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EFFECTS OF PROXIMITY TO ANTHROPOGENIC DISTURBANCES ON NESTING COLONIES OF RED-THROATED BEE-EATERS

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ABSTRACT

Anthropogenic disturbances are major threats to biodiversity especially birds in their nesting habitats. Therefore, proximity of nesting sites to such disturbances remains a concern to biodiversity conservation. This research investigated the relationship between the proximity to various surrounding features (distance to building, distance to nearest road, distance to farmland, distance to quarry, and distance to refuse dump) and nest selection in avian species belonging to the family Meropidae nesting in Plateau State using binomial regression. The results revealed associations between certain features and nest selection. The distance to nearest road (0.004, z = 2.523, p = 0.012) and distance to farmland (0.007, z = 2.007, p = 0.045) exhibited significant positive effects, indicating that greater distances from roads and farmland were associated with increased nest selection. However, the distance to quarry (-0.001, z = -0.902, p = 0.367), distance to building (-0.003, z = -1.812, p = 0.070), and distance to refuse dump (0.001, z = 1.858, p = 0.063) did not show significant effects on nest selection. These findings suggest that the proximity to roads and farmland may influence nest selection, while the distances to quarry, buildings and refuse dump may not have a significant impact. Environmental awareness in communities with nest records is therefore recommended.

Key Words: Environmental disturbances, Meropidae, Nesting colonies, Red-throated Bee-eater.

1.0 Introduction

Environmental disturbances are major threats to biodiversity especially birds in their nesting habitats and the effects are not just restricted to species loss. Therefore, understanding the impact of the urban environment and its anthropogenic disturbances on biodiversity is becoming a very urgent and interesting area of research (Ding *et al*., 2023). Urbanization comes with numerous challenges for organisms due to the habitat destruction and fragmentation which affects organisms both in their foraging and breeding sites, for example, increased human disturbance and pollution (Lowry *et al*., 2012; Sol *et al*., 2013; Matuoka *et al*., 2020). Therefore, assessing the functional diversity, which measures the range and value of ecological traits of organisms provides a direct link between biodiversity and ecosystem functioning.

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Human proximity often have negative consequences on wildlife. However, species may also benefit from human proximity in terms of availability of resources and protection from predators and parasites (Moller and Diaz, 2018). Species responses to disturbances depends on their ecological traits while ecosystem functions may be influenced by human activities (Matuoka *et al*., 2020).

Many countries in tropical Africa are experiencing very rapid population explosion and this tend to put severe pressure on the natural habitat of man thereby affecting their native flora and fauna (Soderstrom *et al*., 2003). This result in habitat loss, destruction and habitat degradation. This loss of habitat is as a result of anthropogenic activities or it can be natural. Anthropogenic activities are reported to contribute more to habitat destruction (Akogwu *et al.,* 2012). Anthropogenic activities especially logging have continued to modify and destroy the natural state of vegetation and consequently the ecological systems across the globe (Akogwu *et al.*, 2012). This uncontrolled modification, disturbances and destruction of the natural vegetation have resulted in severe ecological degradation. The current rate of deforestation due to logging and other forms of human activities in Nigeria has been put to about 40,000 ha per annum (Akogwu *et al.,* 2012). Timber extraction poses a serious threat to tropical forests and is responsible for a quarter of the annual loss of primary rainforest around the world (Soderstrom *et al*., 2003).

The Bee-eaters are slender and brightly colored species of birds possessing long, pointed, and slightly decurved bills and they also have triangular wings. They are insectivorous birds and feeds mainly on bees and wasps. All Bee-eaters belong to the family Meropidae and are basically hole nesters, excavating holes in a variety of environments such as flat ground, small mounds of soil, eroded cliffs, steep earthen banks along cleared areas and in river gorges and aerial insectivores that feeds on a variety of insect orders (Yaun et al., 2006). Some species like the Blue-tailed bee-eater (*Merops phillipinus*) are socially monogamous with helpers in attendance in some nests and majority of the *Merops* species nest in colonies that range in size from as few as three to as many as above 100 breeding pairs (Yaun et al., 2006).

Therefore, this paper focused on the effects of proximity of nesting colonies of red-throated bee-eaters to certain environmental disturbances and the result can be used as a baseline data for other avian species.

2.0 Materials and Methods

2.1 Study site

This research was conducted at different altitudes in Plateau State where nesting colonies of red-throated bee-eaters had been recorded (Figure 1). The state is located in north central Nigeria and has three distinct habitat types which have been devastated as a result of anthropogenic disturbances like tin mining and fuel wood cutting (Elgood *et al*., 1994; Vickery and Jones, 2002; Yadok *et al*., 2014; Turshak and Mwansat, 2011).

