

Chapter 12

STATUS AND CONSERVATION OF BIRD DIVERSITY IN WESTERN GHATS OF KARNATAKA, SOUTH INDIA

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- ◆ Introduction
- ◆ Birds of Malnad
- ◆ Peoples practices and attitudes
- ◆ Coffee plantations
- ◆ Cardamom cultivated patches
- ◆ The Forest tracts
- ◆ Conservation and Management
- ◆ The Wetlands
- ◆ The protected Areas
- ◆ The Forests
- ◆ The cultivated tracts
- ◆ Summary
- ◆ Acknowledgement



Introduction

The Malnad (which in the local, Kannada or Canarese language means the land of hills covered with forests), is the Western Ghats area of Karnataka in Southern India embracing 25 taluks of eight districts. Of the Biodiversity components, birds are proven bioindicators of environmental quality, change and are ecologically and economically important. Fairly comprehensive studies on Western Ghats (W.G.) avifauna have been published (Betts, 1951; 1952; Taylor, 1987; Ali and Ripley, 1974; Ranjit Daniels et al., 1990, 1992; Pramod et al., 1997; Chakravarthy and Tejaswi, 1992; Chakravarthy, 1997; Shankar Raman and Joshi, 2001; Vijayan and Priya Davidar, 2001). Most recent publications on Western Ghats Biodiversity are to be found in *Current Science* (Volume 73, 1997), in *Tropical Ecosystems : Structure, Diversity and Human Welfare*, (Editors : K.N.Ganeshiah and others 2001) and in *Trends in Wildlife Biodiversity Conservation and Management* (Editors : Hosetti, B.B. and Venkateshwarlu, M.). Yet, at the ground level research based conservation or management measures or interventions are wanting (Utkarsh et al. 2001; Achar et al. 2000). Also the impact of people and their actions in saving and sustaining species diversity are poorly assessed, monitored and integrated (Chakravarthy, 1997). In fact, the interest, land use and importance that the local people attach to an area should form the basis for developing conservation/developmental programmes in that area. This is crucially important because W.G. is world's one of the 25 mega diversity hot spots and home for about 350 endemic plant (Rajendran, 2001) and 324 vertebrates species (Daniels, 2001). Therefore, this paper examines the Research, Conservation and Management issues of bird diversity in the context of their implementation in the field in Malnad, a part of the Western Ghats of Karnataka (WGK).

Western Ghats run parallel to the West Coast covering 21,756 km². Moist tropical forests, dry tropical forests, montane sub-tropical forests and montane temperate forests are the four major forest types recognized (Anonymous, 1999). However, in this paper much of the discussion will be on four districts of Malnad viz., Hassan, Chikmagalur, Coorg and Shimoga where field observations on birds are being carried out from 1986 (See Map). Nevertheless, inferences from other parts of Western Ghats have also been drawn.

Malnad receives an annual 261 mm rainfall, of which nearly 83% is received between June and September. The minimum temperature being 6.5° C (January) and the maximum is 35.5° C (March-May). Malnad is located between 13° 10' and 13° 94' North and South, longitudes 75° 30' and 76° 85' East and West with elevation of 900 m in major areas and with lateritic soil. In its expanse, Malnad is replete with natural scenery and support a rich variety of geographical features - rolling mountains, deep valleys, bluish-green swamps, streams, tanks, riverbeds, plateaus and forests. Birds provide beauty, colour and endearing sounds and lasting aesthetics.

Comparison and distribution of birds in Malnad with other parts of W.G. can be

understood and appreciated given long term habitat/landscape changes. Exploitation of forests during pre-colonial era was mostly for non-commercial purposes. During the British rule, State Forest Department became the custodian of the forests and controlled large areas of forest. However, substantial forest areas and natural vegetation remained in private control or under Revenue Department. A study by the French Institute of Pondichery and Karnataka Forest Department shows that Karnataka's part of W.G. has 55% of the forest under Reserved Forests (RF) category and 45% outside it, mostly as Revenue Forests (Ramesh and Swaminath, 1999). The study also indicates that 12% of forest cover has been lost in the past two decades. These changes are related to increases in human and livestock populations and consequent pressure on forest land for non forest purposes. Until recently, forest management policies were largely a legacy of the colonial era with it's bias on industrial/commercial uses. Locals had free access to reserved forests and forests were converted to crop lands. About 25% of virgin forests in Malnad is being converted to coffee/cardamom or areca plantations. Coffee pulper or areca processing wastes are being discharged to river streams. The existing forest management policies are incapable of limiting the onslaught on forests.

Currently India being a signatory to International Convention on Biological Diversity, Indian forest policy has given important to Joint Forest Management (JFM) and formation of Village Forest Committees (VFC). The Joint Forest Planning and Management Scheme was implemented in 1993-94 in Malnad for instance in Bhadra wild life sanctuary, Muthodi, Chikmagalur and VFC with 15 membrs was formed in 1994-95. The primary purpose of JFM and VFC was to encourage the villagers to participate in the protection of forests particularly against fire and poaching.

Malnad contributes 12.5% to the Karnataka's Agricultural productivity (Anonymous, 1988). So the productivity of the land and life of the people of Malnad depend much on the way the natural resources are utilised and managed. The sustenance and perpetuation of birds, therefore, is of pivotal importance. Krishna, Bhima, Cauvery, Hemavathi, Bhadra, Tunga, Veda and Yagachi rivers originate from the Malnad. These rivers leave vast expanses of river beds along course of flow which are thronged by the wader birds in large flocks in the winter. The river courses also hold dense vegetation. Relationships between vegetation and birds is crucial to understand biodiversity conservation and management. But, this has remained unattended. Yoganarsimhan et al. (1983), Saldanha and Nicolson (1976), Keshavamurthy and Yoganarasimhan (1990), Rao (1990), Pascal (1988) and Nair and Gadgil (1980) dwell on different aspects of vegetation in Malnad.

Mainad bears Bauxite, Iron and Manganese in substantial quantities and there has been a great deal of open cast mining for these ores in the area. Each mining centre like Kudremukh is responsible for the loss of natural regeneration extending 8 to 10 km every year. Vegetation in mining areas is represented by broken scrub patches. Such habitats hold few bird species. Kemmungundi and Kudremukh are good



examples for such sites. There is considerable scope for biologists to restore vegetation and wild life in these areas. Uttangi (1993) documented the impact of hydroelectric project on birds in Mahadayi valley, W.G.

