



Consultation Document on Listing Eligibility and Conservation Actions

Pseudomys fumeus (Smoky Mouse)

You are invited to provide your views and supporting reasons related to:

- 1) the eligibility of *Pseudomys fumeus* (Smoky Mouse) for inclusion on the EPBC Act threatened species list in the endangered category; and
- 2) the necessary conservation actions for the above species.

Evidence provided by experts, stakeholders and the general public are welcome. Responses can be provided by any interested person.

Anyone may nominate a native species, ecological community or threatening process for listing under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or for a transfer of an item already on the list to a new listing category. The Threatened Species Scientific Committee (the Committee) undertakes the assessment of species to determine eligibility for inclusion in the list of threatened species and provides its recommendation to the Australian Government Minister for the Environment and Energy.

Responses are to be provided in writing either by email to:
species.consultation@environment.gov.au

or by mail to:

The Director
Marine and Freshwater Species Conservation Section
Biodiversity Conservation Division
Department of the Environment and Energy
PO Box 787
Canberra ACT 2601

Responses are required to be submitted by 3 July 2019.

Contents of this information package	Page
General background information about listing threatened species	2
Information about this consultation process	3
Draft information about the common name and its eligibility for listing	4
Conservation actions for the species	11
Collective list of questions – your views	12
References cited	18

General background information about listing threatened species

The Australian Government helps protect species at risk of extinction by listing them as threatened under Part 13 of the EPBC Act. Once listed under the EPBC Act, the species becomes a Matter of National Environmental Significance (MNES) and must be protected from significant impacts through the assessment and approval provisions of the EPBC Act. More information about threatened species is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/index.html>.

Public nominations to list threatened species under the EPBC Act are received annually by the department. In order to determine if a species is eligible for listing as threatened under the EPBC Act, the Threatened Species Scientific Committee (the Committee) undertakes a rigorous scientific assessment of its status to determine if the species is eligible for listing against a set of criteria. These criteria are available on the Department's website at:

<http://www.environment.gov.au/biodiversity/threatened/pubs/guidelines-species.pdf>.

As part of the assessment process, the Committee consults with the public and stakeholders to obtain specific details about the species, as well as advice on what conservation actions might be appropriate. Information provided through the consultation process is considered by the Committee in its assessment. The Committee provides its advice on the assessment (together with comments received) to the Minister regarding the eligibility of the species for listing under a particular category and what conservation actions might be appropriate. The Minister decides to add, or not to add, the species to the list of threatened species under the EPBC Act. More detailed information about the listing process is at:

<http://www.environment.gov.au/biodiversity/threatened/nominations.html>.

To promote the recovery of listed threatened species and ecological communities, conservation advices and where required, recovery plans are made or adopted in accordance with Part 13 of the EPBC Act. Conservation advices provide guidance at the time of listing on known threats and priority recovery actions that can be undertaken at a local and regional level. Recovery plans describe key threats and identify specific recovery actions that can be undertaken to enable recovery activities to occur within a planned and logical national framework. Information about recovery plans is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/recovery.html>.

Privacy notice

The Department will collect, use, store and disclose the personal information you provide in a manner consistent with the Department's obligations under the Privacy Act 1988 (Cth) and the Department's Privacy Policy.

Any personal information that you provide within, or in addition to, your comments in the threatened species assessment process may be used by the Department for the purposes of its functions relating to threatened species assessments, including contacting you if we have any questions about your comments in the future.

Further, the Commonwealth, State and Territory governments have agreed to share threatened species assessment documentation (including comments) to ensure that all States and Territories have access to the same documentation when making a decision on the status of a potentially threatened species. This is also known as the '[common assessment method](#)'. As a result, any personal information that you have provided in connection with your comments may be shared between Commonwealth, State or Territory government entities to assist with their assessment processes.

The Department's Privacy Policy contains details about how respondents may access and make corrections to personal information that the Department holds about the respondent, how respondents may make a complaint about a breach of an Australian Privacy Principle, and how the Department will deal with that complaint. A copy of the Department's Privacy Policy is available at: <http://environment.gov.au/privacy-policy>.

Information about this consultation process

Responses to this consultation can be provided electronically or in hard copy to the contact addresses provided on Page 1. All responses received will be provided in full to the Committee and then to the Australian Government Minister for the Environment.

