

MANZEENE AVENUE, LARA
TARGETED GOLDEN SUN MOTH SURVEY

Manzeene Avenue Development Trust Pty Ltd



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1. EXECUTIVE SUMMARY

Manzeene Avenue Development Trust Pty Ltd engaged Brett Lane and Associates Pty Ltd (BL&A) to conduct a targeted survey for Golden Sun Moth at Manzeene Avenue, Lara, an area proposed for residential subdivision.

BL&A undertook a flora, fauna and habitat hectare assessment at the study area in January 2012. During the assessment, it was identified that some areas of native vegetation had the potential to support Golden Sun Moth and a targeted survey was recommended.

A targeted survey for Golden Sun Moth was undertaken by BL&A from November 2012 to January 2013 within all areas of potential Golden Sun Moth habitat at the study area. No Golden Sun Moth was detected during this targeted survey.

Based on the results of the current survey it is considered unlikely that a population of Golden Sun Moth are resident at the study area. It is not expected the Golden Sun Moth would occur in the study area regularly and as such, there are no implications in regards to the Golden Sun Moth.

2. INTRODUCTION

Manzeene Avenue Development Trust Pty Ltd engaged Brett Lane and Associates Pty Ltd (BL&A) to conduct a targeted survey for Golden Sun Moth at Manzeene Avenue, Lara, an area proposed for residential subdivision.

BL&A undertook a flora, fauna and habitat hectare assessment at the study area in January 2012. During the assessment, it was identified that some areas of native vegetation had the potential to support Golden Sun Moth and a targeted survey was recommended (BL&A 2012).

The aims of the current targeted survey were to:

- Identify whether the Golden Sun Moth was present within areas of potential habitat in the study area;
- If present, identify the population size, distribution and whether female Golden Sun Moths were present; and
- Provide a summary of suitable habitat on site such as the presence of host plants and connectivity to similar habitats.

This report presents the findings of the assessment, identifies issues and provides recommendations and mitigation options where relevant. It is divided into the following sections:

Section 3 details the biology of the Golden Sun Moth.

Section 4 describes the methods of the targeted survey.

Section 5 presents the results of the assessment.

Section 6 provides the conclusions of the assessment.

This investigation was undertaken by a team from BL&A, comprising Chanaka Ruwadeniya (Zoologist), Miles Jennings (Zoologist), Rani Sherriff (Ecologist), Rachel Omodei (Ecologist), Alistair Stewart (Zoologist), Louisa Robertson (Zoologist), Curtis Doughty (Zoologist), Mal Wright (Senior Ecologist), Peter Lansley (Senior Ecologist), Annabelle Stewart (Senior Ecologist) and Inga Kulik (Senior Ecologist & Project Manager).

3. GOLDEN SUN MOTH BIOLOGY

3.1. Status and Description

The Golden Sun Moth is listed as ‘critically endangered’ under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), is listed as threatened under the *Flora and Fauna Guarantee Act 1988* (FFG Act) and is considered as critically endangered in Victoria (DSE 2009). An action plan has been prepared for this species in Victoria (No. 106).

The small diurnal GSM belongs to the family *Castiniidae*. The females are semi-flightless and are relatively immobile. Dispersal appears to be low with a range of up to 100 metres (Cook and Edwards 1993). The forewings of the male are dark brown with grey scales and the hind wings are bronze-brown and black (Figure 1). The underside of the male is pale grey with brown patches. The forewings of the female are brown and grey and the hind wings are bright orange with black submarginal spots. The male has a wingspan of about 3.5 centimetres whilst the female is smaller with a wingspan of about 3 centimetres.



Figure 1: Male Golden Sun Moth

3.2. Life-cycle

The Golden Sun Moth life-cycle is characterised by two stages: larval stage and adult stage. Larvae of GSM are thought to feed on the underground parts of wallaby grasses. The reproductive life cycle is estimated to be 2-3 years (Common 1990). Eggs are laid between the tillers of the food plant and the soil. The larvae remain underground and feed on the roots of the wallaby grass. When they are ready to pupate, the larvae prepare a tunnel to the surface through which the pupa eventually emerges (Van Praagh 2005).

Adults emerge around mid November to mid December to mate and lay eggs. Adult GSM are short-lived, surviving only a few days as they lack functional mouthparts and cannot feed (Van Praagh 2005). The females are semi-flightless and are therefore relatively immobile (DSE 2004). Dispersal from their natal area appears to be low, travelling no further than 100m (Cook and Edwards 1993).