Birds of Malnad

Cardew (1895) was the first to document birds of WGK. Davidson (1898) prepared a comprehensive list of birds of North Karnataka, a district adjoining Chikmagalur in the north. He recorded 259 species. Ranjit Daniels added 150 more bird species from the same area after about a century. Betts (1930, 1932, 1934 and 1938) in a series of articles recorded several aspects of bird life in the Coorg. He recorded 190 species. Betham (1902), Phythian - Adams (1934) and (1939), Brooke - Worth (1953) and Ghorpade (1977) conducted bird surveys. Chakravarthy and Tejaswi (1992) recorded 294 species and Chakravarthy (1997) recorded 313. Davidar (1980) recorded 107 species in the Kudremukh - Aroli - Ganga mula tract in Chikmagalur. Salim Ali (1942-43) with notes by Whistler carried out a survey of the birds of old Mysore and Coorg and did field work from 12 January to 13 February 1940 in Coorg, Sakleshpur (Hassan), Kemmangundi and Jagar valley (Chikmagalur) and in Setihalli, Agumbe and Jog (Shimog). There is no avifaunal work published of Hassan and Shimoga, though C.J.W. Taylor wrote, "A tentative list of the Birds of Manzeerabad (near Sakleshpur, Hassan), Mysore in 1887". Only recently did Gururaja and Co-workers (1993) documented bird-life of urban Shimoga.

Most of the resident, endemic and native forest bird species are not found north of Goa. Endemic bird species are primarily birds of rain forests and the higher elevation shola grassland complexes (Daniels, 1997). Locally, when equal areas are compared, there are more species of birds per unit area in the central parts of the W.G. This is due to mixing of migrants and generalist species of birds with the resident specialists and endemics. Wet evergreen forests and montane sholas, despite proving habitat to a number of specialists and endemic birds with greater conservation value, are comparatively less diverse in bird species than secondary / disturbed evergreen and moist deciduous forests (Daniels, *et al.*, 1991; 1992; 2001).

Human interference of forests has led to the disappearance of birds locally in the W.G. However, when large landscapes are considered, the avifauna has remained stable during the past 100 years (Daniels *et al.*, 1990a). Bird diversity is inversely related to woody plant species diversity (Daniels *et al.* 1992). Monocultures may support an assemblage of birds as diverse as (or even more diverse than) evergreen forests. However, birds that inhabit the monocultures are often generalist habitat users drawn from a wide range of neighbouring habitats (Daniels *et al.* 1990b, Pramod *et al.* 1997). Hence, rain forests with climax vegetations assume significance.

A total of 313 bird species belonging to 17 orders, 54 families and 174 genera were recorded from 1972 to 1986, from 1990 to 1996 and from 1998 to date. Fifty five per cent are residents and thirty six per cent migratory (Fig 1). The migratory birds not



only arrive to Malnad from parts of oriental region but also from Russia, Siberia, Korea, Africa and West Asia (Chakravarthy, 1997). In Malnad species richness varied from season to season (Fig. 2) with 83% being terrestrial species (Fig. 3).

The value of Malnad as a reservoir of biological diversity is indicated by 32 bird species being sighted rarely. Birds belonging to the family Irenidae (Iora, Chloropses and Fairy Bluebird), the only family endemic to oriental region, is well represented in Malnad. The Malnad avifauna represents 100 species (30%) of forest birds and 134 (46%) of passeriformes. Like in W.G. in Malnad also forest tracts support twenty or lesser number of species. But these (eg. Lesser Kestrel, Rock Bush Quail, Blackheaded oriole, White-bellied Black woodpecker and others) are rare and of high conservation value. The monocultured, man-made plantations (eg. of exotic eucalyptus, acacia, etc.) support little bird life (less than 10 to 12 species, on an average) but mixed plantations support 34 species. Mixed bamboo forest tracts attracted ten to twelve more species than mixed teak forests in Malnad. Tree species attracting higher number of bird species is depicted in Fig.4.

How does bird community and guild attributes vary with elevation in the tropical rain forest of the W.G.? Does elevation and habitat quality relate predictably with change in bird community? To answer these questions, Shankar Raman and Joshi (2001) carried out a study in the evergreen rain forest of Kalakad-Mundathurai Tiger Reserve (Tamil Nadu). Across fourteen sites, 250 bird species were observed and none of the measured vegetation parameters was significantly correlated to elevation, except for bamboo density that showed a positive correlation (Table 1). Bird species richness and diversity indices were significantly negatively correlated with leaf litter depth. There were no significant correlations between birds and vegetation. Although some variation in guild structure could be attributed to elevation, bird guild structure was maintained by species replacements along the gradient.

The lack of a definite species trend and variations in bird composition along elevation and vegetation composition in WGK has consequences for bird conservation in the region. Hill tops of WGK may be represented by a few bird species (eg. Osprey, Yellow backed sunbird), but these birds are not normally sighted along other gradients. So, to protect full complement of rain forest bird communities, areas at all elevations be conserved (Shankar Raman and Joshi, 2001; Chakravarthy, A.K., Pers. Obs., 2001).

Peoples practices and attitudes

By tradition, people worship and protect by sentiments birds like Peacocks (*Pavo cristatus*), Owls (*Athene brama*), Pigeons, rodents, snakes, monkeys and langurs and a wide variety of herbs, shrubs and trees. These creatures stand deification to several gods and goddesses, are known by a variety of names across Malnad. People derive multiple benefits from forests and harvest the resources in a way that renewability and generation capacity of the source is not affected. Patches such as *Gomala*



(Grazing lands), *Soppina betta* (green manure yielding patches for areca and coffee plantations) and *Devara kadu* (forest patches attached with religious sanctity) which were parts of virgin forests earlier, serve as refugia for birds and other animals. Similarly the scrub patches, barren uplands or lands of low economic value, often used as grazing lands, hold very few species but add to the biodiversity. For instance, barren uplands are inhabited by Ashy-crowned Finch-lark, Malabar crested Lark and Paddy field pipit. The mixed-farming situations in the plains of Malnad offer feeding sites for over 30 species, temporarily. The people have practical means of deriving benefits without affecting the conservation value of the habitats (Chakravarthy, 1997).

