

# *Neamblysomus julianae* – Juliana’s Golden Mole



**Taxonomic status:** Species and subpopulation

**Taxonomic notes:** Bronner (1995, 2013) assigned this species to the genus *Neamblysomus*. Consistent colour, dental and DNA differences exist between the topotypical subpopulations from the eastern (Kruger National Park) and western geographical extremes (Bronberg Ridge and Modimolle) of its distributional range suggesting that these are potentially distinct species (Bronner 1990, 1995). Furthermore, ongoing molecular research suggests pronounced genetic partitioning between the Kruger National Park (KNP) and the other two subpopulations (Maree et al. 2003; Jackson 2007). More specimens from the KNP area are urgently needed to clarify the taxonomic status of this subpopulation. The outcome could have profound implications for the conservation status of the species.

<b>Regional Red List status (2016)</b>	<b>Endangered B2ab(iii)*</b>
<b>Bronberg Ridge subpopulation</b>	<b>Critically Endangered B1ab(ii,iii,iv) + 2ab (ii,iii,iv)*†</b>
National Red List status (2004)	Vulnerable B2ab(ii,iii)
<i>Bronberg Ridge subpopulation</i>	Critically Endangered A2c; B1ab (i-v) + B2ab (i-v)
Reasons for change	Non-genuine change: New information
<i>Bronberg Ridge subpopulation</i>	No change
Global Red List status (2015)	Endangered B2ab(iii)
<i>Bronberg Ridge subpopulation</i>	Critically Endangered B1ab(ii,iii,iv) + 2ab (ii,iii,iv)
TOPS listing (NEMBA)	None
CITES listing	None
Endemic	Yes

\*Watch-list Data †Conservation Dependent

This is the only golden mole that is actually golden in colour – the fur of the other species ranges from orange through varying shades of brown to black. The name “golden moles” refers not to fur colour but to the iridescent sheen on the fur of all species.

## Assessment Rationale

In 2004 and 2008 the species was listed as Vulnerable in view of estimated area of occupancy (AOO; < 2,000 km<sup>2</sup>). New information led to more accurate calculations of AOO (160 km<sup>2</sup>) and confirmed that the population is severely fragmented. It is known from only three isolated and range-restricted subpopulations in South Africa, two of which occur within protected areas. There are no intermediate distribution records suggesting no gene flow between them. Only a small part of the range of the subpopulation occurring in and around Nylsvley Provincial Nature Reserve (Modimolle district, Limpopo), falls within this protected area; the rest being in adjoining farmlands where suitable habitat is subject to severe alteration, degradation and fragmentation. Although almost the entire range of the KNP subpopulation (Mpumalanga) is protected in the south-western section of the park, road infrastructure may form barriers that impede golden mole movements. For these reasons the species has been up-listed to Endangered status.

The Bronberg Ridge subpopulation, lying east of Pretoria (Tshwane, Gauteng), is treated as a distinct subpopulation, as there are no intermediate locality records or evidence of gene flow between this subpopulation and the other two geographically isolated subpopulations documented in South Africa. Localities documented in the Bronberg area do not fall in any national or provincial protected areas. Much of its natural sandy habitat has been dramatically altered, degraded and fragmented as a result of intense urbanisation and high-density housing developments along nearly the entire length of its very restricted extent of occurrence (EOO; 9.2 km<sup>2</sup>) on the Bronberg Ridge. Its entire distributional range has been fragmented into four sections by two major roads and a housing development. Quartzite mining operations pose an additional and severe threat of destroying the sole remaining primary east-west dispersal corridor inside the largest intact section of remaining natural habitat (about 7.5 km x 0.9 km), and thus requires urgent conservation interventions. Such impacts are known to lead to genetic erosion (reduced

## Taxonomy

*Neamblysomus julianae* (Meester 1972)

ANIMALIA - CHORDATA - MAMMALIA - AFROSORICIDA - CHRYSOCHLORIDAE - *Neamblysomus julianae*

**Synonyms:** *Amblysomus julianae* (Meester 1972)

**Common names:** Juliana’s Golden Mole (English), Juliana se Gouemol (Afrikaans)

**Recommended citation:** Maree S, Bennett NC, Bronner GN. 2016. A conservation assessment of *Neamblysomus julianae*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Selier J, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

