

Notice and reasons for the Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to list *Synemon plana* (Golden Sun Moth) Walker 1854 as a VULNERABLE SPECIES in Part 3 of Schedule 1 of the Act and, as a consequence, to omit reference to *Synemon plana* (Golden Sun Moth) Walker 1854 from Part 2 of Schedule 1 (Endangered species) of the Act. Listing of Vulnerable species is provided for by Part 4 of the Act.

The NSW Threatened Species Scientific Committee is satisfied that *Synemon plana* (Golden Sun Moth) Walker 1854 has been duly assessed by the Commonwealth Threatened Species Scientific Committee under the Common Assessment Method (DAWE 2021). The acceptance of this assessment is provided for by Part 4.14 of the Act.

Summary of Conservation Assessment

Synemon plana Walker 1854 was found to be Vulnerable in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3(c)(d)(e i, ii, iii, iv). The main reasons for this species being eligible are: i) *Synemon plana* has a moderately restricted geographic range; ii) the population and habitat of the species are severely fragmented; and iii) there is inferred continuing decline in the abundance, geographic distribution, and number of locations of the species, and in the area, extent and quality of its habitat, due to impacts from agriculture, urban expansion, and weed invasion.

The NSW Threatened Species Scientific Committee has found that:

1. *Synemon plana* Walker 1854 (Castniidae) is described as “*Fem.* Brown, white beneath. Antennae blackish-brown, not annulated. Oviduct tawny. Fore wings with two large dark brown spots in the disk, and with a row of small dark brown spots along each tip; under side white, with two brown dots in the disk near the tip along which there is a slender testaceous band. Hind wings yellow, with four small brown spots forming a short much interrupted band across the disk, and with a slender brown hind border; under side white, with the brown dots more or less distinct. Length of body 8, 9 lines [16.9–19.1 mm]; of the wings 14, 16 lines [29.6–33.9 mm]” (Gray and Walker 1854). Males can be distinguished from females by their bronze hind wings and larger wingspan (~34 mm) (EPSDD 2017a).
2. Historically, *Synemon plana* was widespread through southeastern Australia. The species had a relatively continuous distribution from central NSW, through the NSW Southern Tablelands and large areas of the Australian Capital Territory (ACT), to central and western Victoria and into eastern South Australia (SA) (Edwards 1991 cited in O'Dwyer and Attiwill 1999; OEH 2019). *Synemon plana* now has a fragmented distribution. The species is known from 164 sites in NSW, Victoria and the ACT, and is likely extinct in SA (Edwards 1994 cited in DEWHA 2009; DAWE 2021). In NSW, *S. plana* is known from 61 sites around and to the north and west of the ACT with records separated by >500 m (R. Armstrong *in litt.* April 2022). Genetic studies suggest that the NSW/ACT subpopulations are evolutionarily distinct from the Victorian subpopulations, representing evolutionarily significant units (Clarke and O'Dwyer 2000; Clarke and Whyte 2003).

