

Myosorex cf. tenuis – Thin Mouse Shrew

Photograph
wanted

Regional Red List status (2016)	Endangered B2ab(ii,iii,iv)*†
National Red List status (2004)	Not Evaluated
Reasons for change	Non-genuine change: New information
Global Red List status (2008)	Data Deficient
TOPS listing (NEMBA)	None
CITES listing	None
Endemic	Yes

*Watch-list Data †Watch-list Threat

The existence of a formally undescribed *Myosorex* clade in Limpopo Province has been discovered through molecular and morphological research and tentatively assigned *M. cf. tenuis*. However, its relationship to the original *M. tenuis* described from Zuurbron, Mpumalanga Province is uncertain and *M. cf. tenuis* may be renamed pending further comparisons of museum specimens (Taylor et al. 2013).

Taxonomy

Myosorex cf. tenuis (Thomas & Schwann 1905)

ANIMALIA - CHORDATA - MAMMALIA - EULIPOTYPHILA - SORICIDAE - *Myosorex* - *tenuis*

Common names: Thin Mouse Shrew (English)

Taxonomic status: Species

Taxonomic notes: Roberts (1951) recognised *Myosorex tenuis* (Thomas & Schwann 1905) as a distinct species based on small cranial size. Although the type specimen is from the Zuurbron, Wakkerstroom District in Mpumalanga Province, he also assigned *M. tenuis* to specimens from Woodbush and Entabeni Forests in the Soutpansberg Mountains, Limpopo Province. The species was not accepted by Meester et al. (1986) or Skinner and Chimimba (2005), but was tentatively accepted by Jenkins

and Churchfield (2013). More recently, Willows-Munro (2008) and Taylor et al. (2013), using a combination of molecular and morphological characters, demonstrated considerable lineage diversification within the *M. cafer* complex. Isolated populations of *M. cafer* in the highlands of Zimbabwe and Mozambique; and north-eastern Limpopo have been previously assigned to *M. cafer* (Friedmann & Daly 2004). However, Taylor et al. (2013) described two new species from specimens previously assigned to these *M. cafer* populations: The Zimbabwe and Mozambique population are considered *M. meesteri* and the Limpopo lineage was tentatively assigned *M. cf. tenuis* based on its small cranial size. However, it is unclear if the Mpumalanga specimen named *M. tenuis* by Roberts (1951) or the Mpumalanga records of *M. cafer* should be reassigned to *M. cf. tenuis* or remain *M. cafer*. Further vetting of museum records is needed to resolve the taxonomy. In order to finally resolve the suitability of *M. tenuis* as the correct name for the Limpopo lineage, further research is needed based on detailed comparisons of dental, morphometric, and molecular characters of the holotype of *M. tenuis*. Pending such analysis, Taylor et al. (2013) provisionally assigned the Limpopo populations to *M. cf. tenuis*. Whether the final name of the species changes or not, it represents a new endemic species to the assessment region.

Assessment Rationale

This is a newly described species, possibly endemic to the Soutpansberg and Volkberg region of Limpopo Province. Further research is needed to determine whether the type specimen from Zuurbron, Wakkerstroom District in Mpumalanga Province, which is described as *M. tenuis*, is congruent with *M. cf. tenuis*. Similarly, comparisons of dental, morphometric, and molecular characters are needed to determine whether specimens assigned to *M. cafer* from Mpumalanga and Swaziland should be renamed *M. cf. tenuis*. Whether the final name and geographical distribution ultimately changes or not, this is certainly a species endemic to the assessment region.

