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The abundance, diversity and distribution pattern of avian species in the Fentie Community Conservation Area, Ethiopia

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Abstract

This study aimed to investigate the species abundance, diversity, and distribution pattern of avifauna in the Fentie Community Conservation Area, East Gojjam, surrounded by farmlands, settlements and mountain ranges. The study carried out in both dry and wet seasons. The study area was stratified based on the four habitat types: forest, woodland, farmland, and shrubland. The point count method was employed in the forest and woodland habitats, and the line-transect used for farmland and shrubland. Data were analyzed using SPSS version 20. In this study, 92 avian species belonging to 38 families were identified during both dry and wet seasons. The highest avian diversity was observed in the forest habitat (H= 4.101 and H= 4.056), followed by shrubland (H=3.874 and H= 3.848), during both dry and wet seasons, respectively. The highest number of birds was recorded in the dry season (n=703) than the wet season (n=439). There was a significant difference in abundance between the habitat types in the dry season (α=0.05, H'=4.142, df=3 and P=0.038) as well as in the wet season (α=0.05, H'=4.113, df=3 and P=0.109). The fewer bird species diversity and abundance discovered in the farmland could be caused by the cleansing of the vegetation for cultivation as it was seen in the study area. Thus, protection of the area is crucial for wildlife conservation especially for birds to enrich their diversity, abundance, and to maintain the natural ecological balance.

Keywords: Crop cultivation, Deforestation, Habitat degradation, Species dominance

Introduction

The size of habitat patches, local resources availability, and vegetation composition are detrimental to avian species richness and abundance (Tsigereda, 2017). Abiotic factors affecting avian species distribution, and interspecies interaction as well as the essential resources are not uniformly distributed in space (Nabaneeta and Gupta, 2010). Different habitats have their own different bird species due to the heterogeneity of vegetation composition and other food

resources (Hailu , 2017). Forest is the most significant habitat for birds supporting around 75% of all the bird species, and only 45% of all bird species have adapted to humans modified habitats (BirdLife International, 2008). Human activities such as farming, settlement, charcoal making, timber cutting and firewood collection have contributed a lot in degradation of forest, that in turn extensively damaged the natural habitat of birds by affecting their variety and variability (Storch et al., 2003).

Birds are habitat-specific which some can occupy more than one habitat type, however, because of land uses changes, most birds have been displaced from their original habitats (Burgess et al., 2002). Responses of birds to habitat changes differ depending on their strategies. Habitat change is beneficial for some of the avian lifestyles, but a principal threat to the others (Tworek, 2002). They are very visible and integral part of the ecosystem occupying many trophic levels in a food chain ranging from consumers to predators (Glorla, 2013). Their occurrences have been helpful as such birds are environmental health indicators, agents of pollination and seed dispersal as well as pest controllers (Hadley et al., 2012).

Distribution, abundance, reproductive success and behaviour of animal species are sensitive to anthropogenic habitat alterations. Birds are particularly useful as indicators to evaluate effects of habitat change because they are easy to watch, and their populations may decrease or increase when the landscape is modified by such activities (Posa and Sodhi, 2006). The study of abundance, diversity and distribution of birds with respect to different habitat types is important to provide an understanding of the avian species diversity, distribution and abundance within natural and human occupied habitats in Fentie Community Conservation Area.

Deforestation for clearance of new farms and firewood are the major causes of habitat loss occurring around Fentie community conserved area. Within the study area, about 21324 m^2 (2.1324 ha.) of the natural closed forest cover had been cultivated to farmlands in 2015. This suggests that there might be displacement of bird species due to land use changes, and also that some might have adapted human modified habitats. Besides, no documented avian study in Fentie Community Conservation Area is available. As a result, comprehensive information on bird abundance, diversity and distribution that covers the entire study area landscape including the settlement areas, farmlands and natural forests is inadequate. The fact that birds are indicators of environmental changes emphasizes the need to study their abundance, diversity and distribution every five years to monitor these changes (MNRT, 2009). Thus, the present study

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was undertaken to investigate the species abundance, diversity and distribution pattern of birds in Fentie Community Conservation Area, East Gojam Zone, Ethiopia.

