



Aurora Conservation Reserve 14 Golden Sun Moth monitoring 2018–2019

Final report

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1. Introduction

Biosis Pty Ltd was commissioned by Development Victoria to conduct annual monitoring of Golden Sun Moth (GSM) *Synemon plana* throughout the Aurora residential development area at Epping, Victoria (Figure 1). GSM is a listed matter of national environmental significance (MNES) under the *Environment and Protection Biodiversity Conservation Act 1999* (EPBC Act). GSM monitoring has been undertaken within the Conservation Reserves (reserves) within the Aurora development area since 2009. This monitoring report records the 2018-2019 flight season which represents year 10 and the final monitoring season of GSM within the Aurora development area, which has been completed in accordance with EPBC Act approval conditions 1 and 2 (EPBC 2007/3524) for the residential development.

1.1 Aurora residential development background

Fourteen Conservation Reserves were initially established within the Aurora residential development. The reserves contain 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 native vegetation 'net gain' targets, which are part of the requirements of the Aurora Conservation Management Plan (CMP) (Biosis Research 2008).

All reserves were initially surveyed to determine the distribution of GSM and to provide management advice for the reserves. GSM monitoring commenced in 2007-2008 and was required for ten years under the CMP.

Eleven of the reserves were sold to Lendlease Communities Pty Ltd (Lendlease) in 2015 however, Conservation Reserve 10, 11 and 14 remain in the possession of Development Victoria. Of these three reserves, Conservation Reserve 14 is the only reserve subject to annual GSM monitoring under the CMP. This report presents the monitoring results for the 2018-19 flight season within Conservation Reserve 14. The 2018-2019 season marks the tenth and final year of annual CMP monitoring. The CMP stipulates that once the 10 year monitoring and management period has concluded the reserves are to be protected on title (covenant or similar) and transferred to the ownership of City of Whittlesea (CoW). The covenant and handover process is expected to extend beyond the 10 year monitoring and management period and the ongoing management and monitoring of the reserves will be required until handover occurs.

1.2 Conservation Reserve 14

Conservation Reserve 14 is 65 hectares in size and the largest reserve in Aurora. The reserve is located on the western side of the Hume Freeway and is separated from the remainder of the Aurora reserves and development area by the freeway. The reserve is comprised predominately of Plains Grassy Woodland (ecological vegetation class (EVC) 55_61) interspersed with patches of Stony Knoll Shrubland (EVC 649). The reserve contains 14 EPBC Act listed Matted Flax-lily *Dianella amoena* plants and habitat for the EPBC Act listed GSM. The Stony Knoll Grassland patches are fenced off from grazing and managed for biodiversity. The remainder of the reserve is managed through biomass control in the form of grazing and targeted weed control for woody weeds and thistles. The understory throughout the majority of the reserve is comprised of Chilean Needle-grass *Nassella neesiana* (dominant), Toowoomba Canary-grass *Phalaris aquatica*, Wallaby Grass *Rytidosperma* sp. and Spear Grasses *Austrostipa* sp. GSM are found throughout the entirety of the reserve where suitable ground cover habitat is present.

