Temporal and spatial dynamics of small terrestrial mammals inhabiting a degradation gradient in a lowland tropical forest in Uganda

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Abstract

A study aimed at assessing the structure of rodent and shrew assemblages inhabiting a degradation gradient while considering rainfall patterns, was conducted in one of few remaining lowland tropical forests in Eastern Africa. We collected a unique dataset of rodents and shrews, representing 24 species (19 rodents, 5 shrews). The most abundant species alternated in dominance as species abundance significantly fluctuated across the study period following a degradation gradient (F2,33 = 5.68, p = 0.007). While only generalist species were observed near the degraded forest edge, habitat specialists such as Deomys ferrugineus, Malacomys longipes and Scutisorex congicus, were observed in the primary forest interior suggesting a significant (X2 = 1165.329, P<0.001) association between species and their associated habitats and habitat attributes. There was also an observed correlation between rainfall patterns and species abundance. Capturing more species in adjacent fallows and along the degraded forest edge suggests that many species are able to live in degraded habitats that offer a variety of food resources. The continued pressure on forest resources, however, may lead to changes in habitat structure. This, coupled with the dependence of forest ecological functions on rainfall, which is typically not the case, may ultimately cause the local extinction of highly specialized but less adaptable species.

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Key words: Habitat degradation, Rainfall patterns, Habitat association, Rodents, Shrews

1.0 INTRODUCTION

Deforestation in Uganda has been severe over the years due to the continued dependence on natural resources for food, energy, medicine and the growing human settlements close to protected areas. Forests in Uganda have been severely degraded and their diversity compromised. Obua et al. (2010) noted an estimated loss of 86% of Uganda's tropical moist forest especially on private land, while National Forestry Authority reported an 88% and 2 % loss of tropical well stocked forest on private land and protected areas, respectively, between 1990 and 2015 (NFA 2016). This is mainly as a result of the increasing human population that has overtime encroached on forested areas for both settlement and farming (Mulugo et al. 2019).

Few countries of equivalent size have as rich and diverse rodent and shrew fauna as Uganda. Apart from many species of rats and mice there is a great variety of other forms including gerbils, squirrels, flying squirrels, porcupines, cane rats, mole rats, and dormice (Delany 1975). The main factors causing this high diversity are the geographical position at the margin of several major biogeographical areas (Linder et al. 2012) and the wide range of altitudes and the complex array of vegetation which support a characteristic rodent fauna (Delany 1975).

A variety of micro habitats with varying characteristics can be found in tropical forests, and rodents and shrews are two of the most species-rich groups of mammals that live there (Carleton & Musser 2005). Because of their diversity and abundance, they are some of the most significant players in the ecological dynamics of forest ecosystems (Angelici & Luiselli 2005). They are essential to the transport of nutrients and materials through the ecosystem and to the food web (Nicolas et al. 2009). In disturbed ecosystems, rodents play important roles in succession as seed dispersers (Nicolas et al. 2009). In contrast, shrews prey on insects and smaller vertebrates (Nicolas et al. 2009) and the population dynamics of their prey are regulated by their voracious feeding habits. Shrews and rodents are both eaten by larger vertebrates like birds and snakes. They are economically important as crop pests and medically important, with many zoonotic heamoparasites such as borrelia, trypanosomes, bacilli, plasmodia and coccobacilli (Katakweba et al. 2012), and can also be employed in ecological evaluation for conservation decision-making.