Materials and methods

Description of the study area

The study was conducted in Fentie Community Conservation Area. This forest is surrounded by farmlands and shrubland patches of East Gojjam Zone, Machakel woreda; and lies between 10^{o} 28' 34"-10^{o} 35' 51"N and 37^{o} 33' 10"-37^{o}33' 60" E (Figure 2). Machakele is one of the Woredas in the Amhara region of Ethiopia. Part of the East Gojjam Zone, Machakele is bordered on the south by Debre Elias, on the northwest by the West Gojjam Zone, on the east by Sinan, and on the southeast by Guzamn. Towns in Machakel include Amanuel that is near to study site. The mean temperature and annual rainfall ranges between 11.01^{0}C and 5.03mm and 29.09^{0}C and 307.48mm, respectively. The altitude of the area is between 6345 ft (1933.96 m) and 7995 ft (2436.87 m). This study covered 137012 m^2/13.7012 ha. The area is located east of Embuli Kebele and northwest of Yenech Kebele. 6.3 km away from Amanuel town in the north west direction, 35km away from Debremarkos town in the northwest direction and 340.3 km northwest of Addis Ababa. It is found around 2 km right sides of Addis Ababa to Bahr Dar route. The study took place in the dry (December to February) and the wet (May to July) seasons. The area is classified as warm and temperate. In winter, there is much less rainfall in the site than in summer. The least amount of rainfall occurs from december to february. The average in this month is 5.05 mm. With an average of 307.48 mm the most precipitation falls in July. The average temperature of the year is highest in March (29.03^{0}C), and the lowest in July (11.01^{0}C) (EMA, 2019). According to Koppen-Geiger climate classification, this climate is classified as subtropical highland oceanic or oceanic climate (Geiger, 1961).

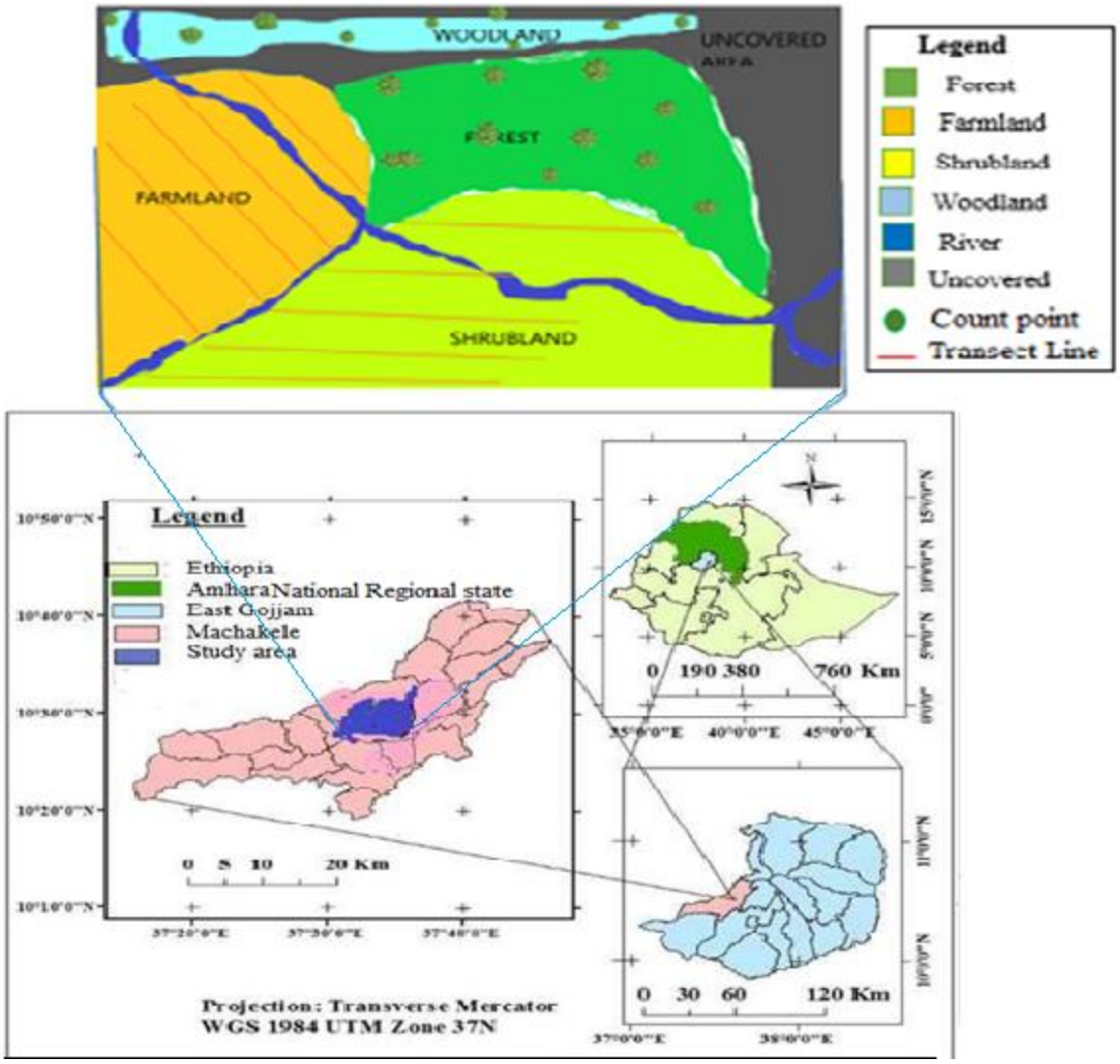

Figure 1. Map of the study area showing the location, habitat features, line transects and count points

