Notice of Preliminary Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016*, has made a Preliminary Determination to support a proposal to list Key's Matchstick Grasshopper *Keyacris scurra* (Rehn, 1952) as an ENDANGERED SPECIES under Part 2 of Schedule 1 of the Act.

How to make a submission

The NSW TSSC welcomes public involvement in the assessment process and places preliminary determinations on public exhibition on the NSW TSSC pages on the Office of Environment and Heritage (OEH) website. This public exhibition provides an opportunity for the public to comment on this preliminary determination as well as provide any additional information that is relevant to the assessment.

Postal submissions regarding this Preliminary Determination may be sent to:

Suzanne Chate
NSW Threatened Species Scientific Committee
PO Box 1967
Hurstville BC 1481.

Email submissions in Microsoft Word or PDF formats may be sent to:
scientific.committee@environment.nsw.gov.au

Submissions close 31st August 2019.

What happens next?

After considering any submissions received during the public exhibition period the NSW TSSC will make a Final Determination and a notice will be placed on the OEH website to announce the outcome of the assessment. If the Final Determination is to support a listing, then it will be added to the Schedules of the Act when the Final Determination is published on the legislation website. www.legislation.nsw.gov.au.

Privacy information

The information you provide in your submission may be used by the NSW TSSC in the assessment to determine the conservation status and listing or delisting of threatened or extinct species, threatened populations and threatened or collapsed ecological communities or to assess key threatening processes.

The NSW TSSC may be asked to share information on assessments with NSW Government agencies, the Commonwealth Government and other State and Territory governments to collaborate on national threatened species assessments using a common assessment method and to assist in the management of species and ecological communities.

If your submission contains information relevant to the assessment it may be provided to state and territory government agencies and scientific committees as part of this collaboration.

If you wish your identity and personal information in your submission to be treated as confidential you must:

- ***request your name be treated as confidential***, and
- ***not include any of your personal information in the main text of the submission or attachments so that it can be easily removed.***

Dr Marco Duretto
Chairperson
NSW Threatened Species Scientific Committee

Exhibition period: 31/05/19 – 31/08/19

Preliminary Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Preliminary Determination to support a proposal to list Key's Matchstick Grasshopper *Keyacris scurra* (Rehn, 1952) as an ENDANGERED SPECIES under Part 2 of Schedule 1 of the Act. Listing of Endangered species is provided for by Part 4 of the Act.

Summary of Conservation Assessment

Keyacris scurra is eligible for listing as Endangered, as the highest threat category met by the taxon across all categories, under Clause 4.3 (b) (d) (e i, ii, iii & iv), because: i) the distribution of the species is very highly restricted with an area of occupancy of approximately 68 km^2; ii) the population and habitat of the species is severely fragmented; and iii) there is continuing decline in abundance, distribution, habitat area and quality, and number of individuals.

The NSW Threatened Species Scientific Committee has found that:

1. *Keyacris scurra* (Rehn, 1952), Key's Matchstick Grasshopper (family Morabidae) are small (females ~25 mm, males ~18mm), slender, wingless grasshoppers characterised by slant faces, splayed hind femora and ensiform antennae. This species occurs in several colour forms, with brown being the most common (Farrow 2018). Within the species there are two parapatric chromosomal races (15 chromosome and 17 chromosome), which are indistinguishable by external features (Key 1987). The distribution of *Keyacris scurra* overlaps with that of *Acrida conica* (Giant Green Slantface), the nymphs of which resemble *Keyacris scurra*. *A. conica* can be differentiated from *K. scurra* by the presence of wing buds (which are absent in *K. scurra*) (R. Farrow *in. litt.* Sept 2018). Another similar species, *K. marcida,* occurs to the west of the distribution of *K. scurra* and is apparently parapatric. At three places in New South Wales (NSW) *K. scurra* and *K. marcida* occur 14–16 km apart (Key 1981).

