Pronolagus spp. – Red rock hares


Pronolagus rupestris Beryl Wilson

Regional Red List status (2016)	
Pronolagus crassicaudatus	**Least Concern***
Pronolagus randensis	**Least Concern**
Pronolagus rupestris	**Least Concern*†**
Pronolagus saundersiae	**Least Concern**
National Red List status (2004)	
Pronolagus crassicaudatus	Least Concern
Pronolagus randensis	Least Concern
Pronolagus rupestris	Least Concern
Pronolagus saundersiae	Least Concern
Reasons for change	No change
Global Red List status (2008)	
Pronolagus crassicaudatus	Least Concern
Pronolagus randensis	Least Concern
Pronolagus rupestris	Least Concern
Pronolagus saundersiae	Least Concern
TOPS listing (NEMBA)	None
CITES listing	None
Endemic	
Pronolagus crassicaudatus	Near
Pronolagus randensis	No
Pronolagus rupestris	No
Pronolagus saundersiae	Yes

*Watch-list Data †Watch-list Threat

Shortridge (1934) said Red Rock Hares 'vanish like shadows behind rocks or down rock crevices on the slightest alarm'.

Taxonomy

Pronolagus crassicaudatus (I. Geoffroy 1832)

Pronolagus randensis Jameson 1907

Pronolagus rupestris (A. Smith 1834)

Pronolagus saundersiae (Hewitt 1927)

ANIMALIA - CHORDATA - MAMMALIA - LAGOMORPHA - LEPORIDAE - *Pronolagus*

Synonyms: *Pronolagus crassicaudatus*: *kariegae, lebombo, lebomboensis (lapsus), ruddi* (Happold 2013a); *Pronolagus randensis*: *capricornis, caucinus, ekmani, kaokoensis, koboensis, maka-pani, powelli, waterbergensis, whitei* (Happold 2013b); *Pronolagus rupestris*: *curryi, fitzsimonsi, melanurus, mülleri, nyikae, vallicola* (Happold 2013c); *Pronolagus saundersiae*: *australis, barrette* (Happold 2013d)

Common names: *Pronolagus crassicaudatus*: Natal Red Rock Hare, Natal Red Rock Rabbit, Greater Red Rockhare, Natal Red Rockhare (English), Natal se Rooiklipkonyn (Afrikaans); *Pronolagus randensis*: Jameson's Red Rock Hare, Jameson's Red Rabbit, Jameson's Red Rockhare (English), Jameson se Rooiklipkonyn (Afrikaans); *Pronolagus rupestris*: Smith's Red Rock Hare, Smith's Red Rock Rabbit, Smith's Red Rockhare (English), Smith se Rooiklipkonyn (Afrikaans); *Pronolagus saundersiae*: Hewitt's Red Rock Hare, Hewitt's Red Rock Rabbit (English), Hewitt se Rooiklipkonyn (Afrikaans)

Taxonomic status: Species

Taxonomic notes: *Pronolagus crassicaudatus* was previously considered a subspecies of *P. randensis* but is now considered a valid species (Happold 2013a). According to Hoffmann and Smith (2005), there are two recognised Natal Red Rock Hare subspecies: *P. crassicaudatus crassicaudatus* and *P. c. ruddi*. Duthie and Robinson (1990) also include *P. c. kariegae*, *P. c. bowkeri*, and *P. c. lebombo*. These are of doubtful validity (Happold 2013a).

For Jameson's Red Rock Hare, there are three recognised subspecies: *Pronolagus randensis caucinus*, *P. r. randensis* and *P. r. whitei* (Hoffmann & Smith 2005). However, mitochondrial DNA analyses suggest little geographical variation and thus the validity of the subspecies is in question (Happold 2013b).

