

## Species Richness and Abundance of Rodents in Hugumbirda-Grakahsu State Forest, Southern Tigray, Ethiopia

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**Abstract:** The study was carried out from January 2012- March 2012 with the aim of assessing species richness and abundance of rodents in Grakahsu-Hugumbirda state forest, Northern Ethiopia. Five altitudinal ranges starting from 1700 - 3000 m elevation having 300 m difference were selected. Sherman live traps were used in all the data collection sessions. Two 60 x 60 m square grids, one in bushland and another in grassland habitats were set to trap rodents in the two habitats. Each grid were consisted of 7 parallel lines, 10 m apart, with trapping station also 10 m apart (i.e. a total of 49 trapping stations per grid). Altogether, 94 individual rodents were captured in the study period. The species recorded were: *Acomys* sp. *Arvicanthis dembeensis* (Ruppel, 1842), *Mastomys awashnesis* (Lavrenchenko, Likhnova & Baskevich, 1998), *Gerbilliscus robustus* (Cretzchmar, 1826), *Praomys* sp., *Mus setulosus* (Peter, 1876) and *Gerbillus* sp. *Acomys* sp. was the most abundant (52.1%) and *Gerbillus* sp. was the least (2.1%) abundant species. Diversity of rodents was influenced by habitat and altitude. Highest (66%) number of rodent was recorded in the bushland habitat while the least (34%) was recorded in the grassland habitat. More number of individual rodents was also caught from 2000 m elevation and the least was in 3000 m elevation. Highest ( $H' = 1.6$ ) species diversity of rodents was observed in 2600 m elevation and the least ( $H' = 0.1$ ) species diversity were recorded in 1700 m elevation. Studying the ecology of rodents in Grakahsu-Hugumbirda state forest helps to establish baseline information about the forest for conservation in the future.

**Key words:** Grakahsu • Hugumbirda • Rodents • Species Richness • Tigray

### INTRODUCTION

Among mammals, rodents are the most ubiquitous and numerous animals and reached to 5,416 species of mammals exist all over the world among them 2,277 species are rodents [1]. Of African mammals, rodents are the most abundant group [2]. There are about 14 families, 89 genera and 381 species of rodents in Africa in East Africa, rodents compose 28% of the total mammalian fauna [4].

The unique topography and wide climatic ranges of Ethiopia have made the country host for diverse biological resources [5]. The diverse topographical features of Ethiopia coupled with variations in temperature have resulted in diversification of the

mammalian fauna. For this reason, the country is considered among the most biodiverse nations in the world [5]. Out of the total 284 mammalian species of Ethiopia, 84 (29.6%) species are rodents [6]. Ethiopia is endowed with highest number of rodent endemism [7]. This suggests that the diversity of rodents in the country is a consequence of diverse geographical and altitudinal features.

Grakahsu-Hugumbirda state forest has been considered as a relatively less disturbed forest in Tigray province. The main environmental challenges resulting in habitat fragmentation in the forest are deforestation and agricultural expansion, both of which are the consequences of population pressure [8]. However, as far as we know, there have been no studies conducted on the

faunal diversity of the forest. Hence, we believe that it is necessary to start by documenting the small mammal species of the forest, since small mammals are considered indicators of biodiversity and ecosystem health [9]. Therefore, this paper reports species richness and abundance of rodents in Grakahsu-Hugumbirda state forest, Northern Ethiopia.

## MATERIALS AND METHOD

**Description of the Study Areas:** Grakahsu-Hugumbirda state forest is located between 12° 22' and 12° 42'N, 39° 28' and 39° 40' E (Fig. 1) at an altitude ranging from 1560 - 3600 m above sea level.

The mean annual minimum temperature of the study area is 12.8 °C and the mean annual maximum temperature is 25.3°C. The hottest month is June with a mean maximum temperature of 25.2°C, and the coldest is October with a mean minimum temperature of 11.8°C. The mean annual rainfall of the study area is 628.8 mm [10].

Grakahsu-Hugumbirda state forest has total area coverage of 21, 654.24 hectares [8]. Out of this about, 532.75 hectares is forest plantation whereas the rest contains disturbed natural forest, bushland, agricultural plots and settlement area [8]. The forest holds 102 tree species belonging to 83 genera and 50 families. *Juniperus procera*, *Olea europaea*, *Nuxia congesta*, *Cassipourea mallosana* and *Olinia rochetiana* were the most dominant tree species [8]. Faunal study of Grakahsu-Hugumbirda state forest has not been conducted. The animals observed in the forest during the study period along the transect lines were hyena, fox, primates, snakes and forest birds.

## Methods

**Rodent Trapping:** Two 60 x 60 m square grids, one in bushland and another in grassland habitats were set to trap rodents in the two habitats. Each grid consisted of 7 parallel lines, 10 m apart, with trapping station also 10 m apart (i.e. a total of 49 trapping stations per grid). The trapping stations were identified by coordinates labeled A to G and numbered 1 to 7.