Study design and methods of data collection

The data were collected from December to February in the dry season and from May to July in the wet season of 2019. The area was stratified into farmland, woodland, forest and shrubland. A forest area was defined as an area with a high density of trees more than 50% and close canopy characterized by over storey layers (shrub layer, herb layer and above layer); woodland as an area of low density trees with open canopy of 20%; and Shrubland was defined as vegetation characterized by height of two meters but not exceeding eight meters. Then, the position of each habitat was Geo-referenced using a hand held GPS.

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Line-transect method was applied in farmland and shrubland, and systematic sampling method was applied to select 10 permanent counting points of 30m radius with a distance of 100m apart; however, the first sampling point in each habitat (woodland and forest) was established randomly.

In each habitat type, nested plot of 1m x 1m, 5m x 5m and 10m x 10m were laid during each sampling occasion (the dry and wet season) to determine the habitat features (i.e. vegetation cover, density and height) using the line intercept method. 1m x 1m quadrate was used to identiy grass and herbaceous plants dencity and coverage, 5m x 5m was used to identify shrubs density and coverage and 10m x 10m quadrate was used to identify trees density and coverage. A quadrate was laid systematically. There were ten quadrates in each stratified area (farmland, shrubland, woodland and forests) in two season to determine habitat features. The quadrates were laid 100m away from one another. At the right side corner of 10m x 10m plots (facing north), a 5m x 5m plot was established, and at the right corner of the 5m x 5m plot (facing north again), a 1m x 1m plot was established (Fig 2) (Yenew and Dessalegn, 2017; Glorla, 2013).

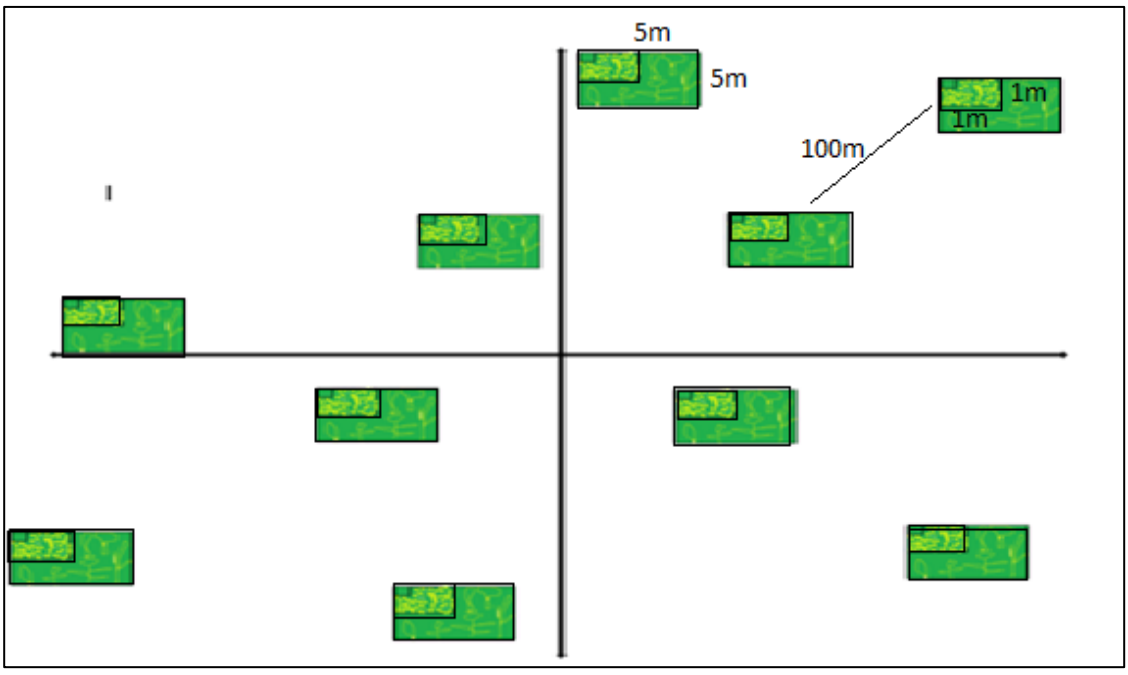

Figure 2. Plotting the area to determine habitat features

Line-transect and point-count methods were used to collect data on birds during the present investigation. Surveys were conducted in the dry season and the wet season. The line-transect followed by Agarnesh and Subramanian (2015) was employed for data collection on farmland