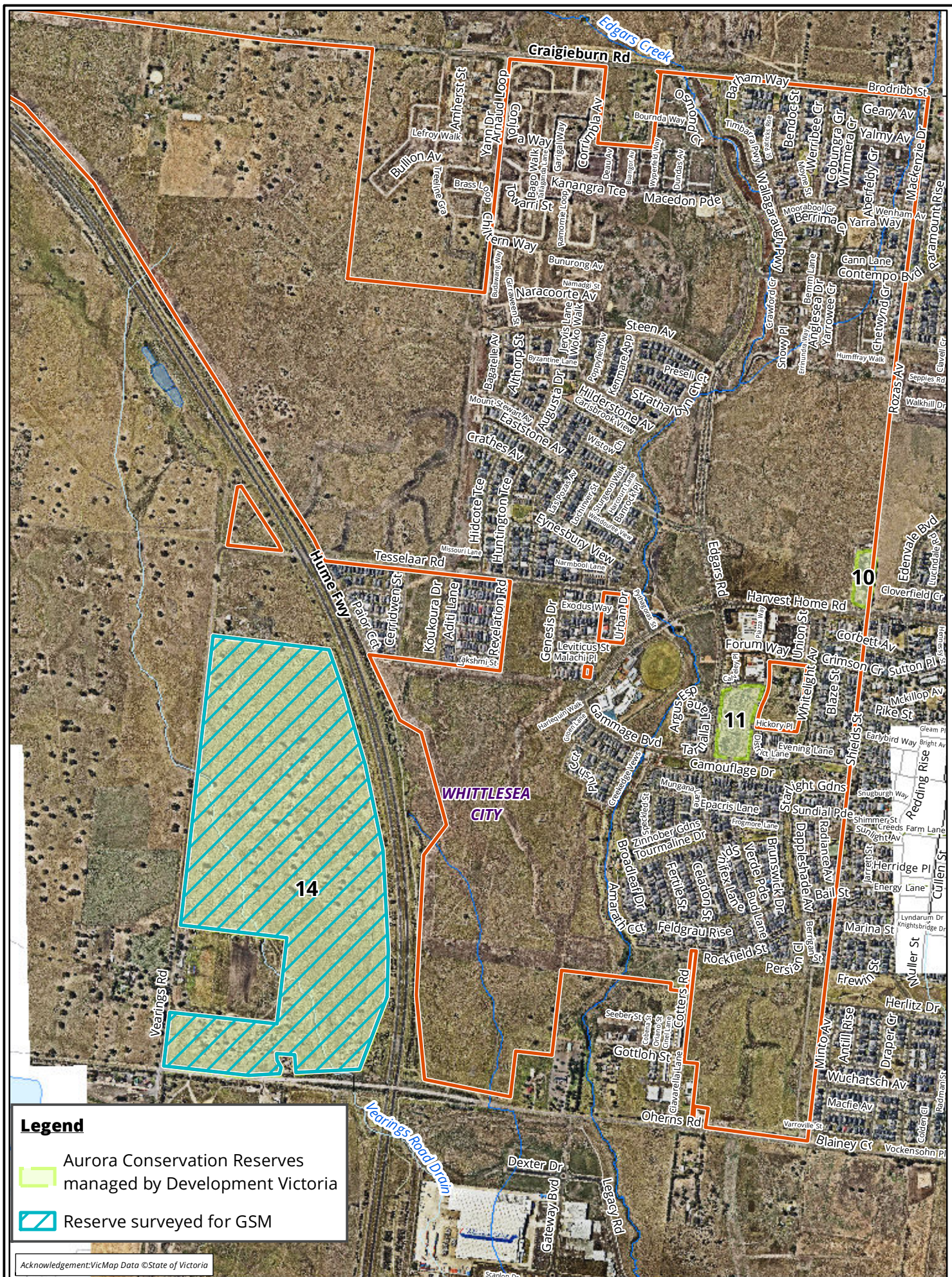
1.3 Golden Sun Moth Background

GSM is a medium sized, diurnal 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) and flash their golden hind wings, which attracts males flying 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 (DEWHA 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. Suitable habitat for GSM must include a cover of a known larval food source (i.e. Wallaby Grass, Spear Grass and introduced Chilean Needle-grass) (DEWHA 2009), along with appropriate inter-tussock space.



2. Methods

2.1 Determining flight season commencement

As the timing of flight seasons varies annually throughout the GSM geographic range, the commencement of the flight season needs to be determined before surveys are undertaken. GSM were first recorded by Biosis flying in the greater Melbourne area on 12 November 2018 and at Aurora South, adjacent to O'Herns Road in Epping on 29 November 2018.

2.2 Transect counts

During the 2018–2019 flight season, walking transect counts were conducted to detect GSM presence and population trends within Conservation Reserve 14. This method has been employed since the 2014–2015 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 5 and 12 December 2018. Conditions were suitable for male flight (above 20°C, minimal cloud cover and wind) and are provided in Table 1. 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 metres apart through Conservation Reserve 14. Tracks were recorded using a Garmin GPS and a waypoint was taken for each location where GSM were observed.