The choice of trapping sites was based on the presence of rodent signs runways, droppings and wholes. Rodents were live trapped using the Sherman LFA live trap (7.5 x 9.0 x 23.0 cm, HB Sherman traps, Tallahassee, USA) baited with peanut butter. Captured rodents were transported to the Biology laboratory of Alamata complete primary School. The trapping grids were rotated every trapping session. In each grid, trapping was conducted intensively for 3 consecutive days simultaneously; from January 2012- March 2012. The identification of rodents was done in the field based on their morphological features.

**Statistical Analysis:** Diversity and relative abundance of rodent species of each grid was computed using Shannon wiener diversity [11].

Shannon wiener diversity index  $[H = -\sum (Pi \ln Pi)]$

were, H= represents the symbol for the amount of diversity in an ecosystem, pi= represents the proportion of each individual species to the total. In pi= represents the natural logarithm of pi. [Relative abundance (%) = (Total number of individual rodent species in both bushland and grassland habitat / Total number of all rodents species in both habitats) x 100].

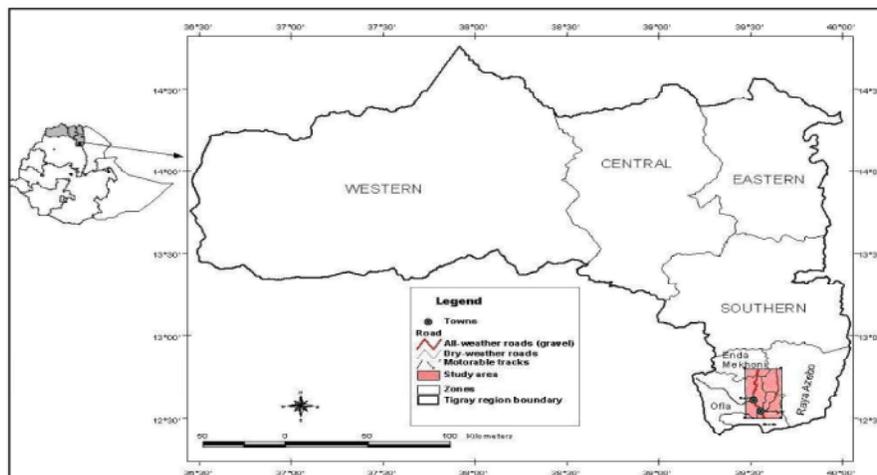


Fig. 1: Map of the study area (Left Ethiopia, right map of Tigray: the study site)



Fig. 2: Trapping sites of rodents at varied elvational gradiants in Grakhsu forest (Source: wikimapia.org).

[Trap success was calculated (Total number of captured individual rodents of each habitat at each elevation/Number of trap night) x 100].

## RESULTS

### Species composition of rodents trapped from Grakhsu-Hugumbirda state forest

A total of 94 individual rodents belonging to seven species were trapped during the study period. The species recorded were: *Acomys* sp. *Arvicanthis dembeensis* (Ruppel, 1842), *Mastomys awashnesis* (Lavrenchenko, Likhnova & Baskevich, 1998), *Gerbilliscus robustus* (Cretzchmar, 1826), *Praomys* sp., *Mus setulosus* (Peter, 1876) and *Gerbillus* sp. (Table 1). *Acomys* sp. was the most abundant (52.1%) and *Gerbillus* sp. was the least (2.1%) abundant species (Table 1).

Table 1: Species composition of rodents trapped from Grakhsu-Hugumbirda state forest

Species	Bushland	Grassland	Total	Relative abundance (%)
<i>Acomys</i> sp.	34	15	49	52.1
<i>A. dembeensis</i>	10	3	13	13.8
<i>M. awashnesis</i>	6	5	11	11.7
<i>G. robustus</i>	6	4	10	10.6
<i>Praomys</i> sp.	2	3	5	5.3
<i>M. setulosus</i>	3	1	4	4.3
<i>Gerbillus</i> sp.	1	1	2	2.1
Total	62	32	94	

Table 2: Trap success of rodents trapped along altitude in Grakhsu-Hugumbirda state forest

Habitat and altitudes (m a.s.l)	Captured individuals	Trap night	Trap success (%)
Bushland – 1700	21	294	7.1
Grassland – 1700	8	294	2.7
Bushland – 2000	23	294	7.8
Grassland – 2000	8	294	2.7
Bushland – 2300	8	294	2.7
Grassland- 2300	5	294	1.7
Bushland – 2600	6	294	2.0
Grassland – 2600	11	294	3.7
Bushland – 3000	4	294	1.4
Grassland – 3000	0	294	0

The overall trap success was (0.3%) (Table 2). The highest trap success (7.8%) was recorded in 2000 m elevation at the bushland habitat and the least (0%) was recorded in 3000 m elevation at the grassland habitat.