3.3. Distribution

Once wide-spread over south-eastern Australia, the Golden Sun Moth is now restricted to fragmented populations across Victoria, NSW and ACT (DEWHA 2009). They are found in native grassland with a good cover of wallaby grass (*Austrodanthonia* spp.) (Edwards 1993). More recently it has been recorded in sites that support a limited cover of wallaby grass and even in sites dominated by exotic species, such as Chilean Needle-grass (*Nasella neesiana*). It is thought that urbanisation and certain agricultural practices have reduced the habitat and therefore increased local extinctions of this species. It is estimated that less than 1% of the original temperate grasslands remain, and much of this is heavily degraded by weeds and overgrazing (Specht 1981).

3.4. Habitat

The Golden Sun Moth requires a specialised habitat of grasslands dominated by wallaby grass. Many species of wallaby grass are low growing tussock grasses, usually separated by bare ground. Species composition and density of the grassland are important components to the survival of this species (Van Praagh 2004).

A critical density of wallaby grass is required because the moths lay their eggs at the base of the wallaby grass tussocks (Edwards 1993). Previous studies indicate that the species requires at least a 40% cover of wallaby grass for survival (O'Dwyer and Attiwill 1999), although recent findings suggest that small populations may persist in more disturbed habitats with less wallaby grass cover than what is considered optimal for the species.

Any disturbance to the soil is particularly destructive for these grass feeding moths. Soil disturbance destroys the subterranean larval stages in addition to killing the native perennial grasses that are their host plants (Douglas 2004).

3.5. Threats

Golden Sun Moth populations have been restricted due to a number of environmental pressures and stressors but the main threats to the species survival and viability are:

- Vegetation removal;
- Inappropriate fire regimes;
- Weed invasion;
- Overstocking;
- Changes to agricultural practices;
- Changes to vegetation structure; and
- Soil compaction (DEWHA 2009).

These threats are particularly damaging to the viability of GSM populations as limited dispersal ability, specific vegetation and structural requirements lowers recruitment (i.e. young unable to replace adults and increase population). Additionally, isolated distribution and short adult life-span prevents them from adapting to changes in environmental conditions. Impacts to this species are considered significant when they have an adverse long-term impact on the population size. In particular, a reduction in habitat quality and availability, fragmentation of an existing population, disruption to breeding cycles and the introduction of non-indigenous species (flora and fauna) can have significant impacts on the species.

4. METHODS

4.1. Existing Information

Records were searched from a wider area, termed the 'search region' defined for this assessment as an area with radius 10 kilometres from the approximate centre point of the study area of coordinates: latitude 38° 00' 52" S and longitude 144° 22' 53.

The presence or likelihood of occurrence in the study area of nationally threatened fauna species was obtained through the EPBC Act Protected Matters Search Tool (DSEWPC 2012).

The Atlas of Victorian Wildlife (AVW), a database administered by DSE (Viridans Biological Databases 2013) was also consulted for records from the search region.

4.2. Habitat Assessment

The quality of Golden Sun Moth habitat was assessed based on the criteria detailed below. These are based on habitat components that include dominant grass species and percentage of cover, bare ground and connectivity. Three quality categories were used, as described below:

Three main habitat quality categories were incorporated and described below.

High: Habitat components listed below are usually all present.

- Grassland dominated by wallaby grasses;
- At least 40% cover of wallaby grasses;
- Bare ground present;
- Connectivity with other areas of suitable habitat.

Moderate: Some habitat components are often missing although linkages with other remnant habitats in the landscape are usually intact.

- Grasslands dominated with exotic vegetation but has at least 25% cover of native vegetation;
- Some areas are dominated by wallaby grasses;
- Some connectivity with other areas of suitable habitat.
- Grassland shows some evidence of disturbance (such as soil erosion, high weed invasion, high levels of phosphorus in soils)

Low: Many habitat elements have been lost. Grassland habitats that are:

- Higher than 75% cover of exotic vegetation;
- Little or no areas that contain wallaby grasses;
- Isolated (little or no connectivity);
- Showing signs of disturbance (e.g. cultivation, erosion, weed invasion).

4.3. Targeted Survey Method

To determine if GSM were present in potential habitat at the study area (Figure 2), a series of transects were walked. Surveys were conducted from November 2012 to January 2013. Potential habitats were surveyed for GSM following state and federal guidelines (DSE 2010; DEWHA 2009). Surveys were conducted in suitable conditions, specifically:

- On a warm to hot day where the temperature exceeded 20°C by 10 am;
- During the warmest part of the day (i.e. between 10 am and 3 pm);
- With a clear or mostly cloudless sky;
- With still or relatively still wind conditions during the survey period; and
- At least two days since rain.

Ideally four surveys, at least one week apart under suitable conditions, are required to test for the presence of this species at a particular site (any grassy area except those under crop of wheat, barley etc.) in order to maximise the chance of detecting GSM. If the species was found, the surveys would cease. Initially, 50 metre separated transects were conducted over the study area, followed by 25 metre and two times 10 metre transects to thoroughly survey the area. This method allowed the areas of potential habitat in the study area (Figure 2) to be traversed within the optimal condition-timeframe when the moths were most likely to be active.

