

## A COMPARISON OF FORAGING SITE CHARACTERISTICS OF TWO AFRICAN RESIDENT INSECTIVOROUS BIRDS IN A BURNED HABITAT

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### Abstract

Detailed investigation of the foraging site utilised by avian species may reveal the habitat factors important in their conservation. This study compared the foraging sites of the Sunlark, *Galerida modesta* and Familiar Chat, *Cercomela familiaris* (both African resident insectivorous birds) a week after fire engulfed about one third of the 300 ha of the Amurum Forest Reserve, Nigeria. Foraging sites were compared based on proxies of food availability (ant, grasshopper and other insect abundance) and vegetation structure. Data on food availability and vegetation structures were obtained by quadrat sampling while foraging spots were determined from four stratified transects each surveyed four times during the study. Food availability was not a significant predictor of foraging site characteristics between the two bird species. However of the nine vegetation variables measured, grass height and proportion of burned grass cover per foraging site significantly distinguished the foraging sites of the two bird species; Sunlark foraged more at sites with shorter grasses and high proportion of burned grass cover as compared to the Familiar Chat. The characteristics of the foraging sites observed might have implications on the foraging success of the birds in line with literature on the Influences of vegetation structure on avian foraging behaviour.

**Key words:** Foraging site, Insectivorous birds, Burn, Vegetation structure, Food availability

### Introduction

Environmental disturbances such as caused by fire often modifies a habitat from its pre-impact form (Turner *et al.*, 2003); some of the detectable changes induced by fires include reduction in foraging habitat (Bowers *et al.*, 1996; Martin and Morrison, 1999), reduction in vegetation cover such as seedlings, saplings, canopy, large trees (Smucker *et al.*, 2005) and litter cover (Kutt and Woinarski, 2007) as well as reduction in species densities (Nelson *et al.*, 2008). Such effects often produce a new set of challenges on survival and reproduction for organisms occupying such habitats. Most especially for organisms relying on habitat cues such as vegetation attributes to determine optimal foraging or breeding sites (Smith and Shugart, 1987; Marshall and Cooper, 2004; Hagar *et al.*, 2007). Thus, the mode of response by organisms to such habitat changes may differ between species or even individuals. In the case of birds, at population levels, response could be numerical such as changes in

population density (as a result of emigration) or functional, such as changes in foraging behaviour (Lyons *et al.*, 2008). Any change in foraging behaviour if it must be termed optimal however, should include ability to select areas providing the best resource either in terms of food availability or vegetation attributes that offers protection during foraging such as density of trees or shrubs (Kotler and Brown, 1988; Gunnarsson, 1996; Marshall and Cooper 2004; McNamara and Houston, 2008). A freshly burned habitat therefore provides the opportunity for comparison between bird species in their ability to quickly untangle optimal foraging sites in the face of sudden change in habitat structure. This is important considering that time since fire (1 – 3 years after burn) have been established to affect other aspects of avian ecology such as bird abundances (Smucker *et al.*, 2005). However, under West African conditions, literature is rare in this regard partly due to the accidental nature of such conditions often providing little time for

planning and data collection. This is perhaps the major reason why most previous studies in this direction are of an experimental nature often at sites where fires are deliberately set to achieve predetermined goals (Kutt and Woinarski, 2007; Powell, 2008) or are conducted several weeks, months or years after burning (Kreisel and Stein, 1999; Kutt and Woinarski, 2007; Powell, 2008). This study therefore compared the foraging sites of the Sunlark, *Galerida modesta* and Familiar Chart, *Cercomela familiaris* (both African resident insectivorous birds) one week after fire from an unknown source engulfed about one third of the 300 ha of the Amurum Forest Reserve, Nigeria. This was with a view to finding out whether foraging sites utilised by the two bird species in the burned areas differ in terms of food availability and vegetation structure.

## Methodology

### Study Site

The study was conducted during the late dry season; February – March 2006 within the Amurum Forest Reserve (9° 53'N, 8° 59'E) located 15 km, northeast of Jos, Plateau State, North-Central Nigeria (Figure 1). The area spans 300 ha and is characterized by various habitat types, which include patches of gallery forest, scrub savannah, rocky outcrops and grassland. Temperatures may range between 15.5 – 30.5 °C (Payne 1998). The forest has been identified as an Important Bird Area (Ezealor, 2001). Part of the Reserve was engulfed with fire from an unknown source on the night of 15<sup>th</sup> February, 2006 where about one third of the Reserve was burned down.

