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## Avian Frugivores Fruit Choice in the Forest Patch of Federal College of Forestry Jos, Plateau State Nigeria

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Page | 3874

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### ABSTRACT

The flora community which attract a different frugivores may be important to the survival of such frugivores. Relationship between avian biodiversity and fruit producing plants may reflect avian fruit choice or preference. This research was done on avian frugivores fruit choice within the forest cover of Federal College of Forestry, Jos in order to study the species and their activity on fruit-producing plants in the site and to compare encounter rate and diversity of avian frugivores across habitats. Bird species were estimated and 212 individual fruit-eating avian species were counted on 28 species of fruit producing plants during this survey. Mean number of fruit-eating birds did not differ significantly in the habitats ( $F_{63} = 0.1245$ , Adjusted  $R^2 = -0.02769$ ,  $P = 0.8832$ ). The abundance of birds in relation to plant species showed a very high significant difference ( $2 = 339.55$ ,  $df = 27$ ,  $P < 0.001$ ). Shannon weiner diversity of birds calculated showed that the diversity in relation to habitat types showed no significant difference ( $\chi^2 = 0.045285$ ,  $df = 2$ ,  $P = 0.9776$ ). This habitat should therefore be seen as an important habitat for birds and other wildlife.

**Keywords:** Avian frugivores, Diversity, Forest patch, Fruit choice, Habitat types

### Introduction

Higher plants are a major diet for frugivores especially the avian species in a typical ecosystem (Walker 2007; Jordano 2014; Daru *et al.*, 2015). Such fruit producing trees are therefore seen as an important resource which is sometimes marked and defended by avian species that utilize them. Birds are a key component of all ecosystems playing important ecological roles in seed dispersal which can contribute to the maintenance of species diversity (Snow 1981; Wenny and Levey 1998; Holbrook and Smith 2000; Peh and Chong 2003). Fruit producing trees such as the figs for example

are well known as a key component of fruit resources in tropical forests (Lamberts and Marshall, 1991; Shanaban *et al.*, 2003). Frugivory is a central and important process in plant populations where natural regeneration is strongly dependent upon animal-mediated seed dispersal (Jordano, 2014).

It is widely believed that foraging animals do not possess the sensory equipment to discriminate precisely among prey of varying profitability and to overcome this problem, animals must make foraging decisions using alternative mechanism

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which are in most cases correlated with profitability (Sallbanks, 1993).

This research was out to determine the fruit choice or preference by avian species in the forest patch of Federal College of Forestry Jos, Plateau State Nigeria.

## Materials and Methods

### Study Area

The study was conducted in Federal College of Forestry Jos located on latitude 09°57'N and longitude 08°54'E and elevation of 1180m above Sea level with mean annual rainfall of about 1250mm (Francis et al., 2017). Three habitat types were categorized, for this research namely; riparian forest, farmland and orchard. Orchard represented an area within the research area where fruit trees are predominantly found being planted some years ago. Farmland represented an area within the research location that serves as a site for planting and other agricultural activities. Riparian forest represented the forest within the study area with a flowing stream. Some major species of plants in the College are *Tectona grandis*, *Eucalyptus camaldulensis*, *Gmelina arborea*, *Delonix regia*, *Terminalia catapa*, *Stenolobium stans*, *Spathodea campanulata*, *Corymbia torelliana*, *Psidium guajava*, *Phallantas mellerianus*, *Bauhinia vahlii*, *Thevetia peruviana*, *Khaya senegalensis*, *Ceiba pentandra*, *Nauclea latifolia*, *Giricidium sepium*, *Mangifera indica*, *Citrus sp*, *Erythrophleum suaveolens* etc (Francis et al., 2017).

### Data collection

Line transects and point count was used for the survey of the frugivorous birds (Bibby et al., 2000, Yellop et al., 2003). A total of 9 transects each of 200m were placed by stratified random sampling in the habitat types totaling 27 and subdivided in to 100m sections each. The start and the end point of each transects were marked with a Global Positioning System (GPS MAP 60). Frugivorous birds were observed in a point count using a pair of binoculars (Trekka, magnification-10×42) from

6:00am to 10:30am for the period of 90 days. Birds were identified with the aid of field guide of birds of Western Africa (Borrow and Deymey, 2004). Point count and opportunities sightings along the 200m transect were done. Birds carrying out the act of frugivory were carefully observed for a maximum of 5minutes. The plants visited by avian species were identified using Field Keys by Hopkins and Stand field (1996) with the assistance of a trained taxonomist.

### Statistical Analysis

Data obtained were analyzed using R Console software (Version 3.2.2). Abundance of birds in relation to plant species was compared using Pearson's Chi-square test. One-way analysis of variance (ANOVA) was used to compare the mean abundance of birds in relation to habitat types. Pearson's Chi-square test was used to compare diversity index of birds across habitat types. The P-values < 0.05 were considered statistically significant.

## Results

A total of 212 individual frugivorous birds were recorded on 28 species of fruits producing plants during this survey (Table 1).

