










Conservation Status	Taxon	Family	No. of records in Study Area	Habitat (WA Herbarium 2012)	Distribution	Flower Period	Picture
P1	<p><i>Brachyscome</i> sp. Wanna Munna Flats (S. van Leeuwen 4662) PN</p> <p>Erect annual herbaceous daisy with pinnatisect leaves and light purple flower heads.</p>	Asteraceae	2 locations (2 plants)	Plain; deep clay loam with very fine buckshot gravel along with a clay crust on the surface	Tom Price, Newman	July, Sep	 <p style="text-align: right;">(ecologia 2012)</p>
P1	<p><i>Brunonia</i> sp. long hairs (D.E. Symon 2440) PN</p> <p>Rosulate herb with long silvery hairs, especially at the base of the leaves and bright blue flowers in an aggregated head.</p>	Goodeniaceae	10 locations (>20 plants)	Along creeklines and floodplains in clay or sandy clay	West Angelas, Newman	May	 <p style="text-align: right;">(ecologia 2012)</p>

Conservation Status	Taxon	Family	No. of records in Study Area	Habitat (WA Herbarium 2012)	Distribution	Flower Period	Picture
P2	<i>Aristida lazaridis</i> A tufted perennial grass. Leaf-blade surface scaberulous; rough on both sides.	Poaceae	3 locations (>23 plants)	Sand or loam	Karijini N.P., Queensland	Apr	 <p>(Western Australia Herbarium 2012)</p>
P2	<i>Eremophila forrestii</i> subsp. Pingandy (M.E. Trudgen 2662) Shrub to 50 cm tall, compact tight bush. Flowers pale yellow-cream to pinky-yellow.	Scrophulariaceae	1 location (1 plant)	Flat terrain, low in landscape, base of broad valley, stony gibber plain above shallow drainage line, red clay-loam.	West Angela Hill, Karijini National Park, Turee Creek Homestead	Jun	 <p>(ecologia 2012)</p>

Conservation Status	Taxon	Family	No. of records in Study Area	Habitat (WA Herbarium 2012)	Distribution	Flower Period	Picture
P3	<i>Acacia</i> aff. <i>subtiliformis</i> Erect, spindly, wispy, single-stemmed, glabrous shrubs, the upper branches scarred where phyllodes have fallen.	Fabaceae	3 locations (~250 plants)	On rocky calcrete plateaus	Hamersley Ranges, Hancock Range, Ophthalmia Range, Hope Down North, Marillana Stn	Jul, Aug	 (ecologia 2012)
P3	<i>Indigofera</i> sp. <i>Gilesii</i> (M.E. Trudgen 15869) An open shrub, to 1.5 m high with purple-pink flowers.	Fabaceae	24 locations (>232 plants)	Pebbly loam amongst boulders & outcrops. Hills	Mt Ella, Newman, Rhodes Ridge, Coondewanna and West Angelas Hill	May or Aug	 (ecologia 2012)

Conservation Status	Taxon	Family	No. of records in Study Area	Habitat (WA Herbarium 2012)	Distribution	Flower Period	Picture
P3	<i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794) Small erect, open shrub or scrambler to 4 m high with green - cream flowers.	Chenopodiaceae	31 locations (>81 plants)	Gravelly silt and sand in sheet-flood fans. Red brown silty clay loam / silty loam on undulating plains.	Tom Price, Paraburdoo, Brockman and Newman	May	 (ecologia 2012)
P3	<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) PN Rounded, densely woolly to velvety somewhat woody shrub, with small ovate ruminant leaves and yellow flowers.	Malvaceae	8 locations (>42 plants)	Skeletal red soils pockets. Steep slope.	Barlee Range, Turee Creek, Paraburdoo, Hamersley Range	Aug	 (ecologia 2012)

Conservation Status	Taxon	Family	No. of records in Study Area	Habitat (WA Herbarium 2012)	Distribution	Flower Period	Picture
P3	<p><i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431) PN</p> <p>A robust Kangaroo Grass, tall, with a bluish tinge to tussock.</p>	Poaceae	7 locations (>3505 plants)	Red clay. Clay pan, grass plain	Karratha, Millstream, Hamersley Stn, West Angelas, Coondewanna Flats	Aug	 <p style="text-align: right;"><i>(ecologia 2012)</i></p>
P3	<p><i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)</p> <p>A diffuse, loose, sprawling rather than rounded, hummock hard spinifex grass, leaves bright mid-green, shiny, very resinous with a distinctive resinous smell.</p>	Poaceae	8 locations (>300 plants)	Rangeland. Hillside and hill top. Brown/red ironstone gravel	Yarraloola Stn, Yalleen Stn., Red Hill Stn., Mt Stuart Stn., Hamersley Range	-	 <p style="text-align: right;"><i>(ecologia 2012)</i></p>

Conservation Status	Taxon	Family	No. of records in Study Area	Habitat (WA Herbarium 2012)	Distribution	Flower Period	Picture
p4	<i>Goodenia nuda</i> An erect herb with yellow flowers with a maroon centre.	Goodeniaceae	2 location (2 plants)	Dry brown-red sand – loam occasionally in areas of recent burns.	Port Headland, Newman, Onslow, Paraburdoo and Tom Price	Apr to Aug	 <p>(ecologia 2011)</p>

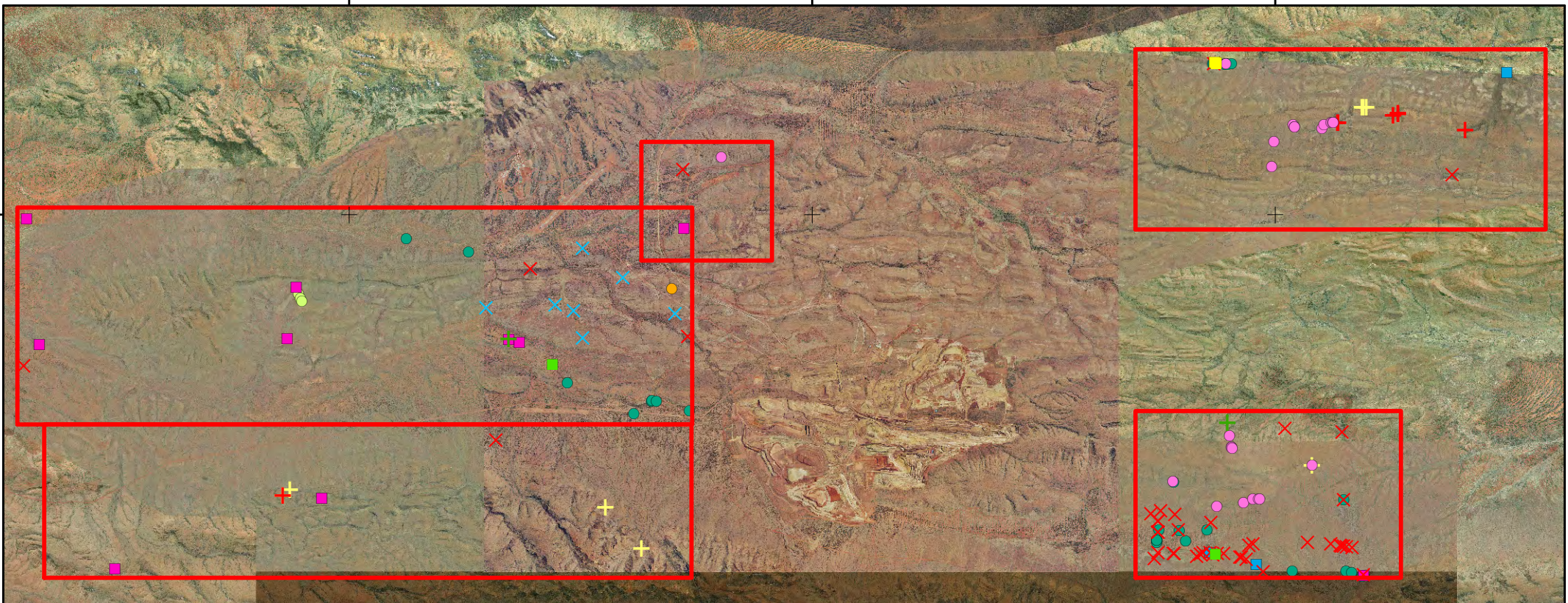
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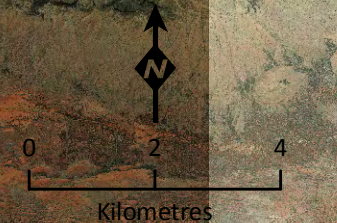