and shrubland. Five transects on each habitat (farmland and shrubland) were laid for one kilometer length with a fixed width of 200 meters (100 meters on either side) and bird surveys were made for each study site. Point-count method was employed for data collection in forest and woodland. In each habitat (forest and woodland), birds were counted within 10 sampling points. The same points were used during both dry and wet seasons. Upon reaching a point, 2-5 minutes were provided for the birds to settle in case of any disturbances (Glorla, 2013). Ten minutes were used to count and record all birds that observe or hear within 30m radius. To avoid double counting there were 10 persons (one person at one point) collect data at the same time each counting points. Each transect lines and points were observed five times per season. Date, bird species, average number of bird species, habitat type and altitude were recorded. Birds were identified to the species level and their taxonomic groups were properly categorized based on field guid books. Plant species, cover and density were recorded from the nested plots. Grass and herbs were recorded from the 1m x 1m plots, shrubs from 5m x 5m plots and trees 10m x 10m plots.

Data analysis

The species diversity of the area for each habitat type was determined in terms of Shannon Wiener diversity index (Shannon and Wiener, 1949).

$H' = -\sum (PiInPi)$ where;

H'=Shannon-Wiener index,

Pi=proportion of the ith species (ni/N),

In=Natural logarithm, ni= individuals in a species,

N= individuals in a community

Species evenness measures the pattern of distribution of bird populations present in the area, were evaluated using Shannon-Wiener evenness index (E) as follows:

$E=H'/Hmax$ where;

E= Shannon-Wiener evenness Index,

H'= Shannon-Wiener diversity index,

H max= natural logarithm of the total number of species in each habitat

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Encounter rate was calculated for each species by dividing the number of birds recorded by the number of hours spent for searching the individuals per hour for each species (Yenew and Dessalegn, 2017; Sutherland et al.,2004).

Encounter rate= Total Number of Individual Birds Observed/ Period of Observation in Hours

Encounter rate was used to determine a crude ordinal scale of abundance as given in the table below.

Table 1. A crude ordinal scale of abundance

Abundance Category	Abundance scale	Ordinal scale
<0.1	1	Rare
0.1-2.0	2	Uncommon
2.0-10.0	3	Frequent
10.1-40.0	4	Common
>40.0	5	abundant

The community similarity of bird species of the habitats was assessed by using Sorensen's coefficient (Yenew and Dessalegn, 2017;Jeffery et al., 2004). The formula was used depending on the number of habitat such as CC=2C/ (A+B), CC=3D/ (A+B+C), so on.

CC= 2C/ (A+B) Where;

CC= Sorensen's coefficient, A= number of species that occur in site A.

B= number of species that occur in site B.

C= number of species that occur in both site A and B.

Spearman Correlation Coefficient test was used in Statistical Package for Social Science (SPSS version 20) to correlate habitat features and bird abundance.

A checklist of bird species was compiled in Microsoft office excel showing families, species and habitat type in which the birds occur. SPSS version 20 was used to analyze the data. Significance test was determined at 0.05 level.

Results

Ninety species of birds grouped into 38 families were recorded during the present study period. A total of 91 species of birds were recorded during the dry season and 88 during the wet season (Appendix B). Among them, Wattled Ibis (*Bostrychia carunculata*), Gold-mantled Woodpecker (*Dendropicos abyssinicus*), Spot-breasted Plover (*Vanellus melanocephalus*) and White-collared

Pigeon (*Columba albitorques*) are endemic to Ethiopia. The highest numbers of species were recorded for the family Accipitridea (7 species). There were 1-4 species recorded in the remaining families. The internal coordination systems of each habitat were related to ground systems of geographical coordinates using a hand held GPS (Table 2).

Table 2. Bird species and their abundance observed at each habitat in two seasons.

Habitat	Coordinate	Altitude	Season	N° of species	Total N° of birds
Farmland	10°28'10" N –10°29'16" N	7726ft–7946ft	Dry	38	250
	37° 30'60"–37° 31'60 "E		Wet	34	221
Shrubland	10°28'34" N –10°29'15" N	7725ft–7948ft	Dry	67	490
	37° 31'53" E –37° 33'56 "E		Wet	64	346
Woodland	10°29'20"N–10°35'51" N	6345ft–7450ft	Dry	68	515
	37° 30'00" E –37° 35'10 "E		Wet	68	313
Forest	10°30'11" N –10°31'33" N	7754ft–7995ft	Dry	80	703
	37° 33'54" E –37° 34'50 "E		Wet	77	439

Results showed that, there was a significant difference in abundance between habitat types in dry season (α=0.05, H'=4.142, df=3, P=0.038) and in wet season (α=0.05, H'=4.113, df=3, P=0.109), and when the two sampling period were combined (α=0.05, H'=4.153, df=3, P=0.057). However, in the dry season mean bird abundance per species count was higher in forest and least in farmland (Table 2). The density of birds was highest in woodland and least in farmland (Table 3).