Pronolagus rupestris was previously included in *P. crassicaudatus* but is now considered a valid species (Happold 2013c). For Smith's Red Rock Hare, there are four recognised subspecies: *P. r. curryi*, *P. r. nyikae*, *P. r. saundersiae*, and *P. r. vallicola* (Hoffmann & Smith 2005). There has been some contention as to the number of possible subspecies of *P. rupestris*; however, until the biological and exact taxonomic status of these clades is clearer, the treatment of Meester et al. (1986) is provisionally upheld. Although the species occurs in both South Africa and East Africa, it is unlikely that there is any

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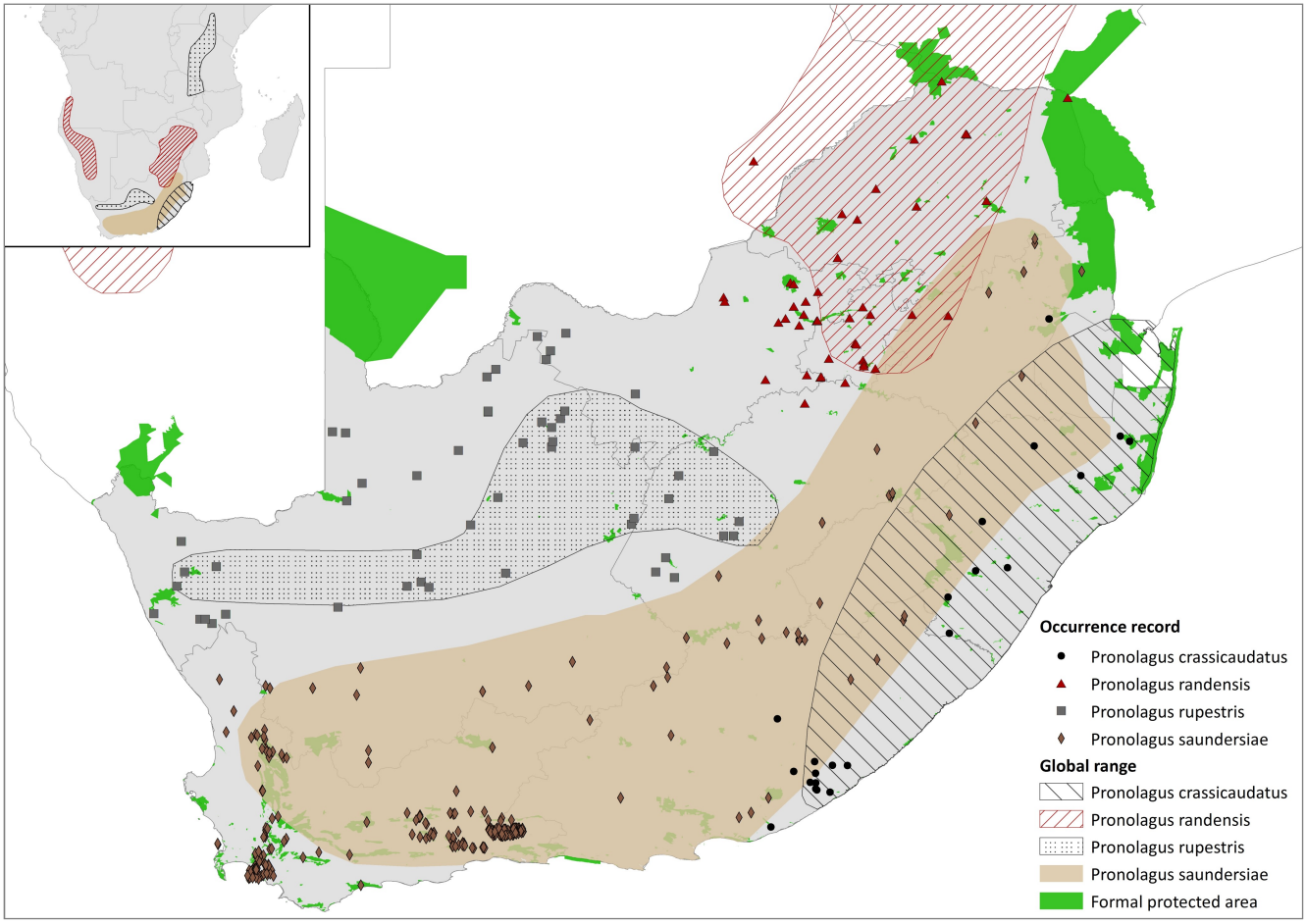

Figure 1. Distribution records for Red Rock Hares (*Pronolagus* spp.) within the assessment region

gene flow between the two populations and subsequent molecular research may reveal *P. rupestris* to be endemic to southern Africa.

