



FIELD MONITORING 2010-2011

ANGAS DOWNS INDIGENOUS PROTECTED AREA

A report of field monitoring undertaken in 2010-2011

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Summary

Angas Downs Indigenous Protected Area (IPA) is a biologically and culturally rich a pastoral lease in the Northern Territory, south west of Alice Springs and within the Finke Bioregion. It is important to the Anangu people from the Pitjantjatjara/Yankunytjatjara language groups. This report summarises field monitoring undertaken during 2010-2011 in accordance with the Angas Downs IPA Plan of Management.

The objective of the Angas Downs IPA Plan of Management is to manage land and wildlife resources in order to maintain Anangu culture, to conserve biodiversity and to enable sustainable production in support of human communities and economic development.

A key requirement of the Plan is to monitor landscape and ecosystem health and wildlife populations with a view to increasing species important to Anangu such as *Malu* (red kangaroo) and *Kalaya* (emu). Important to this is the involvement and leadership of Anangu in land management and monitoring, integrating traditional knowledge and science.

Monitoring and fieldwork with Angas Downs' Anangu Rangers commenced in July 2009. This report details work undertaken from July 2010 up until June 2011. The following indicators were assessed:

- Bird, reptile and small mammal surveys
- Aerial surveys for large mammals - kangaroo, emu, camel, horse, wild cattle
- Ground survey species presence / absence using Cybertracker
- Photo point to record vegetation change over time
- Track-based monitoring – species presence / absence on sandy substrates
- Landscape Function Analysis (LFA) – a landscape health assessment tool
- Mapping of cultural sites
- Mapping of important and rare plants
- Fire risk assessment.

In 2011, monitoring showed an improvement in most indicators. This is due to the recovery from drought in central Australia during 2010-2011. The average rainfall for the region is approximately 240mm — in 2009 <80mm fell; in 2010 540mm fell.

Future monitoring will indicate whether these improvements will persist as a result of Ranger activities such as feral animal management and fencing.

1. Introduction

The Angas Downs Indigenous Protected Area (IPA) is an Indigenous owned 320,500 hectare pastoral lease, 135 km east from Uluru-Kata Tjuta National Park and 40km from Mt Ebenezer Roadhouse on the Lasseter Highway (Figure 1). It was declared and formally recognized as an Indigenous Protected Area on 10 June 2009.

The community owned Imanpa Development Association holds the lease for Angas Downs and operates the property through its company Lisanote Pty Ltd. The Lisanote Board is elected from the Imanpa community by the community to represent their interests. Residents of Imanpa include Matutjara descendants (the original occupiers of Angas Downs region), Yankunytjatjara and Pitjantjatjara people.

1.1 Climate

Angas Downs IPA is in the arid region of central Australia with an average annual rainfall of approximately 240-250mm. Between 2007-2010, the region was experiencing drought with below average rainfall. In 2010, the drought was broken with soaking rains of 544mm (recorded at Angas Downs Station) – more than double the average. By early May 2011, 120 mm had fallen (recorded at Curtin Springs – BOM 2011).

1.2 Vegetation

Angas Downs has diverse landscapes and vegetation –desert oak woodlands, sand dunes and plains, mulga, watercourse areas, limestone/calcrete and ironstone plains, rocky/hill country and areas of spinifex grasslands.

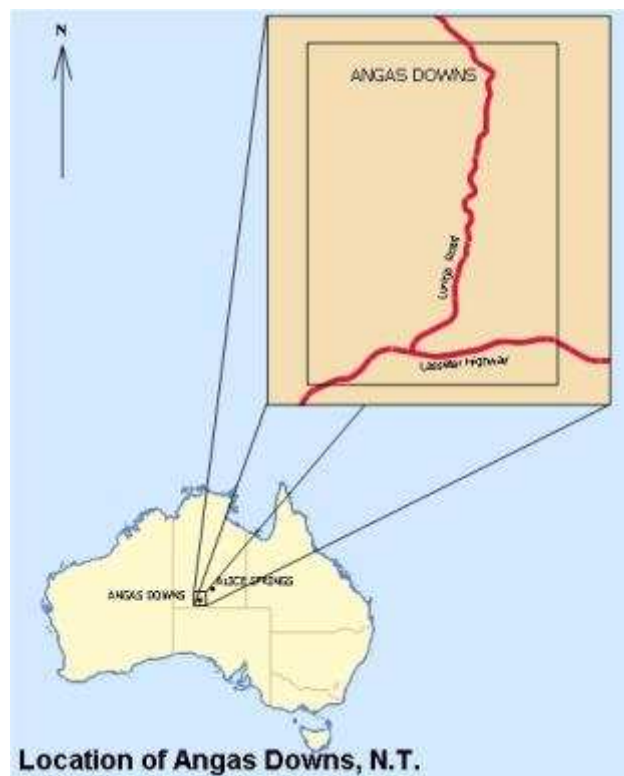


Figure 1 Location of Angas Downs IPA

1.3 Angas Downs IPA Plan of Management

The Angas Downs IPA Plan of Management (Wilson *et al* 2005) outlines the natural and cultural resource base, land management operations, sustainable development opportunities, training and education and collaborative relationships and partnerships. The property also provides valuable cultural resources for Aboriginal communities to carry out traditional ceremonial business.

The objective of the Angas Downs IPA Plan of Management is to: “manage land and wildlife resources in order to maintain Anangu culture, conserve biodiversity and enable sustainable production in support of human communities and economic development.” A key feature of this plan is to monitor landscape and ecosystem health and wildlife populations. Through Indigenous aspirations to sustainably use Angas Downs’ land and wildlife resources, detailed information on plant, wildlife and landscape health are being collected.

Anangu Rangers employed under the Working on Country Program, direct and help Australian Wildlife Services (AWS) staff in wildlife monitoring using Cybertracker, taking photographic data at photo points and track-based monitoring. Australian Wildlife Services also trains the rangers in other aspects of wildlife and landscape assessment techniques. The survey methods used on Angas Downs are described in this report include:

- Reptile and small mammal surveys – funnel and pitfall traps along fence lines
- Bird surveys
- Aerial surveys – large species population estimation – kangaroo, emu, horse, cow, camel, euro and dingo.
- Cybertracker surveys - wildlife species presence / absence
- Track Based monitoring – species presence / absence on sandy substrates
- Photo Points to assess visual change to ecosystems over time
- Landscape Function Analysis (LFA) – a landscape health assessment tool
- Mapping of cultural sites
- Mapping of important and rare plants
- Fire risk assessment.

2. Methods

2.1 Reptile and small mammal surveys

During October and December 2010 and March and June 2011, Angas Downs IPA Rangers and AWS surveyed reptiles and small mammals across Angas Down’s landscapes. Surveys were conducted using pitfall and funnel traps along drift fences, as well as active searches.

A permit to trap using drift lines and pitfall traps was obtained from Territory Parks and Wildlife Service for the period Sept 2010 to Sept 2015 (Permit number 38812).

Trapping was completed at 16 sites of varying vegetation and substrate during October 2010, 4 sites during December 2010 and 1 new site in March 2011.

Figure 5 shows site locations for these surveys. Site information including location, vegetation, bird species present and weather conditions is detailed in Appendix 1.

'Drift fence' barriers were erected by the rangers to direct foraging animals / reptiles towards the traps. Pitfall traps consisted of 20 Litre PVC white buckets dug into the substrate (see Figure 2).

Funnel traps were made from green mesh with a funnel at either end and access zip above (Figure 3-4) – these traps were borrowed from the Australian National University in Canberra.

Traps were open for three consecutive days each. Traps were checked daily within 3-4 hours of sunrise so as to not cause heat stress to the animal or provide opportunity for predation. Species were identified using reference books including Wilson and Swan – “A complete guide to reptiles of Australia” and “A field guide to mammals of Australia”.

Pitfalls were closed during the hot daylight hours by placing a large stick in the buckets for animals to climb out. Funnel traps were removed during the hot daylight hours and replaced in the evening. Buckets were left in the ground after trapping concluded for revisiting at a later date.

Results are outlined in Section 3 and shown in Appendix 2.



Figure 2 Bucket trap design – Site Old Road dune

funnel trap

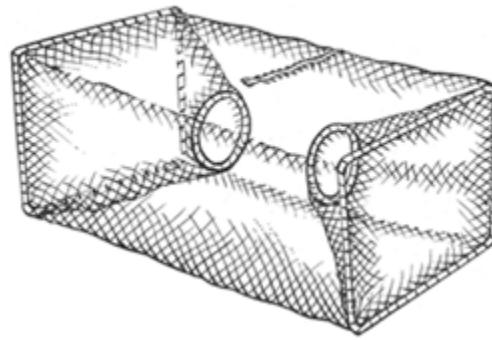


Figure 3 Funnel trap design



Figure 4 Paul setting funnel traps October 2010

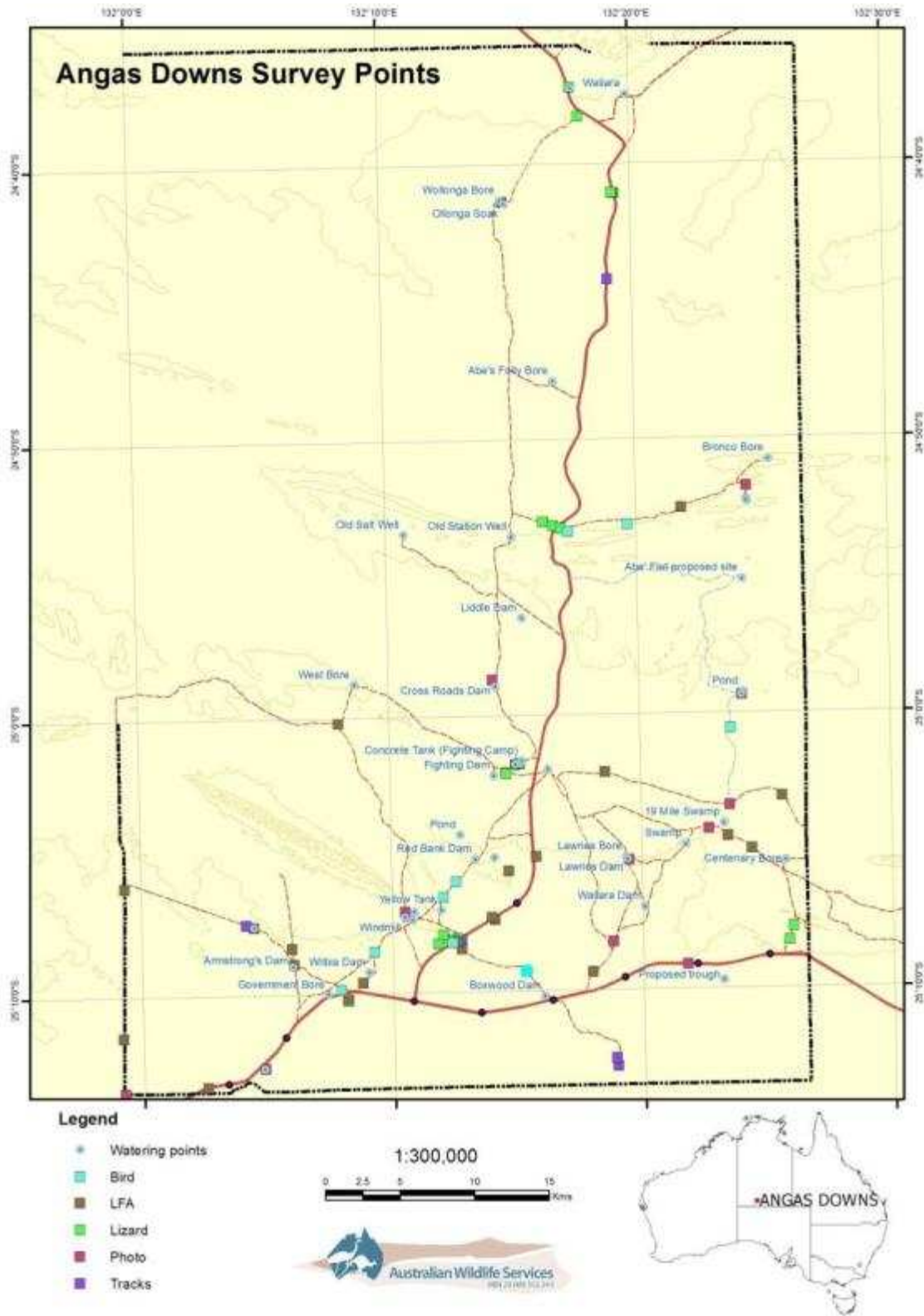


Figure 5 Survey Point Locations

2.2 Bird surveys

Bird surveys were undertaken at eight sites in March 2011 (Figure 5). From an access point (track, road etc), straight transects of approximately 200 m were walked up and back for 15 minutes. Bird species seen and heard during the surveys were recorded. Counts were taken of observed species. The purpose of the data collected is to represent presence / absence and indicate changes in populations after future surveys. Opportunistic bird surveys and sightings were also undertaken year round, including with use of the Cybertracker (see Section 2.4). GPS located photos were also taken where opportunity arisen. Results are described in Section 3.2.

2.3 Aerial survey

Aerial surveys are a cost effective way of assessing populations over large areas quickly. Much of Angas Downs does not have road access and aerial surveys can monitor trends both in the context of feral animal control operations to reduce physical environmental damage and to manage plans to increase numbers of preferred species such as kangaroos. During June 2010, fixed wing aerial surveys were conducted over Angas Downs and surrounding landscape.

Ten transects were placed 7.5 km apart running east-west across the width of the property. The lines were flown using a fixed-wing Cessna 182 aircraft flown at a ground speed of 185 km h^{-1} (100 kts), and a height of 76 m (250 ft) above ground level (

Figure 6).



Figure 6: Strip transect sampling from fixed-wing aircraft

Observers counted kangaroos, camels, horses, cattle, emus, bustards, euros and dingos. Sampling intensity was approximately 5% of the total 4000 km^2 area (or 6% of Angas Downs area 3205 km^2). A correction for habitat was applied to the kangaroo data (Caughley *et al* 1976). Population estimates were translated into approximate grazing pressures for the property using the following dry sheep

equivalents (DSE): 12 DSE for cattle (Millear et al 2001) 10 DSE for horses (Millear et al 2001); 5.4 DSE for camels (Guerouali and Wardeh 1998) and 0.5 DSE for Kangaroo (Wilson and Edwards 2008¹)

For more details on the survey method and results please see the report “Angas Downs IPA Aerial Survey June 2010” downloadable from www.awt.com.au (Australian Wildlife Services 2010a). Results are shown in Section 3.3.

2.4 Cybertracker

CyberTracker is a software program built for field monitoring and data capture installed on hand-held PDAs (Personal Digital Assistants), which have Global Positioning System (GPS) capability. CyberTracker was developed to support indigenous trackers retain and develop their tracking skills, and document findings. The program uses lists of icons and photos making it easier to use by non-literate people. It is an efficient way to gather large quantities of geo-referenced data for field observations. It is used widely across Indigenous Ranger groups in Australia for management of both land and sea resources.

The aims of implementing CyberTracker Wildlife Surveys on Angas Downs IPA are to:

- involve the rangers in monitoring native and feral species on Angas Downs
- progress involvement in sustainable wildlife management
- combine Indigenous knowledge with science to monitor environmental factors.

A detailed but simple Cybertracker sequence (species lists and other data to be collected) was developed for Angas Downs by Australian Wildlife Services. Species listed are specific to Angas Downs to help identify quickly species observed.

CyberTracker information is collected by the Angas Downs Rangers. Surveys are either operated by driving one of eight survey routes across the property or opportunistically. Data is collected on feral animals and management, native fauna and kuka, birds, bushtucker plants, rare plants, weeds, fire, road kills, hunting, fence condition and, cultural and historical sites etc (Figure 7 – Figure 9). Data is downloaded at the Angas Downs Office. The data are then collated and uploaded to maps and interactive layers in Google Earth.

Results of the Cybertracker surveys during 2010-2011 are shown in Section 3.4.

¹ This is a very conservative number – Munn et al (2009) have estimated it closer to 0.35 DSE – **Munn, A.J., Dawson, T.J., McLeod, S.R., Croft, D.B., Thompson, M.B. and Dickman, C.R. 2009.** Field metabolic rate and water turnover of red kangaroos and sheep in an arid rangeland: an empirically derived dry-sheep-equivalent for kangaroos. *Australian Journal of Zoology* **57**(1): 23–28.



