Tree Layer Characteristic and Regeneration pattern of central Himalayan Forest in relation to catchments area

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ABSTRACT: The present study was carried out in the forest located in the catchments of Nainital lake located in Uttarakhand. To study various qualitative and quantitative parameters, the study site was divided into North- East aspect and South – West aspect. In North East aspect two forests, Oak forest (hill base), and Oak-conifer forest (hill top and mid hill) were studied. Along the South-West aspect also three forests were studied: Oak forest (hill base), mixed forest (mid hill) and mixed forest (hill top). A total of 8 tree species were reported across all the study sites. These were: *Quercus leucotrichophora, Quercus floribunda, Cupress torulosa, Cedruss deodara, Rhododendron arboreum, Acer pictum, Aesculus indica and Cornus macrophylla.* The density within each forest ranged from 10 – 250, 30- 220, 120 – 380, 10 – 150, 20- 130 and 20 – 180 trees/ ha. Total density was found ranging from 220-560 trees / ha across the study sites. Abundance/frequency (A/F) ratio was found ranging from 0.01- 0.08 among the forest sites indicating that the species were distributed in regular, random and random – contagious pattern. The total basal area ranged from 16.7-69.9 m^2/ ha and the total IVI (269.93 – 299.9) across the forest studied. The moisture in the northern aspect ranged from 45.14% to 32.29%, where as the soil moisture in southern aspect ranged from 39.68% to 30.12%. The soil carbon in the northern aspect is found to be higher than the southern aspect. The soil carbon in the northern aspect ranged between 2.9% (0-10cm) to 1.3%(30-60cm),where as in southern aspect it varies from 2.3%to0.8%.Bulk density ranged between 0.88gm g cc^{-1} to 0.91gm gcc^{-1}in northern aspect while in southern aspect it ranged 0.79g $cc^{-1}$to 0.82g cc^{-1}. Based on the study, it is concluded that the forests which were close to the human habitation has suffered much damage than the sites far from the human settlements. The poor occurrence of seedlings and saplings in the studied forests indicate that immediate efforts are needed to boost the regeneration and employing suitable silvicultural and management practices for preserving the catchment protection value of the forest of Nainital lake catchment. [New York Science Journal. 2009;2(4):42-45]. (ISSN: 1554-0200).

KEY WORDS: Vegetation analysis, composition, catchments, regeneration

INTRODUCTION

The Indian subcontinent is a region of moderate to very high biodiversity including two of the global hot spot of vascular plant endemism in the Western Ghats and the Eastern Himalaya (Myers et al, 2000). In the central Himalayan region forest is potential vegetation above up to 3500 to 4000 m elevation. (Singh and Singh,1987).The Himalayan forest vegetation ranges from tropical dry deciduous forest in the foothills to alpine meadow above timberline (Singh and Singh,1992), however as data collected from land's imaginaries indicate, right now only 29% of the reported area (51,000sq km^2) is forested and good forests (with more than 60%forest cover) occur only in 4.4% of the area (Singh and Singh, 1987). Concentration of human settlements in the forest area, lopping and felling and occasional fire spreading from pine forest have reduced the area under forest (Champion and Seth,1968).The plant diversity is found extremely rich from the valley regions to the highly elevated alpine meadows (Sati, 2005). Forest diversity is the main source of live hoods of people living in Uttrakhand central Himalaya (Ram et al, 2004). Among the natural resource of Uttarakhand, forest are the most important both economically and environmentally. The forest area is reported to be 3,466 thousand ha and accounts for around 62.27%0f the area of the Uttarakhand. Through out the state, serious environmental problems have already emerged. There environmental problems are particularly noticeable in main land of Uttarakhand as a form of degradation and depletion of forest resources (Sati, 2005). In Uttrakhand, composition of forest is diverse varies from place to place because of varying topography such as plains, foothills and upper mountains (Singh, 2006). Strategies are being suggested to receive the forest cover in the region, including the replacement of agriculture by forestry (Singh and Singh, 1987), because of the human onslaught on the forest, the ecosystem succession

of communities and regeneration affects. To study the forest it is necessary to know the phytosociology of the forest. According to (Sexana and Singh, 1982), Himalaya offers and array of forest types below the timber line, and is cradle of major river of India harboring a network of catchments areas. As the catchments efficiency depends upon the type quality and stratification of forest vegetation a quantitative evaluation of its vegetation is pre-requisite. Some scientist have made few studies (Puri, 1960), (Champion and Seth, 1968 et al) found variation in the humid tropical forest and forest in the South East Asia respectively. Regeneration of the structure of a forest community can be communicated by constituting a profile diagram. The present study deals with tree layer compositions of forest and regeneration pattern of central Himalayan forest in relation to catchments area.

