The Ecoscan 10(1&2): 91-95, 2016
AN INTERNATIONAL QUARTERLY JOURNAL OF ENVIRONMENTAL SCIENCES
www.theecoscan.com

AVIAN DIVERSITY IN A SACRED NATURAL FOREST SITE IN ODISHA

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ABSTRACT

A field exploration made to study the avian diversity in a sacred natural forest site in Odisha, revealed the presence of 28 bird species belonging to 22 families. Out of the these, 11species were insectivorous, 5 grainivorous, 3 piscivorous, 2 frugivorous, 3 carnivorous, 3 omnivorous and one nectivorous types with respect to their food habits, Further out of these, 9 species were always spotted in the core area, 13 in the edge and 6 were found both in interior and peripheral regions of the site. Two bird species (*Spilopelia senegalensis*, *Spilopelia chinensis*) could be noticed to be in pair, while 6 bird species (*Turdoides striata, Dicrurus macrocercus, Sturnus contra, Acridotheres tistis, Lonchura punctulata, Eremopterix griseus*) were noticed to be in flocks (in each flock, the number varies from 4 to maximum of 8) and rest 20 species were noticed in single.. The species richness and diversity of birds varied from a minimum value of 14 and 2.48 in the month of August to a maximum value of 25 and 3.07 in March respectively. The mean annual IVI value of the birds indicated *Turdoides striata* as the dominant species of bird in the site.

KEY WORDS
Avian diversity
Conservation
Sacred natural site
Ecosystem services

Received : 13.11.2015
Revised : 07.01.2016
Accepted : 22.02.2016

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INTRODUCTION

In the context of the rapid decline in biodiversity (Pimm *et al*., 1995; Wilson, 2002; Loreau *et al.,* 2001), there has been scientific arousal for the effective conservation measures around the globe (Purvis and Hector, 2000; Cooney, 2004; Brooks *et al.,* 2007; Squires, 2013). Sacred natural sites, defined as areas of natural landscape of spiritual significance to local people and communities (Wild and McLeod, 2008) are considered as the informal protected epicenters of biodiversity conservation in many eco regions of the world (Chandran and Hughes, 1997; Byers *et al.,* 2001; Berkes and Davidson, 2006; Bhagwat and Rutte, 2006; Malhotra *et al.,* 2007;Ormsby and Bhagwat, 2010; Gao *et al*., 2013). Due to the socio-cultural beliefs of natives, such sites can serve as the participatory conservation centers (Kothari *et al.,*1996; Gao *et al*., 2013). In many countries including India (Malhotra *et al.,* 2007), these natural sacred sites have been reported as the lingering samples of natural vegetation in the man modified landscapes (Gadgil and Vertak,1976; Khiewtam and Ramakrishnan, 1989;Tiwari *et al.,* 1998; Upadhaya *et al*., 2008) and can act as refuge to large number of endemic, endangered and threatened species (Khan *et al*., 1997; Jamir & Pandey, 2003).

Birds represent one of the important segments of biodiversity (Furness and Greenwood, 1993) and are regarded as the indicator of the health of natural sites including forests (Bilgrami, 1995;Zhijun& Young, 2003). According to Sekercioglu (2006), birds act as the mobile link for ecosystem functioning in both natural and human dominated ecosystems. Role of birds for different ecological services including supporting and regulating services like pollination, seed dispersal, pest control, nutrient cycling etc. has been reported by different workers (Van Bael *et al.,* 2003; Sekercioglu, 2006; Whelan *et al.,* 2008;Wenny*et al.,* 2011). Works relating to the avian diversity in Odisha has also been reported by many workers (Debata *et al*., 2014; Gouda *et al*., 2014; Palei *et al*., 2012) as well as from other regions of Indian subcontinent(Mize and Tsomu, 2012; Devi *et al*., 2012; Roy *et al.,* 2012; Chopra *et al.,* 2013; Mize *et al*., 2014). As reported by Brandt *et al.,* (2013), sacred forests are considered as a keystone structure for bird conservation. On the basis of the fact that the sacred natural sites can act as the refuge for bird species (Deb *et al*., 1997), we attempted to explore the avian diversity in a sacred natural site. We hypothesize that the site, which stands as a remnant forest patch amidst the agricultural landscape can play its role as a conservation epicenter for the avian diversity.

MATERIALS AND METHODS

Study area

The present study was carried out in a scared natural site i.e. Papanga Sacred forest situated in the Bargarh district of western part of Odisha, an easternly located states of India (21º10′14.5" N- 21º11′24.4" N and 83º48′04.3"E - 83º49′17.2"E).