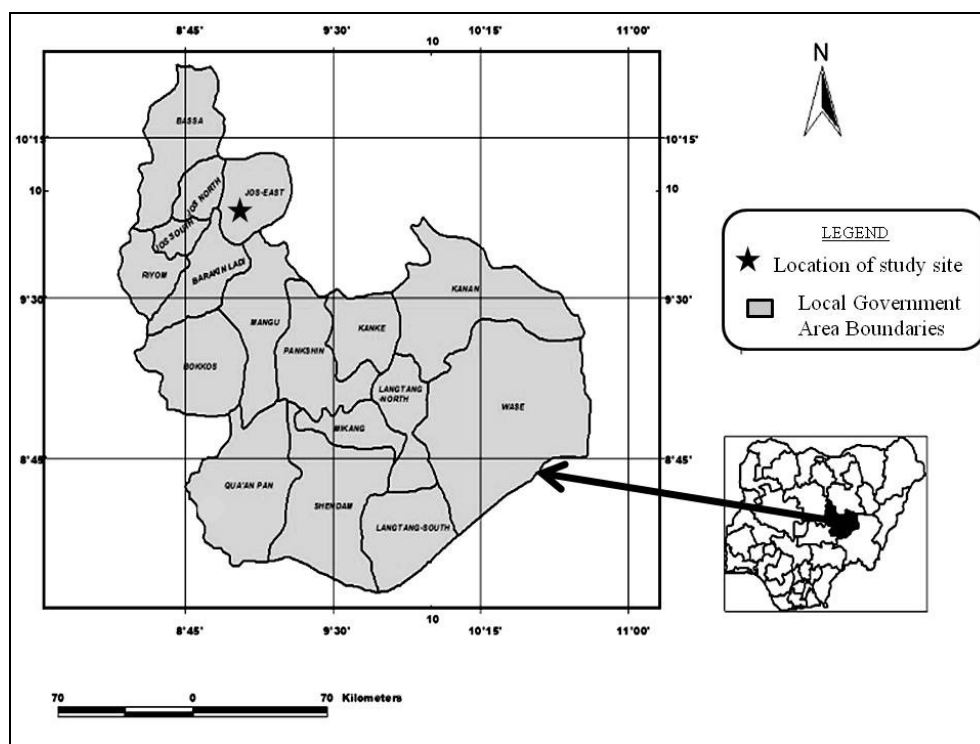


Figure 1: Map of Plateau State, Nigeria showing location of the study site

### Avian data collection

Four transects of 1000 m lengths stratified 100 m apart in the burned area of the Reserve were surveyed for the candidate bird species beginning from 0630 – 1030 hrs each day; two transects were surveyed per day. Each transect was eventually surveyed four times between 22<sup>nd</sup> February (a week after the burning incident) to the 10<sup>th</sup> of March, 2006. Bird identification was by the use of a binocular

(Trekka, 10 x 42 field of view) and bird identification guide (Sinclair and Ryan, 2003). Each individual of the candidate bird species encountered on transect was recorded as well as its activity.

### Measurement of environmental variables at foraging sites

Environmental variables measured were classified into two viz; indicators of food abundance and vegetation structure. Indicators

of food abundance include number of ants, number of grasshoppers and other flying insects. This generalisation is because specific insects constituting diet of the two insectivorous birds are not well established. However, a recent study in similar environment (The Jos Wildlife Park, Nigeria) had reported the insect Orders Hymenoptera (e.g. ants) and Orthopterans (e.g. grasshoppers) as constituting the top three insect Orders in the diet of insectivorous birds in the area (Turshak and Mwansat, 2011). Vegetation variables measured to characterise vegetation structure of foraging sites include: average shrub height, average grass height, grass cover, shrub cover, bare ground, burned grass, sprouting fresh grass, dry unburned grass and number of trees.