While *P. saundersiae* was formerly included as a subspecies in *P. rupestris* (Hoffmann & Smith 2005), it has been distinguished as a valid species (Whiteford 1995; Matthee & Robinson 1996; Bronner et al. 2003; Robinson & Matthee 2005), with no recognised subspecies (Happold 2013d).

Assessment Rationale

Red rock hares are widespread but patchily distributed within the assessment region due to their restriction to areas of rocky habitat. While no estimates of population size or trend are available for any species, we infer large populations for each, given their extents of occurrence, and retain the Least Concern status for all species. However, while their rocky habitats are largely inaccessible and unlikely to be transformed, increasing hunting pressure (inferred from expanding human settlements and anecdotal reports of decline), loss of foraging areas from agricultural expansion, and habitat degradation from overgrazing may be causing local declines and possibe extinctions. These species are easily hunted and are thought to be substantially utilised for subsistence or sport hunting. For example, anecdotal reports from the Northern Cape suggest Smith's Red Rock Hare has declined over the past 30 years. Similarly, the Natal Red Rock Hare occurs in areas of high human population density and may be increasingly locally threatened by hunting. Emerging threats to Smith's Red Rock Hare may be increased competition with Rock Hyraxes (*Procavia capensis*) following the decline of raptors in the region, grazing pressure from goats and sheep, and increased predation from mesocarnivores due to lack of holistic management.

Concerted research into population size, densities and trends, as well as quantifying the identified threats, should be conducted before specific interventions are implemented if needed. Specifically, the area of occupancy and population trends of Smith's and Natal Red Rock Hares should be determined and both species reassessed once such data are available. Long-term monitoring sites should be established to detect subpopulation trends in different regions.

Regional population effects: For Natal Red Rock Hare, the majority of the population occurs within the assessment region so no rescue effects are possible. Jameson's Red Rock Hare has a disjunct distribution between the Namibian population and the rest of its range and it is unlikely that there is any gene flow between the two. However, dispersal between South Africa, Botswana and Zimbabwe is suspected to occur. Thus, rescue effects are possible. For Smith's Red Rock Hare, given the approximately 1,750 km separation between the East African and South Africa populations, it is possible that these are two different species and no rescue effect can occur. If this is the case, then the South African population would be near endemic.

Distribution

The close confinement of all *Pronolagus* species to rocky areas means their distribution is discontinuous and

Table 1. Countries of occurrence within southern Africa

Country	Presence	Origin
Botswana		
P. crassicaudatus	Absent	-
P. randensis	Extant	Native
P. rupestris	Absent	-
P. saundersiae	Absent	-
Lesotho		
P. crassicaudatus	Possibly extant	Native
P. randensis	Absent	-
P. rupestris	Absent	-
P. saundersiae	Extant	Native
Mozambique		
P. crassicaudatus	Extant (marginal)	Native
P. randensis	Extant (marginal)	Native
P. rupestris	Absent	-
P. saundersiae	Absent	-
Namibia		
P. crassicaudatus	Absent	
P. randensis	Extant	Native
P. rupestris	Extant (marginal)	Native
P. saundersiae	Absent	-
South Africa	Extant (all)	Native
Swaziland		
P. crassicaudatus	Extant	Native
P. randensis	Absent	-
P. rupestris	Absent	-
P. saundersiae	Extant	Native
Zimbabwe		
P. crassicaudatus	Absent	-
P. randensis	Extant	Native
P. rupestris	Absent	-
P. saundersiae	Absent	-

naturally fragmented with vast areas of land within their extent of occurrence unsuitable for them (Skinner & Chimimba 2005). As these species exist in habitat patches, area of occupancy should be calculated using land-cover data and remote sensing.