Decrease in number of birds was observed in the dry season compared to the wet season. The decrease was detected in farmland by 12%, shrubland by 29.39%, and woodland by 39.22% and forest by 37.55% (Table 3). The mean abundance of birds was highest in forest and lowest in farmland. The decrease in bird abundance resulted in the decrease in the number of individuals per m^2 with the highest and lowest density occurring in the shrubland and farmland respectively (Table 3).

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Table 3. Abundance and density of birds within the four habitats

Habitat	Area/m^2	N° of birds		Density (N° of birds/m^2)		N° of species	
		Dry season	Wet season	Dry season	Wet season	Dry season	Wet season
Farmland	29571	250	221	0.009	0.008	38	34
Shrubland	29314	490	346	0.017	0.012	67	64
Woodland	28714	515	313	0.018	0.011	68	65
Forest	49413	703	439	0.014	0.009	80	77

Relative abundance of avifauna among the four different habitats during wet and dry seasons indicated that 30.64% of the species were frequent, 13.25% common, 8.49% abundant, 38.72% uncommon and 8.9% rare (Table 4).

Table 4. Relative abundance of species of birds during the wet and dry seasons in 2019

Habitat	Season	Rare	Uncommon	Frequent	Common	Abundant
Farmland	Dry	5	14	12	4	3
	Wet	3	15	11	3	2
Shrubland	Dry	8	26	21	7	5
	Wet	3	22	24	9	6
Woodland	Dry	4	26	19	11	8
	Wet	2	27	22	9	5
Forest	Dry	11	26	21	13	9
	Wet	7	31	28	8	3

In the dry season,mean bird abundance variation was highest between forest and farmland and least between forest and woodland. In the wet season, the variation was significant between forest and farmland. When sampling periods combined, the highest distinction was discovered between forest and farmland; while the least between forest and shrubland (Table 5).

Table 5. Bonferroni Multiple comparison for mean abundance of birds between habitat types in 2019

Dependent variable	Habitat (I)	Habitat (J)	Mean difference (I-J)	P-value
Mean abundance of birds in dry season	Forest	Farmland	90.60*	0.000
		Shrubland	42.60*	0.009
		Woodland	37.60*	0.022
Mean abundance of Birds in wet season	Forest	Farmland	43.60*	0.004
Mean abundance of Birds in dry and wet seasons	Forest	Farmland	134.20*	0.000
		Shrubland	61.20*	0.005
		Woodland	62.80*	0.004

*The mean difference is significant at the 0.05 level.

In the dry season, the species dominance was higher in the woodland and the farmland, but relatively lower in the shrubland and the forest habitats. In the wet season, though the result showed slight changes in dominance from that of the dry season, still dominance was higher in the farmland and the woodland, while lower in the shrubland and the forest. On the other hand, avian diversity was higher in the habitats with less human disturbance; such as forest (4.056), shrubland (3.874), and woodland (3.859), respectively, while it was lower in the farmland (3.284) that has higher human disturbance. Despite of the temporal decrease in the diversity, the forest fetches the highest diversity. Regardless of the slight changes, evenness was higher in the forest and shrubland compared to the woodland and farmland in both seasons (Table 6).

Table 6. Structural properties of bird species for four habitats

Habitat	Farmland		Shrubland		Woodland		Forest	
Season	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Dominance (D)	0.076	0.095	0.059	0.043	0.080	0.048	0.050	0.034
Shannon (H')	3.284	3.173	3.874	3.848	3.859	3.874	4.101	4.056
Evenness (e)	0.903	0.900	0.921	0.925	0.915	0.922	0.936	0.934

Irrespective of the distance between the habitat types, bird species similarity was the highest between shrubland and Woodland; while the least between farmland and forest in both dry and wet seasons (Table 7).

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Table 7 Sorensen's similarity index of bird species for different habitats

Habitats	Distance between habitats (m)	Similarity index	
		Dry season	Wet season
Farmland and Shrubland	0	0.629	0.621
Farmland and Woodland	1	0.547	0.556
Farmland and Forest	0	0.542	0.541
Shrubland and Woodland	2.5	0.815	0.822
Shrubland and Forest	0	0.740	0.723
Woodland and Forest	0	0.811	0.789

The study recorded 3277 birds from 38 families, 92 species, and 3 unknown bird species in the two sampling periods were distributed within the farmland, shrubland, woodland, and forest. Four of the 92 species observed were endemic in the East Africa, particularly in Ethiopia. The study found that some species had occurred in all habitat types, while others were found only in one, two or three habitat types. Meanwhile, most bird species (on average 78 spp.), occupy the forest habitat (Figure 3).

