

## Sacred Groves as refuges for Bird diversity in the Human dominated landscapes of the Northern Western Ghats, India

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### Keywords:

Avifauna,  
Northern Western  
Ghats,  
Sacred Groves,  
Species Richness

### Abstract

Biodiversity loss through anthropogenic process in human dominated landscapes of Western Ghats has caused its sacred groves to form important repositories of regional biodiversity (Godbole, A. J and Sarnaik, J. 2004). The current study measures species richness of avifauna in nineteen such sacred groves confined within Sangameshwar Taluka of Northern Western Ghats. Birds were sampled from September 2012 to March 2013 using Standard Point Count technique. A total of 101 species belonging to 43 families, comprising of 13 orders were recorded throughout the study period, among them there were 85 residents, 13 migratory, 2 local migratory and 1 unknown respectively. The bird communities compared among different ecological guilds showed a dominance of insectivores (40.59%) and middle canopy nesters (31.68%). Highest numbers of individuals were observed foraging (53.70%) followed by perching (33.14%) as the other dominant activity. Species richness of each sacred grove was analysed using Menhinick's richness index and Margalef's diversity index. The observed high species richness indicates that these sacred groves can form a key node in effective corridor management.

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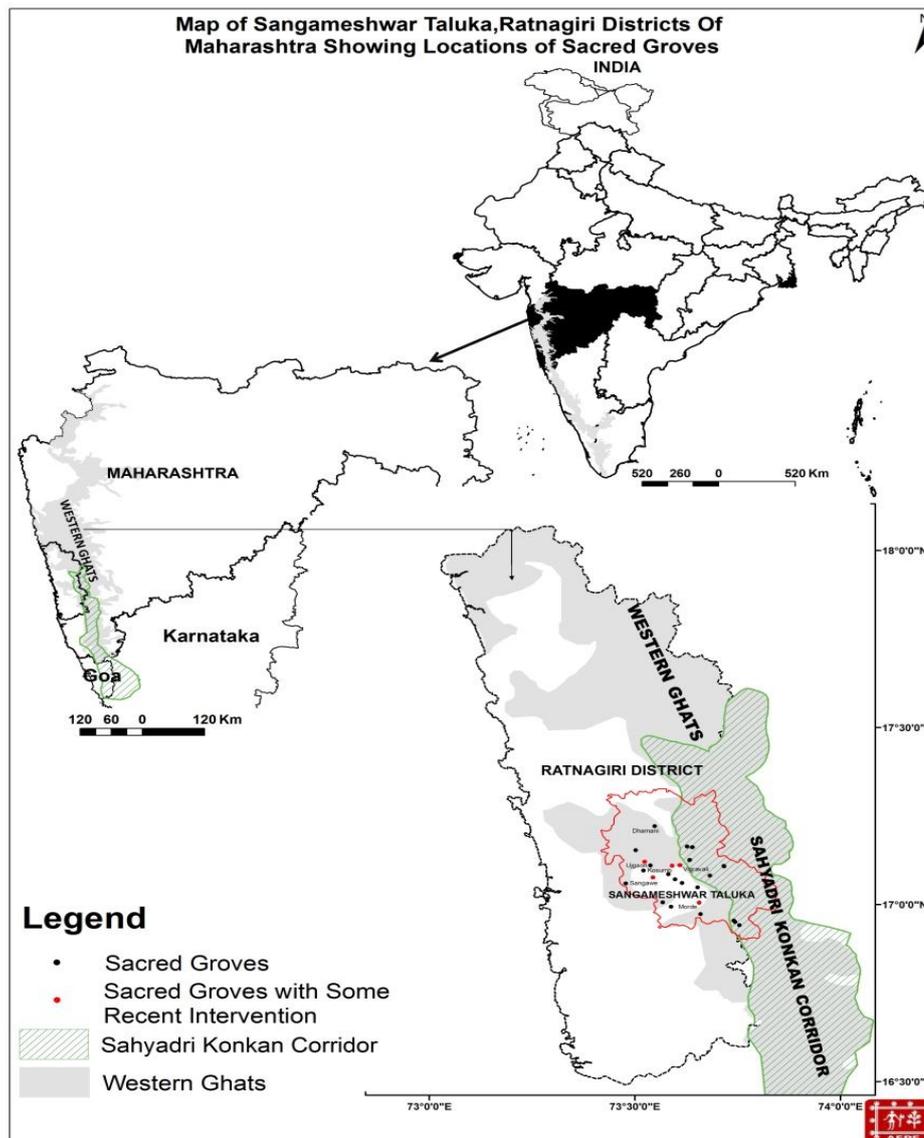
### INTRODUCTION