Pronolagus crassicaudatus is near endemic to the assessment region, with only a tiny part of its range in southern Mozambique in the Maputo Province (known from only two records there, Happold 2013a). It is found in southeastern South Africa in the provinces of Eastern Cape, KwaZulu-Natal and Mpumalanga (Duthie & Robinson 1990; Matthee et al. 2004), and in Swaziland in the Lumbobo and highveld regions where it is considered uncommon (Monadjem 1998). Although Meester et al. (1986) indicated that it occurs in eastern Lesotho, as it is found from sea level to 1,550 m in elevation (Duthie and Robinson 1990), it is unlikely to occur extensively in Lesotho. Thus, field surveys and specimens are needed to confirm its presence in the country (Lynch 1994). It does occur against the grassy slopes in the KwaZulu-Natal Drakensberg (Pringle 1974). While it is not recorded from the Free State or northeast Eastern Cape (Lynch 1983, 1989), some specimens from the northeastern Eastern Cape possessed both *P. rupestris* and *P. crassicaudatus* characters (Lynch 1994).

Pronolagus randensis was first described from Observatory Hill, in what is now almost the centre of Johannesburg. Jameson's Red Rock Hare occurs in northeastern South Africa, Botswana, Zimbabwe, western Mozambique, and a separate, isolated population exists marginally in western Angola to central Namibia (Duthie & Robinson 1990; Happold 2013b). There is no reason to suspect gene flow between the two isolated populations, which are some 900 km apart, and taxonomic resolution is required. Within the assessment region, it occurs in Gauteng, Limpopo, Mpumalanga and North West provinces.

Pronolagus rupestris occurs in South Africa (Free State, North West, and Northern Cape provinces), and in a separate, isolated population in southwestern Kenya, central Tanzania, eastern Zambia, and Malawi (Duthie & Robinson 1990; Robinson & Matthee 2005). The two populations are separated by 1,200 km and thus require taxonomic resolution (Happold 2013c). Although previously thought to no longer occur in Namibia (Bronner et al. 2003; Happold 2013c), there is one confirmed record from Keetmanshoop (C. Matthee unpubl. data). Field surveys are needed to determine the continued existence, extent and viability of the Namibian population. The species is restricted to rocky outcrops, so the exact area of occupancy is probably lower than indicated from its wide extent of occurrence. Much of the habitat in the region of the distribution map is characterised by isolated rocky outcrops.

Pronolagus saundersiae is endemic to the assessment region (Happold 2013d), with a continuous range along the escarpment of South Africa, including Lesotho and Swaziland. It is widely distributed in the southern and eastern regions of South Africa (including portions of Western Cape, Free State, Northern Cape, Eastern Cape, KwaZulu-Natal, Limpopo and Mpumalanga provinces), as well as Lesotho and western expanses of Swaziland. It occurs throughout the Drakensberg escarpment range (Rautenbach 1982; Lynch 1983, 1989), and is restricted mostly to the top of rocky outcrops but does marginally occur in the KwaZulu-Natal midlands. Although Robinson (1982) excluded Hewitt's Red Rock Hare from occurring in northern Free State Province, specimens were positively identified by Lynch (1983). While Hewitt's and Natal Red Rock Hares occur sympatrically over some areas, all specimens collected in northeast Eastern Cape were identified as Hewitt's Red Rock Hare, except one specimen from the farm Hamilton (3028Ca) that could be Natal Red Rock Hare (Lynch 1989). The two species are generally separated by habitat preference where *P. saundersiae* occurs at higher elevations (C. Matthee unpubl. data). For example, in KwaZulu-Natal Province, it occupies the escarpment and top of the Drakensberg from Underberg to Newcastle (Pringle 1974). In Lesotho, only a single specimen (Mt Moorosi) of Hewitt's Red Rock Hare was collected by Lynch (1994). However, it is inferred to be more widespread in the country due to observations of its characteristic oval and flattened dung pellets and personal communications with local residents

(Lynch 1994). The area of occupancy is in a continuous mountainous region and there is no reason to believe that this region is limited or contracting. Due to the rocky nature of the habitat, it is well conserved in many localities.

All museum records need vetting following taxonomic resolution of these species to accurately delineate the distribution maps.

Population

There are no population size or trend estimates available for any *Pronolagus* species. The near-endemic Natal Red Rock Hare is a widespread and locally abundant species (Duthie & Robinson 1990; Taylor 1998). However, continually increasing hunting and trapping due to expanding rural settlements is suspected to be causing local declines. This species has a relatively restricted distribution within areas characterised by rapid human population increase.