Figure 7: Angas Downs Rangers using Cybertracker



Figure 8: TDS Nomad GPS for Cybertracker use on Angas Downs

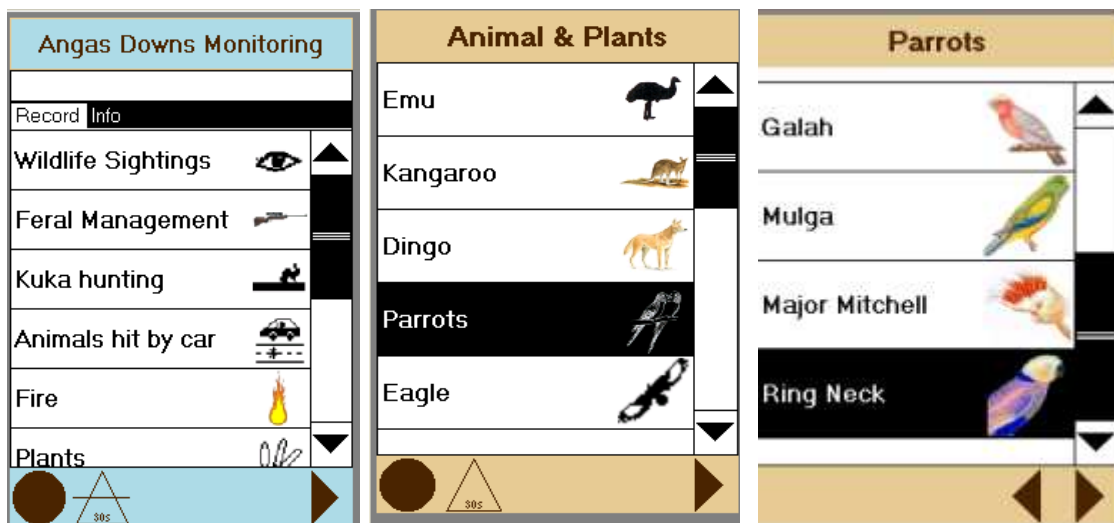


Figure 9: Examples of CyberTracker screen shots

2.5 Track based monitoring

Seven tracking plots on sandy substrate areas have been set up since 2009 at locations listed in Table 1 (also see mapped locations in Figure 5). Each is approximately 2ha (100m x 200m). Rangers accompany AWS personnel to find and record all evidence of animal tracks, scats and other traces within the plot area using the methodology described by Southgate and Moseby (2008). Age of the sign and abundance are also recorded. During 2010-11 to date, four of the tracking plots were assessed. Results are discussed in Section 3.5.

Table 1 Locations of tracking plots

Plot Name	Longitude	Latitude	Vegetation type
Desert Oak Tracks Plot	132.3178	-24.7371	Desert Oak (<i>Allocasuarina decaisneana</i>) open woodland over spinifex (<i>Triodia</i> sp.) Irregular sand dunes and plains.
Boxwood Tracking Plot	132.2098	-25.1361	<i>Acacia kempeana</i> (Witchetty Bush), <i>A. aneura</i> (Mulga) open-shrubland over mixed grasses (<i>Eragrostis eriopoda</i> (Woollybutt grass), <i>Triodia</i> sp. (soft and hard spinifex)) (Mallee Present). Sand plain.
Tim's Camp North sand plain Tracks Plot	132.2107	-25.1355	<i>Acacia aneura</i> (Mulga) open-shrubland over <i>Senna</i> sp., <i>Eremophila</i> (Fuchsia) sp. shrub layer over mixed grasses <i>Triodia</i> sp., <i>Eragrostis eriopoda</i> , <i>Monachather paradoxa</i> (Mulga grass). <i>A. estrophiolata</i> (Ironwood), <i>Grevillea</i> sp, <i>Santalum acuminatum</i> (Quandong) and <i>Aluta maisonneuvei</i> (dune crests) also present. Sand plain and dune.
Fighting Tracking Plot	132.244	-25.0347	<i>Acacia kempeana</i> (Witchetty Bush) <i>A. aneura</i> (Mulga) medium to tall open-shrubland over tussock grasses (<i>Monachather paradoxa</i> , <i>Eragrostis eriopoda</i>) and <i>Senna</i> sp. Sand Dune.
Sanctuary Tracking Plot	132.0697	-25.1243	<i>Acacia kempeana</i> (Witchetty Bush), <i>A. aneura</i> (Mulga) medium to tall open-shrubland with <i>Senna</i> <i>Eremophila</i> (Fuchsia) over tussock grass (<i>Eragrostis eriopoda</i>). <i>Aluta maisonneuvei</i> (dune crests). Mulga burnt in 2002. <i>Corymbia opaca</i> (Desert Bloodwood). Sand dune and plain.
South East Tracking Plot (Northern)	132.315	-25.208	<i>Acacia</i> (Ironwood) open woodland / Mulga-Cassia (<i>Senna</i>) shrubland over mixed grasses including spinifex, kerosene grass, Woollybutt and other forbs. Sand plain and sections of Mulga Earth.
South East Tracking Plot (Southern)	132.317	-25.214	Mixed shrubland (<i>Acacia</i> , <i>Grevillea</i> , <i>Dodonaea</i> , <i>Cassia</i>) over spinifex on sand dunes.

2.6 Photo points

32 photo points have been established around the property since 2009. Locations (see Figure 5) were selected using two main criteria:

- an area of interest – for example, different fire history, different management technique
- a representation of different landform/landscape types over the property.

At each photo point, Angas Downs Rangers erect 2 steel posts 10 meters apart (see Figure 7) along a North-South line. The two posts are for aligning the photos. The post at the end which the photo is to be taken was painted white so photo orientation was obvious.

Rangers have been trained to take regular photos at these points. In 2010, a geolocated camera was purchased to help the rangers with their survey photos. Photos points will be compared through time to show landscape and vegetation improvement or deterioration.

These are listed in Table 2.

Table 2 Photo Points Angas Downs

Name	Long	Lat	Type	Dist to water (km)	Vegetation	Other
Armstrong calcrete-sand	132.10	-25.15	Photo LFA	0.16	Sand dune/Sandplain Low sparse shrubland (<i>Acacia</i> , <i>Maireana</i> , <i>Eremophila</i>)	Inside sanctuary
Athel Pine Control	132.08	-25.21	Photo	7.28	Small drainage depression/dam	Athel Pine knockdown; outside sanctuary, south of Lasseter Highway
Back of Wilbia - over grassland	132.18	-25.12	Photo	0.57	Overlooking forbland and Wilbia Soak.	Possible overgrazed area, regeneration
Bloodwoods Sand	132.08	-25.13	Photo LFA	3.72	Sand plain/Sand dune <i>Acacia and Senna sp</i> Tall shrubland over Woollybutt grass, mulga grass	Proposed bore site; Inside sanctuary
Boxwood Bore Sand	132.26	-25.16	Photo LFA	0.08	Sandplain Tall open <i>Senna/Acacia sp.</i> shrubland (<i>Quandong Santalum acuminatum</i> in distance)	Inside cattle paddock
Boxwood Calcrete	132.21	-25.14	Photo LFA	6.61	Calcrete grassland – oat grasses (<i>Enneapogon sp</i>), low chenopods and other forbs	Within the cattle paddock
Buffel Grass	132.36	-25.15	Photo	8.30	Buffel Grass invasion from road corridor – sand (<i>Cenchrus ciliaris</i>)	Weed management and control of spread
Burnt Mulga Cattle	132.38	-25.07	Photo	5.50	Overlooking burnt mulga woodland patch	To show recruitment and growth of new mulga overtime.
Calcrete Rabbits Cattle Paddock (fenced)	132.26	-25.09	Photo LFA	6.00	Calcrete grassland– oat grasses (<i>Enneapogon sp</i>)	Rabbit activity - adjacent to areas unfenced, inside the cattle paddock
Calcrete Rabbits (unfenced)	132.25	-25.09	Photo LFA	5.27	Calcrete grassland– oat grasses (<i>Enneapogon sp</i>)	Rabbit activity - outside fenced areas
Calcrete Cattle 2 (near Wallara Dam)	132.31	-25.14	Photo	5.57	Calcrete grassland– oat grasses (<i>Enneapogon sp</i>)	Inside cattle paddock - improving coverage of the landscape
Cattle Paddock North (both ways)	132.39	-25.06	Photo	5.29	Sparse shrubland over tussock grasses	Show management effects inside and outside of the cattle fence
Cattle Spinifex	132.33	-25.09	Photo	0.16	Spinifex sand	Inside cattle paddock
Centenary Grassland	132.39	-25.07	Photo LFA	4.20	Sparse-Open Forbland / grassland – oat grasses (<i>Enneapogon sp</i>)	Inside cattle paddock
Centenary Mulga	132.41	-25.08	Photo LFA	2.38	Mulga tall open shrubland	Inside cattle paddock
Cronks Flat	132.40	-24.99	Photo	11.58	Grassland – <i>Digitaria sp</i> (Cotton	Outside fenced areas -

Name	Long	Lat	Type	Dist to water (km)	Vegetation	Other
Grassland					panic)	
Curtin Springs Boundary	131.99	-25.10	Photo LFA	12.45	Sandplain – Sparse tussock grassland	Camel degradation; Burnt 2002; Inside sanctuary
Desert Oaks	132.32	-24.68	Photo LFA	7.60	Sand dune/sand plain Allocasuarina Spinifex open woodland	Burnt 2002; Outside sanctuary
Eagles Nest	132.43	-25.05	Photo LFA	4.45	Sand dune crest; tall open shrubland with tussock grass understorey	Inside cattle paddock
Fighting Trough Calcrete-sand	132.25	-25.03	Photo LFA	0.01	Sandplain Mid Open <i>Acacia</i> and <i>Maireana</i> Shrubland	Outside sanctuary
Mulga santuary	132.10	-25.14	Photo LFA	1.24	Mulga mature	Inside sanctuary
Puna Kura Kura	132.41	-24.86	Photo	16.00	Gibber plain (rocky surface) Tussock Grassland	Erosion in distance; Outside sanctuary
Puna Kura Kura Burnt	132.36	-24.88	Photo LFA	11.60	Sand plain Spinifex low-mid open shrubland <i>Acacia/Casuarina</i> burnt, not regenerated	Burnt 2002; Outside sanctuary
South West Corner	131.99	-25.23	Photo	14.10	Calcrete depression Gilgai Low open shrubland (<i>Maireana</i> sp). Mitchell grass (<i>Astrebla</i> sp)	Camel degradation and erosion; Inside sanctuary; Spinifex behind fire managt
Spinifex	131.99	-25.19	Photo LFA	12.35	Spinifex grassland	In the sanctuary area
Stoves Swamp	132.30	-25.16	Photo LFA	3.66	Swamp, clay pan Coolibah (<i>Eucalyptus coolabah</i>) low open woodland,	Swamp; Inside cattle paddock
Water Rock	132.24	-24.98	Photo	0.48	Clay pan/sand plain Crusted area	Landform type; Outside sanctuary
West Bore Ironstone grassland	132.13	-25.00	Photo LFA	12.90	Alluvial plain? Open grassland/forbland	Outside sanctuary
Wilbia Dam Calcrete	132.15	-25.16	Photo LFA	0.80	Calcrete grassland	Inside the sanctuary area, distance to water
Wollunga Solar Gypsum	132.25	-24.69	Photo LFA	0.05	Calcrete/gypsum pan Low open <i>Acacia</i> shrubland (Dead finish – not alive) tussock and onion grass	Drought affected vegetation; Rabbit issue; Outside sanctuary
Wilbia soak fenced	132.2	-25.12	Photo	0.00	Coolibah, ripartian vegetation	Fenced soak area
Wurldunda soak fenced	132.2	-25.12	Photo	0.00	Samphires and saltbush	Fenced soak and drainage area



Figure 10 Angas Downs Rangers (David Wongway and Paul Pumpjack) establishing photo point pickets.



Figure 11 White paint to guide photo orientation

2.7 Landscape function analysis (LFA)

Landscape functional Analysis (LFA) is a field based method of assessing soil and site conditions and vegetation cover. LFA assesses how the landscape regulates the resources, whether they are being lost or recycled within the landscape and hence how healthy or unhealthy a landscape is, and how it is functioning. On Angas Downs, 30 LFA transects have been assessed at selected photo points and other areas of interest (Table 2 and Figure 5). LFA is being used to monitor landscape health over time and assess progress of rehabilitation of the landscapes of Angas Downs IPA. Transects align with the maximum slope of each chosen site. Transect lengths depended on the length of the landform and whether the landscape organisation and vegetation was homogeneous. A continuous record of patches and interpatches was made with a precision of $\pm 2\text{cm}$ (referred to as landscape organisation). Patches were determined as areas that were accumulating and conserving resources by restricting downslope flow, such as grass swards, litter accumulation around shrubs and trees and log trash. Interpatches were identified as areas where resources tended to be mobilised and transported down slope or by wind, e.g. bare soil. Randomly selected areas of each patch/interpatch type were assessed for eleven soil surface properties as per the scoring system in Tongway and Hindley (2004) – See Table 3. Each of these soil surface assessment indicators refers to a process identified in the TTRP framework.

Eleven (11) LFA sites assessed in October 2009 were reassessed in December 2010: due to high rainfall and time constraints, the sites could not be assessed in October 2010 -1 year from the original data collection. Two sites were abandoned (relevance), 1 moved (poor location) and 19 new sites set up in 2011.

Table 3 Eleven soil surface properties assessed for each patch/interpatch type in the Landscape Function Analysis method (Tongway and Hindley 2004)

- | | |
|--------------------------------------------|-----------------------------------------------------------|
| 1. Soil cover (rainsplash protection). | 7. Deposited materials (sediment). |
| 2. Perennial vegetation cover. | 8. Surface roughness. |
| 3. Litter cover, origin and decomposition. | 9. Surface resistance to disturbance. |
| 4. Cryptogram cover. | 10. Emerson aggregate test / slake test (soil stability). |
| 5. Crust brokenness. | 11. Soil texture. |
| 6. Erosion type and severity. | |

Field procedures are detailed by Tongway and Hindley (2004).

2.8 Mapping of cultural sites

Mapping of cultural sites occurred on Angas Downs during 2010-2011. As cultural sites are located, Australian Wildlife Services has been recording them photographically and where possible, filming Anangu elders telling the site's stories. Angas Downs IPA entered a funding proposal in 2010 with the Indigenous Heritage Program, Department of Environment, in order to properly document the known sites and find unknown sites by an anthropologist – rock art specialist) and to record elders not in the immediate area (ie Docker, Muti, Tempe Downs, Alice Springs).

2.9 Mapping of important and rare plants

Plant surveys were conducted property wide (but almost always close to vehicle access) during 2010-11. Structure and floristics were recorded at each photo and LFA site and interesting plants noted opportunistically (geolocated). Preliminary surveys of the Eastern section of the Kerno Range was also undertaken during 2010. Species identified in 2010-11 are discussed in section 3.9 and listed in Appendix 3. Surveys did not assess plant species density, just presence/absence and plant diversity at each site. Plant density is an indicator assessed within LFA studies (Section 2.7).

2.10 Fire risk

Fire risk for Angas Downs was determined using rainfall data from BOM and Angas Downs rainfall records collected daily during 2010. Trial burn-offs were also mapped using Landsat TM images. Results are shown in Section 3.10.

3. Results

3.1 Reptile and small mammal surveys

The surveys were completed between 2-9 October, 6-9 December 2010 and March 2011. 40 reptile 6 small mammal and 4 frog species were recorded, many of which had not yet been listed on Angas Downs IPA's species lists. Reptile, amphibian and mammals observed during the survey are listed in Appendix 2.

3.1.1 Reptiles and amphibians

Reptiles and amphibians observed are listed in

Table 4. Photographs of reptiles and mammals observed are shown in Figure 12.



Figure 12: Some reptile species identified during 2010-11 surveys (left to right): *Nephurus levis levis*, *Nuphrurus laevisissimus*, *Egernia inornata*, *Varanus eremius*, *Ctenotus calurus*, *Ramphotyphlops endoterus*, *Suta punctata*, *Pygopus nigriceps*, *Simoselaps bertholdi*

(Photos: G. Kay and J. Smits)

Table 4 Reptiles and Amphibians observed on Angas Downs IPA 2010-11

Reptiles		Reptiles	
<i>Amphibolurus longirostris</i>	Long-nosed Dragon (Ta-Ta)	<i>Lerista bipes</i>	Two-toed Lerista
<i>Cryptoblepharus plagiocephalus</i>	...skink	<i>Menetia greyii</i>	Common dwarf skink
<i>Ctenophorus isolepis</i>	Central Military Dragon	<i>Moloch horridus</i>	Thorny Devil
<i>Ctenophorus nuchalis</i>	Central netted dragon	<i>Morethia ruficauda</i>	Fire-tailed skink
<i>Ctenophorus reticulatus</i>	Western netted Dragon	<i>Nephrurus levis levis</i>	Smooth Knobtail Gecko
<i>Ctenopus brooksi</i>		<i>Nuphrurus laevissimus</i>	Pale Knob-tailed Gecko
<i>Ctenopus calurus</i>	Blue-tailed Ctenopus	<i>Pseudechis australis</i>	King Brown Snake
<i>Ctenopus dux</i>	Narrow-lined Ctenopus	<i>Pseudonaja nuchalis</i>	Western Brown Snake
<i>Ctenopus helenae</i>	Clay-soil ctenopus	<i>Pseudonaja modesta</i>	Ringed Brown Snake
<i>Ctenopus leonhardii</i>	Leonhard's Ctenopus	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot
<i>Ctenopus pantherinus ocellifer</i>	Leopard Ctenopus	<i>Ramphotyphlops endoterus</i>	Interior Blind Snake
<i>Ctenopus piankai</i>	...skink	<i>Rhynchoedura ornata</i>	Beaked Gecko
<i>Ctenopus quattuordecimlineatus</i>	14-lined skink	<i>Simoselaps anamolous</i>	Desert Banded Snake
<i>Ctenopus schomburgkii</i>	Barred Wedged Snout Ctenopus	<i>Simoselaps bertholdi</i>	Jan's banded snake
<i>Delma nasuta</i>	...legless lizard	<i>Strophurus ciliaris</i>	Northern Spiny-tailed gecko
<i>Demansia psammophis</i>	Yellow Faced Whip Snake	<i>Suta punctata</i>	Little Spotted Snake
<i>Diplodactylus conspicillatus</i>	Fat-tailed gecko	<i>Tiliqua Multifasciata</i>	Centralian Blue Tounge
<i>Egernia inornata</i>	Desert Skink	<i>Varanus eremius</i>	Pygmy Desert Monitor
<i>Gehyra variegata</i>	Varigated Gecko	<i>Varanus gouldii</i>	Gould's Goanna
<i>Heteronotia binoei</i>	Bynoe's gecko	<i>Varanus giganteus</i>	Perentie
Amphibians			
<i>Limnodynastes ornatus</i>	Ornate Burrowing Frog		
<i>Litoria rubella</i>	Desert Tree Frog		
<i>Neobatrachus centralis</i>	Trilling Frog		
<i>Notaden nichollsi</i>	Desert Spadefoot Toad		



Figure 13 *Notaden nichollsi* Desert Spadefoot – Juvenile, Yaua Waterhole March 2011 Photo: Smits



Figure 14 *Neobatrachus centralis* Trilling Frog, Yaua Waterhole October 2010 Photo: Kay



Figure 15 *Limnodynastes ornatu* Orate Burrowing Frog, Yaua Waterhole October 2010 Photo: Kay

3.1.2 Small mammals

The October 2010 surveys found six species of small mammals – Sandy Inland Mice (*Pseudomys hermannsburgensis*), Kultarr (*Antechinomys laniger*) and Spinifex Hopping Mice (*Notomys alexis*) (Figure 16), Wongai Ningai (*Ningai ridei*) and Lesser Hairy Footed Dunnart (*Sminthopsis youngsoni*) (Figure 17) and *Echidna* (Figure 18). Kultarr, Mitchell's Hopping Mouse (*Notomys Mitchelli*) and Lesser Hairy-footed dunnart were also observed in June 2011. Kultarr is listed as Lower Risk-Near Threatened in the Northern Territory and Mitchell's Hopping Mouse (3 found) are well out of their normal range extending from southern parts of WA and SA. House Mice/Sandy inland mouse and Spinifex Hopping Mice were extremely common (very high densities across the property) in June 2011.



