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Habitat corridors use by wildlife in wooded patches of an agricultural landscape in New Bussa, Nigeria

Udochi Inwon Fingesi

Federal College of Wildlife Management, P. M. B. 268, New Bussa, Niger State

Corresponding email: irokau@gmail.com

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Abstract

This study assesses the dispersal and use of corridors by wildlife in wooded patches of an agricultural landscape in New Bussa. The study was undertaken to derive information on the species of wildlife associated with different habitat corridors in both wet and dry seasons in the area, as well as to determine their relative abundance and diversity in the area. The direct/indirect method of census was used. The data collected were analyzed using descriptive statistics (tables), and Analysis of Variance [ANOVA] was used to test if species distribution differed between habitats. The results showed that compared to the dry season, the rainy season had the greatest diversity of mammal species. In both the wet and dry seasons, there are more animal species in fencerows and hedgerows. During the two seasons, it was discovered that Agama agama, Rattus rattus of the Muridae family and Rousettus acguptiacus of the Pteropodidae family, *Sciurus spermophilus, Sciurus carolinensis, and Epomophorus ganbianus* were quite common in all habitat categories.. The Estrildidae family, followed by the Ardedae family, has the largest relative abundance among the various bird species. While avian species diversity in the three habitat types in the wet and dry seasons indicates substantial species diversity in all habitats, mammal species diversity between habitats was considerably low ($P>0.05$) in both the wet and dry seasons. Therefore, in the agricultural environment of New Bussa, all habitat corridors with representative samples of animals are valuable for wildlife conservation.

Keywords: Abundance, Diversity index, Habitat Corridors, Nigeria, Wildlife

Introduction

A habitat corridor is a narrow strip of vegetation that connects two ecosystems continuously or nearly continuously. Landscape patterns called corridors are essential to the protection of nature because they foster connection for species, communities, and ecological processes (Dickson *et al.,* 1995). Instead of being linear habitats, wildlife movement corridors—also known as dispersal corridors or landscape linkages—are linear features whose main wildlife function is to link at least two key habitat areas (Beier and Loe, 1992).

For our wildlife, fragmentation and habitat loss pose serious risks. Therefore, habitat corridors are likely to be a more effective way to encourage landscape connectivity in areas where a significant portion of the landscape has been altered and is uninhabitable to native species, for species that are habitat specialists or have a necessity for undisturbed habitats, and for species with a small range of movement relative to the distance to be covered. Resources for sustaining a population or individual residents must be available along the habitat corridor. Because of the complicated daily needs of wildlife, they must move securely from one location to another in search of nesting places, food, water, a safe place to rest, and shelter. The corridors connect the otherwise limited and isolated ecosystems by bridging the gap between them. The existence of animal colonization lanes may help supplement dwindling populations before they actually go extinct, decreasing the rate of extinction of species—a process known as the "rescue effect." Riparian vegetation, fencerows and hedgerows, and forest linkages are examples of the several kinds of fragmentation corridors. Species suited to streamside habitats that are infrequent in nearby habitats are typically supported by riparian ecosystems. Riparian vegetation frequently survives as linear habitat or corridor remnants in highly disturbed habitats including agriculture, cities, and plantations of alien tree species all over the world (Rushton *et al.,* 1994).

Numerous places have vast networks of hedgerows connecting trees and forests that have been preserved in the rural environment with farming (Fritz and Merriam, 1994). Many studies have focused on the use of hedgerows as a habitat for birds, especially in Great Britain, and this has given insight into their value for wildlife (Green *et al.,*1994). The presence of hedgerows significantly increases the diversity of birds, especially woodland species in farmlands.

