A Study on Plant Diversity

Shilpi Bajpai

Research Scholar of CMJ University, Shillong, Meghalaya

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INTRODUCTION

Plant diversity reaches an astonishing level in tropical forests. At the same time, it is changing at an unprecedented rate as a complex response to several human-impacts. Documenting such impacts, which date back to antiquity and even to pre-history, on genetic diversity of forests is a difficult matter and little quantitative data exist. Primary forests of Asia, particularly those of the Western Ghats and the Eastern Ghats of peninsular India are disappearing at an alarming rate due to human-impacts.

Consequently, forests comprising inferior species replace them or the land use pattern gets changed. The disappearance of tropical forests comes at a time when our knowledge on their structure and dynamics is woefully inadequate. While, understanding plant diversity of human-impacted forests is necessary for the assessment of potential impacts, amelioration of effects of disturbance, optimization of productivity and rehabilitation of ecosystem.

The 'mega-diversity' status of tropical forests is generated by species interaction such as competition and niche diversification and by high humidity and temperature. The trees in tropical forests have vital roles (both structural and functional) in maintaining the equilibrium of the ecosystem. Hence, tree diversity is fundamental to total forest biodiversity. In addition, the trees provide resources and habitat structure for almost all other forest species. So, plant diversity inventories of tropical forests mainly focus on trees as against non-trees, which are stated to contribute little to the total species diversity in tropical forests.

Nevertheless, non-trees such as lianas also form an important structural and functional component of tropical forests. Also, some tropical forests might possess the most herb-rich plant communities on earth and ground herbs might prove to be a good indicator of forest succession status. To substantiate the latter statement, the available data are not sufficient. Hence, investigations involving the whole plot plant diversity in tropical forests are essential; but, such studies are fewer and the scales of such inventories also vary considerably.

REVIEW OF LITERATURE:

Tropical forests are distinguished from all other terrestrial ecosystems by a very high diversity on many levels and are the most heterogeneous of the world's ecosystems. They are acknowledged to harbor the greatest wealth of biological and genetic diversity of any terrestrial community. Most plant life-forms and especially trees exhibit a similar diversification on a local scale.

Consider the mystery of tropical forests; plant ecologists have plunged into explorations to address the most obvious question: "Why are the tropical forests so rich?" The question continues to pose a difficult challenge to community theory and evolutionary biology. The mystery is further compounded by the fact that "not all tropical forests are rich in plant species"; indeed, some are very species-poor. Added to this complication in understanding tropical forest diversity, it is to be answered whether human-impacts on forests increase or decrease the plant diversity. Human-impacts on the plant diversity of forests date back to antiquity and even to prehistory and little quantitative data exist on this aspect to conclude unequivocally about the human disturbance. Further, the adequate protection and sustainable management of tropical evergreen forests require a good knowledge of their plant diversity. A review of plant diversity inventories enshrining trees, regeneration, lianas and understory plants in various tropical forests is given in the following pages.

Plant diversity inventories in tropical forests have mainly focused on trees than any other life-forms, *viz.* lianas, understory plants, *etc.* The reason behind this is that tree diversity is fundamental to total forest diversity and trees provide resources and habitat structure for almost all other forest species. Besides being a pivotal and dominant life-form, trees are easy to locate precisely and count and are taxonomically a well-known group. Thus, tree diversity inventories gained impetus in the hands of plant ecologists and a plethora of literature exist for trees.

There are variations in the number and abundance of tree species between the world's three main tropical forest blocks - the American, the Asian and the African. This variation is also present in the sub-regional blocks. There are several studies that support the contention that some tropical rain forests have more plant species on small areas of up to a few hectares than any other kind of vegetation on earth.

