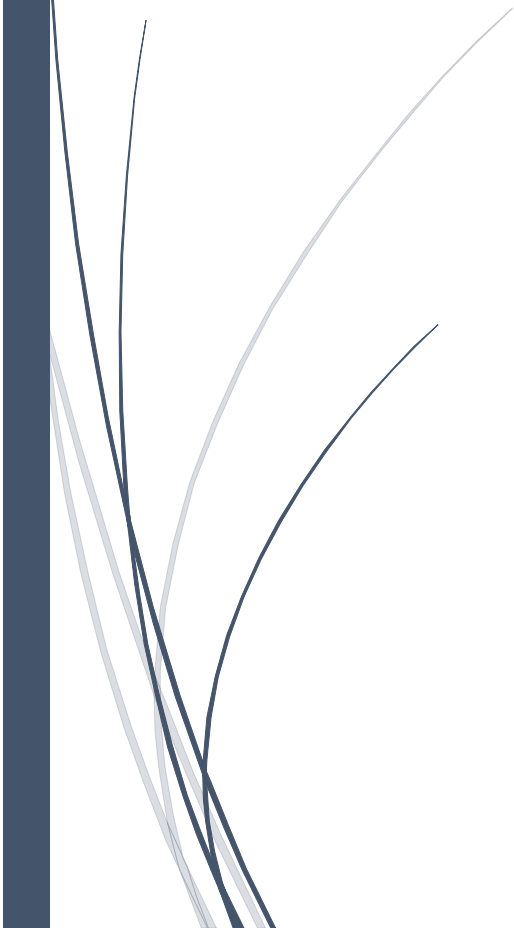


Jarramlee Subsidence Paddock

Golden Sun Moth habitat mapping



Alison Rowell
BIOLOGIST AND ENVIRONMENTAL CONSULTANT
PO Box 777 Dickson ACT 2602
September 2018

Contents

1. Introduction	3
2. Methods	5
2.1 Habitat quality categories.....	5
2.2 General characteristics of biomass classes	6
2.3 Step-point transects	6
3. Results.....	10
3.1 Extent of GSM habitat in different condition categories.....	10
3.2 Subsidence paddock biomass levels	10
3.3 Vegetation assessments within different categories of GSM habitat.....	10
4. Discussion	15
5. References	16
Appendix 1. Reference photographs of GSM habitat transects.....	17
Appendix 2. Jarramlee transect data from March 2018 (SMEC 2018b)	23

1. Introduction

Jarramlee environmental offset (112 hectares) is located on the north-western boundary of the ACT (Figure 1). It was established to compensate for the impacts of the Lawson South residential estate on Natural Temperate Grassland and habitat for the critically endangered Golden Sun Moth *Synemon plana* (EPBC 2010/5549). The ACT Parks and Conservation Service has responsibility for implementing offset management plans and in 2017 engaged environmental consultants to map Golden Sun Moth (GSM) habitat condition across Jarramlee (SMEC 2018a). However, a six hectare area south of Ginninderra Creek known as the Jarramlee subsidence paddock (Figure 2) was not mapped in 2017. This is because the area was closed in 2015 due to health and safety risks posed by subsidence which has followed demolition of the former Belconnen Sewerage Treatment Plant.

The Jarramlee Offset Management Plan (TAMS 2013) identifies the vegetation in the Jarramlee subsidence paddock as 'Native Pasture: Wallaby Grass/Speargrass', and the GSM habitat quality as Moderate. Vegetation mapping of the Jarramlee Subsidence Paddock was undertaken in March 2018. Mapping occurred after mowing in February. The purpose of the mowing was to remove vegetation (up to a metre in height) which had grown since the paddock was closed in 2015. This mapping was supported by 21, 50-m step-point transects and showed a mosaic of native pasture, mixed native/exotic grassland and exotic pasture (Figure 3; SMEC 2018b).

The purpose of the current project is to map the current extent and condition of GSM habitat in the subsidence paddock, which will provide data to inform land management decisions.

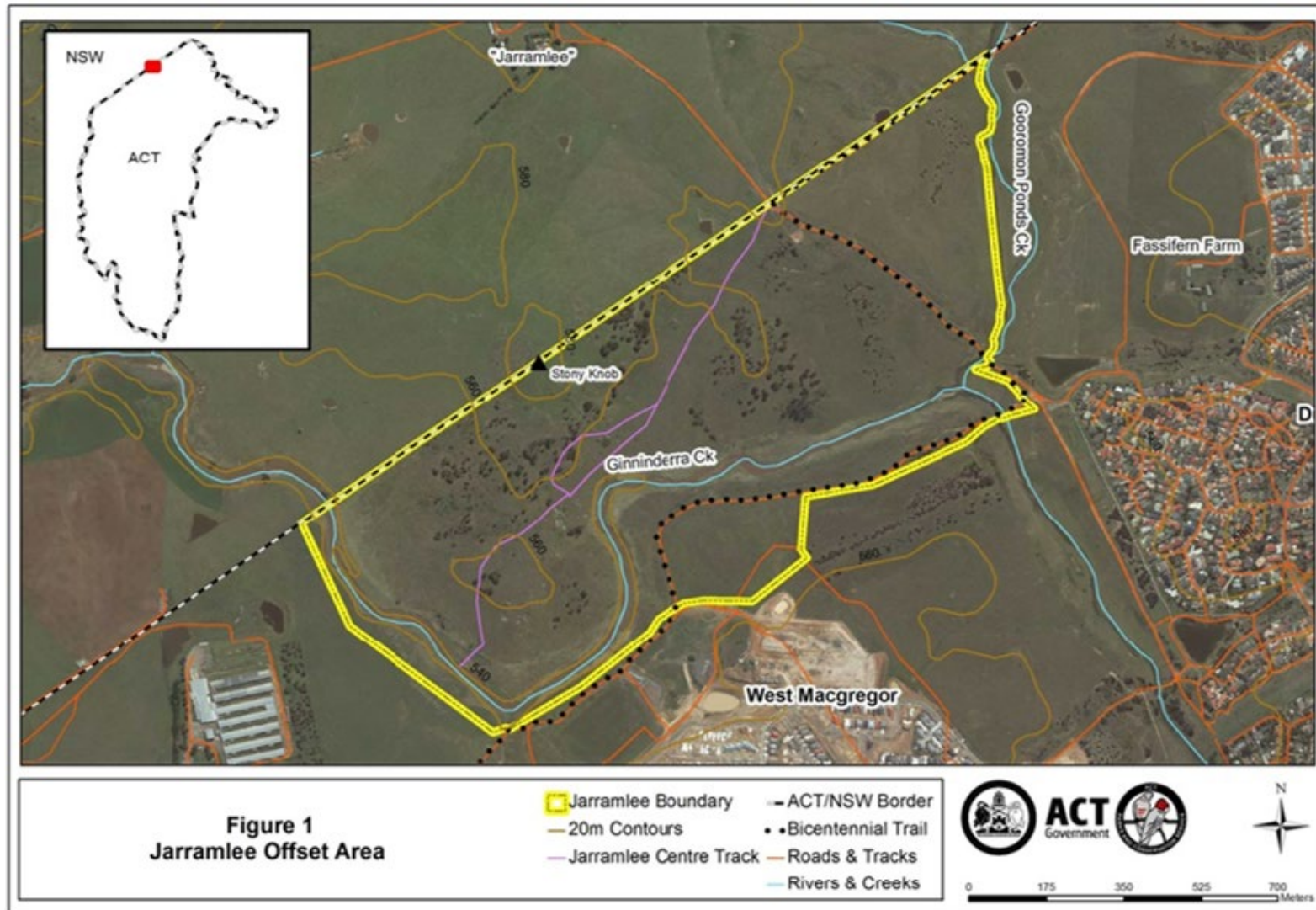


Figure 1. Jarramlee Offset Area (from Jarramlee Offset Management Plan; TAMS 2013).