People's perceptions towards nature and natural resources are also reflected in the way the crops are cultivated. A majority of the rural population are subsistence farmers traditionally cultivating paddy, coffee, areca, etc. For instance, how the three cultivated cropping landscapes sustain birds, is given below:

Coffee plantations

Coffee (*Coffea arabica* and *C. robusta*) plantations represent the minimal modifiers of basic bird habitats in Malnad. Agribusiness is centred around coffee. Most planters have conservative attitudes and often do not abuse agricultural chemicals, nor fell the multitudinous species of shade trees that represent elements of tropical rain forests. In fact, coffee cultivation began over a century ago, when planters maintained patches of natural forest besides coffee estates. Coupled with this, the branching pattern of the coffee plant, where the branches embrace a thick overlapping canopy about 2 m high, provides food (arthropods mostly), nesting area and shelter for shade-living as well as shrubby-living arboreal birds. Coffee planting and tending does not require intense human pressure throughout the plant growth period. Coffee plant alone supports nesting of more than twelve species and hold 50 to 60 species at a time. Coffee plantations are the main refuge for more than 30 species during migration (September to January).

Cardamom cultivated patches

Farmers in Malnad plant rows of cardamom (*Elettaria cardamom Maton*) the Queen of spices along streams in valleys. These cultivated patches are preferred habitats for the Malabar Whistling Thrush, Little Spiderhunter, Spotted Babbler, Jerdon's Blackbird, Orange headed Ground Thrush, Paradise flycatcher, Woodpeckers and bulbuls. The use of these patches by birds is high as farmers do not disturb them nor use pesticides. This traditional system of maintaining coffee and cardamom plantations accrue many benefits to the planters, such as bio-control of pests and pathogens, soil and water conservation, soil fertility restoration and sustainable crop yields.

Paddy fields

Paddy (*Oryza sativa*) covers 33% of the cultivated area in Malnad. Farmers maintain rows of shrubs and/or trees at the bare field edges. These niches provide birds with



sites for shelter, food and roosting. The rice plants stays in the field for about five months and provide suitable habitat for 28 to 30 birds.

At seedling stage, the puddled paddy fields with sheet of water offer attractive feeding sites for sandpipers, plovers, rails, crakes, snipes and stints. The vegetative stage is inhabited by paddy field warbler, wagtails, chats, etc. In the crop maturing stages, mynas, swallows, wagtails, harriers, hawks, kites, owls, munias, bayaweavers, Red-headed bunting and warblers visit paddy fields. Throughout the crop herons, paddy bird or pond heron (*Ardeola grayii*) in particular and egrets, storks, Ibises, frequent the paddy fields. Mason and Lefroy (1912), Mukherjee (1971 and 1975) and Majumdar and Brahmachari (1987) reviewed the literature on bird predators and concluded that the activities of birds in paddy fields were highly beneficial and that birds played the role of biocontrol agents.

In Malnad, birds are encouraged to frequent paddy fields, as farmers do not use pesticides, fertilizers or deploy heavy machinery or mechanized farming techniques. Cultivated areas when compared to a number of primary habitats including forests have proved to be more species rich in birds (except fresh water marshes). Birds as Malabar Pied Hornbill (*Antracoeros coronatus*) considered rare in W.G. itself, can be sighted in good numbers in drier agricultural tracts of Uttara Kannada. Similarly Crested Hawk-eagle (*Spizaetus cirrhatus*) was sighted in an agricultural area bordered by remnant forest trees (Daniels, et al., 1991). So a balanced approach to the management and conservation of birds in cultivated patches is required.

The Forest tracts

Of 15.5 lakh ha in Malnad, 10% is forest, so that the way people use and manage forests has profound influence on birds. The rain forest is characterised by species of *Alstonia*, *Artocarpus*, *Dipterocarpus*, *Palaquium (Dichopsis)*, etc. One widely distributed tree is *Mimusops elengi*, which especially attracts green pigeons (of species *Ducula*, *Treron*) to its fruits and is found in Sringeri, Agumbe and Kalasa. *Myristica dactyloides* (Myristicaceae) is encouraged at higher altitudes (> 1000 m) in Agumbe, Gangamoola, Kudremukh, Kalasa, Magundi and South Coorg areas and is well known for attracting birds.

In Chikmagalur, forests support more than 20 rare bird species (i.e. Shaheen Falcon, Lesser Kestrel, White-bellied Black woodpecker, Ashy Drongo, etc.). Over exploitation of forest resources has reduced the forest cover. For example, in Uttara Karnataka district, forest area has reduced from 8000 km² to 6000 km² in about ten years (Potter, 1996). In W.G. forests cover 27,000 km². Only 10% of forests can now be classified as dense with a canopy cover of over 80%. The rest is degraded. For Malnad, the corresponding figure is 7%. Forests in Malnad are degraded partly through excessive logging of teak and Rose wood., softwood tree species as *Bomgax*, *Evodia*, *Macilus*, *Alstonia*, *Artocarpus* and others for match wood and plywood industries and more seriously through a lack of regeneration. Without adequate regeneration, traditional



management using variation of selection system is not possible and the forest may be replaced by scrub land.

Lack of forest regeneration is attributed to three main causes : removal of fuel wood and small sized poles for building, trampling and grazing by cattle and loss due to fire. The last being the most important. If these unique forest tracts are destroyed, not only will the local population be deprived of fuel, green manure and a wide range of other forest products, but there will be no timber and the plant and animal genetic resources will be irrevocably lost to India. So in Malnad, biodiversity monitoring and conservation is the need of the hour. In this contest, the Western Ghats Biodiversity Network (NGBN), Center for Ecological Sciences, Indian Institute of Science, Bangalore monitored Biodiversity in Malnad involving 300 students and two dozen teachers. Each college studied a nearby village landscape about 25 km². This flexible and exploratory design rather than hypothesis - driven approach facilitated participatory monitoring of biodiversity that is very much required now-a-days. Along 20,500 m length transects, species richness and abundance of trees, birds, butterflies and ants were sampled (Kunte *et al.* 1999; Nagendra and Gadgil, 1999) after land use classification and mapping.