OBJECTIVES OF THE STUDY:

The present investigation reports the results of plant diversity inventories conducted in undisturbed and human-impacted sites of tropical evergreen forest in the Kolli hills, Eastern Ghats, south India. The diversity components considered in this inventory include those of mature trees, regeneration trees , lianas and understory plants in four plots. The prime objectives of this investigation include the following:

(1) to assess the tree species (alpha) diversity, population,, density, stand structure, dispersion patterns and P diversity of undisturbed and human-impacted tropical evergreen forest sites in the Kolli hills;

(2) To understand the regeneration patterns of tree species in undisturbed and human-impacted tropical evergreen forest sites of the Kolli hills;

(3) To compare the liana species diversity, density and liana stand structure in undisturbed and human-impacted tropical evergreen forest sites in the Kolli hills;

(4) To evaluate liana-host relationships;

(5) To estimate understory plant diversity in undisturbed and human-impacted tropical evergreen forest sites;

(6) To arrive at the total plant diversity of the tropical evergreen forest sites in the Kolli hills of the Eastern Ghats, India.

RESEARCH METHODOLOGY:

The study comprises tropical evergreen forests in the Koki hills of the Eastern Ghats located near Nmzkhai town in 'Tamil Nadu. The Indian Eastern Ghats is delimited in the north by iihondinal hills of Orissa state. The middle section extends from Krishna to near about Chennai and includes the Nallumalai, Palbonda and Veikonda hills. 'The last section runs in direction meeting the Western Ghats in the Nilgiris and the conspicuous features are the Javari's, the Pachain, the Karajan, the Shemarayan and the Biligirirangan hills.

The Kolli hills cover area of 282.93 km2 and consists of heterogeneous vegetation along elevation gradient. The foothills are clothed with scrub vegetation; while with increasing elevation occur dry deciduous, mixed deciduous and evergreen forests. Patches of evergreen forests, locally called 'shoals', occur between 900 m and 1300 m above mean sea level and are found with a veritable mixture of species. The evergreen forests in the Kolli hills are two to three storied and are spread over the upper slopes, hill tops and sometimes on steep slopes.

The trees in them are robust, and tall with dense crowns. The tree branches are often festooned with epiphytic moss, ferns, lichens, aroids and orchids. Epiphylls are also abundant. Herbaceous and woody vines are not infrequent. The ground vegetation is dense and the ambience is humid and moist, very moist during rains when leeches abound. The geological substrate of the Kolli hills is associated with gneissic and varied rocks and a thin Layer of fulminous sandy soil.

DATA ANALYSIS

Species diversity expressed in terms of species richness for the mature and regeneration trees, lianas and understory plants in each study plot was calculated by numerical computation of values recorded from the respective plot. Similarly, the other higher genus and family richness and density were obtained by summing their respective number encountered in the individual and pooled samples.

As all the data of mature trees and lianas were collected in 10 m x 10 m quadrates of the contiguous grid, a sequential arrangement of 10 m x 100 m was considered for their species-area curves. The species-area curves were constructed for the regeneration trees by summing the 10 m x 10 m scores. Species-area curves for the understory plants of the four plots were constructed by scores of pooled sample results obtained from each 10 m x 100 m (0.1 ha) belt in each plot.

Basal area (BA) of trees and lianas was calculated by using the formula: BA of species 'X' = c2 / 4 x 3.14, where C is the circumference (girth) at breast height of species 'X'. Importance value index of the mature tree species was calculated by adding relative density, relative frequency and relative basal area of each species. A modified IVI for a total score of 200, was calculated for regeneration trees, lianas and understory species. In the case of regeneration trees and lianas, the relative density and the relative basal area were summed. While in the case of understory plant species, the modified IVI for a score of 200 included the relative density and the relative frequency. The density of a species is the total number of individuals in the samples,

and frequency refers to the number of occurrences in the total samples.

RESULTS:

The diversity of mature trees ***(2***30 cm) in the total 8-ha area totaled 78 species in 61 genera and 36 families. Species richness of the four study plots varied from a lowest value of 39 species in disturbed plot MS to a highest value of 58 species in undisturbed plot PS . The mean species richness (41 species) of disturbed plots was 25.6 % lower compared to that (55 species) of undisturbed plots (PS and VS).

