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THE ECOLOGICAL IMPACT ON WEAVERBIRDS´ ACTIVITIES IN EKONA FARMS, SOUTHWEST REGION, CAMEROON

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ABSTRACT

Birds are among the most diverse and evolutionarily successful groups of animals. They occupy almost every habitat on earth, often occurring in large number and in a great variety of forms, especially in the tropics. The objective of this study was to investigate the ecological role on the activities of weaverbirds in Ekona farms. The research data was collected from March to August 2016, by randomly laying six transects of 1km long and 100m wide within the study area. Four ecological sites were used to study the daily activities of the weaverbirds. The ecological data of the weaver birds nesting behaviour was observed and recorded, against the day-period, weather and seasonal changes. The data was analysed using Chi-square and Pearson correlation statistical models. It was observed that activities of weaverbirds were significant with the weather changes(X^2=21.325; df=8 P< 0.05). From the chi-square test results (X^2=13.624, df=6, P < 0.05), there is a significant between spread distance of weaverbirds and the day-period. Also, the weaverbirds activities and the day-period showed a very positive significance (X^2= 830.752, df=44, P < 0.05). This study has discovered that weather changes and the day-period have an impact on the weaverbirds. The survey recommends that more studies be carried out on the population ecology of the weaverbirds in Ekona farming area and the neighbouring villages and town to have the population of weaverbirds under control.

Keywords: Weaverbirds, ecological role, farming area, day-period, weather changes.

INTRODUCTION

The activity pattern of birds in croplands is influenced by a number of factors, such as crop type, non-crop physical structural arrangement and the agricultural practices (Rodenhouse *et al*.,

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1995). Shift in cultivation timing also significantly affects the activity pattern of cropland birds, which causes further reduction of the population of farmland birds (Jobin *et al*., 1996). An annual shift in the cultivation timing is dependent on the onset of the new season. The rainfall period affects bird breeding activities, habitat formation and food availability. In spite of the natural and atmospheric conditions, the increase in land-use by humans for purposes other than agriculture influences bird habitat degradation rate, as these birds are sensitive to the changing pattern of agricultural practices (Lohr *et al*., 2002). Cropland birds have significantly adapted to the dynamic nature due to their unique metabolism and non-selective food habit (Järvinen, 1979). There has been an enormous deterioration in bird populations in the last 30 years and consequently many farmland birds are listed as endangered species (Donald *et al*., 2006). Considerable measures are required to protect bird biodiversity (Ranganathan *et al.*, 2012).

Weaverbirds are in a large family of birds found mostly in Africa, with a few species found in Southern Asia and the West Indian Ocean islands (Craig, 2004). Following Craig (2004), there are 116 species in 16 genera. These can be placed in three subfamilies which, in broad terms, consist of genera which make stick nests, grass nests and woven nests. All the species of weaverbirds seem to take insects opportunistically, and some are virtually omnivorous, and besides grain, include berries, nectar, flowers, arthropods and a few small vertebrates in their diet. The majority of avian pests are weaverbirds (Family: Ploceidae) which cause serious damage to cereals - maize, rice, sorghum, millet and wheat - which are cultivated in many parts of Africa and form the staple diet in many localities. Pestiferous weaverbirds live and feed gregariously and are therefore able to inflict devastating damage on a cereal crop within a short time. The most notorious of the weaverbirds, the Quelea (*Quelea quelea*) which occurs in huge colonies of up to a million birds and has been known to totally liquidate many cereal farms. The village weaverbird (*Ploceus cucullatus*) and the red-headed dioch (*Quelea erythropus*) are much less numerically abundant as the Quelea but nonetheless cause damage of comparable dimensions. The birds' feeding habits may pose both positive and negative effects on crops.