According to Harris and Woollard (1990), sites with hedges, ditches, or linear woodlands have more species than comparable amounts of arable land. According to studies, there is a strong correlation between species richness and remote habitats connected to surrounding forested areas (Newmark, 1991). This field of conservation biology, or "corridors," that connects to small natural areas, has seen a lot of interest and

action. As a conservation measure to mitigate the effects of habitat loss and fragmentation, the protection or supply of continuous corridors of habitat to connect isolated habitats, such as nature reserves, forests, or areas of old-growth forest, has been widely advocated. Therefore, it is anticipated that the study's findings will highlight the importance of protecting habitat corridors and/or links as well as their conservation significance. The study's goals are to assess the importance of habitat corridors for wildlife conservation in wooded patches of an agricultural landscape in New Bussa, to provide a list of the species of wild animals associated with various habitat corridors in the region during both wet and dry seasons, to assess the relative abundance of wildlife species associated with various habitat corridors during wet and dry seasons, and to assess the diversity of wildlife species in the area.

Materials and Method

Study area

New Bussa is the administrative headquarters of Borgu Local Government Area of Niger state, it covers a total land mass of about 16,200km^2 and it is situated between Latitude 9^{o}N and 11′ N and longitude 20^{o}E and 40′E. It has a total population census of 171, 965 people. The length of the rainy season is from about 175 to 190 days (5 – 6 months) during which 1000mm -1250mm rainy is recorded annually. The rainy season normally comes in April accompanied by strong wind and thunderstorms reaching its peak in July to August and declines in September.

Generally, the temperature is high during dry season just before the rain. It declines during the rainy season from June to October and rises again in November and drop slightly in December and January due to Harmattan in the dry season. The mean maximum temperature is 35^{o}C - 40^{o}C but minimum temperature ranges between 14^{o}C – 15^o C in the Harmattan. The vegetation may be described broadly as wooded guinea savanna with legumes accounting for 55.7% of trees and almost an equal mixture of legumes and Combretacae plants making up shrubs and small trees while grasses dominates the herbaceous layers. The vegetation has a lot of flora species which are found all over the area which includes: *Annona senegalensis,Boswelia dalselli,Combretum molle, Combretum nigricans, Terminalia, glaucoscens,Terninalia, mollis Terminalia macroptera, Anogeissus leiocarpus, Afzellia africana, Daniella oliverii* etc. While the fauna species found in the study area includes: Civet cat, Bats, Squirrels, Fishes, Snails, Duikers, Monkeys, Baboons Snakes, Skink, Lizard, Crocodiles, Hawks, Senegal coeval, stone partridge, Guinea fowls, Green parrots, Grey-horn bill etc. (Ekeke and Stopfords, 1984).

Firgure1. Map of Nigeria showing Location of the study area

Design Survey

The study was conducted in the Guinea savanna agricultural landscape of New Bussa and its environments. Three areas totaling 9 km^2 were chosen as study sites: 3 km^2 of riparian forest woodland in Monia, 3 km^2 of thicket woodland in Donian, and 3 km^2 of hedgerows and fencerows in New Bussa Residential. The study's methodology made use of both direct and indirect census methods. For a total of six months, each study site underwent a wildlife species identification and census, which was carried out for three months during the wet season and three months during the dry season. In both seasons, five days per month were spent at each location. Every day, from six in the morning to noon(4.00pm to 6.00pm) in the evening, the census was carried out.

Data Collection Techniques

In order to view the animal species, the researcher and a student field assistant walked at a maximum pace of 1.5 km/h along the strips, road, fence/hedge row, and border of the woodlands. On the datasheet, the following details were noted when the animals or birds were seen: the name of the species, the number of individuals in the species, their activities, and the state of their habitat.

Data Analysis

Both qualitative and quantitative statistics were carried out. Percentages and Tables were used to present descriptive analyses of species population.

Relative abundance; The relative abundance was estimated using the ratio of total individual species to the total population counted thus;

$$\text{Relative abundance} \quad A = \frac{n}{N} x100 \qquad \text{(eq 1)}$$

Where A = Relative abundance

n = Quantity of each species present

N = Quantity of all species present.