One of the elements that shapes and influences small mammal groups in tropical forests is habitat structure (Tews et al. 2004). In a Brazilian rain forest, Pardini et al. (2005) discovered that the forest structure affected both the overall abundance of species and the abundance of particular species on an individual basis. In Africa, where the majority of these natural areas are threatened by anthropogenic activities, there has generally been a dearth of ecological study on rodents and shrews in all habitats (Nicolas et al. 2009, Obua et al. 2010). Even though there is a lot of forest damage in Africa, these activities' immediate and long-term repercussions are rarely examined (Malcom & Ray 2000). Few studies have specifically looked at how habitat degradation affects small mammal groups over time in Africa (e.g. Struhsaker 1997, Malcolm & Ray 2000). Small mammal communities' reactions, whether individual or collective, provide evidence of the effects of disruptions. Some of the most significant human-mediated disruptions to forest ecosystems are expanding agriculture, selective harvesting for lumber, and charcoal burning, among others (Malcolm & Ray 2000, Baranga 2007, Obua et al. 2010). Depending on the extent, severity, and kind of the disturbance, as well as the context of the landscape, human-induced habitat alterations have both direct and indirect consequences on small mammal groups (Malcolm & Ray 2000).

A number of surveys of rodents and shrews of Uganda Forest Reserves have been previously conducted. Basuta and Kasenene (1987) reported 14 species from a study in Kibale Forest National Park, Davenport et al. (1996) and Howard et al. (1996) reported on more comprehensive small mammal surveys from Ugandan forests. In the Mabira Central Forest Reserve (CFR), Dickinson & Kityo (1996) conducted earlier surveys of the rodent and shrew population, followed by the recent survey conducted by Waswa et al. (2016) and Ssuuna et al. (2020). These studies assessed small mammals throughout the forest with a variety of objectives; Dickinson & Kityo (1996) focused on the distribution of species, whereas Waswa et al. (2016) examined the composition and organization of rodent communities and Ssuuna et al. (2020) assessed rodent communities in different forest compartments with varying degrees of degradation. However none of these studies has looked at spatial and temporal dynamics of rodent and shrew communities in MCFR along a degradation gradient while considering habitat characteristics and rainfall patterns.

Mabira CFR is uniquely located between metropolitans of Lugazi, Mukono, Jinja, and Kampala city (Fig. 1). As a result, the forest is under a lot of pressure to provide a variety of products, the most important of which are charcoal and timber. The forest is currently being invaded by the invasive paper mulberry, which has taken over all of the forest boundaries as gaps have opened up. Numerous groups of rodents and shrews that depend on forests, particularly highly specialized ones with low degrees of adaptation, may be pushed toward local extinction as the size of natural habitats declines. The situation is made worse by the general lack of studies, species monitoring programs, and/or habitat monitoring programs in the region, which causes biodiversity to decline in the absence of a baseline.

A thorough grasp of rodents and shrew ecological niches is necessary to properly explain their importance to the dynamics of the forest ecosystem. Such data is required to classify specific forest sections' management regimes and/or forest habitats according to how important they are to the local wildlife. It is hoped that the study highlights the effect of forest habitat deterioration on a micro scale hence stimulate fresh approaches for management of MCFR and other forests in Uganda. Mainly the study focuses on temporal and spatial changes in assemblages of rodents and shrews living along a degradation gradient. The main specific objectives are: (i) to assess the diversity and distribution of rodents and shrews along a habitat degradation gradient; (ii) to evaluate how habitat characteristics affect the occurrence of rodents and shrews along a habitat degradation gradient; (iii) to analyse how rainfall patterns affect the abundance of rodents and shrews along a degradation gradient.

2.0 METHODS

2.1 Study areas

The study was conducted in Mabira (CFR); (Fig. 1) in Uganda Griffin Falls (0°26'14.28"N, 32°57'14.31"E, 1179 m a.s.l.) from August 2018-December 2019. This is the largest forest reserve in Central Uganda (Colwell & Coddington 1994), managed by Uganda National Forestry Authority (NFA) as a Central Forest Reserve (CFR). According to Howard (1991) MCFR is considered secondary regenerating, in which the most dominant vegetation represents sub culmination communities, heavily influenced by man through continued excess of illegal resource use and encroachment. However, some parts are now fully regenerated with tall mature trees especially in the strict nature reserve compartment of the forest (Ministry of water and environment 2010). The MCFR's vegetation is classified as a semi-deciduous medium altitude forest. Mabira forest continues to exist in central Uganda as an isolated but sizable forest island without any land linkages to the various little pockets of forest in the Lake Victoria basin. Mabira (CFR) has a special position as the last substantial sanctuary for forest biota in this area due to its survival as the only fairly large contiguous forest estate in this area (Kityo 2008).