At each spot where individuals of the Familiar chat or Sunlark were sighted foraging, a 1 x 1 m quadrat was placed to enumerate number of ants. Furthermore, in a 10 x 10 m quadrat, the following variables were quantified:

- i. Average shrub height
- ii. Average grass height
- iii. Grass cover (Percentage)
- iv. Shrub cover (percentage)
- v. Bare ground (Percentage)
- vi. Burned grass (Percentage)
- vii. Sprouting fresh grass (percentage)
- viii. Dry unburned grass (percentage)
- ix. Number of trees
- x. Number of grasshoppers and other flying insects

Average shrub and grass height were each obtained from two randomly selected sites within the quadrat using a meter rule. However, grass cover, shrub cover, bare ground, burnt grass, sprouting fresh grass and dry un-burnt grass were estimated visually as the percentage of the 10 x 10 m quadrat covered by each variable. Also, Number of grass hoppers and other flying insects were quantified using a sweep net; 30 sweeps were made twice in each 10 x 10 m quadrat. Insects collected were sorted and enumerated into two categories; grasshoppers and other flying insects generally.

#### **Statistical Analysis**

All statistics were done using the software package SPSS (version 17.0, 2011). Data were

statistically explored for normality and equality of variance using the 1-Sample Kolmogorov Smirnov test and Levene statistic; non parametric test was used where the assumptions of parametric test could not be satisfied. The Mann-Whitney U-test (a non parametric equivalent of the Independent Sample t-test) was used to compare differences in the foraging sites of the Sunlark and Familiar Chat. Variables compared were categorized into two; proxies of food availability (ant, grasshopper and other insect abundances) and vegetation structure (average shrub height, average grass height, grass cover, shrub cover, bare ground, burned grass, sprouting fresh grass, dry unburned grass and number of trees).

#### **Results**

A total of 43 individual birds were recorded across 35 foraging locations during the study. Of these, 25 birds (representing 58.1 %) were Sunlarks recorded at 18 different foraging spots. While 18 birds (i.e. 41.9 %) were foraging Familiar Chats observed at 17 different locations.

#### **Foraging site characteristics: Food availability**

In terms of food availability, foraging sites of the Sunlark were highly similar to that of the Familiar Chat as there was no significant differences observed between the foraging sites of the two study bird species either in terms of ant abundance (Mann-Whitney U-test,  $Z = 0.848$ ,  $P = 0.397$ ), grasshopper abundance ( $Z = 1.886$ ,  $P = 0.059$ ) or other flying insects ( $Z = 1.842$ ,  $P = 0.065$ ).

#### **Foraging site characteristics: vegetation structure**

Seven of the habitat variables measured as surrogates of vegetation structure (i.e. average shrub height, grass cover, shrub cover, bare ground, sprouting fresh grass, dry unburned grass and number of trees) did not significantly distinguish the foraging sites of the Sunlark from that of the Familiar Chat. However, grass height and burned grass cover per foraging site differed significantly between the two bird species studied (Table 1); Sunlark foraged more at sites with shorter grasses and high proportion of burned grass cover as compared to the familiar chat (Table 2).

Table 1: Differences in foraging site vegetation structure between the Sunlark and Familiar Chat

Statistic	Habitat variables	Z	P
Mann-Whitney U-test	Bare ground (%)	0.136	0.892
	Sprouting fresh grass (%)	0.335	0.738
	Shrub cover (%)	1.373	0.170
	Shrub height (m)	0.687	0.492
	Dry grass cover (%)	1.746	0.081
	Number of trees	0.271	0.787
	Grass height (m)	2.555	0.011*
	Burned grass cover (%)	2.947	0.003*

\* = significant at 0.05 level

Table 2: Mean differences in foraging site characteristics between the Sunlark and the familiar Chat in burned areas of Amurum Forest Reserve between February – March, 2006.