Diversity index which states the structure of the community and the stability of the ecosystem. Species studied in the field can be identified by calculating the value of species diversity. Simpson's Diversity Index is a measure of diversity which takes into accounts both richness and evenness. As species richness and evenness increase, so diversity increases.

Diversity of species was achieved using Simpson's (1949) diversity index.

he index is mathematically stated thus: $D_s = \sum^{S}{}_{t\_1} \frac{(n_1(n-1))}{(N\,(N-1))}$ (eq 2)

Description:

- D_s = Simpson's diversity index
- n_1 = Total number of individuals in each species
- N = Total number of individuals in all species
- s = Number of species present
- $\sum$ = Summation sign.

The evenness of species is the distribution of individuals between species in a balanced community. Species are considered maximum if all species in the community have the same number of individuals. Species evenness index*(E)* shows the level of evenness of individuals per species. The value of the Species Evenness Index (E) provides insight into the stability of a community in an ecosystem. It indicates the evenness of the distribution of individuals among different species in a community (Sipahutar, 2017). A higher E value suggests that the species are more evenly distributed and not dominated by any particular species. The closer the E value is to 1, the higher the evenness value below 0.6 is low. Ludwig and Reynolds (1988), the value of E is calculated using the following mathematical formula.

E = H′ Ln (S) (eq 3)

Where:

- E = Species Evenness Index;
- H' = Index;

- S = Number of Types found;
- Ln = Natural logarithm.

Analysis of Variance [ANOVA] was used to test if species population distribution differed between sites.

Data entering and coding

Data that was generated from the field was coded, entered and stored using Microsoft excel spread sheet, then Microsoft Office Excel® 2013 was used to calculate the percentage relative abundance, Paleontological Statistics software (PAST) were used to calculate the diversity of wild animals and birds.

Results

Species list and Composition Type

Table1. Species list of wild animals utilizing Habitat fragmentations corridors, the habitat types and the seasons in which they were sighted. The result shows that in habitat A, seventeen (17) species of mammals were sighted in the wet season and fifteen (15) in the dry season, in habitat B, sixteen (16) species of mammals were sighted in the wet season and 15 in the dry seasons while in habitat C, fourteen (14) species of mammals were recorded in wet and dry seasons. While for the birds' species, 84 birds found in 28 families were observed and inventoried in each of the habitat types.

Table 1. Species List of Wild Animals Utilizing Habitat Fragmentations Corridors in the study area

Family name	Mammals	Scientific name	Riparian forest A		Thicket woodland B		Hedgerows and Fencerows C	
			W	D	W	D	W	D
Leporidae	Hare	Oryctolagus cuniculus	0	0	X	X	0	0
	Giant Rat	Cricetomy gabianus	X	X	0	0	0	0
Cercopithecidae.	Patas Monkey	Erythrocebus patas	X	0	0	0	0	0
Erinaceidae	Hedgehog	Atelerit frontalis	X	0	X	0	0	0
Viverridae.	Civet Cat	Paradoxurus hermaphroditus	X	X	X	X	X	X
Pteropodidae	Egyptians fruit bat	Rousettus acguptiacus	X	X	X	X	X	X
	Gambian fruit bat	Epomophorus ganbianus	X	X	X	X	X	X
Molossidae	Free tail bat	Tadarida brasiliensis	X	X	X	X	X	X
Muridae	Brown Rat	Rattus norvegigus	X	X	X	X	X	X
	House Rat	Rattus rattus	X	X	X	X	X	X
Soricidae	Shrew Rat	Chrotomys gonzalesi	X	X	X	X	X	X
Sciuridae	Gray Squirrel	Sciurus carolinensis	X	X	X	X	X	X

