



Aurora Conservation Reserve 14 Golden Sun Moth survey 2017–2018 season

Final report

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1. Introduction

Biosis Pty Ltd was commissioned by Development Victoria to conduct annual monitoring of Golden Sun Moth *Synemon plana* throughout the Aurora residential development area at Epping, Victoria (Figure 1). Golden Sun Moth (GSM) is a listed Matter of National Environmental Significance (MNES) under the *Environment and Protection Biodiversity Conservation Act 1999* (EPBC Act).

1.1 Golden Sun Moth Background

GSM is a medium sized, diurnal (day flying) moth with clubbed antennae (Edwards 1993). The species is sexually dimorphic, with the females having an enlarged abdomen and ovipositor that aids in egg laying. The species is also sexually dichromatic in wing colour. The forewings of females are brown and grey while the hind wings are yellow with black spots. Male GSM have dark brown forewings with grey scales and bronze-coloured hind wings. Females, which only fly irregularly, position themselves on the ground in a conspicuous location (usually in inter-tussock spaces), flashing their golden hind wings (petticoats) to the males, who fly low over the grasses searching for them.

GSM prefer warm, dry conditions (above 20°C with little to no wind and cloud) and are usually observed flying during the warm part of the day between 10:00 and 14:00 (Clarke and O'Dwyer 2000). Since 2005, Biosis have often observed GSM active on cooler days, with cloud cover and moderate to strong wind conditions and also at times earlier and later in the day than generally accepted as optimal observation times.

GSM breeding season begins in mid-October and continues through to early January (Commonwealth of Australia 2009). The breeding season differs slightly from year to year depending on climate and location. Adult moths emerge continuously in cohorts and males are seen actively flying in search of females.

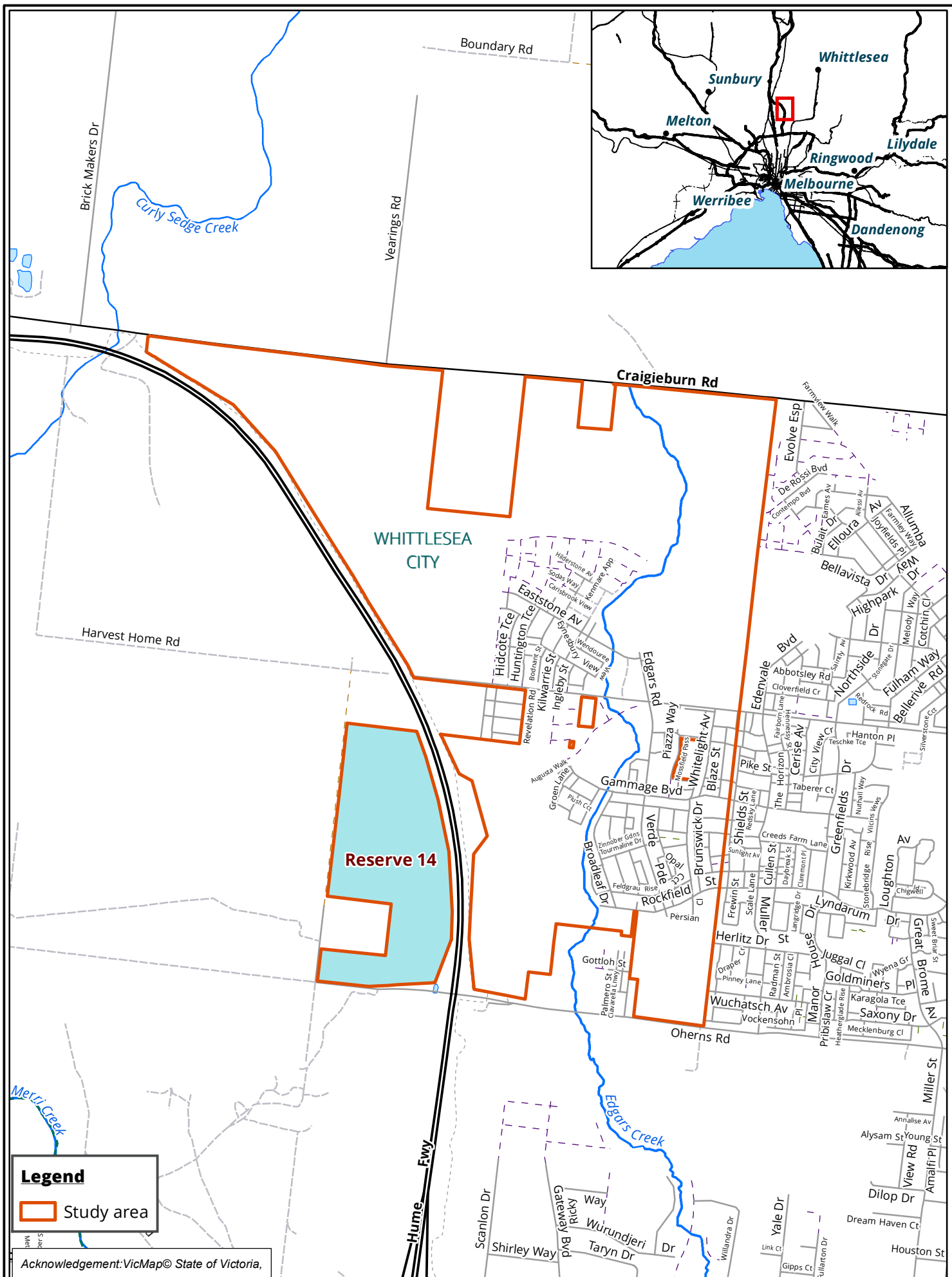
Potential habitat for GSM consists of areas which support or had supported native grasslands or grassy woodlands (including derived grasslands) across the historical range of the species. Previous studies found that GSM display a preference for Wallaby Grasses *Rytidosperma* spp. (particularly *R. carphoides*, *R. auriculata*, *R. setacea*, *R. eriantha* and *R. racemosa*). However, more recent surveys have found GSM present in degraded grasslands and patches invaded with weedy species, including areas dominated by Red-leg Grass *Bothriochloa macra*, Spear Grasses *Austrostipa* spp. and Weeping Grass *Microlaena stipoides* and the introduced Chilean Needle-grass *Nassella neesiana* (Braby and Dunford 2006, Gilmore *et al.* 2008).