Legend

Study Area

Threatened and Priority Flora

- Lepidium catapycnon* (T)
- Aristida jerichoensis* var. *subspinulifera* (P1)
- Brachyscome* sp. Wanna Munna Flats (S. van Leeuwen 4662) (P1)
- Brunonia* sp. long hairs (D.E. Symon 2440) (P1)
- Aristida lazaridis* (P2)
- Eremophila forrestii* subsp. *Pingandy* (M.E. Trudgen 2662) (P2)
- Acacia* aff. *subtiliformis* (P3)
- Indigofera gilesii* subsp. *gilesii* (P3)
- Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3)
- Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3)
- Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3)
- Triodia* sp. Mt Ella (M.E. Trudgen 12739) (P3)
- Goodenia nuda* (P4)



Absolute Scale - 1:120,000



**Threatened and Priority Flora of the Greater West Angelas
Study Area**

Figure: 4.2
Project ID: 1457

Drawn: CP
Date: 16/10/2012

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CP148

4.2.4 Range Extensions Recorded in the Study Area

The extensions of the known range of distribution for flora recorded in the Study Area have been subdivided into three categories:

- Bioregional Extensions: the taxon has not been previously recorded in the IBRA Bioregion in which the Study Area is located;
- Range Extension: the records in this study are at least 100 km from the boundary of distribution based on lodged records; and
- Bridging Record: a record lying between widely separated populations.

Based on collection records lodged at the WA Herbarium (Western Australian Herbarium 1998-2013), records from the current survey include one bioregional extension, *Maireana lanosa*, although only 44 km north of the known population. Records of two taxa represent range extensions; *Corymbia zygophylla* and *Euphorbia schultzi* (Table 4.4). Threatened and Priority Flora Report Forms have been completed for these taxa ready for lodgement and can be found in Appendix F

One additional species, *Yakirra australiensis* var. *australiensis* has been determined to be a bridging record, as its collection point was at least 250 km from any other known location.

Table 4.4 – Collections in the Survey Area that Increase the Known Distribution of its Taxa

Taxon	Type of record	Notes	ecologia locations	WAHERB locations
<i>Maireana lanosa</i>	Bioregional Extension	44 km N of known population First record of the species in the Pilbara Bioregion	1	28
<i>Corymbia zygophylla</i>	Range Extension	210 km S of northern population and 300 km E of western population in the Pilbara	1	97
<i>Euphorbia schultzi</i>	Range Extension	102 km SE of known population	2	50
<i>Yakirra australiensis</i> var. <i>australiensis</i>	Bridging Record	264 km SE of Pilbara population and 700 km W of eastern record	1	9

4.3 INTRODUCED FLORA

4.3.1 Weeds of National Significance (WONS)

At a national level there are twenty introduced flora species listed as Weeds of National Significance (WONS). *The Commonwealth National Weeds Strategy: A Strategic Approach to Weed Problems of National Significance* (2012) describes broad goals and objectives to manage these species. Of these species, eight are currently recorded within the Pilbara (Mesquite, *Prosopis* spp.; Athel Pine, *Tamarix aphylla*; Common prickly pear, *Opuntia stricta*; *Parthenium hysterophorus*; *Prosopis glandulosa x velutina*; Mesquite, *Prosopis pallida*; Salvinia, *Salvinia molesta*; Athel tree, *Tamarix aphylla*; and Parkinsonia, *Parkinsonia aculeata*) but are not known from the Study Area.

No Weeds of National Significance were recorded in the Study Area.

4.3.2 Declared Plants

Weeds that are, or have the potential to become, pests to agriculture can be declared formally under the *Agriculture and Related Resources Protection Act 1976* (ARRP Act Department of Agriculture and Food 1976) as Declared Plants. Weeds listed under this Act are listed with Standard Control Codes that outline the requirements for their control. Five priority groupings exist (P1, P2, P3, P4 or P5) and more than one priority may be assigned to a weed species. Different priority levels apply to different municipal districts. Details of these codes are included in Appendix G. Landholders having Declared Plants on their property are obliged to control them at their own expense, and are encouraged to follow the standard control codes.

No Declared Plants were recorded by *ecologia* in the West Angelas Study Area.

4.3.3 Environmental Weeds

A third and much more extensive categorisation of weeds has been developed by the DEC, formerly the Department of Conservation and Land Management (CALM) in the Environmental Weed Strategy for Western Australia (Department of Conservation and Land Management 1999). Weed species considered to adversely affect the communities they invade are evaluated based on the degree of invasiveness, distribution and environmental impacts. Weeds listed as Environmental Weeds are ranked into four categories using the above criteria and the scoring system:

- High; a species which scores as yes to all three of the above criteria. A rating of high indicates a species that should be prioritised for control and/or research;
- Moderate; a species which scores yes for two of the above criteria. A rating of moderate indicates a species which should be monitored. Control or research should be directed to it if funds are available;
- Mild; a species which scores yes to one of the criteria. A mild rating indicates monitoring or control if appropriate; and
- Low; a species which does not score yes for any of the criteria. A low rating indicates a low requirement for monitoring.

The assessment has recently been expanded to include a number of other criteria, although no revision of the Environmental Rating has been published.

The following nine weed species were recorded within the Study Area:




- *Acetosa vesicaria*;
- *Bidens bipinnata*;
- *Cenchrus ciliaris*;
- *Cenchrus setiger*;
- *Flaveria trinervia*;
- *Malvastrum americanum*;
- *Portulaca oleracea*;
- *Sigesbeckia orientalis*; and
- *Vachellia farnesiana*.





The locations at which these species were recorded are listed in Appendix H and mapped in Figure 4.3. The characteristics and broad distributions of these species are summarised in Table 4.5 and Table 4.6.