### Comparison of frugivorous bird's abundance in relation to habitat types

Frugivorous birds were encountered in all the habitat types during this study. Therefore, the mean abundance of the birds in relation to habitat types showed no significant difference ( $F_{63} = 0.1245$ , Adjusted  $R^2 = -0.02769$ ,  $P = 0.8832$ , Figure 1). Even though statistically, there was no significant difference in the abundance of the frugivorous birds across habitats, but from the bar plots in figure1, more frugivorous avian species were seen in the Riparian forest followed by the Orchard and then Farmland.

### Comparison of bird's abundance in relation to plant species

*Corymbia torelliana* had the highest number of frugivores visit, followed by *Ficus species*, *Eucalyptus camaldulensis*, *Vitex doniana* and *Anacardium occidentale*. Others had low visit (Table1). Therefore, the abundance of birds in relation to plant species for the Chi square showed a very high significant difference ( $\chi^2 = 339.55$ ,  $df = 27$ ,  $P < 0.001$ ).

### Diversity index of birds in relation to habitat types

Shannon weiner diversity of birds calculated showed that the diversity in relation to habitat types showed no significant difference ( $\chi^2 = 0.045285$ ,  $df = 2$ ,  $P = 0.9776$ ). Avian frugivorous species were more diverse in the riparian forest followed by the orchards and then the farmland, even though the Shannon-weiner diversity index for the three habitats was less than 2.4 suggesting low diversity (Lameed, 2011; Francis *et al.*, 2017).

**Table 1:** Demographic information of the selected subjects, the Mean  $\pm$  SD and range

Species	Habitat types			Birds abundance
	Farmland	Orchard	Riparian forest	
<i>Albizia lebbeck</i>		√		2
<i>Anacardium occidentale</i>	√	√		14
<i>Annona senegalensis</i>		√		2
<i>Calusena anisate</i>	√			2
<i>Canarium schweinfurthii</i>	√			5
<i>Combretum nigricans</i>	√			2
<i>Corymbia torelliana</i>	√	√	√	43
<i>Eucalyptus camaldulensis</i>	√	√	√	26
<i>Ficus cordata</i>	√	√		10
<i>Ficus glumosa</i>	√	√		27
<i>Ficus ingens</i>			√	10
<i>Ficus platyphyla</i>			√	2
<i>Ceiba petendra</i>			√	1
<i>Gmelina arborea</i>	√	√		5
<i>Isobertina doka</i>	√			2
<i>Mangifera indica</i>	√	√		5
<i>Nauclea latifolia</i>		√		1
<i>Phoenix dactylifera</i>			√	2
<i>Phoenix reclinata</i>			√	5
<i>Senna siamea</i>			√	3
<i>Senna singueana</i>			√	1
<i>Spathodea campanulata</i>		√		5
<i>Syngium guineense</i>			√	5
<i>Terminalia curatellifolia</i>	√			3
<i>Terminalia macroptara</i>	√			3
<i>Trema orientalis</i>				11
<i>Uapaca spp.</i>				1
<i>Vitex doniana</i>				14
Number of birds	46	65	101	212

√: Plant species present

**Table 2:** Shannon-Weiner diversity index of frugivorous birds in Orchards

Species	Number	Pi	ln(Pi)	Pi[ln (Pi)]
Common bulbul	20	0.307692	-1.17865	-0.36266
Laughing dove	2	0.030769	-3.48124	-0.10712
Senegal parrot	8	0.123077	-2.09495	-0.25784
Speckled mouse bird	6	0.092308	-2.38263	-0.21993
Western grey plantain eater	29	0.446154	-0.80709	-0.36009
Total	65			-1.30764
H' = - (-1.307639)				
H' = +1.307639				

**Table 3:** Shannon-Weiner diversity index of frugivorous birds in Riparian Forest

Species	Number	Pi	ln(Pi)	Pi[ln (Pi)]
Bruce's green pigeon	5	0.049505	-3.0056826	-0.1488
Common bulbul	37	0.366337	-1.0042026	-0.36788
Common white eye	8	0.079208	-2.535679	-0.20085
Laughing dove	1	0.009901	-4.6151205	-0.04569
Senegal parrot	8	0.079208	-2.535679	-0.20085
Speckled mouse	25	0.247525	-1.3962447	-0.34561
Violet turaco	2	0.019802	-3.9219733	-0.07766
Western grey plantain eater	15	0.148515	-1.9070703	-0.28323
<b>Total</b>	<b>101</b>			<b>-1.67055</b>

H' = - (-1.67055)