The weaverbird damage to cereal crops has been a chronic problem to African farmers for centuries. Damage caused by the red-billed quelea (*Quelea quelea*) was noted by early Portuguese explorers and began to cause official concern in the 1980s (Anon. 1975). International attention in the form of bilateral and multilateral assistance programs to governments began in the late 1940s and early 1950s as bird pests began threatening the continent's many new, large-scale grain production schemes. The goals of many countries for meeting their population's food requirements increasingly are dependent on these large, often mechanized schemes. However, with the emphasis since the late 1960s and early 1970s by national and regional plant protection organizations on trying to protect these production centers, the traditional farmers, for priority and logistical reasons, usually have been left to their own

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initiative to protect their crops. This is unfortunate, because traditional farming is still the mainstay of agricultural production in many developing countries. Because the quelea is an agricultural pest, official statements are often made that its populations are increasing, or are causing serious damage to crops, or are becoming permanently resident in agricultural areas. Such reports may be made to induce a sense of urgency or to encourage national treasuries or donors to fund quelea control projects (Elliott, 2006). The statements are also sometimes repeated in scientific publications, but usually without supporting data (Mundy and Herremans, 1997).The high visibility of quelea flocks, and the fact that most quelea control involves the aerial spraying of pesticides at government cost, often encourages farmers to exaggerate their problems. On the other hand, farmers have to scare the birds from their fields all day long.

Maize (*Zea mays)* is an important cereal crop that ranks third in the world after wheat and rice (Mahmoodi and Rahimi, 2009), with an annual cultivation area of more than 150million hectares and harvest of almost 800 million tons yearly (FAOSTAT, 2007). The major producers are the United States, Brazil, France, India and Italy(FAOSTAT, 2007). Maize tops the list of close to 150 species of crops grown in Sub Saharan Africa each year and its contribution to Africa`s food basket is estimated at more than 43% of all cereals (Pingali, 2001). Maize was introduced by the Portuguese in West Africa in the 16th century and probably in East Africa in the 17th century.

The fertile slope of Mount Cameroon is an attraction to local crop-farming, a source of livelihood to the local population resident in the area. However, over the years, crop-farming in this part of the country has experienced a weaver bird's population increase, destructive to the farm-crops, and leaving the local farmers with very little harvest at the end of each cultivation season. Hence, this study is focused on the destructive activities of the weaver birds on ecological changes.

MATERIALS AND METHODS

This study was carried out in Ekona town which is located in Muyuka Sub-Division found in Southwest Region of Cameroon. Ekona is located between latitude 4° 9' N of the equator and longitude 9° 14' E of the Greenwich Meridian. The town is located along the Atlantic Coast within the Gulf of Guinea. The area has a surface area of about 179km^2 with an estimated population of 17513 people. Ekona is situated on the Eastern slopes of Mount Cameroon and is made up of seven villages which include, Ekona-yard, Ekona-Mbenge, EkonaL-elu, Powo, Mundame village, Leola Buea and Masuma (Figure 1). The population of Ekona has been changing since its founding, from harboring only its originators, the Bakweries to having a diverse group of people from different parts of the country seriously involved in crop-farming. The climatic pattern of Ekona and the coastal area of the Gulf of Guinea interact between the anticyclone and maritime air which is very unstable and humid. The rainy season, which starts

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from March to December is interrupted by short dry season in July and August sometimes but the main dry season is from November to March. It has a mean annual rainfall of 2085mm, mean monthly temperature range of 19 to 30°C and mean annual relative humidity of 86%. The vegetation type has a mixture of primary and secondary forests, with the former located far from settlement and the latter found closer to settlement. The vegetation comprises mostly of oil palm plantation of extensive hectares and cocoa trees in the secondary forest and others.