The sacred forest of Papanga represents a tropical dry deciduous forest patch on a hillock and it covers an area of around 270 ha. The area experiences tropical monsoonal climate with three distinct seasons *i.e.* summer (March- June), rainy (June-October) and winter (November - February). The air temperature fluctuates between 10ºC (during December) to 47ºC (during May). The annual rainfall of the area average around 1300mm out of which 80 to 90% falls during rainy season. The vegetation of the site comprises mostly tropical deciduous tree species like *Cleistanthus collinus, Lagerstoremia parviflora, Diospyros melanoxylon, Pterocarpus marsupium, Buchanania lanzan* etc. with thick floor of herbaceous layer during rainy and post rainy months (July-November period). The tree canopy density of the site varies from 30 to 60%.Approximately 30% of the total area of site is covered by exposed barren rocks and has poor canopy coverage. The area has a water body (of 0.36 ha), which is located in the north-west direction at the foot hill region. The water body is both rain and spring fed and is perennial in nature. The site houses a deity in a temple, which is worshipped by the local community throughout the year. An annual religious fair called Chattar yatra is organized by the local community every year during April. Due to strong religious belief, the entire site is considered as the adobe of God and People neither destroy the vegetation nor do they go for animal hunting.

Methods

The field survey was carried out at monthly interval stating from July 2013 toJune 2014 by adopting the point count method (Bibby *et al.,* 1992). For this 10 observing points (5 points in the periphery and 5 in the core region of the site) were randomly selected maintaining a minimum distance of 150meters between the points. Every month, at each point observations were made for 3consecutive days to observe different bird species. The time duration for each observation at different points was of 30 minutes,during the morning hours (07.30 to 10.30 A.M.). The birds were observed carefully through binocular (Bushnell 10x-70x) and their identifying features were noted. The identification thus made was authenticated and their feeding habits were ascertained following the manuals of Ali and Ripley, (1987), Ali, (2002) and Grimmett *et al*. (2009).

Frequency of individual bird species was calculated as:

$$\text{Frequency (\%) of a bird species} = \frac{\text{No. of sampling points at which birds were noticed}}{\text{Total no of sampling points}} \text{ X } 100$$

$$\text{Relative frequency was calculated as} = \frac{\text{Frequency of an individual species}}{\text{Sum of frequencies of all the species}}$$

Considering relative frequency as IVI, Shannon's diversity index (Shannon and Weiner, 1963) was calculated following the formulae:

$$H' = - \sum ni/N \ln (ni/N)$$

Where,

H′ = Diversity,ni = individual IVIand N = sum total of IVIs

Expected maximum diversity, H_{max} = lnS, where S = total number of species

RESULTS

The study explored the presence of total 28 bird species which were taxonomically affiliated to 22 families (Table -1). On the basis of the food habit, these 28 species could be categorized into insectivorous (11species), grainivorous (5 species), piscivorous (3species), frugivorous (2species), nectivorous (1species), carnivorous (3 species) and omnivorous (3species) types. Further out ofthese 28 species,only 9 species could be spotted in the interior core area of the site and hence were the interior species. Similarly, on the basis of their occurrence in the peripheral region, 13 species were classified as edge species, which included 3 aquatic dependent species (*Halcyon smyrnensis*, *Alcedo atthis*, *Ardeola grayii*). Rest of the 6 bird species were found in boththe interior and peripheral regions of the site. Only 2 bird species (*Spilopelia senegalensis*, *Spilopelia chinensis*) belonging to the genus *Coraciidae*, could be noticed to be in pair, while 6 bird species (*Turdoides striata, Dicrurus macrocercus, Sturnus contra, Acridotheres tistis, Lonchura punctulata, Eremopterix griseus*) were noticed to be in flocks (in each flock, the number