2.2 Study design

The study was conducted in the village of Namusa in the MCFR for 12 months between August 2018 and December 2019. Data were intermittently collected (with a one-month break after two months of data collection) along a gradient of habitat degradation that included a primary forest interior, a degraded forest edge, and fallows, gardens, sugarcane plantations, homesteads close to the forest, collectively referred to as adjacent habitats (Figure 1). For every sampling regime, nine transects were set in subjectively selected sites, namely primary forest interior, depleted forest edges and adjacent habitats (Figure 1). Rodents and shrews were trapped using Sherman traps set in transects of 200 m with 20 stations and an inter-station distance of 10 m with a trapping effort of 40 traps per transect (Mulungu et al. 2011). Traps were baited with a mixture of peanut butter, maize flour, ripe bananas and silver fish, and traps laid out for 3 nights. Morphometric measurements were taken from every captured specimen including the total length (TL), tail vertebrae length (TV), hind foot length (Hf), ear length, and weight (Wt). All measurements were recorded in millimeters and weight in grams. All specimens collected were kept as wet specimens in 75% ethanol and kept as vouchers in Makerere zoological museum. Collected specimens were identified to species using morphometric measurements cross references with published identification guides (Brambell 1973, Delany 1975, Thorn & Kerbis 2009, Monadjem et al. 2015) For selected individuals of each morphotype, identifications were confirmed by sequencing of partial mitochondrial cytochrome b gene (i.e. DNA barcoding) from 96% ethanol-preserved samples at the Institute of Vertebrate Biology (IVB) of the Czech Academy of Sciences. Obtained sequences were compared with the sequences in GenBank and further unpublished sequences in the database of IVB. The barcoding protocol (i.e. used primers, PCR conditions and sequencing) is described in Bryja et al. (2014). Microhabitat variables were also subjectively recorded by observation for every transect. These were canopy cover (Delineated by percentage cover where any cover below 40% was considered as no canopy cover), forest undergrowth (measured by low, medium, max), while water source (with aa 500m proximity) and leaf litter (which was measured by presence or absence). Vegetation cover type (garden, fallow and plantation) was used for adjacent habitats. Average monthly rainfall data was obtained from the Sugar Cooperation of Uganda Lugazi (SCOUL) and used to assess how species abundance fluctuates with rainfall over time

2.3 Data analysis

Trapping success (TS) was computed using the formula;

$$TS = \left(\frac{N_i}{T_n}\right) \times 100$$

Where; $N_i = \text{number of specimens collected}, T_n = total\ number\ of\ traps\ set.$

Shannon-Wiener diversity index was computed from the formula;

H'=-pi [?] ln pi

where

pi is the proportion of individuals found in species i

ln Natural logarithm

Species abundance was assessed based on the number of individuals recorded for every species.

Correspondence analysis (CA) was performed for the different sampling sites to show the chi-square distance among sites and also assess the significance of association between species and habitats.

To certify adequate sample size, rarefaction curves were developed using Vegan statistical package in R (Oksanen et al. 2016). Where the smoothed averages of the individual curves represent the statistical expectation of species accumulation per sampling site.

Small mammal community composition and association was measured using "multipatt" function in "R" using packages "vegan" and "indicspecies" (Miquel De Caceres 2013). In order to run an indicator species analysis, a vector containing the classification of the sites micro habitat types into groups was done using non-hierarchical cluster analysis with different "r" functions in packages "indicspecies" and "vegan". In order to determine which species can be used as indicators of different sampling sites; an approach commonly used in ecology is the use of the Indicator Value index (Dufrˆene & Legendre 1997, De Caceres et al. 2010). The approach calculates the "IndVal" (indicator value) index between the species and each site group and then looks for the group corresponding to the highest association value, the statistical significance of this relationship is then tested using a permutation test. All analyses were performed with R statistical software R Core Team (2013). Multiple linear regression was carried out to assess the relationship between species richness and species abundance with rainfall. The assumption is that species richness and abundance follow rainfall patterns. Line graphs were made to examine for any temporal trends in species richness and abundance, while cross correlation graphs were made to seek for relationship patterns between species richness, abundance and rainfall.

