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A SURVEY OF SMALL MAMMALS IN THE BUFFER ZONE OF ASUBIMA FOREST RESERVE

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May 2011

CONTENTS

1. ABSTRACT

Small mammals support a wide range of wildlife population and also provide food and income for people. Best strategies for small mammal conservation help maintain their population to sustain its dependants. Knowledge of the presence of small mammal species, their habitats requirement, distribution and diversity will inform the strategies required to manage them. Small mammal population was surveyed in the Buffer zone of Asubima Forest Reserve. The method used was live trapping along transects. A total of 28 individuals representing three species of rodents were caught within the five microhabitats (riparian, grassland, cultivated tomatoes farm, fire-damaged area and the teak plantation) of the study area. Overall abundance of captured individuals consists of Soft-furred mouse (64.3%), Multimammate rat (21.5%) and Rusty-bellied rat (14.2%). Shannon diversity in the riparian, grassland, fire-damaged area and teak plantation microhabitats were 0.447, 0.415, 0.276 and 0.196 respectively. There was no significant difference between sampled microhabitats. This study has shown that there is low diversity and abundance of small mammals in Asubima Forest reserve.

2. 1 INTRODUCTION

2.1 Background

Across West Africa, forest cover has been reduced to less than 30% of its potential extent (Bakarr, 2001). Ghana has lost roughly 80% of its forest habitat since the 1920s (Cleaver, 1992) and the inventory of Asubima Forest reserve (Abeney et al., 2008) has shown that little of the original vegetation remains. Many of the plants and animals typical of forest environment were lost in the reserve through the degradation process (Sools and Wanders, 2009).Wildlife population of Asubima Forest reserve has diminished greatly in the last decade and bushfire was considered the main cause of this decline (Sools and Wanders, 2009).Several species of African small mammals have been classified recently as “rare” or “vulnerable” (Nicoll et al., 1990).

In this study, small mammal species is defined as mammal species less than 1kg as described by Stuart and Stuart (2006).Determining numbers of animal population is indispensable in all aspects of Ecological management (Harris, 1987). Fleming (1975) commented on the dearth of information on diversity and abundance of mammals in Africa. In a discussion on the systematic and distribution of small mammals of Ghana, Booth (1956, 1959); Cansdale, (1948); Ingoldby, (1929) cited in Attuquayefio and Ryan (2006) and few papers (Sools and Wanders, 2009; Abeney et al, 2008) which enumerated on small mammals in Asubima Forest Reserve, there are still much more surveys to be done because small mammals have a low status among wildlife enthusiasts, particularly when compared to other large fauna and the abundant avifauna found in the tropics.

Also gaps in information exist because the ecology and distribution of many small mammalian taxa groups are poorly understudied. Determining the best strategies for conservation will require a better understanding of small mammal presence or absence and distributions in Asubima Forest reserve and this may help to develop a comprehensive and successful conservation strategies.

2.2 Objectives:

i. To identify the small mammals in Buffer zone.
ii. To estimate relative abundance of small mammals in the buffer zone
iii. To estimate diversity of small mammals recorded in the study site.

3. MATERIALS AND METHOD

3.1 Study Area

Asubima forest reserve lies within Latitude: 7° 27' 0 N, Longitude: 1° 52' 0 W with an area of 79 Km^2 (Hawthorne and Abu- Juam 1995; Sools and Wanders, 2009). It was reserved in 1945 and last logging was recorded in 1989. The entire Reserve is located within the dry semi deciduous forest zone (DSFZ), (Hall and Swaine 1981). Literature search yielded scanty information about the Asubima forest reserve. Satellite imagery shows that the forest reserve is degraded with sparse areas of green vegetation (satellite views.net, 2008). It is bounded on the south west by Nkinkensu and Akumadan further North West to Techiman On the north east is Nkoranza. The Forest reserve lies at the northern fringes of the semi-deciduous forest ecological zone of Ghana and about 100km north of Kumasi and 7km west of Akumadan in the Ashanti region (Sools and Wanders, 2009). The buffer zone of the forest is 15km^2 and made of five microhabitats; riparian forest, grassland, teak plantation, cultivated land and fire-damaged area. The reserve falls under the Authority of the Offinso Forest District (Sools and Wanders, 2009).