Conservation Reserve 14 was surveyed twice throughout the 2018–2019 flight season. This level of survey effort was considered sufficient to achieve the CMP objective of confirming the population size and to assess the effects of management activities within the reserve.

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 (DELWP) under the *Wildlife Act 1975*, *Flora and Fauna Guarantee Act 1988* and *National Parks Act 1975*.

2.4 Mapping

Mapping was conducted using hand-held (uncorrected) GPS units (GPSMap 64) and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration.

Table 1 Weather conditions during Golden Sun Moth surveys, Aurora Conservation Reserve 14, 2018–19 flight season

Date	5/12/2018	12/12/2018
Start time	11:00	10:18
End	13:59	12:10
Golden Sun Moth recorded	Y	Y
Site temperature (°C) (start/end)	20/24.8	27.7/31
Cloud cover (%) (start/end)	20/15	20/20
Wind direction (start/end)	E/SE	N/N
Average wind speed (km/hr) (start/end)	6/9	41/18
Ground conditions	Dry	Dry
Humidity (%) (start/end)	54/41	49/38
Reference site where moths were recorded on day of survey	Reserve 14 is known reference site	Reserve 14 is known reference site

3. Results

The continued presence of GSM in Conservation Reserve 14 was confirmed during the 2018–2019 flight season. The 2018-2019 survey recorded the largest number of moths since the commencement of the monitoring program with a total of 2586 moths recorded over the two survey days.

GSM counts from both survey dates are shown below in Table 2 and spatial distribution is displayed in Figure 2. A summary of GSM count data throughout the CMP annual monitoring ten year period is provided in Table 3 and **Error! Reference source not found..**

Table 2 Golden Sun Moth survey results, Conservation Reserve 14, 2018–2019 flight season

Reserve	Number of GSM 5/12/2018	Number of GSM 12/12/2018	Total number of GSM for 2018-2019 flight season
14	2050	536	2586