3.0 RESULTS

3.1 Species composition and abundance

A total of 1411 individuals were captured from 18360 trap nights representing 19 species of murid rodents (Muridae) and 5 species of shrews (Soricidae) (Table 1). Species richness was equally highest in adjacent habitats and degraded forest edges with 19 species, and lowest in primary forest interior. Species diversity was highest in adjacent habitats and least in the primary forest interior while trap success was highest in adjacent habitats and least along the degraded forest edges (Table 1).

Hylomyscus stella and *Praomys jacksoni* were the most abundant species in forested areas while *Lemniscomys striatus* was the most abundant in adjacent habitats (Table 1). *Lophuromys stanleyi and Crocidura olivieri* were the only species recorded from all sampled habitats. Other notable species recorded include*Scutisorex congicus* (Hero shrew), *Deomys ferrugineus* and*Malacomys longipes* , i.e. typical Congo basin forest species with MCFR being their eastern geographical limit (Thorn & Kerbis 2009, Monadjem et al. 2015, IUCN 2018).

3.2. Species accumulation

A comparison of species accumulation in relation to sample size using rarefaction curves shows that adjacent habitat areas attained the asymptote while curves of degraded forest edges and primary forest interior did not attain the asymptote (Fig. 2). For the sites that did not attain the asymptote it means that further surveys might yield more species.

3.3. Rodent and shrew habitat association in Mabira Central Forest Reserve

The different microhabitat attributes for the different survey areas in MCFR were clustered forming groups as a result of association of different species with different habitat attributes. *Group 1* is associated with closed canopy habitats, *Group 2* is associated with grass fallow, gardens, bush fallow and sugarcane plantations,*Group 3* is associated with thick undergrowth and leaf litter;*Group 4* is associated with habitats around homes; and *Group 5* had habitats associated with rivers, streams and open canopy.

An indicator species analysis was completed, and an indicator species list for each microhabitat (or microhabitat group combination) was obtained. Two species *Scutisorex congicus* and *Praomys missonnei* were found to be significantly associated (p=0.043 and 0.051 respectively) with closed canopy, leaf litter and thick undergrowth.*Mastomys erythroleucus* was significantly associated with grass and bush fallows, gardens and plantations (p=0.012). *Cricetomys ansorgei* , *Hylomyscus stella* and *Praomys jacksoni* , were associated with microhabitat groups one, three and five at p=0.012, p=0.025 and p=0.026 respectively.

The chi square test of independence between the different habitat variables and species ($X^2 = 1165.329$, P=0.000001), suggests that there is a significant strong association between species and their associated habitats. A correspondence analysis graph showing the chi-square distances among sites of MCFR and the strength of association between species and sampling areas is represented in Figure 3.

3.4 Temporal fluctuations in rodent and shrew abundance in Mabira (CFR)

Overall abundance of small mammals significantly varied across habitats ($F_{2,33} = 5.68$, $p = 0.007$). Adjacent habitats were characterized by the highest abundance (mean = 44.33±12.6), followed by primary forest interior (mean = 36.4±13.4) and the least abundance along degraded forest edges (mean = 27.4±10.8). Temporal fluctuations in abundance for four most abundant species indicates peaks for*Hylomyscus stella* in September, December and May with least captures in March, *Praomys jacksoni* had peaks in September-November, February and May with least captures in December while *Hylomyscus stella* was at a peak (Figure 4). In adjacent forest habitats, *Lemniscomys striatus* had two peaks in September and March while *L. stanleyi* showed two major peaks in December and March (Figure 4). It was also observed that species sharing the same habitat alternate in dominance over time