MATERIAL AND METHODS

The study area Nainital is located between 29º 21'- 28º 24' and north latitude between 1938 m to 2292 m elevation. For the detail study of tree layer composition, characteristic of forest and aspect along the elevational gradient i.e. hill base (1938-2000m) hill slope (2000-2110m) and hill top (2110-2292m).In the past both the aspect are subjected to landslides (based on personal inventory with the locals), on aspects between located 1938 to 2110m, the characteristic features anthropogenic disturbances and absence of regeneration. Altitudinaly the study area was located in a temperate environment but latitudnally it exists with in the subtropical belt. The basic climate pattern is governed by monsoon. The annual rainfall was 200-300mm of which three fourth occurred in rainy season (Mid June to September). The mean monthly temperature ranged between 17˙0˚ c (January) and 33˙0˚ c (April), and mean minimum temperature ranged between 0˙0˚ c (January) and 14.5˚ c (August). The study was conducted during the year 2004-2005 from each site; the composite soil samples were collected from 0-10cm, 10-30cm, 30-60cm.depths packed in polythene bags and brought to the laboratory for analysis. Moisture content was determined on dry weight basis. Soil bulk density was determined by (Mishra1968). Soil carbon percentage was determined by (Walkey and Blacks's methods, 1958).Vegetation analysis made for all the sites. Tree layer was analyzed sampling 10 quadrates 10x10 size in each site. The size and number of sample was determined following (Saxana and Singh, 1982). The vegetational data were quantitatively analyzed for abundance, density, and frequency (Curtis and Mcintosh, 1950). The importance value index (IVI) for the tree layer was determined as the some of the relative frequency, relative dominance (Curtis, 1950).The distribution pattern of different species using the ratio of abundance to frequency.

RESULTS AND CONCLUSION

SOIL

The moisture in the northern aspect ranged from 45.14% to 32.29%, where as the soil moisture in southern aspect ranged from 39.68% to 30.12%. The soil carbon in the northern aspect is found to be higher than the southern aspect. The soil carbon in the northern aspect ranged between 2.9%(0-10cm)to 1.3%(30-60cm),where as in southern aspect it varies from 2.3%to0.8%.Bulk density ranged between 0.88gm g cc^{-1} to 0.91gm gcc^{-1}in northern aspect while in southern aspect it ranged 0.79g $cc^{-1}$to 0.82g cc^{-1}.

TREE LAYER

On the northern aspect at the hill base the lowest tree density was reported for *Acer pictum* (10ind-ha^{-1}) and the highest for *Quercus leucotrichophora* (150 ind-ha^{-1}). At the hill slope the lowest density was reported for *Aesculus indica* and *Cupress torulosa* (20 ind –ha $^{-1}$each) and highest for (Quercus leuchotrichophora130ind-ha^{-1}), Where as at hill top the lowest density was reported for *Rhododendron arboreum* (20ind ha^{-1}) and highest for *Quercus leucotrichophora* (130ind-ha^{-1}), where as at hill top the lowest density was reported for *Aesculus indica* and *Cupress torulosa* (20ind-ha^{-1}each) and highest and highest for Quercus leuchotrichophora (130ind-ha^{-1}), where as hill top the lowest density was reported for *Rhododendron arboretum* (20ind ha $^{-1}$) and highest for *Quercus leucotrichophora* was (180ind-ha^{-1}). *Quercus leucotrichophora* was dominant all the sites (IVI=76.33) and hill top (IVI=74.59) and *Cedruss deodara* at hill slope (IVI=102.64).

In the southern aspect at the hill base the lowest density was reported for *Cornus macrophylla* and *Cupress torulosa* (10ind ha^{-1}) and highest for *Quercus floribunda* (250ind^{-1}). Density at hill slope ranged between (30ind-ha^{-1}*). Rhododendron* arboretum and *Cupress torulosa* (220ind ha^{-1}) for *Quercus floribunda*, where as it ranged between 120ind ha^{-1} *Quercus leuchotrichophora* and 380ind –ha $^{-1}$for Quercus

floribunda. The maximum (IVI=120.26) followed by *Quercus leuchotrichophora*(IVI= 82.04) and *Cupress torulosa*(IVI=78.1). At hill slope *Quercus leucotrichophora* was the dominant species (IVI= 85.73) followed by *Cupress torulosa* (IVI= 82.04) and Cupress *torulosa(*IVI=78.1). At the hill slope *Quercus leucotrichophora* was the dominant species (IVI=85.73) followed by *Cupress torulosa*(IVI=78.55) and *Quercus floribunda* (Quercus *leucotrichophor*(IVI=77.98).At the hill top IVI of *Quercus leuchotrichophora* respectively.

REGENRATION PATTERN

The study sites were to close human habitation, this indicates that lack of regeneration in each forest site there were identified no seedlings and saplings because the sites were also constructed by the builders and encroached by the local residents.

CONCLUSION

Loss of forest in central Himalayan region results in severe, ecological and economic cost lost watershed protection, regional climate change, reduced supply of timber, fuel wood, fruits etc, and also affects peoples lives (Jagdish et al,1997). As far as the species concerned in study area, total 08 species were reported in all the forest sites; however the range was 2-5 species, which were much less than the value 28 reported for central Himalayan forests (Upetri et al,1985) and 17 species for Oak Reserve forest (Bisht and Lodhiyal, 2005).This indicates that the most of the species has been disappeared from the study forest site because of human pressure and illegal tree cuttings this tempo need to be checked.

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