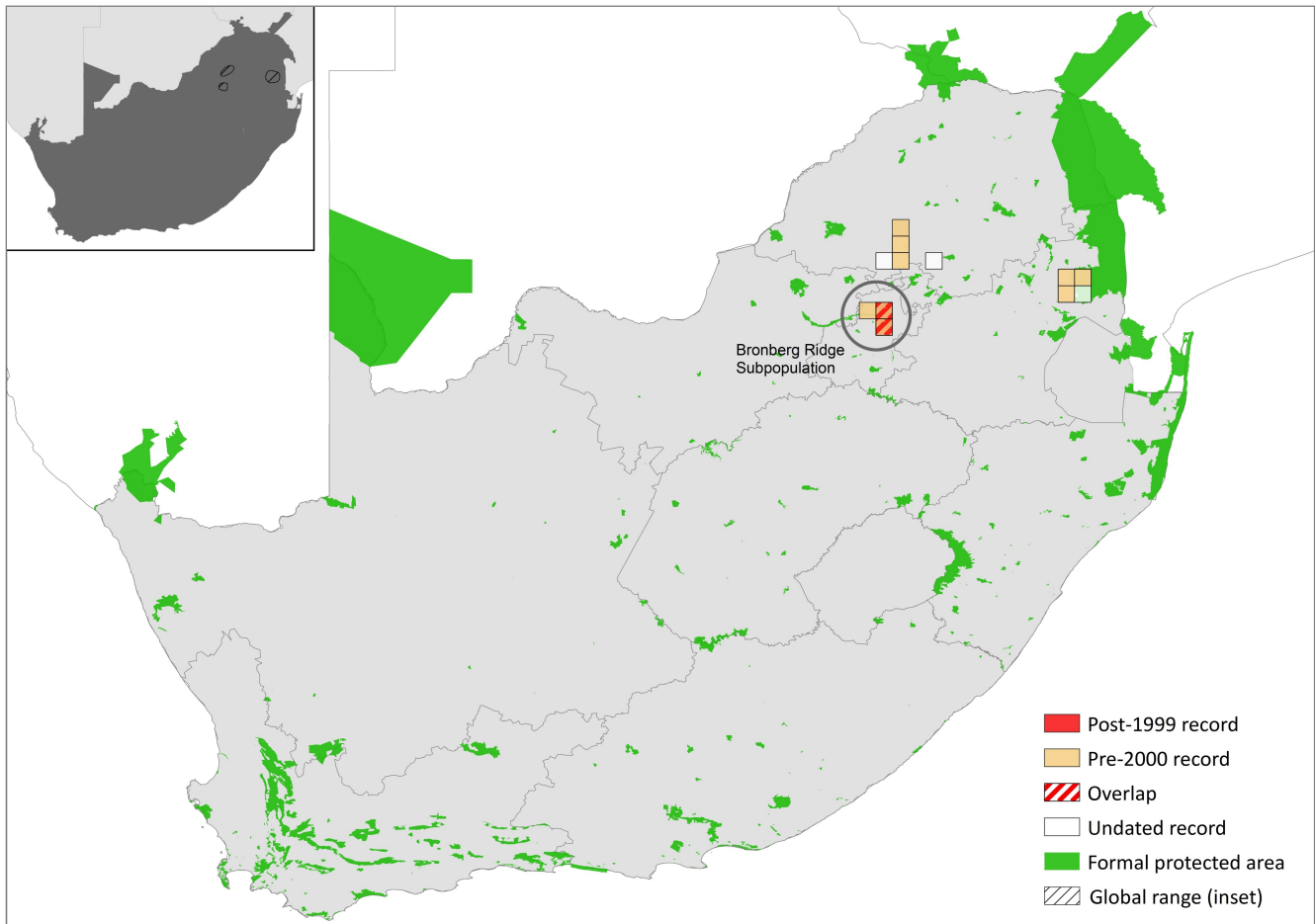


Figure 1. Distribution records for Juliana's Golden Mole (*Neamblysomus julianae*) within the assessment region

Table 1. Countries of occurrence within southern Africa

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

variability and inbreeding) and reduced population viability (also see **Conservation**). Therefore the reassessment confirms Critically Endangered status for this subpopulation.

## Distribution

Three geographically separated subpopulations have been documented:

1. The Bronberg Ridge east of Tshwane (Pretoria), Gauteng. Records have been confirmed at 10 sites including west and south of Willows Quarry, The Willows, The Glades, Wapadrand, Shere Agricultural Holdings, Bronberg Conservancy and Tygerpoort Primary School on the northern slopes, and Olympus and Zwavelpoort on the southern slopes of the ridge (Jackson et al. 2007). These sites are considered to

represent one location, as intense threats (habitat loss and alteration) could lead to rapid and severe reduction or elimination of the entire subpopulation.