3.5 Effect of rainfall on species abundance along a degradation gradient

A linear regression analysis revealed that species abundance was not significantly influenced by rain with an $R^2 = 0.003$. However, cross correlation graphs for species abundance and rainfall along the degradation gradient revealed some relationships and patterns, with species abundance in adjacent habitats and degraded forest edge showing a strong correlation with rainfall. While in primary forest interior the correlation was weak (Fig 5). Further analyses to assess how the most abundant species in the forest and adjacent habitats fluctuate with rainfall revealed that forest species abundance is not influenced by rain as compared to those outside the forest (Fig 6).

4.0 DISCUSSION

4.1 Diversity and spatial variations of rodents and shrews

The overall rodent and shrew species composition inhabiting the forest ecosystems of Mabira Central Forest Reserve is relatively diverse as reflected in the high number of determined species (20 rodents and 5 shrews). Previous studies have also recorded high species numbers. For example, Ssuuna et al. (2020) reported 14 rodent species, Kasozi (2017) reported 11 rodents and five shrews, Waswa et al. (2016) reported 13 rodents and seven shrews, while Dickson & Kityo (1996) reported 13 rodents and 2 shrews. This could be attributed to the fact that MCFR represents the only contiguous large mass of forested habitat acting as refugia for many forest dependent species (Kityo 2008, MWE 2017). The rarefaction curves for the four sampling areas in MCFR (Fig. 2) suggest that the techniques used were effective for sampling the rodent and shrew communities but more sampling effort is still required in forested areas because of the fewer shrew species collected compared to those in Waswa et al. (2016) who additionally reported a *Crocidura* novice. This could be because we did not employ pitfall traps, which are a more effective method of trapping shrews (Umetsu et al. 2006, Stromgren & Sullivan 2014).

The primary forest interior has some habitat specialists such as *Malacomys longipes* which was collected mostly along the river (Kerbis & Patterson 1995) and *Deomys ferrugineus,* while along the degraded forest edge only adaptive habitat generalist species such as *P. jacksoni* and *L. stanleyi* were recorded. *L. stanleyi* , although considered an Albertine rift endemic (Monadjem et al. 2015) it is believed to be widely occurring over arrange of habitats (Monadjem et al. 2015). Pardini et al. (2005), Lucie & Séverine (2016) reported that specialized species of rodents and shrews disappear following primary forest disturbance. The fact that more species have been recorded in adjacent fallows and along the degraded forest edge suggests that, many species are adapting or prefer to living in disturbed habitats Lucie & Séverine (2016). Any form of disturbance in a forest opens up space giving rise to various plants that were previously surpassed by low light (Catford et al. 2012) which in turn provide more food alternatives. This abundance of herbaceous plants provides cover and food for various species hence increase in diversity (Brockerhoff et al. 2017). However, the plight of specialized species is in balance with chances of being out-competed by the more aggressive species and ultimately eliminated from their habitat (Thomas et al. 2013) . The continuing illegal activities of resource extraction in MCFR (MWE 2016) continue to reduce the habitat quality for rodents and shrews in the reserve. The recording of new records for the forest is not in its self a testament of the quality of habitat but rather a fact that the forest is understudied. The continued decline in habitat quality in Mabira CFR and its surrounding, is reflected in the lack of records of grassland specialists like *Mylomys dybowskyi and Lemniscomys zebra* (as *barbarus*) recorded in Davenport et al. (1996) but have not been reported in the preceding surveys. Habitat quality is compromised through loss of canopy cover, reduction in decaying logs since many are extracted as firewood, and reduction in plant species richness through logging which gives chance to the evasive paper mulberry to proliferate (Mulugo et al. 2019), this in time will lead to loss of rodent and shrew species forest specialists (Lucie & Séverine 2016, Pardini et al. 2005).