Similarly, while Jameson's Red Rock Hare is thought to be fairly common throughout its range (Duthie & Robinson 1990), it too may be experiencing local declines due to encroachment of human settlements and subsequent hunting pressure. Happold (2013b) describes it as being very common in the granite hills of Matopos Hills in Zimbabwe and the sandstone formations of eastern Botswana.

Smith's Red Rock Hare is thought to have large subpopulations in the Kuruman and Springbok areas but the majority of anecdotal reports collected from farmers across the Northern Cape report a decline in numbers over the past 30 years (B. Wilson unpubl. data.). Happold (2013c) reports the total population size as being above 10,000 mature individuals in South Africa, but this needs investigation.

Hewitt's Red Rock Hare is considered fairly abundant throughout its distribution (Happold 2013d), although Lynch (1983) recorded it as being rarely collected. Happold (2013d) reported the total population size as being above 10,000 mature individuals in South Africa, but this needs investigation.

All *Pronolagus* species use latrines and the characteristically disc-shaped pellets are an indication of their presence in an area.

Current population trend: Declining, especially Smith's Red Rock Hare.

Continuing decline in mature individuals: Yes, from hunting pressure and competition for food resources.

Number of mature individuals in population: Unknown for any species.

Number of mature individuals in largest subpopulation: Unknown for any species.

Number of subpopulations: Unknown for any species.

Severely fragmented: Yes. All species ranges are naturally fragmented across mountainous and rocky areas.

Habitats and Ecology

All species of *Pronolagus* seem to have similar habitat requirements in that they are confined to rocky areas that provide shelter and occur in krantzes, rocky hillsides, boulder-strewn koppies, rocky ravines and amongst rocks in dry river beds (Skinner & Chimimba 2005). Such areas must provide palatable grasses (they are grazers) and some cover of scrub bushes. They are predominantly nocturnal, emerging at dusk to feed but never forage far from their shelters, although they forage around the base of koppies looking for fresh sprouting grasses (Skinner & Chimimba 2005). Shortridge (1934) remarked on their ability to 'vanish like shadows behind rocks or down rock crevices on the slightest alarm'. Also characteristic of the genus are their flattened round dung pellets deposited on flat spaces amongst rocks (Lynch 1983). They use latrines established away from their resting sites. Rock hares are unique in their ability to run and jump over rocks and can run up steep rock faces to reach crevices when fleeing. Key vegetation types are those typical of mountainous and rocky terrain, including Afromontane and Afroalpine areas.

The Natal Red Rock Hare is usually observed in tall, dense grassland on rocky slopes where grasses and shrubs grow among the rocks or at their bases (Happold 2013a). They are nocturnal, relying on rocks for shelter during the day, although they have occasionally been flushed in thick grass where they presumably were resting. They defecate at specific sites (latrines), which is often the only evidence of their presence in an area. This is the largest of the rock hare species. Much like the other members of the family, this species is rabbit-like with thick, dense woolly pelage typically greyish in colour becoming rufous on the rump and limbs. The chin is white to grey, with colour extending in a broad band along the lower jaw to the inferior margin of the nape patch (Robinson 1982). The feet are generally rufous-brown whilst the tail is bright rufous above and below. This species lives in small colonies consisting of a few individuals. Whilst not much is known about the reproduction of this species, it is likely to be similar to other red rock hares. Nests are typically built in shallow excavations and lined with fur from the mother's belly and flanks over a grass and stick structure. This species probably breeds year-round and has 1–2 young per litter. The Natal Red Rock Hare was described by Isidore Geoffroy Saint-Hilaire, a French zoologist, and the species name means "fat tail".

Jameson's Red Rock Hare is named after Dr. Henry Lyster Jameson, an Irish zoologist and biologist from Dublin. Much like the other members of the Red Rock Hare family, this species is a medium-sized rabbit-like hare with thick, dense woolly pelage typically cinnamon-rufous in colour. Its cheeks are strikingly light grey, in contrast to the colouring of its back and sides (Robinson 1982). Generally, the feet are darker red with the soles covered in very dense dark brown hair. The tail is reddish-black and typically darker than the other species. Where its range overlaps with that of Hewitt's Red Rock Hare, it tends to occur in the drier low-lying mountain slopes where there are many jumbled boulders and rock crevices, whereas Hewitt's is found at higher altitudes with fewer boulders and crevices and higher rainfall (Happold 2013b). Generally nocturnal and solitary in nature, they can sometimes be seen in small groups when grazing.