Table 4.5 – Environmental Status of Introduced Species Recorded in the Study Area

Taxa	DEC Environmental Threat Assessment for the Pilbara Bioregion (DEC 2011)								No. locations within Study Area
	Env. Rating	Current Distrib.	Abundance	Ecological Impact	Invasiveness	Feasibility of Control	General Trend	Status	
<i>Acetosa vesicaria</i>	Unrated	High	Common	High	Rapid	High	Increasing	Established	1
<i>Bidens bipinnata</i>	Unrated	High	-	Unknown	Rapid	Low	-	-	72
<i>Cenchrus ciliaris</i>	High	High	Abundant	High	Rapid	Low	Increasing	Established	1
<i>Cenchrus setiger</i>	High	High	Abundant	High	Rapid	Low	Increasing	Established	1
<i>Flaveria trinervia</i>	not listed								2
<i>Malvastrum americanum</i>	Moderate	High	Abundant	High	Rapid	Low	Increasing	Established	22
<i>Portulaca oleracea</i>	Low	-	-	Low	-	-	-	-	17
<i>Sigesbeckia orientalis</i>	Moderate	Moderate	-	Unknown	Rapid-Moderate	Low	-	-	4
<i>Vachellia farnesiana</i>	High	High	Common	High	Rapid	Low	Stable	Established	2

Table 4.6 – Introduced Flora Recorded in the Study Area

Taxon	Description	Picture
<p><i>Acetosa vesicaria</i></p> <p>Polygonaceae</p> <p>(ruby dock; rosy dock)</p>	<p><i>Acetosa vesicaria</i> is an erect, stout, fleshy herb from 0.2 to 1 m high (Western Australian Herbarium 1998-2012) with broadly triangular leaves and inconspicuous flowers (Hussey <i>et al.</i> 2007). Red or pink flowers can be seen from July to September (Western Australian Herbarium 1998-2012).</p> <p>This weed is widely distributed in the Eremaean and South-west regions of Western Australia along roadsides and disturbed areas (Western Australian Herbarium 1998-2012).</p> <p>Native to North Africa, Middle East and India (Hussey <i>et al.</i> 2007).</p>	 <p>(ecologia 2012)</p>
<p><i>Bidens bipinnata</i></p> <p>Asteraceae</p> <p>(beggar's ticks)</p>	<p><i>Bidens bipinnata</i> is an erect annual herb, 0.1 to 1.5 m high with yellow flowers from March to September (Western Australian Herbarium 1998-2012).</p> <p>It grows on alluvium, clay, loam over sandstone, limestone, along rivers and creeks, coastal areas and rocky hillsides (Western Australian Herbarium 1998-2012).</p> <p><i>Bidens bipinnata</i> is found worldwide and in Western Australia it is distributed in the Northern, Eremaean and South-West (Western Australian Herbarium 1998-2012).</p>	 <p>(ecologia 2012)</p>
<p><i>Cenchrus ciliaris</i></p> <p>Poaceae</p> <p>(Buffel grass)</p>	<p><i>Cenchrus ciliaris</i> is a tufted, often tussocking perennial grass up to 1 m high (Hussey <i>et al.</i> 2007). The inflorescence is cylindrical, with purple flowers produced from February to October (Western Australian Herbarium 1998-2012).</p> <p>This species is found on white, red or brown sand, stony red loam or black cracking clay in the Northern, Eremaean and South-west regions of Western Australia (Western Australian Herbarium 1998-2012).</p> <p>Apart from being widely distributed in Western Australia (Western Australian Herbarium 1998-2012), it is present in all States and territories of continental Australia (PlantNET 2013).</p> <p>Native to Africa and India (Hussey <i>et al.</i> 2007).</p>	 <p>(ecologia 2012)</p>

Taxon	Description	Picture
<p><i>Cenchrus setiger</i></p> <p>Poaceae</p> <p>(birdwood grass)</p>	<p><i>Cenchrus setiger</i> is a tufted perennial up to 0.8 m high with a compact, green spike-like inflorescence up to 20 cm long (Hussey <i>et al.</i> 2007). Flowers are cream and purple, produced from April to May (Western Australian Herbarium 1998-2012).</p> <p>The distribution of this species ranges from the Kimberley to Geraldton (Hussey <i>et al.</i> 2007).</p> <p>It is native to Africa and India, and was introduced as a fodder plant in pastoral areas but is now a serious weed (Hussey <i>et al.</i> 2007).</p>	 <p>(Ecologia 2012)</p>
<p><i>Flaveria trinervia</i></p> <p>Asteraceae</p> <p>(Speedy weed)</p>	<p><i>Flaveria trinervia</i> is a herb with yellow flowered clustered at the top and with finely serrated leaves.</p> <p>It occurs in disturbed areas and waterways, and can often be found under the shade of other trees or shrubs.</p>	 <p>(Ecologia 2012)</p>
<p><i>Malvastrum americanum</i></p> <p>Malvaceae</p>	<p><i>Malvastrum americanum</i> is an erect perennial herb or shrub from 0.5 to 1.3 m high (Western Australian Herbarium 1998-2012). The flowers are yellow to orange in a dense terminal spike (Hussey <i>et al.</i> 2007), open from April to July (Western Australian Herbarium 1998-2012).</p> <p>It occurs in various soil types, including sands, clays, limestone and calcrete and can be found along drainage lines, floodplains, stony ridges and hillsides (Western Australian Herbarium 1998-2012). Distributed in the Northern and Eremaean regions of Western Australia (Western Australian Herbarium 1998-2012).</p>	 <p>(Ecologia 2012)</p>
<p><i>Portulaca oleracea</i></p> <p>Portulacaceae</p> <p>(pig weed, purslane)</p>	<p><i>Portulaca oleracea</i> is a succulent, prostrate to decumbent annual, herb up to 20 cm high (Western Australian Herbarium 1998-2012). Under water stress the whole plant becomes reddish (Hussey <i>et al.</i> 2007). It flowers between April and May and the petals are yellow (Western Australian Herbarium 1998-2012).</p> <p>This species occurs in clay loam and sands and is often observed in disturbed sites (Western Australian Herbarium 1998-2012). It is a common and widespread weed of horticulture, paddocks and gardens (Hussey <i>et al.</i> 2007).</p>	 <p>(Ecologia 2012)</p>

Taxon	Description	Picture
<p><i>Sigesbeckia orientalis</i> Asteraceae (Indian weed)</p>	<p>It is distributed widely in Western Australia, in the Northern, Eremaean and South-west (Western Australian Herbarium 1998-2012).</p> <p><i>Sigesbeckia orientalis</i> is an erect slender annual herb up to 1 m high (Western Australian Herbarium 1998-2012).</p> <p>It occurs on loamy soils over limestone or granite and can be found in rock gullies, limestone ranges or creek beds (Western Australian Herbarium 1998-2012).</p> <p><i>Sigesbeckia orientalis</i> is a cosmopolitan weed found in the Pilbara, and in forested areas between Perth and Albany (Hussey <i>et al.</i> 2007).</p>	 <p><i>Sigesbeckia orientalis</i> Photos: R. Davis (Western Australian Herbarium 1998-2012)</p>
<p><i>Vachellia farnesiana</i> Fabaceae (mimosa bush)</p>	<p><i>Vachellia farnesiana</i> is an erect, spreading, thicket-forming, thorny tree or shrub up to 4 m high (Western Australian Herbarium 1998-2012). It has dark grey bark and pinnate green leaves (Western Australian Herbarium 1998-2012). Its flowers are yellow and open from June to August (Western Australian Herbarium 1998-2012).</p> <p>This species occurs in various types of soil in disturbed sites in low-lying areas, river or creek banks in the Kimberley and Eremaean regions of Western Australia and also North of Perth (Western Australian Herbarium 1998-2012).</p>	 <p>(ecologia 2012)</p>

