40	-
	<i>Abies pindrow</i>	13	-	-
	<i>Syzygium cumini</i>	33	-	-
		<b>799</b>	<b>645</b>	<b>692</b>
8	<i>Quercus semecarpifolia</i>	146	-	6
	<i>Rhododendron arboreum</i>	20	-	60
	<i>Acer sp</i>	13	-	-
	<i>Rhododendron anthopogon</i>	20	-	-
	<i>Picea simithiana</i>	180	-	-
		<b>379</b>	<b>0</b>	<b>66</b>

**Table 2:** Density (ind ha<sup>-1</sup>) for shrubs

Species	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
<i>Daphne cannabina</i>	29675	14000	5625	-	3425	-	-	-
<i>Vibrunum cylindricum</i>	1675	4675	800	2125	425	2875	675	6875
<i>Berberis petiolaris</i>	1750	2000	925	3250	-	-	1550	
<i>Daphne papyracea</i>	-	600	-	-	-	-	-	-
<i>Thamnoclamus jonsarensis</i> (Ringal)	-	-	-	39100	-	-	-	-
<i>Cotonneaster microphyllus</i>	-	-	-	-	3425	-	-	1800
<i>Skimmia anquetilia</i>	-	-	-	-	-	-	22675	2425
<i>Cotoneaster acuminatus</i>	-	-	-	-	-	-	4050	-
<i>Rosa sericea</i>	-	-	-	-	-	-	1925	-

**Table 3:** Density (ind ha<sup>-1</sup>) for herbs

Species	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
<i>Lycopodium sp</i>	42800	-	-	-	-	-	-	190400
<i>Fragaria Sp</i>	388800	418800	484000	366800	42800	-	118000	-
<i>Heteropogon contortus</i>	232800	-	232000	-	202000	-	40800	-

<i>Impatins thomsonii</i>	28000	-	-	-	-	-	-	-
<i>Gentiana peldicellata</i>	38000	340800	266000	-	84000	104000	-	238800
<i>Ocimum americanum</i>	184000	68000	-	10000	32000	52000	-	-
<i>Pusiyaghass*</i>	104800	-	-	416000	-	526000	28800	230800
<i>Dryopteris sp</i>	40000	254000	-	112800	-	44000	46800	96000
<i>Bistorata macrophylla</i>	-	106000	252000	104800	30000	168000	122000	-
<i>Daphniphyllum himalense</i>	-	58000	-	160800	-	38800	-	-
<i>Potentilla fulgens</i>	-	92000	54000	-	425	-	-	114000
<i>Sellaginella sp</i>	-	-	172800	-	-	-	-	-
<i>Lentanasp</i>	-	-	100800	-	-	-	100800	18400
<i>Saxifraga andersonii</i>	-	-	-	16800	30800	-	-	-
<i>Potentilla fulgens</i>	-	-	-	32800	-	-	-	-
<i>Valeriana jatamansi</i>	-	-	-	100800	-	-	16000	44800
<i>Impatins thomsonii</i>	-	-	-	378000	-	68800	-	-
<i>Pteris cretica</i>	-	-	-	-	-	-	104000	60000
<i>Gaultheria nummylariodes</i>	-	-	-	-	-	-	-	290800
<i>Nardostachys jatamansi</i>	-	-	-	-	-	-	-	74800

\* Locally identified

## DISCUSSION

The present study area is located in the altitudinal range of 2500-3500m and divisible of 8 different study sites on the basis of various disturbances such as grazing, browsing, litter removal and lopping. *Quercus semecarpifolia* and *Rhododendron arboreum* are the dominant tree species in all study sites. Giri, et al (2008) reported, the total tree density ranged from 320 to 1560 ind ha<sup>-1</sup> in *Quercus leucotrichophora* forest and 320 to 1960 ind ha<sup>-1</sup> in *Quercus floribunda* forest, but it was not recorded in *Quercus semecarpifolia* forest. The total tree density ranged from 323-2488 ind ha<sup>-1</sup>, total sapling density from 0-645 ind ha<sup>-1</sup> and seedling density from 0-692 ind ha<sup>-1</sup> were recorded in present study sites. The tree density was comparatively high than the value of other oak reported by Giri, et al (2008). The anthropogenic pressure on *Quercus semecarpifolia* forest for firewood, fodder and timber, play an important role in declination of forest together with lichen moss collection.

In the present years the awareness regarding to conservation of flora and fauna among the local community and in people residing in the forest has helped in a large extend in protecting the forest in this area. The tendency of the people has changed as they are earning their livelihood regularly from forest by some alternative (selling milk, firewood by utilizing the forest foliage) instead of destroying trees.

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