Figure 16 Kultarr (*Antechinomys laniger*) (with young) & Spinifex Hopping Mice (*Notomys alexis*)



Figure 17 Lesser Hairy Footed Dunnart (*Sminthopsis youngsoni*) & Wongai Ningai (*Ningai ridei*)



Figure 18 Echidna tracks (*Tachyglossus aculeatus*) December 2010

3.1.2 Large native mammals

Large native mammals observed in 2010-2011 included *Malu* Red Kangaroo, *Papa* Dingo, *Kanayla* Euro and tracks of an echidna. See aerial survey results below for estimated kangaroo numbers.

3.1.3 Feral mammals

Feral mammals observed in 2010-2011 included fox, camel, cat, horse, cattle, house mouse and rabbit (Appendix 2). Rabbits have not seemed to substantially increased since the good season but active warrens are being kept an eye on.

3.2 Bird surveys

Bird surveys at eight sites recorded 47 bird surveys species during March 2011. Numbers of species observed at each site are shown in Table 5.

Full site species lists are shown in Appendix 4.

Opportunistic bird surveys during 2010 recorded 78 species. Opportunistic (coupled with bird surveys) bird observations during 2011 to date (to March 2011) have recorded 62 species.

Bird observation highlights include:

- *Kipara* Bustard – Bush Turkey (VU)
- *Kalaya* Emu (VU)
- White-browed Tree Creeper
- Varied Sittella
- Grey-fronted honeyeater
- Grey Fantail
- Spotted Harrier
- Black Shouldered Kite
- Collared Sparrowhawk
- Chiming Wedgebills
- Sacred Kingfisher
- Black-breasted Buzzard, Little Eagle
- Waterbirds including Nankeen Night Heron, Black-fronted Dotterel, Black-tailed Native-hen, White-faced Heron, Banded Lapwing, Pacific Black Duck, Hardhead, Wood-ducks, Hoary-headed Grebe, Little Black Cormorants
- Nesting Major Mitchells
- Nesting Bourke's parrot and mulga parrots

(VU Listed as vulnerable in the NT)

Table 5 Number of bird species observed during surveys in March 2011

Site	Dead Camel Rd Mulga	Centenary LFA Mulga	Tim Dump Mulga	Puna Kura Kura mulga	Puna Kura Mulga recent burn	Thick watercourse mulga past yellow tank
Total species per site	11	6	25	10	7	6
Site	Open woodland past yellow tank	Entry Road to yellow tank	Ironwoods near Wilbia Dam	Bird Pt 10 (Boxwood gate)	Bird Pt 11 (Lasseter Hwy Mulga watercourse)	
Total species per site	5	3	10	6	16	

Birds uncommon in 2009 and common in 2010-11 included Brown and Rufous Songlarks, Red Chats, Little-button Quail, Budgerigar, Bourke’s Parrots, Common Bronzewing, Pallid Cuckoo, Sacred Kingfisher, Cockatiels, Richard’s Pipit. Water birds not seen on Angas Downs for many years were present in 2010 (see lists above and Appendix 4), however few water birds were observed during March 2011 despite surface water and full dams across the property. Rains elsewhere in the country would have caused these birds to keep migrating off Angas Downs.

There is also anecdotal evidence that emu numbers have been increasing (pers comm. David Wongway – Senior Anangu Ranger 2010). There were a string of sightings during 2010, including a male with chicks on the plains near West Bore during October 2010 (see Figure 5 for location).

Rainbow Bee-eaters were not observed during 2010 in the numbers seen in 2009. During October 2009 surveys, rainbow bee-eaters were extremely common as they were migrating through the area. There was no migration to this area by Rainbow Bee-eaters in 2010. Only 1 was seen in October 2010. It is suggested that this change would be due to the unusual rainfall patterns across the country.

3.3 Aerial Survey

The results and analysis of the 2010 Angas Downs IPA Aerial Survey are shown in Table 6 and Figure 19. Population density estimates for herbivores kangaroos, camels, cattle and horses are shown in Figure 20 - Figure 22 and total grazing pressure is shown in Figure 24.

Kangaroo populations were estimated at 2900 ± 1000 for the property, camel populations were estimated at 600 ± 350 . The estimated kangaroo population is a good base for numbers to start increasing in the landscape where pressures on the population are reduced (ie. restricted hunting and competition from feral animals). Camel numbers were higher than expected on Angas Downs, despite likely population dispersion due to high rainfall during 2010. Camel population management, along with feral horses and cattle is a priority for Angas Downs’ management but is difficult while there is a lot of water and lush vegetation in the landscape.

The aerial survey enhanced the Anangu Ranger’s knowledge of the density and distribution of kangaroos, camels, horses and cattle. This will help them to manage landscapes where these animals exist to either encourage populations or control them.

No emus (*Dromaius novaehollandiae*) were observed during the June 2010 surveys on Angas Downs or surrounding land. Bustards (bush turkeys) (*Ardeotis Australis*) and various other species of birds such as budgerigars (*Melopsittacus undulatus*), Major Mitchells (*Lophochroa leadbeateri*) and galahs (*Eolophus roseicapilla*) were observed during the aerial surveys however, density analysis was not conducted. No Euros (*Macropus robustus*) were observed but their presence in the hills on the station has been during ground surveys. Dingos were observed from the air but not during the surveys periods.

For more details on the aerial survey results please see the report “Angas Downs IPA Aerial Survey June 2010” downloadable from www.awt.com.au (Australian Wildlife Services 2010a).

Table 6 Aerial survey statistics

	Kangaroo (vegetation corrected)	Camel	Horse	Cattle All	Cattle Feral
Average density (km²)	0.91	0.18	0.09	0.14	0.04
Confidence Interval 95%	0.32	0.12	0.06	0.10	0.05
Range					
Min	0.60	0.06	0.03	0.04	0
Max	1.23	0.31	0.15	0.24	0.09
Estimated Population on Angas Downs					
Average	2927	590	284	452	131
Confidence Interval 95%	1011	363	176	315	144
Range					
Min	1917	227	109	137	0
Max	3938	953	460	767	275

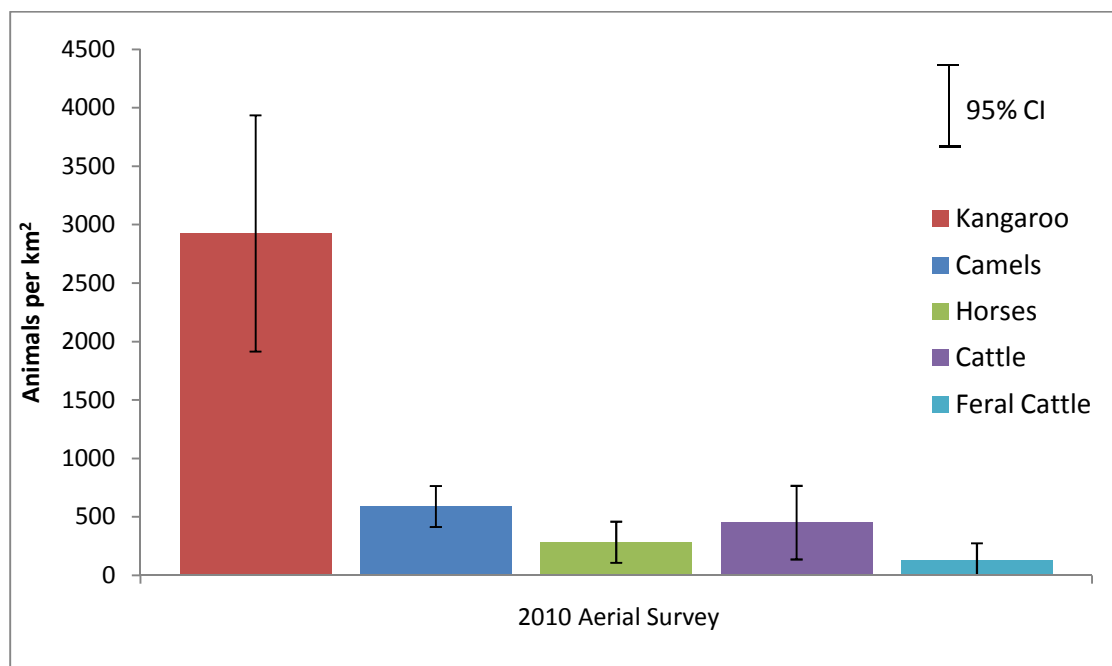


Figure 19 Estimated populations on Angas Downs during 2010 aerial survey

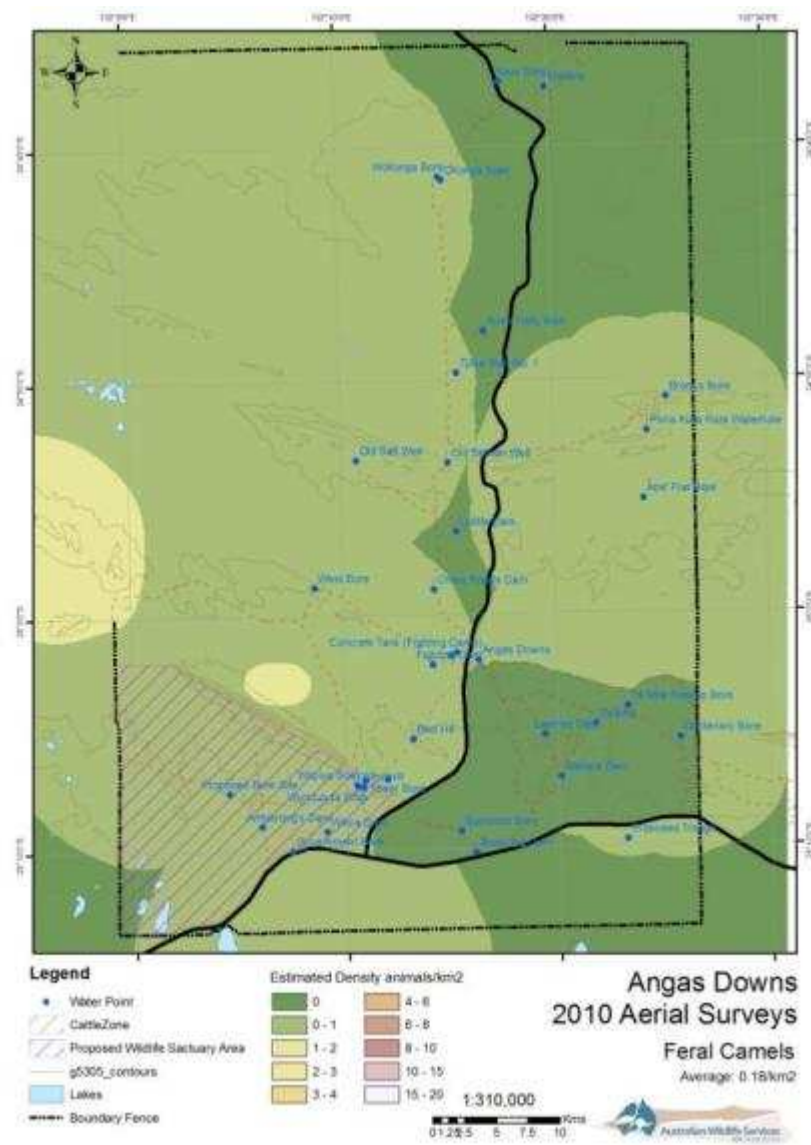
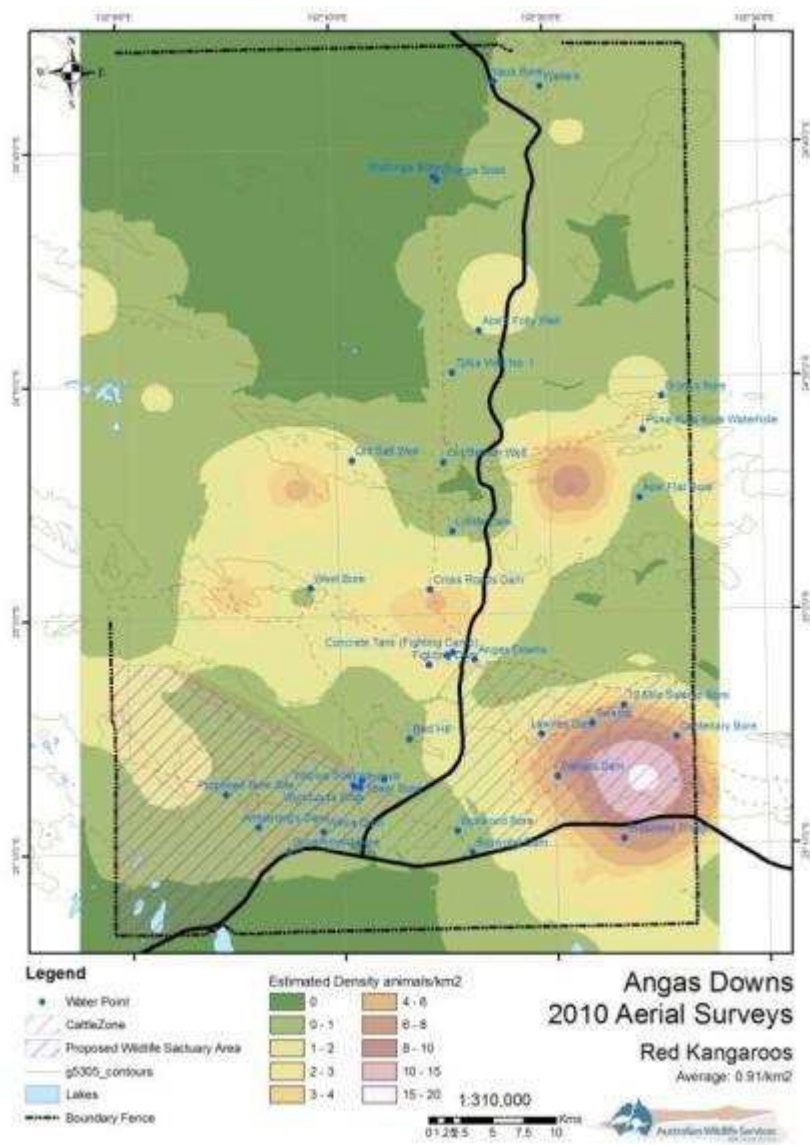


Figure 20 Map of red kangaroo population density Figure 21 Map of camel population density