2. Methods

2.1 Habitat quality categories

The Jarramlee Subsidence Paddock was surveyed on 27 June and 4-5 July 2018. The GSM habitat was categorised according to four condition zones:

1. High-quality habitat

Primary NTG or native pasture dominated by native larval food plants (i.e. Wallaby Grass *Rytidosperma* spp. and/or Speargrass *Austrostipa* spp.), with low weed cover and some bare ground. Minimum conditions would usually include:

- >10% cover *Rytidosperma* spp.
- >20% cover *Rytidosperma* spp. and *Austrostipa* spp. combined
- >5% bare ground
- <5% exotics
- native forbs present
- low to moderate biomass (see biomass descriptions below)
- litter sparse to medium
- no evidence of pasture improvement (pasture grasses and subterranean clover)

2. Moderate-quality habitat

Primary or secondary grassland, with a moderate component of *Rytidosperma* sp. and/or *Austrostipa* sp., and/or moderate weed cover. Approximate minimum condition includes:

- >1% cover *Rytidosperma* spp.
- >10% cover *Rytidosperma* spp. and/or *Austrostipa* spp. combined
- >3 %cover bare ground
- <10% exotics
- Low to moderate biomass
- Litter sparse to medium

OR

Native-dominated grassland with a high component of *Rytidosperma* spp. and/or *Austrostipa* spp., but less than high-quality habitat because of one or more of the following conditions:

- On a steep slope or hill top
- On a south or east-facing slope
- Soil very shallow and/or stony, rock outcrops present
- Secondary grassland or contains scattered trees.

3. Low-quality habitat

Larval food plants (*Rytidosperma* spp., *Austrostipa* spp. and/or Chilean Needle Grass *Nassella neesiana*) are a minor (<10%) component of the ground layer, growing sparsely or in patches among unsuitable vegetation such as:

- Exotic species (excluding Chilean Needle Grass)
- Native ground layer species which are not known larval food plants
- Trees, shrubs, regeneration, plantings
- Litter may be dense

4. CNG (Chilean Needle Grass) dominated habitat

Grassland dominated by Chilean Needle Grass.

2.2 General characteristics of biomass classes

While habitat quality was being mapped, an assessment of biomass levels was also undertaken. Biomass was classified according to three categories:

1. Low biomass

Tussocks up to 10 cm high, bare ground usually common between tussocks, litter layer usually sparse.

2. Medium biomass

Tussocks up to 20 cm high, little bare ground between tussocks, litter common but not continuous.

3. High biomass

Tussocks greater than 20 cm high and closely spaced, little or no bare ground, litter layer continuous and thatchy, often including subterranean clover.

For all condition classes, the ideal biomass condition would be low to medium, i.e. most areas without dense thatch or tall dense tussock grasses over 10 cm high.

2.3 Step-point transects

The methods supplied by the ACT Government stipulated surveying a step-point transect of at least 100 paces or metres in each habitat condition zone. However, the disturbance and fragmentation of this site meant that it was difficult to place 100-m transects within the same habitat zone, so six 50-m transects were surveyed (Figure 2). Where possible, these transects aligned with those established for vegetation mapping conducted in March 2018 (Figure 3; SMEC 2018b) to facilitate comparisons with past surveys.

At each point along the transect, a single (dominant) groundcover feature was recorded. This differs from 'multiple hit' transects where more than one feature can be recorded at each point, e.g. where a vertical projection (the 'point') touches a grass leaf and a forb stem then ends on bare ground. In the 'single hit' method, the dominant feature may be obvious, e.g. when the vertical projection ends in the middle of a large tussock or a patch of bare ground. Where more than one feature is intersected and neither is easily discerned as dominant, the diameter of the projection is extended to 10 cm and the dominant feature in that diameter is chosen. The groundcover features identified included the following categories:

- Cryptogams
- Bare earth
- Rocks
- Litter/dead vegetation
- Chilean Needle Grass
- Serrated Tussock
- Annual exotic grass
- Perennial exotic grass (including Chilean Needle Grass and Serrated Tussock)
- Exotic broadleaf
- Wallaby Grass
- Speargrass
- Other perennial native grass
- Other native plants

To minimise artificial, seasonal inflation of litter measures, identifiable standing dead vegetation was assigned to a live vegetation category rather than the litter/dead vegetation category.

Notes were also made of features relevant to GSM population persistence and demography e.g. pupal case locations, soil type, presence of trees/shrubs, site damage, biomass, grazing type and pressure, evidence of recent fire, evidence of recent slashing, evidence of erosion etc.

