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Birds and Insectivory: Agrobiodiversity Implications in Sustainable Agriculture

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Birds and insects have one common feature; both are winged and capable of flight. This makes them together an interesting biota-complex for further studies in terms of insectivory. Insectivorous birds have often kept a strong check on insect pests that are explosive in their breeding especially in mono-cropping situations. Major insectivorous birds belong to the families Accipitridae, Aegithinidae, Apodidiae, Campephagidae, Cisticolidae, Hirundinidae, Laniidae, Meropidae,Monarchidae, Motacillidae, Muscipidae, Paridae, Picidae, Rhipiduridae, Sylviidae, Turidae and Upupidae (Ali, 1979)

It has been realized that birds which feed on invertebrates, specially insects, contribute immensely to their population dynamics (Verghese and Sriharan, 1993). Many a times birds are not specific predators and are invariably generalists and this is often thought of as a disadvantage in conventional biocontrol where parasitoids with narrow host range are used on target pests (Ali, 1979; Verghese and Sriharan, 1993). Birds are not amenable for indundative releases in areas of prey (pests) as they cannot be reared and introduced in a field especially with biocontrol as the focus. Therefore, the best options would be habitat management and conservation of birds by enhancing roosting, resting, feeding and breeding niches. For many practitioners of pest management this can be helpful since birds and insects have common behaviour in terms of aerial motion leading to habitat-overlap which plays a significant role in influencing agriculture pest scenario in agro-ecosystems (Canaday, 1996). Documentation of insectivory in India began with Mason and Lefroy's (1912) book (now not available in print) where birds were dissected and their gut analyses for insects were carried out. This is still the only major documentation available for us. With strict schedules banning wildlife (birds included) killing, gut analysis in birds is ruled out. This study therefore, has used archived notes of the first author to extrapolate the bird biodiversity trends over decades *vis-à-vis* pest diversity.

Materials and Methods

This study was conducted in north Bangalore in horticultural and wetland ecosystems. The main crops grown here are an array of fruits vegetables and paddy. The area roughly measured around 400 acres of varying crops and soil types. The study began in 1975 and the documentation was done till 2015 lasting about 40 years. Main documentation was on the bird species diversity that was regularly carried out by irregular roving surveys along a definite transect path that encompassed all areas of the area. To facilitate documentation, the survey was done on a bicycle or on foot. A pair of 7×35 field glasses which was zoomable x 50 was used. The data base of pests on the crops of which the first author was part of, was used to extrapolate pest diversity. The first author maintained the notes. Analyses were done to see the diversity of bird's on a temporal scale at approximate temporal yearly mid points in 1985, 1995, 2005 and 2015 (Table 1). The change in habitat structure, cultivation practices, use of inputs especially insecticides were also recorded. From the data collected, the impact of insectivory in terms of bird diversity decline on pest resurgences was extrapolated. These observations and inferences were facilitated by two authors' being in the entomology division of the Indian Institute of Horticultural Research Hessarghatta, Bangalore, India.

Discussion

In the present study, it was evident that in a span of four decades the biodiversity of insectivorous birds (Species Richness, S Table 1, Fig. 1) declined from 55 to 40 species in one decade and to 32 and further to 25 by the third and fourth decades respectively. There have been intensive agri-horticultural operations in the study area which probably caused the decline (Hallman *et al*., 2014). Regular uses of insecticides have had a negative effect on the insectivorous birds especially the fantail flycatchers, iora, white-eye etc (Verghese and Sriharan,

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Table 1. List of insectivorous birds and their diversity