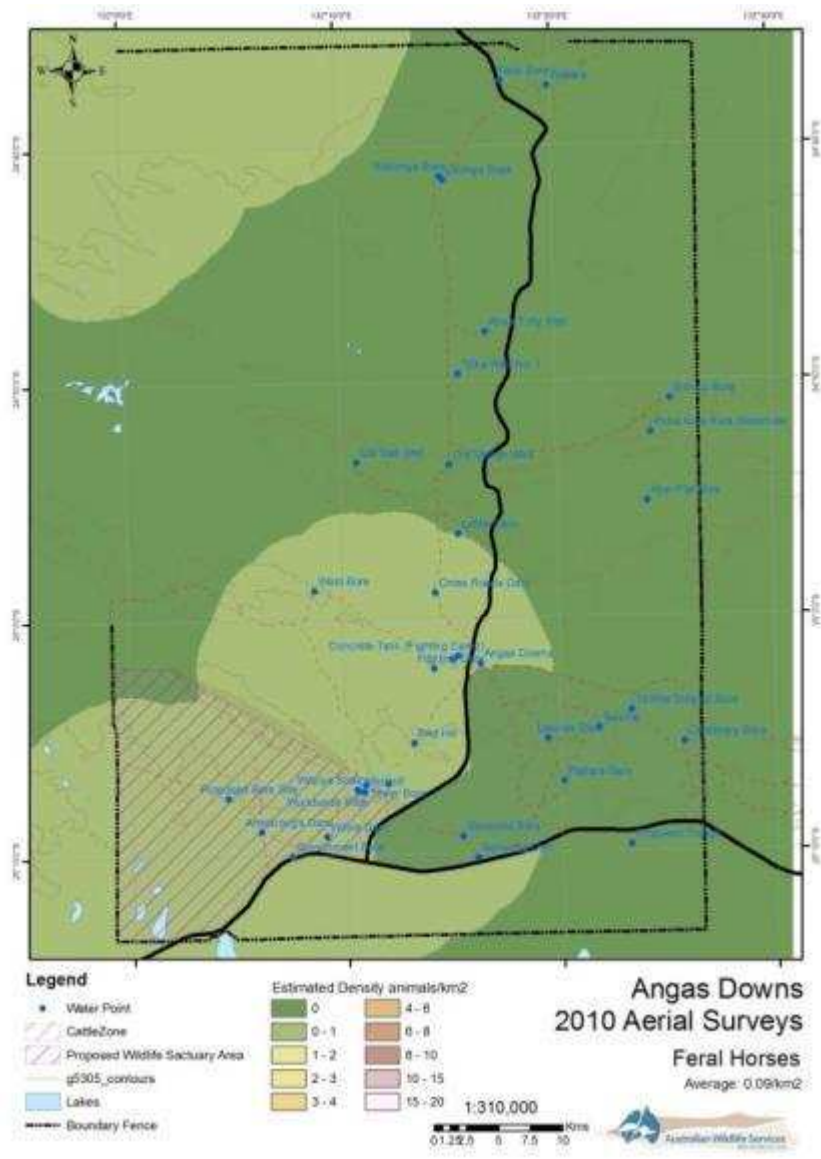


Figure 22 Map of feral horse population density

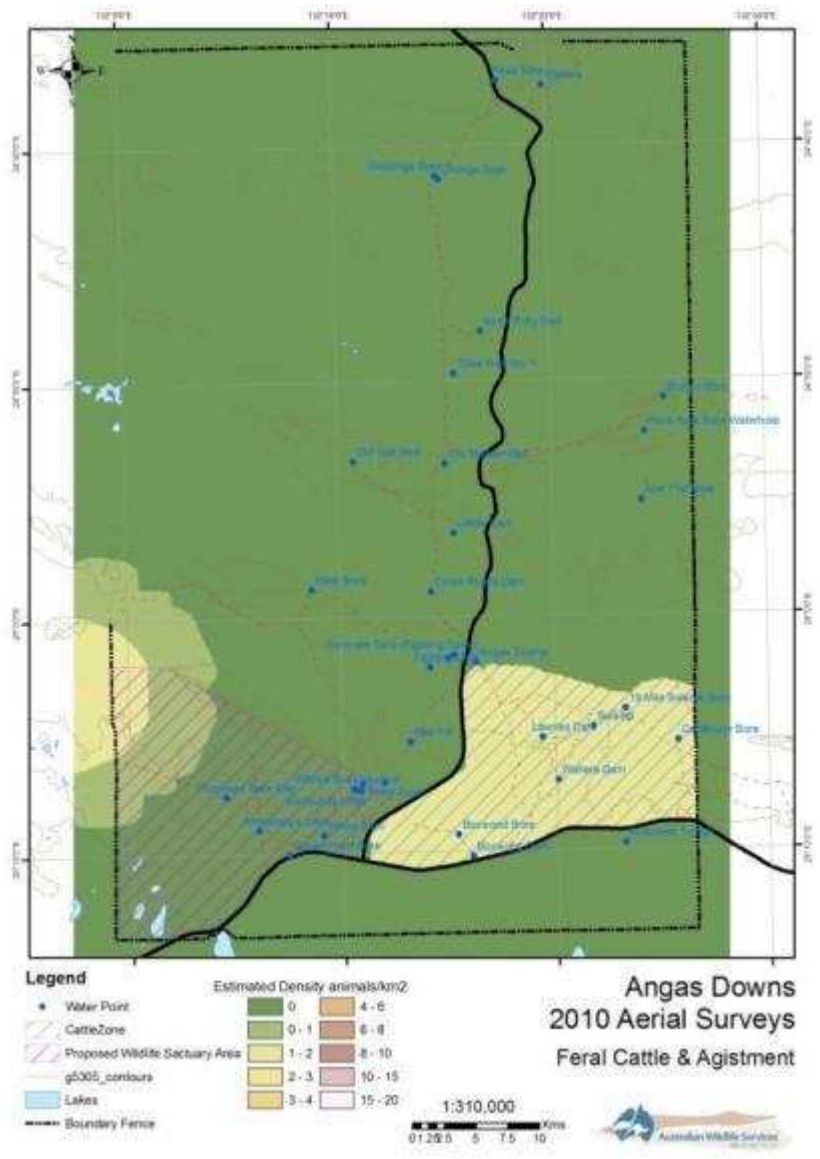


Figure 23 Map of cattle population density

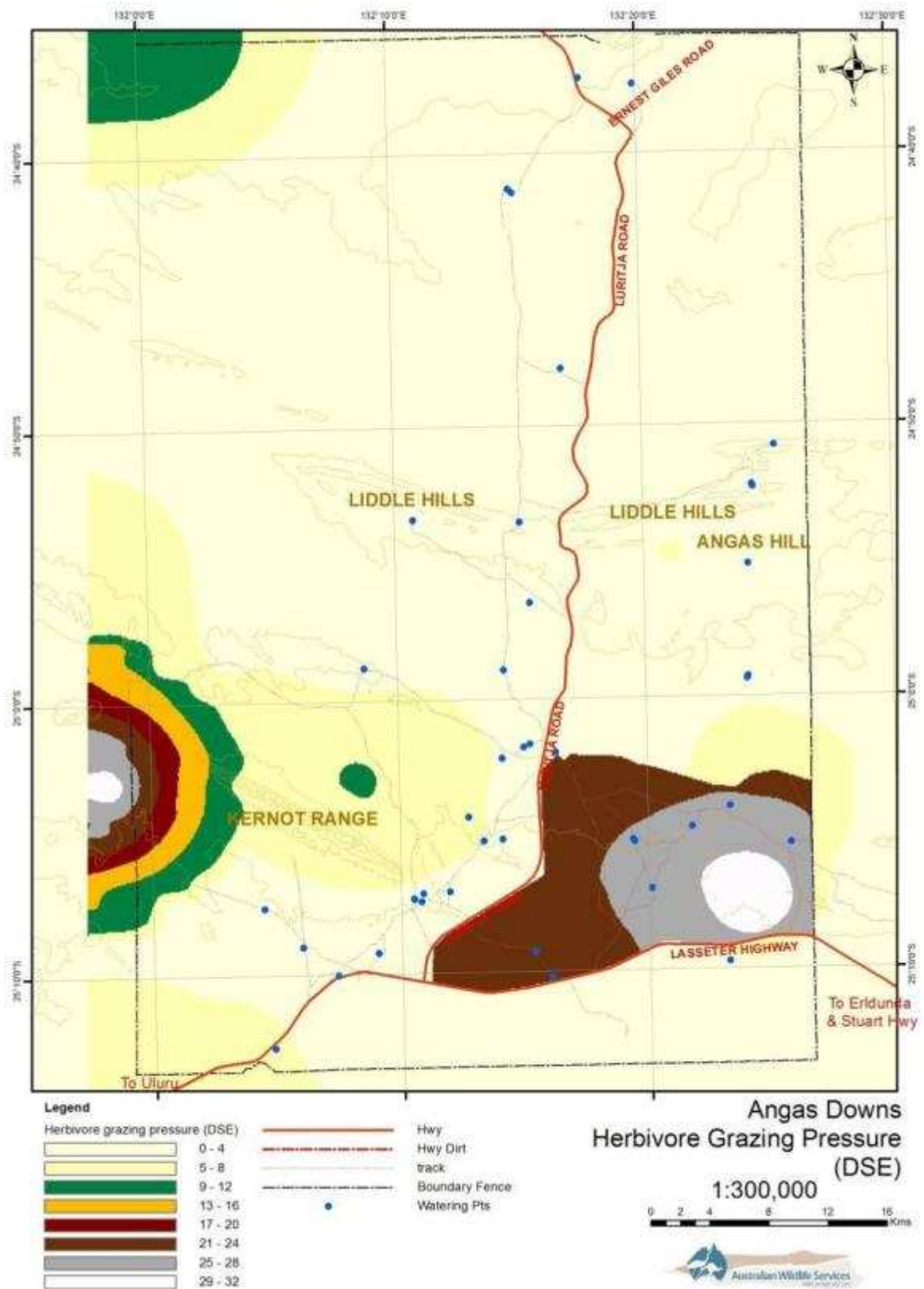


Figure 24 Total herbivore grazing pressure (horse, cattle, kangaroo, camel) dry sheep equivalent (DSE)

3.4 Cybertracker

Cybertracker observations were collated and mapped using ArcGIS 10 (Figure 25). Data only shows presence / absence of species, which is heavily biased to access tracks from which the surveys are undertaken. The data shown for camels, horses and kangaroos shown in Figure 25 helps locate where large mobs of feral animals occur and where they compete with native animals such as the kangaroo.

Surveys were not conducted regularly enough to obtain density estimations. Much of the data was also collected opportunistically by the rangers – the use of this data is limited to presence / absence (which is very important in itself); however, Cybertracker has been an excellent tool to urge the rangers to be more involved in monitoring and recording species and the environment on their land. As they become more familiar with the software, the data will have greater accuracy and application.

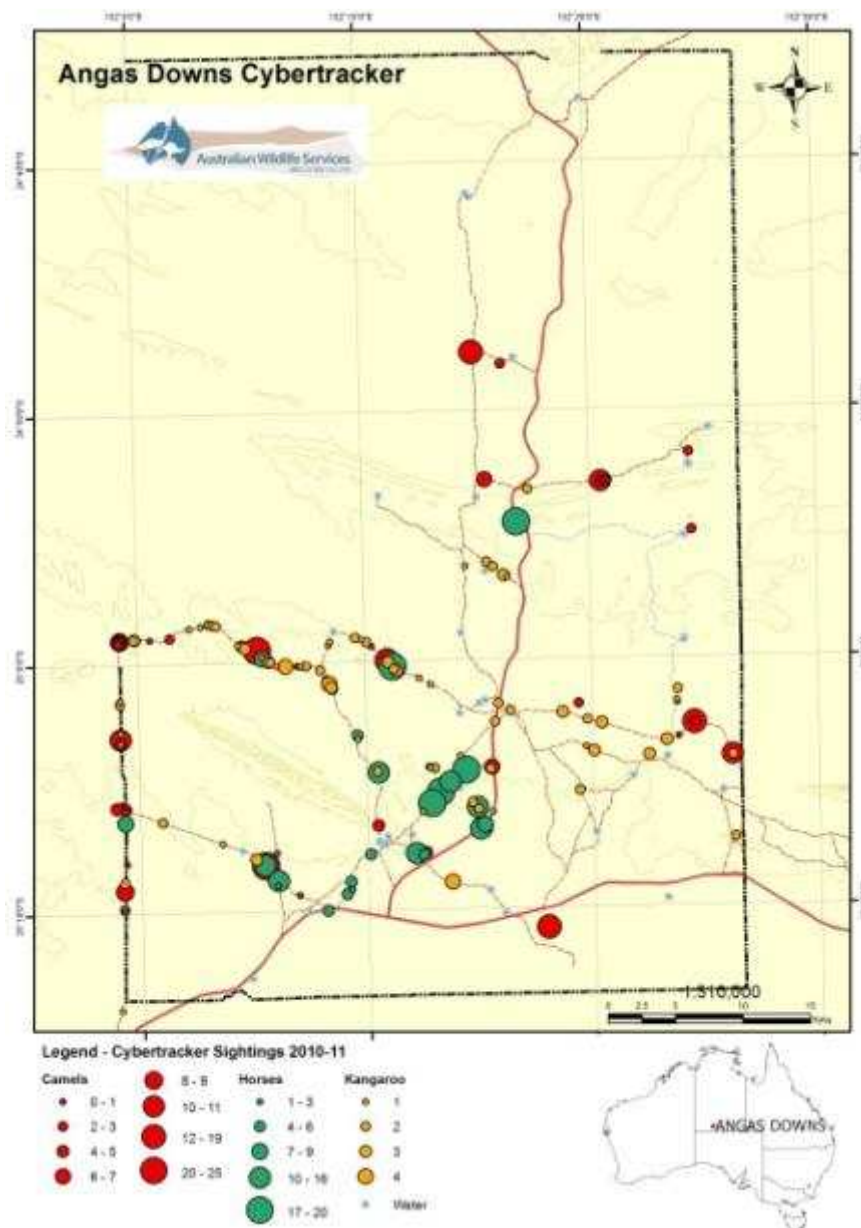


Figure 25 Cybertracker Sightings during 2010-2011 – Camels, Horses and Kangaroo

3.5 Track based monitoring

Four tracking plots on sandy substrate were assessed in 2010, each approximately 2ha (100m x 200m). Malu (red kangaroo) and native mice tracks (Sandy inland, Spinifex hopping mouse, Dunnarts etc) were observed to occur at all four sites. Cats, foxes, rabbits and snakes were observed at three of the four sites. Dingos, camels, echidnas and goanna (tinka) were observed at two the sites. Other track observations included perentie, horse, non-descript birds and small lizards, mulga parrots, woodswallows and budgerigars.

To date, the technique has been useful for tracking feral animals such as cats and foxes and for helping locate sites useful for trapping (ie where Mulgara (*Dasyercus cristicauda*) tracks are thought to be seen). Raw data is shown in Appendix 5.

3.6 Photo Points

Photo point pictures over time are shown in Appendix 6 and can be viewed online [View Album](#).² The above average rainfall during 2010 (540mm) has seen most sites show remarkable increases in plant cover and growth (example shown in Figure 26).



(left March 2010; right October 2010)



(left December 2009; right December 2010)

Figure 26: Example of how photo points show change over-time

²<https://picasaweb.google.com/101023482628629136878/PhotoPointsAngasDowns?authkey=Gv1sRgCNT3oZmKjsinjAE#>

3.7 Landscape Function Analysis

In the majority of instances, 2009 sites reassessed in 2010 increased all their LFA indices - stability, infiltration, nutrient cycling - reflecting the exceptional rainfall seasons 2010 (2009 rainfall 72mm, 2010 rainfall 540mm, average 240mm). Where indices did not increase or reduced, the sites were often located near watering points. The greatest increase was seen at Wilbia where fences have been erected to stop feral animal access to the soaks. These are named “fenced” and “unfenced” LFA sites.

3.7.1 Wilbia / Wilpiya

There was an increase for all indices in the feral free fenced off area at Wilbia/Wilpiya soak (Figure 27). Areas inside the fenced area that were bare in 2009 have been colonised by *Acacia victoriae*, annual grasses and weed species including buffel grass (see Figure 25).

Weed species are more abundant in 2010 with buffel grass being a greater presence on the LFA transect. Despite this, soil and stability conditions under the buffel was exceptional – greater organic matter input and swards so dense as to not allow loss of litter and soil out of the system (Figure 26). Mustard Weed and Couch had also thickened and spread. Considering Wilbia is a significant site on Angas Downs, it is recommended that weeding occur as soon as possible.

Outside the boundary of the feral free fence, there has been a great increase in stability, infiltration and nutrient cycling despite grazing access for large feral herbivores. Total patch size (area) and number of patches increased due to an increase in perennial species, including invasion of buffel grass. Number of patches nearly doubled from 2009 (from 7.8 to 15.1sq m). The abundance of water and feed in the landscape would have temporarily relieved grazing pressure at this site. This would be the case for much of the landscape. Furthermore, seed and water flowing from adjacent fenced area supports the high increase in growth and LFA indices. Future LFA assessment at this site will be needed to assess whether there has been a long-term increase in function. Another contributing factor could be that evidence of a dingo/dog residing or utilising Wilbia could be deterring camels, cattle and horses.

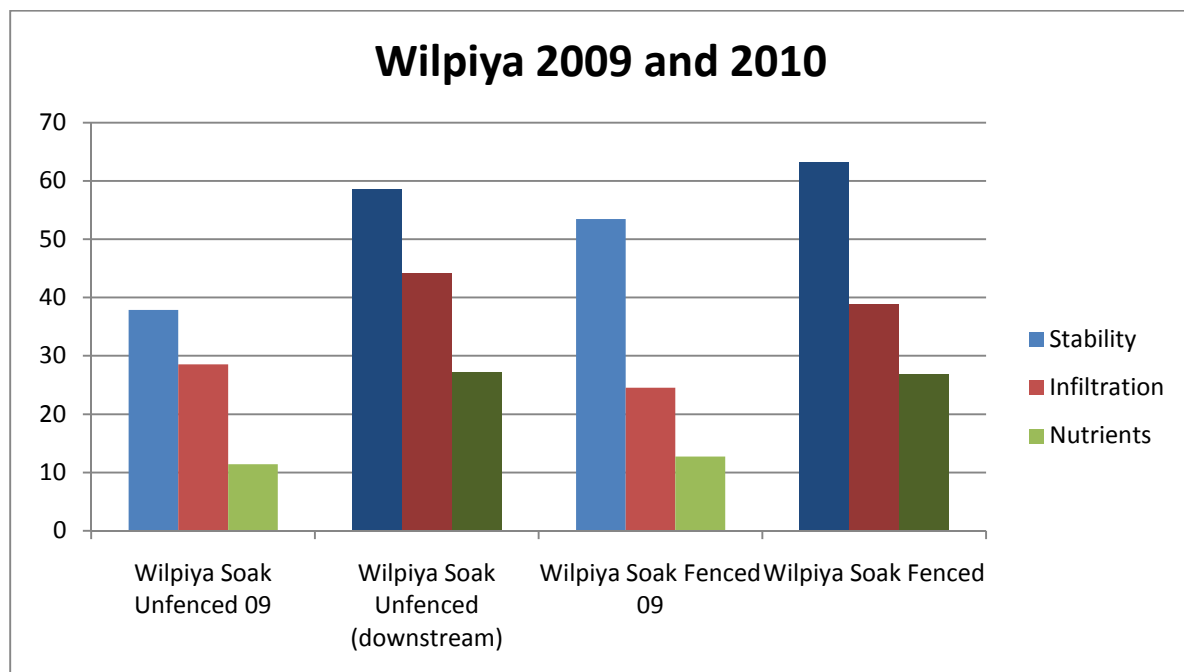


Figure 27 Wilpiya/Wilbia LFA results 2009 & 2010



Figure 28 Photo of the LFA transect undertaken within the fenced area of Wilpiya in December 2010. Plant growth has been extremely good.