It is an Afromontane grassland specialist existing in fragmented and possibly degraded patches. The extent of occurrence is estimated as 5,345 km² while the area of occupancy (AOO), using remaining natural Afromontane grassland (2014) as a proxy for suitable habitat, is estimated as 537 km². However, this represents maximum available AOO and does not incorporate potentially unoccupied patches, of which there are likely to be many given the fragmented nature of grassland patches and the poor dispersal capabilities of the species. Thus, we think it is reasonable to assume that true AOO is < 500 km². This species is threatened by continuing declines in habitat area and habitat quality caused primarily by human settlement expansion, commercial plantations and mining, as well as associated overgrazing, water abstraction and fuelwood extraction relating to these land-use changes. Continuing decline is inferred from recent land satellite image and land-cover analysis: between 2000 and 2013,

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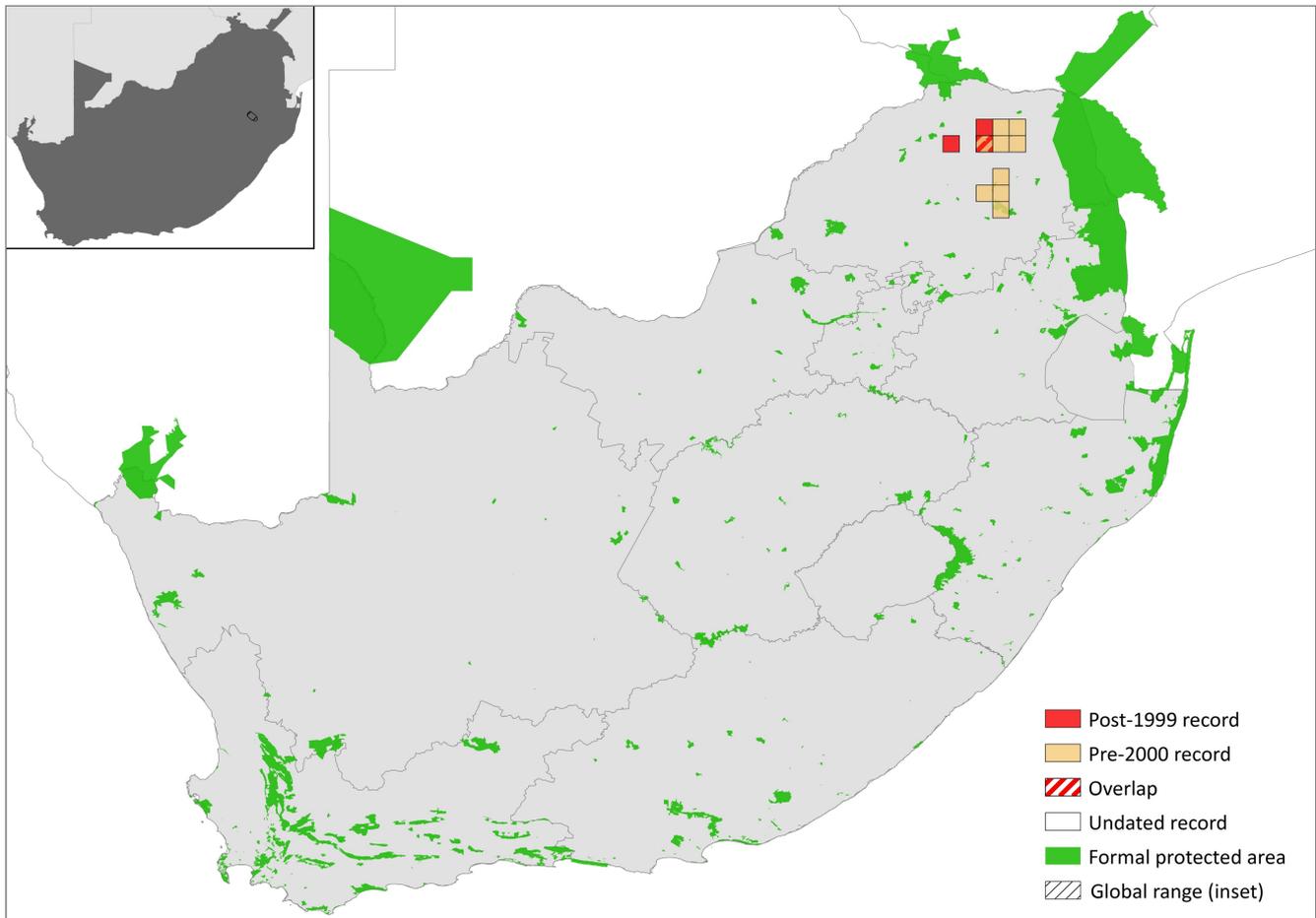