Human habitations harboured high bird diversity (Table 2). Management strategy should focus on maximizing total biodiversity value of the mosaic of habitat types within the landscape (Pramod *et al.* 1996b). For instance, nurturing of keystone specie like Figs (*Ficus* sp.) is both socially appealing and biodiversity friendly (Utkarsh and Almeida, 1999). Likewise in Malnad, species of *Ficus*, *Carya*, *Erythrina*, *Butea*, *Bombax* and *Lagerstromea* attract 6 to 9 families of birds (Chakravarthy, 1997). These tree species also hold other animal taxa.

Gap analysis programs have been used to determine biodiversity hot spots, identify gaps in existing protection and for conservation prioritization (Jennings, 2000). Unfortunately, detailed inventories in field are constrained by severe resource and time limitations. Alternative strategies for collecting biodiversity data include vegetation analysis of satellite imagery and spatial analysis of existing and future landscape changes (Menon *et al.* 2001).

Conservation and Management

Given the foregoing background for the status of natural resources particularly birds in Malnad, following actions are worthy of implementation.

The Wetlands

The wetland habitats in Malnad-streams, river beds, estuaries, ponds, lakes, water beds, marsh are interlinked forming a network which constitutes a complex ecosystem, where plants, animals and people are interdependent. The main environmental issue concerning wetlands in Malnad are excessive growth of vegetation and weeds, reduction in water clarity, enrichment of waters, siltation and high microbial activity (Chakravarthy



and Sridhar, 2000).

a. In Chikmagalur, Hassan, Coorg and Shimoga, coffee pulping and areca curing waste waters are entering into river streams and have polluted much of the natural network of wetlands. For instance in Bhadra wild life sanctuary, Somvahini river is the only source of water for the people of the forests. Coffee planters surrounding the sanctuary drain water from the pulper units into river stream, polluting the entire river system. Curing centers are not adopting environmental safety norms. Gangamoola, the source of several rivers including Bhadra is located 11 km from the new area prospected for lease by the mining company. What effect mining and ore extraction activities will have on avifauna is yet to be ascertained. The coffee pulper waste waters need to be diverted to pits underground and areca curing waters need to flow in broad channels, thus exposing for natural cleaning processes.

b. Silting and sedimentation problems need to be addressed immediately. All cultivation, brick making and mud lifting activities around wetlands are seriously affecting wetland ecology and biodiversity. These activities have affected more than 100 wetlands in Malnad. Arasikere - Alampura, Ambelekere tanks in Chikmagalur, Bhuvassamudra and Sigadikere in Coorg and Purale and Navile tanks in Shimoga district are instances of such onslaught on water bodies.

The afforestation of catchment areas of wetlands will not only help in preventing silting, meet the biomass needs of the local people but also enrich productivity/ biodiversity of the habitats. Trees like *Acacia nilotica*, *Casuarina equisetifolia*, *Dalbergia sissoo*, *Ficus glomerata*, *Lalgerstromia speciosa*, species of *Pongamia*, *Populus*, *Myristica* and others can be planted at different strata, layer by layer, depending on the ability of the species to withstand flooding, inundation, dry conditions as the case may be for afforestation. Proper landscape improvement in ecological terms for catchment and shore areas need to be adopted.

Major pockets and habitats associated with large populations of birds like Gudavi and Mundagadde in Shimoga, Alur and Madenur tanks in Hassan and Iyankere and Karaghattakere in Chikmagalur need to be cleaned-up, provided with more perches for shelter and nesting of herons, egrets, cormorants and shorebirds like plovers, sandpipers, lapwings, etc.

c. Lakes and ponds in and around all major towns like Sakleshpur, Madikeri, Hassan, Chikmagalur, Belur are becoming boggy with green and brown algal blooms. Most of these water bodies have lost seasonality and wetland values. For surface feeders like teals, spot billed ducks, Coots, Dabchicks and Piscivorous species like cormorants it has become difficult to adapt to turbid waters. Owing to proximity to industries, urbanized set-up, fertilized fields and other sources of pollution tanks are turning to eutrophic ecosystems and there is a need to arrest tanks from these processes.



- d. Poaching and hunting of birds is prevalent in 18 tanks in Hassan, 11 in Coorg, 29 in Chikmagalur and 19 in Shimoga. Conflicts between waterbirds and man has increased especially in wetlands leased out to harvest fishery resources.
- e. Fishery resources in most of the river streams is too low to support the waterfowl and aquatic avifauna. For instance in Chikmagalur in Tunga, Bhadra, Hemavathi, Yagachi, Veda, Avati, Nethravati, etc. river streams annual fish catches are too low for sustainable harvesting. So fishing should be prohibited in important sections of river streams. For instance, the Coorg wildlife society, Coorg, banned fishing in 25 km stretch of Cauvery river in Shuntikopa and this resulted in the retreatment of the prized fish, the Mahasheer and rare species of water birds like Green heron, Large egret, etc.

The protected Areas

- a. Effective management is the responsibility of the protected area management staff. A reduction in the total area of the ecosystem reduces species diversity until it reaches an equilibrium of the size of the ecosystem. The case in point is that of the Kuvempu Biosphere reserve, Kuppalli, Thirthahalli, Shimoga. Of 6866 acres, only 3230.50 acres has been declared as Biosphere reserve. Over 2336 acres adjoining to the Biosphere reserve has remained as revenue lands and over 1,300 acres as minor forest area. So the Government of Karnataka should extend the Biosphere reserve and enact gazette of all remaining areas.
- b. Ecotourism in developing countries like India with tropical forests has become big business. The growing demands for ecotourism should present numerous opportunities for increasing sustainable, rural and national development, while still protecting biodiversity. For instance in Kuvempu Biodiversity Park, few cottages and thatched huts should serve the purpose of researchers, ecotourists and environmentalists. Uncontrolled tourism development and impacts can degrade the sustainable and scenic resources of the park.
- c. Traditional cultures in and around protected areas, sanctuaries have evolved practices over the year to promote sustainable use from the conserved natural resources. But the same practice has just the opposite effect as population begins to increase rapidly. The survival strategies of the poor particularly, their search for food, fodder, fuel and shelter often lead to over-exploitation of natural resources, accentuating environmental degradation (Fig. 5). This is the situation particularly in Bhadra wildlife sanctuary, Chikmagalur and Nagarhole National Park in Coorg. In the former, in 24 villages inside the sanctuary, the human population has increased four folds in the last two decades and people inside the sanctuary are not interested in the forests, natural resources. In Nagarhole park, the clashes between the tribals inhabiting the sanctuary and the Forest officials have increased by many folds. There should not be delay in the resettlement of inhabitants outside the sanctuary/park and people should not be allowed to cultivate the land inside the sanctuary/park.