Figure 29 Photo of the soil surface found under buffel grass at Wilbia

Litter and soil are captured and/or retained under these dense swards of Buffel at Wilbia however, Buffel is considered an environmental weeds and could take over much of the area – reducing biodiversity of native plants. This may impact bird life that the site currently supports. Also buffel grass presence can increase the risk of large hot fires which may damage the progress the site has had since fencing.

3.7.2 Wurldunda

There was no improvement in LFA indices outside or inside the fenced area at Wurldunda (Figure 30)³. Despite there being an increase in annual plant growth in some areas due to good rainfall, it was not sufficient to register any effect on litter cover and nutrient cycling except under existing Samphires. There was very little new growth of any species at this site. One new LFA site was established – Wurldunda unfenced (upstream) for better comparison between the fenced and unfenced areas.

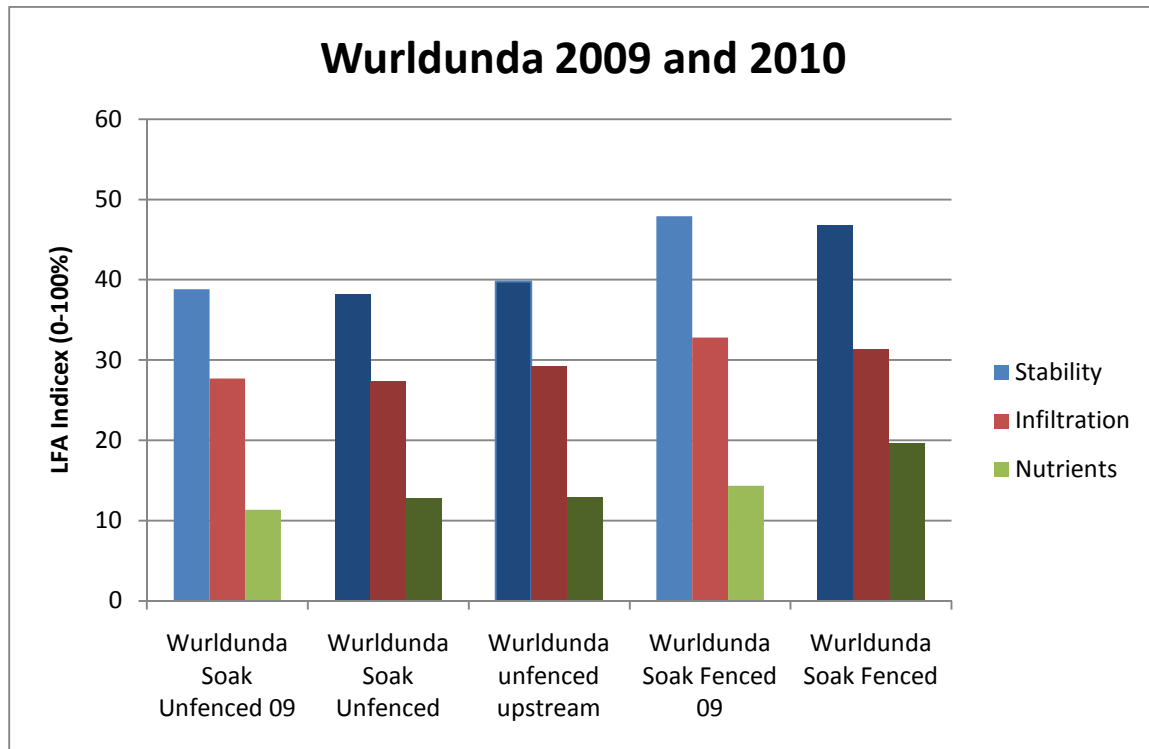


Figure 30 Wurldunda LFA results 2009 & 2010



Despite the above average rainfall, new perennial plants have failed to colonize inside and outside of the fenced area. December 2010.

³ It is possible that there was some negative overlap with which species were assessed at perennial in 2009 and 2010; however, it was viewed that most plants on sites outside of the fenced area were annuals – predominantly annual Maireana, Sclerolaena and Sida species

Outside the fenced area, increased annual plant growth has occurred but what litter is being produced on the site is failing to be captured and retained (ie blown away) – nb not functioning.

There was a slight decrease in stability and infiltration indices inside the fenced area. The site is actively eroding where there is no lag or plant cover.

Failure to increase in stability function both outside and inside the fenced area suggests that grazing pressure is no longer a driving force of degradation within the fenced area, nor is water a limiting resource. It is likely this ecosystem has gone through a significant “tip” in function – in this instance this is likely to be the significant scalding of the earth by salt and compaction and loss of topsoil that renders the substrate incapable of substantial growth. No new annual species were recorded outside or inside the fenced area.

There was an increase in nutrient cycling within the Wurldunda fenced area since 2009 - attributable to the samphires, although samphires did not seem to be actively growing or spreading on the site. The soil under each samphire shrub was in an improved state – evidence of nutrient cycling and stability, dark moist non-crustured soils – compared to surrounding areas which are actively eroding.



Photo of soils found under samphires at Wurldunda.

It is recommended that active rehabilitation takes place on Wurldunda Soak as it is a significant site on Angas Downs and not improving (Couch grass invasion has also occurred toward the North of the fenced area.)



Above and Below: active erosion occurring along the LFA transect within the fenced area at Wurldunda.

3.7.3 Mulga LFA

Only one mulga site assessed in 2009 was reassessed for LFA in 2010 Centenary Mulga (cattle paddock) (Figure 31). There was an improvement in all indices.

Patch Area was similar between the two years, the increase in LFA indices being attributed to increased perennial and litter cover within existing patches. It is expected that nutrient cycling lags behind stability and infiltration increases (pers comm. D. Tongway, ANU), especially in dry hot environments such as at Angas Downs as the breakdown and assimilation of litter is slow.

Three new sites were assessed in 2010. The highest LFA indices were obtained from the Mulga within the sanctuary despite being close to a water source (Armstrong's Dam). As the feral proof fence is yet to be completed around the outside of the sanctuary, it is too early to tell whether existing feral management has contributed to the better functioning of the landscape at this site (opportunistic ground shooting). Feral animals (horses) and cattle were observed within 800 meters of this site in December 2010. Feral animals also occur in the unfenced Mulga assessed and cattle grazing occurs of the Cattle and Centenary Mulga LFA points. Further analysis and data collection in subsequent years is essential to assess the benefit of feral management on biodiversity and landscape health.

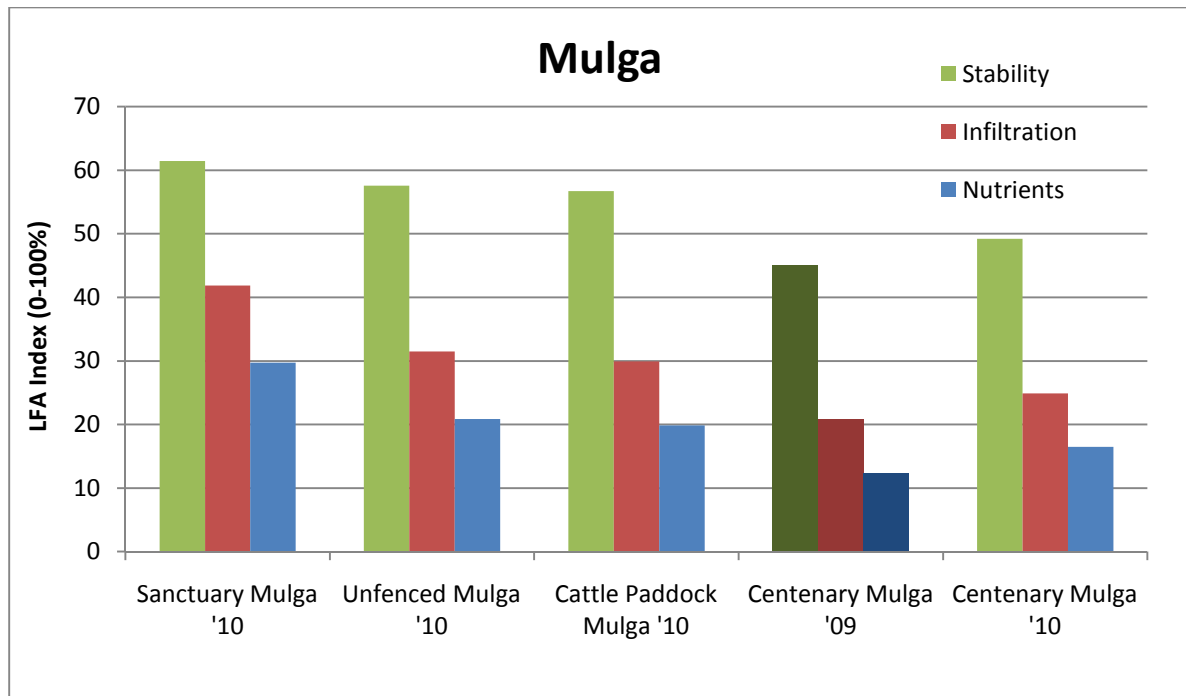


Figure 31 Mulga LFA results 2009 & 2010

3.7.4 Calcrete / Calcrete Sand / Gypcrete

Four calcrete / Calcrete Sand / Gypcrete LFA sites assessed in 2009 were re-assessed in 2010 (Figure 32). In most cases there was an increase in all three LFA indices – stability, infiltration and nutrient cycling associated with above average rainfall and increased plant growth.

The LFA site at Armstrong’s Dam was moved from the previous 2009 site due to being too close to a graded road. The new site was located approximately 20m away. The results are shown here as a comparison but any differences in indices will be taken lightly in 2010.

Five new Calcrete LFA sites and two “other” similar sites were set up in 2010. Results are shown in Figure 33-Figure 34.

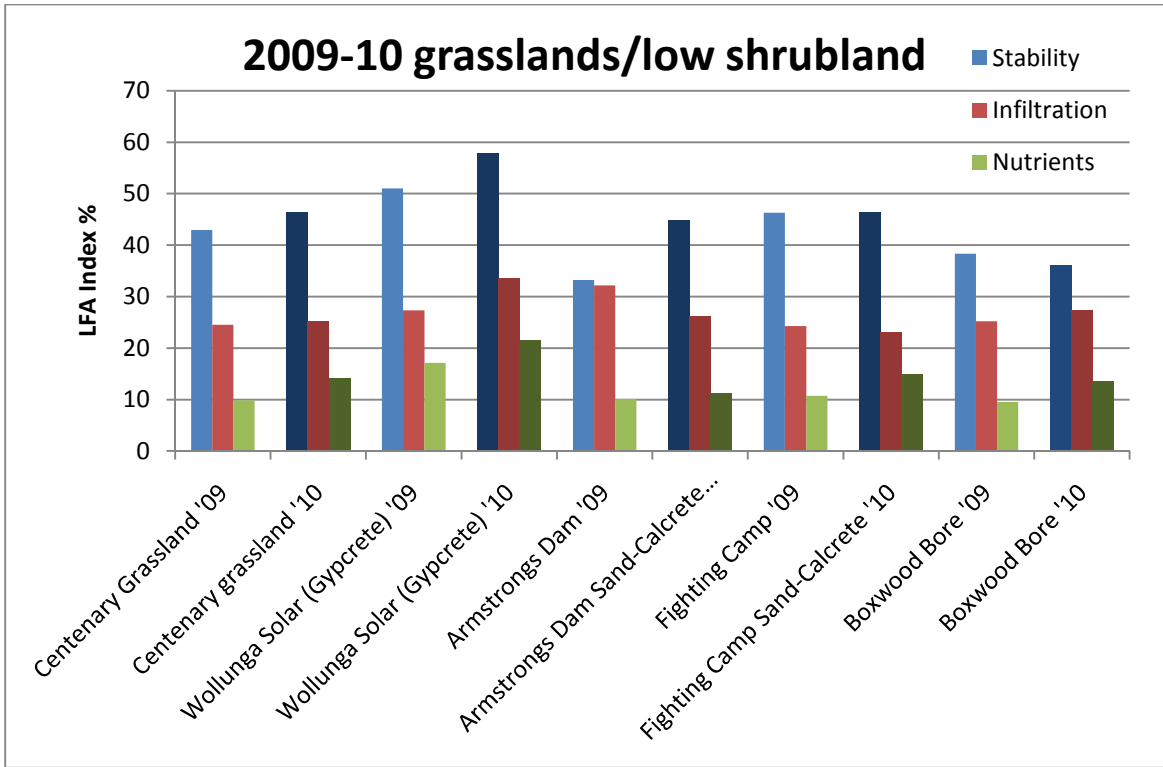


Figure 32 Grasslands/low shrublands over calcrete/gypcrete/sandy calcrete LFA results 2009 & 2010

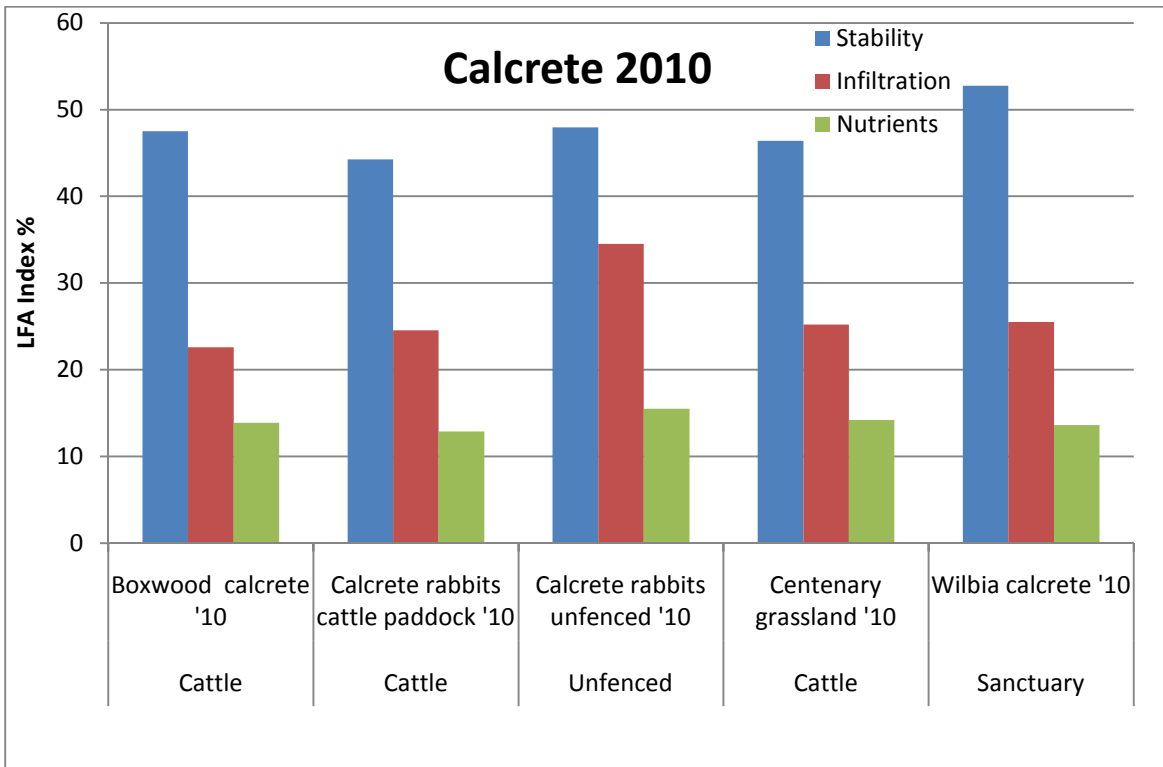


Figure 33 Calcrete LFA results December 2010

When comparing Armstrong's, Fighting Camp and Boxwood Bore Sand-Calcrete LFA sites (Figure 34) all three are similar in vegetation and proximity to water. The sites outside of the cattle area appear

to be functioning better. From 2009, indices in the cattle paddock Boxwood Bore Sand-Calcrete were reduced despite the excellent growing season.

