International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 8; Issue 01(F); January 2019; Page No. 17119-17123
DOI: http://dx.doi.org/10.24327/ijcar.2019.17123.3194

Research Article

HABITAT SERVICES OF URBAN ISOLATED TREES IN MALAPPURAM, NORTHERN KERALA, INDIA

Linshina T., Shabana T. P and Sobha T. R

Research Department of Zoology, Farook College, Calicut, Kerala, India

A R T I C L E I N F O

Article History:
Received 6th October, 2018
Received in revised form 15th November, 2018
Accepted 12th December, 2018
Published online 28th January, 2019

Key words:
Urban trees, Isolated tree, Habitat services, Bird diversity, Organisms in urban area

A B S T R A C T

Urban isolated trees provides a number of environmental functions such as survival of urban dwelling species. This study analyses the organisms which depend upon isolated trees for different purposes. We found 3 species of mammals, 31 species of birds, 3 species of reptiles, 42 species of arthropods, 17 species of plants, during the study conducted in 10 isolated urban trees in various towns of Malappuram, northern Kerala, India. Usage pattern of trees by humans also studied.700 people use the shade of the tree and 101 vehicles were parked under the tree. This paper also analyzes the relationship between urban isolated tree characteristics (structural characters: tree height &canopy volume and spatial characters: vegetation area, built area around tree and distance from the city center) and avian diversity, because birds are powerful indicators of urban forest functionality. There is a positive correlation between structural and spatial characters (except built area around tree) and avian diversity. The implications of this study are particularly relevant to urban decision makers, who should consider the existence of great diversity of organism when developing and implementing masterplans.

INTRODUCTION

'Ecosystem Services' refers to the benefits human Population derived from Ecosystem functions(TEEB 2013) .Locally generated ecosystem services have a high impact on the quality of life in urban area .It is difficult to quantify or justify the benefits (Hastne 2003). Ecosystem Services are the direct or indirect benefits, they can be divided into five categories, like provisioning services ,regulating services, habitat services ,cultural services and supportive services. Provisioning Services are the products that got from Ecosystem such as wood, fiber, water, Genetic resources, food and medicine. Regulating Services defined as the benefits obtained from regulation of ecosystem. It include climate regulation, pollination, pest control, reducing storm water runoff, noise regulation, storing and sequestering atmospheric carbon, and improves air and water quality, microclimate regulation (reduction of energy consumption by direct shading by trees). supporting services defined as the services that are needed for the production of all other ecosystem services. These include Production of atmospheric Oxygen, Biomass production, formation and retention of soil nutrients and water cycling etc. The ecological state of a city depends having on the state of its urban trees (whitford *et al*; 2001; Dobbs *et al*; 2011)

Corresponding author:* **Linshina T
Research Department of Zoology, Farook College, Calicut, Kerala, India

Cultural Services include nonmaterial benefits such as spiritual enrichment, recreation, intellectual improvement and aesthetic values (TEEB, 2013). Some benefits like economic benefits and social benefits are also there ,as a part of cultural service. Economic benefit is large tress can increase property value up to 20 percent (Brian 2004) and Social Benefits include increased job Satisfaction, faster recovery time for hospital patients and improved child development (Brain, 2004). Properly placed and maintained trees have even been shown to reduce crime (kwo *et al*.1998). Habitat Services describes the importance of Ecosystem in providing habitat for native and migratory species and to sustain the viability of gene pools.

Trees provide site for nesting and resting of birds, mammals like monkeys and bat, rodents like squirrels(Adams et al) reptiles like lizards, gecko, amphibians (Rarely) and other smaller organisms like bees, butterflies, insects also present in those trees. And plants like epiphytes, parasites and twiners etc. They have limited resources most of them entirely depend on isolated urban trees. Usage pattern of these resources are different among various groups of organisms (Heezik 2008). Isolated trees enhances bird diversity outside the forest. Birds are attracted to fruits and berries, nectar and insects. They are frugivorous, nectarivores and insectivorous birds respectively. Birds make nest by raw materials such as twigs, fibers, leaves which are also tree derivatives or they use tree holes as home. 'Bees' get nectar and pollen as food and get substratum for

making comb. E.g. Honeybee, stingless bees (meliponines). Butterflies visit trees for nectar, tree sap, pollen and rotten fruits and fruit juice. The larvae of moth, beetles, weevils feed mostly on leaves shoot, stem and petiole. Countless insects live and completes their life cycle in small crevices, under barks, leaves, roots and other parts of tree. Another plants on trees also provide a rich and diverse habitat for other organisms like fungi, bacteria etc (Oviak 2003).