Family name	Mammals	Scientific name	Riparian forest A		Thicket woodland B		Hedgerows and Fencerows C	
			W	D	W	D	W	D
Sciuridae	Tree Squirrel	Sciurus spermophilus	X	X	X	X	X	X
Elapidae	Cobra	Naja nigricollis	X	X	X	X	X	X
Viperidae	Rattlesnakes	Crotalus horridus	X	X	X	X	X	X
Teiidae	Agama lizard	Agama agama	X	X	X	X	X	X
Scincidae	Skink	Scincella lateralis	X	X	X	X	X	X
Varanidae	Nile monitor Lizard	Varanus niloticus	X	X	X	X	X	X
	Total		17	15	16	15	14	14
	AVES							
Ardedae	Cattle egret	Ardeola ibis	X	X	X	X	X	X
	Little egret	Egretta garzetta	X	X	X	X	X	X
	Grey Heron	Ardea cinera	X	X	X	X	X	X
Accipitridae	Black kite	Milvus migrans	X	X	X	X	X	X
	African harrier hawk	Polyboroides radiatus	X	X	X	X	X	X
	Grasshoper buzzard	Butastur rufipennis	X	X	X	X	X	X
Phasianidae	Grey- breasted Helmented guinea fowl	Numida meleagris	X	X	X	X	X	X
	Stone partridge	Ptilopachus petrosus	X	X	X	X	X	X
	Double spurred francolin	Francolinus bicalcaratus	X	X	X	X	X	X
Turdidae	Whin chat	Saxicola rubetra	X	X	X	X	X	X
	Wheatear	Oenanthe oenanthe	X	X	X	X	X	X
	Red tailed chat	Cercomela familaris	X	X	X	X	X	X
	Red breasted chat	Oenanthe bottae	X	X	X	X	X	X
	Ant chat	Myrmecocichla aethiops	X	X	X	X	X	X
	White fronted black chat	Myrmecocichla albifrons	X	X	X	X	X	X
	West African thrush	Turdus pelios	X	X	X	X	X	X
Sylviidae	Melodious warbler	Hippolais polyglotta	X	X	X	X	X	X
	Singing cresticola	Cresticola cantans	X	X	X	X	X	X
	Nuthatch warbler	Sylvietta brachyura	X	X	X	X	X	X
	Fan-tailed swamp warbler	Schoenicola platyura	X	X	X	X	X	X
Muscicapidae	Black flycatcher	Melaenornis edollioides	X	X	X	X	X	X
	Spotted flycatcher	Muscicapa striata	X	X	X	X	X	X
	Pale flycatcher	Bradornis pallidus	X	X	X	X	X	X

Family name	Mammals	Scientific name	Riparian forest A		Thicket woodland B		Hedgerows and Fencerows C	
			W	D	W	D	W	D
	Grey tit babbler	Myioparus plumbeum	X	X	X	X	X	X
Paridae	West Africa penduline tit	Remiz parvulus	X	X	X	X	X	X
			X	X	X	X	X	X
Nectarinidae	Mouse brown sunbird	Anthreptes gabonicus	X	X	X	X	X	X
	Collard sunbird	Anthreptes collaris	X	X	X	X	X	X
	Yellow bill sunbird	Nectarinia venusta	X	X	X	X	X	X
	Splendid sunbird	Nectarinia coccinigaster	X	X	X	X	X	X
	Copper sunbird	Nectarinia cuprea	X	X	X	X	X	X
Lanniidae	Long-crested helmet shrike	Prionops plumata	X	X	X	X	X	X
	Yellow- breasted shrike	Laniarius atroflavus	X	X	X	X	X	X
	Great grey shrike	Lanius excubitors	X	X	X	X	X	X
Sturnidae	Splendid glossy starling	Lamprotornis splendidus	X	X	X	X	X	X
	Blue –eared glossy startling	Lamprotornis chloropterus	X	X	X	X	X	X
	Long –tailed glossy starling	Lamprotornis caudatus	X	X	X	X	X	X
	Crag chestnut glossy starling	Onychognathus morio	X	X	X	X	X	X
Ploceidae	Buffalo weaver	Bubalornis albirosris	X	X	X	X	X	X
	Slender billed weaver	Ploceus luteolus	X	X	X	X	X	X
	White –fronted gross beak	Amblyosiza albifrons	X	X	X	X	X	X
	Vieillot''s black weaver	Ploceus nigerrimus	X	X	X	X	X	X
	Red bishop	Euplecets orix	X	X	X	X	X	X
	Fire-crowned bishop	Euplects hordeaceus	X	X	X	X	X	X
	Crested malimbe	Malimbus malimbicus	X	X	X	X	X	X
Estrildidae	Malibe finch	Pytilia melba	X	X	X	X	X	X
	Black face fire finch	Estrilida larvata	X	X	X	X	X	X
	Orange –checked wax bill	Estrilida melpoda	X	X	X	X	X	X
	Cameroon indigo finch	*Vidua chalybeate*	X	X	X	X	X	X
Viduidae	Pintail whyday	*Vidua mcroura*	X	X	X	X	X	X

