

CONCLUSION

The present dissertation work characterizes the phytosociological attributes of the vegetation in different zones along the altitudinal gradient in Darjiling part of Eastern Himalaya. Due to its varied topographic, geographic, physiographic, edaphic and climatic factors, the different vegetation zones along the altitude reflect a great diversity and species composition during different seasons.

The species distribution pattern in Darjiling hills indicates a rich phytodiversity with heterogeneity of species with little change in altitude and habitat. This can be understood from the number of species recorded during the work that reveals a rich flora with a total number of 911 species and varieties belonging to 509 genera under 145 families. These species count are from inside the forest and does not incorporate species from fringe areas or road sides.

The phytosociological status and community analysis of the vegetation during different seasons in different ecological zones reflected a healthy distribution of species along the altitude with diversity as high as 5.236 during post-monsoon and as low as 2.908 during pre-monsoon. Analyses of diversity indices indicate temperate forest to be more diverse with high richness and low dominance. It may be due to the transitional nature of the forest harboring species both from the higher and the middle zones. This is followed by tropical and sub-temperate forest with significantly high diversity and richness values. The other zones expressed moderate values though showing a reasonably good diversity. Similarly the total richness for the species at different zones ranged between 4.318 in the sub-alpine forest to 9.353 in the diverse temperate forest. As per Rahbek (1997), the species richness decreases with altitude.

The association and closeness of the species in various type of habitat was also reflected through the evenness that ranged from 0.976 to 0.990. The concentration of dominance of the species is inversely related to the diversity which is in accordance with Odum, (1971) and it also indicates increased stability of the vegetation (McNaughton, 1967). The maximum values of dominance were 0.007 towards sub-alpine zone and a minimum value of 0.001 for the temperate vegetation.

The pH of the soil at different zone ranged from 4.69 to 6.61 with lowest in the sub-tropical forest and maximum for the temperate. The organic carbon and nitrogen both was estimated highest for the tropical zone. However, it was

observed that the sub-alpine soil had lowest value of nitrogen present and so was the content of phosphorus.

The dominating species recorded include *Shorea robusta* in lower hill forest to *Lithocarpus* in mid zones and *Abies densa* in the forest of highest zones. Similarly in the shrub layer, species like *Mikania* seems to be dominating lower zones while in the middle forests species such as *Stephania japonica*, *Rubus acuminatus* and *Rubus buergeri* and towards the higher belt *Cotoneaster microphyllus*, *Gaultheria nummularioides* and *Yushania maling* were populated. The ground covers that were dominant along the altitude include species such as *Oplismenus compositus*, *Lepidagathis incurva* and *Nephrolepis cordifolia* towards lower hill forest to *Isodon lophanthoides*, *Melissa axillaris* at middle zone to *Fragaria nubicola*, *Galium elegans* and *Primulas* at high alpine vegetation. In the lower hill forest the populations of trees were more than the higher hills but in the higher vegetation, the herb occupies major percentage of species.

The growth of the forest vegetation can also be understood from the regenerating tree saplings that expressed healthy density in some quadrats. The high percentage of low girth class revealed that the vegetation is in developing state while the maximum percentage of girth class above 75 cm depicted an established climax forest towards higher zones. The amalgamation of the species were also observed at various zones and the similarity index estimated between the vegetation was moderate with some species having wide ecological amplitude and distributed both at low and high forest habitats.

Many of the species were found to be endemic to the region whereas some species were categorized under RET. The distribution of the invasive elements was also speculated and it was also observed that some of the species have posed a serious threat to the native flora. The hills also house many plant species of medicinal values that were dispersed at various sites under study.

However, several categories of threats have been observed at certain level and a number of conservation measures have been proposed. Nevertheless, the favorable climatic condition that prevails in Darjiling Himalaya has always been a boon for the vegetation to develop and flourish making the habitat rich in this botanical paradise of the world. Although, several earlier workers have explored the Darjiling part of the Himalaya, the present dissertation is the first of its kind that

highlights the plant sociology and community analysis and thereby characterizes the vegetation of Darjiling hills in different seasons at various altitudinal zones.