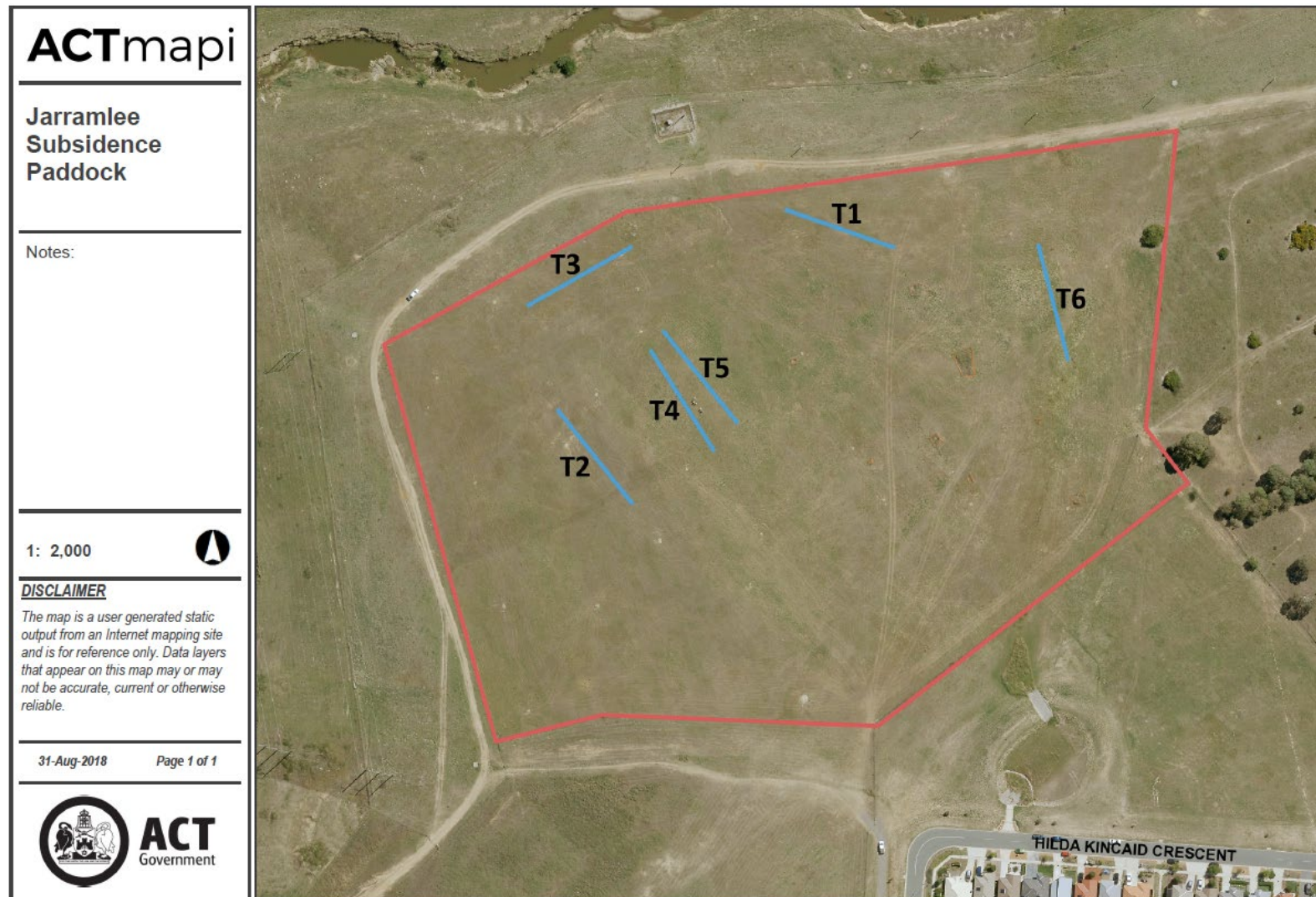


Figure 2. Golden Sun Moth habitat transects in Jarramlee Subsidence Paddock.

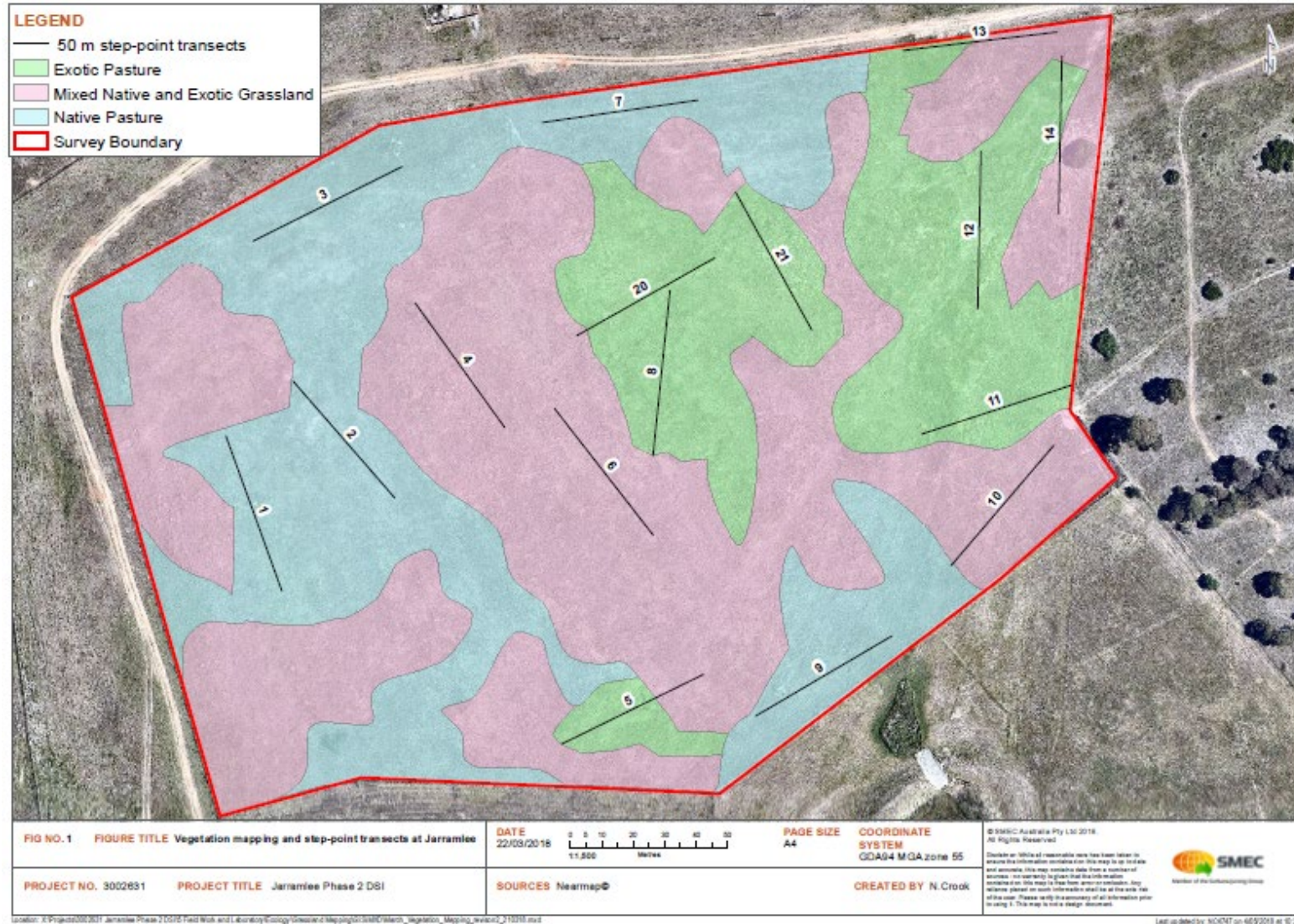


Figure 3. Vegetation mapping in Jarramlee Subsidence Paddock (SMEC 2018b)

Jarramlee Subsidence Paddock, GSM habitat mapping. A. Rowell, 2018.

3. Results

3.1 Extent of GSM habitat in different condition categories

Winter is not an ideal time to conduct vegetation transects, consequently the GSM habitat was assessed generously due to the suboptimal survey season. There was no high-quality habitat on the 6 hectare site, but 0.58 hectares were assessed as moderate-quality habitat and 3.45 hectares as low-quality habitat (including 0.31 hectares of CNG-dominated vegetation) (Figure 4). Areas shown as not being GSM habitat are mostly low-lying, dominated by exotic species and considered to have insufficient Chilean Needle Grass to support GSM.

Table 1. Hectares of GSM habitat in Jarramlee Subsidence Paddock

GSM habitat quality	Habitat area (hectares)
High	0.00
Moderate	0.58
Low	3.14
Chilean Needle Grass	0.31
Not habitat	2.05
TOTAL	6.08

3.2 Subsidence paddock biomass levels

The site showed signs of considerable past disturbance, with exotic species on areas of disturbed soil and dense exotic grasses in the drainage lines. Tussock height did not vary much across the site due to summer mowing and low winter rainfall, so biomass mainly varied with tussock density/frequency (Figure 4).

The vegetation also did not match well with all the criteria for the biomass categories due to artificially high litter levels across the site following the February 2018 mowing of very tall vegetation after two years without biomass control. The result was that bare ground was lower and litter higher than described in the low and medium biomass classes, so the assessment of biomass prioritised tussock density to allow separation of classes.