Western Ghats are ecologically highly sensitive; presence of pristine forest habitats as well as high level of endemism has recently provided Western Ghats a place in world heritage site list (UNESCO, 2012). The north Western Ghats is an eco-region forming a part of the Western Ghats which predominantly consists of moist deciduous forest with a slope ranging from 250 to 1000 meters elevation. Northern Western Ghats boasts high number of 'Sacred Groves', a concept which has been part of Indian tradition for centuries. Sacred groves is an area of natural vegetation, preserved through local taboos and sanctions and are sign of spiritual and ecological values (UNESCO, 1996). Studies have shown that even though sacred groves are small and fragmented they are of high importance in ensuring the survival of the rare species (Punde, 2007). In the recent past, sacred groves of northern Western Ghats have been witnessing high destruction rates. The primary reasons are increasing disbelief in traditional cultural systems, Economic pressure from the commercial markets for the need of natural resources etc. These factors have turned sacred

groves to shrink into even smaller and isolated fragments of forest patches. The loss of biodiversity due to human interventions in such sacred groves can be studied using indicators. Birds constitute one of the common fauna of all habitat types, and because they are responsive to change, their diversity and abundance can reflect ecological trends in other biodiversity (Furness and Greenwood, 1993). They also act as seed dispersal and flower pollinating agents of the indigenous plant species (Nason, 1992). Such specific habitat requirements make them intolerant to even slightest of change or disturbance to their ecosystem. Thus surveying avian diversity can provide a good indication of the health and current ecological status in and around sacred groves. Bird survey manual published by Birdlife International mentions Point Count method as an effective way to monitor and estimate the species diversity in a fragmented area. For the current study nineteen sacred groves from the Sangameshwar Taluka of Ratnagiri, North Western Ghats has been studied for the avian species richness using standard point count techniques.

## MATERIALS AND METHODS

## Study area:



**Fig 1: Map of Study Area showing all Sacred Groves**

The study was undertaken at Sangameshwar Taluka of Ratnagiri district in Northern Western Ghats. Sangameshwar block ( $17^{\circ}10'14''N$   $73^{\circ}32'1''E$ ) is one of the 9 Talukas (Total area =1268.45 sq km) which falls under Ratnagiri district. Geomorphologically the area is composed of Estuarine Plains, Lateritic Plateaus, Residual hills & Scrap faces of Sahayadri (D.N.Mandal, 2009). The main Sangameshwar town is located on the banks of two important rivers Shastri & Sonvi. The area has a tropical climate and the monsoon generally occurs from June to October with an average of 3868.2mm of annual rainfall (D.N.Mandal 2009). The landuse/land cover of the area can roughly be with an area ranging from 0.068 Ha to 5.70 Ha were selected. Forest present is of dry deciduous

categorized into forest land, cultivable land, open grasslands and human settlements. The principle crops for cultivation in the area consists of 4 major commercially viable species i.e. Rice, Nachani, Cashew Nut & Mango. Reserve. In sangameshwar Taluka sacred groves are known as 'Devrahati' meaning abode of gods (Godbole A.J., Sarnaik. J, 2004). Most of the villages in Sangameshwar block manage such sacred groves (Verschuuren.B. *et.al*, 2010). Marleshwar. It also encloses villages present under buffer of the newly formed Sahayadri Tiger For the The area is also one of the prominent tourist spot due to presence of Lord Shiva Temple at current study nineteen prominent sacred groves consisting of primary vegetation such as *Terminalia bellerica*, *Mangifera indica*, *Syzygium cumini*,

*Bombax ceiba*, *Terminalia arjuna*, *Terminalia elliptica*, *Artocarpus heterophyllus*, *Ixora brachiata*, *Caryota urens*, *Dillenia pentagyna*, etc (Godbole, A. J and Sarnaik, J. 2004). These sacred groves also harbour rare and endangered plants species like *Strychnos nux-vomica*, *Antiaris toxicaria*, *Saraca asoca*, *Hydnocarpus pentandra* etc (Punde, 2007). Seven of these sacred groves fall within a 100 meter distance of deciduous forest zone while others are isolated and surrounded by either villages or agricultural fields.

