

**Bird community structure along the altitudinal
gradient in Silent Valley National Park, Western
Ghats, India**

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SUMMARY AND CONCLUSION

My research on bird community along the altitudinal-habitat gradients and their nest-site partitioning across habitats in Silent Valley National Park (SVNP) has portrayed several patterns. The work has explored some aspects of the processes which accounted for the patterns of variations in the community structure of birds in a pristine forest representative of the post Miocene and Pleistocene uplifted Western Ghats of India. In particular, the study addressed how altitude affected the distribution of birds and how the breeding birds shared their resources. This chapter synthesizes the hitherto information presented in the early chapters and articulate the argument of the thesis.

Three variants of the evergreen forest at an altitude of 900 to 2200 m - evergreen with grassland (EGGL), disturbed evergreen (EGD) and evergreen (EG), two variants of the southern montane wet temperate (shola) forests between 2000 - 2200 m - shola forests (SHOLA) and shola with grassland (SHOLAG), and the broad-leaved hill forests (BLHF) located between 1500 - 1700 m were the specific habitat types selected within the SVNP for the study.

A range of habitat variables were measured in these six habitats in order to relate patterns of bird-habitat interactions. A total of 1872 trees of 152 species were recorded from the six localities studied with the maximum species richness (72) in evergreen followed by EGD (68) and then BLHF (55) with an average species numbers of 16.7, 13.2, and 8.4 respectively in the plots. Tree density was high with a mean of 780 ha⁻¹ in SVNP and a maximum of 910 ha⁻¹ in EGD. The tree species diversity indices of the tropical forests in this area decreased in the order: evergreen forest, slightly disturbed evergreen forest, broad-leaved hill forest, shola forest, evergreen with grassland, shola grassland habitats. There were variations in the tree species diversity between different samples of the same forest type, especially when

the samples were taken from the ecotone or near the edges of forests. This depended greatly on the microenvironment of the habitats which resulted in a species-rich community. Tree species with small population sizes, especially the species represented by only one individual, substantially contributed to the tree species diversity.

The upward progression of the species area curves showed rate of accumulation of more taxa which is an effect of the shift in the habitat when transects approached BLHF and above mid-elevation. The mean tree density (780 individuals/ha) found at SVNP in the present study is in accordance with studies elsewhere in the Western Ghats. Analysis of plant dominance in the communities studied at SVNP suggested that a minority of species dominated the majority of the available resources, a characteristic of tropical forest. Plant families namely, Lauraceae and Euphorbiaceae were the two dominant families in the study area. A reverse J-shaped curves in girth class abundance in the plant communities indicate predominance of lower diameter classes, which is the typical pattern exhibited by tree species in climax undisturbed forests.

The present study resulted in 5253 birds of 108 species, including 14 endemic species, from the 2314 point counts conducted in six habitats. The total number of species observed was 145 including opportunistic observations. Bird community structure of various habitats in corresponding altitudes varied significantly in terms of composition, abundance and diversity. The maximum species (59.2%) and individuals (27.2%) were in evergreen forest habitat and minimum in BLHF (22.8 % and 5.73% respectively). Shola habitats located at higher altitudes in the study area possessed higher species richness than mid-elevation broad leaved hill forest, which occurs within the altitudinal range of 1500- 1700 m. BLHF could be considered as a transitional zone between evergreen and shola forest. The significant difference in tree species richness of BLHF with adjacent EG and SHOLA habitats partly explain the reduction in number of bird species in this transitional zone.

Elevational gradients in the tropics have a more or less stable condensation zone (cloud zone) at a certain level, causing favorable

conditions for certain taxa (e.g. epiphytes) at mid-elevation, which in turn create microhabitats and food for other taxa. As local climate can vary prominently over a few kilometers or hundred meters in the tropics, the exact location of a "climatic optimum" can vary considerably regionally and locally, causing differences in the pattern of the elevational gradient even within the same taxa (Rahbek 1995). Presence of relatively higher number of bird species in SHOLA than BLHF could be also an effect of variation in incidence of direct sunlight and various other microclimatic factors that differ between top and middle portion of the hill. Another important factor in the pattern observed may be an outcome of scale of elevation gradient considered (900-2220 m), while major studies in the Neotropics had a broader spectrum of altitudinal gradients (Terborgh 1971, 1977, Rahbek 1977). The existence of a "plateau" or a "hump" on a curve comparing species richness with elevation should not be regarded as unexpected considering that - although temperature declines with elevation, another life support factor, stable water supply, increases (at least to a certain elevation).