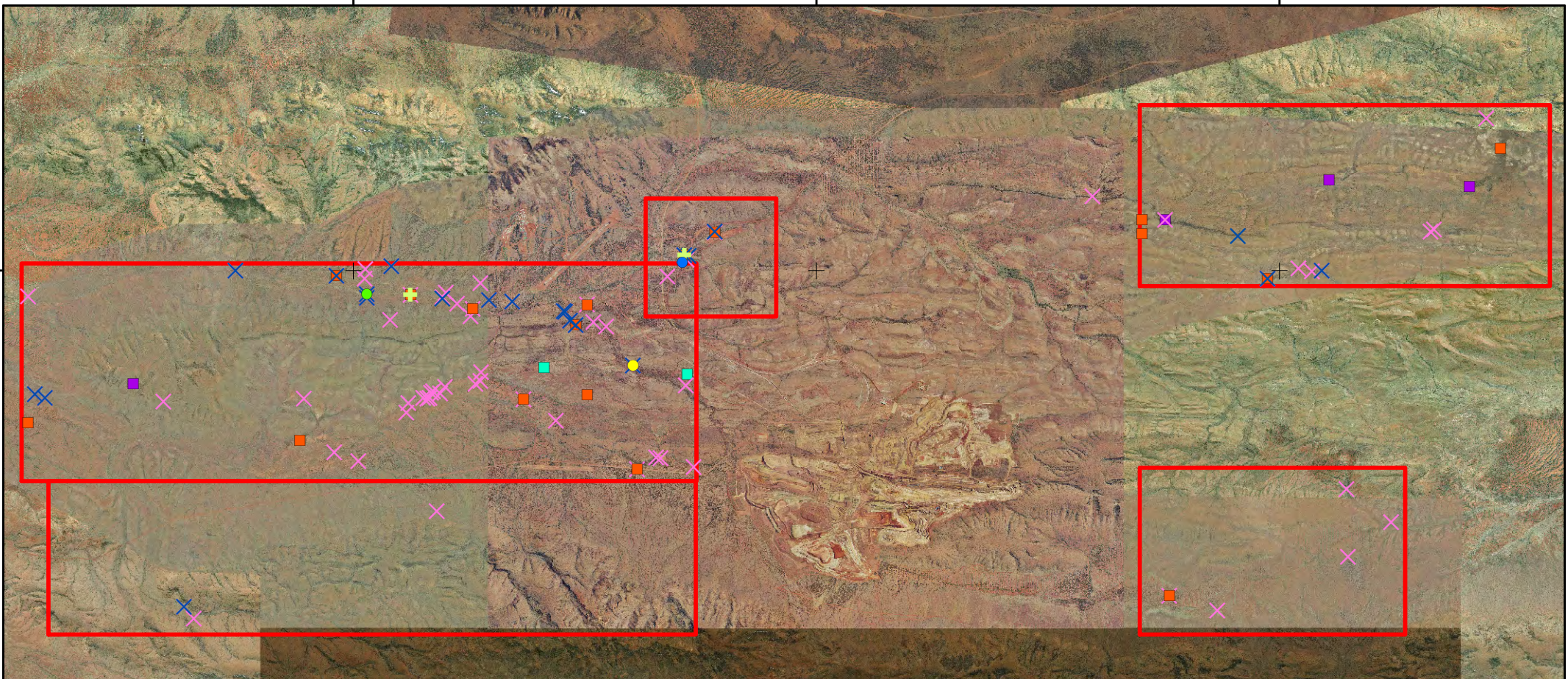
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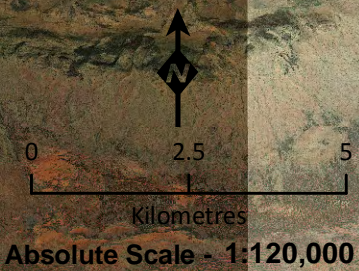
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Legend

- Study Area
- + *Flaveria trinervia*
- × *Malvastrum americanum*
- *Acetosa vesicaria*
- *Portulaca oleracea*
- × *Bidens bipinnata*
- *Sigesbeckia orientalis*
- *Cenchrus ciliaris*
- *Vachellia farnesiana*
- *Cenchrus setiger*



**Introduced Flora of the Greater West Angelas
Study Area**

Figure: 4.3
Project ID: 1457

Drawn: CP
Date: 16/10/2012

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CP149

5 VEGETATION

5.1 VEGETATION CONDITION

The Study Area is not bound by, nor does it form part of any pastoral lease in the area. Exploration and mining leases owned by RT encompass 100% of the Study Area, which is subject to little grazing pressure from cattle or other livestock. Recorded evidence of grazing, scats and animal tracks from introduced species was minimal and this is reflected in the assessment of vegetation condition in surveyed quadrats, with 51% and 36% assessed as being in excellent or very good condition, respectively. The remaining quadrats were recorded as good (11%) or poor (2%). None were recorded to be in very poor condition. The disturbance most commonly observed was the presence of weed species, usually *Bidens bipinnata*, with a small number of areas subject to disturbance from previous exploration activities. Figure 5.1 details the condition rankings of all quadrats assessed within the Study Area. The majority of quadrats ranked as in good or poor condition are located within the drainage systems where seeds can be dispersed by water flow and upstream impacts from cattle grazing can be carried downstream.

5.2 FIRE HISTORY OF THE STUDY AREA

The majority of the Study Area has not been recently burnt, with 50% of quadrats assessed as burnt more than 5 years ago or with no evidence of fire and 44% burnt 2-5 years ago. The pattern of burning appears sporadic and localised (Figure 5.2), which is typical of fires arising during the early wet season from lightning strikes that are extinguished relatively rapidly, rather than larger scale fires that burn an extensive area before being extinguished.

5.3 VEGETATION COMMUNITIES

Twenty two vegetation communities were described to association level (NVIS level V) and delineated within the Study Area, the characteristics of which are summarised in Table 5.1. The distribution of each vegetation unit is mapped in Figure 5.3 to 5.18 and the relative similarity of quadrats as determined by multivariate analysis is detailed in Figure 5.21. The structure and floristic composition of each quadrat is detailed in Appendix B.

The cluster analysis used in this study is based on both species composition and abundance. The resulting groups are in many cases based on the *Acacia*, *Senna* and *Triodia* species, which are commonly dominant taxa. In some cases, however, the vegetation units were also characterised by indicator species; i.e. taxa which are not dominant, but are totally or partially restricted to that particular vegetation unit.