- d. The entire sanctuary/park should be under the control of one District Forest Officer (DFO), under one Division.
- e. In Malnad, considerable forest area, particularly the shola forests are under the Revenue Department and the encroachment into forest area is rampant. All these lands are very crucial for the sustenance of the sanctuary and should be under the control of Forest Department. The Government Forest policies are being implemented but implementation is tardy with deficiencies. Poaching and hunting activities are rampant during night. The number of guards/watchers are too low. Even those that are present are working 'hand-in gloves' with poachers and smugglers. So monitoring and strict vigilance are urgently required in all the protected areas in Malnad.
- f. River systems of protected areas are being increasingly polluted. The pollution Control Board should keep a strict vigilance and sustain clean waters.
- g. In protected areas, there should be a close and good co-ordination among the various Government Departments like Revenue, Electricity Board, Forest, Police, Environment, Water and Sewerage Board, Animal Husbandry, etc. This is lacking in almost all the protected areas.
- h. Wild life habitat fragmentation and destruction should be halted, cultivation and timber extraction should not be permitted within 10 km² of the protected area.
- i. Buffer zones need to be created around all the protected areas in Malnad.

The Forests

The eight districts of WGK have 70.8 per cent of the forest area, which is 38.3 per cent of the state geographic area. As a percentage of the total geographic area of these eight districts, 32% is reserved forests which are governed by law, where grazing is regulated, fuel wood collection is controlled and restricted to dead wood. In such forests the man-animal conflict is minimum and bird diversity is maximum. Such forest tracts support even nesting of top consumers like black eagle, *Ictinaetus malayensis* Shaheen falcon, *Falco peregrinus* and owls of several species.

Unfortunately important forest areas such as Magundi, Hebbe forests, Kaiga, Jagar valley, Kalasa, Kemmangundi and Kudremukha have been alienated to non-forestry uses. Mines and hydroelectric installations have made significant contributions to the economy but with an accompanying loss of over 2,00,000 ha of state forest land. A further 50,000 ha have been allocated for cultivation, rehabilitation of displaced people and other purposes. In addition, 24,500 ha of the W.G. forests have been subject to encroachment by cultivators. Control of encroachment is made difficult where boundaries are not marked. Grazing today is unrestricted and unregulated. Firewood collection is widely extended to the cutting of live material such as saplings and small poles. Fire is widespread during summer in the deciduous forest types and in the grassy areas within the forests. The result today that reserved forests are in serious decline, land outside forests is degraded and no longer meet the requirements



of local people.

To ameliorate the crisis, Joint forest Planning and Management (JFPM) and Village Forest Committees (VFCS) have been formulated and implemented. Efforts have been made to identify the biodiversity hot spots in different forest types. Threatened habitats have been identified and multiple native species of planting trees have begun. Permanent monitoring plots have been established. In such habitats many native species have been retreated. The forests of W.G. need to be managed on sustainable basis. Following measures are required to restore forests of W.G.

- a. Restoration of highly degraded forests.
- b. Improved management of less degraded forests like bamboo, cane, sandalwood, timber and non-timber forests management.
- c. Farm forestry and agro-forestry for extending tree cover in areas outside forest lands.
- d. Supply and installation of energy saving devices.
- e. Maintenance and improvement of the existing protected areas network.
- f. Strengthening of Forest Department capabilities for forest protection such as increasing number of watchers/guards and rotating them in each locality.
- g. Relief or reduction of man-animal or bird conflict around protected areas.
- h. Inventory of forest resources and establishment of information systems.
- i. Training of forest personnel, extension services for NGOs, communities.

Earlier, forest protection, timber production, afforestation and consolidation of the forest area from encroachment were the main concerns of the forest department. Now, the management priority has been focused on the conservation and protection of forest resources for their environmental benefits. The policy of the Forest Department now is to protect and conserve forests involving local people and NGOs through participatory processes.

The cultivated tracts

In Malnad, about 60% of workers are engaged in agricultural fields. The per capita agricultural land is 0.22 ha with an average area of 1.66 ha. The average size of farm holdings is only 1.16 ha. Small (i.e. 1-2 ha) and marginal (less than 1.0 ha) land holdings account for 76.1% of the total number and 36.3% of the total area of farm holdings in W.G.K. This is indicative of the small farm based economics of the Western Ghats region and consequently the need for other income sources to supplement the low income derived from farms. The considerable areas given to permanent/perennial cash crops accentuate the problems associated with the small area of land available for food crops. On the western and central portions of Ghats, there are 1,00,000 ha of coffee estates, 56,000 ha of areca gardens, 37,000 ha of



cashew, 31,000 ha of cardamom and 50,000 ha of coconut plantation. As a result, the land available for food crops is very low. Because of the wide fluctuations in market price of these products, farmers approach to farming is 'sustainable agriculture', which is a balanced approach. So crop production should be more balanced considering the biodiversity this unique ecosystem holds. Forman and Godron (1986) have introduced some fundamental principles related to biodiversity conservation in fragmented habitats. The cultivated fields, both natural and cultivated, interspersed with corridors, ecotones and water courses should be hedges/tree-line or shrubs at borders, should not use often broad-spectrum pesticides, heavy machinery and should encourage insectivorous birds by providing sufficient perches, shelter/nesting sites, food alternatives and roosting sites.

Summary

The Malnad in Western Ghats (W.G.) region of Karnataka represents one of the world's 25 mega diversity hot spots and Western Ghats is home for 350 endemic plants, 324 vertebrates and nearly 400 bird species. The bird diversity is declining in Malnad because of increases in human and livestock populations and consequent pressure on forest for non-forestry purposes. By tradition, people are conscious of conservation and maintain sustainability and renewability of natural resources. The development programmes like construction of dams, mining, roads and huge building constructions should not jeopardize this activity of the region.