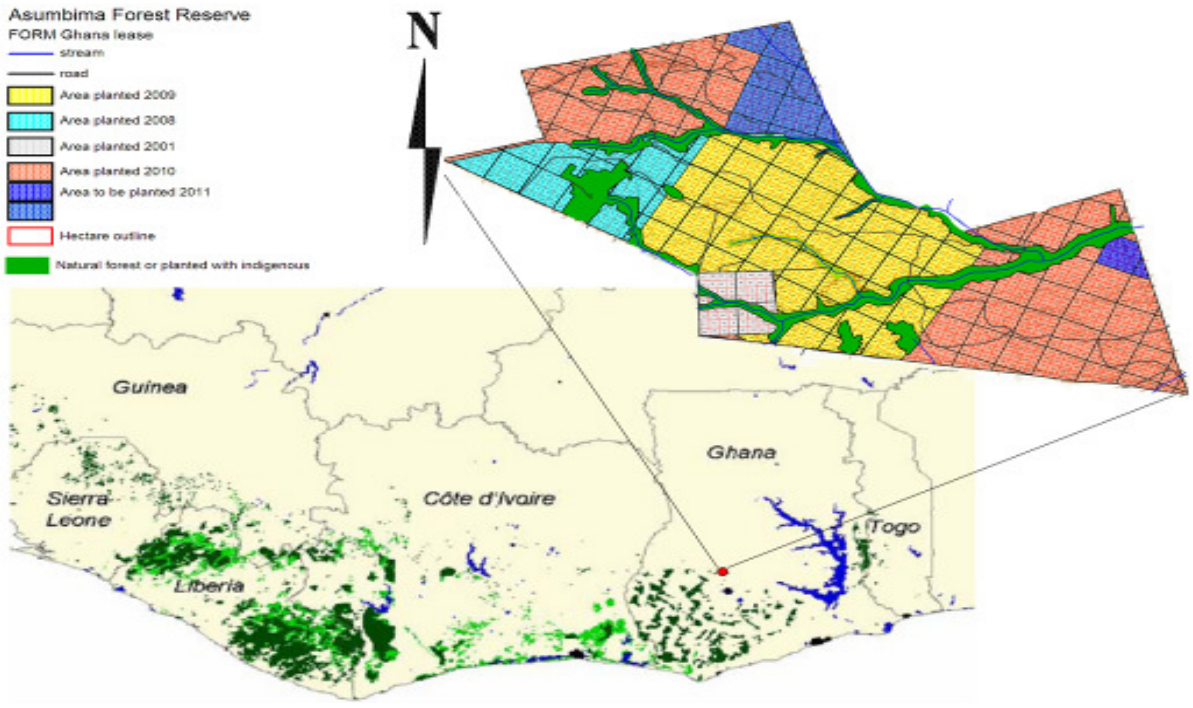

Plate 1: Map of Asubima Forest Reserve

3.1.1 Climate

The zone has a tropical monsoon climate with alternating wet and dry seasons. The long wet season starts around mid-March and ends in mid-July. It is followed by a short dry season until the end of August. From September till the end of October there is a short rainy season, followed by a long dry season from November till mid-

March (Sools and Wanders, 2009). Temperatures are generally high and uniform throughout the year. Mean annual temperature is about 260 ^{o}C. February and March are the warmest months (Sools and Wanders, 2009).

3.1.2 Topography, Flora and Fauna

The topography of Asubima Forest reserve is undulating and some rocky outcrops are found in the reserve (Sools and Wanders, 2009). The deforestation has given most part of the reserve a savannah condition. Due to intensive farming activities and reported annual fires very little of the original forest still remains and what is left is a vast area of grassland (Amponsah-Kwatia, 1993). The vegetation of the reserve is mostly of a dry semi- deciduous forest type. A total of 133 plant species (Sools and Wanders, 2009) is in the buffer vegetation. These species belong to 40 different families and represent trees, shrubs, lianas as well as herbs. The most common species are two invasive species called York (*Broussonetia papyriera*) and Acheampong (*Chromolaena odorata*). The high presence of these species is indicative of severe degradation (by fire) of the vegetation in the area. The most common indigenous tree species is Kyenkyen (*Antiaris toxicaria*) (Sools and Wanders, 2009). Other trees include Teak (*Tectona grandis*), Mansonia (*Mansonia altissima*), Odum(*Milicia excelsa*), Wawa (*Triplochiton scleroxylon*), Ofram (*Terminalia superba*), Emeri(*Terminalia ivorense*), Subaha(*Mitragyna stipulosa*), Kusia (*Nauclea diderrichii*) and Watapuo (*Cola gigantea*).

