Note on the small mammals of small, isolated forest patches in the Eastern Cape, South Africa

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1 INTRODUCTION

Anthropogenic habitat modification is the single biggest cause of forest habitat loss (Alroy, 2017; Ewers & Didham, 2006; Fahrig, 2003). Due to the continued rise of the human population and its resource needs (Leaver & Cherry, 2020), the conversion of forests to agricultural land and for the extraction of timber increases the loss of natural vegetation, creating ever smaller patches which can negatively affect small mammal populations (Fischer & Lindenmayer, 2007; Schmid-Holmes & Drickamer, 2001). Despite having a high floristic and faunal diversity (Berliner, 2005), the Forest Biome in South Africa is highly fragmented (Lawes et al., 2000), susceptible to climate change and fire, and is under severe threat from a range of human activities (De Villiers & White, 2002; Leaver & Cherry, 2020; Mucina & Rutherford, 2006). Thus, investigating the small mammal populations in South African forests is an important first step to understanding the effects of forest fragmentation on forest fauna (Lindenmayer et al., 2002). The loss of contiguous habitat can threaten animals, especially non-volant species resulting in a loss in connectivity which can negatively affect the species richness and genetic diversity of small mammals (Fischer & Lindenmayer, 2007; Palmeirim et al., 2020). The aim of our study was to identify the small mammals present across a range of fragmented forest patches in the Eastern Cape Province, South Africa.

2 METHODS

2.1 Study sites

Southern Mistbelt Forests occur on south and south-east facing slopes in fire-shadow habitats along the Great Escarpment in the KwaZulu-Natal and Eastern Cape provinces of South Africa (Mucina & Rutherford, 2006). Forest patches vary in size but are all found between 850–1600 m.a.s.l. These forests are characterised by emergent trees of *Afrocarpus falcatus* and deciduous and semi-deciduous species such as *Zanthoxylum davyi*, *Vepris lanceolata*, *Celtis africana* and *Calodendrum capense* (Mucina & Rutherford, 2006).

Nine distinct forest patches in the Eastern Cape, South Africa were selected as study sites (Figure 1). These patches were selected because they are all Southern Mistbelt Forest (Mucina & Rutherford, 2006), were accessible, spanned a clear climatic gradient and varied in size, altitude and latitude (Junkuhn, 2015) (Table 1).

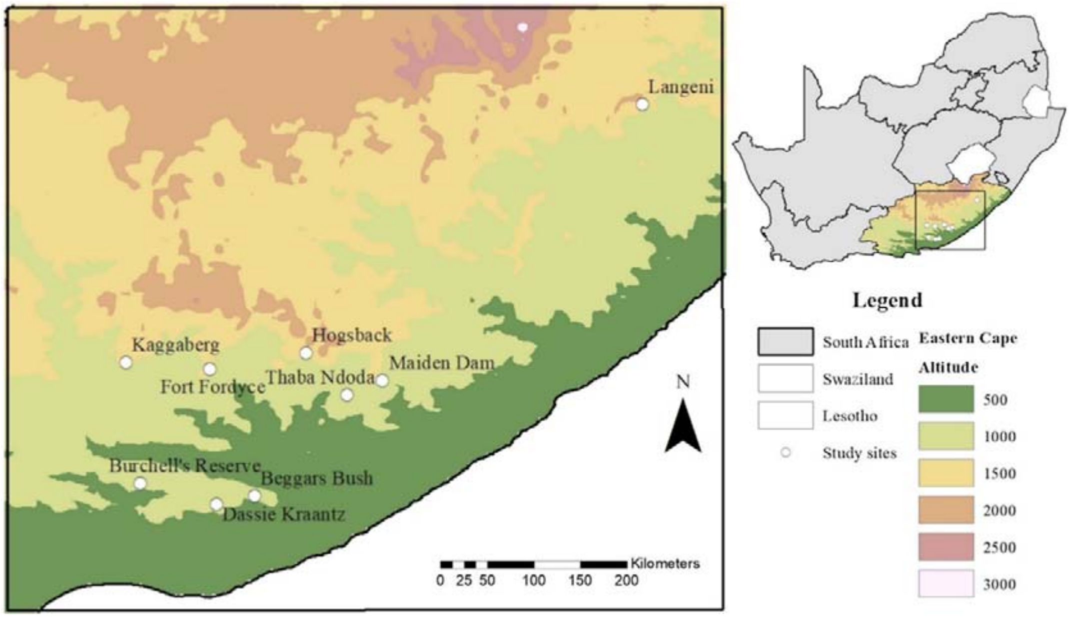

FIGURE 1. Nine forest patches that were sampled for small mammals during the 2013 summer season in the Eastern Cape, South Africa

TABLE 1. The physical and climatic characteristics of each of the nine forest patches sampled in the Eastern Cape, South Africa

Site	Altitude (m)	Patch Size (km²)	Slope	Aspect	Herbaceous Richness	Herbaceous Cover (%)	Mean Annual Rainfall (mm)	Mean Annual Potential Evaporation (mm)	Heat Units Annually (°days)	Mean Annual Temperature (°C)
Hogsback	1164	7.34	0.31	SE	80	21	1371	1675.8	103.6	11.9
Langeni	1092	1.75	0.18	SE	133	62	1157	1578.8	101.3	13.7
Fort Fordyce	1014	6.93	0.27	SW	33	10	701	1771.7	111.8	12.4
Kaggaberg	942	7.9	0.31	S	76	25	537	1723.3	108.9	16.7
Thaba Ndoda	867	1.66	0.07	S	100	40	653	1723.7	118.4	13.3
Burchell's Reserve	846	1.05	0.3	S	73	22	412	1884.8	111.3	14.5
Dassie Krantz	741	0.1	0.23	SW	24	11	576	1761.6	114.7	13.1
Beggars Bush	684	0.67	0.36	S	32	10	495	1734.8	118.6	13
Maiden Dam	551	10.1	0.04	SE	104	15	898	1719.5	119	12.4