The full complement of rain forest bird communities along the gradient of W.G. need be conserved. Coffee, Cardamom, paddy and other crop's patches should continue to hold higher bird diversity. Joint Forest Management and Village Panchayat committees should ensure forest conservation via soil and water conservation measures, agro-forestry and farm forestry practices, improvement of protected areas network and by reducing man-animal conflicts. Protection to bamboo patches, preventing silting, sedimentation and encroachment of wetlands and forest patches and hunting and poaching of birds through peoples participation is important. Protection of forests from fire is a critical factor for bird conservation and diversity in Malnad. Bird diversity in mosaic of cultivated patches should have characteristics to hold endemic as well as migratory birds. In all, biodiversity in Malnad is declining and concerted efforts to preserve diversity is urgently needed.

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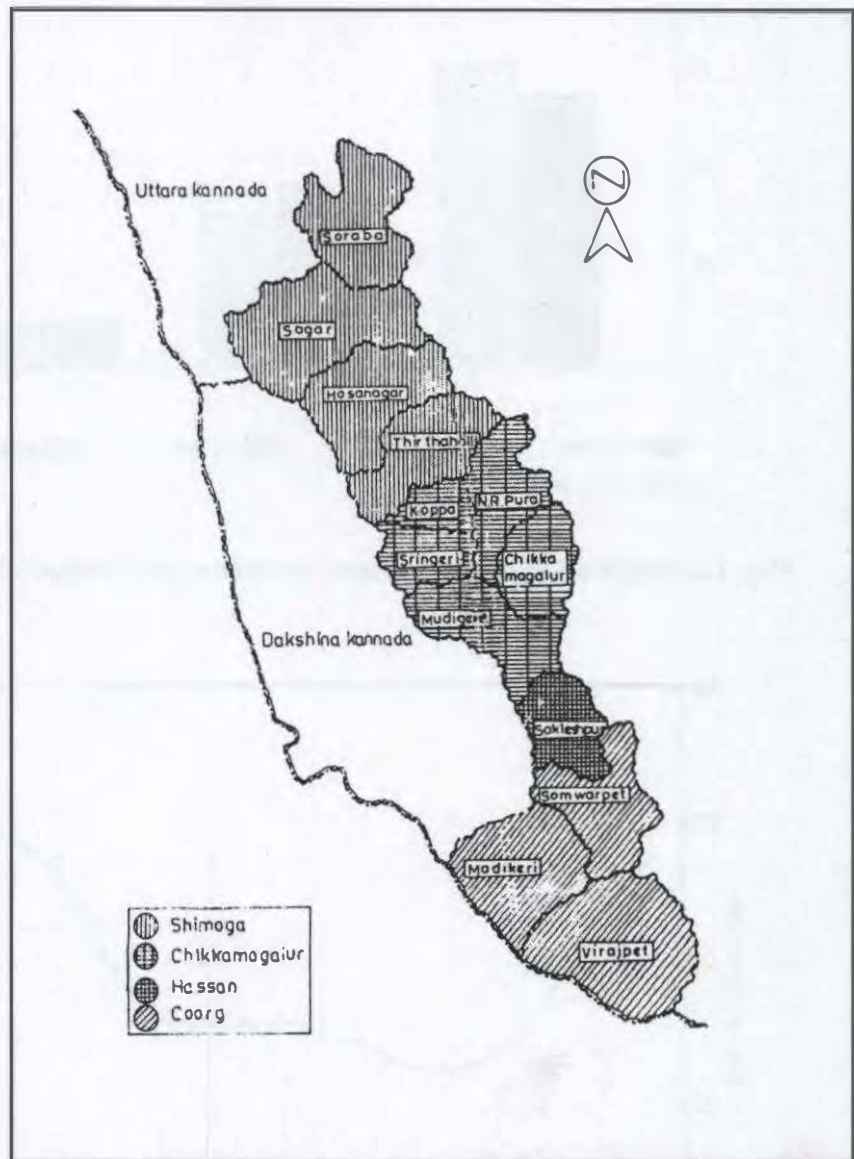
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A Map of four Districts in Malnad