Figure 1. Distribution records for Thin Mouse Shrew (*Myosorex cf. tenuis*) within the assessment region

Table 1. Countries of occurrence within southern Africa

Country	Presence	Origin
Botswana	Absent	-
Lesotho	Absent	-
Mozambique	Absent	-
Namibia	Absent	-
South Africa: Limpopo	Extant	Native
South Africa: Mpumalanga	Presence uncertain	Native
Swaziland	Presence uncertain	Native
Zimbabwe	Absent	-

there has been a 14.9% and 8.8% rate of urban and rural expansion in Limpopo Province, respectively; and 20% of forest and woodland cover was lost between 1990 and 2006 in the Soutpansberg Mountains due to residential expansion and pine/eucalyptus plantations. Furthermore, climate change is an emerging threat to this species, as modelling predictions reveal a decline in suitable habitat ranging from 35–41% between 1975 and 2050.

Vetting existing museum records to more accurately delimit range distribution for this new species, particularly in Mpumalanga and Swaziland, is of utmost importance. Once these data have been generated, this species should be reassessed. For now, we assume it is a Limpopo Province endemic and list as Endangered B2ab (ii,iii,iv) under a precautionary purview, due to its restricted and severely fragmented area of occupancy, and an

inferred continuing decline in habitat and habitat quality from human settlement, industrial and agricultural expansion in Limpopo Province. Key interventions include protected area expansion of Afromontane grassland and forest habitats, including the creation of corridors between patches and across elevational gradients to facilitate gene flow, as well as the enforcement of regulations restricting disturbance to suitable habitats.

Distribution

Recent molecular and morphological evidence argued for reassignment of populations formerly classified as *M. cafer* from the northern escarpment of South Africa and the Soutpansberg Mountains of Limpopo Province to *M. cf. tenuis* (Taylor et al. 2013), pending formal description. Thus, currently, *M. cf. tenuis* is endemic to the Limpopo Province (Figure 1, Table 1). However, pending ongoing research, the range may extend southwards to the type locality of *M. tenuis* (Zuurbron, Wakkerstroom District, Mpumalanga Province), and perhaps into Swaziland. The previous IUCN Red List assessment showed only the type specimen locality (Baxter & Hutterer 2008). It is strange that no museum specimens have yet been assigned to *M. tenuis* from the northern Drakensberg region of Mpumalanga Province (being assigned rather to *M. varius* or, perhaps erroneously, *M. cafer*), which separates the Limpopo population from the type locality. A more accurate geographical distribution will be revealed following an analysis of such museum specimens.

Whether *M. cf. tenuis* it is a tropical or temperate species is unclear. Although subpopulations occupy montane grassland and forest habitats (Taylor et al. 2013), they

occur mostly north of the Tropic of Capricorn (in the Soutpansberg Mountains) and at lower altitudes (up to 1,750 m asl in the Soutpansberg, and 2,050 m asl in the Wolkberg), which is characterised by moderate temperatures; for example, mean monthly temperatures measured at 1,750 m in the Soutpansberg varied from -0.4°C to 29.6°C (Taylor et al. 2015).

Using confirmed *M. cf. tenuis* records, the extent of occurrence in Limpopo is estimated to be 5,345 km². Using a recent land cover dataset from 2014 (GeoTerralimage 2015), area of occupancy (AOO) was estimated as 537 km² by using remaining natural Afromontane grassland as a proxy for suitable habitat (*sensu* Taylor et al. 2016). However, it must be noted that this does account for potentially unoccupied patches and thus represents maximum available grassland. Similarly, the amount of available forest habitat is 181 km². Grassland and forest habitat together is 718 km². Since specimens have been collected primarily from moist grasslands and sometimes forest edges (but not within forests), using Afromontane grassland as a proxy for AOO is probably more accurate. They are sympatric in some areas with the more widespread *M. varius*.