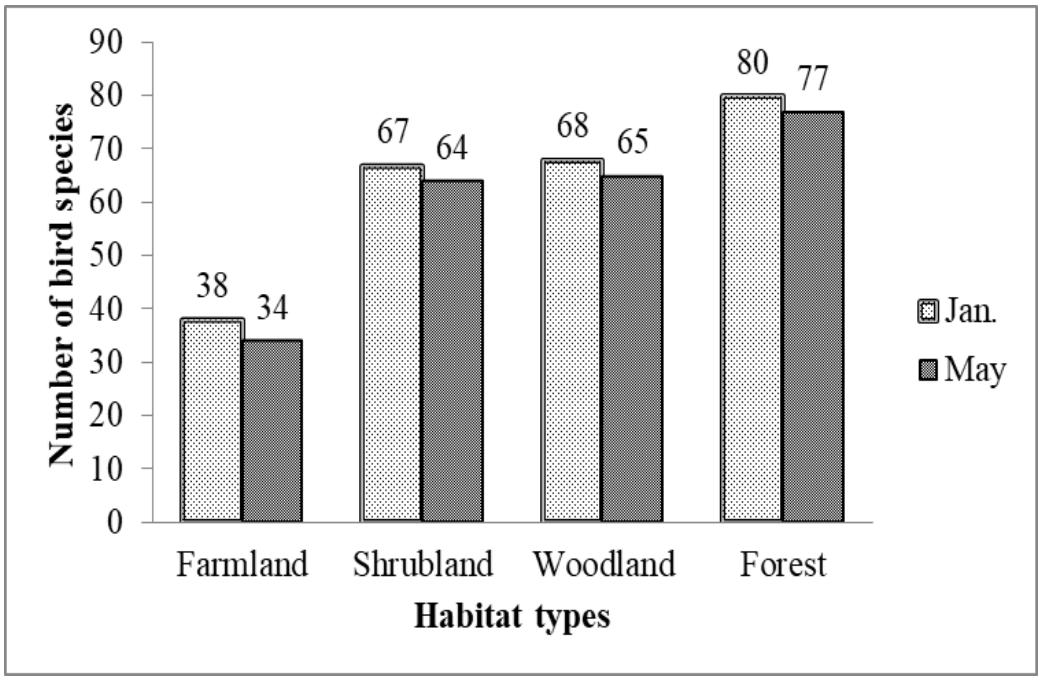

Figure 3. Bird species distribution

Three types of birds coded as B93 (36 counted in the dry and 16 counted in the wet), B94 (one the dry season and nil in the wet season), and B95 (one in the dry and nil in the wet) recorded during the survey time were unidentified bird species. These birds could not be identified because of their size and could not be found in the bird lists. B93 is a small- sized bird with pointed beak and v-shaped tail (Figure 4A). It was mostly found in a canopy of acacia tree species. B94 is a beautifully-marked and small sized bird with short beak, black feather, and a single spot on top of each wing. It iInhabits shrubland that mostly associated with shrubs, it might be solitary bird (Figure 4B); and B95 is also a small- sized bird with greyish colour, pointed beak,; and found on Justicia shimperiana's flower; that might be a nectar eater, secretive and solitary bird. It could not be captured by photo camera. It was observed only in the dry season that might be a migrating bird.

(A) **(B)**

Figure 4. (A) B93 bird and (B) B94 bird (Photo: Lamesginew Tadesse, 2019)

The dry season amount of grass cover and density, and coverage of leaves of trees and shrubs was lower than that of the wet season, due to the lower amount of precipitation in the dry season (as the ten years average rainfall was 5.95 mm for the dry seasons and 140.83 mm for the wet seasons) (EMA, 2019) (Table 8).

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Table 8. Habitat feature of the area

Month	Habitat	Total N^{o} of grass/shrub/ tree per total plants x 100			Density (Numbers grass/shrub/tree per m^2)		
		Grass Cover%	Shrub Cover%	Tree Cover%	Grass Density	Shrub Density	Tree Density
January	Farmland	96.225	3.76	0.013	6.751	0.266	0.001
	Shrubland	94.489	5.497	0.014	21.7	1.262	0.003
	Woodland	98.516	1.398	0.086	13.96	0.198	0.012
	Forest	12.29	79.072	8.638	8.638	1.136	1.136
May	Farmland	97.087	2.901	0.012	6.952	0.266	0.001
	Shrubland	95.427	4.561	0.012	22.713	1.262	0.003
	Woodland	98.549	1.378	0.073	14.131	0.198	0.012
	Forest	19.756	73.031	7.213	0.327	1.136	0.124

Correlation of the habitat feature with bird abundance

The bird abundance was found to correlate with the habitat features. In the dry season, strong positive correlation was observed between bird abundance, grass and tree percentage cover, and tree and grass density, respectively (Table 9). But, bird abundance had no significant correlation with the shrub percentage cover (-0.270) (weak negative correlation) and shrub density (very weak positive correlation). In the wet season, bird abundance had significantly positive correlation only in the grass and tree density, respectively, while weak negative correlation with shrub percentage cover (Table 9).