Sl No	Common name	Scientific name	Density No/sq km			
			1985	1995	2005	2015
1	Grey Heron	*Ardea cinerea*	3	1	x	1
2	Little Egret	*Egretta garzetta*	18	10	4	4
3	Pond Heron	*Ardeola grayii*	22	16	4	2
4	Cattle Egret	*Bubulcus ibis*	17	20	24	30
5	Night Heron	*Nycticorax nycticorax*	*6*	*x*	*x*	*x*
6	Shikra	*Accipiter badius*	1	1	x	x
7	Black-Winged Kite	*Elanus caeruleus*	1	1	x	x
8	Merlin	*Falco columbarius*	1	x	x	x
9	Black Winged Stilt	*Himantopus himantopus*	4	x	x	2
10	Red-Wattled Lapwing	*Vanellus indicus*	2	2	2	2
11	Wood Sand Piper	*Tringa glareola*	8	3	x	x
12	Little Stint	*Calidris minuta*	4	x	x	x
13	Spotted Owlet	*Athene brama*	3	2	2	1
14	Indian Nightjar	*Caprimulgus asiaticus*	2	1	1	x
15	Asian Swift	*Apus apus*	20	16	16	x
16	Indian Roller	*Coracias benghalensis*	2	1	1	1
17	White Breasted Kingfisher	*Halcyon smyrnensis*	2	1	1	1
18	Green Bee-Eater	*Merops orientalis*	37	28	28	18
19	Hoopoe	*Upupa epops*	2	1	1	x
20	Golden-Backed Woodpecker	*Dinopium benghalense*	2	x	x	x
21	Wood Shrike	*Tephrodornis pondicerianus*	1	x	x	x
22	Common Iora	*Aegithina tiphia*	2	x	x	x
23	Brown Shrike	*Lanius cristatus*	1	1	1	x
24	Black Drongo	*Dicrurus macrocercus*	8	6	6	4
25	White-Browed Fantail Flycatcher	*Rhipidura aureola*	2	1	1	x
26	House Crow	*Corvus splendens*	48	52	52	21
27	Jungle Crow	*Corvus macrorhynchos*	150	176	176	254
28	Great Tit	*Parus major*	2	1	1	x
29	Indian Bushlark	*Mirafra erythroptera*	2	x	x	x
30	Ashy-Crowned Finched Lark	*Eremopterix griseus*	3	2	2	x
31	Barn Swallow	*Hirundo rustica*	4	4	4	x
32	Red-Rumped Swallow	*Cecropis daurica*	12	4	x	x
33	Reed Warbler0	*Acrocephalus scirpaceu*	1	1	x	x
34	Blyths Reed Warbler	*Acrocephalus dumetorum*	1	x	x	x
35	Leaf Warbler	*Phylloscopus*sp	1	1	1	1
36	Jungle Prinia	*Prinia sylvatica*	2	x	x	x
37	Ashy Prinia	*Prinia socialis*	2	2	4	2
38	Common Tailor Bird	*Orthotomus sutorius*	2	2	1	1
39	Jungle Babbler	*Turdoides affinis*	7	8	12	7
40	White-Eye	*Zosterops palpebrosa*	2	1	1	x
41	Jungle Myna	*Acridotheres fuscus*	18	24	36	48
42	Common Myna	*Acridotheres tristis*	22	26	28	31
43	Pied Bush Chat	*Saxicola caprata*	2	x	x	x
44	Indian Robin	*Copsychus fulicatus*	2	x	x	x
45	Tickells Flower Pecker	*Dicaeum agile*	4	8	14	18
46	Purple-Rumped Sunbird	*Leptocoma zeylonica*	2	1	x	x
47	Purple Sunbird	*Cinnyris asiaticus*	8	12	10	6
48	House Sparrow	*Passer domesticus*	300	x	x	x
49	Streaked Weaverbird	*Ploceus manyar*	28	x	x	x
50	Baya Weaver Bird	*Ploceus philippinus*	44	x	x	x
51	White Wagtail	*Motacilla alba*	3	2	1	1
52	Pied Wagtail	*Motacilla maderaspatensis*	4	2	2	2
53	Yellow Wagtail	*Motacilla flava*	2	1	1	1
54	Grey Wagtail	*Motacilla cinerea*	1	1	1	1
55	Indian Pipit	*Anthus rufulus*	1	1	x	x
Biodiversity- Species richness			55	40	32	25

Table 2. Major insect pests of mango and corresponding insectivorous birds

	Insect pests, 1978- 1990	Insect pests, 1991-2015	Insectivorous birds
Hoppers	*Idioscopus niveosparsus* *Amritodus atkinsoni*	*Idioscopus niviosparsus* *Idioscopus clypealis* *Idioscopus nagpurensis* *Amritodus atkinsoni* *Amrasca splendens*	Leaf warbler White-eye **X** Tailor-bird Ashywren warbler Tickells Flowerpecker Grey-tit **X** Rufous-tailed flycatcher **X** Iora **X**
Cerambycid borer	*Batocera rufomaculata* (only in neglected orchards)	*Batocera rufomaculata,* *Glenea multiguttata* Buprestids (now also in young trees)	Golden-Backed Woodpecker **X**
Lepidopterans	*Acrocercops* sp *Parasa lepida* *Chumetia transversa* *Euthalia garuda*	*Citripestis eutraphera* *Orthaga exvinacea* *Citripestis etraphera* *Dudua aprobola* *Chumetia transversa* *Nanaguna breviascula* *Penicillaria jacosatrix*	Leaf warbler White-eye **X** Tailor-bird Ashy-wren Warbler Tickells flowerpecker Grey-Tit **X** Rufous-tailed Flycatcher **X** Iora **X** Green Bee-eater Hoopoe **X** Wood-shrike **X** Black Drongo Jungle Babbler Jungle Myna Common Myna House Sparrow **X**

X= Not recorded between 2001- 2015 period.