2. Historical records of *Keyacris scurra,* Key's Matchstick Grasshopper occur across the wheat and grazing belt in Victoria (Vic.), Australian Capital Territory (ACT) and NSW (White 1956, 1957, 1963; White *et al.* 1963; Rowell and Crawford 1995, 1999). Most occurrence records for *K. scurra* are from primary and secondary native grasslands with areas containing tall stands of *Themeda triandra* and known food plants (particularly species of the family Asteraceae) (Rowell and Crawford 1995). Land uses where the species is most often reported include cemeteries, railway easements, travelling stock routes and conservation reserves. Recently, a small number of photographic records have been attributed to this species from atypical habitats such as wet sclerophyll forest, montane low forest, grassy box woodlands, heathland, and montane grasslands (R. Farrow *in litt.* July 2018). Unlike other grasshoppers, this species does not disperse over large distances, so observations of *K. scurra* are indicative of resident populations rather than dispersing individuals.

3. *Keyacris scurra* feeds on a range of native and introduced species, preferring smaller ephemeral plants to larger perennial species, the latter consumed when small ephemerals are not available (Blackith and Blackith 1966). Although *K. scurra* does not feed on *Themeda,* this grass may provide protection from predators or climatic

stressors and it is present at most known localities (White 1956). In a very few reported locations where incidental photographic records have been attributed to this species, there is an absence of both *Themeda* and Asteraceae species, suggesting that *K. scurra* may exist in areas that lack these habitat features (R. Farrow *in litt.* July 2018).

4. Observations on breeding suggest that *Keyacris scurra* only produces a single generation per year with eggs hatching over December and January (White 1956). Most males reach maturity by May but females overwinter as nymphs and do not mature until the spring (White 1956). Copulation has been observed in nature from September to the end of November (White 1956). Fecundity is low with the maximum number of eggs reported per female being 40 with an average of 25 (White 1977).

5. The current geographic distribution of *Keyacris scurra* is inferred to be highly restricted. Based on all records available in the period 2008-2019, including unvouchered credible observations, the extent of occurrence (EOO) is 15,906 km^2 and the area of occupancy (AOO) is 68 km^2 (ALA 2018; A. Hoffman *in litt* Feb 2018; *R. Farrow in litt. June 2018; Canberra Nature Map 2018; ANIC 2018; Kearney in litt. Feb 2019).* The EOO is based on a minimum convex polygon encompassing all known locations, the method for assessing EOO recommended by IUCN (2017). The area of occupancy is estimated using a 2 km x 2 km grid cell, the scale recommended for assessing AOO by IUCN (2017). The extent of native grasslands and grassy woodlands with a suitable disturbance history is also highly restricted (see Keith 2004; Environment ACT 2006), although further survey is required to refine geographic range estimates.

6. White (1956) considered that *Keyacris scurra* was already geographically restricted and had undergone decline. Since the 1950s and 1960s the geographic distribution of *K. scurra* appears to have continued to decline (based on available records). Records from the 1950s and 1960s indicate that the EOO was 93,070 km^2 and AOO was 560 km^2 (White 1956, 1957, 1963; Rowell and Crawford 1995, 1999; Pullen 2000; Mulvaney 2012; A. Hoffman *in litt* Feb 2018; Atlas of Living Australia 2018; *R. Farrow in litt. June 2018; OEH Bionet 2018; Canberra Nature Map 2018;* ANIC 2018; *Kearney in litt. Feb 2019*). The geographic range has apparently contracted with average reductions over a ten-year period of 39.5% (AOO) and 30.0% (EOO) calculated between 1955 and 2018 (Hope and Law 2018). Survey effort for *K. scurra* was higher in the 1950s and 1960s (when this species was used extensively in cytological investigations, see Grodwohl 2017) than the following decades so available data are temporally biased.

7. The species is now absent from some previously known sites. A survey in 2017 of twelve of White's (1956) listed sites located two individuals, one in each of two nearby cemeteries at Gundagai and Gundagai South, and it was not recorded and may be locally extinct at sites which were previously studied intensively (e.g. Murrumbateman and Benalla) (Hoffman *in litt.* 2018). The species may now be extinct in Victoria (Victorian SAC 2018). Local extinctions in NSW and ACT have been documented. Jones (1993, cited by Rowell and Crawford 1995) revisited 13 known sites in the ACT and NSW and found the species was absent from all of these sites. Rowell and Crawford (1995, 1999) did not detect the species or found the habitat was unsuitable at 4 known sites. The species is apparently locally extinct at Blundells Flat in the ACT (Butz 2004).