Plate 2: Overview of Asubima Forest Reserve, photo by Gameli Collins

Sools and Wanders (2009) reported the declined wildlife population and considered bushfire, wildlife overexploitation and logging as the main causes. Kwatiah (1993) also stated the presence of monkeys, reptiles, squirrels, duikers, grass cutter, tortoise and giant rat before the reserve became deforested.

3.2 Data Collection

Sherman live traps baited with a mixture of groundnut paste and maize meal were used to capture the small mammals (Sutherland, 1996). Five 1 km transects were laid in the study area. Ten trap stations with 2 traps per station at a minimum of 100

m spacing were placed on each transect (Siemers *et al.*, 2003). Apart from the first transect which was chosen at random, other transects were distributed across the different types of vegetation in the reserve, thus teak plantation, grassland, fire-damaged area, cultivated land and riparian forest. Each microhabitat had a transect laid in it.

A prebaiting period preceded actual trapping to allow the small mammals acclimatize to the new objects (traps and bait) (Sutherland, 1996). At 16: 00 GMT of the last predating day, traps were set and visited twice daily starting at 7:00 GMT and at around 15:30 GMT. Trapping lasted for 8 nights. Captured animals were euthanized with chloroform (Siemers *et al*., 2003) and identified using Stuart and Stuart (2006). Standard morphometric measurements (body, tail, ear, and hind foot lengths, in mm) were taken (for the purpose of identification) for all individuals as follows: TBL- total body and tail length, from nose-tip to end of tail; TL- tail length, from base of tail at right angles to body to end of tail; HFL- hind foot length, from heel to tip of the longest toe, excluding claw; EL- ear length, from basal notch to distal tip of pinna; WT- weight, in grams (Appendix C).

3.3 Data Analysis

i. Species richness was calculated using Biodiversity Pro 2.0 (2007)
ii. The relative abundance of the small mammal was estimated:

$$Relative\ Abundance\ (RA) = \frac{Number\ of\ Individuals\ captured}{Number\ of\ Trap\ Nights\ (TN)} \times 100$$

Where one trap night = one trap set for one night.

iii. Species diversity was calculated using the Shannon-Wiener index of diversity in the software package (BioDiversity Pro2.0, 1997)

iv Difference between sites was analyzed using one-way ANOVAs in the software (Statistics calculator 2.0)

4. RESULTS

4.1 Species Richness and Abundance

Twenty-eight individuals belonging to3 species of the family Muridae were recorded in the area (Table 4.1). In total *Praomys tullbergi* was most abundant (64.3 % of the total catch) with Multimammate rat (21.5%) and Rusty-bellied rat (14.2%) following in descending order. The main parameters of small mammal community in the sample areas are shown in Table 4.2 In the riparian, 10 individuals were identified belonging to 3 species: *Praomys tullbergi* (50%), *Mastomys natalensis* (30%) and *Lophuromys sikapusi* (20%). The most numerous species in the riparian was *Praomys tullbergi.*
Three species of 7 individuals were registered in the grassland. The most common among them was *Praomys tullbergi* (57.1 %). Twenty-five percent of the total catch was recorded in the grassland. Two individuals of *Praomys tullbergi* constituting seven percent of the total population were identified in the cultivated land. Two species made up of three individuals (*Praomys tullbergi* (66.7%) and *Mastomys natalensis* (33.3%)) was recorded in the fire damaged area. There were similar numbers of individuals of *Praomys tullbergi* between the riparian and the teak plantation. Also similar recordings were made for *Mastomys natalensis* in the fire-damaged area, the grassland and the teak plantation. *Praomys tullbergi* formed the greatest proportion of the small mammal community whilst the rarest species was *Lophuromys sikapusi.* Species recorded were all listed as Least Concern in the IUCN Red List of Threatened Species (2010).

Table 1: Distribution of small mammal species in the Buffer zone of Asubima Forest Reserve

Species	Common name	Riparian	Grassland	Cultivated land	Fire-damaged area	Teak plantation
Praomys tullbergi	Soft-furred mouse	5	4	2	2	5
Mastomys natalensis	Multimammate rat	3	1	-	1	1
Lophuromys sikapusi	Rusty-bellied rat	2	2	-	-	-
Total		10	7	2	3	6

Estimated species richness of individual species captured and their respective relative abundance are shown in Table 4.2. *Praomys tullbergi* formed the greatest part of the total catch, being the only species present in all the sites sampled (Plate 4.1). The number of species per equal number of individuals pooled from a sampled population at any point in time was highest in the riparian.