The aim of this paper is to analyze some of 'Habitat services generated by Isolated tree in an urban ecosystem'. The emphasis is to identify the 'Habitat services', with greatest relevance to towns in Malappuram District. Objectives of the study are to monitor the habitat services of isolated trees with respect to organisms, to assess the significance of isolated trees in urbanized areas, to analyze site specific, temporal, seasonal differences between distribution and richness of organism with special reference to birds.

METHODS

This study conducted in 10 urban isolated trees in Malappuram district. As a general figure, Malappuram (11.0510^{o} N,76.0711^{o} E) extends to approximately 3550 km^2 with a population of 41 ,10000 lakh (census 2011) The urban area was selected based on the developmental activities such as number of building and distance from the town center (Bibby *et al* 1998). Based on a survey conducted along the roads in Malappuram district we collected number of isolated trees and following random sampling we fixed isolated study species (Bibby *et.al* 1998). Selected trees are isolated in terms of distance from other trees are more than 50m. The landscape type is also a significant factor for the use of urban isolated trees. Hence we determined the area of different type or land use around isolated trees. Following (YAP *et al.* 2002), a 50 meter radius circle was drawn, around the trees with the help of Google Earth, and using Easy acreage software and later by ground truth for confirmation.

From each tree, the organisms were observed and noted by "Direct observation method" From September 2017 to February 2018, we collected the data related to species richness. Faunal activities are monitored for a fixed following focal animal sampling (Altmann 1973) and observed the activities with the help of a binocular, 80x40 (Martin and Geupal 1993) From the sampling point a species were observed for a fixed period to record the type of activities like feeding ,making calls ,resting ,roosting, building nest, preening, jumping, flying etc. And the time noted by a stop watch. (Altman 1974).The required data were collected with maximum accuracy and precision. The observations were made from 6-7am (forenoon) 12-1pm (noon) and 4-5pm (afternoon). Surveys conducted except in heavy rainy days each study area is visited three times in a day. First visit was in September-November. And second visit was in December-February.

Birds were identified in the field using the information available from 'The Book of Indian birds"(Salim ali,2000)and 'Pocket guide to the birds of Indian subcontinent'(Richard Grimmer, Carol inskipp and Tim Inskipp,1993)We identified the floral species in the isolated trees using field guide pertinent to the study area (Singh and sign 1997). The climbers associated with the trees were noted. To record the epiphyte & parasite, we selected two branches from each tree in order to avoid bias while counting. The photograph taken were zoomed and counted to get the number of epiphytes. Total length, breath, diameter of breast height, canopy area are noted by a tape and canopy volume calculated by V=4/3 x pi x ABC, V=Volume of canopy. Secondary data also were collected by asking to the natives. Usage pattern of isolated tree by human is analyzed by number of shade users and the counting the vehicles parked under the tree. Urban isolated tree characteristics (structural characters: tree height &canopy volume and spatial characters: vegetation area, built area around tree and distance from the city center) are calculated by google earth. Alpha diversity of species are calculated by Shannon-weaver formula. And the relation of isolated characteristics with avian fauna are calculated by Pearson correlation co-efficient.

Habitat Analysis of the Study Areas

Table 1 Habitat analysis of the study area

Study area	code	Distance from city (m)	Built area (m^2)	Vegetation area (m^2)	Tree canopy volume(m^3)	Tree height (m)
Angadippuram	AFI	250	3718	1802	2120.58	18
kottappadi	KFI	100	5570	994	3329	22
Orodumpalam	OFI	535	2675	1862	9817	30
Valluvambram	VAS	50	4166	861	1334	13
Irumoolipparambu I	IPE	534	689	2828	335	10
Irumoolipparambu II	IMI	396	702	4100	265	9
Ambalappadi	AMP	43	3920	556	1231	12
Koottilangadi	KTC	68	4753	882	205.25	8
makkaraparamba	MMI	445	1900	2196	3694.52	16
Morayur	MFB	42	2181	1871	469.5	14

RESULT

This study analyses the organisms which depend upon isolated trees for different purposes. We found 3 species of mammals,31 species of birds,3 species of reptiles,42 species of arthropods, 17 species of plants, during the study conducted in 10 isolated urban trees in various towns of Malappuram, northern Kerala, India.