4.2. Effects of vegetation cover characteristics on the occurrence of rodents and shrews

Vegetation cover is a major driver in the occurrence and distribution of various rodent and shrew species Flores-Peredo and Vazquez-Dominguez (2016), various vegetation assemblages such as forest, fallow, garden, and plantations as exploited in this study provide varying degrees of food resources and cover. As such most species have co-evolved to occupy various vegetation assemblages given the resources available (Avenant 2011). Even the more adaptive such as *Mastomys erythroleucus* can only occur in a select group of habitats (section 3.2) but not everywhere. The observed association between species and type of site, suggests that different species have different habitat requirements. Therefore, the more diverse an ecosystem is in terms of habitat characteristics, consequently making it have a high microhabitat diversity and an equally high species diversity Bantihun & Bekele (2015). As noted by Johnson & Horn (2008), the distribution of species is dependent on habitat type, vegetation cover, and microhabitat characteristics. For example, *Scutisorex somereni* was significantly associated with forested environs of closed canopy and leaf litter. This is in line with findings of Kasozi (2017), who stated that it was associated with primary forest with leaf litter. Such findings also help emphasize the importance of some habitats and their attributes as key to species conservation Lucie & Séverine (2016). With the facts above its important to protect the forest with all its microhabitat diversity by regulating illegal and high resource extraction.

4.3. Rainfall as a driver of temporal fluctuations of rodent and shrew species abundance along a degradation gradient

The observed rodent and shrew species fluctuation, is indicative that rodent species abundance follows seasonal busts in food which also follows rainfall patterns. Mesele & Bekele (2012) noted that fluctuations in species abundance is a result of seasonal variation in vegetation structure, ground cover and other related environmental variables which are also driven by rainfall patterns. Alternation in abundance of species occupying the same habitat (Figure 4) could be as a result of resource partitioning mainly through dietary separation of species with similar requirements (Symes et al. 2013).

Rainfall is a known factor that drives rodent and shrew demography in various ecosystems (Thomas & Richard 1999, Delany 2008, Pavey & Nano 2013), however in this study, fluctuations in species abundance in forested environments, did not correlate to fluctuations in rainfall as compared to habitats outside forest. This is because forest ecosystems create a micro climate usually independent of the overall climate of an area (Pieter et al. 2021). Comparisons of abundant species in forest and adjacent habitats revealed similar trends suggesting that fluctuations in abundance of forest species may not be explained by weather patterns alone but maybe a combination of both biotic and abiotic factors (Ward-Fear et al. 2021). With the degradation and microhabitat modification, forest resident species population will be forced to follow fluctuations in weather variables calling for adaptations. Species that cannot quickly adapt will most likely be eliminated from the ecosystem leading to local extinctions. (Ocampo-Peñuela et al. 2020).

5.0 CONCLUSION and RECCOMENDATION

Mabira (CFR) is an important forest for rodent and shrew species conservation and ecological research given the high species diversity and high density. The recording of *Hylomyscus stella* and*Praomys jacksoni* in high numbers can be used as a proxy to monitor the health of the forest, this can be done in combination with the forest specialist species like *Deomys ferrugineus* ,*Praomys missonei* and *Malacomys longipes* recorded.Some species were observed to be associated with certain habitats, suggesting that they have different habitat requirements and highlighting the importance of habitat heterogeneity. This also provides useful information required for habitat management like protecting the forest from any activities leading to habitat modification. Rodent and shrew species abundance fluctuations are independent of the local rainfall patterns but with the ongoing habitat modification, forest mammals may have to adapt to changes in the rainfall patterns which patterns are increasingly becoming unpredictable. This implies that species that will not be able to adapt fast might be ultimately eliminated from the ecosystem. From this study, we recommend an assessment of how habitat homogeneity due to the proliferation of*Broussonetia papyrifera* , which is invading the forest following forest degradation, affects rodent and shrew populations in forested environments.