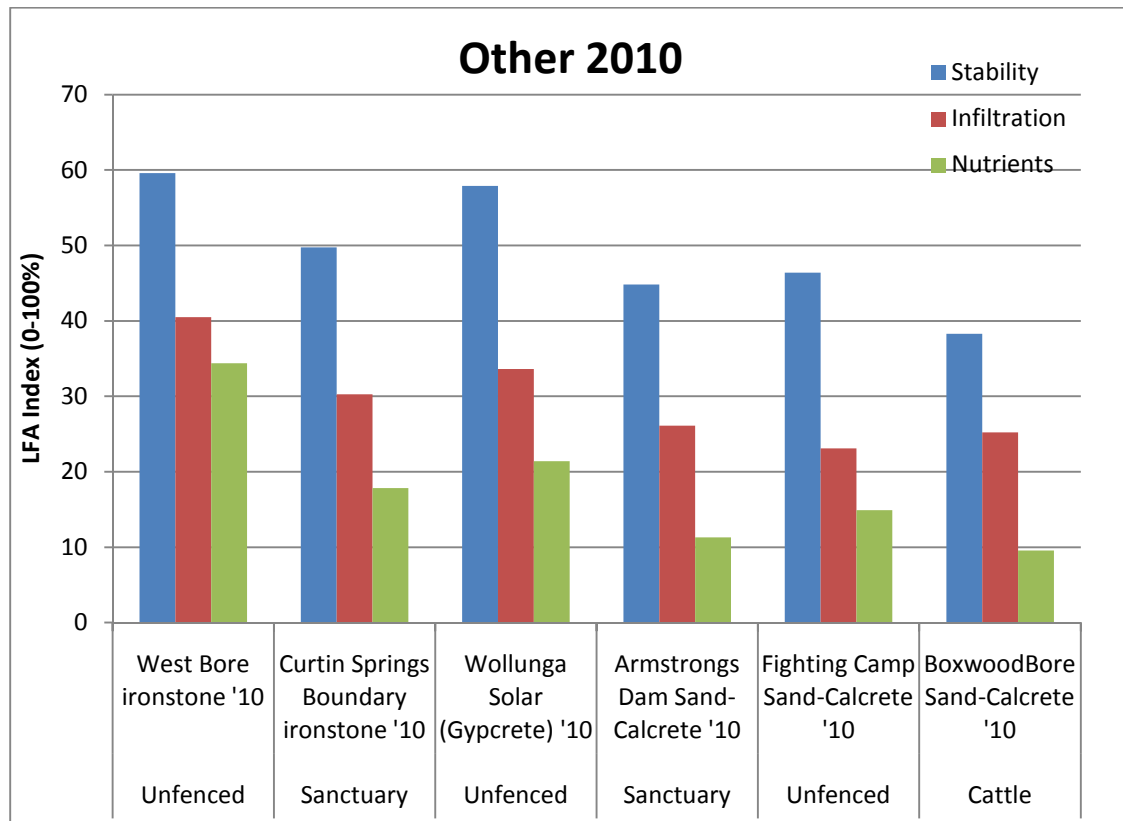


Figure 34 Other LFA sites set up December 2010

3.7.5 Sandy substrates

Two sandy substrate (dunes) LFA sites assessed in 2009 were re-assessed in 2010 (Figure 35). Stability, infiltration and nutrient cycling indices increased for the sites reassessed.

Six new sites were also assessed in 2010 (Figure 36) including sites located within the cattle paddock, sanctuary area and outside all fenced areas.

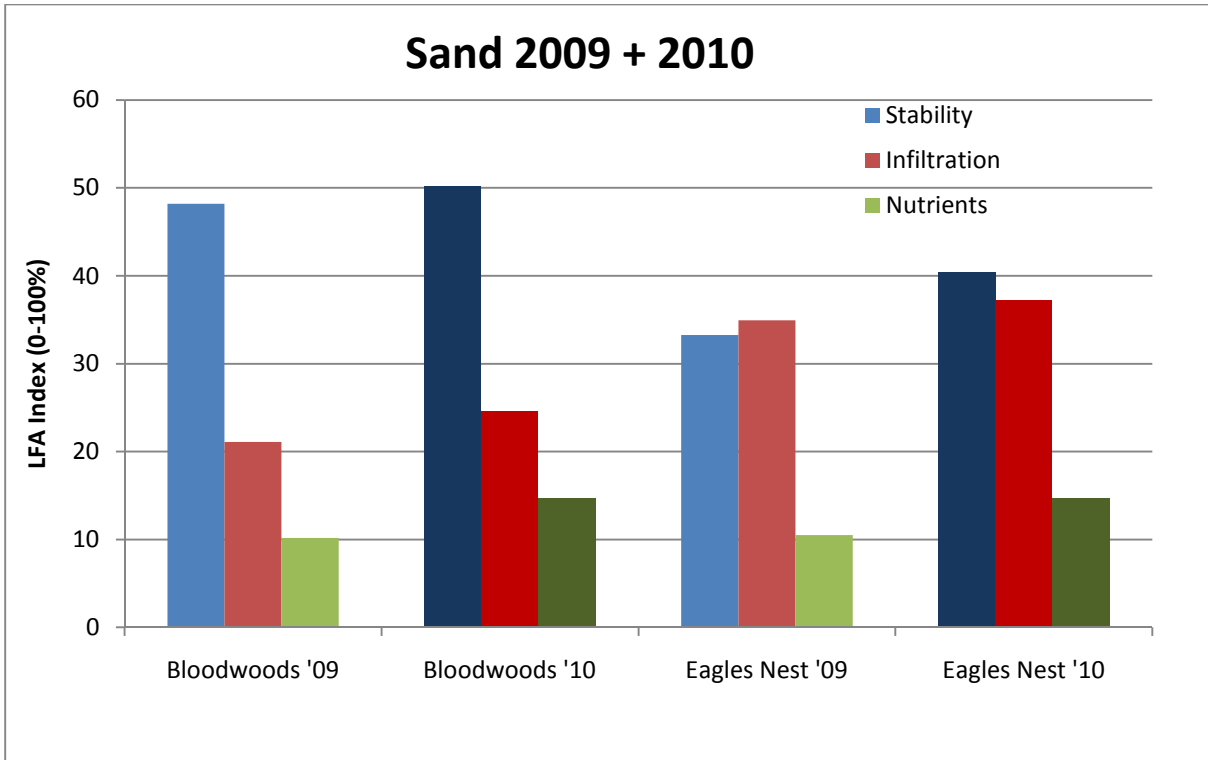


Figure 35 Sandy substrates LFA results 2009 & 2010

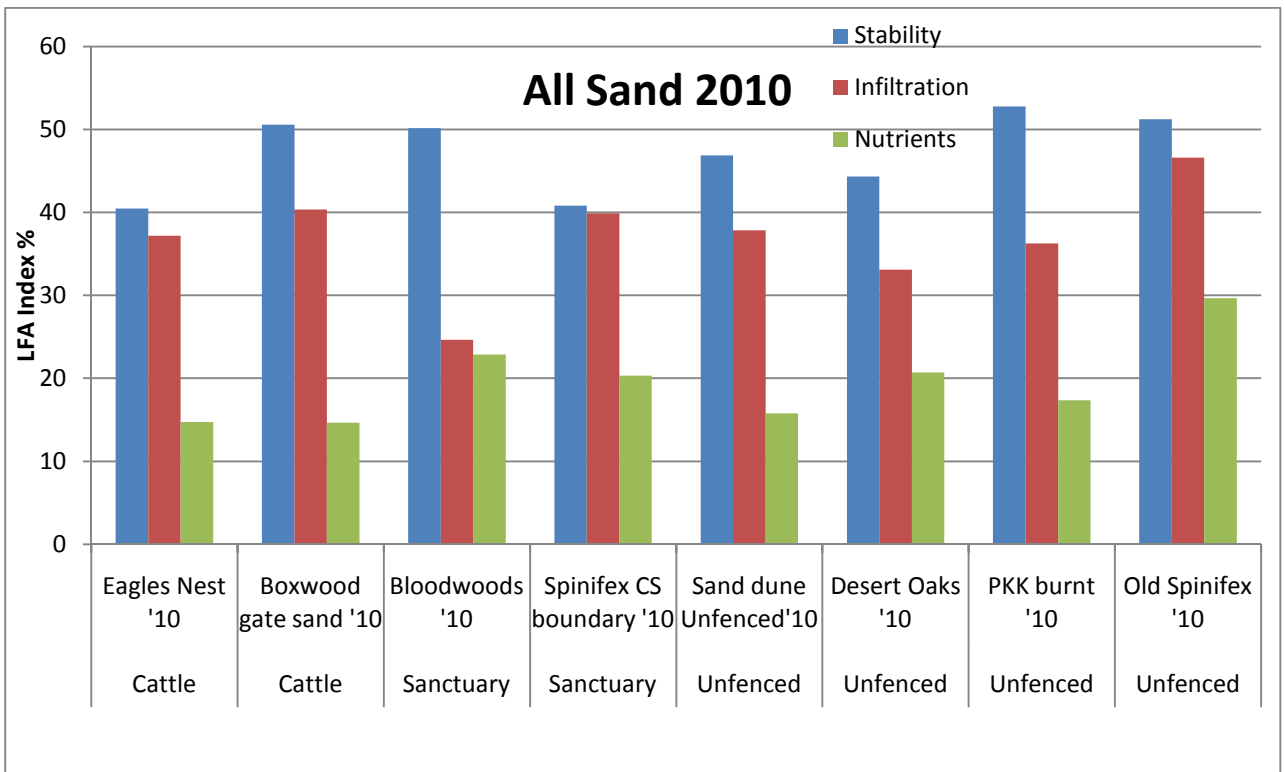


Figure 36 Sandy substrates LFA results December 2010

3.7.6 Patch Area index

Patch area index (total patch area/maximum area if all the transect was patch (transect length * 10)) for sites assessed in 2009 and 2010 is shown in Figure 37. Patch Area Index is an LFA index that describes the ability of the landscape to capture and retain resources. In most cases, the Patch Area Index increased in 2010 from 2009 values. This is again attributable to above average rainfall during 2010. The Bloodwoods site was the only site to decrease in Patch Area Index – at this site the transect length was increased from 32m to 50m from 2009 to 2010 to improve accuracy and is likely to be the reason in decreased patch area index as other LFA indices (stability, infiltration, nutrient cycling – Figure 35) increased during this period.

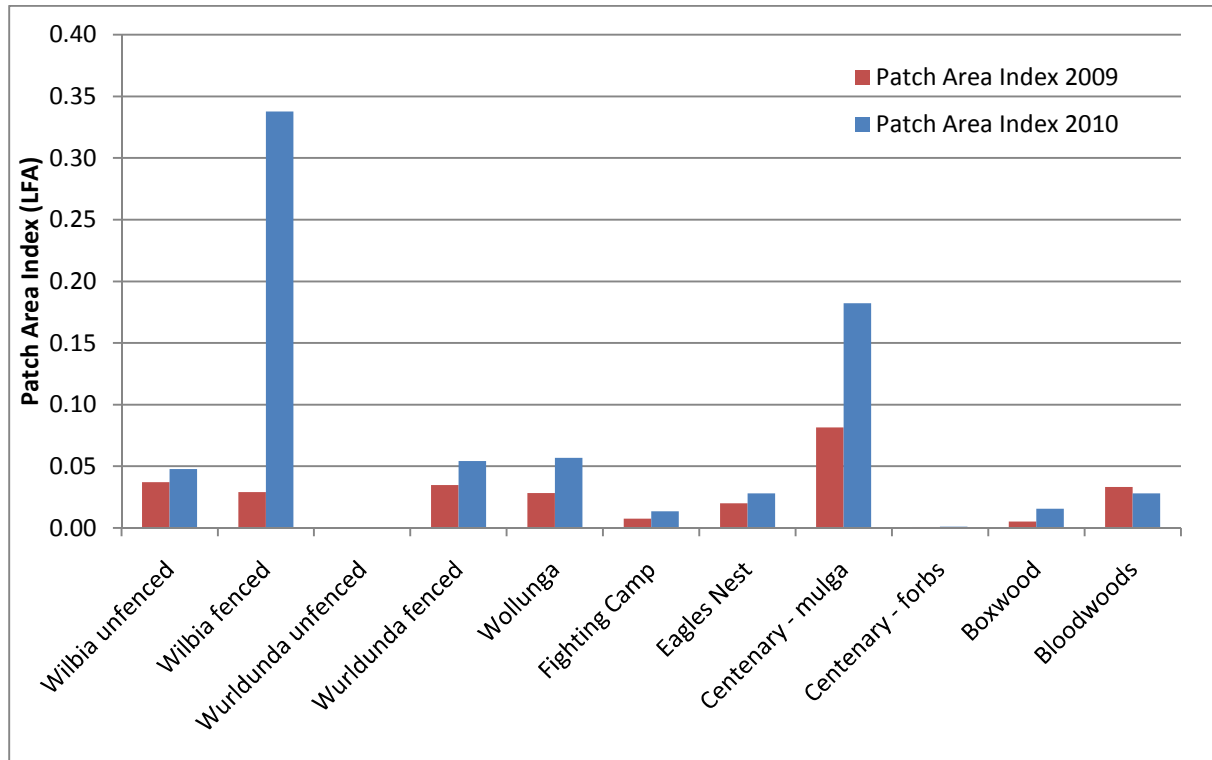


Figure 37 Patch area index for sites assessed in 2009 and 2010

3.8 Mapping of cultural sites

There is ongoing mapping of cultural sites on Angas Downs IPA using a combination of Ranger Cybertracker surveys and photographic/voice/video records (Figure 38). Elders from the Imanpa community have been recorded telling stories about the land. Photo and video files will be entered into the Ara Irititja Anangu cultural database at Imanpa, a purpose-built computer archive that digitally stores repatriated materials and other contemporary items. During December 2010, nine disks of video footage and photographs were delivered to the Ara Irititja cultural database. These will be uploaded in 2011.

Angas Downs holds places of significant Indigenous heritage important to the members of the Imanpa community and wider Anangu. Places that hold great meaning and significance to Indigenous people include:

- places associated with 'Dreaming' stories depicting the laws of the land
- places that are associated with their spirituality
- places where other cultures came into contact with Indigenous people (Angas Downs Homestead, Old Liddle Homestead)
- places that are significant for more contemporary uses.

There are to date two registered sites, five recorded sites and restricted works areas on Angas Downs recorded under the Northern Territory Aboriginal Sacred Sites Act 1989. The reason for significance is not revealed under the Act. Locations are shown on Map 1. There are two sites of Bioregional Botanical Significance on Angas Downs including the Kernot Range.

However, during routine inspections of an important site in August 2010, Puna Kura Kura (see Map 2), Anangu rangers and Australian Wildlife Services staff found previously unrecorded paintings and engravings (unrecorded by Piranpa and unknown to the Anangu rangers).

It is likely that there are many sites that have not been located, documented or listed as Indigenous Heritage places including important waterholes, caves, rock engraving and paintings. The significance of these sites is unknown and will remain unknown without further research and specialist input. A proposal to the Indigenous Heritage Program was submitted in 2011 for support to document new and existing sites by information gathering from other communities, and engaging an anthropologist and rock art specialists.

To locate and document these is important to the Anangu and Lisanote Board.



Puna Kura Kura previous unrecorded paintings



Puna Kura Kura previous unrecorded engravings



Possible "cupules" at Puna Kura Kura

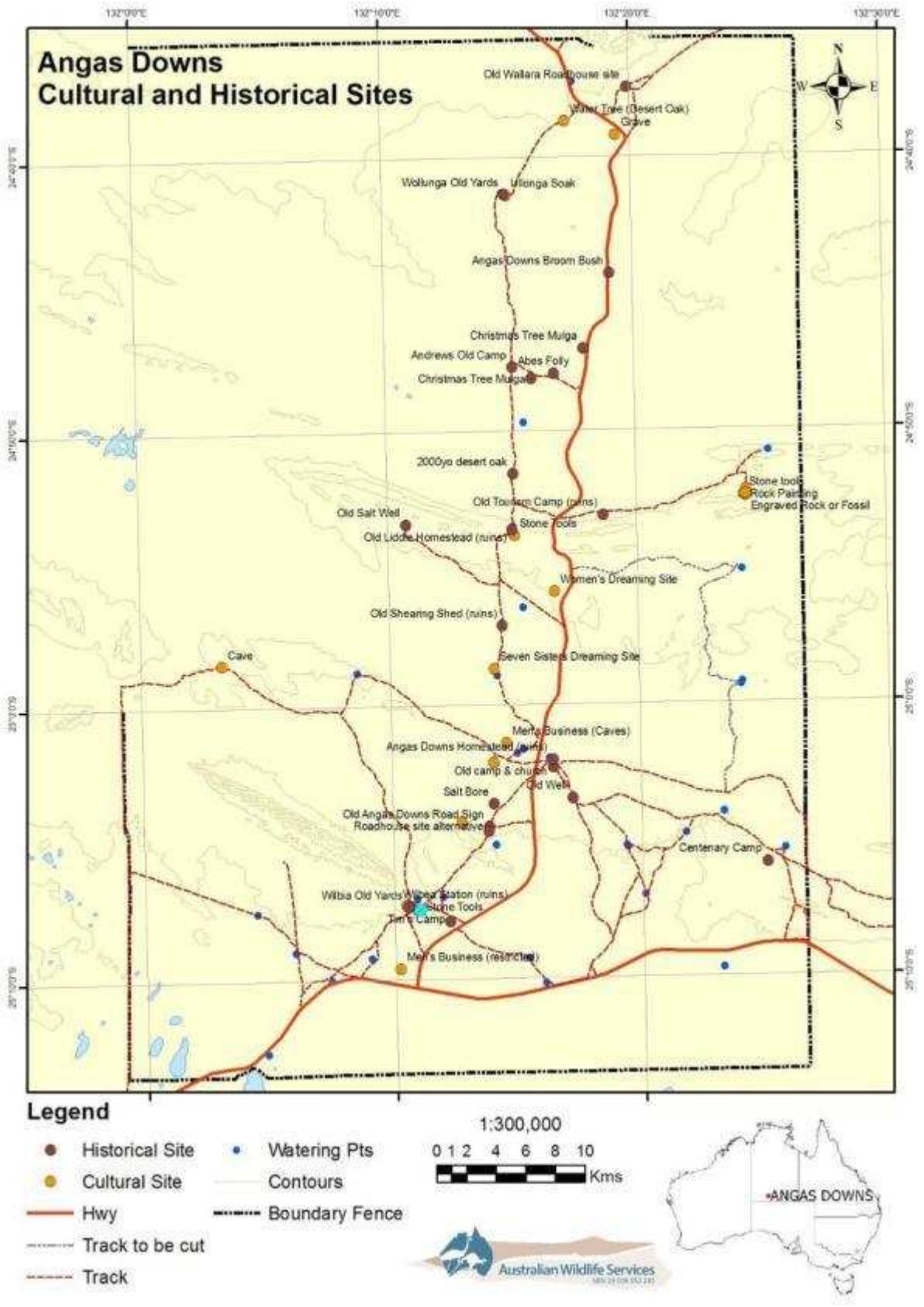


Figure 38 Ongoing mapping of Angas Downs Cultural and historic sites

3.9 Mapping of important and rare plants

Plant surveys were conducted property wide (but almost always close to vehicle access) during 2010-11.