Population

The abundance and population size of this species are not known. However, it may show an increase in abundance at higher elevations, similar to other Afromontane grassland small mammals (Taylor et al. 2015).

Current population trend: Declining. Inferred from ongoing forest and grassland habitat loss.

Continuing decline in mature individuals: Unknown

Number of mature individuals in population: Unknown

Number of mature individuals in largest subpopulation: Unknown

Number of subpopulations: Unknown, but perhaps as few as two, corresponding to the Soutpansberg and Wolkberg regions in Limpopo Province.

Severely fragmented: Yes. Remaining Afromontane grassland and forest patches are patchily distributed between plantations, human settlements, mines and agricultural lands.

Habitats and Ecology

The type specimen in Wakkerstroom, Mpumalanga Province was collected in thick grass at the edge of a stream at 1,600 m asl (Roberts 1951). In the Soutpansberg Mountains, Limpopo Province, they have always been collected from wetlands and moist grasslands, and some specimens were collected from the margins of mistbelt forests (Taylor et al. 2013), which emphasises the ecological separation between this species and the forest specialist *M. cafer*.

Ecosystem and cultural services: Candidate for flagship species in most grasslands biodiversity stewardship schemes in Limpopo Province.

Use and Trade

There is no known subsistence or commercial use of this species.

Threats

The main threat to this species is the loss or degradation of moist, productive areas such as wetlands and rank grasslands in Afromontane habitats. The two main drivers behind this are habitat loss and abstraction of surface water and draining of wetlands through industrial (for example mining) and human settlement expansion, and overgrazing of moist grasslands, which leads to the loss of ground cover and decreases small mammal diversity and abundance (Bowland & Perrin 1989). Suppression of natural ecosystem processes, such as fire, can also lead to habitat degradation through bush encroachment or loss of plant diversity through alien invasives, and is suspected to be increasing with human settlement expansion. There are also clear overlaps and synergistic effects between these threats. Shrews have a high metabolic rate and thus rely on highly productive and complex environments, where small mammal diversity is highest (Bowland & Perrin 1993). Unfortunately, 65% of wetland ecosystem types within the assessment region are threatened (48% of all wetland types Critically Endangered, 12% Endangered and 5% Vulnerable; Driver et al. 2012).

Additionally, climate change is considered the principal emerging threat to Afromontane *Myosorex* species, as climate modelling projected a 35–41% decline in available suitable habitat between 1975 and 2050 (Taylor et al. 2016).

Current habitat trend: Suitable montane grassland and woodland cover is declining within Limpopo Province. There has been a significant expansion of the mining sector in recent years where prospecting and mining activities have been proposed or are currently underway in significant areas of high biodiversity, particularly in the Limpopo Valley, Soutpansberg, Blouberg, Makgabeng and Sekhukhune (V. Egan unpubl. data). Habitat loss and degradation is specifically apparent in the Soutpansberg, which is the core range of the species: significant habitat transformation occurred over the last 150 years (Hahn 2006), which is corroborated by recent land-cover analysis demonstrating that 20% of forest and woodland cover was lost from 1990 to 2006 in Soutpansberg Mountain region due to residential expansion and pine/eucalyptus plantations (Munyati & Kabanda 2009). Additionally, between 2000 and 2013, there was a 14.9% and 8.8% rate of urban and rural expansion in Limpopo Province, respectively (GeoTerralimage 2015). This not only indicates loss of habitat outright, but increased pressure on ecosystems from human disturbance.