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7.0 Figures and Tables

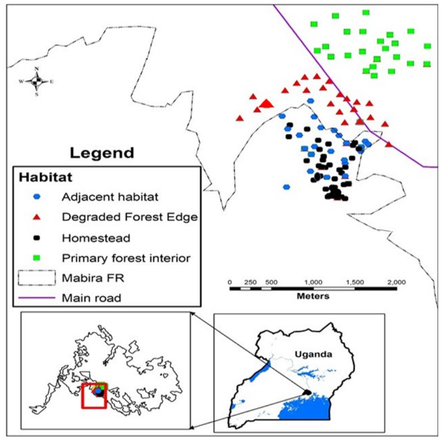

Figure 1: Map of MCFR zoomed out from the map of Uganda to illustrate the survey area and the stratified sample locations in detail

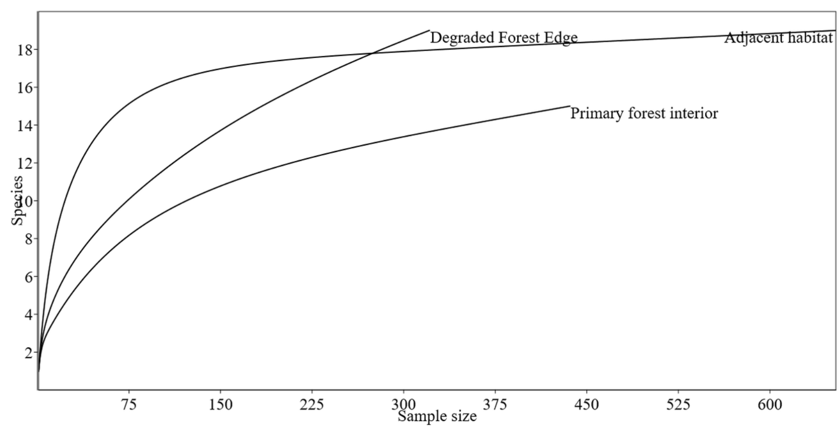

Figure 2: Rarefaction curves comparing sample size and species accumulation for the different survey areas in Mabira Central Forest Reserve

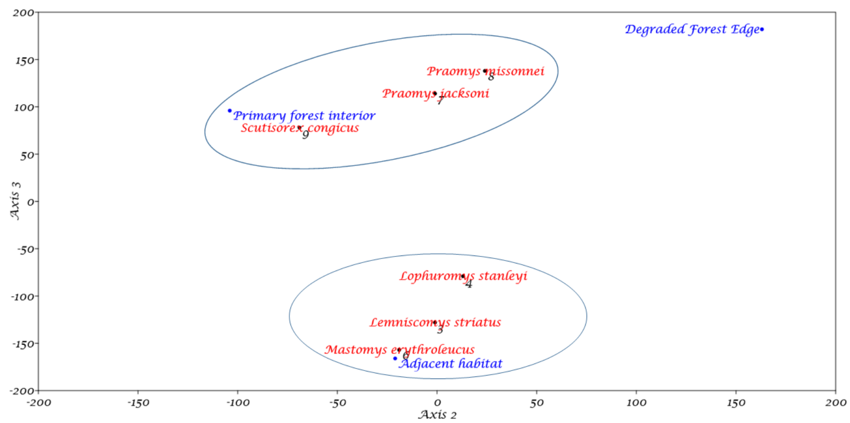

Figure 3: Community structure of rodents and shrews in MCFR along a degradation gradient

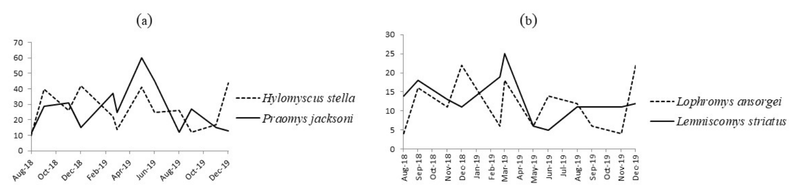

Figure 4: Temporal fluctuations in abundance of four most common rodent species in MCFR, (a) in forested habitats (b) in adjacent habitats such as fallows and plantations