Family name	Mammals	Scientific name	Riparian forest A		Thicket woodland B		Hedgerows and Fencerows C	
			W	D	W	D	W	D
Fringillidae	Yellow-fronted canary	*Serinus mozambicus*	X	X	X	X	X	X
	Grey canary	*Serinus leucopygius*	X	X	X	X	X	X
Cuculidae	Senegal coucal	*Centropus senegalensis*	X	X	X	X	X	X
Columbidae	Vinaceous dove	*Stretopelia vincacea*	X	X	X	X	X	X
	Laughing dove	*Stretopelia senegalensis*	X	X	X	X	X	X
	African mourning dove	*Stretopelia decipiens*	X	X	X	X	X	X
	Red eye dove	*Stretopelia semitorquata*	X	X	X	X	X	X
	Speckled pigeon	*Columba guinea*	X	X	X	X	X	X
Strigidae	White-faced owl	*Otus leucotis*	X	X	X	X	X	X
Apodidae	Palm swift	*Cypsiurus parvus*	X	X	X	X	X	X
	White–rumped swift	*Apus caffer*	X	X	X	X	X	X
	Bates's black swift	*Apus batesi*	X	X	X	X	X	X
Meropidae	Black bee-eater	*Merops gularis*	X	X	X	X	X	X
	Little bee-eater	*Merops pusillus*	X	X	X	X	X	X
	White-throated bee-eater	*Merops albicollis*	X	X	X	X	X	X
Coraciidae	Abyssinianin roller	*Caracias adyssinica*	X	X	X	X	X	X
	Grey hornbill	*Tockus nasutus*	X	X	X	X	X	X
	Piping hornbill	*Bycanistes Fistulator*	X	X	X	X	X	X
	White crested hornbill	*Tropicarnus albcristatus*	X	X	X	X	X	X
Capitonidae	Yellow bill barbet	*Trachyphonus purpuratus*	X	X	X	X	X	X
	Speckled tinker bird	*Pogoniulus scolopaceus*	X	X	X	X	X	X
Picidae	Grey Woodpecker	*Mesopicos goertae*	X	X	X	X	X	X
Motacillidae	African pied wagtail	*Motacilla aguimp*	X	X	X	X	X	X
Pycnontidae	Little green bulbul	*Adropadus virens*	X	X	X	X	X	X

Family name	Mammals	Scientific name	Riparian forest A		Thicket woodland B		Hedgerows and Fencerows C	
			W	D	W	D	W	D
	Simple leaf love	*Chlorocichla simplex*	X	X	X	X	X	X
	Yellow-billed greenbul	*Phyllasterphus Falvostriatus*	X	X	X	X	X	X
Timaliidae	Brown babbler	*Turdoides plebejus*	X	X	X	X	X	X
	Blackcap akalata	*Malacocincla rufipennis*	X	X	X	X	X	X
Malconotidae	Many–coloured bush shrike	*Malaconotus multicolor*	X	X	X	X	X	X
	Greta grey grey-headed bush shrike	*Lanius excubitor*	X	X	X	X	X	X
Nicator	Mountain sooty boubou	*Lanius execubitor*	X	X	X	X	X	X
Corvidae	Hooded crow	*Corvus corone*	X	X	X	X	X	X
	Red checked cordon blue	*Estrilda bengala*	X	X	X	X	X	X
	Black mega pie	*Ptilosomus afer*	X	X	X	X	X	X
	Bunting	*Passerina cyanea*	X	X	X	X	X	X