2. Nylsvley flood plain, Modimolle district, Limpopo. Recorded from Nylsvley Provincial Nature Reserve and surrounding farms to the south, south-east and south-west of it (Jackson et al. 2008b; Jackson & Robertson 2011).
3. Numbi Gate, Pretoriuskop and Matjulwana districts of the south-western Kruger National Park, in the Lowveld of Mpumalanga Province (Jackson et al. 2008b).

The very restricted ranges of these subpopulations are possibly insufficient to ensure the long-term persistence of the species (Jackson & Robertson 2011). A Species Distribution Model (SDM) compiled for all three populations using ecological niche modelling identified limited potentially suitable habitat for the species and enabled identification of two previously unrecorded localities in the Modimolle area (Jackson & Robertson 2011). The first site was c. 20 km due south of the town of Modimolle and the second site was c. 80 km south east of Modimolle; and are further than 35 km and 24 km respectively from the nearest known occurrence of the species). This confirms previous suggestions of a wider distribution in the Modimolle area based on skull fragments identified from owl pellets at Witkoppen Cave, c. 25 km east of Nylsvley Nature Reserve (Bronner 2013). No new subpopulations were found in Gauteng.

## Population

Juliana's Golden Mole is considered locally common, with 2–3 individuals / ha in prime habitat. However, dispersion is patchy and clumped within each subpopulation owing to specialized habitat requirements (for example, soil properties; Jackson et al. 2008b).

**Current population trend:** Unknown (*N. juliana*); declining (*N. juliana* Bronberg Ridge subpopulation).

**Continuing decline in mature individuals:** Unknown (*N. juliana*); yes (*N. juliana* Bronberg Ridge subpopulation).

**Number of mature individuals in population:** Unknown

**Number of mature individuals in largest subpopulation:** Unknown

**Number of subpopulations:** Three

**Severely fragmented:** Yes, this species is only recorded from three geographically isolated subpopulations in South Africa.

## Habitats and Ecology

This species is confined to sandy soils with tree or vegetation cover (Jackson et al. 2008a, 2008b), often in pockets of weathered sandstone associated with rocky ridges, in the savannah biome of South Africa, and marginally into the grassland biome in the Tshwane district (Gauteng). The subpopulation on Nylsvley floodplain occurs in Clay Thorn Bushveld, the Bronberg Ridge subpopulation east of Tshwane in Rocky Highveld Grassland, whereas the KNP locations occur in Sour Lowveld Bushveld. *N. juliana* is common in well-irrigated suburban and rural gardens and small-holdings supporting livestock. They are, however, absent from grasslands on the heavier soils of the Mpumalanga escarpment where the larger-sized *A. septentrionalis* and *A. robustus* instead occur.

The species' presence is positively correlated with soil features (poorly graded size distribution of sand particles) that determine soil density, drainage, compatibility, and texture and penetration resistance. These influence energy expenditure of these golden moles during sand swimming/tunnelling (Jackson et al. 2008b). Subsurface foraging tunnels are visible as broken ridges on the soil surface. Most foraging activity occurs within the upper layer of 10–20 cm (Bronner & Bennett 2005), mainly in the late afternoon and early evening. Contrary to earlier reports of strictly nocturnal activity regimes, bimodal (but flexible) diurnal/nocturnal activity patterns were recently documented by radio-telemetry tracking of one specimen for six days in Nylsvley Nature Reserve (Jackson et al. 2008b, 2009). Activity patterns were primarily dependent on ambient soil temperatures ( $T_a$ ) and the same resting sites were consistently used. Body temperature fluctuated according to  $T_a$  and bouts of shallow torpor were recorded during periods of low soil  $T_a$  (Jackson et al. 2009).

**Ecosystem and cultural services:** Not known to provide any ecosystem services, but this may simply reflect the paucity of information available for this poorly known species.