1.2 Aurora residential development background

Fourteen conservation reserves were initially established within the Aurora residential development. The reserves contain patches of native vegetation and fauna habitat that are currently managed for the protection of biodiversity values, including threatened flora and fauna species. The reserves provide offsets which contribute to the project's net gain targets, which are part of the requirements of the Aurora development Conservation Management Plan (CMP) (Biosis Research 2008).

All reserves were initially surveyed to determine the distribution of Golden Sun Moth within Aurora and provide management advice for the reserves. Monitoring throughout these reserves began in 2007–2008 and are scheduled to continue for 10 years under the CMP, as per the condition of approval under the EPBC Act referral for Aurora (EPBC 2007/3524).

Eleven of the reserves were sold to Lendlease in 2015, but Reserve 10, 11 and 14 remain the property of Development Victoria. Of these three reserves, Reserve 14 is the only reserve requiring annual GSM monitoring under the CMP. This report presents the monitoring results for the 2017–18 flight season within Reserve 14. The 2017–2018 season marks the ninth year of annual CMP monitoring.



2. Methods

2.1 Determining flight season commencement

As the timing of flight season varies annually and throughout GSM geographic range, the commencement of flying needs to be determined before surveys are undertaken. GSMs were first observed flying at Aurora south, adjacent to O'Herns Road in Epping on 29 November 2018.

2.2 Transect counts

During the 2017–18 flight season, walking transect counts were conducted to detect GSM presence and population trends within the Aurora reserves. This method has been employed since the 2014–15 flight season. Point count methods, which were employed for the initial five years of the survey, were abandoned after statistical analysis determined this to be less reliable than walking transect counts.

Monitoring surveys were undertaken on 13 and 27 December 2017. Conditions were suitable for male flight (above 20°C, minimal cloud cover and wind). Surveys commenced at 11:00am and concluded at approximately 2:00pm. Surveys were at least one week apart to capture any variation in emergence patterns.

Surveys were conducted by qualified zoologists walking a series of transects approximately 50 m apart through Reserve 14. Tracks were recorded using a Garmin GPS and waypoints were taken for each location where GSM were observed.

Reserve 14 was surveyed twice throughout the 2017–2018 flight season. This level of survey effort was considered sufficient to achieve the objective of confirming continued GSM presence within the reserve and to accurately record GSM abundance.