Three species of mammals observed on the tree, *Funambulus palmarum,* is present in trees with higher canopy volume like *Ficus*and*Mangifera* species. Even though the trees where isolated, these trees with high canopy area were enough for them. Three species of reptiles are found in the study area,2 *Geckonidae,* and 1 *Agamidae* from IMI and IPE ,because it is highly vegetated area than others. No amphibians are observed at the study site.

42 Species of Arthropods were observed, out of these 32 were insects :3 species of Blattodea,4 species of Coleoptera, 1 species of Diptera,2 species of Hemiptera,11 species of hymnoptera,8 species of Lepidoptera,1 species of monodean,1species of odonata,1 species of orthoptera and 10 species of class Arachnida.

Table 2 Distribution of higher organism

Higher organism		A.F.I	K.F.I	O.F.I	V.A.S	I.P.E	I.M.I	A.M.P	K.T.C	M.M.I	M.F.B
Mammals	*Cynopterusbrachyotis*	+	+	+	_	_	_	_	_	_	_
	Funambuluspalmarum	+	+	+	_	+	+	_	_	+	+
	Felisdemesticus	_	_	_	_	_	+	_	_	_	_
	Corvussplendense	+++	+++	+++	++++	++	++	+	++++	+++	++
	Dendrocittavagabunda	++	++	++	_	+	+	_	+	+	++
	Acredotherestristis	++	+	++	++++	+	++	+	++++	+	+
	Leptocomazeylonica	+	_	+	_	+	+	_	_	+	+
	Pycnonotusjocosus	+	+	++	_	+	+	_	_	_	+
	Dicaeumerythrorynchus	+	+	+	_	+	_	_	_	_	+
	Turdoidesstriata	+	_	+	_	++	++	_	_	+	+
	Megalaimaviridis	++	++	++	+	+	++	_	_	+	++
	Corvusmacrorynchos	+	_	+	_	+	+	_	_	_	+
	Dicrurusmacrocercus	++	+	++	+	++	++	_	+	+	++
	Dicrurusparadiseus	+	+	++	_	+	+	+	_	+	+
	Dicaeum agile	+ +	+	++	_	+	+	_	_	_	+
	Passer domesticus	+	++	+	++	_	_	+	+	_	_
	Oriolusoriolus	+	_	+	_	+	+	_	_	_	+
Birds	*Oriolusxanthornus*	++	++	++	+	++	+	+	+	+	++
	Turdoidesaffinis	++	+	++	_	++	++	_	+	++	++
	Cinnyrisasiaticus	+	_	+	_	++	++	++	_	+	_
	Terpsiphorneparadiseus	_	_	_	_	+	+	_	_	_	_
	Copsychussaularis	+	+	++	_	++	++	_	_	+	++
	Columba livia	+	+	+	+	+	+	_	+	+	+
	Meropsoreintalis	+ +	_	+	_	_	_	_	_	_	_
	Halcyon smyrnensis	+	+	+	_	+	+	_	_	_	_
	Ocyceros griseus	_	_	+	_	_	_	_	_	_	_
	Eudynamysscolopaceus	_	+	++	_	+	+	_	_	+	+
	Centropussinensis	_	+	+	_	+	+	_	_	+	+
	Ardeolagrayii	+	_	+	++++	_	_	_	_	_	_
	Alcedoatthis	_	_	+	_	+	+	_	_	_	_
	Nycticoraxnycticorax	_	_	_	++	_	_	_	_	_	_
	Phalacocoraxniger	_	_	_	++++	_	_	_	_	_	_
	Milvus migrans	+	_	_	_	+	_	_	_	+	_
	Agamidae .sp	_	_	_	_	+		_	_	_	_
Reptiles	*Geckonidae.sp I*	_	_	_	_	_	+	_	_	_	_
	Geckonidae.sp II	_	_	_	_	_	_	_	_	+	_

(+ = 1-5) (+ + = 5-10) (+ + + =10-50) (+ + + + = more than 50)

Table 3: Distribution of arthropods

	Class:Insecta									Class:Arachnida
Tree	Blattodea	Coleoptera	Diptera	Hemiptera	Hymnoptera	Lepidoptera	Mantodea	Odonata	orthoptera	Arachnea
AFI	-	-	-	-	++	_	_	_	_	_
KFI	+	-	-	-	++	_	_	_	_	_
OFI	-	-	-	-	++	+	_	_	_	+
VAS	-	-	-	-	-	_	_	_	_	_
IPE	-	+ + + +	+	++	++	+	+		+	+ + + +
IMI	-	-	-	-	+ + +	+ + +		+		+ + + +
AMP	-	-	-	-	++	+	_	_	_	+
KTC	-	-	-	-	+	_	_	_	_	_
MMI	+	-	-	-	+ + + +	+	_	_	_	_
MFB	+	-	-	-	+	_	_	_	_	_