In providing comments, please provide references to published data where possible. Should the Committee use the information you provide in formulating its advice, the information will be attributed to you and referenced as a 'personal communication' unless you provide references or otherwise attribute this information (please specify if your organisation requires that this information is attributed to your organisation instead of yourself). The final advice by the Committee will be published on the department's website following the listing decision by the Minister.

Information provided through consultation may be subject to freedom of information legislation and court processes. It is also important to note that under the EPBC Act, the deliberations and recommendations of the Committee are confidential until the Minister has made a final decision on the nomination, unless otherwise determined by the Minister.

Pseudomys fumeus

Smoky Mouse

Note: The information contained in this Conservation Advice was primarily sourced from 'The Action Plan for Australian Mammals 2012' (Woinarski et al. 2014). Any substantive additions obtained during the consultation on the draft will be cited within the advice. Readers may note that Conservation Advices resulting from the Action Plan for Australian Mammals show minor differences in formatting relative to other Conservation Advices. These reflect the desire to efficiently prepare a large number of advices by adopting the presentation approach of the Action Plan for Australian Mammals, and do not reflect any difference in the evidence used to develop the recommendation.

Taxonomy

Conventionally accepted as *Pseudomys fumeus* (Brazenor 1934).

Species/Sub-species Information

Description

The Smoky Mouse is a native mouse, similar in size to a small rat (Watts & Aslin 1981). It is pale grey to blue-grey to black above, with a grey to white belly (Cockburn 1995) and a ring of dark hairs around each of its large, bulging eyes. The feet are pink with white fur (Cockburn 1995). The species is distinguished by its bicoloured tail, which is blue-grey dorsally, white ventrally and lightly furred. The species has a head and body length of 85–100 mm (average 90 mm), a tail length of 110–145 mm (average 140 mm) and weighs between 45–86 g (Cockburn 1995).

Variability in size and colour has been noted between two forms found in Victoria. The western form, known only from the Grampians, is larger and darker than the eastern form (east of Melbourne) (Cockburn 1995). It appears that the specimens found in New South Wales are similar to the eastern form and a male trapped in the Brindabella Ranges had a pink scrotum (Osborne & Preece 1987), whereas those from the Grampians were darkly pigmented.

Distribution

The Smoky Mouse occurs in Victoria, New South Wales and the Australian Capital Territory, over a wide but disjunct distribution with small and fragmented populations (Menkhorst & Broome 2008). The species was first recorded in New South Wales and the Australian Capital Territory in 1985 (Menkhorst & Broome 2008). In Victoria, the Smoky Mouse is known from the greater Grampian area, the Otway Range, the south-east highlands area (the Central Highlands and the Victorian Alps) and the East Gippsland lowland area (Menkhorst & Broome 2008). Fossil records have been collected from caves in far western Victoria and eastern Victoria (Menkhorst & Broome 2008). Despite rigorous survey efforts, the species has not been reported from the Otway Ranges or the Australian Capital Territory since the 1980s, or from East Gippsland since 1990 (Menkhorst & Broome 2008; Nelson et al. 2009; Burns et al. 2015).

In New South Wales, the Smoky Mouse is recorded from Kosciuszko National Park (NP), Bondo State Forest (SF), Buccleugh SF, Ingbyra SF, Nullica SF and South-East Forests NP (Menkhorst & Broome 2008; Schulz & Wilks 2017). In the Australian Capital Territory, the Smoky Mouse is known from the Brindabella Range, Namadgi NP. Fossil specimens have been collected in caves in the southern highlands, south-east Queanbeyan and south-west of Sydney (Menkhorst & Broome 2008).

Relevant Biology/Ecology

The Smoky Mouse uses a range of vegetation communities as habitat including coastal and subalpine heath, Snow Gum (*Eucalyptus pauciflora*) woodland in the subalpine regions and dry forest dominated by eucalypts such as Broad-leaved Peppermint (*E. dives*), Brittle Gum (*E. mannifera*), Mountain Gum (*E. dalrympleana*) or Alpine Ash (*E. delegatensis*). The species has

also been trapped in fern gullies in wet forest in the Grampians (Menkhorst 1995). Surveys undertaken in eastern Victoria and south-eastern New South Wales (Menkhorst & Seebeck 1981; Jurskis et al. 1997; Ford 1998a; 1998b; Ford et al. 2003) indicate that the species' preferred habitat is ridge-top sclerophyll forest (Cockburn 1995) with a diverse understorey of heathy shrubs. However, a recent study captured more individuals in damp drainage systems than on dry slopes (Burns et al. 2015) and suggested that further investigation is needed to determine their habitat requirements.