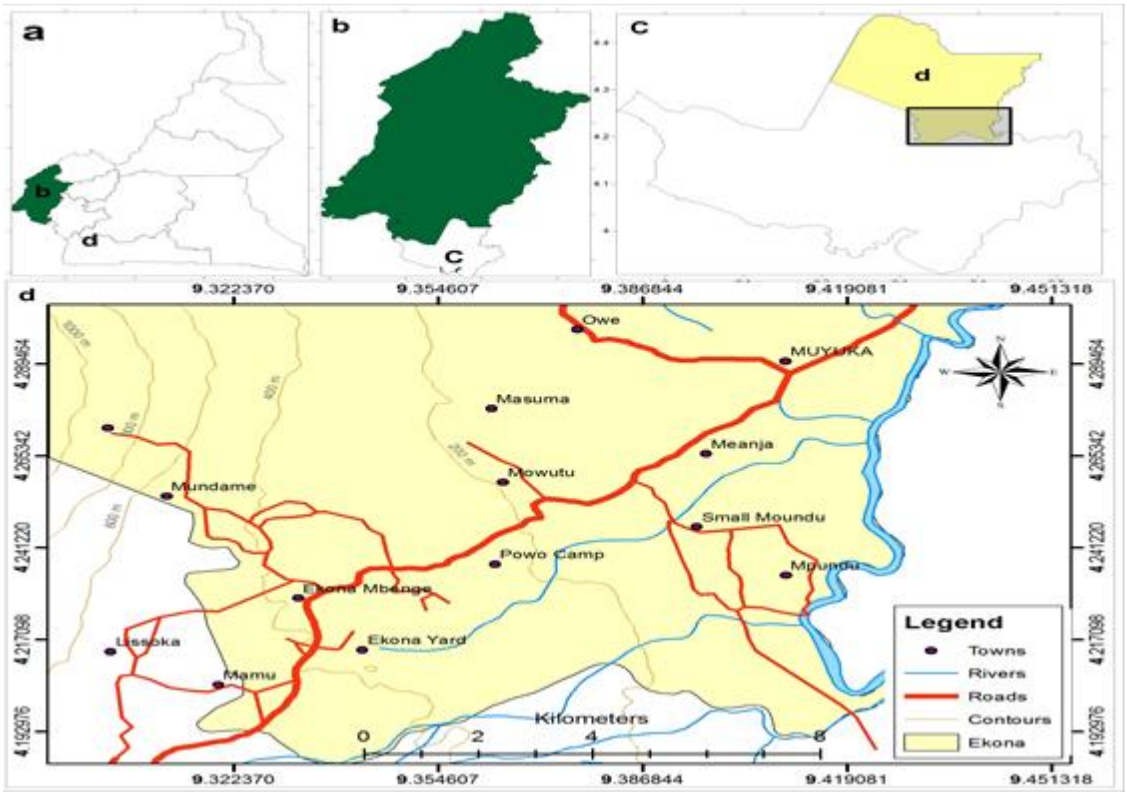

Figure 1: The study map. Source: Field Study Map (2016).

Data collection and analysis

The data collection of the population distribution of the weaverbird nest was carried out through line transects sampling. A total number of 6 transects were laid, with a dimension of 1 km in length and 100m in width within a disturbed and an undisturbed vegetation habitat. In laying these transects, a handheld compass was used to get the direction and bearing readings for each of the transects. A Global Positioning System (Garmin 60CSx) was used to get the geographic coordinates of the starting and ending points of each transect. The direct counting method used involved the observation and counting of weaverbird nests along the transect line and recorded on the check-sheets. The nests were observed on a transect-walk for each day of the month

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within the entire study period. Four different zones with different groups (colony) of weaverbirds was visited for a period of 4 months. The ecological parameters like weather changes, day-period and seasonal changes were recorded at same time.

The counting of the individuals in the colonies were done and the observation of the social behaviours of the weaverbird activities were recorded (feeding, nest-building, roosting, flying, and vocalization). And it was done simultaneously by recording ecological parameters such as weather, plant-type, landscape and day-period. Data collection was done every day for 12 days in 4 months (May to August), starting 6:00a.m in the morning to 6:00p.m in the evening within a 15min interval. These birds were watched from a distance of at least 10 to 15m away from their nesting or foraging groups, due to their shyness. The data was coded and imputed into SPSS version 20.0, to facilitate the comparison of the dependent and the independent variables. The research data was hence run using the statistical models like Pearson correlation and Chi-square.

RESULTS

Table 1 shows the percentages of weaver population in each transect, with T1 having a total of 526 (27.3%) weaverbirds,T2 has 423 (23.5%) weaverbirds, T3 has 247 (12.8%) weaverbirds, T4 has 321 (16.7%) weaverbirds, T5 has 151 (7.8%) weaverbirds and T6 has 228 (11.8%) weaverbirds respectively, with total mean population of 321 weaverbirds. Weaverbird population density in the six transects was 1.6 weaverbirds per kilometer.

Table 1: Weaver birds counts.

Months	T1	T2	T3	T4	T5	T6
March	83	53	23	42	19	51
April	145	96	64	59	22	10
May	69	121	59	51	17	51
June	64	73	37	101	36	41
July	103	64	30	38	28	37
August	62	46	34	30	29	38
Total	**526(27.3%)**	**453(23.5%)**	**247(12.8%)**	**321(16.7%)**	**151(7.8%)**	**228(11.8%)**

T= transects.