Conservation

There are no direct conservation measures in place for this species. It is not known if the species is present within any protected areas. Additional studies are needed into the taxonomy, distribution, abundance, general ecology and threats to this little-known species. However, we suspect the main intervention for this species is the protection and restoration of wetlands and grasslands. Protected area expansion should focus on connecting disparate patches of montane grasslands, which are highly fragmented (Neke & Du Plessis 2004). Biodiversity stewardship schemes should be promoted if landowners possess wetlands or grasslands close to core protected areas or remaining forest areas, and the effects on small mammal subpopulations should be monitored. Protecting such habitats may create dispersal corridors between suitable habitat patches.

Table 2. Threats to the Thin Mouse Shrew (*Myosorex cf. tenuis*) ranked in order of severity with corresponding evidence (based on IUCN threat categories, with regional context)

Rank	Threat description	Evidence in the scientific literature	Data quality	Scale of study	Current trend
1	<i>3.2 Mining & Quarrying</i> : habitat loss from mining in high biodiversity areas, including the Soutpansberg. Current stress <i>1.3 Indirect Ecosystem Effects</i> : fragmentation and isolation of remaining grassland patches with limited dispersal between.	-	Anecdotal		Increasing, measured through increase in prospecting applications.
2	<i>2.2.2 Agro-industry Plantations</i> : pine and eucalyptus plantations causing grassland habitat loss. Current stress <i>1.3 Indirect Ecosystem Effects</i> : fragmentation and isolation of remaining grassland patches with limited dispersal between.	Munyati & Kabanda 2009	Indirect (land cover change from remote sensing)	Regional	20% of woodland cover was lost from 1990–2006 in Soutpansberg.
3	<i>2.3.2 Small-holder Grazing, Ranching or Farming</i> : wetland and grassland degradation through overgrazing (removal of ground cover).	Bowland & Perrin 1989	Empirical	Local	Possibly increasing with human settlement expansion and intensification of wildlife farming.
		Driver et al. 2012	Indirect	National	45% of remaining wetland area exists in a heavily modified condition.
4	<i>11.1 Habitat Shifting & Alteration</i> : moist microhabitats lost from Afromontane forest cover reduction and aridification.	Taylor et al. 2016	Simulation	National	Increasing; a potential reduction in area of occupancy of 35–40% between 1975 and 2050.
5	<i>1.1 Housing & Urban Areas</i> : forest habitat lost to residential and commercial development. Current stress <i>1.3 Indirect Ecosystem Effects</i> : fragmentation and isolation of remaining grassland patches with limited dispersal between.	GeoTerralimage 2015	Indirect (land cover change from remote sensing)	Regional	Continuing. Area of urban expansion has increased by 5.6% and 6.3% for KwaZulu-Natal and Eastern Cape provinces respectively between 2000 and 2013.
		Munyati & Kabanda 2009	Indirect (land cover change from remote sensing)	Regional	20% of woodland cover was lost from 1990 to 2006 in Soutpansberg.
6	<i>7.2 Dams & Water Management/Use</i> : wetland loss through drainage/water abstraction during agricultural, industrial and urban expansion.	Driver et al. 2012	Indirect (land cover change from remote sensing)	National	65% of wetland ecosystem types threatened.
7	<i>7.1.2 Suppression in Fire Frequency/ Intensity</i> : human expansion around forests has decreased natural fire frequency. Current stress <i>1.2 Ecosystem Degradation</i> : altered fire regime leading to bush encroachment (including alien vegetation invasion) and thus loss of moist grasslands.	-	Anecdotal	-	-

Legislation should be enforced to prevent development or human encroachment in key habitats, which includes stricter zonation on development to decrease fragmentation of remaining grasslands.

At the local scale, landowners and managers should be educated, encouraged and incentivised to conserve the habitats on which shrews and small mammals depend. Retaining ground cover is the most important management tool to increase small mammal diversity and abundance. This can be achieved through lowering grazing pressure (Bowland & Perrin 1989), or by maintaining a buffer strip of natural vegetation around wetlands (Driver et al. 2012). Research will be needed to set the recommended length of the buffer strip in various habitats, but 500 m may provide a good indication of ecological integrity (Driver et al. 2012). Small mammal diversity and abundance is also higher in more complex or heterogeneous landscapes, where periodic burning is an important tool to achieve this (Bowland & Perrin 1993).