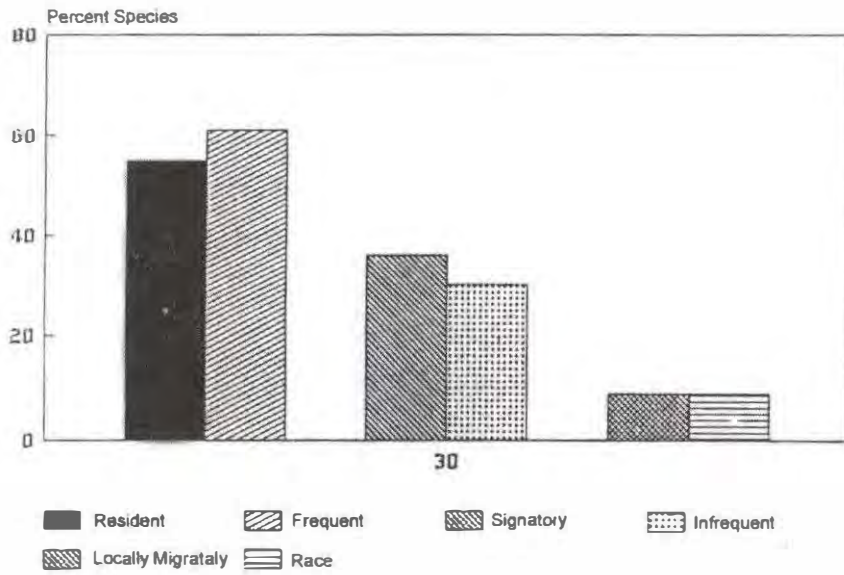


Fig. 1 Classification of birds based on status and frequency of occurrence

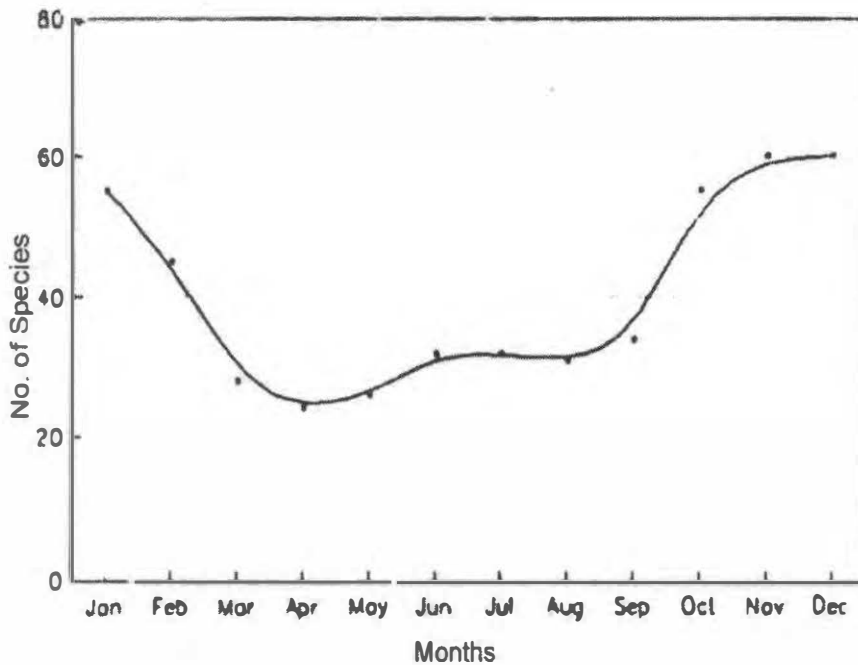


Fig. 2 Seasonal fluctuation in Bird species



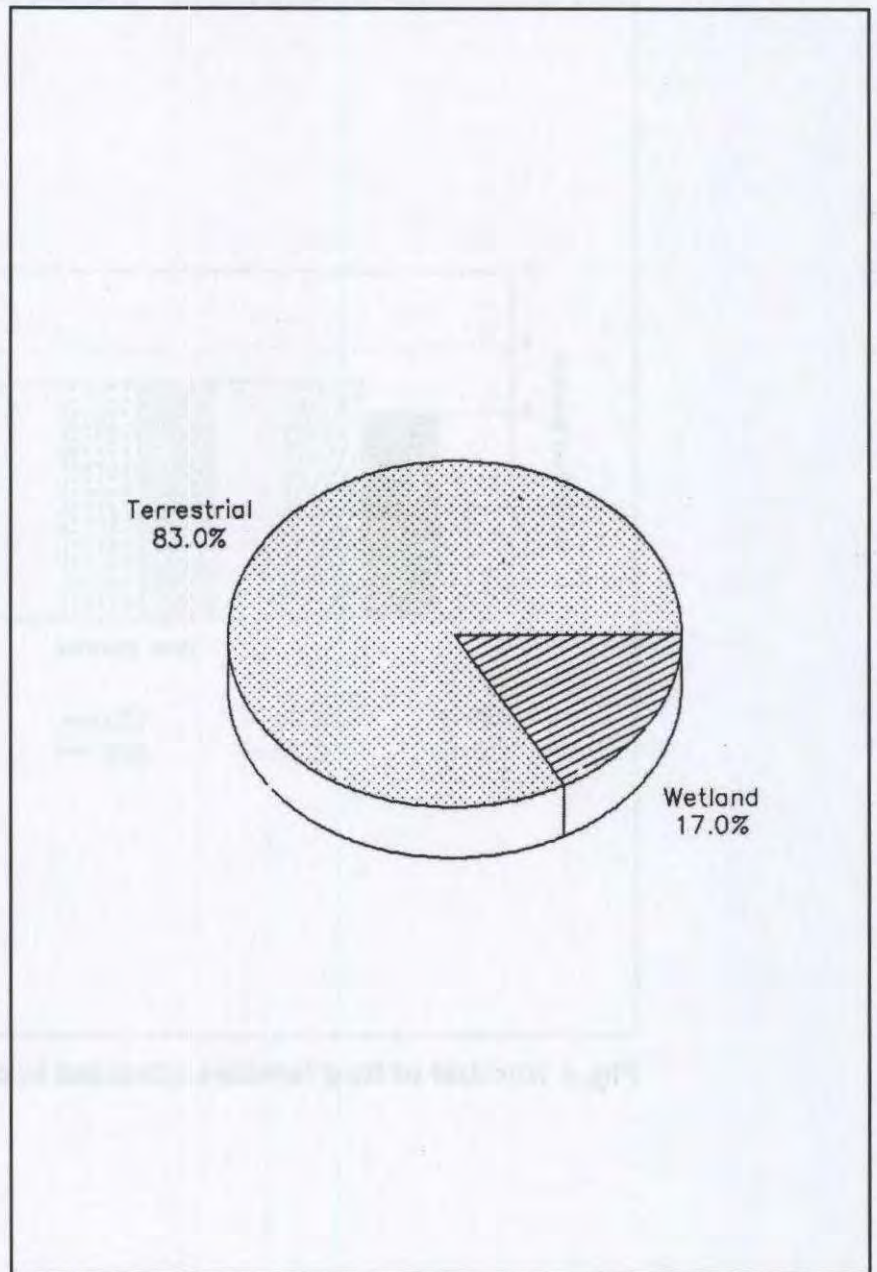


Fig. 3 Number percent of bird species inhabiting Terrestrial and Wetland eco systems