To study the avian diversity, Point count method (Colin Bibby et.al, 2000) was used with a point of 15 meter in radius (decided according to the visibility). The sampling points were monitored twice in a day at morning (between 7:00 am to 10:00 am) and evening (between 3:00 pm to 6:00), since bird activity during these periods is at its peak. To produce an accurate representative sampling unit, point counts were laid using stratified random sampling technique. A minimum distance of 50 meters was maintained between each point and a time limit of 8 minutes per point (3 minutes as settling time for birds and 5 minutes of actual observation) was observed to avoid the bias of double counting. Details like species name, number of individuals, sighting direction, distance from the sighting, height and type of activity were noted down in the data sheet. Most of the sampling was carried out from September 2012 to march 2013, since this is the time when migratory birds visit this region and the sighting of the birds is generally high. It also coincides with the winter and spring seasons of Indian subcontinent which compensates the seasonal variations observed. For bird sightings, a pair of (Olympus 10x50 DPS I) binoculars were used and confirmed identification was based on Pocket Birds of Indian subcontinent book by Richard Grimmett, 2010.

**Data Analysis:**

Measurement of Species Richness: Species richness indices like Margalef’s Index (R1) and Menhinick’s Index (R2) were calculated for each sacred grove. Margalef’s index is a simple measure of species richness (Margalef, 1958) calculated by given formula-

$$\text{Margalef's index (R1)} = (S - 1) / \ln N$$

Where,

S = total number of species  
 N = total number of individuals in the sample  
 ln = natural logarithm

Menhinick’s index is calculated by given formula-

$$\text{Menhinick's index (R2)} = S / \text{SQRT (N)}$$

Where,

S= total number of species  
 N= total number of individuals in the sample

Birds were also studied for their occurrence in different ecological guilds based on their feeding and nesting preference. Their percentage values were calculated and are produced in the form of a table (see table no 1).

Ecological Guilds	Percentage of Individuals sighted
Top Canopy	9.901%
Cavity Nester	15.84%
Middle Canopy	31.68%
Lowland Scrub	26.73%
Terrestrial	15.84%

Table1: Species sighted based on their Nesting preference

Activities of Bird species recorded during the survey included foraging, flying, nesting, and perching. The frequency of each activity was summed up and the percentages values of the frequency were calculated (see table no 2).

**Results:**

Ecological Guilds	Percentage of Individuals sighted
Carnivores	11.88%
Insectivores	40.59%
Frugivores	20.79%
Omnivores	26.73%

Table2: Species sighted based on their Feeding preference

During the present study, a total of 101 bird species belonging 76 genus and 43 families under 13 orders were recorded of which 85 species were resident, 13 migratory, 2 local (resident) migratory and 1 unknown status. Six species were found to be endemic to Western Ghats and two species viz; *Great Hornbill (buceros bicornis)* and *Malabar Pied Hornbill (Anthracoceros coronatus)* come under near threatened category of IUCN Red List. The dominant order was Passeriformes (64 species) followed by Coraciiformes (7 species). Broadly four types of feeding guilds were classified for the present study namely, carnivores, frugivores, insectivores and omnivores. The results showed that sacred groves were dominated by insectivores (40.59%) followed by omnivores (26.73%) and frugivores (20.79%). Carnivore species (11.88%) were the feeding guild recorded least often in all the sacred groves. Nesting guilds were classified according the vertical gradient as top canopy nester, cavity nester, middle canopy nester, lowland scrub nester, and terrestrial nester. Here Middle canopy nester (31.68%) was dominant followed by Lowland scrub nesters (26.73%). Species present in cavity nester and Terrestrial guilds showed equal presence (15.84%) while top canopy nesters (9.90%) had the least presence.