A characteristic of Smoky Mouse habitat (with the exception of wet gullies) is the presence of floristically diverse heath or heathy understorey with members of the plant families *Epacridaceae*, *Fabaceae* and *Mimosaceae* well represented (Cockburn 1981a; Menkhorst & Seebeck 1981; Jurskis et al. 1997; Ford 1998a; 1998b; Ford et al. 2003). Adequate ground cover (low heath, grass tussocks, logs, rocks or leaf-litter) and soil conditions conducive to growth of hypogeal fungi (a major component of the diet) are also likely to be critical habitat elements (Menkhorst & Broome 2008).

An exception to the above has recently been recorded, with four individuals caught in an artificial boulderfield in Kosciuszko National Park in 2015 (Schulz & Wilks 2017). This result is significant as the Smoky Mouse is considered not to occur in disturbed areas, yet in this case was found in a field of rubble but not in the adjacent vegetation nor natural scree slopes despite extensive effort. It is also the first live capture of the species in Koscuisko National Park and only the second locality where live captures have been made in New South Wales since 2001.

The diet of Smoky Mouse includes seeds, berries, underground fungi, flowers, and some invertebrates (Menkhorst 1995), with composition showing marked seasonal variation; fungi eaten in winter, and seeds and invertebrates (especially Bogong Moths *Agrotis infusa* in summer (Cockburn 1981; Ford et al. 2003)), with potential resource bottlenecks between these periods (Cockburn 1981).

Breeding is seasonal, with females producing one–two litters of three–four young per year, and most births in the period October to January (Cockburn 1981b; Menkhorst 1995). Breeding may be communal, with several females cohabiting in burrows (Woods & Ford 2000; Ford et al. 2003). The population shows a marked annual variation, with severe decline before the breeding season (Cockburn 1981b). Males and females breed in their first year, and many survive to breed in a second year (Cockburn 1981b), so generation length is taken to be one–two years.

The Smoky Mouse displays both long-term range contractions and short-term boom-bust population cycles. Individual populations may at times show 'booms' of high detection rates (5–19 percent trap success) and busts where no, or very few, detections are made. True variation in population density may also be confounded with variability in capture/detectability, making it difficult to accurately determine when a true decline or range contraction has occurred. Failing to detect the species when it is present is a key problem for surveys of species such as the Smoky Mouse (Nelson et al. 2009; Burns et al. 2015).

There are multiple methods available for detection of Smoky Mouse including Elliott traps, hair tubes and camera traps. None are optimal, and at times one may get better results than another (Nelson et al. 2009). The sampling duration and number of traps per night that are required to detect the species during periods of low abundance may be much greater (Burns et al. 2015). Methods based on motion-sensitive cameras may improve understanding of both persistence and population cycles as date stamping of photos, and multi-day deployment of cameras, allows detection histories to be developed that enable estimation of detection probabilities. Sampling in the Central Highlands of Victoria had estimated detection probabilities of 89 percent or higher for two models of camera, and detected Smoky Mice at 21 of 120 sites (18 percent) (Lumsden et al. 2013).

Persistence of Smoky Mouse populations over a period of 40 years has recently been demonstrated in the Grampians (Victoria), despite drought, invasive predators and significant fire (Burns et al. 2015). There was evidence of a possible range contraction but there were insufficient data to determine when this occurred (within a 39 year period) nor whether the larger

earlier distribution was due to a single dispersing individual (Burns et al. 2015). Similarly, there were suggestions that shorter term fluctuations were associated with rainfall/drought cycles but insufficient statistical power to assess them effectively. Smoky mice persisted within an area severely burned by wildfire for at least 21 months post-fire (Burns et al. 2015).