2.2 Measurement of anthropogenic disturbances

For each of the identified nesting colony, we measured distance to nearest farmland, distance to nearest buildings, distance to nearest road or foot path, distance to the nearest refuse and sewage dump sites. This was to check effect of proximity of nesting colonies to anthropogenic disturbances. Distances were measured in meters using the GPS.

2.3 Statistical analysis

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Data was entered in excel and analyzed using R-console. A binomial regression analysis was carried out to check the influence of proximity to surrounding features on nest selection by the avian species.

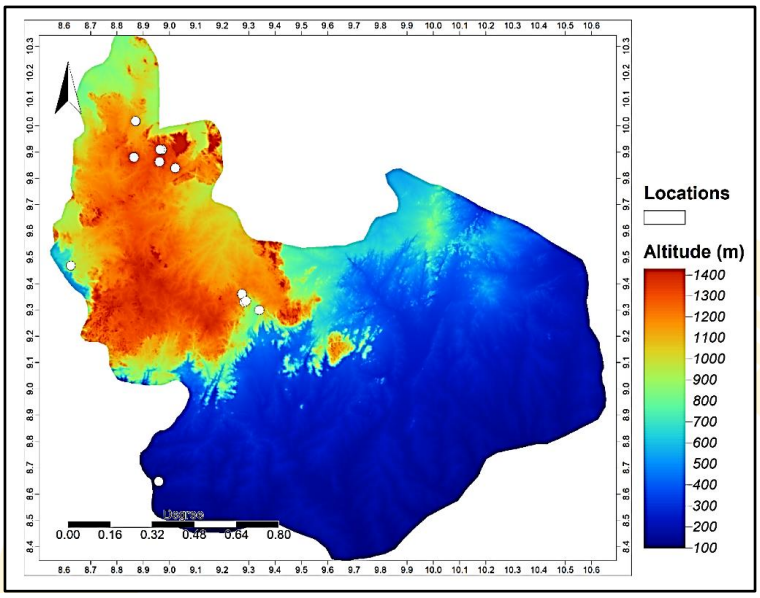

Figure 1: Map showing the location of eroded gullies with nesting colonies of Red-throated bee-eaters across altitude in Plateau State

3.0 Results and Discussion

The results revealed associations between proximity to certain features and nest selection. The distance to nearest road (Estimate=0.004, z = 2.523, p = 0.012) and distance to farmland (0.007, z = 2.007, p = 0.045) exhibited significant positive effects, indicating that greater distances from roads and farmland were associated with increased nest selection (Figure 2).

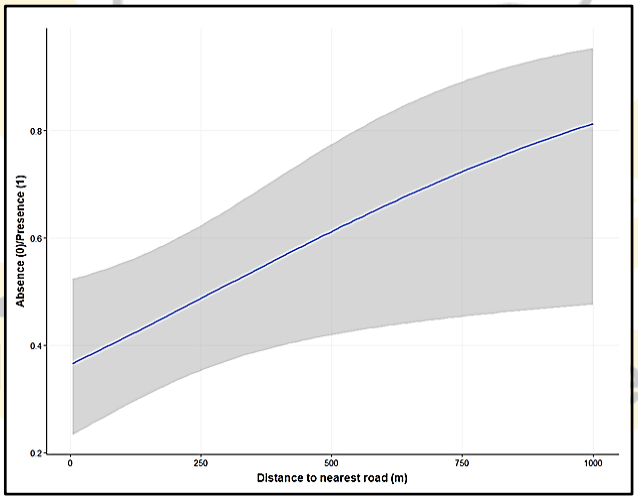

Figure 2: Graph of regression of distance to road and nest selection

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However, the distance to quarry (-0.001, z = -0.902, p = 0.367), distance to building (-0.003, z = -1.812, p = 0.070), and distance to refuse dump (0.001, z = 1.858, p = 0.063) did not show significant effects on nest selection (Table 1; Figure 2).

Table 1: Influence of proximity to surrounding features on nest selection

Parameter	Estimate	Std. Error	z value	*p*
(Intercept)	-1.054	0.514	-2.052	0.040
Distance to building (m)	-0.003	0.001	-1.812	0.070
Distance to nearest road (m)	0.004	0.001	2.523	0.012
Distance to farmland (m)	0.007	0.003	2.007	0.045
Distance to quarry (m)	-0.001	0.001	-0.902	0.367
Distance to refuse dump (m)	0.001	0.001	1.858	0.063

The distance to nearest road and distance to farmland exhibited significant positive effects, indicating that greater distances from roads and farmland were associated with increased nest selection. This is similar to the findings of Palomino and Carrascal, (2007) on threshold distances to nearby cities and roads where urban development and road networks impacted on the surrounding habitats along a variable distance, affecting birds living in natural environments. In their study, they identified the threshold distances upon which several cities and roads across a landscape of ca.300km2 in Central Spain where the abundance pattern of the native avifauna was altered. The effect of roads was negative and highly generalized according to their findings.