## Use and Trade

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

## Threats

Inferred major threats are habitat loss, modification and fragmentation as a result of anthropogenic activities. For example, urban expansion in Gauteng, Limpopo and Mpumalanga has increased by 7.5%, 13% and 9.5% respectively between 2000 and 2013 (GeoTerralimage 2015). The type population on Bronberg Ridge (Gauteng) is severely impacted by degradation, fragmentation and loss of its natural soil habitat owing to intensive

**Table 2. Threats to the Juliana's Golden Mole (*Neamblysomus juliana*) 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 <i>Agro-industry Farming</i> : habitat loss from agricultural expansion and habitat degradation from ecologically poor agricultural practices.	Driver et al. 2012	Indirect (remote sensing)	National	Stable, but degradation possibly increasing.
		Jackson et al. 2008a,b	Indirect (correlational)	Regional (3 sites)	
2	1.1 <i>Housing &amp; Urban Areas</i> : habitat loss and degradation from residential and urban development and associated infrastructure.	GeoTerralimage 2015	Indirect (remote sensing)	Regional	Increasing
3	1.2 <i>Commercial &amp; Industrial Areas</i> : habitat loss and degradation from residential and urban development and associated infrastructure.	GeoTerralimage 2015	Indirect (remote sensing)	Regional	Increasing
4	3.2 <i>Mining &amp; Quarrying</i> : habitat loss from mining activities.	Driver et al. 2012	Indirect	National	Increasing (based on number of prospecting applications received).
		MTPA 2014	Indirect	Regional	
5	2.3.2 <i>Small-holder Grazing, Ranching or Farming</i> : habitat degradation from overgrazing.	-	Anecdotal	-	-
6	8.1.2 <i>Invasive Non-Native/Alien Species/ Diseases</i> : predation by domestic pets.	-	Anecdotal	-	-

urbanisation and an expanding quartzite mining operation within its highly restricted range. The extent of occurrence of this subpopulation has been fragmented into four sections by two major roads and a housing development. Quartzite mining operations pose an additional and severe threat of destroying the sole remaining primary east-west dispersal corridor inside the largest intact patch of remaining natural habitat (about 7.5 km x 0.9 km) (Jackson 2007; Jackson et al. 2008b). Such impacts may lead to genetic erosion (reduced genetic variability via inbreeding) and reduced population viability.

While the other two subpopulations (Modimolle district and south-western KNP) occur within protected areas, there are no intermediate distribution records suggesting gene flow between them. Agricultural practices on farms surrounding the subpopulation from the vicinity of Nylsvley Provincial Nature Reserve are altering and degrading patches of suitable habitat on farms (Jackson et al. 2007, 2008a, 2008b), and could be reducing numbers at some locations of the Modimolle subpopulation. Road infrastructure in KNP (soil compaction) may create barriers for golden mole movement. The direct and indirect impacts of various land uses on the species and its natural habitat may be poorly understood, but habitat fragmentation (especially in range-restricted taxa) causes obstructions to animal movement and thus prevents gene flow, increases inbreeding potential, reduces genetic variability and increases risk of extinction.

The species' elusive habits often obscure signs of its presence. Developers committed to following recommendations of Environmental Management Plans (EMP) and Requirements of Development (RoD) are reliant on golden mole specialists for guidance in respect of minimising impacts on the species. If genetic clarification reveals that two taxa exist within the current extent of occurrence (see **Taxonomic Notes**), adequate measures to protect the reduced distributional ranges of each taxon would be all the more important.

Inferred minor threats are predation by domestic pets and persecution by gardeners and land owners.

**Current habitat trend:** Declining in area and quality. In Mpumalanga, 40% of the grassland vegetation types are

listed as threatened and only 51% of the grasslands are still natural and previously not ploughed (MTPA 2014). The Mpumalanga Parks and Tourism Agency (MTPA) mapped all development applications received at a cadastral scale over a 14-year period (2000–2014) and showed that greatest pressure for land-use change has come from prospecting applications (54% of the land surface area of Mpumalanga) and mining (25% of land surface area). The province can anticipate much greater expansion in the mining sector than ever before (MTPA 2014). In Gauteng, there has been a 13% loss of natural habitat between 1995 and 2009 (Driver et al. 2012). Much suitable habitat remaining within their very limited range along the Bronberg Ridge is undergoing severe transformation and fragmentation as a result of urbanisation and quartzite mining. The size and connectedness of the remaining patches of suitable habitat will define if they can sustain golden moles (Jackson 2007; Jackson et al. 2007; Jackson & Robertson 2011).