Threats

Table 1: Threats impacting the Smoky Mouse in approximate order of severity of risk, based on available evidence

Number	Threat factor	Threat type and status	Evidence base
1.0	Invasive species		
1.1	Predation by Feral Cats (<i>Felis catus</i>)	known current	Three Smoky Mouse individuals found dead at Yarrangobilly in 1998 was most likely the result of Feral Cat predation (Ford 1998b). The Smoky Mouse is particularly vulnerable to predation because it has a relatively low reproductive rate, often inhabits vegetation with an open ground layer, and uses communal burrows with well-defined entrances that can be staked out by 'sit and wait' predators such as Feral Cats (Menkhorst & Broome 2008).
1.2	Predation by Red Fox (<i>Vulpes vulpes</i>)	suspected current	Red Foxes have been suspected of predating on the species however there is no referenced study to demonstrate the impact. Red Fox predation could be significant for small isolated populations, and for communal nesting species such as the Smoky Mouse. There is some concern that control efforts focussed solely on Red Foxes may lead to an increase in rabbits and cats (Risby et al. 2000), leading to a detrimental effect on Smoky Mouse populations.
2.0	Habitat loss		
2.1	Vegetation clearance/ Habitat fragmentation	known current	Smoky Mouse populations (colonies) fit a metapopulation model, whereby populations are largely isolated from one another and reestablishment of a locally extirpated population depends on immigration from other populations. The discrete and ephemeral nature of Smoky Mouse colonies, together with their apparent low persistence at sites, means that Smoky Mouse populations are likely to be profoundly affected by habitat fragmentation. Fragmentation may occur through timber harvesting, road making or clearance of freehold land (Menkhorst & Broome 2008).
	Habitat loss caused by Cinnamon	Suspected current	Many of the plant families and genera characteristic of Smoky Mouse habitat are particularly susceptible to Cinnamon Fungus.

	Fungus (<i>Phytophthora cinnamomi</i>)		It is evident that Smoky Mouse habitat in some areas of infestation has already been degraded or eliminated in both Victoria and New South Wales (Menkhorst & Broome 2008).
3.0	Fire		
3.1	Too frequent burning	suspected current	<p>Too frequent burns, such as repeated prescribed burns, are likely to simplify the heath understorey in dry forests towards early successional species, depleting floristic diversity and encouraging ingress of predators.</p> <p>The Smoky Mouse has been trapped in vegetation ranging from early to senescent seral stages following fire (2-40 years) and have recently been shown to persist within an area severely burned by wildfire for at least 21 months post-fire (Burns et al. 2015).</p> <p>Insufficient data exist to determine the optimal successional stage(s), which are likely to differ between vegetation communities. It has been suggested that the understorey floristics and density at most Smoky Mouse sites in heath and dry forests can be maintained by fire regimes of moderate frequency (15–20, but up to 40, year intervals) and moderate intensity (Menkhorst & Broome 2008).</p>
	Increased fire frequency/ intensity due to climate change	Suspected future	Current climate change predictions suggest that wildfires will become more frequent and have greater severity. Whether such 'unplanned' fire regimes <i>per se</i> will be unfavourable for the Smoky Mouse and its habitat is uncertain. However, the effect of higher-severity wildfire events could result in a greater probability of local extinctions of Smoky Mouse populations. More frequent fuel reduction burns (in response to perceived greater fire threat) could also present a threat to the Smoky Mouse if the resulting fire regime promotes habitat characteristics that are less suitable for the species (ACT Government 2013).

Assessment of available information in relation to the EPBC Act Criteria and Regulations

Criterion 1. Population size reduction (reduction in total numbers) Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered Very severe reduction	Endangered Severe reduction	Vulnerable Substantial reduction
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%
<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.</p> <p>A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) <i>cannot be used for A3</i>]</p> <p>A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.</p>	<p><i>based on any of the following</i></p> <p>(a) direct observation [except A3]</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</p>		

Evidence:

The results of surveys of Smoky Mouse populations undertaken to date are highly variable, with detections often followed by extended absences before being detected again at that site or nearby. For example, in the Grampians in Victoria a Smoky Mouse population persisted for 40 years despite extended periods of (probable) low abundance when it was undetected (Burns et al. 2015). There is evidence of regional extinctions, with Smoky Mouse not detected in the Otway Range, East Gippsland or Namadgi National Park for two decades (Menkhurst & Broome 2008; Nelson et al. 2010; Belcher 2011). However, the live trapping of several individuals in Kosciuszko National Park in 2015 after unsuccessful efforts to do so spanning a 70 year period (Schulz & Wilks 2017) demonstrates the difficulty in concluding that local extinction has occurred.

A decline in the Smoky Mouse population overall is suspected but it is not possible to determine a trend in population size for the species from these data.