Among the four 2 ha study plots, 20 species (25.6 %) were common to all of them. Of the total 78 species, 12 species (15 %) were deciduous while the remaining 62 species (85 %) were evergreen. The number of buttressed trees was greater (44 %) in plot KS (with a steep slope of 25 % to 30 %) and lesser (7 %) in plot MS (with a slope of 10 % to 15 %). This indicates that tree buttressing in the evergreen forests of the Kolli hills increases with increasing slope.

The species-area curves of the four 2 ha contiguous plots rapidly increased until 0.5 ha. The curves continued to increase, but in slow pace, till 1.5 ha and thereafter species addition was almost none. However, a light spurt: at the end of the curves in the study plots VS and MS can be noticed. Consolidated details of macro tree diversity inventory in the four 2 ha plots in four study sites, Perurnakkai shoal (PS), Vengodai shoal (VS), Kuzhivalavu shoal (KS) and Mottukkadu shoal (MS) in the tropical evergreen forest of the Kolli hills, Eastern Ghats, south India

REFERENCES:

- Abdulhadi, R., Srijanto, A. and Kartawinata, K. Conlposition, structure, and changes in a montane rain forest at the Cibodas biosphere reserve, West Java, Indonesia. pp. 601-612. In: Forest biodiversity research, monitoring and modeling conceptual background and old-world case studies. Dallmeier, F. and Comiskey, J. A. (eds.). Parthenan Publishing, Paris.

- Andel, T.V. Floristic composition and diversity of mixed primary and secondary forests in northwest Guyana. *Biodiv. Conserv.* 10: 1645- 1682.

- Annaselvam, J., and N. Parthasarathy. Inventories of understory plants in a tropical evergreen forest in the Anarnalais, Western Ghats, India. *Ecotvopica 5:* 197-21 1.

- Appanah, S., Gentry, A. H. and LaFrankie, J. V. Lima diversity and species richness of Malaysian rain forests. *J. Trap. For.* ***Sci.*** 6: 1 16- 123.

- Appanah, S. and Putz, F.E. 1984. Climber abundance in virgin dipterocarp forest and the effect of pre-felling climber cutting on logging damage. *Malay. For.*47: 335-342.

- Arevalo, J. R., Fernandez-Palacios, J. M., and Palmer, M. W. 1999. Tree regeneration and future dynamics of the laural forest on Tenerife, Canary Islands. *J: Veg. Sci.* 10: 861-868.

- Armesto, J.J. Mitzel, J.D. and Villagran, C. A comparison of spatial patterns of trees in some tropical and temperate forests. *Biatropica* 18: 1-1 1.

- Ashton, P.S. A quantitative phytosociological technique applied to tropical mixed rain forest vegetation. *Malay. For.27:* 304-307.

- Ashton, P.S. Speciation among tropical forest trees: some deductions in light of recent evidence. *Biol. J. Linn. Soc.* I: 155-196.

- Augspurger, C.K. Light requirements of Neotropcial tree seedlings: a comparative study of growth and survival. J. *Ecol.* 72: 777-796.

- Augspurger, C.K. and Kelly, C.K. Pathogen mortality of tropical tree seedlings: experimental studies of the effects of dispersal distance, seedling density, and light conditions. *Oecologia* 61 :2 *1* 1-2 17.

- Avalos, G., and Mulkey, S. S. Seasonal changes in liana cover in the upper canopy of a neotropical dry forest. *Biotropica* 3 1 : 186- 192.

Climatologically data of Salem, the nearest station and 50 km from the study area, available for a 30-year period reveals a mean annual temperature of 28.3" C and the mean annual rainfall 1014 mm. The mean monthly temperature ranged from 250 C during December-January to 310 C in April-May for the same period. The mean maximum temperature was 37.20 C in April, while the mean minimum temperature was 19.20 C in January for the above period.

To summarize and comprehend the human-impact on plant diversity, the plots PS and VS are graded as relatively undisturbed while the sites KS and MS are human-impacted sites. It may be noted that the study plots of the Kolli hills are referred throughout the thesis as PS, VS, KS, and MS, after their respective study sites.