Smith's Red Rock Hare is confined to rocky outcrops and hills covered with grass and shrubs (Lynch 1983). Whilst this species was described by Smith in 1834, and subsequently named after him, Smith was not the first person to notice this species in the literature. Levaillant, a French explorer, mentioned a "roode-gat-haas" in Little Namaqualand in 1795. Much like the other members of the red rock hare family, this species is a medium-sized

rabbit-like hare with thick, dense woolly pelage typically cinnamon-rufous in colour. Generally, the feet and tail are darker red with the soles covered in very dense dark grey hair. Their distribution range is typically at lower elevations than Hewitt's Red Rock Hares (Happold 2013c). Nests are characteristically built in shallow excavations and lined with fur from the mother's belly and flanks over a grass and stick structure. Breeding is restricted to warmer months during which time a female could produce 3–4 litters. Litter size is 1–2 young (Duthie and Robinson 1990) and the young are born naked.

Hewitt's Red Rock Hare was first described by Hewitt as a subspecies of *P. rupestris* in 1927 in which he named it after Miss Enid Saunders, a young zoologist, who had substantially contributed to the Albany Museum's rodent collection (Hewitt 1927). It was recently recognised as a full species and named after its original proposer (Matthee & Robinson 1996; Robinson & Matthee 2005). Much like the other members of the red rock hare family, this species is a medium-sized rabbit-like hare with thick, dense woolly pelage typically cinnamon-rufous in colour. Generally, the feet and tail are darker red with the soles covered in very dense dark grey hair. Whilst not much is known about the reproduction of this species, it is likely to be similar to other red rock hares. Breeding is restricted to warmer months during which time a female could produce 3–4 litters of 1–2 altricial (naked) young on each occasion. Habitat preferences for Hewitt's Red Rock Hare are considered similar to those of other *Pronolagus* species, but it is generally found at higher altitudes.

Ecosystem and cultural services:

- The endemic (*P. saundersiae*) and near-endemic (*P. crassicaudatus* and *P. rupestris*) species are flagship species for their regions.
- Hares and rabbits are recognised as important seed dispersal agents, particularly in harsh environments.

Use and Trade

These species are likely to be fairly important in subsistence communities where they are easily obtained. Maliehe (1993) specifically mentioned rock hares as being an important bush meat item in Lesotho and in Zululand, but this is likely to be true throughout their ranges. As a fairly slow-moving species, they are easily hunted with dogs. At night, they have a tendency to freeze when chanced upon in spotlights and can be easily shot or captured in nets (B. Wilson pers. obs.). During the day, it is also possible to hunt them in their refuges, using a coiled piece of barbed wire that hooks and drags the animal out of its shelter (B. Wilson pers. obs.). Whilst having a particularly warm and thick fur, pelts from these species are prone to hairslip and do not cure well, making them unsuitable for hardwearing fur items.

Threats

The main threat to rock hares is hunting, both for bushmeat and for sport. For example, the survival of Hewitt's Red Rock Hare in Lesotho is threatened due to hunting pressure from herders with packs of dogs (Lynch 1994). While skittish, they can be caught by hand when hiding under rock ledges or boulders (Skinner & Chimimba 2005), and thus may be susceptible to being hunted (see Use and Trade). Hunting pressure is thought to be more severe in areas of high-density human settlements. For example, in the southern part of Jameson's Red Rock Hare's eastern range, intensive urbanisation (Johannesburg, Pretoria and surrounds) is likely to be impacting on local subpopulations. Similarly, a high density of rural settlements in KwaZulu-Natal Province, where hunting may be primarily subsistence based, is suspected to be impacting the Natal Red Rock Hare. Sport hunting with dogs may also be impacting these species, particularly Hewitt's and Natal Red Rock Hares, as empirical evidence suggests a wide range of species are affected and the sport hunters are indiscriminate (Grey-Ross et al. 2010). Additionally, agricultural and rural settlement expansion may be increasing incidental predation on rock hares by domestic dogs. Hunting is suspected to be causing local declines (and possibly local extinctions) in all species but it is uncertain whether there is a net decline in the populations. Long-term monitoring should be established to quantify subpopulation trends across species.