Some bird species such as those of deciduous woodlands are already adapted to human disturbances and have shown higher resilience to influences from nearby cities and roads including farmlands (Palomino and Carrascal, 2007; Akogwu *et al*., 2012).

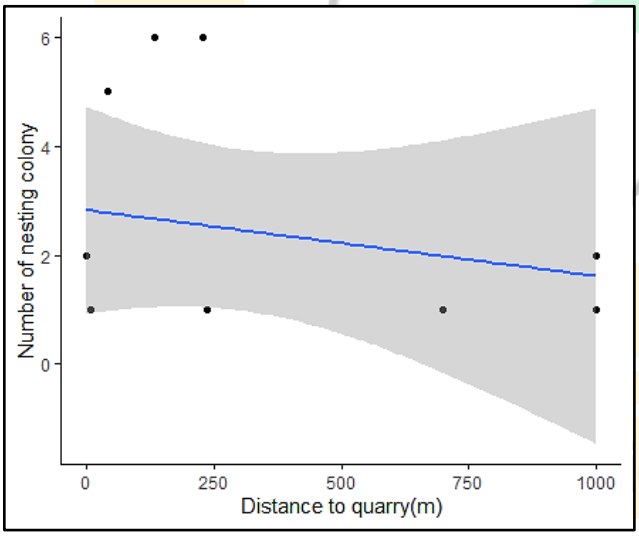

Figure 3: Graph of regression of distance to quarry and nesting colony

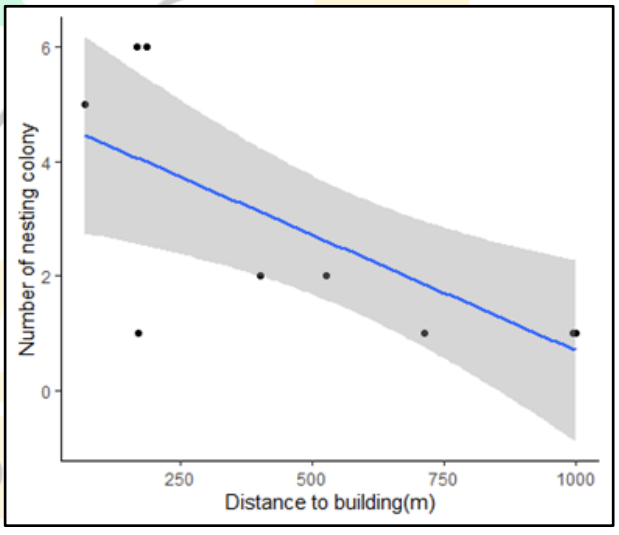

Figure 4: Graph of regression of distance to building and nesting colony

Studies are very few in Africa on the effect of disturbed habitats such as farmland on the avian species (Hulme, 2007). Human activities involve exploitation of the natural environment which consequently change habitat structures, mainly by modifying previously natural landscapes (Seress and Liker 2015). The expansion of logging in forests and the widespread introduction

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of intensive farming have brought about major habitat changes in the vicinity of human settlements where biodiversity is seriously threatened (Francis *et al*., 2017). Such habitat transformation results in the loss of biodiversity, including that of foraging and breeding bird communities (Seress and Liker 2015). Different farm practices may have different level of effect on the avian community.

Anthropogenic activities such as logging, agriculture, deforestation, overgrazing and building of infrastructure have altered a lot of habitats thereby negatively affecting their native flora and fauna. The impact of logging on the environment is an important area of research. Timber exploitation and other forms of vegetation exploitation are detrimental to ecosystems and also showed that disturbances due logging greatly affects species abundance and diversity and these anthropogenic activities is typical of our study site.

4.0 Conclusion

These findings suggest that the proximity to roads, and farmland may influence nest selection, while the distances to quarry, buildings and refuse dump may not have a substantial impact. It would be desirable not to build new scattered urban road networks within the remnant natural areas with nest records of the bee-eaters because the existence of such roads and connection to nearby cities by the new roads would add negative effects on these birds which are considered as ecosystem engineers whose nesting holes provides cover and nesting environment for other weak hole nesters cutting across avian species, mammals and reptiles.

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Conflict of Interest

The Authors declares no conflict of interest.

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