3.3 Vegetation assessments within different categories of GSM habitat

Two 50-m step-point transects were surveyed in moderate-quality habitat and three 50-m transects in low-quality habitat (one transect with a small amount of Chilean Needle Grass and two transects without Chilean Needle Grass). One 50-m transect was surveyed in an area that was exotic-dominated and contained very little Chilean Needle Grass, so was not assessed as GSM habitat. The results for vegetation surveys are shown in Table 2 and transect photographs are in Appendix 1.

Chilean Needle Grass was present but not dominant (< 25% cover) on the site (Figure 4), possibly due in part to competition with other perennial exotic grass species (such as Phalaris, Tall Fescue, Paspalum, and Cocksfoot). Subterranean Clover was present but not common and the exotic perennial pasture grasses were most common in the drainage lines, which suggests that the site has not recently been subjected to pasture improvement.

The vegetation on the site was generally in poor condition, with 21 native species and 32 exotic species recorded (Tables 3-6). The areas dominated by native grasses contained very few native forbs and cover of GSM food species was relatively low (< 20% cover on all transects), with Wallaby Grasses

noticeably uncommon (< 1% cover, and no 'hits' in any of the transects). There was insufficient fertile material to identify the Wallaby Grasses, but they were provisionally identified as *Rytidosperma carphoides* (uncommon with < 1% cover on the site, but the species was found in some moderate-quality habitat) and *R. caespitosum* (sparsely scattered with < 1% cover across the site). No Wallaby Grasses were 'hit' on transects, and the highest cover of Speargrasses was 18%. The most common native grass was Redleg Grass (*Bothriochloa macra*) with 60% cover on one transect. However, this is a C4 species not generally associated with GSM.

Plant litter (fallen) was moderate to high on all transects (range: 16-24% cover). Transects in moderate-quality GSM habitat were characterised by cryptogams, low amounts of bare ground (range: 4-6% cover), high cover of native grasses (range: 42-46% cover), occasional occurrence of native forbs (range: 0-2% cover), relatively low but variable cover of exotics (range: 2-20% cover), and very low cover of annual grasses (range: 0-2% cover). Low-quality habitat contained no cryptogams, almost no bare ground, relatively high cover of exotics (range: 50-60% cover), and (mainly C4) native grasses (especially Redleg Grass) (range: 16-40% cover).

Direct comparisons with the SMEC (2018b) vegetation mapping was not possible due to different methods of data collection. However, the three transects that were surveyed in both projects (Transects 2-4) showed similarities in vegetation structure, especially in the proportions of perennial species (native and exotic) (see Appendix 2).

There were several small fenced-off areas of active subsidence and ponding, which will require rehabilitation after hazard removal and stabilisation.

Table 2. Percentage cover categories for six 50 metre step-point transects.

Transect	START	END	Cryptogam	Bareground	Rock	Litter	CNG	Serrated Tussock	Annual Exotic Grass	Perennial Exotic Grass	Exotic Broadleaf	Wallaby Grass	Speargrass	Perennial Native Grass	Other Native	NOTES
T1	682225 E 6102857 N	682270 E 6102841 N	8	4	0	24	0	0	0	16	4	0	18	24	2	GSM habitat Moderate (to Low). Biomass Low (to Medium).
T2 (=SMEC2)	682130 E 6102774 N	682161 E 6102735 N	28	6	0	16	0	0	2	0	2	0	18	28	0	GSM habitat Moderate (to Low). Biomass Low (to Medium).
T3 (=SMEC3)	682161 E 6102842 N	682117 E 6102817 N	0	2	0	16	0	0	0	4	2	0	6	70	0	GSM habitat value Low. Biomass Medium.
T4 (=SMEC4)	682169 E 6102799 N	682195 E 6102757 N	0	0	0	22	14	0	18	26	4	0	10	6	0	GSM habitat Low (with some CNG). Biomass Medium.
T5	682174 E 6102807 N	682205 E 6102768 N	0	0	0	24	0	0	22	8	6	0	14	26	0	GSM habitat Low. Biomass Medium.
T6	682330 E 6102843	682343 E 6102794 N	0	2	0	20	0	0	14	60	2	0	0	2	0	Not GSM habitat (no food plants). Biomass Medium (to High).

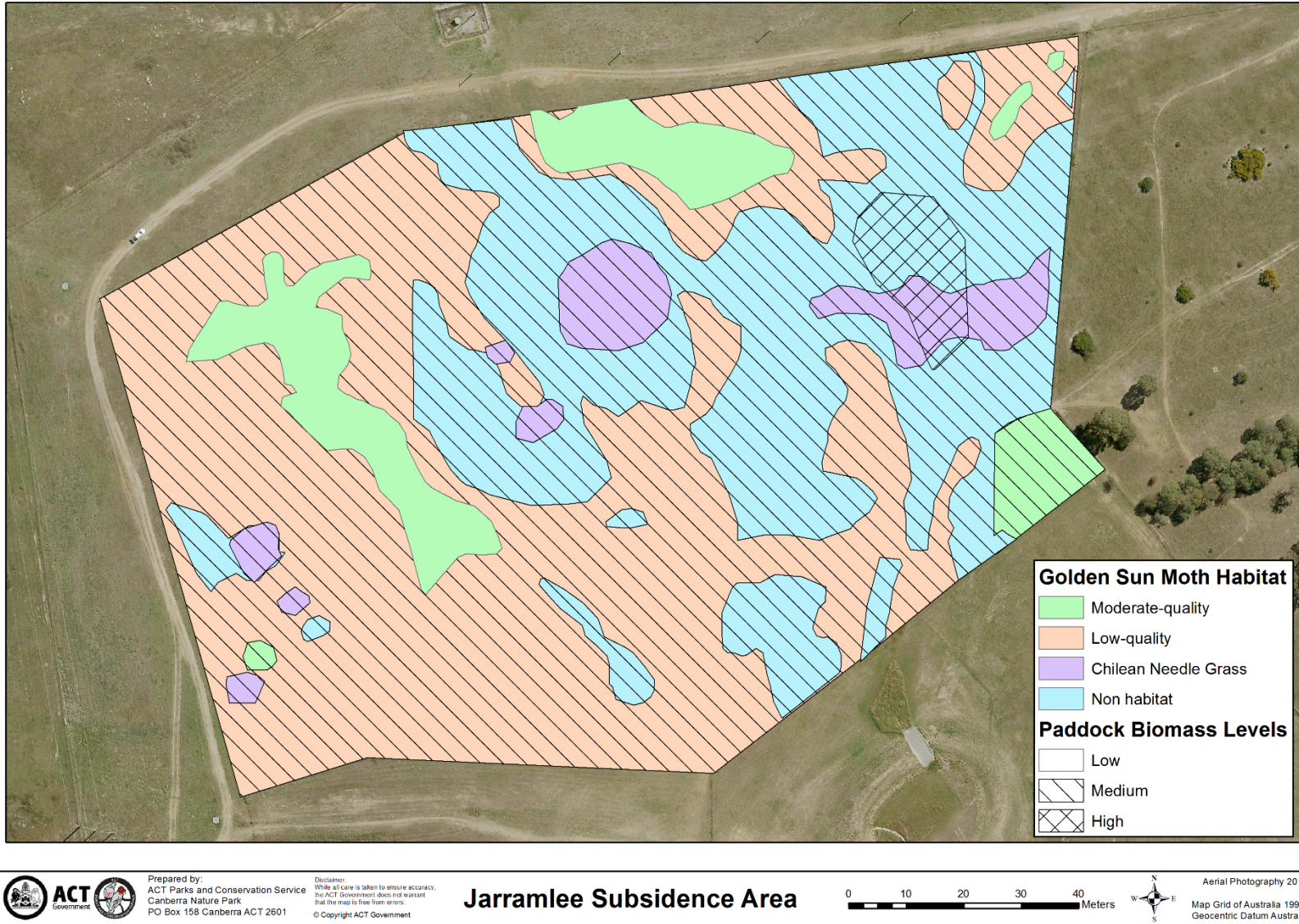


Figure 4. Golden Sun Moth habitat quality, including areas of Chilean Needle Grass.