From the table above = present, W= Wet season and D= Dry season

Species Abundance

Table 2 shows the wet and dry season relative abundance (%) of mammal species in habitat corridors in the study area. The table shows that in the wet season, *Agama agama* having relative abundance of (25.71% is the highest, followed by the *Rattus rattus of* Muridae (14.06% and *Rousettus acguptiacus* of Pteropodidae family with (11.2%) relative abundance, while in the Dry season *Agama agama* having relative abundance of (22.96 %) is the highest, followed by *Sciurus spermophilus* (12.35%), *Sciurus carolinensis* (11.63%), and *Epomophorus ganbianus* (11.77%), while *Erythrocebus patas* and *Atelerit frontalis* were not sighted in the dry season across the sites.

Table 2. Wet and Dry season relative abundance of mammal species in the study area%

S /No	Family Name	Mammals	Scientific Name	Seasons	
				Wet	Dry
	Leporidae	Hare	*Oryctolagus cuniculus*	0.23	0.44
		Giant Rat	*Cricetomy gabianus*	0.46	0.87
	Cercopithecidae.	Patas Monkey	*Erythrocebus patas*	0.11	0.00

S /No	Family Name	Mammals	Scientific Name	Seasons	
				Wet	Dry
	Erinaceidae	Hedgehog	*Atelerit frontalis*	0.34	0.00
	Viverridae.	Civet Cat	*Paradoxurus hermaphroditus*	0.57	0.44
	Pteropodidae	Egyptians fruit bat	*Rousettus acguptiacus*	11.20	11.19
		Gambian fruit bat	*Epomophorus ganbianus*	9.26	11.77
	Molossidae	Free tail bat	*Tadarida brasiliensis*	3.20	1.02
	Muridae	Brown Rat	*Rattus norvegigus*	6.86	6.68
		House Rat	*Rattus rattus*	14.06	9.30
	Soricidae	Shrew Rat	*Chrotomys gonzalesi*	1.71	3.49
	Sciuridae	Gray Squirrel	*Sciurus carolinensis*	9.94	11.63
		Tree Squirrel	*Sciurus spermophilus*	9.37	12.35
	Elapidae	*Naja* Snake	*Naja nigricollis*	2.54	3.34
	Viperidae	Rattlesnake	*Sistrurus miliarius*	1.03	0.87
	Agamidae	Agama lizard	*Agama agama*	25.71	22.96
	Scincidae	Skink	*Panaspis togoensis*	1.14	1.16
	Varanidae	Nile monitor Lizard	*Varanus niloticus*	2.28	2.47

Table 3 shows the wet and dry season relative abundance (%) of Birds species in habitat corridors in the study area. The table shows that in the wet season family, Estrildidae having a relative abundance of 23.18% is the highest, followed by the Ardedae family with a 10.34% relative abundance Paridae with 0.09% is the lowest.