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3. The distribution of *Synemon plana* is closely correlated with native temperate grasslands dominated by *Rytidosperma* spp. (Wallaby Grasses), which have been heavily reduced and fragmented since European colonisation (Edwards 1993 cited in O'Dwyer and Attiwill 1999; EPSDD 2020). Many of the known *S. plana* sites are small grassland remnants (<5 ha), though some sites are larger (>300 ha) (Gibson and New 2007; Richter *et al.* 2013b; EPSDD 2020). *Synemon plana* also occur in open woodland and secondary native grassland; however, these habitats generally support fewer moths than native temperate grasslands (DAWE 2021).
4. The distribution of *Synemon plana* is considered to be moderately restricted. Using all known species occurrences recorded between 2000–2019, the national area of occupancy (AOO) is estimated to be at least 1,596 km² (DAWE 2021), based on 2 x 2 grid cells, the method of assessment recommended by the IUCN (2022). *Synemon plana* occupies an estimated extent of occurrence (EOO) of 145,322 km², based on a minimum convex polygon enclosing all species occurrences recorded between 2000–2019 (DAWE 2021).
5. Increased survey effort in recent decades has resulted in the discovery of the species at new sites, including in NSW to the north of the ACT (DEPI 2013; Hogg 2010 cited in EPSDD 2017a). However, extensive areas of potential habitat remain unsurveyed for *Synemon plana*, including in southern NSW, where the majority of potential habitat occurs on private land (DAWE 2021).
6. *Synemon plana* has specialised habitat requirements. These include tussocks of food grasses for shelter, egg laying, and larval development, and inter-tussock bare ground for basking and for females to display and attract mates (DAWE 2021). *Synemon plana* larvae likely feed on the roots of native temperate grasses, particularly *Rytidosperma* spp. and *Austrostipa* spp. (Spear Grasses), as well as invasive *Nassella neesiana* (Chilean Needlegrass) and *Nassella trichotoma* (Serrated Tussock) (Richter *et al.* 2013a; EPSDD 2017b).
7. *Synemon plana* females are semi-flightless, while males are unlikely to travel distances >100 m (Harwood *et al.* 1995 cited in O'Dwyer and Attiwill 2000; Clarke and O'Dwyer 2000; OEH 2012). Thus, sites separated by >200 m are likely to be isolated, and vacant grassland remnants are unlikely to be (re)colonised (Clarke and O'Dwyer 2000). The limited dispersal ability of *S. plana* compounds the impacts of habitat fragmentation and results in the species predominantly occurring in small, isolated patches of habitat (DAWE 2021). Consequently, the population and habitat of *S. plana* are considered to be severely fragmented (DAWE 2021).
8. While the subterranean life stages (egg, larva, and pupa) are not well understood, the larval period of *Synemon plana* is likely 2–3 years (Edwards 1994 cited in DEWHA 2009; Richter *et al.* 2013a). Adults have no functional mouthparts and live for only 1–4 days after emerging to breed between mid-October and early January (O'Dwyer and Attiwill 2000; Gibson and New 2007; EPSDD 2017a). Thus, generation length is 2–3 years (DAWE 2021).
9. The loss, fragmentation, and degradation of habitat due to agriculture and urban development are key threats to *Synemon plana* and are inferred to result in continuing decline in the area, extent, and quality of habitat for the species (DAWE 2021). Direct and

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indirect impacts from agriculture and urban expansion, including ploughing, overgrazing, rabbit burrowing, mowing, and soil disturbance and compaction, can damage or destroy host plants and the subterranean life stages of the species (Douglas 2004; DEWHA 2009; DEE 2016; EPSDD 2017a; DAWE 2021). Less than one percent of the native temperate grasslands that existed pre-European colonisation remains (EPSDD 2020). The sites at which *S. plana* persists are generally small, not secure from development and are considered isolated due to the limited dispersal ability of the species (DEWHA 2009; EPSDD 2017a). The 'Natural Temperate Grassland of the South Eastern Highlands' ecological community, which supports *S. plana* in NSW, is not currently listed under the Act, but is listed as a critically endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. 'Clearing of native vegetation' is listed as a Key Threatening Process under the NSW *Biodiversity Conservation Act*.

10. The invasion of native temperate grasslands by introduced pasture grasses can alter the structure of *Synemon plana* habitat such that it is lower quality or no longer appropriate for the species (DEWHA 2009; EPSDD 2017a). Grasses (and herbs) posing a significant threat to native temperate grasslands include *Phalaris aquatica*, *Eragrostis curvula* (African Lovegrass), *Paspalum dilatatum*, *Avena* spp. (Oats), *Hypericum perforatum* (St John's Wort), and *Carthamus lanatus* (Saffron Thistle) (EPSDD 2017b; OEH 2019). *Nassella neesiana* and *N. trichotoma* also threaten native temperate grasslands. However, as likely larval food plants, removal of these weeds at *S. plana* sites where suitable native grasses do not persist may decrease the area of habitat for the species (DAWE 2021). 'Invasion of native plant communities by exotic perennial grasses' is listed as a Key Threatening Process under the Act.
11. *Synemon plana* Walker 1854 is not eligible to be listed as an Endangered or Critically Endangered species.
12. *Synemon plana* Walker 1854 is eligible to be listed as a Vulnerable species as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing a high risk of extinction in Australia in the medium-term future as determined in accordance with the following criteria as prescribed by the *Biodiversity Conservation Regulation 2017*:

Assessment against *Biodiversity Conservation Regulation 2017* criteria

The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome: Vulnerable under Clause 4.3(c)(d)(e i, ii, iii, iv).

Clause 4.2 – Reduction in population size of species

(Equivalent to IUCN criterion A)

Assessment Outcome: Data Deficient.

(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

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	(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: Vulnerable under Clause 4.3(c)(d)(e i, 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 Clause C)

Assessment Outcome: Clause 4.4 is not met.

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

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		(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: Clause 4.5 is not met.

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.

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 is 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.
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NSW Threatened Species Scientific Committee

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References:

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