Jarramlee Subsidence Paddock, GSM habitat mapping. A. Rowell, 2018.

Table 3. Native grass species recorded at Jarramlee Subsidence Paddock

FAMILY	SPECIES
Poaceae	<i>Aristida ramosa</i>
Poaceae	<i>Austrostipa bigeniculata</i>
Poaceae	<i>Austrostipa scabra</i>
Poaceae	<i>Bothriochloa macra</i>
Poaceae	<i>Chloris truncata</i>
Poaceae	<i>Eragrostis trachycarpa</i>
Poaceae	<i>Panicum effusum</i>
Poaceae	<i>Rytidosperma carphoides</i>
Poaceae	<i>Rytidosperma caespitosum</i>
Poaceae	<i>Sporobolus</i> sp.
Poaceae	<i>Themeda triandra</i>

Table 4. Other native species recorded at Jarramlee Subsidence Paddock

FAMILY	SPECIES
Rosaceae	<i>Acaena ovina</i>
Crassulaceae	<i>Crassula sieberiana</i>
Asteraceae	<i>Euchiton</i> sp.
Haloragaceae	<i>Haloragis heterophylla</i>
Juncaceae	<i>Juncus</i> sp.
Polygonaceae	<i>Persicaria prostrata</i>
Polygonaceae	<i>Rumex</i> sp.
Asteraceae	<i>Vittadinia muelleri</i>

Table 5. Exotic grass species recorded at Jarramlee Subsidence Paddock

FAMILY	SPECIES
Poaceae	<i>Avena</i> sp.
Poaceae	<i>Bromus</i> sp.
Poaceae	<i>Cynodon dactylon</i>
Poaceae	<i>Dactylis glomerata</i>
Poaceae	<i>Eleusine tristachya</i>
Poaceae	<i>Eragrostis curvula</i>
Poaceae	<i>Festuca arundinacea</i>
Poaceae	<i>Nassella neesiana</i>
Poaceae	<i>Nassella trichotoma</i>
Poaceae	<i>Paspalum dilatatum</i>
Poaceae	<i>Phalaris aquatica</i>
Poaceae	<i>Vulpia</i> sp.

Table 6. Other exotic species recorded at Jarramlee Subsidence Paddock

FAMILY	SPECIES
Myrsinaceae	<i>Anagallis arvensis</i>
Boraginaceae	<i>Echium plantagineum</i>
Geraniaceae	<i>Erodium</i> sp.
Asteraceae	<i>Gamochaeta americana</i>
Brassicaceae	<i>Hirschfeldia incana</i>
Asteraceae	<i>Hypochaeris radicata</i>
Clusiaceae	<i>Hypericum perforatum</i>
Malvaceae	<i>Modiola caroliniana</i>
Plantaginaceae	<i>Plantago lanceolata</i>
Rosaceae	<i>Pyracantha</i> sp.
Iridaceae	<i>Romulea rosea</i>
Rosaceae	<i>Rosa rubiginosa</i>
Rosaceae	<i>Rubus fruticosus</i>
Polygonaceae	<i>Rumex crispus</i>
Lamiaceae	<i>Salvia verbenaca</i>
Rosaceae	<i>Sanguisorba minor</i>
Fabaceae	<i>Trifolium angustifolium</i>
Fabaceae	<i>Trifolium glomeratum</i>
Fabaceae	<i>Trifolium subterraneum</i>
Verbenaceae	<i>Verbena bonariensis</i>

4. Discussion

GSM habitat mapping indicated that the extent of moderate-quality habitat is limited, and most of the subsidence paddock comprises low-quality or non-GSM habitat. Further, it is possible that the areas assessed as moderate-quality habitat (due to the presence of Speargrasses, occasional Wallaby Grasses and bare ground) will later be assessed as no better than low-quality habitat, as the bare ground may be a result of soil scraping or compaction by vehicles.

Previous surveys for flying GSM on this site found low numbers of flying males (Biosis 2010 & 2015, Rowell 2015) or none (Braby 2005), with no females or pupal cases recorded and no flying males recorded in the south-western part of the site. It is likely that the low numbers of GSM reflect the limited extent of moderate-quality habitat, the low cover of Wallaby Grasses, past soil disturbance and biomass fluctuations. Unless habitat conditions improve (see recommendations below), it is likely the site will continue to support only a sparse GSM population.

Rehabilitation of the site with the aim of improving GSM habitat should be undertaken by:

- Increasing the cover of Wallaby Grasses by planting tube stock into well-drained areas of low-quality habitat (after spraying weeds where necessary). This would be especially beneficial on the north and west-facing slopes of the ridge in the west of the site, as this area has a good open structure but is currently dominated by Redleg Grass.
- Revegetating highly disturbed areas with native grasses, including ecologically appropriate species of Wallaby and Speargrasses (e.g. *Rytidosperma duttonianum* in lower areas, *R. carphoides* and *Austrostipa scabra* on shallow soil or ridge tops, *R. caespitosum* and

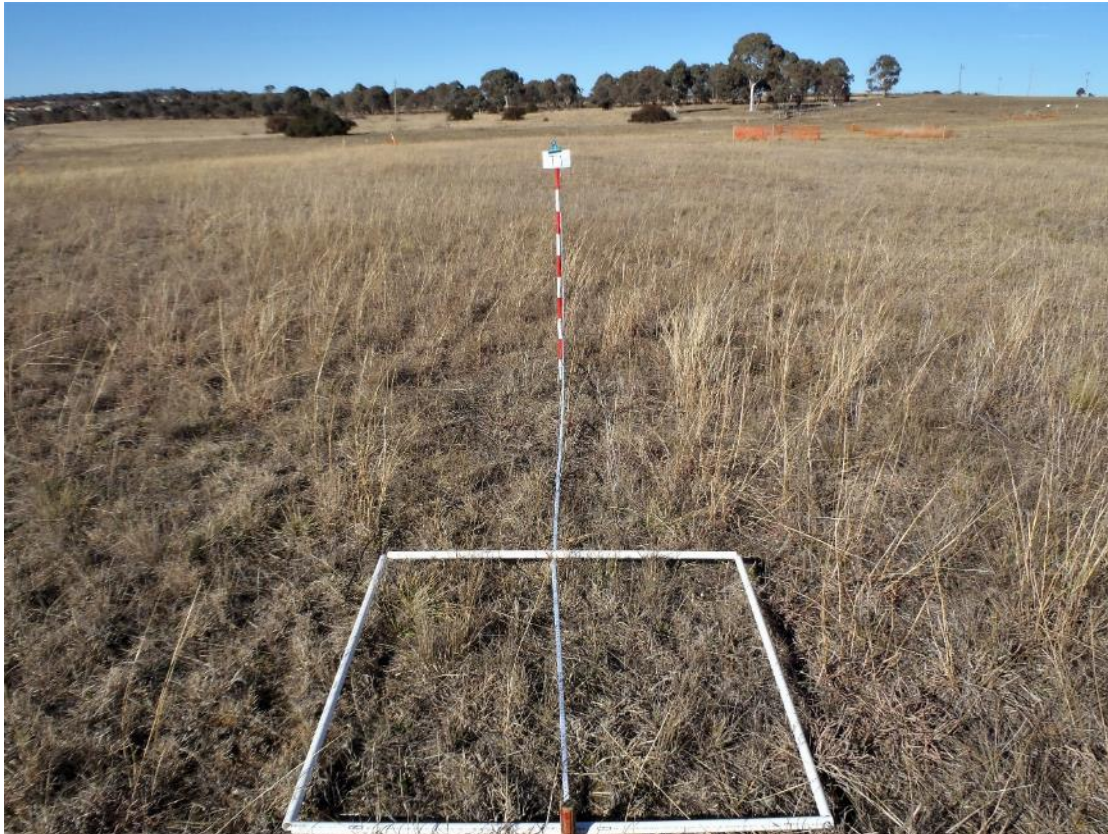
A. bigeniculata in other areas). Outside drainage lines, the soil is generally poor and should favour the establishment of native grasses.