(here the(+)sign directly depicts the number

Table 4 Distribution of epiphytes, and twiners in different tree species

Tree species	Epiphytes		Twiners			Parasite	Othor
	Akambapraemorsa	*Ficusbenghalensis*	*Anamirtacocculus*	*Pothoscanthos*	*Mussandavellila*	*Loranthusmicranthus*	
AFI	+	_	+	+	+	_	_
KFI	+	+	+	_	_	_	_
OFI	+	_	+	+	+	_	_
VAS	+	_	_	_	_	_	+
IPE	_	_	_	_	_	_	+
IMI	+	_	_	_	_	+	+
AMP	_	_	_	_	_	_	_
KTP	_	_	_	_	_	_	+
MMI	+	_	_	_	_	+	+
MFB	+	_	+	+	+	_	_

17 species of plants were there including 2 species of epiphyte,6 species of twiners,1species of parasites and 8 species of other associated flora. Trees serve as host for numerous epiphytes (Oviak 2003).

In our study also we found some species of epiphytes and twiners. Trees act as a supporting substratum for these plant species. We observed that *Akamba praemorsa* species have the highest number. It indicates that the species is suitable to

the area and its needs are sufficiently present in the selected areas. Like that of the twiners, *Anamirta cocculus* having the highest number which is showing that it has suitable surroundings in the selected area. Epiphytes and twiners are dependent on tree species only for substratum, not for nutrients (Butler 2007). Loranthus is the only parasite found in the urban isolated trees.

Table 5 Usage pattern of study area –Human dimension

Tree speceis	Morning		Noon		Evening	
	Vehicle	People	Vehicle	People	Vehicle	People
AFI	5	30	9	28	3	54
KFI	4	85	3	39	3	101
OFI	4	11	6	22	2	17
VAS	3	7	5	6	7	24
IPE	-	2	-	-	-	3
IMI	-	6	1	6	-	13
AMP	8	10	7	37	7	39
KTC	2	9	1	11	4	8
MMI	1	11	-	42	1	53
MFB	4	7	7	3	4	15

The usage pattern of study area was analyzed by number of shade users (n=700) and vehicles parked under the tree (n=101).

Avian fauna vs isolated tree characteristics

30 species of birds under 9 orders was visited the tree for various purposes during the study time, under which Passeriformes are higher in number (n=18).Others are Cuculiformes (n=2),Ciconiformes (n=3), Coraciiformes (n=2),Suliformes (n=1), Buceratiformes (n=1),Columbiformes (n=1) ,Galliformes (n=1), Acciptiformes (n=1).These birds use the trees for various purposes like Feeding (on fruits /insects on the tree/nectar from flowers), resting on branch or on nest, preening, flying on branch, making calls, Breeding and brooding.

The large part of the birds were generalist species like *Corvussplendense* (House crow),*Acredotherestristis* (Common myna), *Dendrocittavagabunda* (Rufous tree pie).Forest type habitat preferable birds found are *Terpsiphoneparadiseu* (Paradise flycatcher) *Ocyceros griseus* (Malabar grey hornbill), they are found IMI and OFI respectively, they are comparatively more vegetated area. Waterbirds like *Ardeolagrayii* (Indian Pond heron), *Egretta intermedia (*Intermediate egret), *Nycticoraxnycticorax(*Black crowned night heron),Found from VAS ,because it was a heronry. Most represented species is *Corvussplendense*.

Feeding guild categories are noted that, Omnivores are most common (n=18)and granivores are with least (n=1).And Frugivores (n=2), Insectivores (n=6),Piscivores (n=3) are also there.