There is ongoing mapping of rare and important plants on Angas Downs IPA using a combination of Ranger Cybertracker surveys (GPS) and photographic records. Important plants include Quandongs (*Santalum acuminatum*), Christmas Tree Mulga (*Acacia aneura* var. *conifera*) and Angas Downs Broom Bush (*Microcorys macrediana*) (shown in Figure 39).

The Angas Downs plant species list is shown in Appendix 2.

Plant species highlights include:

Scientific	Pitjantjatjara	Common Name
<i>Acacia aneura</i> var <i>conifera</i>		Christmas Tree Mulga Stand
<i>Acacia oswaldii</i>	wilpiya	Wilpiya/water bush
<i>Acacia minyura</i>		
<i>Gilesia biniflora</i> (NT)	Western Tarvine	
<i>Brachychiton gregorii</i>	ngalta	Desert Kurrajong
<i>Calytrix carinata</i>		Desert Fringe Myrtle
<i>Eremophila gibsonii</i> , <i>E. Gibsonii</i> , <i>E. Goodwinii</i> , <i>E. willsii</i>		Eremophila sp
<i>Erythrina vespertilio</i>	ininti	Bean Tree
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>		Desert Spurge
<i>Ficus platypoda</i>	iji	Native Rock Fig
<i>Grevillea striata</i>	iltilpa	beefwood
<i>Hibiscus sturtii</i> var <i>grandiflorus</i>		Sturt's Hibiscus
<i>Microcorys macrediana</i>		Angas Downs Broom Bush
<i>Micromyrtus flaviflora</i>		Yellow Fringe Myrtle
<i>Petalostylis cassioides</i>		Butterfly Bush
<i>Prostanthera sericea</i>	walyuwalyu	mintbush
<i>Prostanthera stratifolia</i>	mintjingka	Striped /striated mintbush
<i>Psyrax latifolia</i>	awalyuru	Native Currant
<i>Santalum acuminatum</i> (VU)	mangaṯa	Quandong
<i>Santalum lanceolatum</i>	arnguḷi	Bush plum
<i>Teucrium racemosum</i>		Grey Germander
<i>Zygophyllum ovatum</i> (NT)	maltantu	Dwarf Twinleaf

(NT) Near Threatened (VU) Vulnerable in the Northern Territory

3.10 Fire risk and management

(This following section has acknowledgements to Grant Allan, Bushfires NT.)

Large uncontrolled wildfires in central Australia in the past 15-25 years have occurred after heavy rainfall. In order to predict high fire risk, rainfall fall can be assessed as a percentage of 24 months of accumulated rainfall. Bushfire researchers suggest that if rainfall is above the 120th percentile of rainfall over the past two years, it is likely there is enough fuel in the landscape for widespread fires to burn uncontrolled (this is without implementing burning strategies to reduce fuel loads and increase landscape mosaic). Rainfall below this level is less likely to result in enough fuel for large wildfires, however, there is still risk of large fires occurring if the conditions are right.

Rainfall descriptions are as follows: below average – less than 80% of expected rainfall received in the preceding 2 years; average between 80-120% of expected rainfall received in the preceding 2 years and above average – greater than 120% of expected rainfall received in the preceding two years.

As at March 2011, rainfall over Angas Downs sits at the 136th + percentile for 24 months of accumulated rainfall (see Figure 40). Therefore risk of fire occurring on Angas Downs is extreme. Visual inspections of fuel loads have confirmed Fuel States 3-4 over the majority of the country. With the cooler winter months approaching, it is the perfect time for the Angas Downs Rangers to start burning to reduce the risk of fire in following seasons. In December 2010, the rangers did two trial burns. These were tracked using Landsat imagery (Figure 41-43). Despite green wet conditions, the burn which was lit from a 700 m line, 40 ha of patchy burn occurred. The fire did not spread into the Liddle Hills.

Another burn was lit from the Sanctuary access road near the proposed Bloodwood Bore site. The fire did not burn a sufficient area to register on Landsat Imagery (30x30m resolution).

For more information see:

Australian Wildlife Services (2010b) *Angas Downs Fire Management Plan 2010-2015* (draft). Angas Downs Indigenous Protected Area. A report to Lisanote Pty Ltd compiled by AWS, 2010.

Curtin Springs 24 Month Cumulative Rainfall:1998 to today

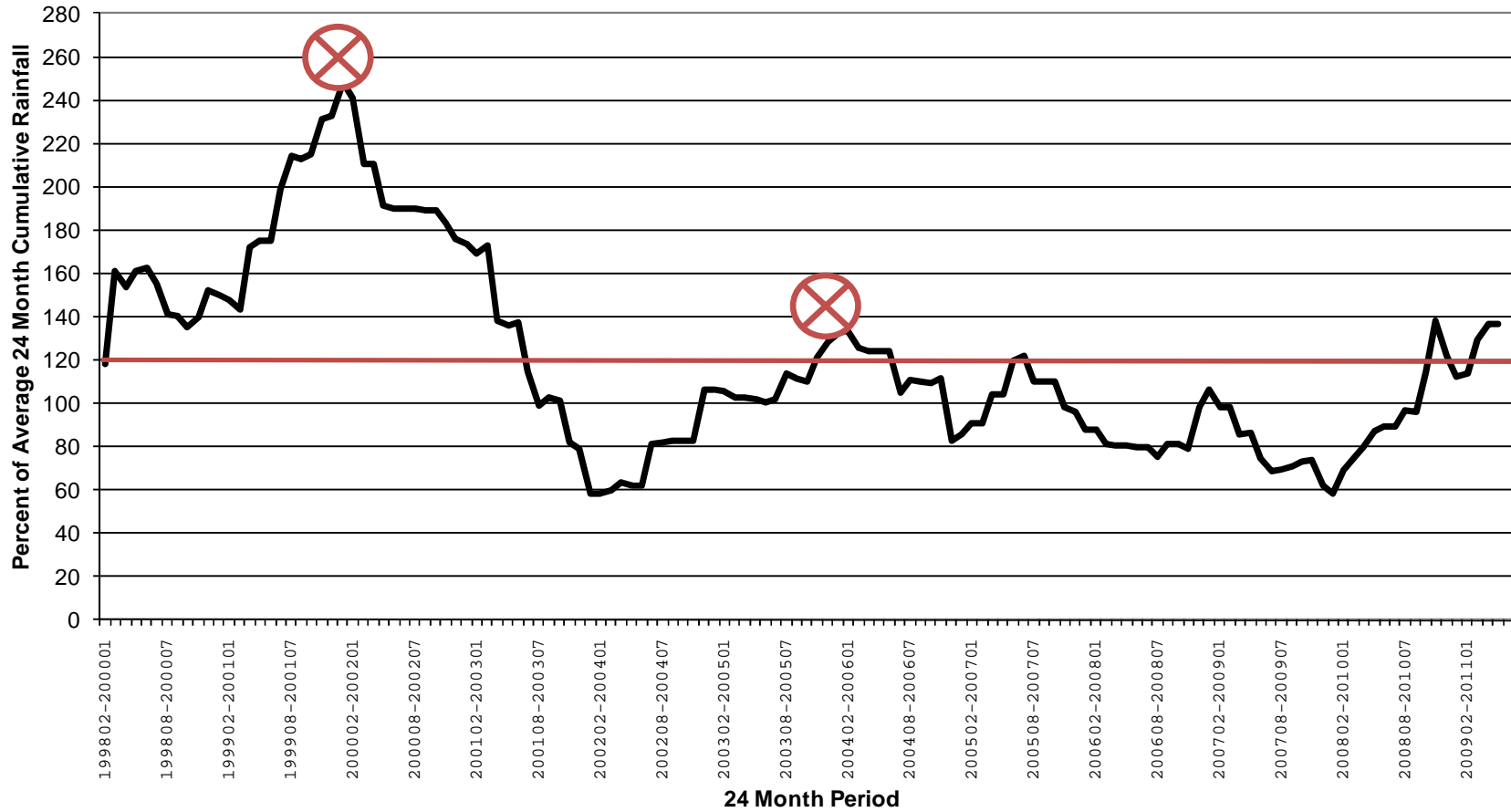


Figure 40 24 Month Cumulative Rainfall Curtin Springs 1998-2011

Source: Grant Allan, Bushfires NT and Bureau of Meteorology 2011.



Fire has occurred on Angas Downs on in the region

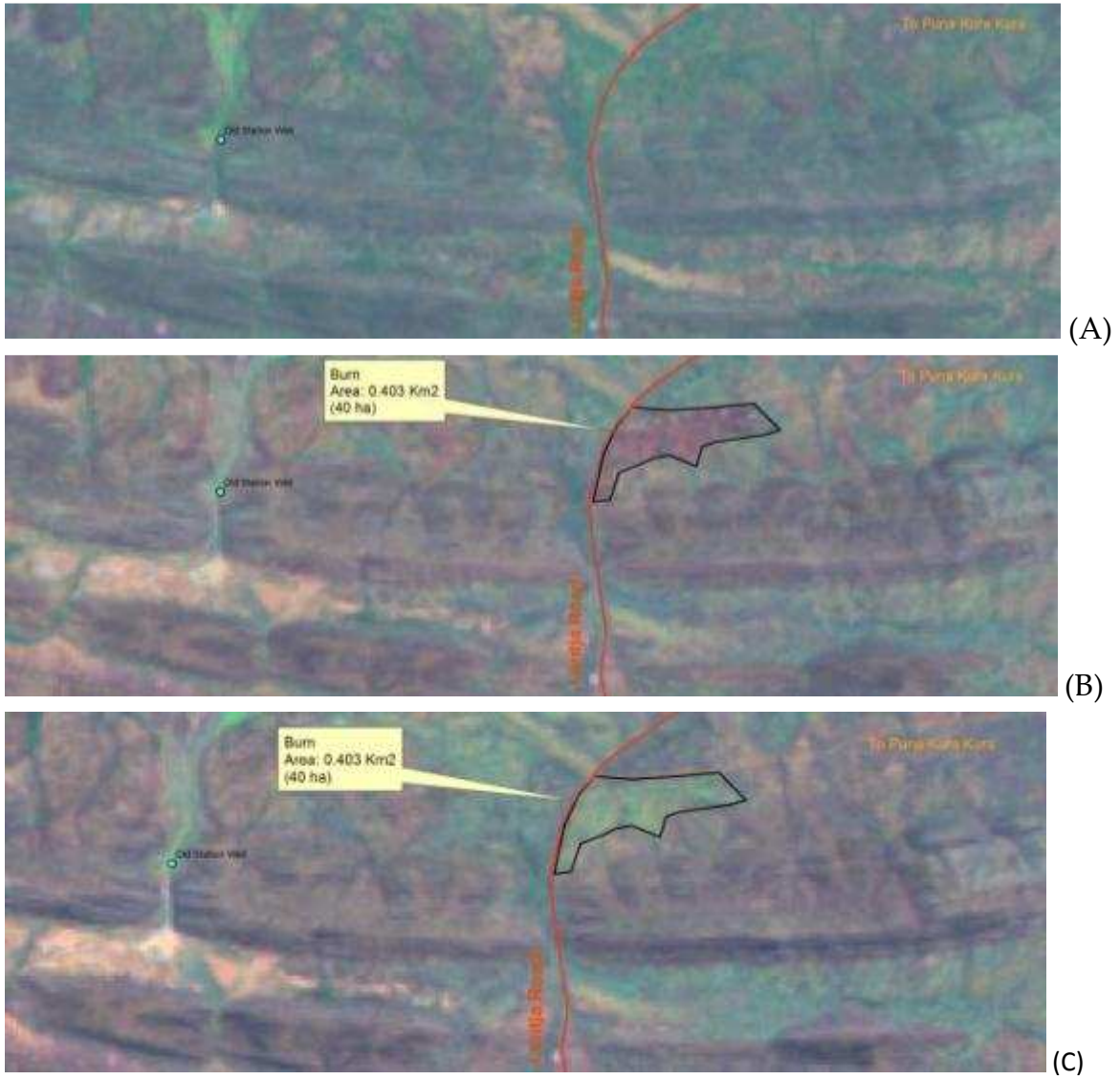


Figure 41 Before and after burning occurred at the junction of Luritja Road and Puna Kura Kura Track, December 2010. (A) October 2010 (B) January 2011 (C) April 2011 showing post fire growth (Landsat Band Composit using Bands 7,4,2).



Figure 42 Senior Ranger David Wongway lighting small patch burn at the junction of Luritja Road and Puna Kura Kura Track, December 2010



Figure 43 Cool burns protect fire sensitive mulga, increases landscape patchiness and reduces fuel loads.

4. References

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- Wilson, G., Pickering, M. and Kay, G. 2005.** Angas Downs Indigenous Protected Area Plan of Management. Australian Wildlife Services. Canberra.

Appendix 1 Reptile and small mammal surveys site information

Site No.	Date Set	Vegetation	Substrate	no of buckets + funnels	Birds observed	Notes
Trap 1 Dump	2/10/10	Sparse mixed acacia shrubland over spinifex	Sand	4 funnels, 3 buckets	yellow plumed honeyeater, pallid cuckoo, rufous songlark, zebra finches	mouse tracks up fence
Trap 2 Tims Hill	2/10/10	Low Mulga, Witchetty, Eremophila shrubland over mulga grass	Rocky	4 funnels	spiny-cheeked honeyeater, yellow plumed honeyeater, 2 white browed babbler, singing honeyeater, crow	
Trap 3 Spinifex fence	2/10/10	Spinifex grassland	Sand	4 funnels	rufous songlark, white winged trillers	
Trap 3 Spinifex fence	4/10/10	Spinifex grassland	Sand	3 buckets, 4 funnels	red capped robin	
Trap 4 Mulga fence	2/10/10	Sparse mixed acacia shrubland	Sand	4 funnels	pallid cuckoo, singing honeyeater, ringnecks, rufous songlark, black faced woodswallow, red backed kingfisher, zebra finches	Fresh goanna hole, Spiders, stick insect, mouse tracks up the fence, beetles
Trap 5 Eastern Boundary Rocky	4/10/10	Low sparse shrub grassland (next to rocky outcrop)	rocky sand	4 funnels	crested bell bird, songlark	rocky outcrop jump up next to 5-10m, dog /fox tracks present
Trap 6 Eastern Boundary sandy	4/10/10	Low sparse shrub grassland	Sand	4 funnels, 1 bucket	songlark, common bronzewing	
Trap 7 Old Spinifex	3/10/10	Old Spinifex, sparse mulga	Sand	4 funnels, 3 buckets		close to calcrete area, iron woods nearby, old hard spinifex, desert heath myrtle present
Trap 8 Old Spinifex	3/10/10	Old Spinifex, sparse mulga	Sand	5 funnels, 3 buckets		Witchetty bush present
Liddle Hills East	5/10/10	Old tall mulga over grass	Sand	3 buckets	2 mistletoe birds, red capped robin, rufous whistler	1 bucket filled with water to brim after heavy rainfall

Liddle Hills West 2	5/10/10	Spinifex low-medium shrub dune complex	Sand	3 buckets, 8 funnels	rufous songlark, singing honeyeater, red browed pardalote, sacred kingfisher, masked woodswallows, crimson chats, budgies, cockatiels	desert poplar near site, 50 m fence, see notes for species present, huge diversity of plant species at this site
Liddle Hills West 1	5/10/10	Spinifex low-medium shrub dune complex	Sand	3 buckets, 4 funnels	rufous songlark, crimson chat, woodswallows	saw 2 central military dragons running around (not trapped) and rat looking thing not trapped or ID, Lerista found under log nearby, huge diversity of plant species
Fighting Camp Sand	5/10/10	Mixed low shrubland on sand dune (cassia and acacia sp)	Sand	3 buckets	piebald honeyeater	
Fighting Camp Mulga	5/10/10	Mature mulga woodland over mulga grass	Sand	3 buckets	willy wagtail, cuckoo shrike, crested bell bird	close to drainage line. 2 buckets filled with water, site was closed after first trap night because of this and access to the site restricted (boggy), GPS 164-165
Old Road Site	7/10/10	Sand dune community (mixed shrubs) over spinifex	Sand	4 buckets, 4 funnels, 50m	woodswallows black and masked, budgies, variegated fairy wren, crimson chats, bird with annoying descending call unidentified but possibly songlark.	notes for plant species present, huge diversity of plant species at this site
Trap Yaua Waterhole	7/10/10	Sand plain into Alluvial, mulga, spinifex, mixed grass and annuals	Sand	3 buckets	budgies, rufous songlark, cockatiels, cuckoo shrike, woodswallows, variegated wrens, splendid wrens, Rufous whistler	ruby salt bush, poached egg daisy, sturts nightshade, hairy verbine, hairy mulla, pussy tails, mixed grasses and spinifex