At a confidence interval (CI) of 95%,sum of square of 24.539, mean square of 6.135 and α-value of 0.144>0.05, there was no significant difference between sampled microhabitats. In other words, there was no sufficient information to show that the number of individuals captured differed per equal number of trapping sessions

sampled in each area. Low samples and low variance might be the cause of this (Torre *et al*., 2006).

Table 2: Estimated species richness and relative abundance of individuals captured

SPECIES	Riparian		Grassland		Cultivated land		Fire-damaged area		Teak plantation	
	SR	RA	SR	RA	SR	RA	SR	RA	SR	RA
Praomys tullbergi	0.5	0.62	0.57	0.5	1	0.25	0.67	0.25	0.83	0.62
Mastomys natalensis	0.3	0.37	0.14	0.12	-	-	0.33	0.12	0.17	0.12
Lophuromys sikapusi	0.2	0.25	0.29	0.25	-	-	-	-	-	-

Legend: SR= species richness; RA= relative abundance

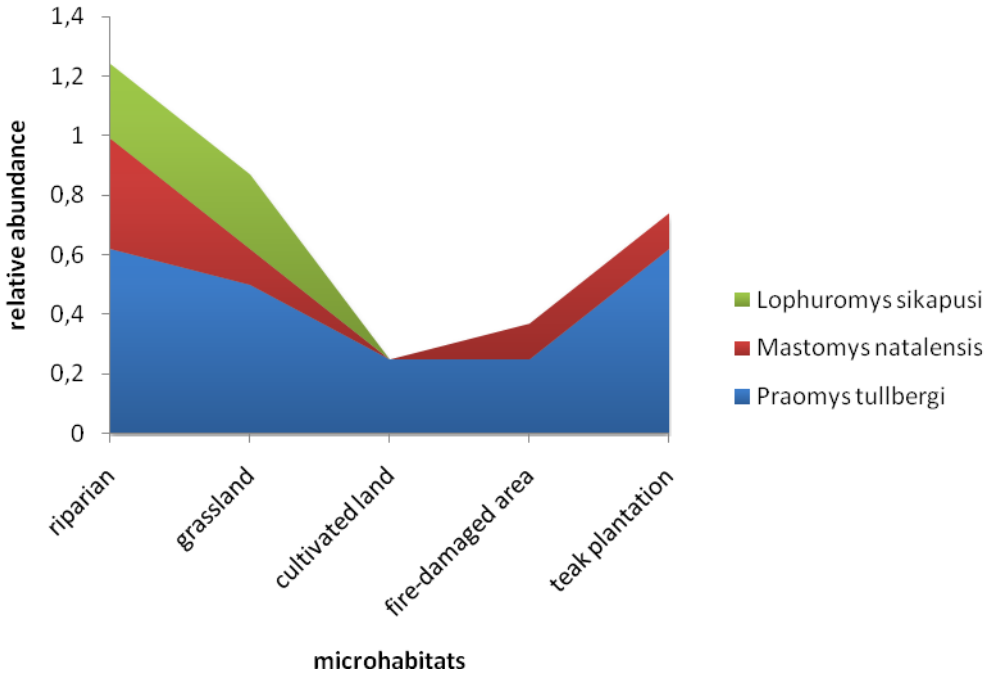

Plate 3: Relative Abundance of Small Mammals captured in Various Microhabitats

4.2 Diversity of small mammals

Alpha diversity, where α is the diversity within a particular habitat is presented in Table 4.3. Shannon and Simpson's indices show somewhat higher small mammal diversity in the riparian forest than the other habitats. The lowest diversity(H-0.196) was recorded in the teak plantation. *Praomys tullbergi* was the only species captured in the cultivated land. There was only one species overlap (*Praomys tullbergi*).

Table 3.3. Small mammals' community parameters in the sampled areas.

Parameters	Riparian	Grassland	Cultivated(tomatoes) farm	Fire-damaged area	Teak Plantation
Number of Trap night	800	800	800	800	800
Number of species	3	3	1	2	2
Number of individuals	10	7	2	3	6
Mean number of Individuals	3.333	2.333	0.667	0.667	2
Variance	2.333	2.333	1.333	1.333	7
Shannon H1	0.447	0.415	-	0.276	0.196
Shannon J1	0.937	0.87	-	0.918	0.65

5. 4 DISCUSSION

5.1 Abundance of small mammals

The highest number of small mammals was recorded in the riparian, this agrees with the observation made by Lina and Dill (1990) as abundance between microhabitat types were compared. The greater number of small mammals captured in the riparian forest suggests a higher preference of this habitat by rodents a fact closely related with perceived predation risk (Bowers, 1998). A selection of dense and thick vegetation which is considered to be an antipredatory strategy against both aerial (Longland and Price, 1991) and terrestrial (Jedrezejewska and Jedrezejewski, 1990) predators might be the reasons for the highest abundance in the riparian forest which has the highest vegetation cover.