Table 6 Birds species richness and diversity

Tree	Species richness	Shannon index
AFI	3.09	2.59
KFI	2.83	2.17
OFI	3.17	2.78
VAS	2.39	1.13
IPE	3.09	2.8
IMI	3.13	2.89
AMP	1.94	1.16
KTC	1.94	.87
MMI	2.07	1,89
MFB	2.79	2.67

Avian diversity was higher in IPE and IMI (2.8 and 2.89 respectively) and lower in KTC and VAS (.87 and 1.13 respectively), these two are roosting sites of birds i.e species abundance is higher on them. Bird species diversity was higher in IPE, IMI and AFI (3.09,3.13 and3.09 respectively) lowest in AMP and KTC (1.94)

Table 7 Pearson correlation coefficient value (r) between structural and spatial characters

	Structural characters		Spatial characters		
	Canopy volume	Tree height	Vegetated area	Built area	Distance from the town center
Species richness	.347	.40	.702	-.59	.5643
Species diversity	.256	.39	.609	-.409	.6218

Avian diversity and richness has a weak positive correlation coefficient value with canopy volume and tree height, and strong correlation value with vegetated area near the isolated tree and distance from the town center. A moderate negative correlation is there between species characters and built area near the tree and avian characters.

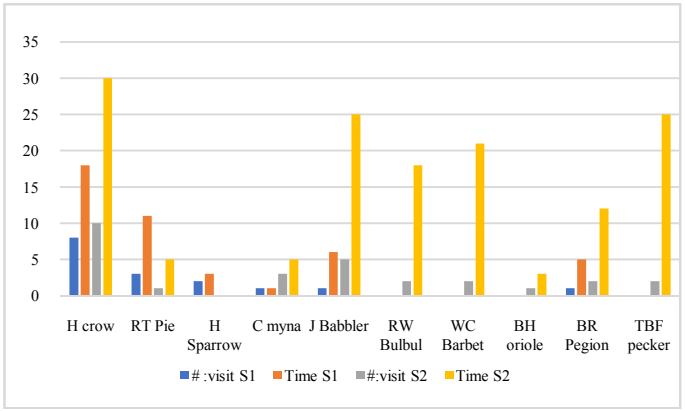

Fig 1 seasonal variation of avian diversity and time spent by them

Species richness and time spent by them on *Ficus* trees were higher in second visit, coincided with fruiting period of the same.

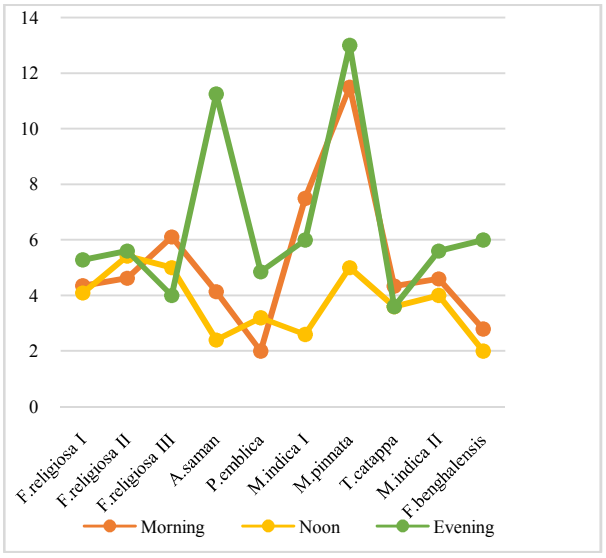

Fig 2 Temporal variation of time spent by birds

Bird activity were higher in morning and evening.

DISCUSSION

Urban isolated trees are essential for the survival of many organisms in urban environment. They provide a wide range of environmental and social functions to cities and urban dwellers. (Costanza et al 1997;Orians 1986) We found 3 species of mammals, 31 species of birds,3 species of reptiles,42 species of arthropods, 17 species of plants. Amphibians are altogether absent in study site. Their double environment life style make them particularly vulnerable (Karolina A.et al.2013) . Studies have demonstrated positive effect of trees in urban area on both invertebrates and vertebrate species, such as spiders (Alairukka et al .2002), ants (Yamaguchi 2004), butterflies (Hermy 2000) Passerines (Wiens 1989;Keast 1990).Although the influence of urban forest trees on species has been the focus of recent studies (Blair 1996). Importance of 'Urban street trees' and 'Isolated rural trees' are discussed by many such studies .Thus this study fills a major gap .These trees are like 'Oasis in deserts' for several organisms including us.

Among all wildlife, birds are one of the most common wildlife in urban area, and many bird population have been declining as a result of urban expansion (G.T Austin 1972; B.R Coppedge 2001;K.L Evans 2009;D.Haase 2009).In our study also showed that 'built area around urban isolated tree' has a negative correlation with avian faunal diversity and there is a positive correlation with 'vegetation area around the tree' . Amount of tree cover is a critical factor supporting avian diversity in urban environment (Sanesi et al.2009).But in our study there is a weak positive correlation with tree cover and bird diversity. In rural area also, the relationship between birds density and vegetation volume is strongly correlated [scott mills et al 1991].Sanesi 2009 found a positive correlation between' distance from town center 'and diversity. Our study also gave the same result.