Table 9: Spearman correlation coefficient(r) between bird abundance in habitat feature

Seasom	Habitat feature	Grass Cover (%)	Shrub Cover (%)	Tree Cover (%)	Grass Density	Shrub Density	Tree Density
Dry	Bird abundance	0.661**	-0.270	0.609**	0.490*	0.020	0.582**
Wet	Bird abundance	0.314	-0.106	0.346	0.527*	0.248	0.517*

**Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level.

Discussion

The mean bird abundance was highest in the forest and lowest in the farmland during both consecutive sampling periods. The habitat feature difference between habitats could be the reason for the abundance differences. The higher bird abundance and densities occurred in the areas with low human disturbance, and lower in the farmland areas with high human disturbance. The result of this study concurs with the finding of Agarnesh and Subramanian (2015) in which the human-disturbed areas provided heterogonous habitats which can attract only human tolerant bird species. Higher abundance and density per species exists in the forest, whereas few species that can coexist with the human; such as Red-billed Fire finch (*Lagonosticta senegala*), Red-cheeked Cordonbleu (*Uraeginthus bengalus*) and Northern grey-headed sparrow (*Passer griseus*) exist in the farmland with higher abundance and density. It was observed that during the dry season, woodland had higher density of birds. This could be associated with the greater openness in the habitat which supports trees and shrubs, that provide food and cover for different bird species (Agarnesh and Subramanian, 2015; Girma and Afework, 2008). Farmland habitat had a few individuals and species type record; this can be attributed to the habitat degradation through cultivation, which can affect the farmland birds. The increment of plant coverage of the habitat provides a hiding place from enemies, shelter, food and breeding sites, and decreases competition within and between species, hence the increase in number can be reflected in the forest (Uday, 2012).

Bird abundance and density were observed decreased in all habitats during the wet season. This might be associated with the increased rainfall during the wet season by 95.79 %; i.e. from the mean of 5.93 mm in the dry season to 140.83 mm in the wet season (EMA, 2019). According to Herrando et al. (2019), Brano et al. (2017) and Time Sparkes et al. (2002), precipitation had an impact on the bird habitats by limiting available resources and degradation of nest. In the dry season, high bird species diversity was observed in the habitats with less human activity and greater vegetation coverage. The minimal species diversity in the farmland might be caused due to the cleaning of herbal vegetation for cultivation. This study also agrees with many other studies that greater vegetation cover assists greater diversity of birds (Girma and Afework, 2008; Agarnesh and Subramanian, 2015; Eshetu et al., 2017) Avian diversity is higher in the forest followed by the shrubland and woodland, respectively, as they are with sufficient vegetation

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cover compared to the farmland which has been affected by the land use (Mantina et al., 2009; Ian, 2004).

The highest species density indicates a complex community, that has a high degree of species interaction. Higher dominance observed in the woodland and shrubland, it implies that few species predominate those habitats. The higher evenness in the forest is supported by continuous vegetation cover which reduces the impact of predation to the adult birds, young's and eggs by other birds or animals. In the farmlands, there are high predation due to the lack of hiding vegetation cover (Alexis et al., 2017; Ian, 2004).

Diversity showed a slight decrease in the three habitats (forest, shrubland and farmland) and a slight increase in the woodlands during the wet season. This indicates that bird diversity is affected by the weather conditions (precipitation and temperature) (Alexis et al., 2017; Brano et al., 2017; Eshetu et al., 2017). The study conducted by Parmesan (2005) noted that, weather condition determines bird diversity by spatial and temporal shift of the species from one habitat to the other, seeking favorable conditions. Similarly in the dry season, the highest diversity seen in the forest is due to the availability of food, shelter, breeding site, breeding material, and cover from predation (Alexis et al., 2017; Westphal et al., 2006; Menhaes and Ribeiro, 2005). In wet season, higher dominance in the farmland were contributed by few species that were feeding insects on the farmland influenced by high rainfall (Humphrey, 2004).