Similarly, the specific fire regime thresholds should be calibrated by research. Removing alien vegetation from watersheds, watercourses and wetlands is also an important intervention to improve flow and water quality, and thus habitat quality, for shrews. This can be achieved through the Working for Water programme (for example, Marais et al. 2004). However, the subsequent effects on shrew subpopulations must be monitored to demonstrate success (sensu Richardson & van Wilgen 2004). Education and awareness campaigns should be employed to teach landowners and local communities about the importance of conserving wetlands and moist grasslands.

Recommendations for land managers and practitioners:

- More accurate estimates of grassland patch occupancy through extensive live-trapping and field surveys should be conducted through dedicated surveys by specialists and conservation authorities

Table 3. Conservation interventions for the Thin Mouse Shrew (*Myosorex cf. tenuis*) ranked in order of effectiveness with corresponding evidence (based on IUCN action categories, with regional context)

Rank	Intervention description	Evidence in the scientific literature	Data quality	Scale of evidence	Demonstrated impact	Current conservation projects
1	1.1 Site/Area Protection: protected area expansion to connect montane grassland patches.	-	Anecdotal	-	-	-
2	1.2 Resource & Habitat Protection: stewardship agreements with private landowners to conserve wetlands and grasslands.	-	Anecdotal	-	-	-
3	5.4 Compliance & Enforcement: minimising habitat loss and fragmentation of grasslands by preventing illegal development.	-	Anecdotal	-	-	-
4	2.2 Invasive/Problematic Species Control: maintain stocking rates of livestock and wildlife at ecological carrying capacity.	Bowland & Perrin 1989	Empirical	Local	Small mammal diversity and abundance significantly higher after decrease in grazing pressure.	-
5	2.1 Site/Area Management: maintain/restore natural vegetation around wetlands.	-	Anecdotal	-	-	-
6	2.2 Invasive/Problematic Species Control: clear alien vegetation from watersheds and wetlands to restore habitat quality.	-	Anecdotal	-	-	Working for Water, Department of Environmental Affairs
7	4.3 Awareness & Communications: educating landowners in the importance of wetlands and grasslands.	-	Anecdotal	-	-	-

to more accurately establish geographical range and potential biodiversity stewardship sites, thus informing spatial conservation planning.

- Enforce regulations on developments that potentially impact on the habitat integrity of grasslands and wetlands.
- Landowners should be incentivised to stock livestock or wildlife at ecological carrying capacity and to maintain a buffer of natural vegetation around wetlands.

Research priorities:

- Further vetting and analysis of museum specimens is needed to correctly identify and delimit the distributions of *M. cafer* and *M. cf. tenuis*, and molecular/morphological comparisons are needed to determine whether *M. tenuis* is the correct name for this species.
- Research should be conducted to determine disturbance thresholds in various habitats (for example, ecological stocking rates, amount of natural vegetation needed to sustain a viable subpopulation, and fire intensity and frequency needed to sustain habitat complexity) needed by managers to conserve shrew species.

Encouraged citizen actions:

- Citizens are requested to submit any shrews killed by cats or drowned in pools to a museum or a provincial conservation authority for identification, thereby enhancing our knowledge of shrew distribution (carcasses can be placed in a ziplock bag and frozen with the locality recorded).

Data Sources and Quality

Table 4. Information and interpretation qualifiers for the Thin Mouse Shrew (*Myosorex cf. tenuis*) assessment

Data sources	Museum records, field study (published), Indirect information (published, unpublished)
Data quality (max)	Estimated
Data quality (min)	Inferred
Uncertainty resolution	Best estimate
Risk tolerance	Precautionary

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Details of the methods used to make this assessment can be found in *Mammal Red List 2016: Introduction and Methodology*.