## Conservation

Two of the three known subpopulations are protected within the KNP (south-western Pretoriuskop, Matjuluwana and Numbi gate areas) and Nylsvley Provincial Nature Reserve, but the most threatened Bronberg Ridge subpopulation is unprotected. In the former Transvaal Province (South Africa), this species was given the highest regional conservation priority score for mammals based on regional occupancy, relative taxonomic distinctiveness, endemism and vulnerability (Freitag & van Jaarsveld 1997). It was listed as Vulnerable under the Threatened or Protected Species (ToPS) Regulations of the National Environmental Management: Biodiversity Act of 2004 (NEMBA 2004), but will no longer be protected by ToPS as it was suggested that the species is not directly utilised by humans.

No Biodiversity Management Plan exists for the entire species. However, a multifaceted approach will be required to successfully conserve the species for future generations. In the short term, it is imperative that current attempts to integrate the available scientific data on the species with policy and legislation persist. This will require concerted efforts including legal intervention, commenting

**Table 3. Conservation interventions for the Juliana's Golden Mole (*Neamblysomus julianae*) 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	1.1 <i>Site/Area Protection</i> : protected area expansion and biodiversity schemes based on key identified sites.	Jackson & Robertson 2011	Indirect	Regional	-	GDARD
2	2.1 <i>Site/Area Management</i> : land managers should reduce stocking rate and conserve vegetation/tree cover.	Jackson et al. 2008a	Indirect	Regional	-	None
3	5.4 <i>Compliance &amp; Enforcement</i> : stricter law enforcement of existing legislation.	-	Anecdotal	-	-	GDARD
4	5.1 <i>Legislation</i> : creation of new laws to protect the Bronberg Ridge subpopulation.	-	Anecdotal	-	-	None
5	4.3 <i>Awareness &amp; Communications</i> : public education and awareness campaigns to increase support or conservation.	-	Anecdotal	-	-	None

on biodiversity policy and legislation drafts, increased pressure from non-governmental conservation organizations, residents associations and the general public to ensure that laws, policies and regulations warranting its protection are enforced. Provincial and national regulatory bodies should be informed of the severe threats facing this ancient and biologically unique species.

Enforcement of existing legislation is urgently needed to conserve the Bronberg Ridge subpopulation. According to the Gauteng Ridge Policy (Pfab 2001), the Bronberg is a Class 2 ridge (5%–35% has been transformed) and a no-go development policy is applicable, whereby only low impact developments will be considered, but then a full Environmental Impact Assessment (including public participation) is required. Gauteng Department of Agriculture, Conservation and Land Affairs (GDACEL), now Gauteng Department of Agriculture and Rural Development (GDARD), commissioned a Strategic Environmental Assessment to assist in formulating a policy to regulate development and activities in this area. The sensitive nature of the Bronberg ecosystem as a whole was emphasized in the Gauteng Conservation Plan version 2 (C-Plan-2, 2006) and version 3 (C-Plan-3, 2011). The authors of this report, based at various departments at the University of Pretoria, started researching certain aspects of the ecology and evolutionary relationships of Juliana's Golden Mole (*Neamblysomus julianae*) in 2003. The Gauteng Department of Agriculture, Conservation and Environment (GDACE) appointed and tasked a specialist researcher with compiling a conservation assessment of the Bronberg subpopulation of the species, based on ecological and molecular genetic findings that culminated in a conservation management plan, specifying actions to be implemented in an attempt to successfully conserve this critically endangered population (Jackson et al. 2007).

Despite all these actions, and a separate EIA tabled by EcoAssessments C.C. on behalf of local landowners, the Department of Mineral and Energy Affairs in 2003 re-issued a mining permit to allow mining to continue into the foreseeable future. In the last quarter of 2013, the Department of Mineral Resources (DMR) approved an intervention strategy for rehabilitation and stabilising of a slippage area in the quarry that will result in the loss of a substantial portion of the largest continuous sections of suitable habitat for the species remaining on the ridge, and destroy the primary east-west movement corridor in the process. Golden mole specialist researchers confirmed the presence of and suitable habitat for the species and strongly advised against the planned intervention. Moreover, several residential and commercial developments have also been approved (last 5–7 years) in areas where clear signs of fresh activity and suitable habitat for the species were found. Local residents (Shere Residents Association) fiercely opposed the destruction of the Bronberg ecosystem and resident golden moles through legal action appeals via the NEMA process (National Environmental Management Authorities), yet these were all unsuccessful.