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Table 2: Relationship between activity and weather.

Chi-square tests			
Parameter	**Value**	**df**	**Asymp. Sig. (2-sided)**
Pearson chi-square	21.325	8	0.006
Likelihood ratio	18.295	8	0.019
Linear-by-linear association	1.079	1	0.299
No. of valid cases	576		

Table 3: Relationship between weave bird activity and time-hourly interval.

Chi-square tests			
Parameter	**Value**	**df**	**Asymp. Sig. (2-sided)**
Pearson chi-square	830.752	44	.000
Likelihood ratio	703.484	44	. 000
Linear-by-linear association	.016	1	.899
No. of valid cases	576		

During the study, activities of weaverbirds were observed within a period of 4 months (May-August, 2016), activities recorded included, vocalizing, movement, feeding, nest-building, grooming (roosting) and resting as shown in Figure 2. It was observed that the activities of weaverbirds were determined by the weather conditions. Figure 3 shows the variability of these activities due to weather aspects (sunny, rainy and cloudy weather types). In addition, Table 2 has shown a significant relationship between activity and weather changes(X^2=21.325,df=8, P=0.05).

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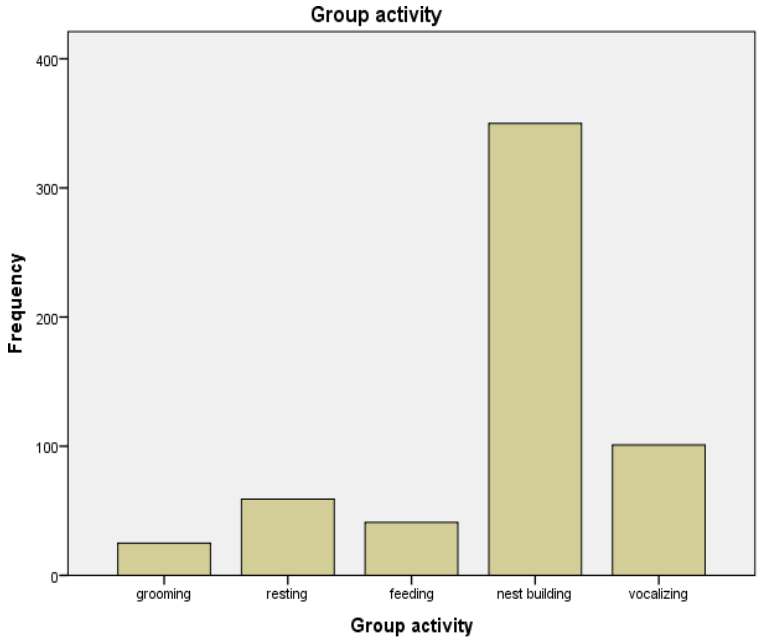

Figure 2: Frequency of daily activity.

