Otomys laminatus – Laminate Vlei Rat

Photograph wanted

Regional Red List status (2016)	Near Threatened B2ab(i,ii,iii,iv); C1+C2a(i)*†
National Red List status (2004)	Least Concern
Reasons for change	Genuine change: Habitat decline
Global Red List status (2008)	Least Concern
TOPS listing (NEMBA)	None
CITES listing	None
Endemic	Yes

*Watch-list Threat †Conservation Dependent

This species has the highest number of laminae on both the M^3 and M_1 molars of all *Otomys* species (Monadjem et al. 2015). As increasing laminae is thought to be an evolutionary trend for increased adaptation to mesic habitats (Pocock 1976), this species is presumably the most specialised of *Otomys* species (Taylor 2013).

Assessment Rationale

This endemic species is restricted to moist grasslands and shrublands and occurs in two isolated populations in the Western Cape (Paarl and Cape Town areas) and eastern grasslands of the Drakensberg of KwaZulu-Natal and Mpumalanga provinces, as well as occasionally occurring in coastal forests. These two populations may represent separate species and should be reassessed following taxonomic resolution. The estimated area of occupancy (AOO), based on remaining natural fynbos and grassland habitat in all occupied grid cells, is 5,293 km^2. However, since it relies on moist areas, effective AOO could be as low as 95 km^2 based on a 32 m buffer of natural vegetation around remaining wetlands. There has been a 32.8% decline in natural wetlands nationally from 1990–2013/14, which is a combination of both genuine wetland loss through anthropogenic activities and the generally drier conditions currently than in 1990. There is also a continuing loss of habitat from agricultural expansion, human settlement sprawl and mining. In KwaZulu-Natal alone, there was a 1.2% loss per annum of natural habitat from 1994 and 2011, which means there has been/will be a 12% loss of habitat over a ten year time period. Climate change is also an emerging threat predicted to significantly reduce area of occupancy in the future (P. Taylor unpubl. data), and may synergise negatively with ongoing land-use change. Additionally, the species is naturally rare and population size may well be below 10,000 mature individuals based on its current patchy distribution and specialised habitat requirements. However, density estimates are needed to confirm population size and further vetting of museum records is required to delimit its distribution more accurately. Thus, under a precautionary purview, we list as Near Threatened B2ab(i,ii,iii,iv), C1 and C2a(i) based on restricted range, fragmented habitat patches, presumed small population size and ongoing and projected declines in habitat. Although the AOO is likely an underestimate, the true occupancy is not likely to be significantly over 2,000 km^2. This species should be reassessed as more specific data are available, as it may qualify for a threatened category.

Taxonomy

Otomys laminatus Thomas & Schwann 1905

ANIMALIA - CHORDATA - MAMMALIA - RODENTIA - MURIDAE - *Otomys* - *laminatus*

Synonyms: *fannini, mariepsi, pondoensis, silberbaueri*

Common names: Laminate Vlei Rat, KwaZulu Vlei Rat (English)

Taxonomic status: Species

Taxonomic notes: It is possible that the two disjunct populations represent different species (Monadjem et al. 2015). Further molecular research is needed. Five subspecies were recognised by Roberts (1951) but it is likely that the four eastern forms are synonymous with the nominate form (Meester et al. 1986).

Distribution

Endemic to South Africa with a patchy distribution in the Western Cape (Paarl and Cape Town areas) and Eastern Cape, as well as the eastern foothills of the central and northern Drakensberg in KwaZulu-Natal and Mpumalanga provinces (Monadjem et al. 2015). It occurs in the Afromontane-Afroalpine, Highveld and occasionally in the Coastal Forest Mosaic biotic zones (Taylor 2013). *Otomys* species are generally associated with mesic grasslands and moorlands within alpine, montane and sub-montane regions of southern, Central, East and West Africa (Monadjem et al. 2015). This species occurs on mid-level grasslands from sea level up to at least 2,000 m asl. It has been referred to in various publications as being recorded from Swaziland but the records for this country have no specimen basis (A. Monadjem pers. comm. 2015). Barn Owl (*Tyto alba*) pellet analysis reveals a potentially wider