The data presented above appear to be insufficient to demonstrate if the species is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 2. Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions indicating distribution is precarious for survival:			

(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Evidence:

The Extent of Occurrence (EOO) is estimated at 102,498 km², and the Area of Occupancy (AOO) estimated at 256 km². These figures are based on the mapping of point records from 1998 to 2018, obtained from state governments, museums and CSIRO. The EOO was calculated using a minimum convex hull, and the AOO calculated using a 2x2 km grid cell method, based on the IUCN Red List Guidelines 2014 (DotE 2015).

There are well known populations of Smoky Mouse in the Grampians, Central Highlands of Victoria and Eden/Nullica Region of south eastern New South Wales. There are also occasional detections in the Snowy Mountains from Kosciuszko National Park through to the Brindabellas near Canberra. Dispersal ability of the species is not well known but it is reasonable to consider this approximately five locations.

Continuing decline in area or quality of habitat can be inferred based on clearing for forestry and increased frequency or intensity of fires due to climate change. Extreme fluctuations in number of mature individuals have been recorded.

The data presented above appear to demonstrate that the species is **eligible for listing as Endangered (B2(a)(b)(iii), B2(a)(c)(iv))** under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 3. Population size and decline				
		Critically Endangered Very low	Endangered Low	Vulnerable Limited
Estimated number of mature individuals		< 250	< 2,500	< 10,000
AND either (C1) or (C2) is true				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	Very high rate 25% in 3 years or 1 generation (whichever is longer)	High rate 20% in 5 years or 2 generation (whichever is longer)	Substantial rate 10% in 10 years or 3 generations (whichever is longer)
C2	An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
	(ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b)	Extreme fluctuations in the number of mature individuals			

Evidence:

There is no reliable estimate of population size for this species. Woinarski et al. (2014) estimated population to be approximately 10 000 individuals. However, since that time Lumsden et al. (2013) recorded the species at 21 of 120 sites across the Central Highlands of Victoria, including at sites where they had not previously been located. Burns et al. (2015) demonstrated population persistence over several decades and also noted that they capture the Smoky Mouse more often in damp drainage sites than dry slopes, suggesting the species may occur across a wider range of habitat than considered previously. Schulz and Wilks (2017) also found the Smoky Mouse in habitat inconsistent with expectations. Given their detection across more numerous and varied sites than considered by Woinarski et al. (2014) it is likely that the population is greater than 10 000 individuals.

The data presented above appear to demonstrate the species is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 4. Number of mature individuals			
	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
Number of mature individuals	< 50	< 250	< 1,000

Evidence:

As described above under Criterion 3, the Committee considers that the population of Smoky Mice is greater than 10 000 individuals.

The data presented above appear to demonstrate the species is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 5. Quantitative Analysis			
	Critically Endangered Immediate future	Endangered Near future	Vulnerable Medium-term future
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Evidence:

Population viability analysis appears not to have been undertaken, there are insufficient data to demonstrate if the species is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Conservation Actions

Recovery Plan

A decision about whether there should be a recovery plan for this species has not yet been determined. The purpose of this consultation document is to elicit additional information to help inform this decision.

Primary Conservation Actions

Use modern survey methods to better identify key populations of Smoky Mouse and whether and where populations persist at low density versus ephemeral occurrences. In these locations control or eliminate populations of feral cats and foxes.

Conservation Actions

Conservation and Management priorities

- Habitat loss disturbance and modifications
 - Designate protection zones around known populations to ensure habitat is not fragmented by roads, timber harvesting or clearing of freehold land.
 - Identify the presence and risk of Cinnamon Fungus infection and protect key areas of habitat.
- Breeding, Seed collection, propagation and other *ex situ* recovery action
 - Establish a captive breeding colony of Smoky Mouse.
- Invasive species (including threats from grazing, trampling, predation)
 - Develop and implement strategies to control predation by foxes, feral cats and wild dogs, particularly in Smoky Mouse protection zones.
 - Establish and trial small mammal refuges (predator-proof enclosures) at key sites
- Fire
 - Implement appropriate fire regimes as determined by further research.

Stakeholder Engagement

- Develop greater awareness of the species and encourage stakeholders to report sightings.

Survey and Monitoring priorities

- Conduct further surveys for Smoky Mouse using remote camera traps and appropriate statistical techniques to assess detection probabilities. Surveys should be conducted late in the breeding season when detectability is higher.
- Use the results of these surveys to examine population dynamics and determine whether populations persist at low abundance or are becoming locally extinct and re-occupied (metapopulation model).

