

SUMMARY

Structural and functional aspects of bird communities are believed to have direct relation with the structure of habitat and thereby act as indicators of environmental changes. Various components such as the type of resource, quantity of resource and spatial and temporal distribution of resources play a major role in determining the community structure. In general, the central theme in the functional aspects of the avian community studies has been, how the available resources for biological activities such as foraging, roosting and nesting are partitioned among the existing group of species. Studies on bird community in different habitats are very few in India, and the pattern and processes of a group of species or an individual species were studied separately. The study of birds in relation to habitats will give valuable data for forest management. Area outside protected area network is also equally important for birds and biodiversity conservation. This study was designed to determine the ecology of the bird communities in the mixed dry deciduous forest and scrub forest (SACON) in Anaikatty Reserve Forest, foothills of Nilgiri Biosphere Reserve, Coimbatore, South India.

The present study was initiated with the following major objectives:

- To determine the structure of bird communities in different habitats (mixed dry deciduous forest and scrub forest) in Anaikatty Reserve Forest;
- To assess the seasonality of birds in these two habitats

- To analyze the impact of disturbance in these two habitats, especially on bird communities, and
- To investigate the general ecology of select bird species.

Study Area

Although 81% of land birds out of 1295 species of birds in the Indian subcontinent are recorded, ecology and biology of only a few species have been studied in detail. The present study was designed to determine the ecology of the bird communities in the mixed dry deciduous forest^(MDDF) and in the highly degraded and regenerating area scrub forest^(SF). Scrub forest is in the campus of Salim Ali Centre for Ornithology and Natural History (SACON) and the mixed dry deciduous forest is in Anaikatty Reserve Forest, foothills of the Nilgiri Biosphere Reserve, at an elevation of about 610-750m above mean sea level. **These** an undulating terrain comprising the foothills and hills, situated between 76° 39' and 76° 47'E and from 11° 5' to 11° 31'N. The total area of Anaikatty Reserve Forest is 4447.74 ha (2292.08 ha of south division and 2155.66 ha of north division) and the area of SACON is 55 acres.

The climate varies considerably in different seasons in ~~these~~ forests. Seasons observed during the study period (1999-2001) were classified into four, namely southwest monsoon, northeast monsoon, winter and summer. The average rainfall during the last 10 years was 668 mm. Rainfall was moderately higher during northeast monsoon, than southwest monsoon and lowest during winter. Maximum temperature varied between 28 °C and 36 °C during the study period. The monthly mean of the relative humidity showed fluctuation between

31-75 (at 8.30 hours) and 72-89 (at 17.30 hours). The monthly mean windspeed recorded was between 3 and 14 km/h.

Vegetation Physiognomy

Altogether 118 plant species belonging to 44 families were recorded from Anaikatty Hills. Phenology of plants was studied on 36 species in mixed dry deciduous forest and 27 species in scrub forest. Shrub species richness and diversity were higher than those of tree species in the mixed dry deciduous forest. The density values of 23 tree species were <1 and only four tree species had >1 . Species (50) having medicinal value are preferred for collection by the tribals.

The scrub forest consisted of the regenerating trees such as *Albizia amara*, *Diospyros ferrea*, *Elaeodendron glaucum* and *Cassia fistula* and shrubs. Cattle frequently visited this area while goats and elephants occasionally. Tree species richness was very low in scrub forest than that of shrubs. Of the 32 shrub species only a few had >1 as their density value. The most common shrub species were *Lantana camara* and *Chromolaena odorata*.

The number of species of plants in flower and fruit as well as the abundance of flower and fruit was similar in both the years, but varies between the two habitats. Plant species in fruit were higher in mixed dry deciduous forest than scrub forest in all the seasons. Abundance of flower was high during summer in both the habitats. In the scrub forest phenological trend was the same for both the years and it showed two peak periods. The maximum fruit

abundance was in June-July and flower was recorded in April-May with a minor peak in October during both the years. Foliage height diversity was high and foliage was available up to 11-12 m in the mixed dry deciduous forest while it was only upto 5m in the scrub forest.

Bird community structure

A total of 129 species were recorded in the study area by census, which was 69% of the total species (187) observed in the Anaikatty Hills. Of the 129 species, 113 species belonged to 38 families in mixed dry deciduous forest and 84 species belonged to 34 families in the scrub forest. 35% of bird species were restricted to the mixed dry deciduous forest and 12% to the scrub forest. The species common to both the habitats were 53%. The number of species decreased but the abundance increased during the second year. The migratory status of bird species in the Anaikatty hills was enumerated as residents, resident/local migrants and winter visitors. The proportions of residents were more in both the habitats. Granivore abundance was higher than the nectarivore abundance in the scrub forest and the former was comparatively higher in the scrub forest than in the mixed dry deciduous forest.

Species belonging to the families of Pycnonotidae, Muscicapidae, Irenidae and Centropodidae were sighted more frequently in these areas. They are Crow-pheasant, Gold-mantled Chloropsis, Gold-fronted Chloropsis, Common Iora, Flycatchers, Warblers, Bulbuls and Babblers. In the mixed dry deciduous forest bird abundance reached the peak in September and the lowest was seen in

June. In scrub forest, highest abundance was noted in January and lowest in July. There was no significant variation between the years.

Unlike abundance, richness was high in mixed dry deciduous forest throughout the year and bird species richness peaked in October and a minor peak was seen in March. There was a definite trend in fluctuation of species richness in mixed dry deciduous forest. Scrub forest peaked in species richness during January. Maximum number of species was observed in October and minimum in June in the mixed dry deciduous forest. In the scrub forest the maximum was in January and the minimum in July. In general, the most common species and dominant species in both the habitats were determined.