2.2 Data collection

The nine forest patches were sampled during the Austral Summer of 2013 (between January and March). At each site, three transects of 30 Sherman live traps (229 × 76 × 89 mm) (Kok et al., 2012; Pearson & Ruggiero, 2003) were laid out perpendicular to the slope, with transects located along contours at the top, middle and bottom of the slope. Within each transect, traps were spaced ~10 metres apart (Keller & Schradin, 2008; Pearson & Ruggiero, 2003), and transects were spaced between 50 and 100 metres apart depending on forest patch size, rendering them statistically independent (Weiermans & Van Aarde, 2003).

A mixture of oats and peanut butter was used as bait (Kok et al., 2013; Schmid-Holmes & Drickamer, 2001) and a small ball of cotton wool was used as nesting material (Sikes & Gannon, 2011). Traps were placed next to prominent microhabitat features such as rocks, logs or tree trunks to increase the likelihood of small mammal capture (Schmid-Holmes & Drickamer, 2001; Stephenson, 1994).

A trap night was defined as the number of traps active per 24 h (Rowe-Rowe & Meester, 1992). Trapping periods lasted between three and five consecutive nights (Caro, 2001; Schmid-Holmes & Drickamer, 2001; Yarnell et al., 2007). Traps were inspected once a day in the morning (Schmid-Holmes & Drickamer, 2001; Stephenson, 1994; Van Aarde et al., 1996). If a small mammal was caught, it was transferred to a ziplock bag, where it was photographed, identified to species level and marked. If an individual was caught with no markings, it was hair-clipped (Van Aarde et al., 1996). Hair-clipping was done to identify recaptures. The species, location on the transect and whether or not it was a unique or a recaptured individual were recorded.

3 RESULTS AND DISCUSSION

We captured a total of 78 small mammals representing four species over 3300 trap nights (Table 2). Sixty-five of these captures were unique individuals (Table 2), and 13 were recaptures. Overall trap success was low (2.4 ± 2.3%). Two species were caught at eight of the nine sites and three species were caught at the ninth site (Table 2).

TABLE 2. Total number of unique individuals of each small mammal species captured at nine forest sites in the Eastern Cape, South Africa. Trapping effort (trap nights) per forest patch is shown in brackets next to each site name

Site	*Michaelamys namaquensis*	*Myosorex varius*	*Graphiurus murinus*	*Mastomys natalensis sensu lato*
Hogsback (450)	–	4	2	–
Langeni (270)	–	11	–	1
Fort Fordyce (450)	–	1	1	–
Kaggaberg (450)	–	1	2	–
Thaba Ndoda (450)	–	2	–	1
Burchell's Reserve (270)	–	3	7	–
Dassie Krantz (270)	–	1	2	–
Beggars Bush (450)	16	2	5	–
Maiden Dam (270)	1	2	–	–
TOTAL	17	27	19	2

Brazilian Atlantic forest fragments (da Fonseca & Robinson, 1990) and fragmented forest in Queensland, Australia (Laurance, 1994) showed similar results to ours. The findings from these two studies and our work may illustrate the potentially depauperate nature of small mammal communities within forest fragments driven by fragmentation effects such as reduced habitat area and increased distance between remnants (Wilson et al., 2010). Alternatively, and perhaps more likely, since our study represented a single, temporal snap-shot of small mammal diversity across nine forest fragments, our trapping success and overall small mammal diversity may have been influenced by other factors (e.g. localised climate variability).

Four species were caught across the nine forest patches; *Michaelamys namaquensis* (Namaqua rock mouse), *Myosorex varius* (forest shrew) *Graphiurus murinus* (woodland dormouse) and *Mastomys natalensis senu lato* (multimammate mouse) (Table 2). Forest shrews, woodland dormice and Namaqua rock mice appeared to be the most abundant small mammals across the nine sites (Table 2). Forest shrews were captured at all sites, and woodland dormice were captured at six of the nine sites. Multimammate mice were only captured at Langeni and Thaba Ndoda (Table 2).

Myosorex varius was the only species to be found in all nine sites while *G. murinus* was found at six sites. The forest shrew (*Myosorex varius*) has a wide distribution and presumably habitat tolerance (Wirminghaus & Perrin, 1993). Similarly, *Graphiurus murinus* has a large distribution over South Africa and is found in a wide range of habitats from grasslands to rocky areas. However, within the Eastern Cape, they are only known to occur in forests (Mzilikazi et al., 2012). Our data support this observation. *Mastomys natalensis* is often found in forest clearings but rarely in the forest itself (Coetzee, 1975) and is often the first coloniser in areas recovering from disturbance before it gets replaced by specialist species through succession (Perrin et al., 2001). These observations may explain why this species was caught so infrequently and only at sites surrounded by timber plantations and forest clearings.

Our work provides some important initial data on the small mammal species present in isolated forest fragments in South Africa. We recommend that future research incorporates sampling at multiple temporal scales and assesses the potential environmental drivers of small mammal diversity in these forest patches.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data to reproduce manuscript analyses are available on Zenodo: https://doi.org/10.5281/zenodo.5814656.

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