Agricultural expansion may also impact the habitat quality (reducing foraging areas) of subpopulations in different regions, for example, cane and fruit crops in KwaZulu-Natal for Natal Red Rock Hare, eucalyptus and pine plantations for Jameson's Red Rock Hare and sheep farming for Smith's Red Rock Hare. For the latter, in areas where there is intensive sheep farming, the species may face grazing competition (B Wilson pers. obs.). Additionally, as a consequence of available food resources, many sheep-farming areas also report higher than normal rates of predators such as Black-backed Jackals (*Canis mesomelas*) and Caracals (*Caracal caracal*), which is exacerbated by indiscriminate and non-holistic predator control methods (Minnie et al. 2016). These predators pose a threat to the rock hares when at abnormally high numbers. Another possible reason for a decline in population numbers in some areas (for example, the lower Karoo) may be linked to higher-than-

Table 2. Use and trade summary for the Red Rock Hares (*Pronolagus* spp.)

Category	Applicable?	Rationale	Proportion of total harvest	Trend
Subsistence use	Yes	Bushmeat	All	Possibly increasing with settlement expansion.
Commercial use	No	-	-	-
Harvest from wild population	Yes	Hunting for bushmeat in their shelters and with dogs.	All	Possibly increasing with settlement expansion.
Harvest from ranched population	No	-	-	-
Harvest from captive population	No	-	-	-

Table 3. Threats to Red Rock Hares (*Pronolagus* spp.) 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	*5.1.1 Hunting & Collecting Terrestrial Animals*: bushmeat poaching and recreational hunting.	GeoTerraImage 2015	Indirect (remote sensing)	National	Possibly increasing with expanding human settlements
2	*1.1 Housing & Urban Areas*: habitat loss from human settlement expansion. Current stress *1.1 Ecosystem Conversion*.	GeoTerraImage 2015	Indirect (remote sensing)	National	Possibly increasing with expanding human settlements
3	*2.3.2 Livestock Farming & Ranching*: habitat loss and degradation from livestock ranching, particularly sheep. Current stresses *1.2 Ecosystem Degradation* and *2.1 Species Mortality*: loss of foraging areas and increased predation by farm dogs.	Jewitt et al. 2015	Indirect (remote sensing)	Regional	Ongoing
4	*2.1.2 Annual & Perennial Non-timber Crops*: habitat loss and degradation from crop agriculture. Current stresses *1.2 Ecosystem Degradation* and *2.1 Species Mortality*: loss of foraging areas and increased predation by farm dogs.	Jewitt et al. 2015	Indirect (remote sensing)	Regional	Ongoing
5	*2.2.2 Wood & Pulp Plantations*: habitat loss from commercial forestry. Current stress *1.2 Ecosystem Degradation*: loss of foraging areas.	Armstrong & van Hensbergen 1996	Indirect	Regional	Stable
6	*7.3 Other Ecosystem Modifications*: increased abundance of mesocarnivores and decreased raptor abundance leading to hyrax population increases. Current stresses *2.1 Species Mortality* and *2.3.2 Competition*: increased predation and competition.	Minnie et al. 2016	Indirect	Regional	Possibly increasing with ranching expansion.

normal numbers of sympatric Rock Hyrax (*Procavia capensis*) (B. Wilson pers. obs.). Following recent declines in raptor species in the region (for example, Anderson 2000), some areas have seen population explosions of diurnal hyraxes. The two species now compete directly for food resources. Since rock hare species occur at relatively low densities, it is unlikely that they are considered a significant competitive grazing species and thus are not expected to be persecuted by farmers.