Table 3. Wet and dry seasons relative abundance of bird species

S /No	**Family name**	**Seasons**	
		Wet	**Dry**
	Ardedae	10.34	12.89
	Accipitridae	0.28	0.41
	Phasianidae	0.49	0.85
	Turdidae	7.55	8.72
	Sylviidae	2.41	2.84
	Muscicapidae	4.75	4.94
	Paridae	0.09	0.11
	Nectarinidae	5.63	6.11
	Lanniidae	3.25	3.46
	Sturnidae	3.66	5.05
	Ploceidae	8.60	10.14
	Estrildidae	23.18	6.26
	Viduidae	1.02	1.42

S /No	Family name	Seasons	
		Wet	Dry
	Fringillidae	1.85	2.22
	Cuculidae	1.09	1.42
	Columbidae	5.48	6.42
	Strigidae	1.09	1.42
	Apodidae	3.12	4.21
	Meropidae	3.33	3.98
	Coraciidae	3.66	5.05
	Capitonidae	1.43	1.94
	Picidae	1.01	1.37
	Motacillidae	1.09	1.42
	Pycnontidae	1.78	2.29
	Timaliidae	1.05	1.61
	Malconotidae	1.88	2.22
	Nicator	0.18	0.11
	Corvidae	1.04	1.09

Diversity of Species

The results of mammal species diversity indices in three habitat types in wet and dry seasons are shown in Table 4. The results indicate low species diversity in all the habitats. In the wet season habitats A and B are more diverse having 0.89 and 0.88 diversity respectively, than habitat C with lower species diversity of 0.79 and evenness of 0.51. In the dry season habitats B and A are more diverse having 0.89 and 0.87 diversity respectively, than habitat C with lower species diversity of 0.79 and evenness of 0.53.

Table 4. Wet and Dry Season Mammal Species Composition, Richness and Diversity (Simpson's index) between Habitat Corridors

Seasons	Simpson index	Habitat types Riparian forest A	Thicket woodland B	Hedgerows and Fencerows C
Wet	Total number of individuals	274	203	398
	Species richness	17	16	14
	S.Index1-D	0.89	0.88	0.79
	Evenness_e^H/S	0.62	0.66	0.51
Dry	Total number of individuals	221	163	304
	Species richness	15	15	14
	S.Index1-D	0.87	0.89	0.79
	Evenness_e^H/S	0.64	0.72	0.53

The results of bird species diversity indices in three habitat types in wet and dry seasons are shown in Table 5. The results indicate high species diversity in all the habitats. In the wet season habitat C and A are more diverse with high evenness, having 0.92 and 0.91 diversity respectively, than habitat B with lower species

diversity of 0.87. In the dry season habitat B and A are more diverse having 0.94 diversity respectively, than habitat C with a slightly lower species diversity of 0.93 with lower evenness.

Table 5. Wet and Dry Season Birds Species composition, richness and diversity (Simpson's index) between Habitat Corridors in the Area

Seasons	Simpson index	Habitat types		
		Riparian forest A	**Thicket woodland B**	**Hedgerows and Fencerows C**
Wet	Total number of individuals	3361	3287	3196
	Species richness	84	84	84
	S.Index1-D	0.91	0.87	0.92
	Evenness_e^H/S	0.6445	0.5394	0.6896
Dry	Total number of individuals	2030	1900	2203
	Species richness	84	84	84
	S.Index1-D	0.94	0.94	0.93
	Evenness_e^H/S	0.7718	0.7888	0.7116

Discussion

In this study, three habitat fragmentation corridors were identified in the New Bussa landscapes such as riparian forest, thicket woodland, and hedgerows /fencerows. Each vegetation type provides wildlife habitat for various wildlife species. For example, they provide cover, feeding and nesting habitats for primates, medium and small mammals, reptiles as well as birds. are shown in Table 1. Similar findings were made by Schroeder *et al.* (1992), who found that 63 different species of wildlife were noticed using fencerows in Lowe, USA, while 93 different species were noted using fencerows in New York State, USA.

Table 2 relative abundance of mammal species in habitat corridors indicates that in the wet season *Agama agama, Rattus rattus of* Muridae and *Rousettus acguptiacus of* Pteropodidae family were highly abundant, while in the Dry season *Agama agama ,Sciurus spermophilus , Sciurus carolinensis* and *Epomophorus ganbianus* were all highly abundant in the hedgerows and fencerows close to residential areas. The presence of hedgerows considerably boosts the diversity of wildlife, especially woodland species, in farmlands, according to Bennett *et al.*(1994) report, which supports this fact. According to Downes *et al.* (1997), this roadside hedgerow serves as a vital habitat and a passage for mammals like bats, especially during the dry season.