- Follow-up removal of weeds in rehabilitated areas.
- Reducing exotic species in the drainage lines by herbicide spraying and replacing them with robust native species such as *Carex appressa*, *Poa labillardierii* and *Themeda triandra*
- Maintaining biomass in the low to moderate range with intermittent cattle grazing.
- Controlling perennial weeds, especially Serrated Tussock, Chilean Needle Grass, Phalaris, Paspalum, St John's Wort and Blackberry. Chilean Needle Grass is currently a widespread but minor component of the vegetation, and management actions should aim to remove it from the site.

5. References

- Biosis 2010. *Monitoring Study for Golden Sun Moth Synemon plana: Macgregor West, Macgregor and Dunlop*. Biosis Research Pty Ltd. February 2010.
- Biosis 2015. *Golden Sun Moth Monitoring Report – Jarramlee Nature Reserve*. Biosis Research Pty Ltd. February 2015.
- Braby, M. 2005. *Distribution and provisional management plan of the Golden Sun-moth Synemon plana (Lepidoptera: Castniidae), in remnant grasslands of Macgregor West, ACT*. For Purdon Associates Pty Ltd, Canberra, on behalf of the ACT Planning and Land Authority. April 2005.
- SMEC 2018a. *Jarramlee Offset Nature Reserve. Golden Sun Moth Population Monitoring and Habitat Mapping 2017*. Prepared for ACT Government – Environment and Planning.
- SMEC 2018b. Map and transect data provided by Environment and Planning, ACT Parks and Conservation Service.
- TAMS 2013. *Jarramlee Offset Management Plan*. Prepared by Territory and Municipal Services on behalf of the ACT Government.

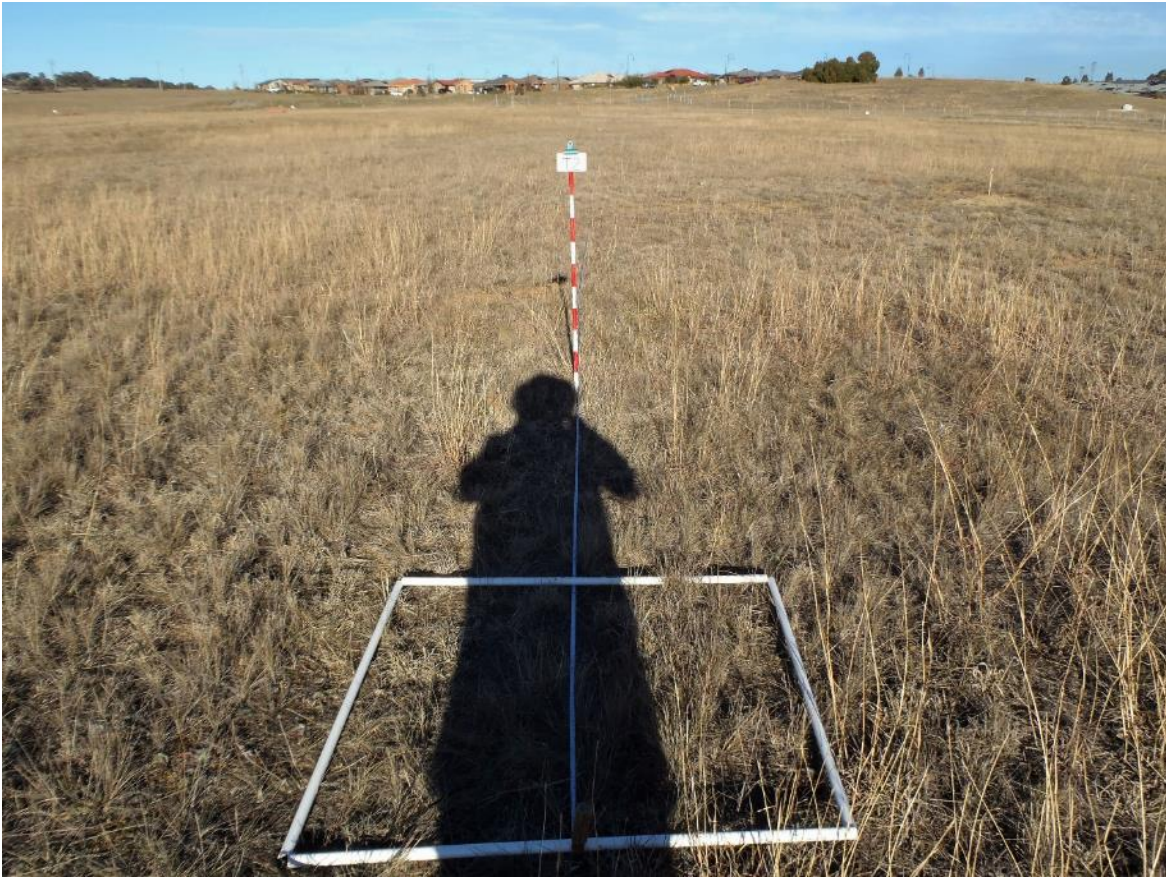
Appendix 1. Reference photographs of GSM habitat transects.



Transect 1. Jarramlee Subsidence Paddock.