Current habitat trend: Declining in quality. While they exist primarily in rocky outcrops, which are generally inaccessible and not likely to be developed, grazing pressure from sheep and goats in some areas may be putting local subpopulations under stress and possibly creating even more fragmentation than naturally experienced. Agricultural expansion, especially around the bases of koppies or other foraging areas, may also be impacting habitat quality. For example, in KwaZulu-Natal Province, natural habitat is being lost at a rate of 1.2% per annum (between 1994 and 2011), primarily due to agriculture (Jewitt et al. 2015), thereby affecting food availability for Natal Red Rock Hare. Similarly, the replacement of natural vegetation by forestry plantations in Mpumalanga and Limpopo provinces will presumably reduce habitat quality for Jameson's Red Rock Hare (*sensu* Armstrong & van Hensbergen 1996). Finally, rural settlements have expanded in all provinces between 2000 and 2013 at a rate of between 0.8% (Eastern Cape) and 39% (Gauteng) (GeoTerraImage 2015), which we infer to indicate increasing hunting pressures. Countering these threats is the expansion of wildlife ranches and private conservancies, which may be increasing available habitat for these species. The net effect on area of occupancy, however, remains to be evaluated.

Conservation

Rock hares exist in numerous national and provincial protected areas, as well as, presumably, private protected areas and conservancies. However, these should be collated and confirmed to estimate current occupancy. They are protected by most Provincial Nature Conservation agencies to a certain degree but not in Gauteng, North West, Western Cape or Eastern Cape provinces. The main intervention at this stage is research to quantify potential threats, area of occupancy, population size and trends. Until such data have been collected, no specific conservation interventions can be proposed. However, the following general interventions will benefit the rock hare species:

1. Set aside land under crop and livestock agriculture to conserve foraging areas around rocky areas or dry riverbeds.
2. Enforce legislation restricting residential development in rocky habitat or hilly slopes.
3. Employ ecological stocking rates to reduce habitat degradation and grazing pressure.
4. Employ holistic management of predators to reduce heightened interspecific predation and competition.
5. The continued formation of conservancies should be encouraged to protect rocky habitat and reduce localised grazing pressure.

Table 4. Conservation interventions for Red Rock Hares (*Pronolagus* spp.) 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	*1.2 Resource & Habitat Protection*: set aside patches of natural habitat around rocky areas in agricultural landscapes.	-	Anecdotal	-	-	-
2	*2.3 Habitat & Natural Process Restoration*: reduce stocking rates in key areas and manage predators holistically to restore grazing areas and reduce interspecific competition.	-	Anecdotal	-	-	-
3	*5.4.3 Compliance & Enforcement*: enforce legislation to limit residential development in rocky or hilly areas.	-	Anecdotal	-	-	-
4	*1.1 Site/Area Protection*: encourage landowners to form conservancies to protect habitat.	-	Anecdotal	-	-	-

Recommendations for land managers and practitioners:

- Holistic management of ranchlands through reduction in stocking rates, predator control or areas of set-aside habitat.

Research priorities:

- Taxonomic revision is suggested for this species, especially for *P. saundersiae* (Robinson & Matthee 2005). We need to know whether the disjunct populations of *P. rupestris and P. randensis* are genetically distinct – all inferences about geneflow have not been tested.
- Fine scale distributional studies across the range.
- Studies on changes in density across a spectrum of habitat quality. Quantification of population size and trends.
- Studies into the dispersal abilities and survival of subadult individuals in different habitats.
- Levels of direct persecution by farmers and subsistence hunters, and the efficacy of education and awareness programmes targeted at landowners.
- Monitoring of population trends.
- Vetting of museum records to revise distribution maps.
- Potential of wildlife ranching and the private sector in conserving rock hares.

Encouraged citizen actions:

- Refrain from having too many dogs on farms.
- Report sightings, especially outside protected areas, on virtual museum platforms (for example, iSpot and MammalMAP). Look out for their disc-shaped pellets as an indication of their presence.
- Balanced farming methods to prevent changes in predation pressures experienced by the hares.

References

Anderson MD. 2000. Raptor conservation in the Northern Cape Province, South Africa. Ostrich **71**:25–32.

Data Sources and Quality

Table 5. Information and interpretation qualifiers for the Red Rock Hares (*Pronolagus* spp.) assessment

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

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