With the exception of Estrildidae (finches) and Ardedae (egret birds), which are abundantly seen (Table 3), especially during the rainy and early dry seasons of July to October, all habitat types (riparian forest

fencerows and thicket woodland) support a significant variety of bird species. However, these species' relative abundance levels differ only slightly among them. Both the rainy and dry seasons were dominated by these birds. Because most birds migrate on a large scale and tolerate a variety of habitats, they were able to roam freely over the mosaic of shards while carrying out their daily tasks.

Diversity of Species

The research found that the diversity of mammal species was high in habitats A and B during both the wet and dry seasons, but notably low in habitat C, where evenness of diversity fell below the threshold for classification (E value greater than 0.6). The richness of mammal species within and between habitat categories and across seasons did not change statistically ($P>0.05$). The diversity of wildlife species varied between areas, though. The riparian forest and the thicket woodland, which have high species richness, are more diversified in mammal population during the rainy seasons, and the thicket woodland is more diversified in mammal population during the dry season. Hedgerows and Fencerows recorded more population of mammals than the other areas having a high number of individuals—398. This outcome supported the findings of Bennett (2003), Recher and Serventy (1991), Barling and Moore (1994), and others that linkages like riparian vegetation, hedgerows, roadside, and wide forested strips provide habitat for a variety of wildlife species, especially during challenging conditions like the dry season.

The diversity of bird species did not differ significantly ($p>0.05$) between habitats throughout the wet and dry seasons. While hedgerows and fencerows are more diversified during the rainy season, the riparian forest has a high species composition during that time. Hedgerows and fencerows have higher species compositions than riparian forests and thicket woodlands during the dry season, which adds support to Doyle's (1990) claim that riparian vegetation is well known as a rich habitat for fauna and that the presence of songbirds in riparian woodlands vegetation in Mexico serves as an appropriate example (Warkentin et al., 1995). Stream edges, floodplains, historic stream channels, successional patterns of vegetation linked to varying water levels, and solitary pools, in particular, all contribute to the diversity of habitats and range of chances for fauna (Murray and Stauffer, 1995). Birds can be found in many types of habitats and throughout the year. Their exceptional diversity and abundance may be due to Kanji Lake National Park's proximity to the fragmented habitats of nearby settlements. These birds travel to and from the park through the corridor. As a result, the landscape's habitats provide ecological connectedness for different wildlife species. In addition, the requirement for ecological linkages is widely acknowledged as a fundamental tenet in land-use planning and land management in developed landscapes (Smith and Hellmund 1993; Forman

1995). According to the E value classification criterion, which specifies that an E value greater than 0.6 implies high species evenness, the evenness index values for all of the environments are classified as high evenness. These findings suggest that, except for the thick natural woodland during the dry season, when hunting and bush burning are at their zenith, the agricultural lanes in New Bussa still maintain a high evenness index. Deforestation, unchecked bushfires, and ongoing land development have all had an impact on species variety and abundance.

Conclusion

From the results, because the New Bussa landscape contains representative populations of mammals, reptiles, and birds, the habitat corridors are valuable for protecting species, according to the data that are currently available. If these habitat types are preserved, the conservation of these faunal species will benefit even more. However, due to the modest sizes of the habitat types found in farming communities, there are not many mammal species. The movement of wildlife species between significant habitat segments will promote the use of the habitats by wildlife species, supply dwindling populations, and ultimately stop the extinction of local wildlife. Deforestation and uncontrolled bush burning should be stopped, indiscriminate bird and other wildlife killing should be discouraged, and villagers need to be educated about wildlife conservation and farmers should use herbicides sparingly and avoid using pesticides near wildlife nesting areas.

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