Desert Oak Spinifex	7/10/10	Spinifex Desert Oak Woodland	Sand	3 buckets, 6 funnels	masked woodswallows, bee-eater, budgies	50m, felty bell flower, honey suckle grevillea, waxy wattle, broombush?
Dune back of Tim' camps	9/03/11	Sand dune heath over spinifex. Mulga also present – sparse.	Sand	3 buckets	(vicinity) see bird survey done: hooded robin, willy wagtail, splendid wrens, white winged wren, red-capped robin, white-browed treecreeper, zebra finch, thornbills, budgies, spiny honeyeater, little button quail, common bronzewing, rufous whistler, rufous songlark, masked woodswallow, crested bellbird, sacred kingfisher, singing honeyeater, black-faced woodswallow (inc juv), red chats, mulga parrots (nesting), triller, white-plumbed honeyeater, white-fronted honeyeater, yellow rumped thornbill, pallid cuckoo juv, brown falcons, 1 collared goshawk	2 blue tailed ctenotus nearby in spinifex - photos and video

Appendix 2 Reptile and mammal survey results

Reptiles observed 2010-11	Common name
<i>Amphibolurus longirostris</i>	Long-nosed Dragon (Ta-Ta)
<i>Cryptoblepharus plagioccephalus</i>	...skink
<i>Ctenophorus isolepis</i>	Central Military Dragon
<i>Ctenophorus nuchalis</i>	Central netted dragon
<i>Ctenophorus reticulatus</i>	Western netted Dragon
<i>Ctenotus brooksi</i>	
<i>Ctenotus calurus</i>	Blue-tailed Ctenotus
<i>Ctenotus dux</i>	Narrow-lined Ctenotus
<i>Ctenotus helenae</i>	Clay-soil ctenotus
<i>Ctenotus leonhardii</i>	Leonhard's Ctenotus
<i>Ctenotus pantherinus ocellifer</i>	Leopard Ctenotus
<i>Ctenotus piankai</i>	...skink
<i>Ctenotus quattuordecimlineatus</i>	14-lined skink
<i>Ctenotus schomburgkii</i>	Barred Wedged Snout Ctenotus
<i>Delma nasuta</i>	...legless lizard
<i>Demansia psammophis</i>	Yellow Faced Whip Snake
<i>Diplodactylus conspicillatus</i>	Fat-tailed gecko
<i>Egernia inornata</i>	Desert Skink
<i>Gehyra variegata</i>	Varigated Gecko
<i>Heteronotia binoei</i>	Bynoe's gecko
<i>Lerista bipes</i>	Two-toed Lerista
<i>Menetia greyii</i>	Common dwarf skink
<i>Moloch horridus</i>	Thorny Devil
<i>Morethia ruficauda</i>	Fire-tailed skink
<i>Nephrurus levis levis</i>	Smooth Knobtail Gecko
<i>Nephrurus laevisissimus</i>	Pale Knob-tailed Gecko
<i>Pseudechis australis</i>	<i>King Brown Snake</i>
<i>Pseudonaja nuchalis</i>	Western Brown Snake
<i>Pseudonaja modesta</i>	Ringed Brown Snake
<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot
<i>Ramphotyphlops endoterus</i>	Interior Blind Snake
<i>Rhynchoedura ornata</i>	Beaked Gecko
<i>Simoselaps anamolous</i>	Desert Banded Snake
<i>Simoselaps bertholdi</i>	Jan's banded snake
<i>Strophurus ciliaris</i>	Northern Spiny-tailed gecko
<i>Suta punctata</i>	Little Spotted Snake
<i>Tiliqua multifasciata</i>	Centralian Blue Tounge
<i>Varanus eremius</i>	Pygmy Desert Monitor
<i>Varanus gouldii</i>	Gould's Goanna
<i>Varanus giganteus</i>	Perentie
40 confirmed reptiles	(10 other species proposed to reside on Angas Downs not

observed in 2010 including Great Desert Skink – Vulnerable)

Amphibians observed 2010-11	Common Name
<i>Neobatrachus centralis</i>	Trilling Frog
<i>Limnodynastes ornatus</i>	Ornate Burrowing Frog
<i>Litoria rubella</i>	Desert Tree Frog
<i>Notaden nicholli</i>	Desert Spadefoot Toad

4 confirmed species of frog

Mammals observed 2010-11	Common Name
<i>Antechinomys laniger</i>	Kultarr
<i>Canis familiaris</i>	Dingo
<i>Leggadina forresti (not confirmed)</i>	Desert short tailed mouse
<i>Macropus robustus</i>	Euro
<i>Macropus rufus</i>	Red Kangaroo
<i>Ningauai ridei</i>	Wongai Ningau
<i>Notomys alexis</i>	Spinifex Hopping Mouse
<i>Notomys mitchellii</i>	Mitchell's Hopping Mouse
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse
<i>Sminthopsis youngsoni</i>	Lesser hairy-footed dunnart
<i>Tachyglossus aculeatus</i>	Echidna

10 confirmed native mammals

Mammals not observed in 2010 but potentially occur on Angas Downs	Common Name
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat
<i>Dasyercus cristicauda</i>	Mulgara
<i>Notoryctes typhlops</i>	Southern Marsupial Mole
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat
<i>Sminthopsis ooldea</i>	Ooldea Dunnart

Introduced Species	Common Name
<i>Bos taurus</i>	Cattle
<i>Camelus dromedarius</i>	Camel
<i>Equus caballus</i>	Horse
<i>Felis catus</i>	Cat
<i>Mus musculus</i>	House Mouse
<i>Oryctolagus cuniculus</i>	Rabbit
<i>Vulpes vulpes</i>	Fox

Appendix 3 Angas Downs plant checklist

See attachment 1.

Appendix 4 Angas Downs bird survey results and checklist

ORDER	FAMILY	COMMON NAME	SPECIES	COUNT - 2011	OBS 2010
STRUTHIONIFORMES	Dromaiidae	Emu	<i>Dromaius novaehollandiae</i>	1	yes
ANSERIFORMES	Anatidae	Pacific Black Duck	<i>Anas superciliosa</i>		yes
		Hardhead	<i>Aythya australis</i>		yes
		Wood Duck	<i>Chenonetta jubata</i>		yes
		Pink-eared Duck	<i>Malacorhynchus membranaceus</i>		
PODICIPEDIFORMES	Podicipedidae	Hoary-headed grebe	<i>Poliocephalus poliocephalus</i>		yes
FALCONIFORMES	Accipitridae	Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>	1	
		Brown Goshawk	<i>Accipiter fasciatus</i>		
		Wedge-tailed Eagle	<i>Aquila audax</i>	3	yes
		Black-shouldered Kite	<i>Elanus axillaris</i>	2	
		Whistling Kite	<i>Haliastur sphenurus</i>	1	yes
		Black-breasted Buzzard	<i>Hamirostra melanosternum</i>	1	yes
		Little Eagle	<i>Hieraaetus morphnoides</i>	1	yes
	Falconidae	Black Kite	<i>Milvus migrans</i>	3	yes
		Spotted Harrier	<i>Circus assimilis</i>	1	
		Brown Falcon	<i>Falco beridora</i>	7	yes
		Nankeen Kestrel	<i>Falco cenchroides</i>	3	yes
		Australian Hobby (Hawk)	<i>Falco longipennis</i>		yes
	CHARADRIIFORMES	Charadriidae	Peregrine Falcon	<i>Falco peregrinus</i>	
Inland Dotterel			<i>Charadrius australis</i>		
Banded Lapwing			<i>Vanellus tricolor</i>	2	yes
CICONIIFORMES	Ardeidae	Black Fronted Dotterel	<i>Eseyornis melanops</i>	1	yes
		White-faced Heron	<i>Egretta novaehollandiae</i>		yes
		Nankeen Night Heron	<i>Nycticorax caledonicus</i>		yes
TURNICIFORMES	Turnicidae	Little Button-quail	<i>Turnix velox</i>	6	yes
GRUIFORMES	Otididae	Australian Bustard	<i>Ardeotis australis</i>	5	yes
		Black-tailed Native-hen	<i>Gallinula ventralis</i>		yes
CHARADRIIFORMES	Burhinidae	Bush Stone Curlew	<i>Burhinus grallarius</i>		
COLUMBIFORMES	Columbidae	Common Bronzewing	<i>Phaps chalcoptera</i>	5	yes
		Crested Pigeon	<i>Ocyphaps lophotes</i>	23	yes
		Diamond Dove	<i>Geopelia cuneata</i>	20	yes
		Peaceful Dove	<i>Geopelia placida</i>		
PSITTACIFORMES	Cactuidae	Major Mitchell's Cockatoo	<i>Cacatua leadbeateri</i>	28	yes
		Galah	<i>Cacatua roseicapilla</i>	35	yes
	Psittacidae	Cockatiel	<i>Nymphicus hollandicus</i>	20	yes
		Mulga Parrot	<i>Psephotus varius</i>	12	yes
		Australian Ringneck	<i>Barnadius zonarius</i>	10	yes
		Bourke's Parrot	<i>Neopsephotus bourkii</i>	16	yes
		Budgerigar	<i>Melopsittacus undulatus</i>	50	yes
		Night Parrots	<i>Pezoporus occidentalis</i>		yes

ODER	FAMILY	COMMON NAME	SPECIES	COUNT - 2011	OBS 2010
		Princess Parrot			
CUCULIFORMES	Cuculidae	Pallid Cuckoo	<i>Cuculus pallidus</i>	1	yes
		Black-eared cuckoo	<i>Chrysococcyx osculans</i>		
		Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>		
STRIGIFORMES	Strigidae	Southern Boobook	<i>Ninox novaeseelandiae</i>	1	yes
	Tytonidae	Barn Owl	<i>Tyto alba</i>		
	Aegothelidae	Australian Owlet-nightjar	<i>Aegotheles cristatus</i>		yes
	Caprimulgidae	Spotted Nightjar	<i>Eurostopodus argus</i>		
	Podargidae	Tawny Frogmouth	<i>Podargus strigoides</i>	1	
CORACIIFORMES	Halcyonidae	Red-backed Kingfisher	<i>Todiramphus sanctus</i>		yes
		Sacred Kingfisher	<i>Todiramphus sanctus</i>	1	yes
	Meropidae	Rainbow Bee-eater	<i>Merops ornatus</i>		yes
PASSERIFORMES	Maluridae	Splendid Fairy-wren	<i>Malurus splendens</i>	12	yes
		Variegated Fairy-wren	<i>Malurus lamberti</i>		yes
		White-winged Fairy-wren	<i>Malurus leucopterus</i>	1	
		Dusky Grasswren	<i>Amytornis purnelli</i>		
		Striated Grasswren	<i>Amytornis striatus</i>		
	Pardalotidae	Red-browed Pardalote	<i>Pardalotus rubricatus</i>		yes
		Striated Pardalote	<i>Pardalotus striatus</i>		
	Neosittidae	Varied Sittella	<i>Daphoenositta chrysoptera</i>	8	
	Climactreidae	White-browed Treecreeper	<i>Climacteris affinis</i>	2	
	Acanthizidae	Weebill	<i>Smicrornis brevirostris</i>		yes
		Western Gerygone	<i>Gerygone fusca</i>	2	
		Inland Thornbill	<i>Acanthiza apicalis</i>	1	
		Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>		
		Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	4	yes
		Banded Whiteface	<i>Aphelocephala nigricincta</i>		yes
		Southern Whiteface	<i>Aphelocephalla leucopsis</i>	5	
		Slatey-backed Thornbill	<i>Acanthiza robustirostris</i>		
		Meliphagidae	Spiny-cheeked Honeyeater	<i>Acanthagenys rufogalaris</i>	10
	Yellow-throated Miner		<i>Manorina flavigula</i>	6	yes
	Singing Honeyeater		<i>Lichenostomus virescens</i>	10	yes
	Grey-headed Honeyeater		<i>Lichenostomus keartlandi</i>		
	Grey-fronted Honeyeater		<i>Lichenostomus plumulus</i>		yes
	White-plumed Honeyeater		<i>Lichenostomus penicillatus</i>	12	yes
Black Honeyeater	<i>Certhionyx niger</i>				

ORDER	FAMILY	COMMON NAME	SPECIES	COUNT - 2011	OBS 2010
		Pied Honeyeater	<i>Certhionyx variegatus</i>		yes
		White-fronted Honeyeater	<i>Phylidonyris albifrons</i>	2	
		Grey Honeyeater	<i>Conopophila whitei</i>		
		Crimson chat	<i>Epthianura tricolor</i>	24	yes
	Petroicidae	Jacky Winter	<i>Microeca fascians</i>		
		Hooded Robin	<i>Melanodryas cucullata</i>	4	yes
		Red-capped Robin	<i>Petroica goodenovii</i>	10	yes
	Pomatostomidae	Grey-crowned Babbler	<i>Pomatostomus temporalis</i>		
		White-browed Babbler	<i>Pomatostomus superciliosus</i>		yes
	Muscicapidae	Crested Bellbird	<i>Oreoica gutturalis</i>	11	
		Grey Shrike-thrush	<i>Colluricincla harmonica</i>		
		Rufous Whistler	<i>Pachycephala rufiventris</i>	21	yes
	Ptilonorhynchidae	Western Bowerbird	<i>Chlamydera guttata</i>		yes
	Dicruridae	Magpie-lark	<i>Grallina cyanoleuca</i>	2	yes
		Grey Fantail	<i>Rhipidura fuliginosa</i>	1	yes
		Willy Wagtail	<i>Rhipidura leucophrys</i>	10	yes
	Orthonychidae	Chiming Wedgebill	<i>Psophodes cristatus</i>	10	yes
		Cinnamon Quail-thrush	<i>Cinclosoma cinnamomeum</i>		yes
	Campephagidae	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	1	yes
		Ground Cuckoo-shrike	<i>Coracina maxima</i>		
		White-winged Triller	<i>Lalage sueurii</i>	2	yes
	Artamidae	White-browed Woodswallow	<i>Artamus superciliosus</i>		yes
		Masked Woodswallow	<i>Artamus personatus</i>	20	yes
		Black-faced Woodswallow	<i>Artamus cinereus</i>	30	yes
		Little Woodswallow	<i>Artamus minor</i>		yes
	Cracticidae	Grey Butcherbird	<i>Cracticus torquatus</i>		yes
		Pied Butcherbird	<i>Cracticus nigrogularis</i>	1	yes
		Australian Magpie	<i>Gymnorhina tibicen</i>	6	yes
	Corvidae	Little Crow	<i>Corvus bennetti</i>	20	yes
		Torresian Crow	<i>Corvus orru</i>		yes
	Motacillidae	Richard's Pipit	<i>Anthus novaeseelandiae</i>	1	yes
	Passeridae	Zebra finch	<i>Taeniopygia guttata</i>	1000s	yes
	Dicaeidae	Mistletoebird	<i>Dicaeum hirundinaceum</i>		yes
	Hirundinidae	White-backed Swallow	<i>Cheramoeca leucosternus</i>		
		Tree Martin	<i>Hirundo nigricans</i>		
		Welcome Swallow		6	yes
	Sylviidae	Rufous Songlark	<i>Cincloramphus mathewsi</i>	11	yes
		Brown Songlark	<i>Cincloramphus cruralis</i>	4	yes
		Number species observed		60	77

Appendix 5 Track-based monitoring results 2010-11

Desert Oak Tracks Plot (December 2010)	Track count	Sanctuary Tracking Plot (Bloodwoods) (December 2010)	Track count
Malu	1	Malu	2
Camel	1	Dingo	4
Cat	1	Hopping Mouse	6
Hopping Mouse	1	Native Mouse (eg sandy inland)	3
Native Mouse (any type)	1	Snake	3
Goanna	3	Legless lizard	1
Snake	1	Lizard - small	2
Lizard - small	2	Rabbit	1
Rabbit	1	Horse	1
Echidna	1		

South East Tracking Plot (Northern) (March 2011)	Track count	South East Tracking Plot (Southern) (March 2011)	Track count
Malu	4	Malu	1
Bird - Hopping	3	Bird - Hopping	4
Bird - Walking	1	Fox	4
Bird - Parrot, cuckoo	3	Hopping Mouse	8
Cat	1	Native Mouse (any type)	14
Dingo	1	Perentie	1
Fox	1	Goanna/tinka	7
Hopping Mouse	6	Snake	2
Native Mouse (any type)	5	Lizard - small	3
Lizard - small	2		
Rabbit	3		
Echidna	1		
woodswallows	lots		

Appendix 6 Angas Downs photo point report

Online link Picasa web album:

<https://picasaweb.google.com/101023482628629136878/AngasDownsIPPhotoPts20092011?authkey=Gv1sRgCOjO67WJqPLNHg#>

Appendix 7 Map of rare and important plants – scientific names
(not attached)