To relate bird community structure with habitat, vertical distribution of the foliage was sampled. A hypothesis, namely "Higher foliage profile layers harbour more species", was tested. Foliage thickness was recorded at different strata seasonally and foliage height diversity was calculated for each stratum. Indices of bird species diversity and foliage height diversity were correlated to test the birds' **relationship** on foliage height diversity, and there was a significant positive correlation between these two in all the seasons except summer.

Seasonality of Birds and Insects

Bird abundance was high during northeast monsoon and winter and low during southwest monsoon in mixed dry deciduous forest and scrub forest respectively. The total number of species shared by the mixed dry deciduous forest during southwest monsoon was 63% and the scrub forest was 37%. The

avifauna of the mixed dry deciduous forest was largely dominated by insectivore guild throughout the study period, followed by omnivore and frugivore. In the scrub forest, the avifauna was dominated by frugivores followed by insectivores. Frugivore abundance was high during northeast monsoon when an exotic weed *Lantana camera* was in fruit and low during southwest monsoon. As frugivores were high, insectivores and omnivores were low during northeast monsoon.

Sixteen groups of insects were encountered in the six various sampling techniques employed in the field. Large sized invertebrates were very few, only 4% in the mixed dry deciduous forest and 2% in the scrub forest. Small sized insects were profoundly abundant in both the habitats. The general abundance of invertebrates from the pooled data in the mixed dry deciduous forest showed, arachnid to be responsible for 21% of invertebrate abundance. The major contribution among the insect groups was Lepidoptera followed by Orthoptera, Diptera and Hymenoptera. In the scrub forest, Hymenoptera was responsible for 26% of invertebrate abundance followed by Arachnid, Hemiptera, Diptera, Lepidoptera and Orthoptera. This hierarchy of abundance was statistically significant. Among the insect groups, Lepidoptera, Orthoptera and Diptera in the mixed dry deciduous forest and Hymenoptera, Hemiptera and Diptera in the scrub forest formed the first three higher abundant groups.

Rainfall showed positive correlation with abundance of birds in mixed dry deciduous forest. Insectivore abundance of the mixed dry deciduous forest showed positive correlation with total insect abundance whereas the insectivore abundance in the scrub forest showed significant positive correlation with

lepidoptera. Total abundance of birds in the mixed dry deciduous forest correlated highly with fruiting plants and abundance of fruits. In the scrub forest also, significant relation was obtained with abundance of birds and plants in fruit, while young and mature leaves had no significance with bird abundance. Shrikes, Warblers, Flycatchers, Drongos, Common Iora, Yellow-eyed Babbler, Oriental Magpie Robin, White-browed Wagtail, Chestnut-Headed Bee-Eater, Plain Prinia, Black-rumped Woodpecker, Rufous Woodpecker, Asian Paradise Flycatcher, Bee-eaters, Swifts and Swallows significantly increased with insect abundance.

Foraging behavior

Foraging data were collected early in the morning during the study period. In total, 42 species were observed, 36 species from the mixed dry deciduous forest and 22 from the scrub forest and they were analyzed. Various foraging dimensions such as method, substrate, height and position in the canopy in both the habitats were analyzed. Foraging attempts were assigned to 12 height categories, seven substrate categories, 9 positions in the canopy and 20 foraging methods. Niche breadth of the species, overlap between and among the species of a community were discussed. Two major guilds, namely gleaners and salliers were identified in both the habitats. The gleaners again formed four and five guilds in the mixed dry deciduous and scrub forests respectively. Foraging dimension of 16 species were compared between the habitats since these

occurred in both the habitats. Thirteen species shared change in the use of substrate while only five species changed the method used.

Five bird species in the mixed dry deciduous forest and 11 species in the scrub forest were considered as specialists as their J' values were zero. In four dimensions (foraging height, foraging method, position in the canopy and foraging substrate), highest mean niche overlap was found in the use of foraging height in the mixed dry deciduous forest and canopy in the scrub forest and the least in the foraging method in both the habitats. There were four major groupings among the bird species based on the food eaten in both the habitats: insectivores, nectarivores, frugivores and omnivores. The plants (shrubs and trees) provided microhabitats such as foliage, twig, flower, fruit, secondary branches and trunk and the proportion of foliage use at different heights was higher in the mixed dry deciduous forest.

Breeding of birds

The study area of 20 ha. was combed for nests in both the habitats. Both opportunistic and observational records were made to enumerate the nests in different seasons. Variables of nests and nest-site characteristics were set at nest, nest tree and nest patch levels. Altogether, 410 nests of 32 species were observed during 1999-2001. There were 118 and 292 nests of 19 and 22 species breeding in the mixed dry deciduous and scrub forests respectively. The maximum number of nests found in both the habitats was of the Red-vented Bulbul.

Ten breeding species were restricted to MDDF, namely Black-hooded Oriole, Common Iora, Crow Pheasant, Jungle Crow, Jungle Babbler, Long-tailed Nightjar, Green-billed Malkoha, Chestnut-headed Babbler, Scimitar Babbler and Spotted Dove while 13 species bred only in SF and 9 species in both the habitats.

Breeding seasonality of birds in both the habitats was examined. Six different types of nests were recorded with statant-cupped nests being more in number. Eight plant species were predominantly used for nesting. Breeding biology including nesting, nest-site selection, clutch size, incubation period and nestling period was studied for nine species, namely Laughing Dove, Yellow-eyed Babbler, Tawny-bellied Babbler, Yellow-billed Babbler, Jungle Babbler, Red-whiskered Bulbul, Red-vented Bulbul, Purple-rumped Sunbird, and Indian Robin. Informal interviews and field records were made to assess the human impact on plants which affected the breeding of birds in the mixed dry deciduous and scrub forests.