2.3 Permits

Biosis conducted the GSM survey under a Research Permit for flora and fauna issued by the Department of Environment, Land, Water and Planning, under the *Wildlife Act 1975*, *Flora and Fauna Guarantee Act 1988* and *National Parks Act 1975* (Permit number 10007569, expiry date 30 April 2018).

2.4 Mapping

Mapping was conducted using hand-held (uncorrected) GPS units (WGS84) and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependant on the limitations of aerial photo rectification and registration.

Table 1 Weather conditions during Golden Sun Moth surveys, Aurora reserves, 2017–18 flight season

Date	13/12/2017	27/12/2017
Start time	10:00	11:38
End	12:00	13:41
Golden Sun Moth recorded	Y	Y
Site temperature (°C) (start/end)	31/33	28/31
Cloud cover (%)	10	5/15
Wind direction (start/end)	N/NE	NNE/NNE
Average wind speed (km/hr) (start/end)	19/19	13/10
Ground conditions	dry/dry	dry/dry
Humidity (%)	29/28	41/38
Reference site where moths were recorded on day of survey	Altona Reference Site	Altona and Sunbury Reference Sites

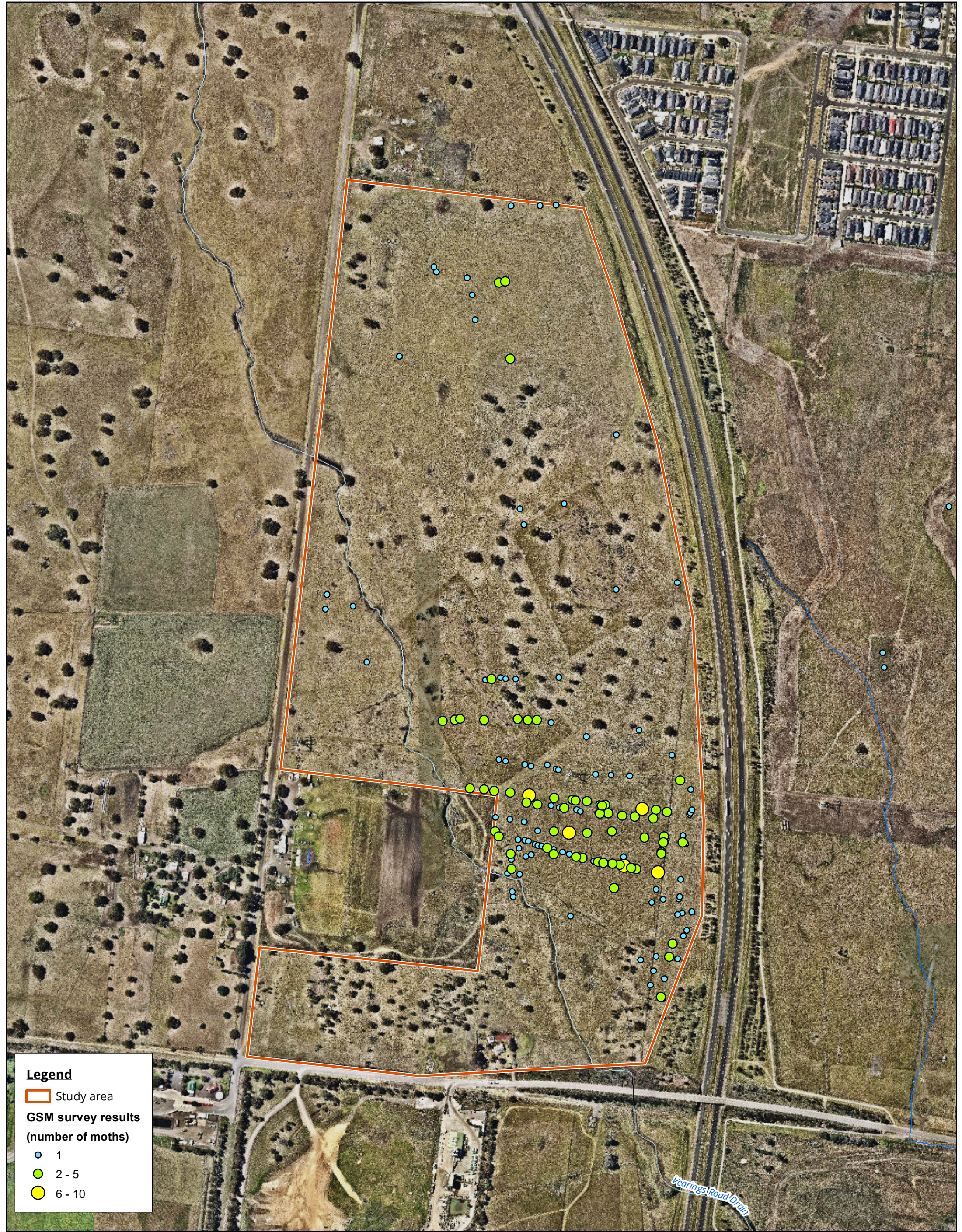
3. Results

The continued presence of GSM at Reserve 14 was confirmed during the 2017–2018 flight season. GSM abundance on both survey dates are shown below in Table 2 and spatial distribution is displayed in Figure 2.

A summary of historical GSM count data during the CMP annual monitoring is provided in Table 3 and Figure 3. The number of individuals recorded in the 2017–2018 was greater than all other surveys (between 2009–2010 and 2015–2016), with the exception of the 2016–2017 season when 748 moths were recorded (Table 2).

Table 2 Golden Sun Moth survey results, Reserve 14, 2017–2018 flight season

Reserve	Number of GSM 13/12/2017	Number of GSM 27/12/2017	Total number of GSM for 2017-2018 flight season
14	160	143	303



Legend

Study area

**GSM survey results
(number of moths)**

- 1
- 2 - 5
- 6 - 10

Figure 2: Aurora Golden Sun Moth survey results for the 2017-2018 flight season

Acknowledgements: Vicmap ©State of Victoria

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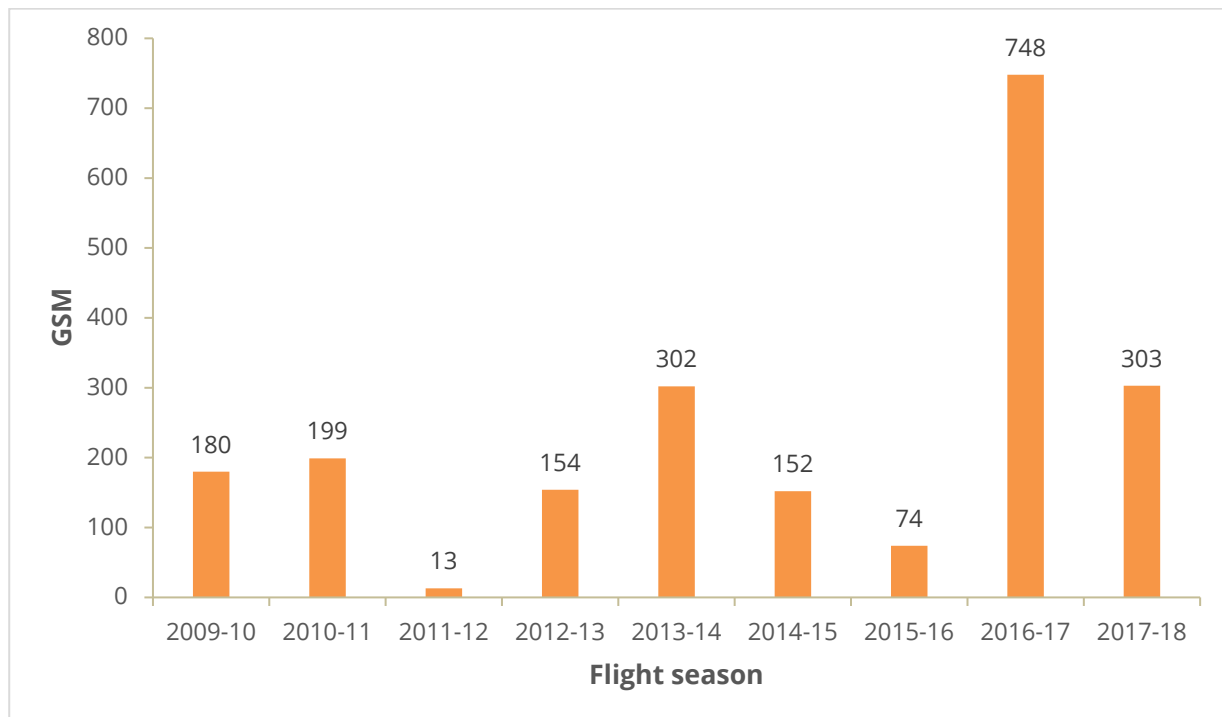