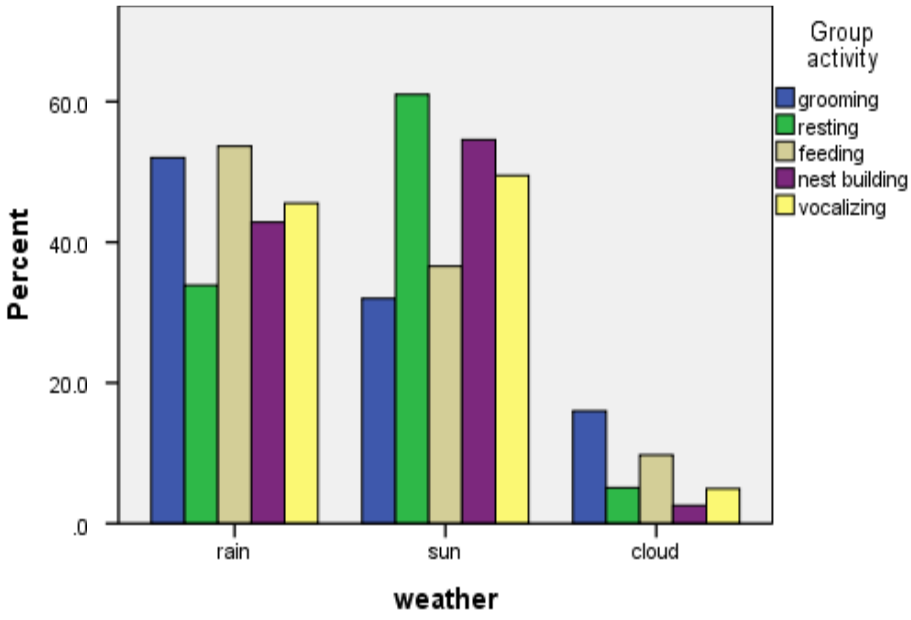

Figure 3: Activity and weather.

The total population of weaverbirds found along the six transects could be a reflection of geographical area of Ekona and more ecological corridors provided by the plant-types for the birds. This was compared with Fernandez-Juricic (2000) who recorded that birds spreading are enhanced by improved wooded road sides for movement and other activities. The population of

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the bird recorded could further be attributed to the group behaviour of the birds as described by Kassen (2002). The highest population of birds from Transects 1 and 2 could be attributed to availability of many human settlements; habitat-use classification of birds was predominantly characterized by human settlement as reported by Lahti *et al*. (2002). They observed that the Village weaverbirds are mostly well-known for affinity to settle around human community. The characterized dense vegetation nature of Transect 3 and large scale oil-palm plantation of Transect 5, with less human settlement could be responsible factors for the low population of weaverbirds. Weaver birds did not nest on palm trees within the oil-palm plantation but will always nest at the borders of this plantation, close to the road or beside the farmers' camp. Transects 4 and 6 were located in areas been considered as farming localities in the study area, which also was considered as a factor for the high number of weaverbirds present in the area. The observed colonized maize farms along Transects 4 and 6, was in accordance with Lahti and Lahti (2002), stating that village weaverbirds inhabit area close to water sources and agricultural farms. Population density of the village weaverbirds could be influenced by food availability, abundance and less predation involvement. It was observed that the nest population was increasing as the rainy season was fast approaching, that is from March to July. It could be seen from Transects 4 and 6 having the lowest population of weaverbirds at the beginning of the rainy season in March and progressively, the population number increased across the months to July, as well as the nest population. This could be as a result of the fact that more farms are been cultivated this period and the birds have more materials from crops to build their nest and it also explains the distribution of the weaver birds in the study area. Time (hourly interval) was an essential parameter to determine the activity of weaver birds in a day (Figure 4). Activity variability on time-hourly interval revealed a relationship. Figure 5 has shown the time put in by the weaverbirds for each activity monitored. The results has shown a strong significance (X^2= 830.752,df=44, $P < 0.05$) between activity of the weaverbirds and the time-hourly interval (Table 3).

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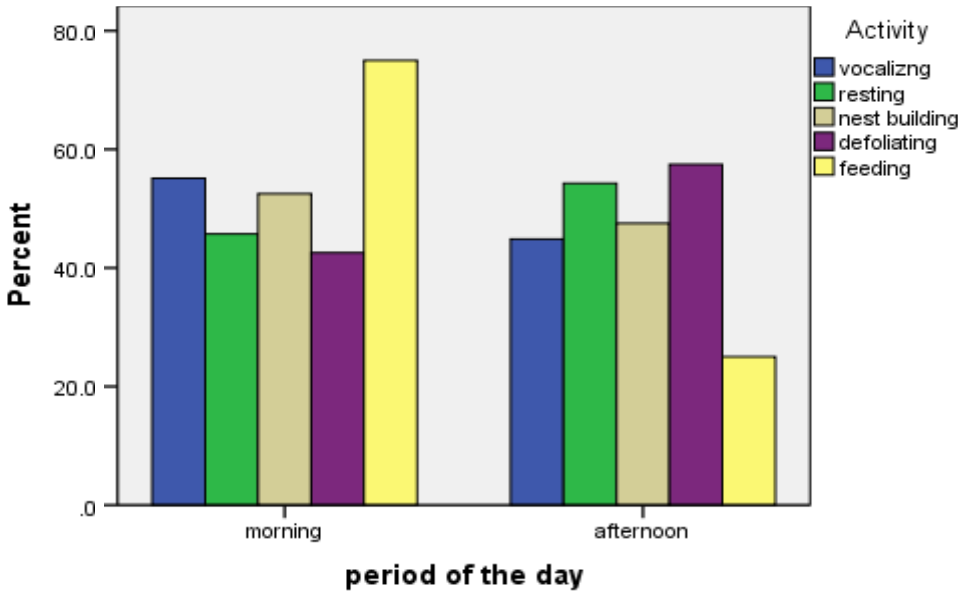