A raising number of experiments have demonstrated the effect of human habitat and man's activities in the abundance of small mammals (Jones *et al*, 2003). The presence of cultivated land (anthropogenic interference into natural habitat) and rearing of livestock by the inhabitants in the reserve might account for the low abundance in those habitat types. Grazing of flora has negative effect on food abundance (Jones *et al*, 2003), this may also account for the low abundance.

The number of small mammals that a given habitat can contain depends on existing microhabitat features which provide food and shelter against predators (Lin and Batzli, 2001). Early succession post fire habitats are covered by little herbaceous vegetation (Appendix B) dominated by one or few species of small mammals (Haim, 1994). Spatial heterogeneity has been described as a major cause factor affecting many biological and ecological processes (Wiens *et al*, 1993; Bower and Matter, 1997). Areas affected by wildfires present a high degree of spatial heterogeneity since wildfires reduce vegetation to a remnant of forest patches surrounded by a burnt shrubby matrix (Forman, 1995).Spatial distribution, abundance and species composition of small mammals community in a heterogeneous area created by wildfires can be attributed to changes in food availability and shelter (Quinn, 1994).This explains the low number of small mammals recorded in the fire damaged area (Haim *et al*, 1997).

Seasonal and annual variations in abundance of small mammals as rainfall produce significant increase in ephemeral herb cover (Meserve *et al*, 1995).High rainfall years were associated with significant increase in food availability for folivorous small mammals (Lima *et al*, 2001).Attuquayefio and Wuver (2003) reported that Small mammals' abundance is higher in the rainy seasons and quoted the work of Green and Taylor (1975) and Happold and Happold (1991) on the same observation. Increase in small mammal species and abundance in periods of high cumulative rainfall is due to increases availability of resources leading to decrease in territoriality, a fact that produces an increase in species diversity that will allow higher detectability through sampling methods. Although three representative species were recorded rarer species may have been under represented due to survey length, timing (season) or methods (Converse, 2005; Anadu, 2007).

5.2 Diversity of Small mammals in the Buffer zone of Asubima Forest Reserve

The Shannon-Wiener diversity index (H) is used to compare distinct habitats and combines two quantifiable measures; species richness (number of species within the community) and species evenness (J), how even the numbers of individual species are. Shannon's diversity index also showed somewhat highest diversity in the riparian forest, which is characterized by higher forest productivity ((Kotler and Brown, 1998). Diversity has a linear relationship with forest productivity (Kotler and Brown, 1998) which outline why the riparian forest recorded the highest diversity of small mammals. There was a higher diversity in the riparian forest than the grassland; however species evenness between the two sites was almost the same, although slightly higher in the riparian.

Based on the results, overall diversity of small mammals was comparatively lower in the teak plantation in contrast to the other sites, except the cultivated land which was made of only one species. This correlates with the study by Abdullah (1998) in Aver Hitam Forest Reserve, Puchong, Selangor where small mammal diversity was lower in a teak plantation as compared to the high forest zone. However, all sampled sites overlapped by only one species; *Praomys tullbergi* which contradicts studies made by Zakaria et al (2001) and Alda Pupila (2006) who compared rodent populations in different microhabitats within Aver Hitam Forest reserve and Teiči Nature Reserve respectively and had an overlapped by two species; *Praomys tullbergi* and *Lophuromys sikapusi* and three species; *Praomys tullbergi, Micromys minutus* and *Lophuromys sikapusi* respectively.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

This study has shown that three representative species in the buffer zone of Asubima Forest reserve and there is low biodiversity and low abundance of small mammals in Asubima Forest reserve.

6.2 Recommendations

Small mammals are very important in the food chain of a forest reserve (Zakaria and Nordin, 1998) and the sustainability of the forest; it is therefore recommended that any future development planned within the Asubima Forest Reserve should take into consideration the habitat of small mammal populations. Future effective biodiversity protection activities in the protected area should include also activities to conserve the population of small mammals.

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8. APPENDIX A: LIST OF PLATES

Praomys tullbergi

Mastomys natalensis

Cultivated tomatoes farm

Fire-damaged area made of patches of vegetations

Teak Plantation

Grassland

Riparian forest