8. Loss of habitat, small colony size, weed invasion, new graves, cultivation, pasture improvement, urban development and poor understanding of management requirements have been identified as current threats to *Keyacris scurra* (Key 1981; Rowell and Crawford 1995; New 2011). Disturbance is an important ecological process within the habitat of this species (Keith 2004), although the disturbance regime that favours this species is not well known. Insufficient disturbance has the potential to decrease habitat quality (e.g., regeneration of eucalypts, dense thatch formation or a reduction in food availability). Conversely, disturbance events that are too frequent or poorly timed, that impact entire populations may lead to localised extinctions in isolated habitat patches. With their very limited ability to disperse between islands of suitable habitat (and in some locations persistence in very small habitat patches) and a non-overlapping annual lifecycle, a single poorly timed mowing or fire event may lead to local extinction (Rowell and Crawford 1999). *Keyacris scurra* is a winter active species and control burns between autumn and spring may have an adverse impact, as slow-moving adults and nymphs are killed by fire (Rowell and Crawford 1995; R. Farrow *in litt.* July 2018). Over-grazing, where soils are compacted and eroded and above ground vegetation substantially removed, is also expected to have negative impacts. 'Clearing of native vegetation' and 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' are listed as Key Threatening Processes under the Act.

9. Most historical records of *Keyacris scurra* are associated with tall native grassland (usually *Themeda*) with native daisies (or other food sources). This vegetation has been widely grazed, cleared and/or burned throughout its original range (Prober 1996; Keith 2004; Environment ACT 2006). Native grassland remnants suitable for *K. scurra* commonly occur in cemeteries which have not been intensively grazed and which are not subject to fire hazard management or agricultural activities. Habitat modification (e.g. cultivation, pasture improvement) and disturbance history appears to be an important determinant of site occupancy and the species appears to be absent from heavily modified sites, and those with historic disturbance regimes incompatible with the lifecycle of this species. Cemeteries often occur on arable, long ungrazed land and are spared some of the impacts of surrounding lands that have long been targeted for agriculture (Prober 1996). After World War II, cemetery management practices shifted away from ornate landscaping towards a more homogenous landscape of mown lawns (Clayden *et.al* 2018), leading to the loss of small refugia and is the probable cause of local extinction at some cemetery sites. The decline of *K. scurra* in cemeteries may be more severe than elsewhere in the range, however long-term data are limited outside such environments.

10. The current number of populations and population size of *Keyacris scurra* is unknown, however a review of all records and published literature indicate this species was present in approximately 160 2 km x 2 km grid squares at some stage in the period 1950 to the present (Hope and Law 2018). Of these, there are recent (2008-2019) credible records from seventeen well-dispersed, 2 km x 2 km AOO grid squares; nine in NSW and eight in the ACT. One major constraint to this comparison is that a number of the known locations (e.g. documented in White 1956, 1957) lack detailed descriptions (and were mapped at coarse scale) and were not able to be relocated by Rowell and Crawford (1995).

11. *Keyacris scurra,* (Rehn 1952) Key's Matchstick Grasshopper is not eligible to be listed as a Critically endangered species.

12. *Keyacris scurra* (Rehn 1952) Key's Matchstick Grasshopper is eligible to be listed as an Endangered species as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing a very high risk of extinction in Australia in the near future as determined in accordance with the following criteria as prescribed by the Biodiversity Conservation Regulation 2017:

Clause 4.2 – Reduction in population size of species
(Equivalent to IUCN criterion A)
Assessment Outcome: Vulnerable under clause 4.2 1(c), 2(c)