Reference sites were also visited on survey days to confirm that weather conditions were optimal for detecting moths. Reference sites were locations near to the study area where GSM have been recorded in the past. These reference sites are generally protected grasslands. The closest reference site to the study area was at Laverton North Grasslands, Kororoit Creek Rd (52 ha) situated 40 kilometres north-east of the study area.

Any Golden Sun Moth observed would have been captured to confirm identification and its location recorded on a GPS to five metre accuracy. All surveys took place during fine and sunny conditions, on days when temperatures reached 20°C by 10:00am. Timing and temperatures during the surveys are presented below in Table 1.

Table 1: Weather conditions during the surveys

Date	Start time	End time	Temperature range (°C)
29/11/2012	10:25	12:24	28 - 32
12/12/2012	10:50	13:19	29.9 - 35.8
18/12/2012	10:50	13:26	24.3 - 28.1
10/01/2013	13:33	15:25	24.6 - 28.2

4.4. Limitations of field assessment

Where feasible, all efforts are made to schedule GSM field surveys in optimal weather conditions and times of year. However, the survey effort was irregularly scheduled due to rainfall events. Ideally, the survey would have commenced in suitable weather conditions at weekly intervals. Although conducted at irregular intervals and beginning times, all surveys were spaced at least one week apart. As

such, the timing of the GSM survey and the weather conditions were considered suitable for detecting the species and estimating its abundance and distribution.

In addition to the survey effort, the detection of adult females is considered very difficult due to their poor flying ability, as they are more likely to walk between tussock grasses (DEWHA 2009). Males can only be surveyed with reasonable confidence as searching for females are laborious and unreliable (Gibson and New 2007). However, it is assumed that GSM have an equal sex ratio (Gibson 2006), like many other similar invertebrates. Since ecologists are searching relatively large areas for a very small moth it is always possible that moths are not seen in optimal conditions even on reference sites and hence sites are surveyed several times at different transect spacings.



Legend

- Study Area
- Potential Golden Sun Moth Habitat

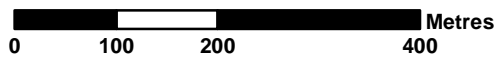


Figure 2: Potential Golden Sun Moth Habitat

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Client: CPG Australia Pty Ltd

Project No.: 11212

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Created By: R. Omodei / M. Ghasemi



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5. RESULTS

5.1. Existing Information

A search of the EPBC Act Protected Matters Search Tool indicated that the Golden Sun Moth had the potential to occur in the search region based on species or species habitat being present. There were no GSM records from the AVW within the search region but this species has been recorded in the Lara region in recent years (BL&A unpubl. data).

5.2. Habitat Assessment

The study area for this investigation (Figure 1) is approximately 60 hectares of public and private land located at Lara, approximately 56 kilometres south-west of Melbourne. It is bordered by Patullos Road to the south, O'Hallorans Road to the west, Kees Road to the south-east and residential housing to the east.

Pre-European vegetation mapping (DSE 2012) indicates that the study area and surrounds would have supported Plains Grassland and Creekline Grassy Woodland prior to European settlement based on modelling of factors including rainfall, aspect, soils and remaining vegetation.

Cracking basalt soils were present on a flat landscape with few dams and no other standing water. The majority of the study area is used for horse and stock grazing. Much of the study area has been regularly slashed.

Disturbed and degraded patches of indigenous vegetation, combined with planted trees and gardens were abundant at the study area. Remnant patches of indigenous vegetation were small and scattered and contained low indigenous species diversity. Common species were spear grasses, Windmill Grass and wallaby grasses. Other indigenous species such as Berry Saltbush and Bindweed were present. Weeds such as Galenia, Ribwort and Couch were dominant.

The study area was surrounded by both residential and farmland. Connectivity to nearby, mostly non-native grassland vegetation forms a network of wider, regional values and may provide limited dispersal routes for this species.

In reference to the habitat assessment criteria in Section 4.2, given that the areas of potential GSM habitat are dominated by wallaby grasses and at least 25% cover, there is limited connectivity to other non-native grassland habitats to the west and there has been evidence of disturbance through grazing and slashing, the potential GSM habitat at the study area is considered to be moderate habitat quality for Golden Sun Moth.

5.3. Survey Results

All surveys were conducted in optimal weather conditions for detecting flying moths as is evidenced by moths being present on reference sites on all of the four survey days (Appendix 1). However, no Golden Sun Moth was detected in the study area.

6. CONCLUSIONS

All of the surveyed grassland patches have been dominated by wallaby or spear grass, which provides potential habitat for Golden Sun Moth. Given the limited connectivity to other native grassland areas and the evidence of disturbance through grazing and slashing, the potential Golden Sun Moth habitat at the study area was considered to be moderate habitat quality for Golden Sun Moth. Previous records of Golden Sun Moth approximately 2 km west of the study area (BL&A unpublished data) and the size of the patches and their inter-connectivity (mostly less than 200m apart) indicate that the surveyed patches would have been suitable to support viable populations of Golden Sun Moth.