Activities of Bird species recorded during the survey included foraging, flying, nesting, and perching. The frequency of each activity was summed up and the percentages values of the frequency were calculated. Half of the individuals observed were sighted while foraging (53.70%) which was followed by perching (33.14%).

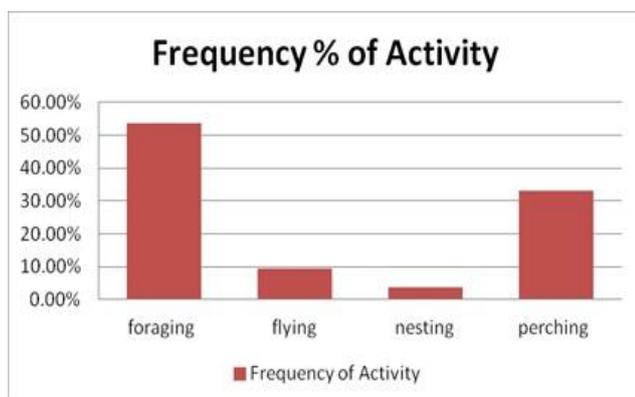


Fig 2: Activity of Bird Species in Sacred Groves

Species richness is a measure of the number of species found in a sample. The average Menhinick’s species richness index (R2) was 2.48 and Margalef’s index (R1) was found to be 4.29.

Table 3: Species Richness Indices for each Sacred Grove

Sacred Grove Name	Sacred Grove size (Ha)	Menhinick's index (R2)	Margalef's index (R1)
kundi	5.6820	3.015113446	5.020890029
kule	4.5482	2.366431913	3.656463383
katavali	1.1108	2.263009527	3.43199601
kosumb	2.4692	1.832541665	3.329613189
pangare	3.5939	1.876388375	3.099813202
vashi	6.4756	2.630383797	4.154068401
vighroli	1.2902	2.988071523	5.649058933
uajgaon	3.4692	3.298574998	6.18356735
nivhe	0.0894	1.671258044	2.375793635
pahsavale	4.5526	3.12990356	5.515188766
devle	3.9676	3.23615934	5.739477836
devde danga	0.7332	3.333333333	6.599234393
kirbet	0.9813	1.80838886	2.769378934
medhe	1.0125	2.592475696	4.253961371
morde	4.2316	2.873684832	4.368100143
talavde	2.7680	2.520504151	4.323691228
bellari	4.0659	2.241794153	3.548459465
chandreshwar	4.6576	2.19089023	3.234155142
marleshwar	0.2841	1.290994449	1.477077492
min	0.0894	1.290994449	2.375793635
max	6.4756	3.333333333	6.599234393
average	2.9465	2.4821001	4.291828412

**Discussion:**

The study shows that sacred groves of the sangameshwar Taluka harbor sizeable number of avian species considering the size and type of the forest. It recorded 101 species including two globally near threatened species. It is evident from the study, that insectivorous birds (40.59%) constitute majority of the bird community in the study area. Therefore it implies that the food availability for these birds is relatively good. This might be one of the reasons for the high value of species richness (Avg Menhinick’s index= 2.48, Avg Margalef’s index= 4.29) and foraging activity (53.70%). The secure and dense mixed forest made of big and thick trees present in sacred groves might be the reason for high sighting of bird species which prefer sub/middle canopy (31.68%) for nests. Majority of these sites also show presence of flowering and fruiting trees which provide these birds a good habitat for nesting and feeding activities, hence protecting such fragmented patches from the current anthropogenic pressure becomes of an utmost importance. The current study produces baseline information on the ecological status of these sacred groves using avifauna so that a strong conservation management strategy can be

implemented with the consent of the primary stakeholders.

#### **Acknowledgement:**

We would like to thank Dr. Archana Godbole, (Director) Applied Environmental Research Foundation (AERF), Pune for the encouragement and timely guidance. We would also like to thank AERF field staff especially Mr. Mangesh Khamkar and Mr. Sanjay Paste for helping us while collecting data. We are also very grateful to the people from the villages where these sacred groves are present.

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