Figure 4: Activity and the day period

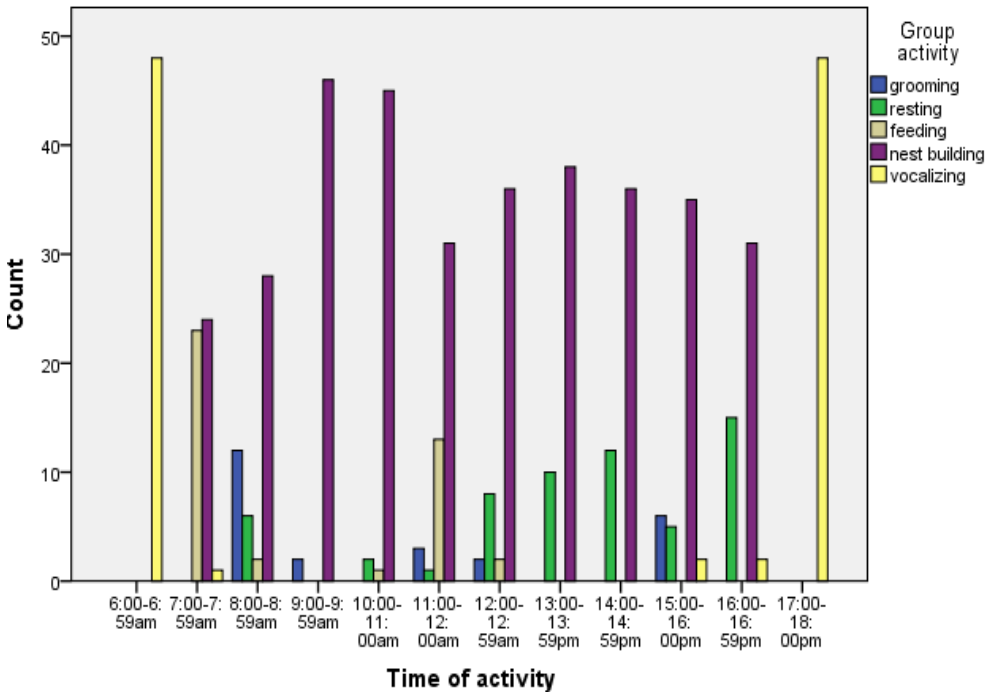

Figure 5: Activity and time.

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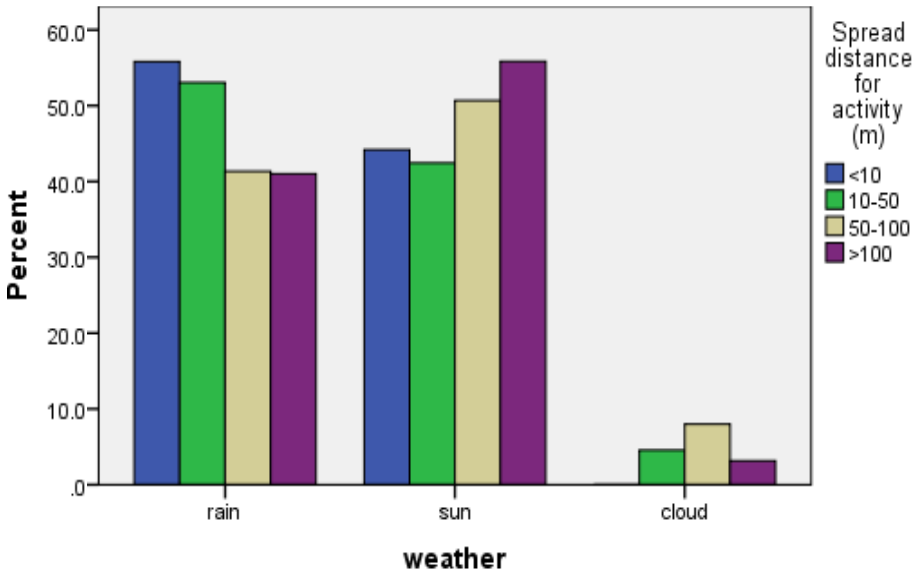

Figure 6: Spread distance of activity and weather condition.