Table 3 Historical Golden Sun Moth monitoring counts, Reserve 14

Reserve	Monitoring Point	GSM 2009–2010	GSM 2010–2011	GSM 2011–2012	GSM 2012–2013	GSM 2013–2014	GSM 2014–2015	GSM 2015–2016	GSM 2016–2017	GSM 2017–2018
14	14.1	6	3	0	3	33	Point count method no longer used			
	14.2	68	2	0	0	6				
	14.3	3	0	0	1	6				
	14.4	0	0	0	2	0				
	14.5	13	10	0	15	0				
	Incidental observations*	90	184	13	133	257	152	74	748	303
TOTAL		180	199	13	154	302	152	74	748	303

* Number of Golden Sun Moth observed for the 2014–2015, 2015–2016, 2016–2017 and 2017–2018 flight seasons are recorded as incidental observations as they were not recorded from the point count locations used in previous flight season surveys.

Figure 3 Historical Golden Sun Moth monitoring counts, Reserve 14.



4. Discussion and conclusions

A total of 303 GSM were observed at Reserve 14 this season across two days of surveys. Apart from the 2016–2017 survey, this was the highest number of GSM recorded since initial, pre-CMP surveys 2007–2008. Reserve 14 is the largest of the reserves at Aurora and has some of the best GSM habitat available throughout the Aurora residential development.

There were less than half the number of GSM recorded this season compared to 2016–2017 surveys. The variability in GSM abundance at Reserve 14 highlights the importance of long-term monitoring projects which identify natural fluctuations in populations. Variation in population size of the GSM at Reserve 14 aligns with the widely acknowledged view that GSM abundance at any given site can vary tremendously both within and between seasons based on environmental conditions (e.g. air temperature, rainfall) leading up to and during the survey period. Furthermore, survey method and effort at Reserve 14 has fluctuated throughout continued monitoring, employing both point counts and transect monitoring. Difference in survey effort can influence the number of GSM recorded at any given site.

In contrast to the preceding season (2016–2017) which received mostly spring rainfall in September and November of 2017, high rainfall this season did not occur in Epping until early December when a total of 130 mm fell by the second GSM survey (27/12/2017). Research by Kutt *et al.* (2015) suggests that higher than average rainfall correlates to reduced GSM populations in the flight season. Increased rainfall during 2016 could have caused a negative lag effect on the abundance of GSM during the 2017–2018 season. In addition, the high rainfall only a few weeks prior to GSM surveys this season could also have impacted the number of individuals recorded.

The distribution of GSM observed during 2017–2018 surveys also varied from the previous season with fewer GSM recorded in the northern two thirds of the reserve. GSM activity was greatest at the south-eastern section of the reserve most likely due to the availability of quality habitat, including slashed areas and tussocks of Chilean Needle-grass.

Populations of GSM across the Aurora residential development continued to be observed this season at other reserves, including Reserve 12, with smaller numbers also observed at Reserves 9 and 13. Management that focusses on the larger reserves (12 and 14) is likely to be most effective, as a greater area of suitable habitat is available for GSM.

Recommendations

GSM prefer grasslands of low biomass dominated by grasses such as *Austrostipa* spp. and *Rytidosperma* spp. (Dorrough *et al.* 2004). Grazing can be beneficial to ensure appropriate habitat is present (O'Dwyer and Attiwill 2000). Continued cattle grazing in the fenced off areas outside the stony knolls is recommended to manage biomass density throughout the greater part of the reserve. The vegetation within the stony knolls is currently managed by contractors and continued weed management in these areas is required to ensure that Toowoomba Canary-grass *Phalaris aquatica* and other weedy species do not outcompete suitable habitat located within these stony knolls.

Toowoomba Canary-grass when allowed to grow freely outcompetes the GSM preferred Chilean Needle-grass and/or native grasses. Furthermore, the growth pattern of Toowoomba Canary-grass is not indicative of tussock forming grasses in which female GSM prefer to lay their eggs (Gilmore *et al.* 2008; Richter *et al.* 2013). Continued grazing throughout the reserve will assist with maintaining the Toowoomba Canary-grass to a suitable biomass.

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