(1) - The species has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of the taxon:			
	~~(a)~~	~~for critically endangered species~~	~~a very large reduction in population size, or~~
	~~(b)~~	~~for endangered species~~	~~a large reduction in population size, or~~
	(c)	for vulnerable species	a moderate reduction in population size.
(2) - The determination of that criteria is to be based on any of the following:			
	~~(a)~~	~~direct observation,~~	
	~~(b)~~	~~an index of abundance appropriate to the taxon,~~	
	(c)	a decline in the geographic distribution or habitat quality,	
	~~(d)~~	~~the actual or potential levels of exploitation of the species,~~	
	~~(e)~~	~~the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.~~	

Clause 4.3 - Restricted geographic distribution of species and other conditions
(Equivalent to IUCN criterion B)
Assessment Outcome: Endangered under Clause 4.3 (b) (d) (e ii, iii & iv).

The geographic distribution of the species is:			
	~~(a)~~	~~for critically endangered species~~	~~very highly restricted, or~~
	(b)	for endangered species	highly restricted, or
	~~(c)~~	~~for vulnerable species~~	~~moderately restricted.~~
and at least 2 of the following 3 conditions apply:			
	(d)	the population or habitat of the species is severely fragmented or nearly all the mature individuals of the species occur within a small number of locations,	
	(e)	there is a projected or continuing decline in any of the following:	
		~~(i)~~	~~an index of abundance appropriate to the taxon,~~
		(ii)	the geographic distribution of the species,
		(iii)	habitat area, extent or quality,
		(iv)	the number of locations in which the species occurs or of populations of the species.
	(f)	extreme fluctuations occur in any of the following:	
		(i)	an index of abundance appropriate to the taxon,
		~~(ii)~~	~~the geographic distribution of the species,~~
		~~(iii)~~	~~the number of locations in which the species occur or of populations of the species.~~

Clause 4.4 - Low numbers of mature individuals of species and other conditions
(Equivalent to IUCN criterion C)
Assessment Outcome: Data Deficient

The estimated total number of mature individuals of the species is:						
	(a)	for critically endangered species			very low, or	
	(b)	for endangered species			low, or	
	(c)	for vulnerable species			moderately low.	
and either of the following 2 conditions apply:						
	(d)	a continuing decline in the number of mature individuals that is (according to an index of abundance appropriate to the species):				
		(i)	for critically endangered species		very large, or	
		(ii)	for endangered species		large, or	
		(iii)	for vulnerable species		moderate,	
	(e)	both of the following apply:				
		(i)	a continuing decline in the number of mature individuals (according to an index of abundance appropriate to the species), and			
		(ii)	at least one of the following applies:			
			(A)	the number of individuals in each population of the species is:		
				(I)	for critically endangered species	extremely low, or
				(II)	for endangered species	very low, or
				(III)	for vulnerable species	low,
			(B)	all or nearly all mature individuals of the species occur within one population,		
			(C)	extreme fluctuations occur in an index of abundance appropriate to the species.		

Clause 4.5 - Low total numbers of mature individuals of species
(Equivalent to IUCN criterion D)
Assessment Outcome: Data Deficient

The total number of mature individuals of the species is:			
	(a)	for critically endangered species	extremely low, or
	(b)	for endangered species	very low, or
	(c)	for vulnerable species	low.

Clause 4.6 - Quantitative analysis of extinction probability
(Equivalent to IUCN criterion E)
Assessment Outcome: Data Deficient under Clause 4.6

The probability of extinction of the species is estimated to be:			
	(a)	for critically endangered species	extremely high, or
	(b)	for endangered species	very high, or
	(c)	for vulnerable species	high.

Clause 4.7 - Very highly restricted geographic distribution of species–vulnerable species (Equivalent to IUCN criterion D2)
Assessment Outcome: Clause 4.7 Not met.

~~For vulnerable species,~~	~~the geographic distribution of the species or the number of locations of the species is very highly restricted such that the species is prone to the effects of human activities or stochastic events within a very short time period.~~

Dr Marco Duretto
Chairperson
NSW Threatened Species Scientific Committee

Supporting Document:

Hope B, Law B (2019) Conservation Assessment of *Keyacris scurra* (Rehn 1952) Key's Matchstick Grasshopper. Version 1. NSW Threatened Species Scientific Committee.

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