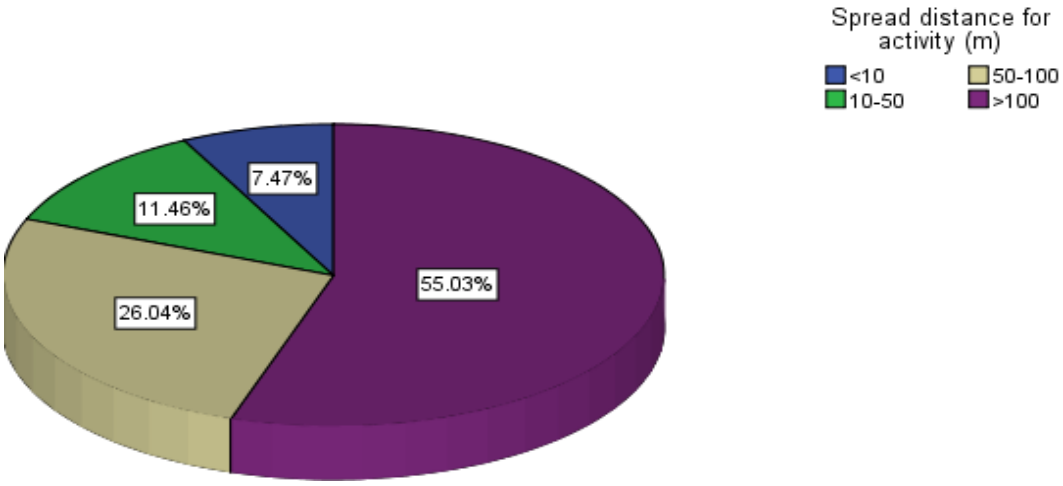

Figure 7: Percentage of spread distance for activity.

The pattern of distance covered by weaverbirds in carrying out their activities was influenced by weather changes. Weaverbirds were more active in a sunny-weather and spread more distance (52.1%) than in a rainy-weather (43.6%), and were least active in a cloudy-weather and spread a lesser distance (4.3%) due to low visibility (Figure 6). Figure 7 shows that the percentage of weaverbirds spread above 100m was 55.03% in carrying out their activities and the least distance covered (<10m) was 7.47%.

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DISCUSSION

Species of weaver birds in Ekona farming area

Three species of weaverbirds were noticed in the study area, with two of these species, the Village weaver (*Ploceus cuculatus*), the Maxwell Black weaver (*Ploceus niggermum*) which are common to this area and the masked or spike's weaver bird (*Ploceus speki*) which is not very common to this area. This was not in agreement with Okolle (2010) who discovered that there are two species of weavers destroying leaves in the study area [spike's weavers (*P. speki*) and a black species (*P. niggermum*)]. The masked or spike's weaverbird (*P.speki*) was the only species found destroying banana and plantain leaves (Okolle, 2010). The village weaverbirds and the black weaverbirds are the two species common in the study area, and are commonly seen destroying leaves from plantains, oil-palms and maize for nest construction.