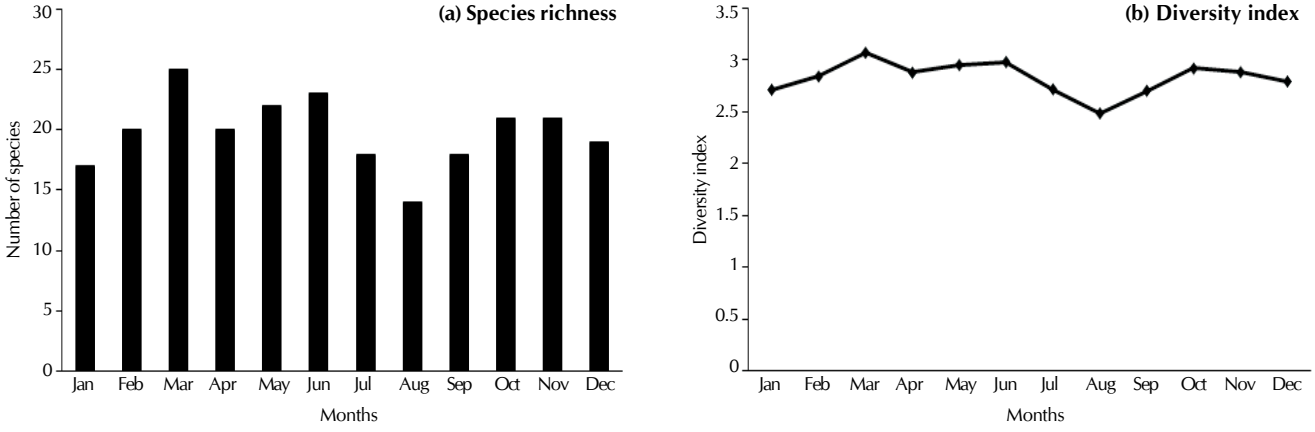

Figure 1: Monthly variation of species richness and diversity of bird species in Papanga

Table 1: List of bird species recorded from the study site along with their family affiliation, English name, habit, site of occurrence and mean annual IVI values

Sl. No	Scientific name	Family	English name	Feeding habit	Seen as	Site of occurrence Interior	Edge	Mean annualIVI
1	*Turdoides striata* Dumant.	Accipitridae	Jungle babbler	Insectivorous	Flock	+	+	0.126
2	*Dicrurus macrocercus* Vieillot	Alcedinidae	Black drongo	Insectivorous	Flock	+	+	0.071
3	*Merops orientalis* Latham	Alaudidae	Green bee eater	Insectivorous	Single	+	+	0.066
4	*Spilopelia senegalensis* L.	Coraciidae	Loughing dove	Granivorous	Pair		+	0.064
5	*Nectarinia asiatica* Latham	Ardeidae	Sun bird	Nectivorous	Single	+		0.053
6	*Saxicoloides fulicatus* L.	Columbidae	Indian Robin	Insectivorous	Single	+	+	0.053
7	*Sturnus contra* L.	Sturnidae	Asian pied starling	Omnivorous	Flock		+	0.052
8	*Acridotheres tistis* L.	Ardeidae	Common myna	Omnivorous	Flock		+	0.051
9	*Megalamia haemacephala* Statius muller	Cisticolidae	Coppersmith barbet	Frugivorous	Single	+		0.045
10	*Lonchura punctulata* L.	Estrildidae	Scaly breasted munia	Granivorous	Flock		+	0.037
11	*Halcyon smyrnensis* L.	Cuculidae	White throated kingfisher	Piscivorous	Single		+	0.035
12	*Spilopelia chinensis* L.	Columbidae	Spotted dove	Granivorous	Pair		+	0.035
13	*Coracias benghalensis* L.	Cuculidae	Indian roller	Carnivorous	Single		+	0.034
14	*Centropus sinensis* Stephens	Dicruridae	Greater coucal	Carnivorous	Single	+		0.033
15	*Ploceus philippinnus* L.	Halcyonidae	Baya weaver	Granivorous	Single		+	0.033
16	*Prinia socialis* Sykes.	Monarchidae	Ashy pinia	Insectivorous	Single	+	+	0.031
17	*Alcedo atthis*	Timaliidae	Common kingfisher	Piscivorous	Single		+	0.028
18	*Copsychus saularis* L.	Sturnidae	Oriental magpie robin	Insectivorous	Single		+	0.027
19	*Pycnonotus jocosus* L.	Muscicapidae	Red whiskered bulbul	Insectivorous	Single	+		0.024
20	*Picoides nanus* Vigors.	Nectariniidae	Indian Pygmy woodpecker	Insectivorous	Single	+		0.023
21	*Eremopterix griseus* Scopoli.	Muscicapidae	Ashy-crowned sparrow	Granivorous	Flock		+	0.019
22	*Eudynamys scolopaceus* L.	Meropidae	Asian koel	Frugivorous	Single	+		0.016
23	*Pycnonotus cafer* L.	Ramphastidae	Red vented bulbul	Insectivorous	Single	+		0.014
24	*Ardeola grayii* Sykes.	Ploceidae	Indian pond heron	Piscivorous	Single		+	0.013
25	*Milvus migrans* Boddart.	Pycnonotidae	Black kite	Carnivorous	Single		+	0.009
26	*Bubulcus ibis* L.	Pycnonotidae	Cattle egret	Insectivorous	Single		+	0.004
27	*Pavo cristatus* L.	Picidae	Peacock	Omnivorous	Single	+		0.002
28	*Terpsiphane paradise* L.	Phasianidae	Asian paradise flycather	Insectivorous	Single	+		0.002

Figure 2: Species distribution curve of bird species in Papanga

variedfrom 4 to maximum of 8) always. Remaining 20 species were always encountered in single.