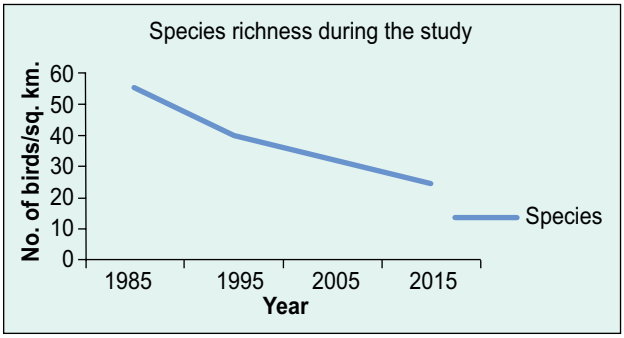


Fig. 1. Decline in species diversity of insectivorous birds during the span of study (1985 to 2015)

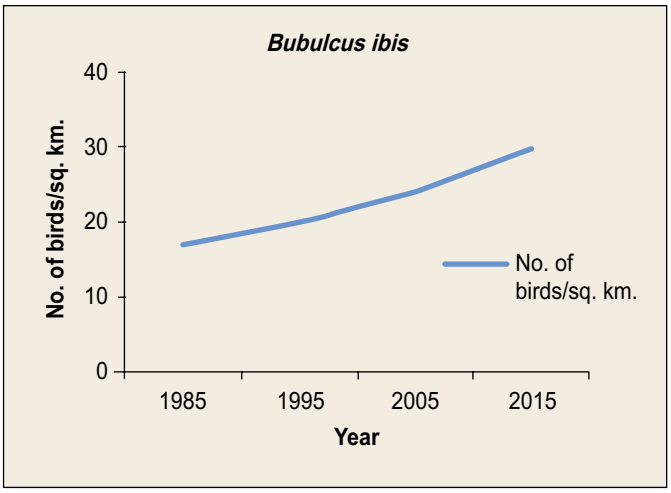
1993). The authors have found dead flycatchers in the mango groves. It was observed that decline of habitats like scrub jungles brought decline of shrikes, shikras, finche-larks, etc.

In the wetlands, the clearing of bull rush reeds caused the disappearance of the weaver- birds and likewise many other wetland birds like sand pipers, stints, water edge feeders like the yellow wagtails and grey wagtails declined. The decline of the house swift, house sparrow and swallows are inexplicable. In the study it is therefore difficult to explain the increase in insect pestilence, due to bird diversity decline, except, accept the trend that insect pests have increased perhaps also because of bird decline.

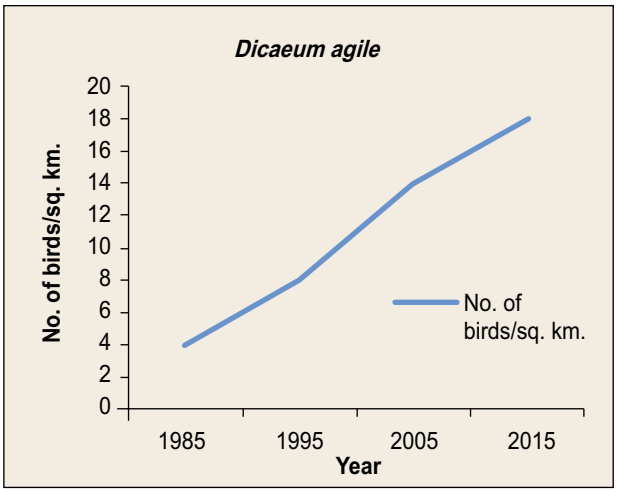
However, documentation of insect pests and birds showed that the there was a perceptible increase in insects in 1991 to 2016 period as against the number of insects prior that. For example, from 1978 to 1990, there were 8 major insect pests in mango in Bangalore while in the past two decades their numbers have increased to more than 15 species of pests probably due to decreased diversity of insectivorous birds (Table 2; Fig. 3).

It was interesting to know that 13 birds were highly sensitive, seven were moderately sensitive, 13 birds were sensitive, 17 birds were tolerant and four had adapted to the human/ farmer interferences and pressures.