A colony usually consists of about 100 to 500 nests built on one or a few trees (Collias and Collias, 1976). In colonies that are associated with human settlements as observed in Transects 1 and 2, nests are usually located at least 4 m from the ground level but nests may be located very close to the ground surface in undisturbed colonies situated in a bush along roadsides or on farmlands, this was observed in Transects 4 and 6. According to Okolle (2010),weaver birds colonies were absent from unbroken high forests or within oil-palm plantations as was observed in Transect 3 and 5. Weaverbirds build two types of colonies; permanent colonies and temporary colonies (Funmilayo and Akande, 1976). The total population of weaverbirds found along the six transects could be a reflection of geographical area of Ekona and more ecological corridors provided by the plant-types for the birds. This was compared with Fernandez-Juricic (2000) who recorded that birds spreading are enhanced by improved wooded road sides for movement and other activities. The population of the bird recorded could further be attributed to the group behaviour of the birds as described by Kassen (2002). The highest population of birds from Transects 1and 2 could be attributed to availability of many human settlements; habitat-use classification of birds was predominantly characterized by human settlement as reported by Lahti et al. (2002). They observed that the village weaverbirds are mostly well-known for affinity to settle around human community. The characterized dense vegetation nature of Transect 3 and large scale oil-palm plantation of Transect 5, with less human settlement could be responsible factors for the low population of weaverbirds. Weaver birds did not nest on palm trees within the oil-palm plantation but will always nest at the borders of this plantation, close to the road or beside the farmers' camp. Transects 4 and 6 were located in areas been considered as farming localities in the study area, which also was considered as a factor for the high number of weaverbirds present in the area. The observed colonized maize farms along Transects 4 and 6, was in accordance with Lahti and Lahti (2002), stating that village weaverbirds inhabit area close

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It was observed that seasonality has a great influence on weaverbird activities, as there was a great variation in activities carried out in both seasons. It was seen that variation was in the context of the rate at which various activities were carried out and not in the types of activities, similar to other passerine birds (Verbeek, 1972). Feeding was observed to have dropped from about 78.0% in the dry season to about 25% in the wet season; this was in relation to Pianka (1974) who recorded that food density has been known to influence negatively the amount of time spent feeding by an animal. The seasonal variation in daily feeding pattern has been described in a variety of birds and is thought to relate to changes in daily patterns of food availability (BoxallandLein, 1989) and ambient temperature (Verbeek, 1972). On the other hand, nest-building, defoliating, vocalizing and resting had a great increase about 25.0, 26.0, 37.0 and 30% respectively in the dry season, to about 75.0, 70.0, 65.0 and 68% respectively in the wet season. According to Collias and Collias (1964), there is an increase in nest-building activity during the breeding season (May-October) which is the wet season. The breeding season is very closely associated with the wet season (Funmilayo and Akande, 1976) and toward the ending of the breeding season (November- March) with the onset of the dry season nest-building becomes rather low as compared to other activities. The locomotion activities (flying and moving around) depended solely on feeding, roosting and nest-building.

It was observed that there is no great variability between this activities and period of the day, but for feeding and vocalizing which had a higher percentage of occurrences in the mornings than in the afternoons. This was in agreement with Lasiewskiet al. (1967) who stated that passerine birds have extremely high weight-specific metabolic rates among vertebrates, thus feeding is typically a dominant daytime activity (Fischer, 1981). However in weaver birds, feeding is the most dominant activity during the breeding seasons. Weaverbird activities involved moving a considerable distance in performing them, as was observed in the study area. Weaverbirds in the study area covered a range of distances (<10, 10-50, 50-100 and >100m) and this depended on the type of activity been carried. Adegoke (1983) stated that food played an important role in the movement of weaverbirds. When sources of food became scarce near their colonies, breeding populations emigrated from their colonies to other neighboring farms where maize was maturing

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(Adegoke, 1983). This movement may involve migration of the weaverbird population to create temporary colonies in the new site as it was observed in Transects4 and 6, and will always return to their permanent colonies at the end of the season. Visual observations indicated that this population migrated over distances of more than the 1.5km (Adegoke, 1983), indicating that village weaverbirds do not undertake long-distance migrations.

CONCLUSION

The important ecological role played by birds in the dissemination and dispersal of seeds in the wild is well known. In addition, their beautiful morphological structure and plumage color displayed in their daily activities has been the major attraction in bird-watching in many parts of the world. Unfortunately, the nuisance created by weaver birds in agriculture in Sub-Saharan Africa, specifically Cameroon is alarming even though under documented. The Ekona area, just as any other areas around Mount Cameroon enjoys a volcanic fertile soil for crop cultivation. However, the local farmers in this part of Cameroon had always recorded a low harvest from their farms due to the weaver birds' destruction, a problem that has been for many years, with very little research effort for a permanent solution. In order to solve this problem this research targeted certain areas of the weaver birds' ecology, specifically the photo-period, weather changes and the monthly activities of the weaver birds in the farming area. Interestingly, the study found that there is a relationship between the weaver birds' activities and changes in ecological factors.

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