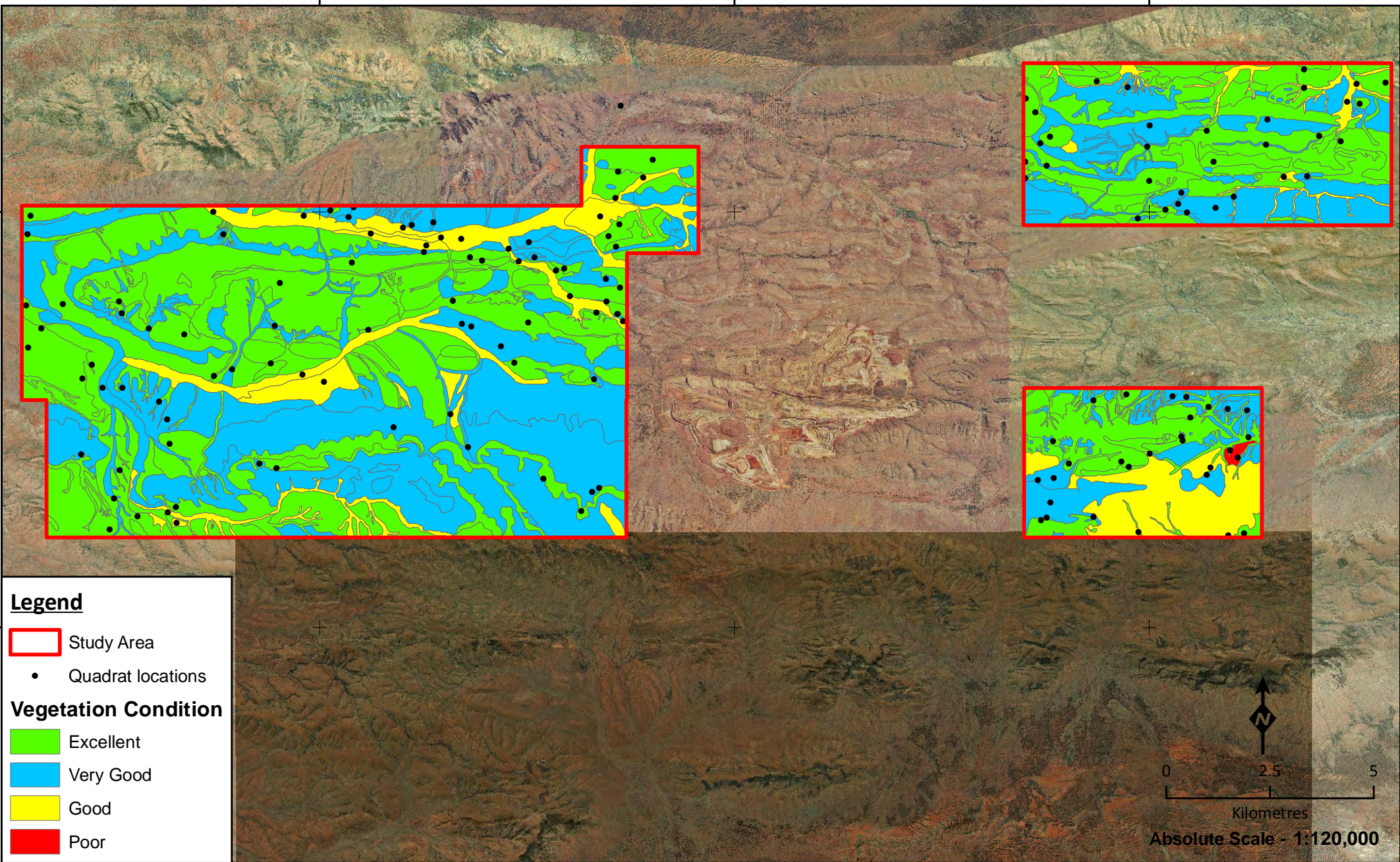
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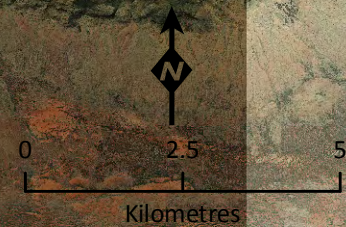


Legend

- Study Area
- Quadrat locations

Vegetation Condition

- Excellent
- Very Good
- Good
- Poor



Absolute Scale - 1:120,000



**Vegetation Condition of the Greater West Angelas
Study Area**

Figure: 5.1
Project ID: 1457

Drawn: CP
Date: 27/09/2012

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CP146

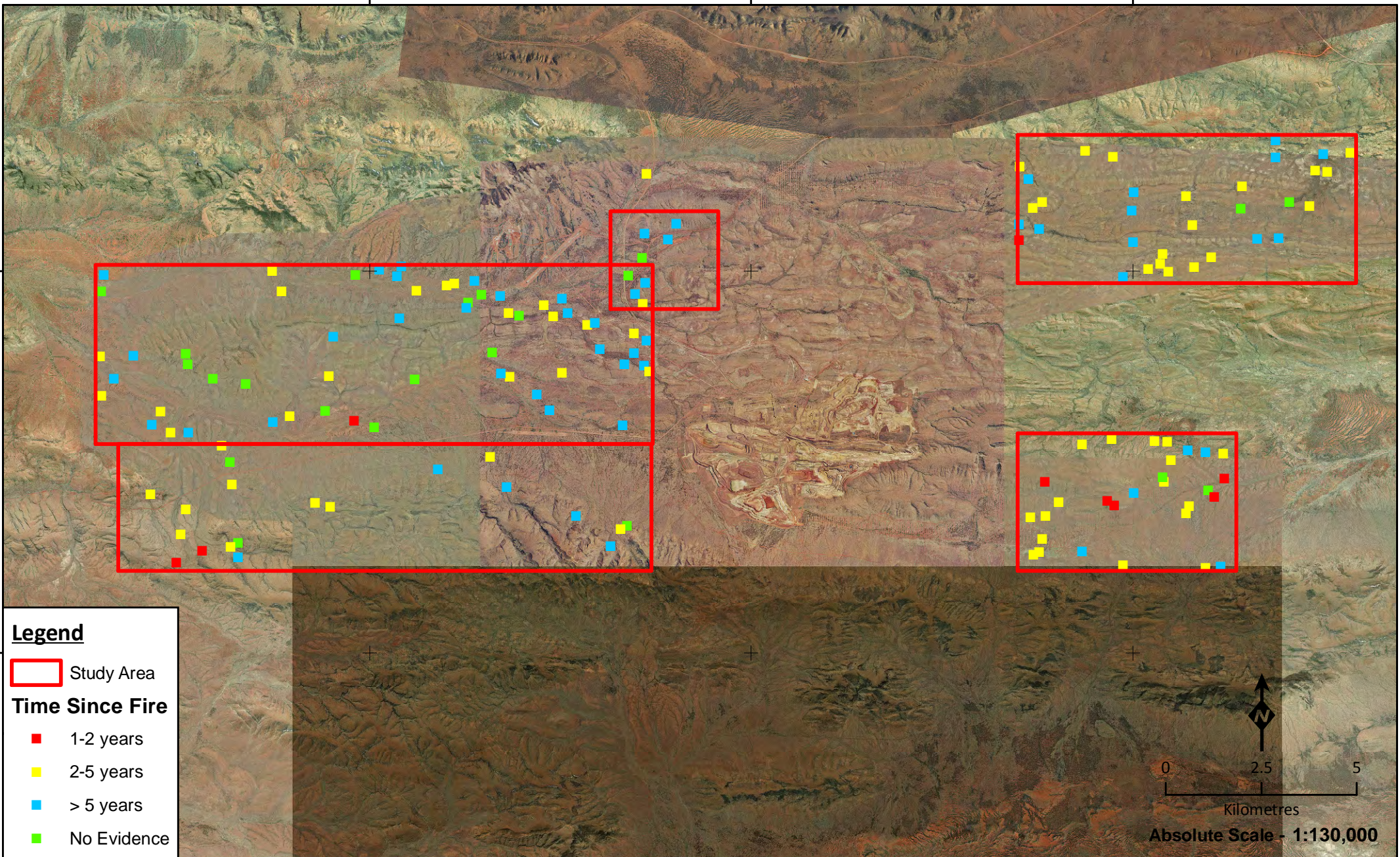
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Legend

Study Area

Time Since Fire

- 1-2 years
- 2-5 years
- > 5 years
- No Evidence

0 2.5 5
 Kilometres
Absolute Scale - 1:130,000



Fire History of the Greater West Angelas Study Area

Figure: 5.2
Project ID: 1457



Coordinate System
 Name: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Datum: GDA 1994



Drawn: CP
Date: 27/09/2012



Unique Map ID: CP145



A4



Table 5.1 – Vegetation Units of West Angelas.



Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level V)	Associated species	Area km ² (% of Study Area)	Photograph
Gravelly Plains					
<i>AaTb</i> Acacia open woodland over <i>Triodia</i> open hummock grassland	14 16 28 75 107 109 114 121	<i>Acacia aptaneura</i> and <i>A. pruinocarpa</i> open woodland over <i>A. bivenosa</i> isolated shrubs <i>Triodia basedowii</i> and <i>T. pungens</i> open hummock grassland. Average species richness = 26.5 ± 1.9 Sample size = 8	<i>Acacia pruinocarpa</i> <i>Triodia basedowii</i> <i>Triodia pungens</i> <i>Acacia aptaneura</i> <i>Acacia bivenosa</i> <i>Aristida contorta</i> <i>Dysphania kalpari</i> <i>Ptilotus calostachyus</i> <i>Enneapogon polyphyllus</i> <i>Eragrostis eriopoda</i> <i>Eremophila forrestii</i> subsp. <i>forrestii</i> <i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1512.6 ha (8.6%)	
<i>SggAbTp</i> Senna and Acacia open shrubland over <i>Triodia</i> hummock grassland	6 8 23 26 34 92 98 100 102	<i>Acacia pruinocarpa</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> or <i>Corymbia hamersleyana</i> isolated trees over <i>Senna glutinosa</i> subsp. <i>glutinosa</i> , <i>Acacia bivenosa</i> and <i>Gossypium robinsonii</i> open shrubland over <i>Triodia pungens</i> hummock grassland. Average species richness = 38.0 ± 5.0 Sample size = 9	<i>Senna glutinosa</i> subsp. <i>glutinosa</i> <i>Acacia pruinocarpa</i> <i>Triodia pungens</i> <i>Acacia bivenosa</i> <i>Gossypium robinsonii</i> <i>Ptilotus obovatus</i> <i>Indigofera monophylla</i> <i>Themeda triandra</i> <i>Ptilotus rotundifolius</i> <i>Evolvulus alsinoides</i> var. <i>villisocalyx</i> <i>Tribulus suberosus</i> <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> <i>Acacia aptaneura</i> <i>Corymbia hamersleyana</i>	1539.18 ha (8.75%)	



Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level V)	Associated species	Area km ² (% of Study Area)	Photograph
Gullies					
AaPoTp Acacia open woodland over Ptilotus isolated shrubs over Triodia open tussock grassland	25 33 72 74 129 148	Acacia aptaneura open woodland over Ptilotus obovatus isolated shrubs over Themeda triandra and Eriachne mucronata open tussock grassland. Average species richness = 39.2 ± 3.0 Sample size = 6	Eriachne mucronata Ptilotus obovatus Acacia aptaneura Trichodesma zeylanicum Triodia pungens Themeda triandra Gomphrena cunninghamii Cymbopogon ambiguus Dysphania rhadinostachya subsp. rhadinostachya Pterocaulon sphaecelatum Dodonaea pachyneura^ Ficus brachypoda^ Cyperus cunninghamii subsp. cunninghamii^	319.01 ha (1.81%)	
Rocky Footslopes/Rises					
AaTssp Acacia open woodland over Triodia open hummock grassland	42 59 60 79 82 90 131 155	Acacia aptaneura and A. pruinocarpa open woodland over A. tetragonophylla, Senna glutinosa subsp. glutinosa and S. artemisioides subsp. oligophylla isolated shrubs over Triodia wiseana and T. pungens open hummock grassland. Average species richness = 39.0 ± 3.2 Sample size = 8	Acacia aptaneura Acacia pruinocarpa Enneapogon polyphyllus Senna glutinosa subsp. Glutinosa Acacia tetragonophylla Duperreya commixta Ptilotus helipteroides Rhagodia eremaea Triodia wiseana Triodia pungens Senna artemisioides subsp. oligophylla Aristida contorta Acacia bivenosa Bidens bipinnata	927.28 ha (5.27%)	



Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level V)	Associated species	Area km ² (% of Study Area)	Photograph
Rocky Hilltops					
<i>EllSggTw</i> <i>Eucalyptus</i> open woodland over <i>Senna</i> open shrubland over <i>Triodia</i> open hummock grassland	2 5 35 57 133 156	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Acacia aptaneura</i> open woodland over <i>Senna glutinosa</i> subsp. <i>glutinosa</i> and <i>S. artemisioides</i> subsp. <i>oligophylla</i> open shrubland over <i>Triodia wiseana</i> or <i>T. pungens</i> open hummock grassland. Average species richness = 23.7 ± 2.7 Sample size = 6	<i>Senna glutinosa</i> subsp. <i>glutinosa</i> <i>Senna artemisioides</i> subsp. <i>oligophylla</i> <i>Acacia bivenosa</i> <i>Acacia inaequilatera</i> <i>Ptilotus rotundifolius</i> <i>Acacia tetragonophylla</i> <i>Triodia wiseana</i> <i>Triodia pungens</i> <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> <i>Acacia aptaneura</i> <i>Acacia pruinocarpa</i> <i>Hakea chordophylla</i>	1227.4 ha (6.98%)	
<i>EllAmTssp</i> <i>Eucalyptus</i> open woodland over <i>Senna</i> open shrubland over <i>Triodia</i> open hummock grassland	20 40 56 105 106 110 113 127 140 142 147 149	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>E. gamophylla</i> open woodland over <i>Acacia maitlandii</i> , <i>A. hamersleyensis</i> , <i>Keraudrenia velutina</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> open shrubland over <i>Triodia wiseana</i> and/or <i>T. pungens</i> and/or <i>T. basedowii</i> open hummock grassland. Average species richness = 27.4 ± 1.1 Sample size = 12	<i>Acacia maitlandii</i> <i>Senna glutinosa</i> subsp. <i>glutinosa</i> <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> <i>Hakea chordophylla</i> <i>Goodenia triodiophylla</i> <i>Triodia wiseana</i> <i>Triodia basedowii</i> <i>Triodia pungens</i> <i>Acacia hamersleyensis</i> <i>Gompholobium oreophilum</i> <i>Keraudrenia velutinea</i> <i>Corchorus lasiocarpus</i> <i>Acacia pyriformis</i> var. <i>pyriformis</i> <i>Eucalyptus gamophylla</i>	1215.97 ha (6.91%)	



Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level V)	Associated species	Area km ² (% of Study Area)	Photograph
AmTw Acacia sparse shrubland over Triodia hummock grassland	37 38 136 153	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> isolated trees over <i>Acacia maitlandii</i> sparse shrubland over <i>Triodia wiseana</i> and <i>T. longiceps</i> hummock grassland. Average species richness = 17.3 ± 3.8 Sample size = 4	<i>Triodia wiseana</i> <i>Acacia maitlandii</i> <i>Acacia bivenosa</i> <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> <i>Petalostylis labicheoides</i> <i>Ptilotus calostachyus</i> <i>Themeda triandra</i> <i>Triodia longiceps</i> <i>Acacia pyrifolia</i> subsp. <i>pyrifolia</i> <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> <i>Senna artemisioides</i> subsp. <i>oligophylla</i> <i>Melaleuca eleuterostachya</i> [^]	108.7 ha (0.62%)	
ElISggTp Eucalyptus open woodland over Senna open shrubland over Triodia open hummock grassland	3 11 24 27 103 139 151 152	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Acacia marramamba</i> open woodland over <i>Senna glutinosa</i> subsp. <i>glutinosa</i> open shrubland over <i>Triodia pungens</i> open hummock grassland. Average species richness = 36.4 ± 3.0 Sample size = 8	<i>Senna glutinosa</i> subsp. <i>glutinosa</i> <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> <i>Aristida contorta</i> <i>Triodia pungens</i> <i>Acacia pruinocarpa</i> <i>Eriachne mucronata</i> <i>Eremophila latrobei</i> subsp. <i>latrobei</i> <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> <i>Enneapogon polyphyllus</i> <i>Ptilotus calostachyus</i> <i>Solanum lasiophyllum</i> <i>Acacia marramamba</i> <i>Acacia aptaneura</i>	2491.87 ha (14.16%)	



Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level V)	Associated species	Area km ² (% of Study Area)	Photograph
<i>SgglrTw</i> Senna shrubland over <i>Triodia</i> hummock grassland	132 134 143 144 160	<i>Acacia inaequilatera</i> isolated trees over <i>Senna glutinosa</i> subsp <i>glutinosa</i> and <i>Indigofera rugosa</i> open shrubland over <i>Triodia wiseana</i> hummock grassland. Average species richness = 27.0 ± 3.6 Sample size = 5	<i>Triodia wiseana</i> <i>Senna glutinosa</i> subsp. <i>glutinosa</i> <i>Acacia inaequilatera</i> <i>Indigofera rugosa</i> ^ <i>Themeda triandra</i> <i>Senna artemisioides</i> subsp. <i>oligophylla</i> <i>Acacia dictyophleba</i> <i>Corytheca micrantha</i> ^ <i>Enneapogon caerulescens</i> <i>Goodenia muelleriana</i> <i>Trichodesma zeylanicum</i>	1045.87 ha (5.94%)	
Rocky Midslope					
<i>AaEffTp</i> Acacia open woodland over <i>Eremophila</i> sparse shrubland and <i>Triodia</i> sparse hummock grassland	85 65	<i>Acacia aptaneura</i> and <i>A. pruinocarpa</i> open woodland over sparse <i>Eremophila fraseri</i> subsp. <i>fraseri</i> and <i>Acacia marramamba</i> sparse shrubland over <i>Triodia pungens</i> sparse hummock grassland. Average species richness = 38.0 ± 5.0 Sample size = 2	<i>Acacia aptaneura</i> <i>Acacia pruinocarpa</i> <i>Triodia pungens</i> <i>Acacia marramamba</i> <i>Eremophila fraseri</i> subsp. <i>fraseri</i> <i>Acacia bivenosa</i> <i>Aristida contorta</i> <i>Codonocarpus cotinifolius</i> <i>Duperreya commixta</i> <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i> <i>Exocarpos sparteus</i> <i>Grevillea berryana</i> <i>Hibiscus burtonii</i>	141.54 ha (0.8%)	


Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level V)	Associated species	Area km ² (% of Study Area)	Photograph
<i>Tp</i> <i>Triodia</i> hummock grassland	4 15 22 36	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Acacia pruinocarpa</i> isolated trees over <i>Senna glutinosa</i> subsp. <i>glutinosa</i> , <i>A. bivenosa</i> and <i>Ptilotus rotundifolius</i> isolated shrubs over <i>Triodia pungens</i> or <i>T. basedowii</i> or <i>T. sp.</i> Mt Ella hummock grassland. Average species richness = 16.8 ± 1.5 Sample size = 4	<i>Senna glutinosa</i> subsp. <i>glutinosa</i> <i>Acacia bivenosa</i> <i>Acacia pruinocarpa</i> <i>Ptilotus rotundifolius</i> <i>Eriachne mucronata</i> <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> <i>Ischaemum albobillosum</i> <i>Triodia pungens</i> <i>Cymbopogon ambiguus</i> <i>Eremophila fraseri</i> subsp. <i>fraseri</i> <i>Paspalidium clementii</i> <i>Triodia</i> sp. Mt Ella <i>Templetonia egena</i> [^] <i>Senna sericea</i> [^]	975.86 ha (5.55%)	
<i>ApTssp</i> <i>Acacia</i> open woodland over <i>Triodia</i> open hummock grassland	30 58 125 128	<i>Acacia pruinocarpa</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> open woodland over <i>Senna glutinosa</i> subsp. <i>glutinosa</i> and <i>A. maitlandii</i> isolated shrubs over <i>Triodia basedowii</i> or <i>T. pungens</i> or <i>T. wiseana</i> open hummock grassland. Average species richness = 15.8 ± 5.7 Sample size = 4	<i>Senna glutinosa</i> subsp. <i>glutinosa</i> <i>Acacia pruinocarpa</i> <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> <i>Acacia maitlandii</i> <i>Senna ferraria</i> <i>Triodia pungens</i> <i>Triodia basedowii</i> <i>Indigofera monophylla</i> <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> <i>Acacia sibirica</i> <i>Corymbia deserticola</i> subsp. <i>deserticola</i>	292.18 ha (1.66%)	

Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level V)	Associated species	Area km ² (% of Study Area)	Photograph
<i>SggTp</i> <i>Senna</i> sparse shrubland over <i>Triodia</i> open hummock grassland	111 112 120 124 126 146	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> isolated trees over <i>Senna glutinosa</i> subsp. <i>glutinosa</i> and <i>Acacia maitlandii</i> sparse shrubland over <i>Triodia pungens</i> open hummock grassland. Average species richness = 34.2 ± 3.8 Sample size = 6	<i>Senna glutinosa</i> subsp. <i>glutinosa</i> <i>Corymbia hamersleyana</i> <i>Themeda triandra</i> <i>Acacia maitlandii</i> <i>Dodonaea lanceolata</i> var. <i>lanceolata</i> [^] <i>Jasminum didymum</i> subsp. <i>lineare</i> <i>Triodia pungens</i> <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> <i>Androcalva luteiflora</i> <i>Gossypium robinsonii</i> <i>Indigofera monophylla</i> <i>Senna ferraria</i>	210.6 ha (1.2%)	
Sandy Floodplains/Dry Rivers					
<i>AaPoTt</i> <i>Acacia</i> open woodland over <i>Ptilotus</i> sparse shrubland over <i>Themeda</i> open tussock grassland	7 31 43 76 84 87 96 97 104 130 141 201	<i>Acacia aptaneura</i> open woodland over <i>Ptilotus obovatus</i> sparse shrubland over <i>Themeda triandra</i> open tussock grassland. Average species richness = 50.1 ± 2.9 Sample size = 12	<i>Ptilotus obovatus</i> <i>Salsola australis</i> <i>Pterocaulon sphacelatum</i> <i>Cleome viscosa</i> <i>Bidens bipinnata</i> <i>Enneapogon polyphyllus</i> <i>Evolvulus alsinoides</i> var. <i>villisocalyx</i> <i>Malvastrum americanum</i> <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> <i>Acacia aptaneura</i> <i>Themeda triandra</i> <i>Rhagodia eremaea</i> <i>Eucalyptus victrix</i> [^] <i>Triraphis mollis</i> [^] <i>Corchorus tridens</i> [^] <i>Amaranthus mitchellii</i> [^]	706.06 ha (4.01%)	

Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level V)	Associated species	Area km ² (% of Study Area)	Photograph
AaTt Acacia woodland over <i>Themeda</i> open tussock grassland	55 99 123 135 137 138 145	<i>Acacia aptaneura</i> and <i>Eucalyptus xerothermica</i> woodland over <i>Ptilotus obovatus</i> isolated shrubs over <i>Themeda triandra</i> open tussock grassland Average species richness = 44.6 ± 2.3 Sample size = 7	<i>Themeda triandra</i> <i>Aristida contorta</i> <i>Pterocaulon sphacelatum</i> <i>Enneapogon polyphyllus</i> <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> <i>Cleome viscosa</i> <i>Duperreya commixta</i> <i>Evolvulus alsinoides</i> var. <i>villisocalyx</i> <i>Acacia aptaneura</i> <i>Eucalyptus xerothermica</i> <i>Ptilotus obovatus</i> <i>Capparis lasiantha</i> <i>Eucalyptus trivalva</i> [^]	391.54 ha (2.23%)	
Floodplains/Drainage lines					
AaAc Acacia open woodland over <i>Aristida</i> sparse tussock grassland	9 12 45 46 47 64 67 69 78 89	<i>Acacia aptaneura</i> and <i>A. pruinocarpa</i> open woodland over <i>Aristida contorta</i> sparse tussock grassland over <i>Pterocaulon sphacelatum</i> and <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> isolated forbs. Average species richness = 37.7 ± 2.8 Sample size = 10	<i>Acacia aptaneura</i> <i>Pterocaulon sphacelatum</i> <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> <i>Abutilon otocarpum</i> <i>Enneapogon polyphyllus</i> <i>Aristida contorta</i> <i>Acacia pruinocarpa</i> <i>Ptilotus helipteroides</i> <i>Salsola australis</i> <i>Evolvulus alsinoides</i> var. <i>villisocalyx</i> <i>Triodia pungens</i> <i>Senna artemisioides</i> subsp. <i>oligophylla</i> <i>Senna notabilis</i>	505.39 ha (2.87%)	

Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level V)	Associated species	Area km ² (% of Study Area)	Photograph
<i>AaSaoTp</i> <i>Acacia</i> open woodland over <i>Senna</i> sparse shrubland over <i>Triodia</i> open hummock grassland	10 19 41 44 54 80 86 154	<i>Acacia aptaneura</i> and <i>A. ayersiana</i> open woodland over <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>S. glutinosa</i> subsp. <i>glutinosa</i> and <i>Eremophila forrestii</i> subsp. <i>forrestii</i> sparse shrubland over <i>Triodia pungens</i> open hummock grassland. Average species richness = 44.8 ± 2.8 Sample size = 9	<i>Acacia aptaneura</i> <i>Senna artemisioides</i> subsp. <i>oligophylla</i> <i>Senna glutinosa</i> subsp. <i>glutinosa</i> <i>Aristida contorta</i> <i>Evolvulus alsinoides</i> var. <i>villisocalyx</i> <i>Hibiscus burtonii</i> <i>Triodia pungens</i> <i>Eremophila forrestii</i> subsp. <i>forrestii</i> <i>Acacia pruinocarpa</i> <i>Eriachne pulchella</i> subsp. <i>dominii</i> <i>Euphorbia australis</i> <i>Sida</i> sp. spiciform panicles <i>Acacia ayersiana</i>	447.27 ha (2.54%)	
<i>EgSggTb</i> <i>Eucalyptus</i> open woodland over <i>Senna</i> sparse shrubland over <i>Triodia</i> open hummock grassland	17 93 116 117 119 122	<i>Eucalyptus gamophylla</i> and <i>Corymbia deserticola</i> subsp. <i>deserticola</i> open woodland over <i>Senna artemisioides</i> subsp. <i>oligophylla</i> and <i>Indigofera monophylla</i> sparse shrubland over <i>Triodia basedowii</i> and <i>T. pungens</i> open hummock grassland. Average species richness = 32.7 ± 3.5 Sample size = 6	<i>Keraudrenia velutina</i> <i>Senna glutinosa</i> subsp. <i>glutinosa</i> <i>Paraneurachne muelleri</i> <i>Ptilotus calostachyus</i> <i>Triodia basedowii</i> <i>Triodia pungens</i> <i>Eucalyptus gamophylla</i> <i>Acacia bivenosa</i> <i>Acacia adsurgens</i> <i>Corymbia deserticola</i> subsp. <i>deserticola</i> <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> <i>Solanum lasiophyllum</i> <i>Acacia ancistrocarpa</i> [^]	309.52 ha (1.76%)	
Sandy Plain					

Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level V)	Associated species	Area km ² (% of Study Area)	Photograph
<i>AaEcTp</i> Acacia open woodland over <i>Eremophila</i> isolated shrubs over <i>Triodia</i> open hummock grassland	29 49 50 53 63 70 71 81 200	<i>Acacia aptaneura</i> and <i>A. pruinocarpa</i> open woodland over <i>Eremophila caespitosa</i> and <i>Tribulus suberosus</i> isolated shrubs over <i>Triodia pungens</i> open hummock grassland. Average species richness = 37.2 ± 2.6 Sample size = 9	<i>Acacia aptaneura</i> <i>Triodia pungens</i> <i>Aristida contorta</i> <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> <i>Senna notabilis</i> <i>Acacia pruinocarpa</i> <i>Enneapogon polyphyllus</i> <i>Ptilotus schwartzii</i> var. <i>schwartzii</i> <i>Eremophila caespitosa</i> <i>Eriachne pulchella</i> subsp. <i>dominii</i> <i>Tribulus suberosus</i> <i>Eragrostis pergracilis</i> [^] <i>Ptilotus roei</i> [^]	1769.85 ha (10.06%)	
<i>AlAp</i> <i>Aristida</i> and <i>Astrebla</i> tussock grassland	21 61 62 66 68 94 95	<i>Aristida latifolia</i> , <i>Astrebla pectinata</i> and <i>Brachyachne convergens</i> tussock grassland with isolated <i>Salsola australis</i> , <i>Boerhavia paludosa</i> and <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> forbs. Average species richness = 35.0 ± 2.3 Sample size = 7	<i>Astrebla pectinata</i> <i>Aristida latifolia</i> <i>Salsola australis</i> <i>Brachyachne convergens</i> [^] <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> <i>Boerhavia paludosa</i> <i>Iseilema vaginiflorum</i> <i>Panicum decompositum</i> <i>Pterocaulon sphacelatum</i> <i>Sida spinosa</i> [^] <i>Hibiscus trionum</i> [^] <i>Themeda</i> sp. Hamersley Station [^]	302.23 ha (1.72%)	

Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level V)	Associated species	Area km ² (% of Study Area)	Photograph
<p><i>PsTp</i></p> <p><i>Pterocaulon</i> sparse forbland with <i>Triodia</i> open hummock grassland</p>	<p>51</p> <p>52</p> <p>108</p>	<p><i>Acacia aptaneura</i> or <i>A. ayersiana</i> open woodland over <i>Pterocaulon sphacelatum</i> and <i>Dysphania kalparri</i> sparse forbland with <i>Triodia pungens</i> open hummock grassland.</p> <p>Average species richness = 36.7 ± 2.6</p> <p>Sample size = 3</p>	<p><i>Pterocaulon sphacelatum</i></p> <p><i>Dysphania kalpari</i></p> <p><i>Aristida contorta</i></p> <p><i>Enneapogon polyphyllus</i></p> <p><i>Aristida jerichoensis</i> var. <i>subspinulifera</i>[^]</p> <p><i>Cucumis variabilis</i></p> <p><i>Euphorbia drummondii</i></p> <p><i>Panicum effusum</i></p> <p><i>Sida</i> sp. verrucose glands</p> <p><i>Triodia pungens</i></p> <p><i>Themeda triandra</i></p>	<p>174.39 ha</p> <p>(0.99%)</p>	
Sandy Undulating Plain					
<p><i>AaTp</i></p> <p><i>Acacia</i> woodland over <i>Triodia</i> open hummock grassland</p>	<p>18</p> <p>48</p> <p>77</p> <p>91</p> <p>115</p> <p>118</p>	<p><i>Acacia pruinocarpa</i>, <i>A. aptaneura</i> and <i>A. ayersiana</i> woodland over <i>Triodia pungens</i> open hummock grassland.</p> <p>Average species richness = 29.3 ± 3.9</p> <p>Sample size = 6</p>	<p><i>Acacia aptaneura</i></p> <p><i>Triodia pungens</i></p> <p><i>Acacia pruinocarpa</i></p> <p><i>Aristida contorta</i></p> <p><i>Hibiscus burtonii</i></p> <p><i>Solanum lasiophyllum</i></p> <p><i>Acacia ayersiana</i></p> <p><i>Enneapogon polyphyllus</i></p> <p><i>Ptilotus nobilis</i> subsp. <i>nobilis</i></p> <p><i>Ptilotus obovatus</i></p> <p><i>Senna glutinosa</i> subsp. <i>glutinosa</i></p>	<p>982.26 ha</p> <p>(5.58%)</p>	