**Species Diversity Index of Rodents:** At 1700 m elevation, higher rodent species diversity was recorded in the bushland ( $H' = 0.4$ ) compared to the grassland habitat ( $H' = 0.1$ ). In 2000 m elevation highest species diversity index of rodents was recorded in bushland ( $H' = 1.3$ ) and the least ( $H' = 1.2$ ) was in grassland habitat In 2600 m elevation highest species diversity index of rodents was observed in both bushland and grassland number of species are equal (3:3) (Table 4).

Table 3: Representation of rodents by altitude and habitat in Grakahsu forest (Figures in parenthesis represents) percent abundance

Species	Altitude														
	1700			2000			2300			2600			3000		
	Bush	Grass	Total	Bush	Grass	Total	Bush	Grass	Total	Bush	Grass	Total	Bush	Grass	Total
<i>Acomys</i> sp.	19(90)	7(87.5)	26(90)	12(52)	4(50)	16(51.6)	3(37.5)	2(40)	5(38.5)	–	2(18.2)	2(11.8)	–	–	–
<i>A. dembeensis</i>	–	–	–	4(17)	–	4(12.9)	4(50)	–	4(30.7)	1(16.7)	3(27.3)	4(23.5)	1(25)	–	1(25)
<i>M. awashnesis</i>	–	–	–	4(17)	1(12.5)	5(16.1)	1(12.5)	1(20)	2(15.4)	1(16.7)	3(27.3)	4(23.5)	–	–	–
<i>G. robustus</i>	1(5)	–	1(3)	1(4)	2(25)	3(9.7)	–	–	–	2(33.2)	2(18.2)	4(23.5)	2(50)	–	2(50)
<i>Praomys</i> sp.	–	–	–	–	–	–	–	2(40)	2(15.4)	1(16.7)	1(9)	2(11.8)	1(25)	–	1(25)
<i>M. setulosus</i>	–	–	–	2(9)	1(12.5)	3(9.7)	–	–	–	1(16.7)	–	1(5.9)	–	–	–
<i>Gerbillus</i> sp.	1(5)	1(12.5)	2(7)	–	–	–	–	–	–	–	–	–	–	–	–
Total	21(72.4)	8(27.6)	29(100)	23(74.1)	8(25.9)	31(100)	8(61.5)	5(38.5)	13(100)	6(35.3)	11(64.7)	17(100)	4(100)	–	4(100)

Table 4: Shannon-weiner diversity index values of rodents trapped from the two habitats in the five altitudes in Grakahsu-Hugumbirda state forest (Were H' is species richness and E is species evenness)

	Altitudes									
	1700		2000		2300		2600		3000	
	Bush	Grass	Bush	Grass	Bush	Grass	Bush	Grass	Bush	Grass
N <sup>o</sup> of species	3	2	5	4	3	3	5	5	3	–
H'	0.1	0.4	1.3	1.2	0.6	1.1	1.6	1.6	1.04	–
E	0.09	0.6	0.8	0.9	0.6	1.1	2.6	0.96	0.9	–

### DISCUSSION

In total, 94 individuals belonging to seven species of rodents were recorded along the two habitats. Although the majority (66%) of the rodents was trapped from the bushland habitat, all of the seven rodent species were represented in both habitats. The dominant species (~52%), in both habitats, was *Acomys* sp. In a study conducted around human settlement and agricultural fields in Tigray [12] reported *Mastomys awashnesis* and *Arvicanthis dembeensis* as the two dominant rodent species (*Acomys* sp. was the least abundant). Similarly [13] reported the later two rodent species as dominant species in agricultural fields in the highlands of Tigray. In irrigated cereal and vegetable fields in the central Tigray, *M. erythroleucus* and *A. dembeensis* were also reported as the dominant species [14]. To the best of my knowledge, this is the first time *Gerbillus* sp. has been reported in Tigray region.

In the present study, more rodents were trapped from the bushland habitat compared to the grassland habitat and higher Shannon-weiner diversity index was estimated for the bushland habitat. This might be due to the heterogeneous nature of the vegetation composition of the bushland habitat that might have provided better food and shelter for the animals.

*Arvicanthis dembeensis* was captured relatively more in the bushland habitats than in the grassland habitats. However, previous reports in Ethiopia have shown that *A.*

*dembensis* was most common species in the grassland habitats than natural forest, plantation and bushland habitats [17]. *A. dembeensis* is predominantly a diurnal species; hence it is not surprising to see more of this species in bushland habitat where overhead vegetation cover provide the much needed shelter against potential predators.

### CONCLUSION

This study has given an indication that the abundance of rodents varies with altitude possibility due to variation in habitat characteristics. While *Acomys* sp., *A. dembeensis*, *M. awashnesis* and *G. robustus* seem to have wider altitudinal distribution, *Gerbillus* sp. seems to have narrower altitudinal distribution. It may also be the case that *Acomys* sp. more common in natural habitats, but less common in disturbed habitats (Agricultural fields and humans settlement) where it could have been replaced by larger and more competitive species such as *M. awashnesis* and *A. dembeensis*.

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