Information and Research priorities

- Use data from any further survey and monitoring work to better understand the habitat requirements of Smoky Mouse and how it responds to different fire regimes.
- Develop and test burning regimes to maintain and enhance habitat quality.

- Conduct genetic research to better understand genetic partitioning between and within biogeographical regions.

Collective list of questions – your views

SECTION A GENERAL

1. Is the information used to assess the nationally threatened status of the species robust? Have all the underlying assumptions been made explicit? Please provide justification for your response.
2. Can you provide additional data or information relevant to this assessment?
3. Have you been involved in previous state, territory or national assessments of this species/subspecies? If so, in what capacity?

PART 1 – INFORMATION TO ASSIST LISTING ASSESSMENT

SECTION B DO YOU HAVE ADDITIONAL INFORMATION ON THE ECOLOGY OR BIOLOGY OF THE SPECIES? (If no, skip to section C)

Biological information

4. Can you provide any additional or alternative references, information or estimates on longevity, average life span and generation length?
5. Do you have any additional information in the ecology or biology of the species not in the current advice/plan?

SECTION C ARE YOU AWARE OF THE STATUS OF THE TOTAL NATIONAL POPULATION OF THE SPECIES? (If no, skip to section D)

Population size

6. Has the survey effort for this taxon been adequate to determine its national adult population size? If not, please provide justification for your response.
7. Do you consider the way the population size has been derived to be appropriate? Are there any assumptions and unquantified biases in the estimates? Did the estimates measure relative or absolute abundance? Do you accept the estimate of the total population size of the species? If not, please provide justification for your response.
8. If not, can you provide a further estimate of the current population size of mature adults of the species (national extent)? Please provide supporting justification or other information.

If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible subspecies numbers, and also choose the level of confidence you have in this estimate:

Number of mature individuals is estimated to be in the range of:

☐ 1–50 ☐ 51–250 ☐ 251–1000 ☐ >1000 ☐ >10 000

Level of your confidence in this estimate:

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, information suggests this range
- ☐ 95–100% - high level of certainty, information indicates quantity within this range
- ☐ 99–100% - very high level of certainty, data are accurate within this range

SECTION D ARE YOU AWARE OF TRENDS IN THE OVERALL POPULATION OF THE SPECIES? (If no, skip to section E)

9. Does the current and predicted rate of decline used in the assessment seem reasonable? Do you consider that the way this estimate has been derived is appropriate? If not, please provide justification of your response.

Evidence of total population size change

10. Are you able to provide an estimate of the total population size in 2008-2010 (*at or soon after the start of the most recent three generation period*)? Please provide justification for your response.

If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible subspecies numbers, and also choose the level of confidence you have in this estimate.

Number of mature individuals is estimated to be in the range of:

- ☐ 1–50 ☐ 51–250 ☐ 251–1000 ☐ >1000 ☐ >10 000

Level of your confidence in this estimate:

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, information suggests this range
- ☐ 95–100% - high level of certainty, information indicates quantity within this range
- ☐ 99–100% - very high level of certainty, data are accurate within this range

11. Are you able to comment on the extent of decline in the species/subspecies' total population size over the last approximately 10 years? Please provide justification for your response.

If, because of uncertainty, you are unable to provide an estimate of decline, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of decline, and also choose the level of confidence you have in this estimated range.

Decline estimated to be in the range of:

- ☐ 1–30% ☐ 31–50% ☐ 51–80% ☐ 81–100% ☐ 90–100%

Level of your confidence in this estimated decline:

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, suggests this range of decline
- ☐ 95–100% - high level of certainty, information indicates a decline within this range
- ☐ 99–100% - very high level of certainty, data are accurate within this range

12. Please provide (if known) any additional evidence which shows the population is stable, increasing or declining.

SECTION E ARE YOU AWARE OF INFORMATION ON THE TOTAL RANGE OF THE SPECIES? (If no, skip to section F)

Current Distribution/range/extent of occurrence, area of occupancy

13. Does the assessment consider the entire geographic extent and national extent of the species/subspecies? If not, please provide justification for your response.
14. Has the survey effort for this species/subspecies been adequate to determine its national distribution? If not, please provide justification for your response.
15. Is the distribution described in the assessment accurate? If not, please provide justification for your response and provide alternate information.
16. Do you agree that the way the current extent of occurrence and/or area of occupancy have been estimated is appropriate? Please provide justification for your response.
17. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the extent of occurrence and/or area of occupancy.