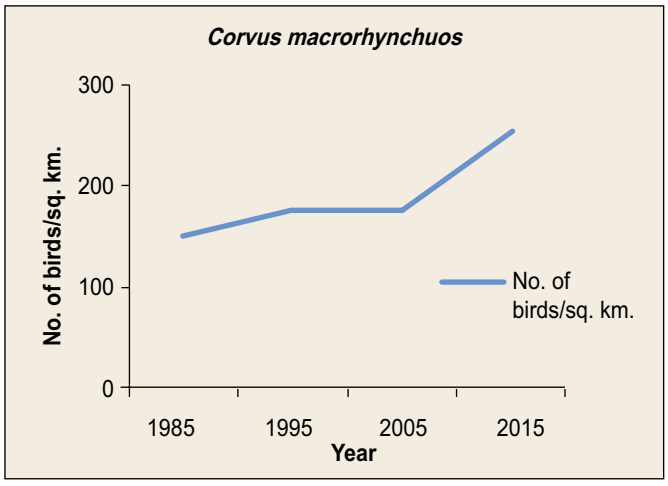
Among the adaptable birds, the cattle egret, jungle myna, jungle crow and Tickells flowerpecker are the ones that in spite of farming interventions survived due to availability of roosting, feeding and breeding niches (Fig. 2).



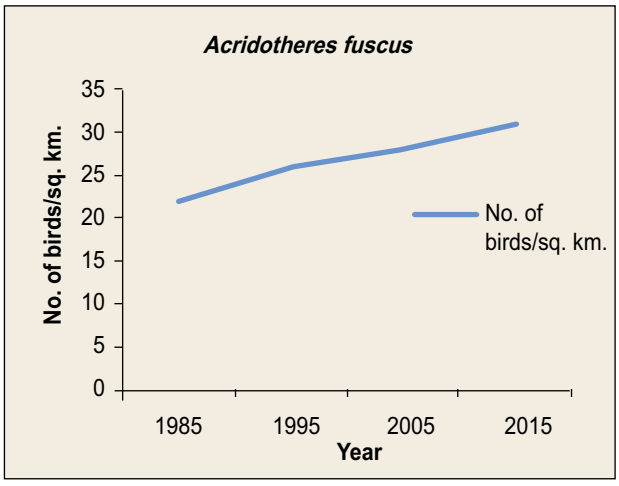
a. Cattle Egret



b. Jungle Myna

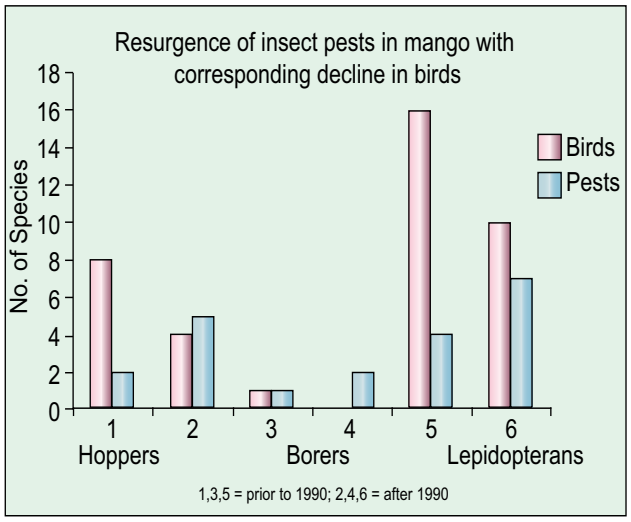


c. Jungle Crow



d. Tickells Flowerpecker

Fig. 2. (a, b, c, d) – Trend in population of birds that adapted to changes in farming ecosystems



References

Ali Salim (1979) The book of Indian birds bombay *Nat. Hist. Soc. & OUP*

Canaday C (1996) Loss of insectivorous birds along a gradient of human impact in Amazonia. *Biol. Conserv.* **77:** 63-77

Hallmann CA, RPB Foppen, CAM van Turnhout, H de Kroon and E Jongejans (2014) Declines in insectivorous birds are associated with high neonicotinoid concentrations. *Nature* **511:** 341-343

Verghese A and Sriharan TP (1993) Insectivorous birds and their use as biological control agents. In: A Verghese, S Sridhar, AK Chakravarthy (eds) *Bird Conservation Strategies for the Nineties and Beyond*. Bangalore: Ornithological Society of India, pp. 207-211

Whittingham MJ (2011) The future of agri-environment schemes: biodiversity gains and ecosystem service delivery? *J Appl Ecol*, **48**:509-513.