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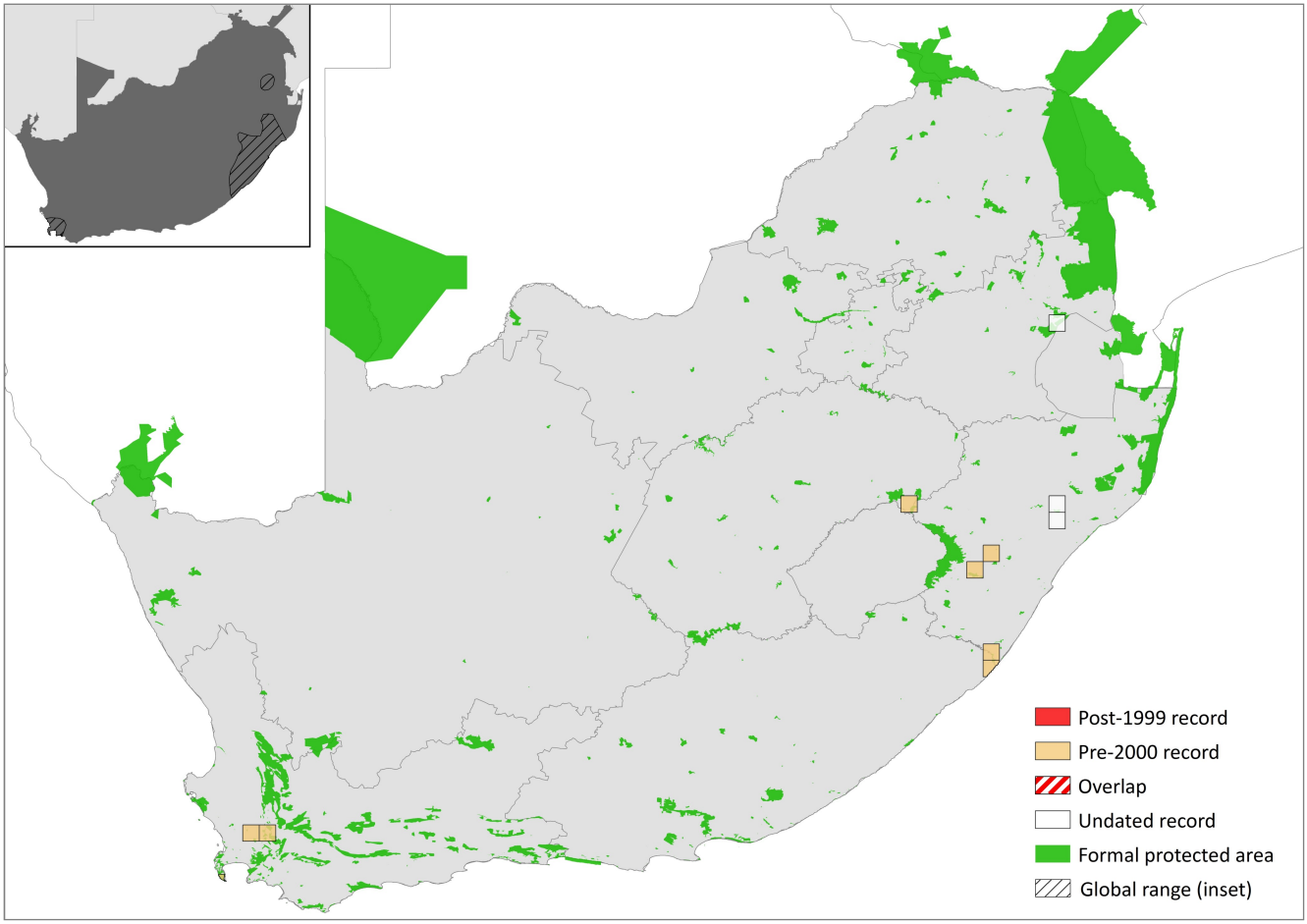

Figure 1. Distribution records for Laminate Vlei Rat (*Otomys laminatus*) within the assessment region

Table 1. Countries of occurrence within southern Africa

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

distribution in the Western Cape Province than previously recorded (Avery et al. 2005). However, further vetting of museum specimens is needed to delimit distribution more accurately.

We calculated area of occupancy based on the amount of remaining natural habitat (grassland and fynbos) in occupied grid cells using a recent (2013) land cover dataset (GeoTerraImage 2015), which is estimated to be 5,293 km^2. However, since it relies on moist areas, effective AOO could be as low as 95 km^2 based on 32 m buffer of natural vegetation around remaining wetlands. Once further localities have been mapped, AOO should be recalculated.

Population

It is considered to be uncommon. For example, it is much less common than *O. irroratus* although occurring in similar habitats (Taylor 2013). However, it is occasionally common; for example, it was the only species of *Otomys* trapped in a pine plantation (N = 56; P. J. Taylor unpubl. data). The population size is currently unknown but there is very low trapping success for this species throughout its range. As such, there may be fewer than 10,000 mature individuals.

Current population trend: Declining

Continuing decline in mature individuals: No

Number of mature individuals in population: Unknown

Number of mature individuals in largest subpopulation: Unknown

Number of subpopulations: Two

Severely fragmented: Yes. Two major subpopulations are isolated from each other. Additionally, most grassland patches are fragmented throughout its range.