In our study most common feeding guild was 'Omnivores' .In Rwanda of Atlanta most common was 'seedeaters' (T.Gatesire et al.2014). Most represented species in our urban area was 'house crow', in Rwanda it was pied crow. (T.Gatesire et al.2014)

According to Heezik et al. (2008) bird activity is more at morning and evening and the activity is low at noon time. In our study, we also observed that the most of the bird species are more active during evening (4-5pm) and morning (6-7pm) and the lowest time is during noon (12-1pm)

CONCLUSION

In India we are facing a destructive face of urbanization. Every day several urban trees will remove to compromise with new developmental activities. Hence such quantification measures will help to give an idea of extends of tree use in urban area and can highlight the importance. Mostly we don't have scientifically quantified data to highlight the importance of isolated street trees. Hence such an attempt may function as a baseline data for future conservation works in the urban area. Urban trees function as costless ecological cleaners of the polluted environment. The data can be used by local government and urban planners for future sustainable development in the city area.

Reference

Alaruikka, D (2002).Carabid beetle and spider assemblages along a forested urban-rural gradient in Southern Finland. *Journal of insect conservation* 6: 195-206.

Altman, D.A., (2007). Valuing ecological services of peri-urban open spaces: a case study of the west tatnuck neighborhood of worcester, Massachusetts. 1-36.

Bibby, C., Jones, M. and Marsden, S. (1998). Expedition field techniques bird surveys. Publisher Expedition Advisory Centre, *Royal Geographic Society*.235-245.

Blair,R.B. (2004).The effects of urban sprawl on birds at multiple levels of biological organization ecology and society 9(5): 2

Bolund, P., & Hunhammar, S. (1999). Ecosystem services in urban areas. *Ecological Economics*, 29(**2**), 293-301.

Hastne,D .(2001). a quantitative review of urban ecosystem service assessment: concepts, models and implementation. *Journal of human environment.*126-128.

Heezik, Y .V, Ludwig, K., Whitwell, K and McLean, I. G. (2008). Nest survival of birds in an urban environment in New Zealand. New zealand*journal of ecolog*y. 32(**2**):155-165.

Hermy, M. (2000)Towards a monitoring method and a number of multifaceted and hierchial biodiversity indicators for urban and sub urban parks. 49.: 149-162.

Karolina,A. (2013). Amphibian situation in urban environment-History of the common toad Bufobufo in Krakow (Poland). *Ecological questions.*18. 73-77.

Keast,A.(1990). Biography and ecology of forest bird communities . SPB Academic. 416.

Klem, J.R .D., Farmer, C.J, Delacretaz, N., Gelb, Y and Saenger P,G. (2009). Architectural and landscape risk factors associated with bird–glass collisions in an urban environment. The Wilson Journal of Ornithology.121 (**1**):126–134.

Martin TE and Geupel GR. (1993). Nest-monitoring plots: methods for locating nests and monitoring success. *Journal of field ornithology* 64(4): 507-519.

Nowak, D.J, Hoehn, R.E, Crane, D.E, Stevens, J.C, Walton, J.T, Bond, J.(2008). A ground-based method of assessing urban forest structure and ecosystem services. *Aboriculture & Urban Forestry*. 34(6):347-358.

Roshnadh.R.(2017).Nesting tree characteristics of heronary birds of urban ecosystems in peninsular India: Implications for habitat management. *Current zoology*. 63(6):599-605.

Sanesi, G., Padoa-Schioppa,. E., Bottoni, L .L and Lafortezza, R. (2009). Avian Ecological Diversity as an Indicator of Urban Forest Functionality. Results from Two Case Studies in Northern and Southern Italy. *Arboriculture & Urban Forestry*. 35(2): 80-86.

Singh, B. and Singh, MP. (1997). Flora of Nilambur Western Ghats. New Delhi.

T.Gatesire et al. (2014). Bird diversity and distribution in relation to urban landscape types in Northern Rwanda. *The scientific world journal.* Article ID(157824): 2-12.

Wiens, J.A. (1989). The ecology of bird communities .2. Processes and variations. Cambridge university press, UK.

Yamaguchi.T.2004. Influence of urbanization on ant distribution in parks of Tokyo and Chiba city, Japan. *Ecological research* 19: 209-216.

****