The number of migrants was almost equal in the lowland evergreen habitats and the upland shola. Out of 14 Western Ghats endemics recorded from the study area, 11 were observed at EG site, nine each at the EGD site, and EGGL site, followed by eight each at the SHOLAG and SHOLA and the least was at BLHF with six species. Each habitat differed in their endemic species composition, despite the lack of significant differences in the endemic species richness among habitat-altitude gradients.

The study delineated 14 trophic guilds of birds in SVNP. The upland shola habitats grasslands harboured more number of feeding guilds of birds than any other habitat types. The evergreen with grasslands and disturbed evergreen closely followed them in feeding guild diversity while the evergreen and broad leaved hill forests showed further poor feeding guild diversity. The study strongly indicated high guild richness in habitats having greater structural complexity irrespective of the elevation gradient.

It was found that bird community composition is correlated to the species richness of trees and not to its abundance and also that the population size of bird species is unaffected by tree diversity.

Comparison between the bird community and vegetation structure has yielded significant results. It is observed that the clustering of the six vegetation types based on species similarity does not match the similar clustering of bird species across the habitats, although on the whole tree and bird communities in SVNP had similar patterns with a clear distinction between the evergreen forest types (EG, EGD and EGGL) and the Shola forest types (SHOLA, SHOLAG), and the BLHF forest type falling in between the two groups. At a finer scale similarities were same in the case of trees and birds in the high altitude areas, SHOLA and SHOLAG (Figure 3.14 and 4.15). In the case of evergreen forests, tree community of EG was closer to EGGL while it was with EGD in birds. BLHF showed closer link with high altitude areas in tree community, whereas it had with evergreen habitats in the case of birds.

Comparison of similarity indices (*Similarity Index Ratio- SIR*) between the vegetation composition and bird community composition in six forest types along the altitudinal gradient has given an opportunity to decipher the key features of the dynamics of vegetation and bird community across habitats. The index has provided a better and amplified picture of the dynamics of relationship of vegetation and bird community similarity across habitats. SIR values indicated similarity in the pattern of bird community structure and vegetation within the evergreen and shola groups of forest types. However, between these groups the SIR values were high between SHOLAG and EGGL followed by EG - SHOLAG. This indicates that these two communities, of trees and birds, behaved differently within the Silent Valley National Park and many other habitat features also play important role in deciding the bird communities which needs further investigation. The results also demonstrate the unique nature of the BLHF forest.

The spatial and temporal variation of breeding of the species in the SVNP was examined with special attention on nest-site partitioning. A total of 517 nests of 32 species were observed during the study period. It was found that nesting species richness and diversity were higher in the evergreen habitats compared to the other forest types. Highest number of nests was found in the evergreen with grassland while highest number of nesting species was in the evergreen forests. Among various nest types

recorded in the area, cup nests were most common and ground nests were rare. While there were high similarities of nesting birds among the three types of evergreen forests, there was absolutely no similarity of them with the shola habitats. Though breeding bird species occurred in adjacent habitats, they were very habitat specific in placing nests. The broad leaved hill forests shared breeding species with the evergreen forest habitats but not with shola. Breeding was found throughout year but peaked during summer while it was less pronounced during the rainy season in accordance with other studies elsewhere in the Western Ghats. The random distribution of most of the breeding bird population in SVNP indicated that the nesting and associated feeding resources are ubiquitous or randomly distributed in the habitats studied.

From the total of 517 nests documented, a subset of 442 nests belonging to 12 commonest nesting species were selected and characterized based on 12 nest-site attributes in order to determine principal parameters influencing nest-site selection. The results of this study provide strong evidence for nest-site partitioning in the breeding bird community of SVNP. The major factors were nest height, nest tree height and distance to the next tree. The study also found that plant species composition could be an important determinant of breeding bird community in the southern Western Ghats. The habitat specificity of many species brings out the significance of the variety of habitats.

The study has thus brought out a new understanding on the dynamic relationship between vegetation and bird community composition. Looking at six different habitat types which reflect the elevation gradient of Silent Valley National Park, the study showed increased abundance of birds at mid-elevation evergreen habitats and the highest shola habitats with a unique dip at the intermediate broad-leaved hill forests. Delineating 14 trophic guilds of birds and by correlating them with vegetation structure, the study shows that guild richness is a direct function of habitat complexity irrespective of altitudinal status. The study demonstrated the overwhelming preference of birds to evergreen habitats for nest building. Apart from the new understanding on the nuances of vegetation-bird community interaction,

the study has brought into focus the importance of maintaining and enriching the vegetation complexity as a major objective of the overall Park Management plan. From a conservation management perspective these results indicate that attention should be given for maintaining (i) structurally complex forest with variation in gap-phase structure and tree size variables, (ii) forest in upper and lower/middle slope habitats and (iii) large areas of continuous forest with an altitudinal gradient.