Habitats and Ecology

It occurs in mesic sub-montane grasslands along the Drakensberg foothills and has also been recorded from coastal forests as well as *Restio*-dominated coastal and mountain fynbos (de Graaff 1981; Taylor et al. 1994; Taylor 1998). Specifically, it inhabits moist habitats such as wetlands and marshes. It may also occur in pine plantations (Taylor 2013), but more research is necessary to determine the extent of this habitat use. It is not known whether it occurs in agricultural landscapes.

It is probably entirely vegetarian, feeding on shoots and stems of grasses, Restio and small shrubs (de Graaff

Table 2. Threats to the Laminate Vlei Rat (*Otomys laminatus*) 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	*2.1.3 Agro-industry Farming*: wetland and grassland habitat loss from agricultural expansion. Current stress *1.2 Ecosystem Degradation.*	Driver et al. 2012 Pence 2012 Lötter 2015 Jewitt et al. 2015 GeoTerraImage 2015	Indirect Indirect Indirect Indirect Indirect	National Regional Regional Regional National	Ongoing
2	*2.1.2 Small-holder Farming*: wetland and grassland habitat loss from agricultural expansion. Current stress *1.2 Ecosystem Degradation.*	Driver et al. 2012 Pence 2012 Lötter 2015 Jewitt et al. 2015 GeoTerraImage 2015	Indirect Indirect Indirect Indirect Indirect	National Regional Regional Regional National	Ongoing
3	*2.3.3 Agro-industry Grazing, Farming or Ranching*: wetland and grassland habitat loss from agricultural expansion. Current stress *1.2 Ecosystem Degradation*: from overgrazing.	Bowland & Perrin 1989, 1993 Driver et al. 2012 Pence 2012 Lötter 2015 Jewitt et al. 2015 GeoTerraImage 2015	Empirical Indirect Indirect Indirect Indirect Indirect	Local National Regional Regional Regional National	Ongoing
4	*2.3.2 Small-holder Grazing, Ranching or Farming*: wetland and grassland habitat loss from agricultural expansion. Current stress *1.2 Ecosystem Degradation*: from overgrazing.	Bowland & Perrin 1989, 1993 Driver et al. 2012 Pence 2012 Lötter 2015 Jewitt et al. 2015 GeoTerraImage 2015	Empirical Indirect Indirect Indirect Indirect Indirect	Local National Regional Regional Regional National	Ongoing
5	*1.1 Housing & Urban Areas*: wetland and grassland habitat loss from settlement expansion. Current stress *1.2 Ecosystem Degradation*.	Driver et al. 2012 Pence 2012 Lötter 2015 Jewitt et al. 2015 GeoTerraImage 2015	Indirect Indirect Indirect Indirect Indirect	National Regional Regional Regional National	Ongoing
6	*3.2 Mining & Quarrying:* wetland and grassland habitat loss from mining expansion.	Driver et al. 2012 Pence 2012 Lötter 2015 Jewitt et al. 2015 GeoTerraImage 2015	Indirect Indirect Indirect Indirect Indirect	National Regional Regional Regional National	Ongoing
7	*2.2.2 Agro-industry Plantations:* wetland and grassland habitat loss from forestry plantations. Current stress *1.2 Ecosystem Degradation*.	Driver et al. 2012 Pence 2012 Lötter 2015 Jewitt et al. 2015 GeoTerraImage 2015	Indirect Indirect Indirect Indirect Indirect	National Regional Regional Regional National	Ongoing
8	*11.1 Habitat Shifting & Alteration*: loss of habitat from climate change.	Taylor et al. 2016	Projected	National	Increasing

1981). *Otomys* species are generally K-selected, giving birth usually to one or two offspring (maximum five), which are precocial (Monadjem et al. 2015). They have a number of predators including felids, jackals, mongooses, genets, snakes and different owl species (*Otomys* skulls typically comprise the bulk of owl pellets) (Monadjem et al. 2015).

Ecosystem and cultural services: Vlei rats are important food for a number of mammalian predators, as well as raptors such as Marsh Owls (*Asio capensis*) and Barn Owls (Skinner & Chimimba 2005; Monadjem et al. 2015). For example, Vlei rats are favoured food by the Serval (*Leptailurus serval*) (Bowland 1990), so their range expansion could be interrelated (Power 2014).

Use and Trade

This species is not known to be traded or utilised in any form.