The current investigation did not detect Golden Sun Moth, despite four surveys undertaken in correct climatic conditions, a thorough coverage of the survey area (50 metres to 10 metres spaced transects) and evidence of Golden Sun Moth flying at reference site on the same day.

Based on the results of the current survey it is considered unlikely that a population of Golden Sun Moth are resident at the study area. It is not expected GSM would occur in the study area regularly and as such, there are no implications in regards to Golden Sun Moth.

The conservation significance of some remnant patches of vegetation were subsequently impacted on by the lack of Golden Sun Moth recordings in the current targeted survey. The very high conservation significance of habitat zones in the flora and fauna report (BL&A 2013) was due to the zones providing the 'best 50 % of habitat' for Golden Sun Moth. The conservation significance of these habitat zones is now reduced to high. The affected zones are Habitat Zones B, C, D, E, F, J, L, N, O, P, Q and R. The habitat hectare assessment details for these zones have been updated in the report (BL&A 11212 (1.3)).

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Van Praagh, BD 2005, 'New sightings of the Golden Sun Moth *Synemon plana* (Lepidoptera; Castniidae) at Craigieburn and Cooper St Grasslands, Melbourne Victoria 2003/2004'. Unpublished report to the Department of Sustainability and Environment.

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Appendix 1: Climatic conditions of transects walked in the study area

Date	Transect Separation Distance (m)	Number of ecologist per transect	Cloud Cover	Wind Strength	Wind Direction	Temp (°C)	Time taken (min)	Reference Site	
								Name	GSM
29th November 2012	50	2	10%	Gentle	South-east	28	4	Cooper St Grassland and Derrimut Grassland	11 male GSMs flying and three females getting blown about respectively
						28	1		
						29	3		
						29	2		
						28	2		
						28	5		
						29	3		
						29	14		
						29	3		
						29	4		
						29	2		
						30	1		
						30	1		
						32	5		
						32	6		
32	3								
12th December 2012	25	2	10%	Gentle	East	31	2	O'Herns Rd Craigieburn, Merimu Bacchus Marsh, and Derrimut Grassland	5 GSMs, 20+ and 2 male GSMs respectively
						30.2	4		
						30.8	2		
						30	1		
						30.5	4		
						30.3	3		
						29.9	2		
						29.9	1		
31.3	1								

Date	Transect Separation Distance (m)	Number of ecologist per transect	Cloud Cover	Wind Strength	Wind Direction	Temp (°C)	Time taken (min)	Reference Site	
								Name	GSM
						30.1	2		
						30.5	3		
						30.2	6		
						30.9	3		
						30.8	2		
						31.7	3		
						32	1		
						32.6	2		
						34.8	2		
						33.5	1		
						35.2	7		
						35.2	7		
						35	1		
						35.8	8		
18th December 2012	10	4	30%	Gentle	South-west	25.9	5	Recorded flying at Altona and Eynesbury	Flying moths in Altona and 6 males at Eynesbury
						25.4	5		
						25.4	3		
						25.4	1		
						25	2		
						25	2		
						25	15		
						24.3	2		
						24.3	3		
						26	5		
						26	5		
						26	5		
						25.4	3		

Date	Transect Separation Distance (m)	Number of ecologist per transect	Cloud Cover	Wind Strength	Wind Direction	Temp (°C)	Time taken (min)	Reference Site	
								Name	GSM
						25.4	2		
						25.4	5		
						25	5		
						25	2		
						25	3		
						25	1		
						24.7	4		
						24.7	2		
						24.7	2		
						26.7	1		
						26.7	30		
						27.5	2		
						27.5	2		
						27.5	5		
						28.1	9		
						26.8	2		
						26.8	12		
						27.5	2		
						27.5	4		
						27.5	2		

Date	Transect Separation Distance (m)	Number of ecologist per transect	Cloud Cover	Wind Strength	Wind Direction	Temp (°C)	Time taken (min)	Reference Site	
								Name	GSM
10th January 2013	10	4	10%	Gentle	West	26.7	1	Cooper St Grasslands and Donnybrook Rd, Mickleham	1 male GSM and 15 male GSMs respectively
						25.4	1		
						26	2		
						26.9	1		
						26.2	1		
						28.2	2		
						24.6	2		
						26.2	1		
						28.2	2		
						24.6	2		
						26.2	2		
						24.6	3		
						26	3		
						26	3		
						25	7		
						25	2		
						25	1		
						25	2		
						28	4		
						25	4		
25.6	2								
25.4	3								
26	1								
26.7	2								
25.4	4								
28	2								