If, because of uncertainty, you are unable to provide an estimate of extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of extent of occurrence, and also choose the level of confidence you have in this estimated range.

Current extent of occurrence is estimated to be in the range of:

- ☐ <100 km² ☐ 100 – 5 000 km² ☐ 5 001 – 20 000 km² ☐ >20 000 km²

Level of your confidence in this estimated extent of occurrence

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, data suggests this range of decline
- ☐ 95–100% - high level of certainty, data indicates a decline within this range
- ☐ 99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested

in the table below of ranges of area of occupancy, and also choose the level of confidence you have in this estimated range.

Current area of occupancy is estimated to be in the range of:

☐ <10 km² ☐ 11 – 500 km² ☐ 501 – 2000 km² ☐ >2000 km²

Level of your confidence in this estimated extent of occurrence:

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% - high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

SECTION F ARE YOU AWARE OF TRENDS IN THE TOTAL RANGE OF THE SPECIES? (If no, skip to section G)

Past Distribution/range/extent of occurrence, area of occupancy

18. Do you consider that the way the historic distribution has been estimated is appropriate?
Please provide justification for your response.

19. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the former extent of occurrence and/or area of occupancy.

If, because of uncertainty, you are unable to provide an estimate of past extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past extent of occurrence, and also choose the level of confidence you have in this estimated range.

Past extent of occurrence is estimated to be in the range of:

☐ <100 km² ☐ 100 – 5 000 km² ☐ 5 001 – 20 000 km² ☐ >20 000 km²

Level of your confidence in this estimated extent of occurrence

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% - high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of past area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past area of occupancy, and also choose the level of confidence you have in this estimated range:

Past area of occupancy is estimated to be in the range of:

☐ <10 km² ☐ 11 – 500 km² ☐ 501 – 2000 km² ☐ >2000 km²

Level of your confidence in this estimated extent of occurrence:

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, data suggests this range of decline
- ☐ 95–100% -high level of certainty, data indicates a decline within this range
- ☐ 99–100% - very high level of certainty, data is accurate within this range

PART 2 – INFORMATION FOR CONSERVATION ADVICE ON THREATS AND CONSERVATION ACTIONS

SECTION G DO YOU HAVE INFORMATION ON THREATS TO THE SURVIVAL OF THE SPECIES? (If no, skip to section H)

20. Do you consider that all major threats have been identified and described adequately?
21. To what degree are the identified threats likely to impact on the species/subspecies in the future?
22. Are the threats impacting on different populations equally, or do the threats vary across different populations?
23. Can you provide additional or alternative information on past, current or potential threats that may adversely affect the species/subspecies at any stage of its life cycle?
24. Can you provide supporting data/justification or other information for your responses to these questions about threats?

SECTION H DO YOU HAVE INFORMATION ON CURRENT OR FUTURE MANAGEMENT FOR THE RECOVERY OF THE SPECIES? (If no, skip to section I)

25. What planning, management and recovery actions are currently in place supporting protection and recovery of the species/subspecies? To what extent have they been effective?
26. Can you recommend any additional or alternative specific threat abatement or conservation actions that would aid the protection and recovery of the species/subspecies?
27. Would you recommend translocation (outside of the species' historic range) as a viable option as a conservation actions for this species/subspecies?

SECTION I DO YOU HAVE INFORMATION ON STAKEHOLDERS IN THE RECOVERY OF THE SPECIES?

28. Are you aware of other knowledge (e.g. traditional ecological knowledge) or individuals/groups with knowledge that may help better understand population trends/fluctuations, or critical areas of habitat?
29. Are you aware of any cultural or social importance or use that the species has?

30. What individuals or organisations are currently, or potentially could be, involved in management and recovery of the species/subspecies?
31. How aware of this species are land managers where the species is found?
32. What level of awareness is there with individuals or organisations around the issues affecting the species/subspecies?
- a. Where there is awareness, what are these interests of these individuals/organisations?
 - b. Are there populations or areas of habitat that are particularly important to the community?

PART 3 – ANY OTHER INFORMATION

33. Do you have comments on any other matters relevant to the assessment of this species?

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