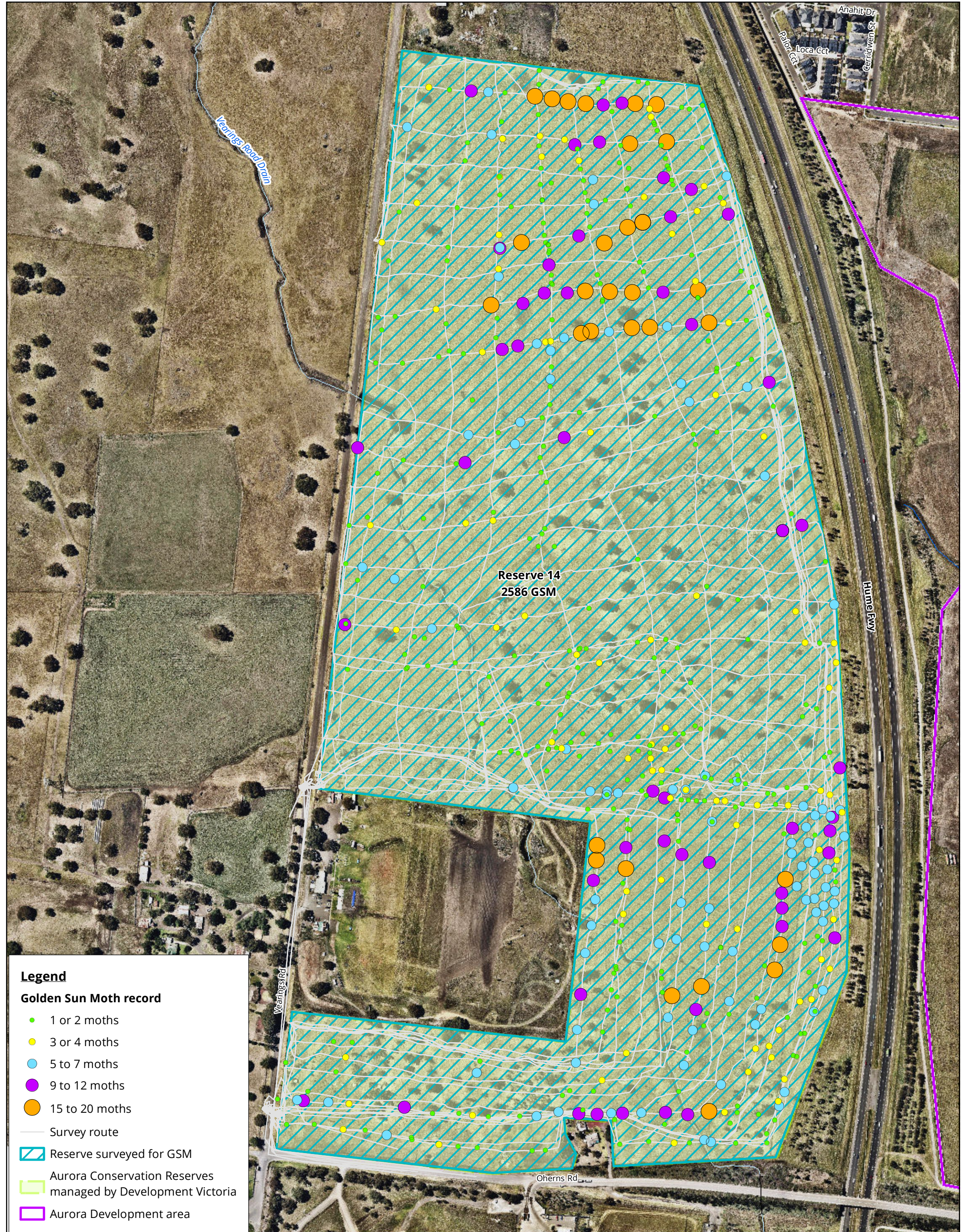


Figure 2 Results of the Golden Sun Moth (GSM) survey 2018-19, Aurora, Epping

Table 3 Golden Sun Moth monitoring counts at Reserve 14 over the ten-year period from 2009 to 2019

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	GSM 2018–2019
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					
	Transect counts						152	74	748	303	2586
TOTAL		180	199	13	154	302	152	74	748	303	2586