In general, forest habitat had higher diversity as compared to the other habitats, when the sampling periods were combined together. The result agreed with many other studies, which conclude that forest is the main habitat which has large bird species diversity (Eshetu et al., 2017; Agarnesh and Subramanian, 2015; Girma and Afework , 2008; Hiwot, 2007). Therefore, the forest bird species may locally extinct if cultivation/ degradation will continue to modify the habitat (Ian, 2004; Vivero, 2001).

Only 92 bird species and three unknown bird species were recorded in the study area. The distribution patterns of bird species normally follow the spatial structure of the environment and habitat requirement of the bird species (Bewketu and Bezawork, 2018; Buckely and Freckleton, 2010; Storch, 2003). The above finding corresponds with the findings of this study, where by habitat specificity and generalization were observed. For example, Black Kite (*Mivus migrans*), Pied Crow (*Corvus albus*), Cape Crow (*Corvus capinsis*), Sudan Golden Sparow (*Paster luteus*), and speckled pigeon (*Columba albitorques*) were recorded in all the habitat types. On the

contrary, crowned lapwing (*Vanellus coronatus*), Hemprich's Hornbill (*Tockus hemprichii*), Somali bee-eater (*Merops revoilii*), and Speckled Moose bird (*Colius striatus*) were recorded in the forest. Although, the forest habitat areas have a mixtures of vegetation and open green patches, bird species have managed to exist and thrive in this complex habitat (Yenew and Desalegn , 2017; Zerihun and Tsyon, 2016). This is explained by the availability of ecological requirements for the species offered by a mixture of an environment with the forest (Tsigerda , 2017; Pennington and Blair, 2011). The study also recorded four endemic birds namely; Wattled ibis (*Bostrychia carunculata*), White-collared pigeon (*Columba albitorques*), Spot-breasted lapwing (*Vanellus melanocephalus*) and Thick-billed raven (*Corvus crassirostris*) of East Africa, particularly, Ethiopia, which were previously recorded by Weldemarian (2016) in the biodiversity survey of Ethiopia.

Most of the birds recorded in all the habitat types are widely distributed in Ethiopia (Yihenew and Bezawork, 2018). The greater the species distribution similarities between the habitats, which are spatially closer indicate that these habitats share some bird species in common, especially the food generalist one (Glorla, 2013). The similarity found between the forest and the woodland habitats was similarly observed by Doggart et al. (2007) on a Mountain of Tanzania. The least similarity found between the farmland and the forest habitats is due to habitat degradation in the farmland. This reveals that there is a distinction in the requirement of bird species. For the reason, it is vital to conserve a mosaic of natural habitats (Glorla, 2013).

The abundance of birds in the forest habitat showed a large number of avian species. This might be due to the complexity of vegetation and inconspicuousness of small birds. Removal of plants for firewood collection, charcoal production and grazing of livestock leads to the habitat degradation and the deforestation of watersheds has resulted loss of genetic resources, flooding and wood scarcity, which affect avian abundance, diversity, and their distributions (Kalkidan and Afework, 2011).

Bird abundance is influenced by habitat features (Cordeiro, 2005). This study indicated that during the dry season, bird abundance had strong positive correlation with the grass cover, tree cover, tree density and grass density. Other features such as shrub cover and shrub Density showed non-significant correlations. This may be attributed to the openness of the habitats that favors less availability of food, nesting material, cover from predator and breeding site compared to the other habitats, which have higher percentage and density of vegetation's. The positive

correlation of Grass and tree cover with bird abundance could be due to the high amount of vegetation cover that supports high number of bird species in the habitat (Glorla, 2013).

During the wet season, avian abundance showed positive correlation with grass density and tree density, but there were no significant correlation wither habitat features; such as grass cover, shrub cover, tree cover and shrub density. The increased rainfall in the wet season could have caused the changes in the recruitment of productivity and food supply that can lead to negative change in bird abundance (Girma et al., 2017).

Conclusion

The bird species diversity was higher in the area of less human activities such as forest, shrubland, and woodland than the farmland. The higher diversity suggests higher ecological stability compared to the human disturbed area where few species occur. The study also evidenced that human induced disturbance may cause low diversity and low mean abundance of birds compared to the forest, woodland and shrubland. These differences occur due to the differences in the resource availability between habitats; such as food, breeding site, nesting material, cover from predator, and other resource limitations that restrict some species to certain habitat types, while others allowing to be widely distributed. The forest remained as the refuge for many of the bird species that conservation is required to maintain integrity of the forest (Fentie Forest). Any activity that can change the habitat structure might also impact on the vifauna abundance, diversity, and distribution. Therefore, protection of the area is crucial for the wildlife conservation; especially for the avifauna to enrich their abundance, diversity, and to maintain the natural ecological balance of the area.

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