Sustained and concerted efforts, including legal interventions, are needed to ensure support for GDARD in implementing their policies and to convince relevant provincial and national regulatory bodies of the dire threats to this population. Non-governmental conservation and legal organisations have now become involved in actions to oppose such developments. Additionally, public education efforts should be sustained and expanded

(especially among residents and local schools) to raise the public profile of this species. Current research on systematics status of the Pretoria subpopulation should be expanded to incorporate conservation genetics data, and a thorough risk assessment should be conducted.

#### **Recommendations for land managers and practitioners:**

- A Biodiversity Management Plan should be developed for this species. Two subpopulations, Modimolle and KNP, do not have systematic monitoring schemes; but the Bronberg Ridge subpopulation has a monitoring scheme in its preliminary phase. GDARD has exercised strict control over developmental actions that could destroy the remaining patches of natural habitat inhabited by the Bronberg Ridge subpopulation (and the larger Bronberg ecosystem). GDARD has also consistently applied the Gauteng Ridge Policy (Pfab 2001), a Strategic Environmental Assessment of the larger Bronberg Ridge area and the Gauteng Conservation Plan (Compaan 2011). The Species Distribution Model for Juliana's Golden Mole (Jackson & Robertson 2011) was integrated in the mammal layer of the Gauteng C-plan 3.3 (Compaan 2011). Golden mole specialists are also required to provide all confirmed locality information to GDARD for updating the sensitivity layer. A draft Biodiversity Management Plan for the Bronberg Ridge subpopulation has been compiled by GDARD officials in association with golden mole specialists (IUCN SSC Afrotheria Specialist Group), based on Jackson et al. (2007). GDARD officials are also monitoring the subpopulation, yet structured surveys of its natural habitat in the area still need to be implemented.
- Incentivise landowners to de-stock to reduce compacting soils as this species needs poorly graded soils and soft soil substrates (Jackson et al. 2008b), and to maintain tree cover, such as *Terminalia sericea* and *Burkea africana* to provide shade and vegetation debris over the soils (Jackson et al. 2008a).
- A thorough risk assessment should be done for each subpopulation to determine the effects of multiple land uses on the suitable habitat remaining in its distributional range.

#### **Research priorities:**

- In the long term, many aspects of its distribution, general biology, ecology, physiology, population trends, taxonomy and population genetics require further investigation to achieve effective conservation management strategies for the future. However, these should build on foundations already set (Bronner 1995, 2013; Maree et al. 2003; Jackson et al. 2008a, 2009; Jackson & Robertson 2011).
- Current research on the systematics status of subpopulations should be concluded and expanded to assess genetic differentiation at a regional and local scale.
- Field surveys to discover other subpopulations and key sites for priority protection. Such surveys can be guided by the model developed by Jackson and Robertson (2011) which has already been used to successfully identify two previously unrecorded subpopulations (in the vicinity of the Nylsvley subpopulation).

## Encouraged citizen actions:

- Report sightings on virtual museum platforms (for example, iSpot and MammalMAP). However, due to their subterranean lifestyle, citizen sightings may be rare.
- Look for distinctive signs of activity (surface runways in deep pockets of sand on hillsides and ridges in bushveld habitats, particularly in eastern Pretoria where rapid urbanisation is degrading available habitat) and report locations (with as much detail as possible) to the IUCN SSC Afrotheria Specialist Group (<http://www.afrotheria.net/>).
- Deposit any dead specimens found in a state or provincial museum, together with information on the date and site where found.
- Create indigenous vegetation gardens.

## Data Sources and Quality

**Table 4. Information and interpretation qualifiers for the Juliana's Golden Mole (*Neamblysomus julianae*) assessment**

Data sources	Field surveys (literature, unpublished), indirect information (literature, unpublished), museum records
Data quality (max)	<i>N. julianae</i> ~ Inferred <i>N. julianae</i> Bronberg Ridge subpopulation ~ Estimated
Data quality (min)	<i>N. julianae</i> ~ Inferred <i>N. julianae</i> Bronberg Ridge subpopulation ~ Suspected
Uncertainty resolution	Best estimate
Risk tolerance	Evidentiary

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## Assessors and Reviewers

**Sarita Maree<sup>1†</sup>, Nigel C. Bennett<sup>1</sup>, Gary Bronner<sup>2†</sup>**

<sup>1</sup>University of Pretoria, <sup>2</sup>University of Cape Town

<sup>†</sup>IUCN SSC Afrotheria Specialist Group

## Contributors

**Andrew Taylor<sup>1</sup>, Claire Relton<sup>1</sup>, Matthew F. Child<sup>1</sup>**

<sup>1</sup>Endangered Wildlife Trust

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