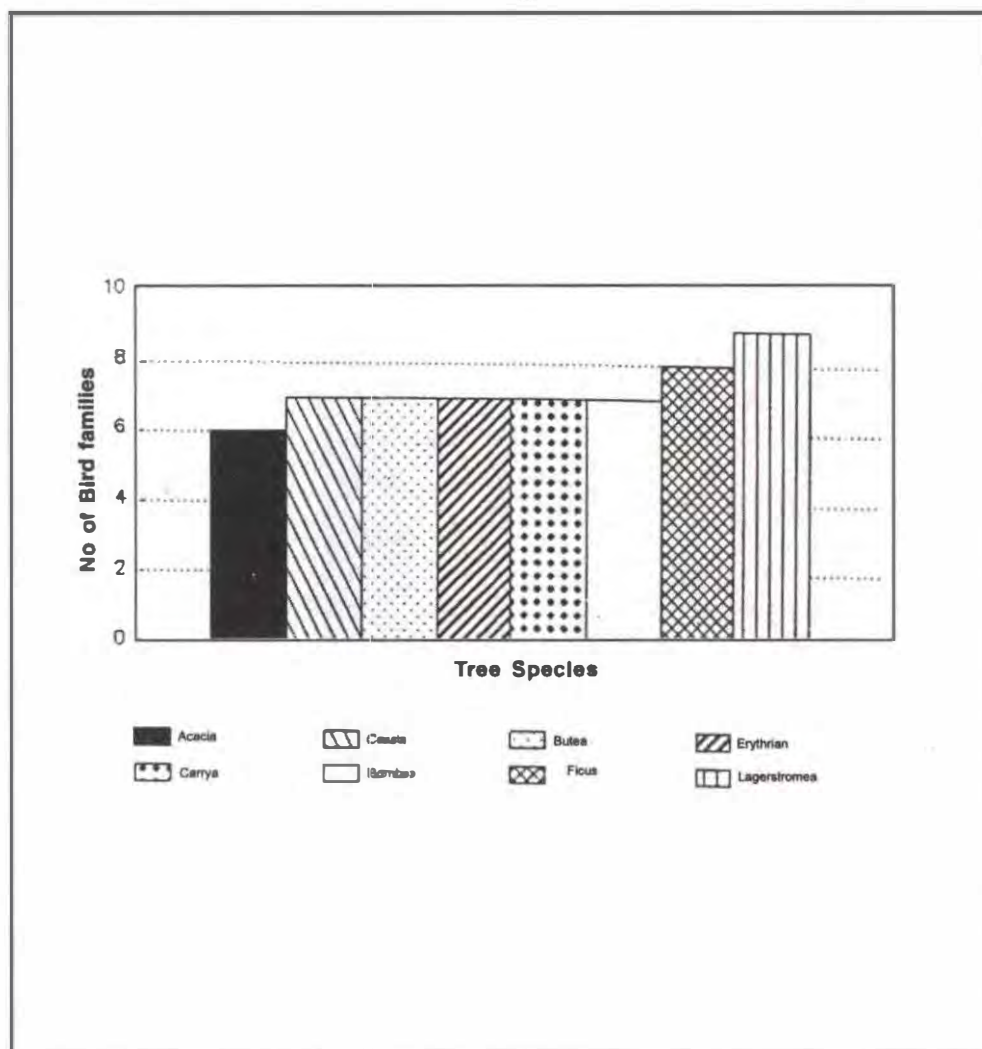


Fig. 4 Number of Bird families attracted to different tree species



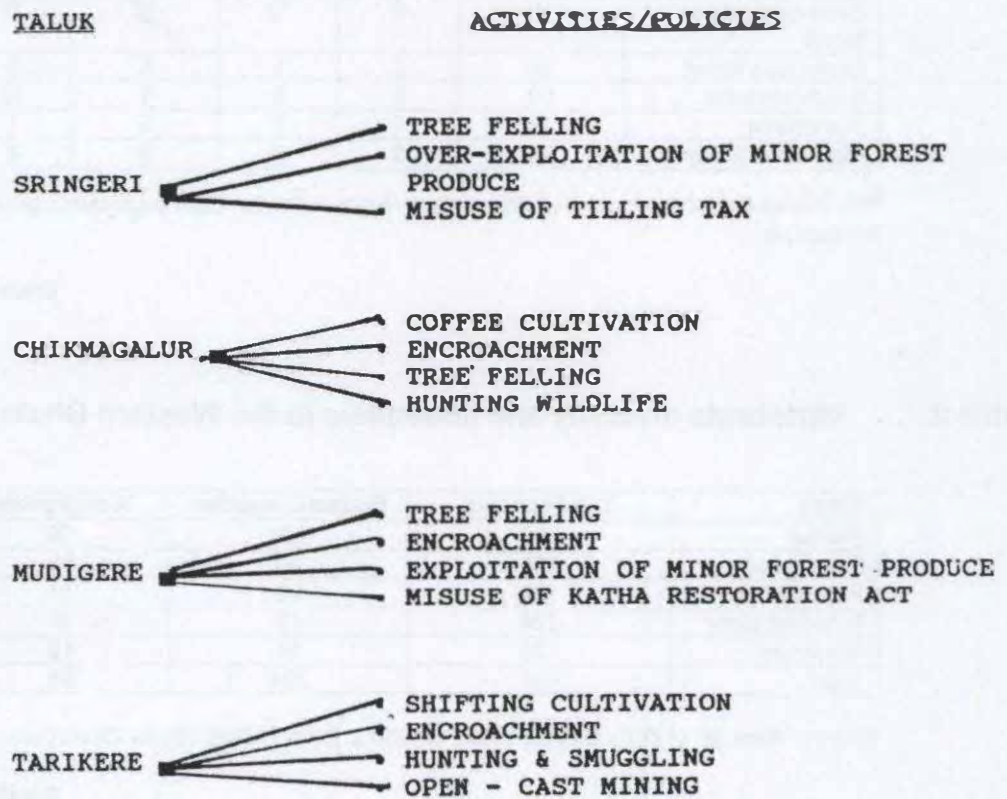


Fig. 5 Policies/activities interfering with natural resources management in selected taluks of chikmagalus district



Table 1. Covariation in biodiversity values across organismic groups and vegetation types.

Vegetable type	% area of landscape	Trees (a)	Birds (b)	Butterflies (c)	Ants (d)	Total (a+b+c)
Evergreen forest	5	10	7	5	9	31
Semi-evergreen forest	10	9	10	10	8	37
Deciduous forest	10	7	5	6	5	23
Scrub/savanna	15	6	6	1	10	23
Plantations	15	1	1	2	1	5
Human habitations	30	5	8	3	2	18

The values depict mean rank of Shanon's diversity index for each organismic group per type per landscape.

Utkarsh et al. (2001)

Table 2. Vertebrate diversity and endemism in the Western Ghats

Class	Total species	Endemic species	% endemism
Fishes	218	108	50
Amphibians	120	90	75
Reptiles	156	93	54
Resident birds	324	19	6
Mammals	120	14	12
Total	938	324	35

Source: Swengel (1991); Daniels (1992 & 1997); Easa (1998); Rema Devi (pers. Comm.)

Ranjit Daniels (2001)