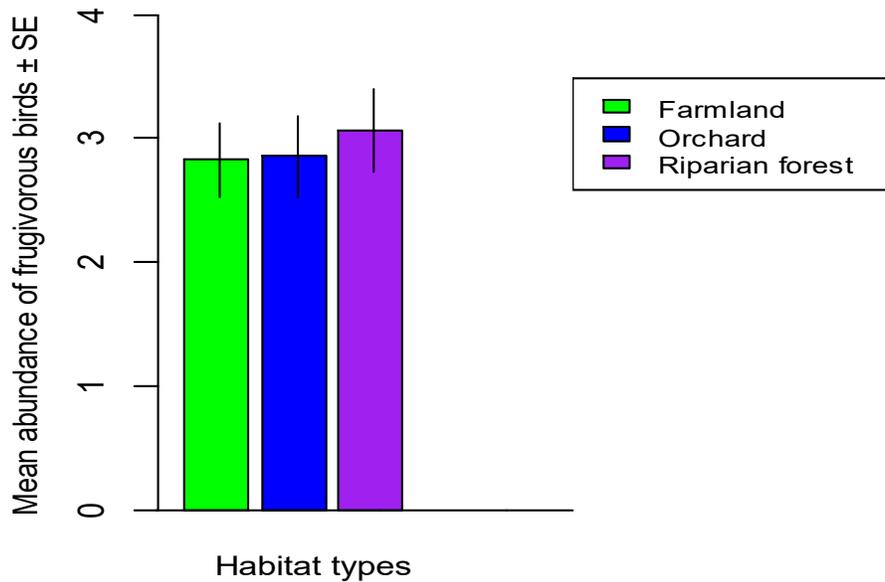
H' = +1.67055

**Table 4:** Shannon-Weiner diversity index of frugivorous birds in Farmland

Species	Number	Pi	ln(Pi)	Pi[ln (Pi)]
African thrush	3	0.06522	-2.73	-0.178
Common bulbul	16	0.34783	-1.0561	-0.3673
Senegal parrot	4	0.08696	-2.4423	-0.2124
Speckled mouse bird	12	0.26087	-1.3437	-0.3505
Western grey plantain eater	11	0.23913	-1.4307	-0.3421
<b>Total</b>	<b>46</b>			<b>-1.4504</b>

H' = - (-1.45042)

H' = +1.45042



**Figure 1:** The mean abundance of frugivorous birds in relation to habitat types

## Discussion

The total number of frugivorous bird species recorded on the plant species shows that availability of fruits especially the ones recorded during the survey is a key factor influencing the abundance and the diversity of the birds. It also shows that the area is a repository for not only avian species but for biodiversity as a whole. The mean abundance of frugivorous birds in relation to habitat types showed no significant difference. Majority of the birds such as Common bulbul, laughing dove, Speckled mouse bird, Western grey plantain eater and Senegal parrot were among the major frugivorous species and were recorded in all the habitat types. They were probably attracted to fruits irrespective of the habitat types the fruit plant grows. Burgess *et al.*, 2002 showed that certain species of birds can occupy or utilize more than one habitat types as long as the habitat provides their basic resource requirements.

## Comparison of Birds Abundance in Relation to Plant species

The abundance of birds in relation to plant species showed a very high significant difference. Majority of the frugivorous avian species were observed to utilize *Corymbia torelliana*, *ficus spp*, *Eucalyptus camaldulensis*, *Terminalia spp* and *Vitex doniana*. Francis *et al.*, 2017 had documented these plants to be some of the most abundant species in the forest cover of the college. What attracted the birds was not the abundance of the plant species but the fruits of the plants. *Corymbia torelliana* was the most visited fruit producing plant and it was recorded in the three habitat types. *Eucalyptus camaldulensis* also occurred in the three habitat types. All the plants that occurred in the three habitat types recorded the highest number of foraging visitors, therefore habitat type was not basically necessary but fruit resource played a major role in attracting frugivorous species. *Ficus* species were also

important food for the Bruce's green Pigeon. Barde and Abiem (2015) had reported *Ficus* species to have a wide range of distribution and uses. It is an important diet for birds. This is similar to the findings of Morel *et al.* (1986) where differential attractiveness of *Ficus* species has previously been reported for African fruit-eating birds such as the Bruce's green pigeon. These birds according to morel *et al.* were more attracted to *Ficus platyphylla*. Daru *et al.* (2015) in their study on birds use of *Ficus* species in Amurum forest Reserve Nigeria reported that frugivorous species such as Bruce's green pigeon fed almost extensively on *Ficus lutea*. It has been reported that plant species that attract a different community of frugivorous avian species may as well be important for the survival of the birds (Peres, 2000). The relationships observed in our study between the birds and the fruit producing trees may reflect avian fruit choice or preference for example, Bruce's green pigeon was attracted to *Ficus cordata* where the birds were observed to feed extensively on the fruit for more than five minutes during the focal observation compared to other fruits.

#### **Diversity Index of Birds in Relation to Habitat Types**

The diversity of birds in the habitats did not differ significantly. The study showed that the value of Shannon-weiner diversity index for frugivores in the three habitat types was lower than 2.4 implying low diversity. Diversity index ranges from 0-5. 0-2.4 shows low diversity while 2.5-5.0 shows high diversity.

Though the three habitats showed low diversity of frugivores, the Riparian Forest had the highest diversity of such feeding guild ( $H= 1.6$ ), followed by the Orchard ( $H= 1.4$ ) and then the Farmland ( $H= 1.3$ ).

#### **Conclusions**

This result shows that the habitats in the study site can still serve as a habitat to a host of biodiversity which in turn calls for effective management and protection.

#### **Competing interests**

Authors have declared that no competing interests exist.

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