Threats

There are three main threats that may cause significant population decline in the near future:

1. Grassland and wetland habitat loss from agricultural expansion, human settlement sprawl and mining (see Current habitat trend). In Mpumalanga, for example, only 51% of the grasslands are still natural and not previously ploughed and 40% of the grassland vegetation types are listed as threatened (Lötter 2015). Water abstraction or filling in of wetlands from human settlement and industrial expansion also leads to habitat loss. Similarly, suppression of natural ecosystem processes, such as fire, can also lead to habitat degradation through bush encroachment or loss of plant diversity through alien invasive species, and is suspected to be increasing with human settlement expansion. Overall, 45% of our remaining wetland area exists in a heavily modified condition, due primarily to onsite modification from crop

Table 3. Conservation interventions for the Laminate Vlei Rat (*Otomys laminatus*) ranked in order of effectiveness with corresponding evidence (based on IUCN action categories, with regional context)

Rank	Intervention description	Evidence in the scientific	Data quality	Scale of evidence	Demonstrated impact	Current conservation
1	*5.2 Policies & Regulations*: prioritising previously cultivated areas "old lands" for development.	-	Anecdotal	-	Unknown	-
2	*2.3 Habitat & Natural Process Restoration*: wetland conservation and restoration.	-	Anecdotal	-	Unknown	-
3	*2.1 Site/Area Management*: holistic management of ranchlands to reduce impacts of overgrazing.	-	Anecdotal	-	Unknown	-

cultivation, coal mining, urban development, dam construction, and overgrazing (and thus erosion) and off-site modifications from disruptions to flow regime and deterioration of water quality (Driver et al. 2012).

2. Overgrazing the vegetation around wetlands reduces ground cover and thus leads to decreased small mammal diversity and abundance (Bowland & Perrin 1989, 1993).The expansion of wildlife ranching will have to be monitored in this regard, as game overstocking may also affect wetland condition.
3. Climate change is projected to reduce area of occupancy significantly by reducing temperate grasslands and fynbos habitats. For example, climate models for the similarly mesic-adapted species, *O. irroratus* and *O. auratus*, show a decline in area of occupancy of 12–24% and 47–61% by 2050 respectively (Taylor et al. 2016). Overgrazing and climate change may synergise to cause non-linear and accelerating population decline. More research is needed to validate these hypotheses.

Current habitat trend: Declining. Wetlands are the most threatened ecosystem in South Africa (Driver et al. 2012). The South African National Land-Cover Change Report found a 32.8% decline in natural wetlands nationally from 1990–2013/14, which is a combination of both genuine wetland loss through anthropogenic activities and the generally drier conditions currently than in 1990 (GeoTerraImage 2015). In the Western Cape specifically, 31% of all wetlands (plus a 32 m buffer) and riparian areas have been transformed or lost to agricultural land use (Pence 2012). Habitat loss due to land transformation in the surrounding matrix further isolates wetlands from one another and exacerbates the degradation of individual wetlands. For example, sugarcane and forestry plantations are often planted right up to wetlands edges, not respecting the appropriate buffer. In KwaZulu-Natal alone, there has been an average loss of natural habitat of 1.2% per annum between in 1994 and 2011 from agriculture, plantations, built environments and settlements, mines and dams (Jewitt et al. 2015). Although no specific rates of habitat loss are available, 61% of Mpumalanga's land surface between 2000 and 2014 has come under pressure from prospecting applications (Lötter 2015).

Conservation

This species is presumably present in several protected areas, but these remain to be documented comprehensively. Mitigating habitat loss outside of protected areas is urgent. The following interventions should be implemented:

1. Using previously cultivated areas for development instead of remaining natural areas: In Mpumalanga, for example, old lands or previously ploughed areas now left fallow make up 8.9% of the grassland biome (Lötter 2015), and these areas should be prioritised for further development. Similarly, in KwaZulu-Natal, abandoned agricultural fields on marginal lands offer an opportunity for further development instead of transforming virgin land and at least 4% of the landscape is available for this (Jewitt et al. 2015).
2. Wetland conservation and restoration: land managers should maintain a vegetation buffer to reduce impacts of land-use practices (Driver et al. 2012).
3. Holistic management of ranch lands: including de-stocking, rotational grazing and buffering wetland vegetation, are encouraged.

Recommendations for land managers and practitioners:

- Land managers should decrease stocking rates to maintain vegetation around wetlands.
- Prioritise old fields for development in systematic conservation planning.

Research priorities:

- Long-term, systematic monitoring is needed to establish subpopulation trends and threat levels.
- Fine scale studies on habitat loss and inferred impact on the species.
- Effects of overgrazing on the density and viability of this species.
- Effects of habitat connectivity on dispersal rates.
- Further vetting of museum records to delimit distribution more accurately.

Data Sources and Quality

Table 4. Information and interpretation qualifiers for the Laminate Vlei Rat (*Otomys laminatus*) assessment

Data sources	Museum records, indirect information (literature)
Data quality (max)	Inferred
Data quality (min)	Suspected
Uncertainty resolution	Expert consensus
Risk tolerance	Precautionary

Encouraged citizen actions:

- Report vlei rat sightings on virtual museum platforms (for example, iSpot and MammalMAP): The feeding signs of this species are easy to detect by short chopped lengths of grass and green moist faecal pellets (Skinner & Chimimba 2005).

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