Habitat variables	Sunlark Foraging site		Familiar chat Foraging site	
	n	Mean ± S.E.	n	Mean ± S.E.
Number of ants	18	18.44 ± 6.91	17	7.18 ± 1.70
Bare ground (%)	18	21.11 ± 2.51	17	20.59 ± 2.70
Sprouting fresh grass (%)	18	3.89 ± 0.39	17	4.82 ± 0.84
Shrub cover (%)	18	17.83 ± 6.00	17	7.06 ± 1.44
Shrub height (m)	18	1.022 ± 0.13	17	0.91 ± 0.14
Number of Grasshoppers	16	0.63 ± 0.20	16	0.19 ± 0.10
Number of other flying insects	18	0.11 ± 0.07	17	2.29 ± 1.05
Dry grass cover (%)	18	5.22 ± 2.59	17	45.88 ± 10.46
Number of trees	18	0.61 ± 0.23	17	0.59 ± 0.29
Grass height (m)	18	0.12 ± 0.01	17	0.48 ± 0.14
Burned grass cover (%)	18	52.22 ± 6.22	17	26.47 ± 7.21

## Discussion

The foraging sites of the Sunlark and Familiar chat in a recently burned habitat were not distinguishable based on the proxies of food abundance explored in this study namely ant, grasshopper and other insect abundances. This was either because the two bird species have similar insect composition in their diet thus selecting areas rich in such required insect species or the specific insect species targeted by the species have not been effectively captured based on the techniques used in the study. Exploitation of similar food resources by different species of birds have been reported in previous studies (McLean *et al.*, 1994; Khanna and Yadav, 2005).

Similarly, there was high correspondence in the vegetation structures characterising the foraging sites of the two bird species in terms of average shrub height, grass cover, shrub cover, bare ground, sprouting fresh grass, dry unburned grass and number of trees. However, average grass height and percentage cover of burned grasses per foraging site significantly distinguished the foraging sites of the two bird species; the Sunlark foraged more at sites with shorter grasses and with high proportion of

burned grass cover as compared to the Familiar Chat. Vegetation structure has been previously reported to have influence on avian habitat selection (Kotler and Brown, 1988; Pribil and Picman, 1997; Whelan, 2001; Marshall and Cooper, 2004). In avian territoriality for example, certain vegetation structures such as leaf dispersion or foliage density could serve as cues in determining food resource rich areas (e.g. caterpillar density). This is possible in situations where food abundance and vegetation features correlate (Whelan, 1991; Marshall and Cooper, 2004). In this study, the shorter grasses and high proportion of burned grass cover characterising the foraging sites of the Sunlark might be cues that help it determine food resource rich areas as previously stated or a deliberate choice of sites where its preferred prey are most vulnerable to predation. Reduced vegetation cover as observed in this case could enhance predator visibility, prey encounter rates, predator manoeuvrability and less free space for prey to escape predation (Crowder and Cooper, 1982; Whelan 2001; Warfe and Barmuta, 2004; Janssen *et al.*, 2007). However, such less vegetated foraging areas could also expose the bird quickly to its prey before any

attack; particularly where target preys are flying insects thereby limiting foraging efficiency.

Conversely, tall grass cover and less burned grasses characterising the foraging sites of the Familiar Chat might be influenced by the birds consciousness of its own predators during foraging thus selection of such complex areas might provide a buffer against possible predators (Bowman and Harris, 1980; Martin and Roper, 1988; Gunnarsson, 1996; Warfe and Barmuta, 2004; Janssen *et al.*, 2007).

### Conclusion

Foraging sites of the Sunlark and Familiar Chat in burned habitat are not distinguishable based on the food resources measured in this study (ant, grasshopper and other flying insect abundance) as well as some of the vegetation variables characterising their foraging sites namely; average shrub height, grass cover, shrub cover, bare ground, sprouting fresh grass, dry unburned grass and number of trees. However, grass height and proportion of burned grass cover where significant predictors of the foraging sites of the two bird species studied. Influences of vegetation structure on avian foraging behaviour and on predator-prey relationship as reported in previous studies (Bowman and Harris, 1980; Crowder and Cooper, 1982; Martin and Roper, 1988; Gunnarsson, 1996; Whelan 2001; Warfe and Barmuta, 2004; Janssen *et al.*, 2007) might have played a role in the selection of utilised foraging sites by the bird species. Also, utilisation of areas with high proportion of burned grasses as done by the Sunlark yet points to the beneficial effects of habitat burning on some fauna.

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