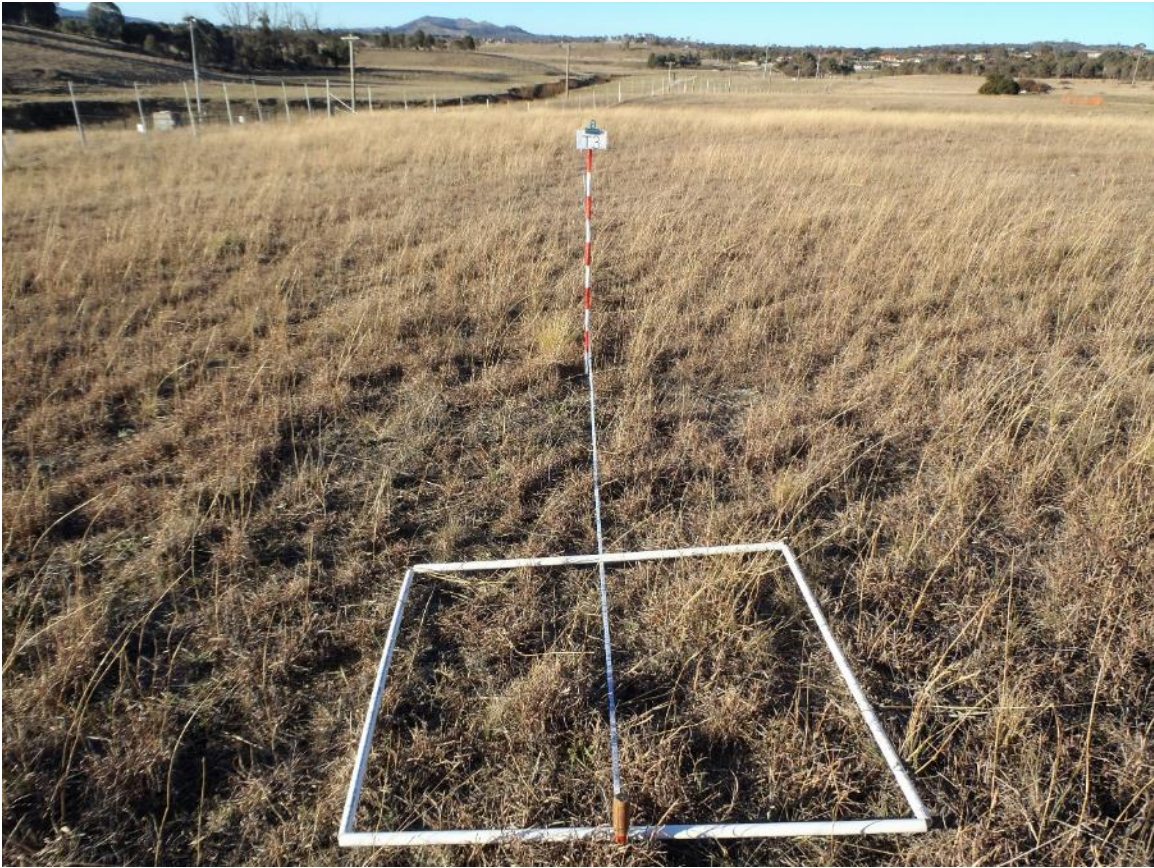
Transect 1 (detail). Jarramlee Subsidence Paddock.



Transect 2. Jarramlee Subsidence Paddock.



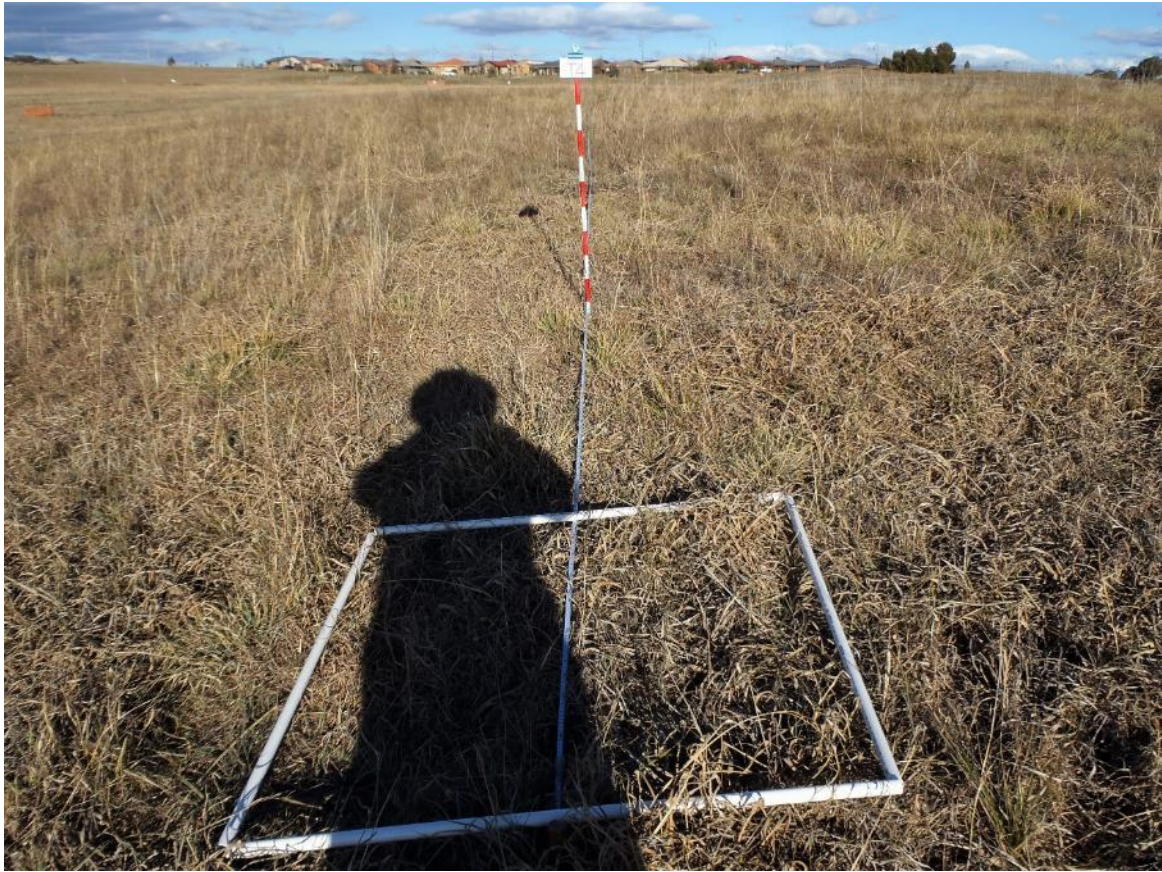
Transect 2 (detail). Jarramlee Subsidence Paddock.



Transect 3. Jarramlee Subsidence Paddock.