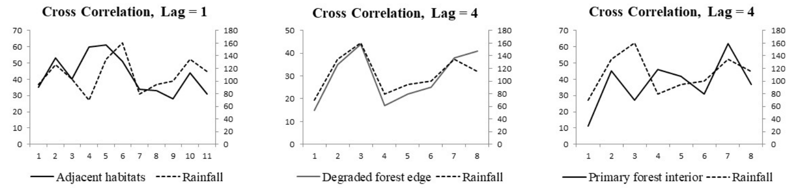

Figure 5: Relationship between Species abundance and mean monthly rainfall along a degradation gradient in Mabira Central Forest reserve

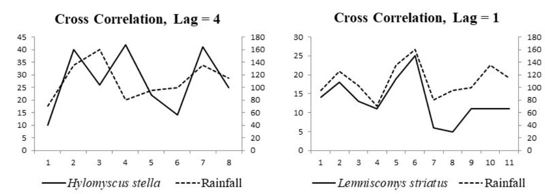

Figure 6: Relationship between mean monthly species abundance for the most abundant species and mean monthly rainfall in Mabira Central Forest reserve

Table 1: Rodent and shrew species composition and number of captured specimens along a degradation gradient in Mabira Central Forest Reserve

Species name	**Adjacent habitat**	**Degraded Forest Edge**	**Primary forest**
Aethomys hindei (Thomas, 1902)	36	-	-
Arvicanthis niloticus (clade C2 Bryja *et al.* 2019)	12	-	-
Cricetomys ansorgei (Thomas, 1904)	-	1	9
Deomys ferrugineus(Thomas, 1888)	-	-	4
Gerbilliscus giffardi (Aghova *et al.* 2017)	24	1	-
Grammomys kuru (Thomas Wroughton, 1907)	-	1	-
Hybomys lunaris (Pradhan *et al.* 2022)	-	3	4
Hylomyscus stella (Nicolas *et al.* 2021)	11	116	192

Species name	**Adjacent habitat**	**Degraded Forest Edge**	**Primary forest**
Lemniscomys striatus (clade E Hánová *et al.* 2021)	139	17	-
Lophuromys stanleyi (Onditi *et al.* 2021)	104	30	7
Lophuromys ansorgei (de Winton, 18964)	53	2	3
Malacomys longipes (Bohoussou *et al.* 2015)	-	-	1
Mastomys erythroleucus (clade C Hánová *et al.* 2021)	62	1	1
Mus minutoides (Smith, 1834)[1]	35	3	1
Mus bufo (Thomas 1906)	11	1	1
Oenomys hypoxanthus (Pucheran, 1855)	1	-	-
Praomys jacksoni (clade Ib Mizerovská *et al.* 2019)	17	118	185
Praomys missonnei (clade IV Nicolas *et al.* 2011)	-	14	15
Rattus rattus (Linnaeus, 1758)	88	3	-
Crocidura luna (Dollman, 1910)	12	1	1
Crocidura turba (Nicolas *et al.* 2019)	22	4	-
Crocidura olivieri (clade IV-A Jacquet *et al.* 2015)	20	4	4
Crocidura cf *macmillani* (Dollman 1915)[2]	6	-	-
Scutisorex congicus (Thomas 1915)[3]	1	1	8
Total number of mammals from each site	654	321	437
Trap success (%)	10.7	7	5
Number of species	19	19	16
Species diversity (H')	2.4	1.7	1.3

[1]As in Bryja et al. 2014 this species may as well represent *M. cf. gratus* , which was confirmed in both Minziro and Kakamega forests (Bryja et al. unpublished data), the two species are morphologically similar with only genetic data the able to tell them apart.

[2] *C. macmillani* is now considered an endemic species in southern Ethiopia, but Malahat and Bryja et al. (unpublished data) have genomic data showing that genetically very similar taxon occurs also in Uganda.

[3] In the field identified as *Scutisorex somereni,* but genomic data revealed it's very similar to *S. congicus* from Semliki (FMNH data).