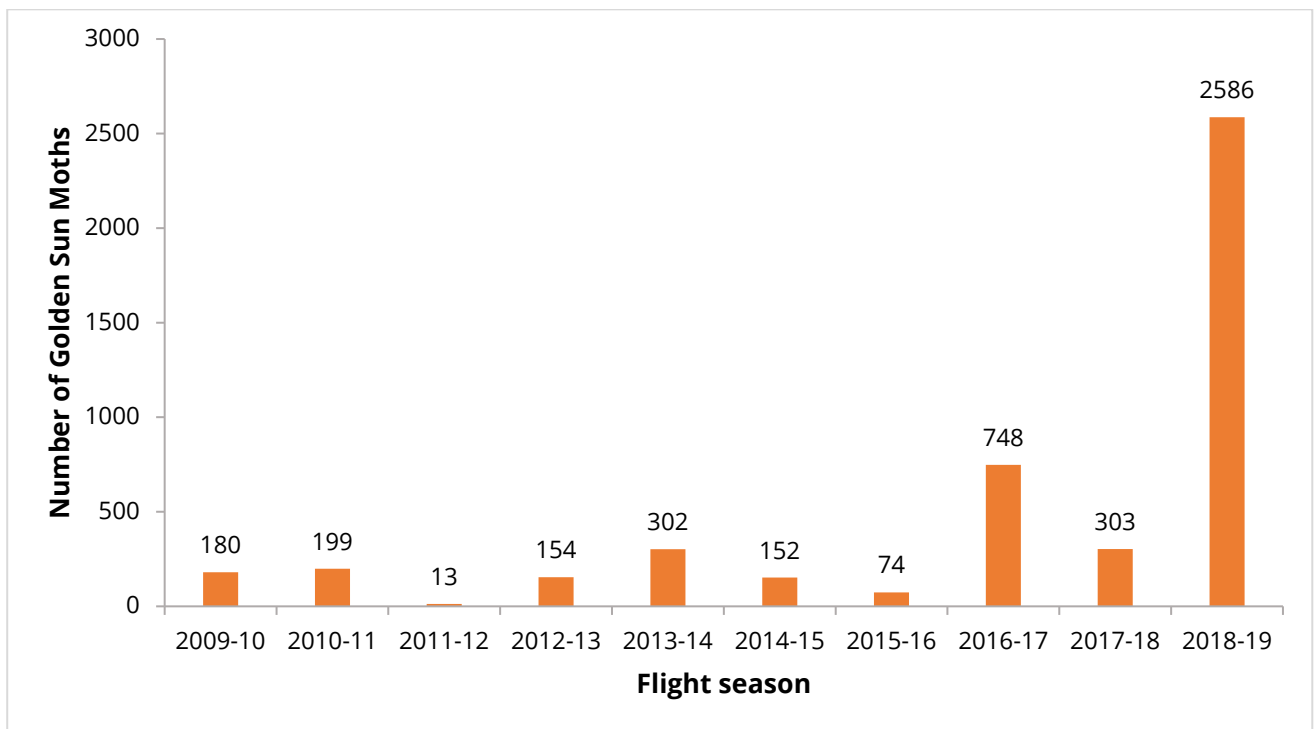


Figure 3 Golden Sun Moth monitoring counts, Reserve 14.

4. Discussion

A total of 2586 GSM were observed within Conservation Reserve 14 across the two monitoring days for the 2018-2019 flight season and the final year of annual monitoring for the species within the reserve under the CMP.

The site condition of Conservation Reserve 14 was optimal for GSM during the 2018/19 season. The pasture area had been subject to moderate cattle grazing throughout the year to maintain the low biomass levels preferred by GSM. This is evident by the distribution of records throughout the entire reserve (Figure 2). In previous years, records have been restricted to slashed firebreaks and managed native vegetation areas when levels of biomass were high throughout the pasture area.

GSM numbers fluctuate greatly between emergence episodes, as demonstrated in the varying numbers of moths detected between surveys in the same season. GSM numbers will vary greatly between emergence years influenced by weather, habitat availability and previous moth numbers.

Research by Kutt et al (2015) suggests that higher than average rainfall correlates to reduced GSM numbers in the proceeding flight season. Although detailed data analysis is outside the scope of this monitoring program, low numbers of moths have been recorded following periods of higher than average rainfall (e.g. 2017-2018). Anecdotal evidence from the monitoring program suggests another potential cause of low GSM numbers during a flight season could be linked to years when biomass in the pasture areas of the reserve was unmanaged (e.g. 2010/11, 2016/17). High biomass affects soil moisture and limits suitable inter-tussock space. The low numbers of moths during these emergence seasons are carried over 2-3 years later when larvae from that flight season emerge as adults.

Should the appropriate management of biomass continue throughout Conservation Reserve 14 and the preferred food plants (Chilean Needle-grass and Wallaby Grass) persist throughout the reserve, it is expected that Conservation Reserve 14 will continue to provide habitat for GSM and remain a stronghold for the local GSM population.

5. Recommendations

The following recommendations have been provided to ensure the ongoing persistence of GSM in Conservation Reserve 14 after the 10 year management period has concluded.

The EPBC Act approval for the Aurora development has effect until July 2033 and whilst the 10 year CMP monitoring period has now concluded it is important to implement measures that will ensure the species persist within the reserve beyond year 10 of the monitoring period.

- Prepare an updated CMP or individual reserve management plan which includes ongoing management and monitoring targets. Ongoing management is essential to ensure that the reserve continues to provide suitable habitat for the species. Ongoing monitoring is required to ensure that the management targets are being met and that the management measures continue to provide and enhance habitat for the species, allowing for adaptive management responses as required.

The updated management plan should include (but is not limited to):

- Maintenance level targets for weed management
- Grazing management plan (currently in draft) and monitoring program to be finalised and implemented
- A list of actions and restrictions for the reserve
- Updated monitoring program for GSM.
- Continue with current reserve management and grazing until an updated management plan is prepared. Ongoing monitoring of biomass levels during reserve visits will be critical to ensure suitable habitat remains within the reserve.
- Undertake protection of the reserve with a conservation covenant and continue planning for the ultimate handover to council.

6. References

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