Fig. 1, illustrates the monthly variation of avian species richness and diversity in the site. The species richness ranged from a minimum value of 14 August to a maximum value of 25 during March. The avian diversity index (H'), during these months, also exhibited the same trend with a range of 2.48 to 3.07. The mean observed diversity of the site was calculated to be 2.83, against an expected maximum diversity (H_{max}) of 3.33.

Fig. 2, represents the species sequence IVIcurve for the recorded bird species from the site. For the purpose, mean IVI of different bird species (calculated from the monthly IVI of different species) were taken into consideration (Table-1). The figure represented a log series species sequence curve with *Turdoides striata* as the distinct dominant species with a maximum IVI value of 0.126. Next to it, *Dicrurus macrocercus* was noted to be the co-dominant species.The gap in IVI valuesbetween the *Turdoides striata* and *Dicrurus macrocercus* was observed to be quitelarge, however both the species couldbe noticeed in maximum number of observation points and during all the sampling months. Species like *Pavo cristatus* and *Terpsiphane paradise* which showed least IVI were noted to be the occasionally found species, specially noted during the month of August in the site.

DISCUSSION

The study site represents a remnant tropical dry deciduous forest patch amidstan anthropogenically converted agricultural landscape and hence acts as a natural refuge for 28 different bird species. Record of 9 bird species as exclusively interior and 14 species as exclusively edge species in the present study is in agreement with the views of McIntyre (1995) that the

fragmented forest patch located within non-forest agricultural landscape often harbors 2 categories of birds i.e. interior and edge species. Such categorization can also be considered as the indication of the effect of anthropogenic fragmentation of the natural landscapes (Blake and Karr, 1987). The site, as per our vegetation survey, houses 33 woody tree species with Shannon-Wiener's diversity (H') value of 2.72. The estimated mean avian diversity (H') of 2.83 in the study site can be due to the structural complexity of the vegetation confirming the views of Kisslinget *al*. (2008). The calculated avian diversity (H' = 2.83) was noted to be 85 % of the theoretically expected diversity (H_{max} = 3.33) and this suggeststheavian conservation potential of the site.

Feeding habit analysis indicated that insectivorousspecies of birds were more in number (39%of the total bird species)as compared to birds belonging to other type of food habits. This finding is in conformity with the findings of Harisha and Hosetti, (2009), who have also observed that insectivorous species are one of the major segments oftotal avian community in the tropics . Seasonal variation of the avian species richness and diversity, with maximum values during March can be due to the phonological patterns like litter fall, new leaf emergence, flowering etc., which controls the avian foraging behavior (Robertson and Hackwell, 1995).

The log series species sequence curve for different bird species, with *Turdoides striata*as the dominant species can be due to the anthropogenic impact in the site. The site represents a fragmented forest patch and often fragmented forest patches being prone to human related disturbance (Wade *et al.,* 2003) exhibit a shift in log normal to log series species sequence curve (Behera and Mishra, 2010). Distinct dominance of *Turdoides striata* having a wide gap of IVI with that of *Dicrurus macrocercus* (the next species to the dominant one) indicated the greater niche width of the former among the recorded bird species. Incidentally *Turdoides striata* and *Dicrurus macrocercus* were both noted from interior as well as edge of the site and this reflected their adoptive capacity of survival in fragmented forest patch.

Avifaunal diversity is considered as the indicator of the environmental health (Padoa- Schioppa *et al.,* 2006) and there have been a global decline in the avifaunal diversity due to the anthropogenic and climatological change (Rapoport, 1993, Chen *et al*., 2011, Sekercioglu *et al*., 2012). Since birds do play an important role in providing different ecosystem services such as insectivorous birds in the pest control, frugivorous birds in seed disposal, nectivorous birds in the pollination etc (Sekercioglu, 2006), the decline is expected to result in loss of different ecological services. Hence there is a need to make study on the avian population in different ecosystem and every attempt should be made for their conservation.

The present study indicates that the natural site, which can resist anthropogenic conversion due to the strong traditional belief, have tremendous potentiality to act as the conservation epicenterfor the local species pool including avian diversity.

ACKNOWLEDGEMENT

Financial support from MoEF, New-Delhi, in form of an All India Coordinated Research Project on Sacred Grove Ecosystem Service Analysis (AICRP on SGESA) for the work is gratefully acknowledged. Authors also thank Head, School of Life Sciences, Sambalpur University for providing necessary facilities to carry out the work.

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