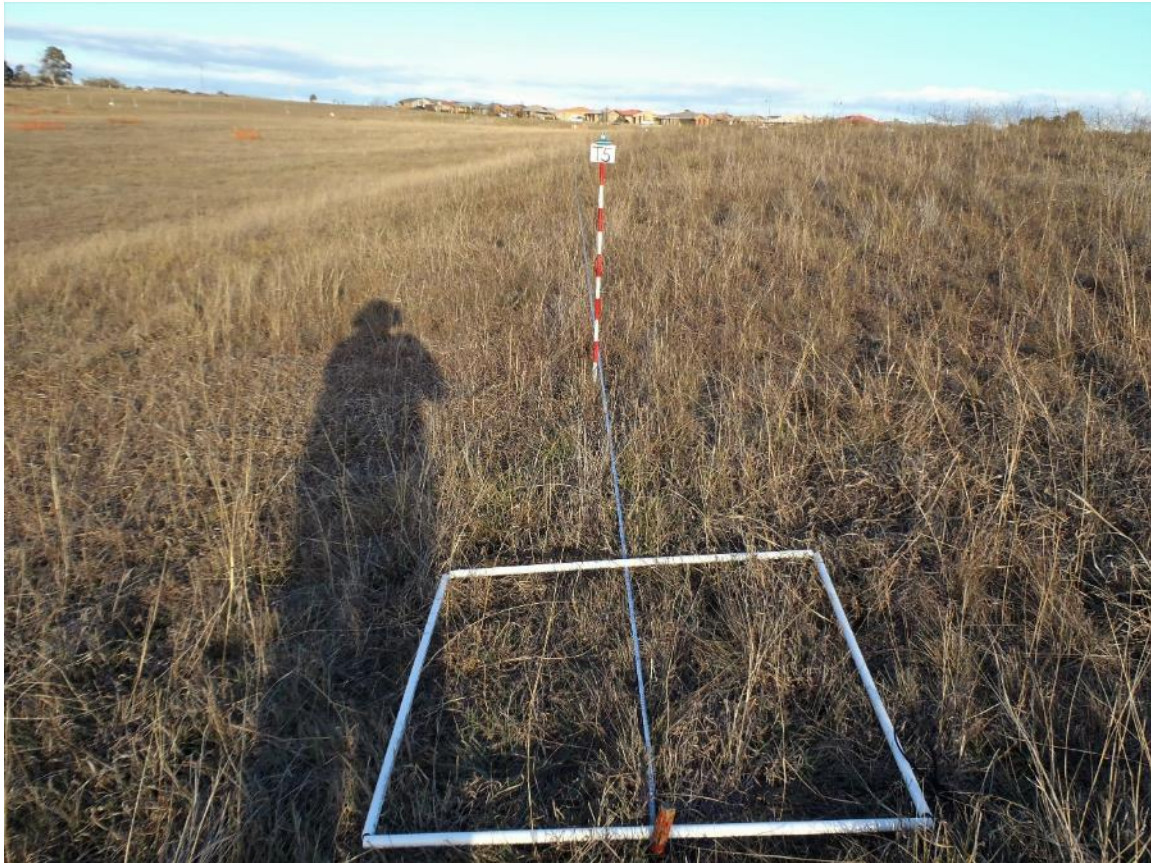
Transect 3 (detail). Jarramlee Subsidence Paddock.



Transect 4. Jarramlee Subsidence Paddock.



Transect 4 (detail). Jarramlee Subsidence Paddock.



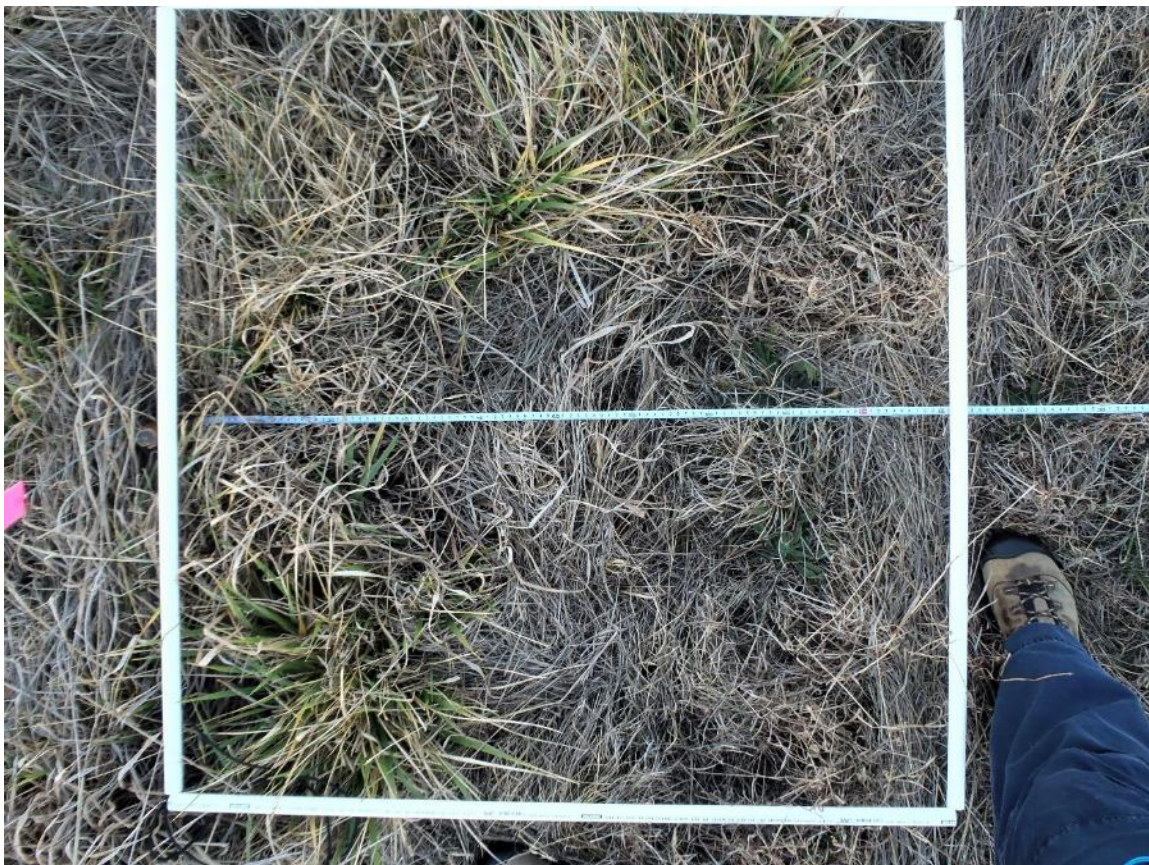
Transect 5. Jarramlee Subsidence Paddock.



Transect 5 (detail). Jarramlee Subsidence Paddock.



Transect 6. Jarramlee Subsidence Paddock.



Transect 6 (detail). Jarramlee Subsidence Paddock.

Appendix 2. Jarramlee transect data from March 2018 (SMEC 2018b)

(July 2018 results for same parameters bold with grey background)

Date	Transect	Crypt	Bare	Rock	Litter	Annual Exotic Grass	Perennial Exotic Grass	Exotic Forb	Perennial Native Grass	Other Native
20-Mar-18	1	0	0	0	20	0	26	18	42	0
20-Mar-18	2	0	2	0	34	0	0	2	60	0
04-Jul-18	2	28	6	0	16	2	0	2	46	0
20-Mar-18	3	0	0	0	18	0	8	6	68	0
04-Jul-18	3	0	2	0	16	0	4	2	76	0
20-Mar-18	4	0	0	0	10	0	48	12	34	0
05-Jul-18	4	0	0	0	22	18	40	4	16	0
20-Mar-18	5	0	0	0	18	0	52	2	30	0
20-Mar-18	6	0	0	0	28	32	32	8	34	0
20-Mar-18	7	0	0	0	16	0	8	10	62	0
20-Mar-18	8	0	0	0	24	18	80	6	0	0
20-Mar-18	9	0	0	0	20	12	32	6	52	0
20-Mar-18	10	0	0	0	14	8	32	4	42	0
20-Mar-18	11	0	0	0	18	20	84	2	4	0
20-Mar-18	12	0	0	0	40	22	70	4	0	0
20-Mar-18	13	0	0	0	18	30	42	10	0	0
20-Mar-18	14	0	0	0	18	20	38	6	16	0
20-Mar-18	20	0	0	0	24	12	74	0	6	0
20-Mar-18	21	0	0	0	18	8	50	8	16	0